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Contents

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The handwriting of Joseph Banks, his scientific staff and amanuenses

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Synopsis

This paper presents information concerning the early history of the Botanical Department of the British Museum, London, the persons who helped in its formation, and the significance of manuscript floras, transcripts, catalogues and other documents in its Library. No serious study of the handwriting of the scientists and clerks associated with Sir Joseph Banks has hitherto been published, and a number of ascriptions accepted over the last century have been found to be erroneous. This paper presents a comparative survey of some of the Banksian manuscripts in the Herbarium and Library of the British Museum (Natural History), illustrated with a large series of photographs. Evidence presented shows that some of the most important manuscripts are not by the persons to whom they have hitherto been ascribed, even by such a diligent worker as James Britten. Much remains to be done; many writers have not been identified, but it is hoped that this preliminary study will be useful in the task of identifying not only handwriting on early Banksian herbarium sheets, but also manuscripts concerned with many early collections, including those made on the voyages of Captain James Cook.

Handwriting on herbarium sheets

Those working in the herbarium of the British Museum (Natural History), London, both staff and visitors, frequently find that the recognition of handwriting of names and endorsements on

Bull. Br. Mus. nat. Hist. (Bot.) **6** (1): 1–85 Issued 28 September 1978

historical herbarium sheets can be very informative. Recognition is sometimes conclusive in establishing the identity and source of the material and can be a useful aid in the typification of a species where there is little or no adequate documentation. Handwriting, types of paper and watermarks can in some instances be useful to establish dates when certain herbarium sheets were prepared, or from which herbaria they originated.

Most of the historic sheets in the departmental herbarium were formerly contained in the extensive collection of Sir Joseph Banks (1743–1820) at Soho Square, London, and came to the British Museum when the Banksian Library and collections were transferred to the Trustees in 1827.

Plant material was, in the Banksian era, mounted on herbarium sheets of hand-made rag paper, off-white in colour, with watermarks of chain lines, sometimes with the addition of the maker's name and date and a variety of emblems. Many of these sheets are now scattered throughout the department's herbarium; they should not be confused with the pale blue, slightly larger sheets used by the Botanical Department of the British Museum at Bloomsbury for about the first fifty years. The endorsements on the reverse sides of these Banksian sheets (and the blue sheets used at Bloomsbury) were always written in ink at the top left corner with meagre information, sometimes just abbreviations like C.b.S. (Caput bonae Spei) or Prom.b.Spei for Cape of Good Hope, Amer. sept, Hort, or Hort Kew etc. (Figs 4, 15, 21, 27, 37). Collector's names were sometimes given and dates but rarely. Pencil was always used on the front of a sheet for the name of the plant and this was written close to the bottom edge (Fig. 61); the pencil writing in many cases has become rather faint. Only one exception to this has been encountered in the department's herbarium where ink has been used for this purpose by one of Banks's amanuenses (Fig. 38). On some sheets two names are given one above the other, usually the uppermost name being a slightly later determination. The original name written at the time when the sheet was prepared for mounting is often found to be an earlier or only a manuscript name.

Solander's Manuscript Slip Catalogue

Many of the manuscript names that appear on Banksian sheets are traceable by referring to Solander's Manuscript Slip Catalogue which was originally prepared by Solander and continued by Dryander and amanuenses. This catalogue, now bound in 24 volumes, was originally filed loose in 'Solander Cases' similar to those that now contain Robert Brown's manuscript catalogue. The catalogue consists of many hundreds of slips of paper folded to a uniform size 6″ × 4″ (15 × 10 cm) secured into small volumes about 2–3″ (5–8 cm) in thickness. The name 'Manuscript Slip Catalogue' was that used for it by Solander.

Most of the slips in the catalogue are written by Daniel Carl Solander (1733–82) who was employed at the British Museum first as an Assistant in 1763, promoted to Assistant Keeper in 1766 and to Keeper of the Natural History Department in 1773. During the first five years Solander was mainly employed cataloguing the specimens in the Natural History Department. During the years 1768–71 he was absent from the Museum accompanying Joseph Banks as naturalist on Captain Cook's First Voyage in HMS *Endeavour*. From 1771 until his death in 1782 Solander besides being Keeper at the British Museum acted concurrently as 'Curator-Librarian' to Banks at Soho Square. In the catalogue the information on most of the slips usually consists of full descriptions in Latin of genera and species but there are some where only short diagnoses are given. Many, possibly the majority, of the names used for genera and species have never been published. There are, however, slips with references to published names, most frequent of course being those published in Linnaeus's *Species Plantarum* (1753). There are also slips in Solander's handwriting that refer to the plants contained in some of the volumes of the Sloane Herbarium. This famous herbarium was part of the original collections of the British Museum, which was founded in 1753 ten years before Solander was engaged there as an Assistant. The slips that refer to this herbarium are recognizable by Solander's large capital letters MB followed by HS (Museum Britannicum Hortus Siccus) followed by volume and page numbers, and it has been noticed that the references are to only a very few of the 334 volumes. It would seem that Solander had a special interest in South African plants as the volumes he refers to on these slips are mainly those that contain the plants of the early collections made at the Cape of Good Hope prior to the *Endeavour* voyage. Solander's determinations are scattered throughout these volumes and are also present in several volumes containing North American plants. There are numerous slips in Solander's handwriting marked M.B.H.S. (Museum Britannicum Hortus Siccus) but not followed by a volume number; these slips refer to the plants collected by John Gregg in the West Indies, the name Earl of Hillsborough enclosed in brackets following Gregg's name on every slip. It has been found that M.B.H.S. is not a reference to the hortus siccus of Sloane but to a collection of plants supposed to have been presented to the British Museum. Solander's friend John Ellis writing to Linnaeus in October 1766 (Smith, 1821) mentions that 'Mr. Gregg has lately sent to Lord Hillsborough a curious collection of specimens of plants which he gathered himself in the islands of Tobago, St. Vincents, Granada and Dominica'. Ellis in the same letter says: 'When Dr. Solander and I have looked them over they are intended for the British Museum'. A search has been made to locate any of these specimens in the departmental herbarium but only one sheet has been found, *Cinnamomum zeylanicum* Nees. This specimen is mounted on Banks's herbarium paper and was presumably included in the Banksian Herbarium; it has Solander's writing on the reverse of the sheet which gives the same details as those recorded on his manuscript slip.

Although the majority of the catalogue slips are in Solander's handwriting (Figs 5, 6, 7), there are nearly as many written by Jonas Dryander (Fig. 18) (1748–1810), who was first employed by Banks in 1778 and succeeded Solander as Curator-Librarian in 1782. Dryander's writing is somewhat less variable and much easier to recognize than Solander's. Many original slips have been added to and amended by him.

Scattered throughout all the volumes are numerous slips where the writing is obviously not that of Solander or Dryander. The handwriting on these slips is thought to be that of amanuenses employed by Banks and working under the guidance of Solander and Dryander. This writing, unlike that of Solander and Dryander, is in most cases very constant and it has been possible to recognize in the catalogue five different individual styles of recurring handwriting. In manuscripts, lists, annotated books, etc. formerly in the Banksian Library there are further differing styles of handwriting but it has been possible only to establish the names of four amanuenses, employed by Banks, Herman Spöring from 17~~7~~6 until his death in 1771, Sigismund Bacstrom from 1772 6
until 1775, Samuel Törner from 1792 until 1797, and John Swan (dates not known).

As it has not been possible to find any information concerning the identity of other amanuenses they are referred to in this article by letters of the alphabet (A–J). The writing of Spöring and that of Bacstrom appears repeatedly in the Solander Manuscript Slip Catalogue as does the writing of amanuenses B (Fig. 49), C (Fig. 52) and E (Fig. 56). Spöring wrote many of the detailed descriptions of plants collected by Banks and Solander in New Zealand in 1769–70. The writing of amanuensis B, with only a few exceptions, is contained in a single volume and consists of generic descriptions only. This volume is wrongly labelled on the spine as '*Solander Manuscripts Transcribed by S. Bacstrom*'. Amanuensis C has copied short diagnoses of some of the Indian plants described in the manuscripts of J. G. Koenig and also diagnoses of South African plants copied from early publications with references to authors (Fig. 52). Amanuensis E (Fig. 56) has written slips concerned solely with the descriptions made by Henry de Ponthieu, who collected in the West Indies about 1778. The entries made by the amanuenses in many cases are descriptions transcribed from contemporary or earlier botanical publications, Linnaeus's *Species Plantarum*, Plukenet's *Opera Omnia Botanica*, Miller's *Gardeners Dictionary*, etc. It is possible to find in some volumes manuscript slips, sometimes folded ones, where the writing is not that of the persons mentioned above and which cannot be matched elsewhere. There are, however, one or two slips written by Johann Gerard Koenig (1728–85) and in the volume entitled '*Cellular Cryptograms*' there are manuscript notes of Ernst Ludwig Heim (1747–1834) concerning the genera *Hypnum* and *Jungermannia*; only one example (Vol. **20** : 519–521) has been found with Banks's writing.

It would seem that the manuscript slips served primarily as a descriptive catalogue of the plants contained in the Sloane and Banksian Herbaria, but no explanation has yet been found for many omissions. There are numerous cases where no slips are to be found for well-known Linnaean genera although specimens from the Banksian Herbarium are to be found in the department's collections. It has likewise been noticed that there are no slips written by Solander for the plants collected by Johann Reinhold Forster and his son Georg, naturalists on Captain Cook's Second Voyage (1772–75). A set of plants was presented to Banks on their return, specimens are in the herbarium mounted on sheets endorsed by Solander, but no corresponding slips in his handwriting are to be found in his catalogue. Just a very few slips in Dryander's handwriting refer to some of these specimens.

Whilst on the voyage of the *Endeavour*, 1768–71, Solander wrote manuscript descriptions of the plants collected; these have been subsequently bound into several small quarto-sized volumes; no books of descriptions have been found for plants collected in Madeira and Brazil. Some of the descriptions were also copied by Solander on to slips for subsequent inclusion in his Manuscript Slip Catalogue. The original descriptions copied on to catalogue slips are those of the plants collected at Brazil, Terra del Fuego, New Zealand and the Pacific Islands. There are only a few slips for the plants collected in Java and South Africa and only a very few have been found for the many plants collected in Australia: these are in Solander's handwriting, with one only in Bacstrom's handwriting. The original descriptions in the bound volumes that have been copied on to slips can be recognized by a vertical line of red ink drawn through those copied. On some of the slips referring to New Zealand specimens, Solander has only copied out short diagnoses, and full descriptions have been completed by Spöring. Many of these slips have the abbreviation 'Fig. Pict.' referring to the illustrations made by Sydney Parkinson, the artist who accompanied Banks and Solander on the voyage.

The unbound loose manuscript slips were first arranged according to the second edition of Linnaeus's *Species Plantarum* (1762–63). Names of genera and page numbers referring to this work are in most cases written sideways on the left-hand side of the slips that precede the descriptions of most genera. The original numbering has been crossed out and a second series of numbering substituted that refers to Reichard's *Linné Systema Plantarum, Ed. Nov.* (1779–80). Later again the *Systema Plantarum* numbering has been crossed out and a third series of numbers substituted. These numbers, which still remain, refer to the pagination of five volumes of a further edition of the *Species Plantarum*, Willdenow's edition, 1797–1810. The copies of these three works, formerly contained in the library of Sir Joseph Banks, are interleaved copies with copious annotations by amanuenses employed by Banks, with notes, additions and amendments by Dryander (Fig. 20).

The annotated editions of Linnaeus's *Species Plantarum*

The manuscript annotations in the books mentioned above have been considered by some people in the past to be in the handwriting of Dryander and this assumption has appeared in several publications. By comparing bona fide writing of Dryander with the annotated books in question it becomes quite apparent that the writing is not entirely that of Dryander. In Linnaeus's *Species Plantarum*, 2nd ed., there are many entries by Dryander, some by Sigismund Bacstrom, a few by amanuensis B, but much of the handwriting is Herman Spöring's (Fig. 31).

In Reichard's *Linné Systema Plantarum* most of the handwriting is thought to be that of Samuel Törner (Fig. 46), with further entries by John Swan. Törner's writing appears on the reverse sides of many Banksian herbarium sheets, but has not been recognized elsewhere. In the Willdenow edition of Linnaeus's *Species Plantarum* the writing of four different amanuenses has been recognized: John Swan (Fig. 42) and amanuenses F (Fig. 57), G (Fig. 58) and H (Fig. 59); the writing of amanuenses F, G and H has not been identified elsewhere.

Most of the annotations are to be found in Linnaeus's *Species Plantarum*, 2nd ed., and in Reichard's *Linné Systema Plantarum*, but in the Willdenow edition of *Species Plantarum* they are much less numerous, especially in the later volumes. It seems that these interleaved and annotated books aimed at providing a short description of all plants hitherto described, coupled with place of publication. The pages of the later volumes in the two latter works have been renumbered in manuscript so as to provide a continuous enumeration. In Reichard's *Linné Systema Plantarum*, renumbering starts at the beginning of Vol. **2** : 778 and in Willdenow's edition of *Species Plantarum* likewise at the beginning of the second volume (p. 1569). The numbers on the spines of the Solander Manuscript Slip Catalogue, however, refer to the renumbered pages of Willdenow's edition of Linnaeus's *Species Plantarum* as do the numbers used in a manuscript index that accompanies the 23 volumes.

The index to Solander's Manuscript Slip Catalogue and Willdenow's edition of *Species Plantarum*

Accompanying the 24 volumes of Solander's Manuscript Slip Catalogue is a manuscript index of generic names obviously prepared by an amanuensis (J) (Fig. 61) many years after Solander's death. The watermark in the paper of some of the pages reads 'T. Edmonds, 1810'. This index was apparently compiled as a means of quick reference to genera published in Willdenow's edition of *Species Plantarum* and also served as an index to the slips in the Solander manuscript catalogue. Some additional names have been included and these seem to be of Australian genera, many of them being names published by Brown in his *Prodromus Florae Novae Hollandiae* (1810). Just a few generic names published in *Species Plantarum* are unaccountably absent from the index and a few of Solander's unpublished manuscript names are included.

In the index, numbers following most of the generic names of angiosperms and gymnosperms refer to the renumbered pagination of Willdenow's edition of *Species Plantarum* and numbers following the names of cryptogamic genera refer to the renumbered pagination of Reichard's *Linné Systema Plantarum*. There are, however, additional names in the index not published in any of the works mentioned above. The numbers following these names refer to the interleaved pages where sometimes there are to be found very short manuscript descriptions inserted near the names of closely related genera. The index is in two parts, the first part being alphabetical and the second according to the Linnaean system.

Sir Joseph Banks's scientific staff

It is perhaps not generally realized that Banks maintained a staff of workers engaged in the extensive library and herbarium that adjoined his residence in Soho Square, London. In the Linnaean Correspondence at the Linnean Society of London is a letter from James Lee, the horticulturalist of Hammersmith, written to Linnaeus and dated 4 October 1776. In this letter, Lee says: 'Mr. Banks's herbarium is certainly the greatest and I believe the best that was collected. It is the daily labour of many servants to paste them on paper and Banks and Solander spend 4 or 5 hours every day in describing and arranging them.' Also, Dr A. G. Uggla (1944) refers to Jonas Dryander 'remaining a member of Sir Joseph's scientific staff until his own death'.

Comprehensive biographical accounts of Robert Brown (Ramsbottom, 1932), Dryander (Uggla, 1944) and Solander (Rauschenburg, 1968) have already been published. It seems desirable, however, to give just a few facts concerning Robert Brown who became the first Keeper of Botany at the British Museum. On the recommendation of Banks, Brown, who in 1801 was already a keen and able botanist, was appointed as naturalist to go on the voyage of HMS *Investigator*. Under the captaincy of Matthew Flinders the *Investigator* circumnavigated the continent of Australia (New Holland), Brown making extensive collections of plants from the south, east and north coasts. The *Investigator* was condemned as unseaworthy and as a result Brown remained at Sydney (Port Jackson) until 1805. He made more collections during his stay in the vicinity of Sydney, and also during a visit of several months to the island of Tasmania (Van Diemen's Land).

Many of the plants he collected were described by him whilst on the voyage. The descriptions were written on folded slips of paper in the same fashion as the manuscript slips of Solander. Many hundreds of these slips are contained in 77 'Solander Cases' now in the Botanical Library of the museum. When in 1805 he returned to England he continued describing his Australian plants deposited in Banks's Herbarium at Soho Square. In 1810 his *Prodromus Florae Novae Hollandiae* was published and in the same year Banks's curator-librarian, Jonas Dryander, died and Brown was employed by Banks as Dryander's successor. When in 1820 Banks died, he bequeathed to Brown his herbarium, library and the lease of 32 Soho Square where Brown resided until his own death in 1858.

In 1827, however, Brown arranged with the Trustees of the British Museum for the transference of the entire Banksian Library and collections to the British Museum at Bloomsbury. With the transference completed, Brown became Keeper of 'Sir Joseph Banks's Botanical Collections' or 'The Banksian Department', which later, in 1856, was termed the Department of Botany.

Sir Joseph Banks's amanuenses: Spöring, Bacstrom, Törner and Swan

It has been possible to obtain only scanty biographical details of Spöring, Bacstrom, Törner and Swan already mentioned as being secretaries or amanuenses employed by Banks.

According to Beaglehole (1962, **1** : 27), the father of Herman Diedrich Spöring 'was a professor of medicine at the University of Abo [now Turku] in Finland and like so many of the learned, a correspondent of Linnaeus. The son was born about 1730: he was a student at Abo from 1748 to 1753 going afterwards to Stockholm for a course in surgery. He must have sought his fortune in London and become known there, and he must have become an able naturalist, as did other men in medicine. Banks seems to have engaged him as a sort of secretary. A grave thinking man as he was later called by his employer.'

On 1 December 1768, Solander, writing in Swedish from Rio de Janeiro, added a postscript in the margin of a letter sent to Linnaeus in Uppsala which reads: 'P.S. A son of the late Prof. Spöring of Abo is with me here, as a clerk; his name is Herman Diedrich, went to sea from Sweden in 1755, and for eleven years lived in London as a watchmaker. For the past two years he has been employed by me as a clerk.' This confirms the date of his engagement by Solander to be the year 1766 as mentioned in his Report to the Trustees of the British Museum. Solander's letter was reproduced by Uggla (1955 : 62–64) and a translation of the marginal note into English is given in the addenda and corrigenda to Beaglehole (1955).

Sigismund Bacstrom, considered to be a Swede, was employed by Banks in 1772. He accompanied Banks and Solander on their voyage to Iceland in the same year as surgeon and secretary, and remained in Banks's service until 1775. Bacstrom fell on hard times in subsequent years and addressed several letters to Banks requesting his help (Fig. 32). These letters are contained in the Banksian correspondence at Kew, and lengthy extracts with a few biographical details are included in an article by James Britten (1911).

Bacstrom's writing is to be found in transcripts, annotations, lists, indices and on herbarium sheets that were once included in the Banksian Herbarium (Fig. 37). Much confusion, however, has occurred in the recognition of Bacstrom's writing, and quite different styles of writing have wrongly been attributed to him.

Reference to Samuel Törner is made in a letter among the Banksian Correspondence at the British Museum, Bloomsbury (B.M. Add. MS 8098.96–98). The letter, dated 9 October 1792, is from Olof Schwartz to Banks, recommending Törner, an M.A. of Uppsala University, for appointment in Banks's Library and Herbarium. In the Dryander Correspondence (p. 123) in the Botanical Library is another letter from Schwartz, dated 17 October 1792, addressed to Dryander (Fig. 44). The letter introduces Törner and Schwartz says: 'It shall make me happy to find Sir Joseph happy with him.'

Another letter among the Banksian Correspondence (B.M. Add. MS 2290.35) dated 21 October 1797 is from George Chalmers, Clerk to the Board of Trade. In this letter, Chalmers requests Banks to assist Dryander to 'obtain a passport for a Swedish gentleman from Gothenburg who is coming as an assistant in the library at Soho Square in succession to Törner, who left in the summer'. It has not been possible to find out who this gentleman was or whether or not he was engaged by Banks.

A request for samples of Törner's handwriting was sent by the Botanical Library to the University of Uppsala, which obliged by sending a Xerox copy of a letter written by Törner (Fig. 45). The letter, dated 14 November 1793, was sent to Sweden from the Soho Square address. The writing in this Xerox copy has been compared and equated with writing on the reverse of many Banksian herbarium sheets (Fig. 47). As already stated, the handwritten entries in the Banksian interleaved copy of Reichard's *Linné Systema Plantarum* are considered to be in Törner's handwriting (Fig. 46).

The identity of another of Sir Joseph Banks's amanuenses is revealed by letters contained in the Banksian Correspondence. A recently examined letter at the British Museum, Bloomsbury (Add. MS 3379, p. 223) addressed to Sir Joseph Banks is dated 28 November 1793 and signed by John Swan. In this letter Swan informs Banks of a long period of unemployment and distress and in order to recover certain sums due to him, it necessitated his going to Scotland. He concludes the letter with these words, 'I could humbly hope that the business in which you have been pleased to employ me may be delayed till my return, and then that I might again be employed to finish it'.

Among the Banksian manuscripts contained in the University of Reading General Library, is a further letter addressed to Sir Joseph Banks, dated 12 April 1799 and signed by John Swan (Figs 39–40). In this letter Swan says: 'Sir, you are pleased to mention that a part of the catalogue yet remains to be transcribed, would you also be pleased to employ me to finish the copying or in any other way, hardly anything should interrupt my unremitting attention to your business.' Banks's scribbled reply accompanies this letter: 'Sir, The copying you mention has been done by another person ever since you left me and is now on the point of being finished. J. B. April 12.'

The very neat handwriting in these two letters has been equated with the writing on many of the interleaved pages of Banks's copies of Reichard's *Linné Systema Plantarum* (1779–80) (Fig. 41) and Willdenow's edition of *Species Plantarum* (Fig. 42), and also with the writing in an incompleted index to '*Koenig Manuscripts*' (Fig. 43). These manuscripts, bequeathed to Banks in 1785, contain Koenig's description of plants of India, Ceylon and Siam.

Transcripts of Solander's original descriptions

Contained in the Department of Manuscripts at the British Museum, Bloomsbury, is Solander's '*Report of Progress in the Natural History Departments 1764–1768*' (Add. MS 45874 which is reproduced here from a microfilm), and it becomes apparent from the report dated 13 February 1765 that his manuscript catalogue was started soon after his previous report in September 1764. He states in his February 1765 report that he 'has been employed in writing names to and forming a catalogue of the Several Plants that are contained in Desmarets, Kiggelaers, Hermannus's, Oldenland's and Meerseveens Hortus Siccus chiefly collected in Africa'. Later, in the report dated 22 February 1766, he reports that 'Dr. Solander has continued in making the catalogue of plants. He has employed a man to copy out his manuscript notes of the catalogue, and doth still employ the same; but as this man cannot be of use to D. Solander in anything else, the Doctor has agreed with another who has skill in Natural History and whose assistance D. Solander is to have immediately after next Easter.' In the further reports, it is not revealed if this man 'who has skill in Natural History' was eventually employed.

However, in the Botanical Library of the British Museum (Natural History) is a bound folio manuscript with the title on the spine '*Solander Descriptions of Plants*', and in the Catalogue of the Library (British Museum, 1915) it is catalogued as '[Descriptions of Plants from various parts of the World, copied out by S. Bacstrom.] *foll. 218*'. This manuscript is definitely not in the handwriting of Bacstrom, who was employed by Banks from 1772–75, but is in the handwriting of the man referred to by Solander in his 1766 report to the Trustees of the British Museum (f. 8) as being employed 'to copy out his manuscript notes of the catalogue'. The entries are a word-for-word copy of Solander's descriptions contained in his slip catalogue, and the handwriting is undoubtedly that of Herman Diedrich Spöring (Fig. 28) who a few years later in 1770 accompanied Banks and Solander as secretary or draughtsman on Cook's First Voyage. Included in this transcipt are copies of Solander's descriptions of plants contained in various Horti Sicci in the Sloane Herbarium as mentioned by him in his report to the Trustees of the British Museum (1765 : f. 4 and 1766 : f. 9). From South Africa the collections of Desmarets, Kiggelaer, etc., and from North America the collections of Bartram, Catesby, Ellis, Garden, Jones, Vernon, etc.

Solander's determination labels for the plants described are in the various Horti Sicci mentioned.

It has been noticed that many of the slips in Solander's catalogue that describe plants contained in the Sloane Herbarium have a symbol that looks like the capital letter L occurring about halfway down the left-hand side. It has been discovered that the descriptions on these marked slips are those that have been copied by Spöring. It has also been found that numbers beneath most of the species names in the transcript agree with the same numbers used on Solander's slips and refer to species numbers used by Linnaeus in Linnaeus's *Species Plantarum*, 2nd ed. (1762). Some of the descriptions, however, have names of species without numbers, and for these there are no corresponding slips in the Solander catalogue. It seems likely that the original slips have been lost or destroyed. A complete and useful manuscript index has been appended in more recent times at the end of this folio and, therefore, in many instances this index is the only way of finding an unpublished Solander description.

In addition to copies of Solander's descriptions of just a few of the plants contained in the Sloane Herbarium, the transcript contains copies of short diagnoses copied from publications available at that period, such as Plukenet's *Opera Omnia Botanica*, and the 1753 and 1762 editions of Linnaeus's *Species Plantarum*. These short diagnoses are in some cases modified, amplified and sometimes completely revised, and some of them have been entered by Spöring on the appropriate page of the interleaved copy of *Species Plantarum*.

Transcripts and fair copies of Solander's descriptions of plants collected on Cook's First Voyage

A lot of misunderstanding has arisen over the years regarding the transcripts and fair copies of Solander's descriptions of plants collected on Cook's First Voyage, and mistaken ideas regarding them have been published by well-known and respected authorities. Original mistakes have been copied, even added to, and passed on by word of mouth. Mistakes are concerned with why, where and when these transcripts and fair copies were made and the identity of the amanuenses. Much of the misunderstanding stems from the published opinions of James Britten, a member of the staff of the Department of Botany from 1871 to 1909.

Britten's handwriting appears on the front end folios of transcripts, fair copies, original Solander descriptions and elsewhere in several other books and manuscripts. The few words or short paragraphs concerning the contents of these books and manuscripts have been taken as gospel truth and quoted by past and present colleagues and by many notable visitors who have been consulting the various works. Belief in the correctness of his manuscript entries in the Solander descriptions and transcripts has perhaps been strengthened by the fact that these entries agree with and are in some cases copies of the words he has used in the introduction prefixing *Illustrations of Australian Plants* (Britten, 1900–5). This introduction was later reproduced as an article entitled 'The collections of Banks and Solander' in the *Journal of Botany* (Britten, 1905).

Although most of the information given in the introduction to this fine work and also some of that given by Britten on the various front end folios is undoubtedly correct, attention should be drawn to several mistakes and misunderstandings. On the second page of the introduction Britten writes 'the descriptions, with the exception of the Australian plants, had been transcribed by him [Solander] for the press'. There are two mistakes in this statement, the first of which concerns the fact that none of the transcripts or fair copies are in Solander's handwriting. Facsimile reproductions of pages from the fair copy of the Pacific Island plants have been published by Merrill (1954 : 194, 344) and by Stafleu (1970 : 234) and are wrongly attributed to Solander presumably on account of Britten's statement.

In the Catalogue of the Library (British Museum, 1915) the transcripts and fair copies of *all* the original Solander descriptions are wrongly attributed to Bacstrom, and on one of the front end folios of the fair copy dealing with the plants of Madeira, Rio de Janeiro and Terra del Fuego, Britten has pencilled his mistaken identification 'Transcript by Sigismund Bacstrom'. This folio volume, and likewise the one of transcribed descriptions of plants of the Society Islands, is undoubtedly in the handwriting of Spöring (Fig. 30) and was written during the first part of the voyage of HMS *Endeavour*. The fair copy of descriptions of the plants of New Zealand *is* in Bacstrom's handwriting (Fig. 33) and must therefore have been written after the voyage. These three immaculately written folio volumes have been carefully prepared and the descriptions of Solander have been classified according to the Linnaean System. Species described by Solander as being new species are given a page reference without indication to any published work. It has been found that the page references are to the interleaved copy of Linnaeus's *Species Plantarum* taken on the voyage and into which have been entered short diagnoses copied from his manuscript slips. These prepared fair copies, entitled '*Primitiae Florae*', unfortunately never reached publication as intended.

James Britten on the second page of his introduction has made another mistake in stating that 'A similar enumeration of the Java plants was begun but only extended to 28 pages'. Thirty-one pages of foolscap manuscript have recently come to light in a box of mixed manuscripts in the Departmental Library. The paper folder enclosing these pages bears the following title '*Commencement of a Systematic Enumeration of the Plants Collected in Cook's 1st. Voyage, by Dr. Solander*'. This title is in the handwriting of James Bennett, who was Robert Brown's Assistant at the British Museum, and who succeeded Brown as Keeper of the Department of Botany. Beneath this title Britten has the single word 'Java' enclosed in brackets. This is a mistake, for although some of the plants collected in Java are included, so are plants from other of Banks's and Solander's collecting localities. The 31 pages are exactly as Bennett states, a commencement of a systematic enumeration of the plants collected, and not as Britten implies, a commencement of a '*Primitiae Florae*' of the plants of Java similar to those prepared by Spöring and Bacstrom. Transcriptions of Solander's descriptions of plants from all of the collecting localities on the voyage that come within Classis 1 of the Linnaean System (Monandria Monogyna) appear to have been completed. The first three pages and a few words at the top of p. 4 are in Solander's handwriting and from p. 4 to the top of p. 28 the handwriting is that of Bacstrom. On p. 28 a commencement has been made on transcribing Solander's descriptions of plants included in the Linnaean Classis II (Diandria Monogyna); these transcriptions have been continued by Dryander on pp. 29, 30, and 31. It would seem that a complete enumeration was envisaged for all of the plants collected on Cook's First Voyage.

The unclassified descriptions of the Australian plants have been transcribed into two small quarto-size volumes and are not by one person as stated by Britten (1905). The first 238 pages of volume one are by an unknown amanuensis (amanuensis A), (Fig. 48), whilst the remainder of the volume and all of the second volume are by another amanuensis (B), (Fig. 50). In both of these two volumes dealing with Australian plants, Britten has pencilled in published names beside the manuscript names provided by Solander. Banks and Solander specimens are usually to be found in the herbarium with these names pencilled on the sheets by Britten. The descriptions of the plants of Java have been copied in a similar fashion into a small quarto-sized volume also by amanuensis B, but Britten has not supplied published names for these. In the Botany Library there is another transcript of Solander's descriptions of the Australian plants collected by Banks and Solander; these were copied into two folio volumes by Robert Brown and were taken by him on the voyage of HMS *Investigator* to Australia in 1801.

A transcript by amanuensis B (Fig. 51) of Solander's descriptions of eight plants from the Cape of Good Hope accompanies the original descriptions in a small quarto-sized volume; both are entitled '*Plantae Capenses*'. In the same volume is a systematic list by Solander entitled '*Index Plantarum Capensium*' which contains approximately 370 names. It is doubtful if descriptions of more than eight of the plants collected were ever drawn up by Solander who, while at the Cape, was 'confined to his bed or chamber' (Banks's Journal for 31 January 1771 in Beaglehole, 1962).

The second statement by Britten that the descriptions had been transcribed 'ready for the press' has generally been accepted, probably on account of Britten's reputation. Merrill's reproduction (1954) of the title-page of Solander's '*Primitiae Florae Pacifici*' has an explanatory footnote in which he says the descriptions were 'transcribed and to a good extent made ready for the press by Bacstrom'. As already mentioned, this transcript is not by Bacstrom but by Spöring. The statement '*made ready for the press*' implies being made ready for the printer, and on p. 329 Merrill (1954) says that the clear copy was 'prepared for the printer'. Stearn (1969) goes a bit further and says that Solander's text was 'carefully marked for the printer'. Much of this misunderstanding perhaps could have originated from the misinterpretation of the word 'press'.

Rauschenberg (1964 : 66) has published a translation called 'A letter of Sir Joseph Banks describing the life of Daniel Solander'. In this letter sent to Clas Alströmer in Sweden in 1784, Banks gives an account of his association with Solander during the voyage of the *Endeavour*. The following extract is most informative: 'When a long journey from land had exhausted fresh things, we finished each description and added the synonyms to the books we had. These completed accounts were immediately entered by a secretary in the books in the form of flora of each of the lands we had visited. Before we arrived home, the florulae of Madeira, Brazil, Tierra del Fuego, the islands of the South Sea, and New Zealand were finished and in the presses. The descriptions of the small island Savon and the island of St. Helena were also finished; however, the death of our amanuensis was the reason they were not in fair copy when we climbed onto land.' It is not known if Britten ever saw a copy of this letter. It seems hardly likely that he would have used the words 'transcribed for the press' if he had read the wording contained in this letter – 'the florulae . . . were finished and in the presses'. Banks's statement, it is thought, applies to the putting of the finished manuscript sheets between cheek-boards and placing them in a press secured by a screw or with straps. It could also perhaps mean that the finished manuscripts were put into a cupboard with shelves, also known as a press. It seems certain that the 'press' has nothing to do with a printer. Publication of these '*Primitiae Florae*' was, of course, envisaged and these fair copies were no doubt a stage in that direction, but they are hardly in a state of readiness.

The extract from Banks's letter given above is indeed very informative. It establishes that some of the '*Primitiae Florae*' were prepared from Solander's descriptions whilst on the voyage and explains why it is that descriptions of plants collected during the latter part of the voyage were not copied in a similar fashion and are written in a different handwriting after the voyage. It also indicates that it is Spöring's handwriting in the '*Primitiae Florae*' of Madeira, Brazil (Fig. 30), Tierra del Fuego and the Pacific Islands, that it is Spöring's writing on many of the slips in Solander's Manuscript Slip Catalogue for these countries (Fig. 29) and also his writing of the short diagnoses copied into the interleaved copy of Linnaeus's *Species Plantarum* (Fig. 31) which must have been taken on the voyage. It has been ascertained that Banks took a small library on board the *Endeavour* but little is known about the contents. The volumes of the interleaved copy of *Species Plantarum* are not stamped on the end pages or title-pages with Banks's stamp (the two words 'Jos. Banks' enclosed within a small rectangle) but only with the official stamps of the British Museum and the British Museum (Natural History). It seems more than likely that these volumes were not taken from Banks's library, but were Solander's contribution. This seems to be substantiated by some of the interleaved pages having diagnoses, copied in Spöring's handwriting, from Solander's Manuscript Slip Catalogue of plants from various parts of the world (North America, South Africa, etc.). These entries must have been made during the two years prior to the voyage of the *Endeavour* when Spöring was engaged by Solander.

Although the name of Spöring is not mentioned in Banks's letter and he refers only to a 'secretary' and an 'amanuensis', it seems clear that it could not have been any other member of the staff that accompanied him on the voyage. Beaglehole (1962 : 27) in his introduction to Banks's Journal states that Banks 'seems to have engaged him as a sort of secretary', and in a footnote 'James Roberts (Banks's servant) in his "journal" lists "Armon Dedrich Sporing" as Banks's svt. [servant] writer'; and Parkinson refers to 'Mr. David [sic] Sporing, clerk to Mr. Banks'. In Banks's Journal for the 13 November 1770 (Beaglehole, 1962 : 191), Banks, in describing a period of convalescence spent at a 'Countrey House' at Batavia, made the following entry 'Dr. Solander being much better and in the Drs. opinion not too bad to be removed we carried him down to it [the 'Countrey House'] and also received from the ship Mr Spöring our writer'. Beaglehole's footnote to this entry reads, ' "Our writer": this argues that Banks and Solander used Spöring as a secretary, as well as an assistant naturalist and draughtsman'.

Contained in a large folio in the Department of Manuscripts at the British Museum, Bloomsbury, (Add. MS. 15507) are drawings and sketches made on the voyage of the *Endeavour*. The ink writing on the pencil sketches of the coastline of New Zealand can be equated with that in the works mentioned above and confirms that all are the work of Herman Diedrich Spöring.

Lists of plants collected on Cook's First Voyage

Entries enclosed in square brackets in the Catalogue of the Library (British Museum, 1915) are those where the information has 'been supplied'. A number of entries entitled 'Solander (D. C.) [Botanical Manuscripts]' in Vol. 5 (1915) are enclosed by the brackets, and the supplier of information to the compilers of the catalogue was undoubtedly James Britten. Some of these entries have been found not to be entirely correct, for example the wrong attribution of transcripts to Sigismund Bacstrom. One of the entries reads 'Manuscript lists of Plants collected during Capt. Cook's first voyage, in the order in which they were placed in the drying books for carriage home'. A somewhat similar entry was made by Britten on one of the front end folios of this folio volume and on another of these pages he wrote: 'This volume should be broken up and distributed among the other vols. of Banksian [sic] MSS. to which its contents relate. The place of the various lists will be easily recognised if the volumes be consulted. J. B. Feb. 1918.' It would have been less misleading if Britten had written 'Solander MSS. formerly in the Banksian Library'. Only some of these lists have recently been broken up and distributed as suggested by Britten. The plants collected at Madeira, Rio de Janeiro, Tierra del Fuego and 'Islands' (Society Islands) are listed in Banks's handwriting, the plants from New Zealand, Australia, Java and St Helena are listed by Solander.

The plant names listed by Banks are classified in a systematic order, followed by references to the second edition of Linnaeus's *Species Plantarum* giving page and species number for those plants recognized as Linnaean species. The number of the 'book' in which each plant was placed follows each name and then the number of specimens gathered. These classified lists by Banks have not been distributed into appropriate volumes as suggested by Britten but still remain bound together. The lists in Solander's handwriting give only the names of the plants placed in each of the numbered 'books'. (Dryander has, at some later date, added to and corrected many of the original Solander names.) These lists by Solander now accompany the descriptions in the various quarto volumes.

The word 'book' used by Banks is perhaps rather misleading. It would perhaps be better to use the words 'quires' or 'bundles'. In the Department of Botany there still exist two of the original bundles in which the plants were placed for 'carriage home'. The smaller bundle (No. 15) from Otaheite still contains a few fragments of the four plants listed by Solander: *Daphne coriacea*, *Vaccinium alaterioides*, *Oxalis* and *Cassytha filiformis*. The larger bundle No. 3 from Madeira still has several complete specimens remaining between the pages. The quires or bundles are made up of once-folded sheets of thin paper 16″ × 20″ (41 × 51 cm) on which are printed pages from *Notes upon the Twelve Books of Paradise Lost* and are tucked one within the other and not sewn into the form of a book. This paper, probably obtained from a printer, must have been taken on the voyage. The words 'drying books' seem to have been coined by Britten, but it is hardly likely that these quires of thin paper were used for the drying of freshly gathered plant material; had they been used for this purpose they would surely be stained or show plant traces; it seems therefore that they were taken on the voyage for the purpose of storing the dried specimens. Drying paper of the period was an absorbent brown or greyish-coloured paper of varying thickness.

Solander's manuscript lists relating to plants of the Cape

A small quarto-size manuscript volume of 118 pages entitled '*Flora Capensis*' is perhaps likely to cause some perplexity. On the title-page Britten has made the following entry: 'D. C. Solander. Catalogue of plants from the Cape of Good Hope, including those collected by Banks and Solander on Capt. Cook's First Voyage (March and April 1771) as well as those previously described'. These same misleading words are given in the Catalogue of the Library (British Museum, 1915).

Some of the plants listed could well have been acquired by Banks and Solander; no indication of any of these is given. The names listed are all of plants described before the date of the voyage (1768), the majority being referred to the second edition of Linnaeus's *Species Plantarum* (1762–

63). Names followed by the abbreviation 'Mscr.' are of Cape plants described by Solander from material in the Sloane Herbarium as mentioned above and therefore it seems most likely that this list was made by Solander before Cook's First Voyage.

A manuscript list, also by Solander, entitled '*Plantae Capenses non adhuc rite cognitae sed quarum figurae extant*' (Cape plants up to the present not sufficiently, (rightly) known but of which illustrations exist) was, until recently, bound into one volume with the '*Flora Capenses*' mentioned above. The binding was obviously not done during Solander's lifetime but at a later date, the two lists probably being bound together for economy reasons; these two lists are now bound separately. Both are considered to be 'checklists' made by Solander and taken on the voyage for reference when the *Endeavour* called at the Cape of Good Hope on the homeward passage. Solander, who had always been interested in the plants of the Cape, must have been very disappointed when he was confined to his bed by illness for three of the four weeks stay at the Cape.

Another manuscript list by Solander is entitled '*Index Plantarum Capensium*' and includes about 360 names. In the '*Journal of Sir Joseph Banks*' (made during the voyage) Banks states that during the month spent at the Cape he did not have 'an opportunity of even making one excursion owing in great measure to Dr. Solander's illness'. Britten (1920) was aware of this journal entry by Banks (he mentions it in his article on early Cape collectors) but on the title-page of '*Index Plantarum Capensium*' he has made the following entry: 'Systematic list of the Cape plants collected by Banks and Solander as they were preserved in the drying books in which they were brought home'. It seems most unlikely that 360 were gathered without even one excursion; some of the species listed are known not to occur in the vicinity of Cape Town. The Botanic Garden there could perhaps have yielded a few, but, according to Banks, two small squares only were set apart for living plants.

In Beaglehole (1955), in vol. **1** of the journal of Captain Cook, 'The Voyage of the Endeavour', there is included in a footnote (p. 466) the statement: 'while so many others were convalescing or drawing near their end: Lieutenant Gore, with only one attendant, a slave belonging to Mr. Brand, a Burgher at the Cape Town, made an excursion, out of curiosity, to the top of the table-hill, where they saw several tigers and wolves, and brought some curious plants, in flower which he presented to Mr. Banks, to whom they were very acceptable'. It is quite possible that Banks's servants James Roberts and Peter Briscoe collected plants as well, but there seems to be no record of this.

Probably the most acceptable explanation of so many plant names being listed in the '*Index Plantarum Capensium*' is that the specimens could well have been given by, or purchased from, Johann Andreas Auge, the Superintendent of the Botanic Garden at the Cape. Britten (1920) refers to a President's Address read before the South African Philosophical Society in 1886 by Professor MacOwan. In the Address (MacOwan, 1887) referring to botanical collections at the Cape, reference is made to Auge collecting together a large herbarium and 'other sets of exsiccata of small extent appear to have been prepared by him for sale or gift to distinguished visitors touching at the Cape on the homeward voyage'.

A limited search has been made in the General Herbarium of the Department of Botany at the British Museum (Natural History), London, for some of the specimens listed but only a few have been found. What has happened to the missing specimens is a matter of conjecture. On those sheets that have been found, the endorsements on the reverse side of some of them reads 'Prom. b. Spei 1771 B. & S.', and on others just 'Prom. b. Spei' without a date or authority. The handwriting on all of the sheets has been recognized as that of Sigismund Bacstrom who was employed by Banks in 1772, the year after the return from the voyage. If it was a prepared exsiccata without collectors' names being specified, Bacstrom apparently put the same endorsement on all the sheets that Banks had acquired at the Cape.

Solander, who had been interested in Cape plants before the voyage, rather surprisingly only prepared Latin descriptions of eight of the specimens listed in the '*Index Plantarum Capensium*'. These eight descriptions are given the title 'Plantae Capenses' and a transcript of them has been made by amanuensis B (Fig. 51).

A folio manuscript of 179 pages by Solander entitled '*Florula Capensis*' was seemingly intended as a complete list in systematic order of all the Cape specimens in the Banks's Herbarium. Every plant name is followed by a collector's name, abbreviated to the initial letter and preceded by either the capital letters M or B or both: referring apparently to the herbaria of Francis Masson and of Banks.

Apart from the specimens attributed to Banks, who was at the Cape for one month in 1771, the majority of the specimens are attributed to the collections of Masson who was there from 1772 for three years. The other collectors indicated, Oldenburg, Auge, Robertson and Thunberg, were also at the Cape at about the same time as Masson and made several excursions into the interior together. Oldenburg, according to MacOwan (1887), like Auge, prepared exsiccata for sale and Banks purchased a thousand of these in 1772. It seems therefore that this '*Florula Capensis*' was prepared by Solander in the seventeen seventies and is a record of the content of the Masson Herbarium, those purchased from Oldenburg, and the plants acquired by Banks at the Cape. A limited search has been made for some of the specimens listed and attributed to Masson and the other collectors, but only some are to be found. Of those located, the endorsement on the reverse of the herbarium sheets is that of Bacstrom in every instance. Bacstrom seems to have dealt with all the collections mentioned in the Cape manuscripts.

Flora of Iceland

A small quarto of 90 pages entitled '*Flora Islandica*' is included in the Catalogue of the Library (British Museum, 1915) with a note that it is 'A list, by S. Bacstrom, with notes by Solander, of the Plants collected by Banks and Solander on their visit to the Island in 1772'. This list is certainly in Bacstrom's handwriting but is *not* a list of the plants collected. The catalogue of plants collected is believed to be a short six-page list in Solander's handwriting, entitled '*Specimina Plantarum Islandiae*' which until recently was bound in with '*Manuscript list of plants collected during Captain Cook's First Voyage*', where it has probably been overlooked. The six pages give the names of 153 plants that were contained in four bundles. This list is now included in '*Plantae Islandicae et Notulae Itinerariae*' (Fig. 9).

Babington (1870) in his paper on the flora of Iceland says: 'In the same year (1772) Dr. Dan. Solander accompanied Sir Joseph Banks to Iceland, where he collected plants. A considerable number of these specimens are preserved in the British Museum, perhaps all of them. He made a catalogue of the plants observed in Iceland by the party, and in many cases noted their localities. The catalogue is kept in the botanical department of the British Museum, and is entitled 'Flora Islandica;' it seems to contain the names of some plants not gathered during the journey of Sir J. Banks, but derived from the Floras of König and Zoega.'

Although Babington did not recognize the handwriting in the catalogue as that of Bacstrom who accompanied Banks and Solander to Iceland, but mistakenly says that Solander made the list, he was apparently correct in noticing that it contained names of plants not collected, but only observed. Hermannsson (1928 : 14) correctly says the handwriting is Bacstrom's (Fig. 34) but mistakenly remarks that the 'Flora of Iceland' is a list of plants collected.

Bacstrom's writing in catalogues, books, etc.

There is in the Department of Botany at the British Museum (Natural History), London, a very cumbersome relic of Captain Cook's First Voyage: a very large and heavy 'elephant folio' (13″ × 22″ and 6″ thick) (33 × 56 × 15 cm) entitled '*Plants of Capt. Cook's First Voyage 1768–1771*'. This 'Pocket Book' (Beaglehole, 1962 : 149) contains small carefully mounted voucher specimens of the plants collected by Banks and Solander at Madeira, Rio de Janeiro, Tierra del Fuego, the Society Islands and New Zealand. These specimens are duplicates separated from the larger specimens which were incorporated in Banks's Herbarium and are now in the General Herbarium in the Department of Botany. As Beaglehole (1962) mentions in a footnote: 'These voucher specimens assume critical importance for certain monocotyledons where the principal specimen was damaged or lost during World War II.' It is interesting to note that the manuscript names on the strapping of each glued-down specimen are in Bacstrom's handwriting and therefore this folio must have been prepared after the voyage.

Bacstrom's writing is also present in several transcripts, books and lists not already mentioned. In a folio volume bound in vellum entitled '*Catalogue of Drawings of Plants of Cook's First Voyage*', most of the plant names are in Bacstrom's handwriting with insertions by Dryander (*Utricularia*, *Mesembryanthemum*) and a few by Solander. The drawings from which copper plates were prepared have the names of engravers written against them in Solander's handwriting.

Riddelsdell (1905 : 290) wrongly attributed the transcript of Lightfoot's Journal, now in the Department of Botany, to Solander; likewise a transcript of 'Samuel Brewer's Journey through Wales in 1726–7'. Britten later realized that neither of the transcripts is in Solander's handwriting, and in an article devoted to Sigismund Bacstrom (Britten, 1911 : 92), he explained how he was able to equate the handwriting in the two transcripts with bona fide writing contained in Banks's correspondence at Kew.

In the same article Britten states that Bacstrom is responsible for transcribing marginal annotations in Sir Hans Sloane's copy of Ray's *Historia Plantarum* into Sir Joseph Banks's copy. This is only partly correct, in fact less than one-third of Vol. **1** (pp. 60–364) has been annotated by Bacstrom (Fig. 35), the remainder of that volume and all annotations in Vol. **2** are by another amanuensis (C) (Fig. 52). Vol. **3** is annotated throughout by Dryander (Fig. 16).

A further example of Britten's misinterpretation is to be found in the case of Thunberg's *Flora Capensis*. Britten (1920 : 44–45) writes: 'We have also a manuscript volume in Dryander's hand entitled "Caroli Petri Thunberg . . . Flora Capensis" which appears to be a transcript of an earlier and unpublished version by Thunberg of his *Prodromus*. Of this transcript we have also a copy by Sigismund Bacstrom in which Dryander's notes are incorporated and which also contains notes by Salisbury.' Britten correctly identified the handwriting of Dryander in the small octavo transcript which is not an author's original as stated in the Catalogue of the Library (British Museum, 1915). The copy he mentions is neither by Bacstrom nor by Dryander as stated in the Catalogue. The handwriting in this copy is large and widely spaced (Fig. 54) and can be recognized among other writings in another folio manuscript entitled '*Day Book Banks Herbarium*' (Fig. 55). As it has not been possible to find the name of this amanuensis, he is here referred to as amanuensis D.

Britten's statement that the copy contains notes by Dryander and Salisbury is an exaggeration. There are no 'notes' by Dryander; by searching through the manuscript only eight instances have been found where Dryander has subsituted differing specific epithets. Salisbury's 'notes' consist of only one small note (leaf 48) concerning a species of *Erica*.

The '*Day Book Banks Herbarium*'

The '*Day Book Banks Herbarium*' is perhaps a rather misleading title on the spine of a folio manuscript of 165 pages that has apparently not hitherto been catalogued. This manuscript is without an original title or title-page, the title on the spine probably being given at the time of its being bound. It is not, as might be expected, an account of the day-by-day activities of Banks's Herbarium. This manuscript, covering the period 1777–96, seems to be a catalogue of the plants sent to the Banksian Herbarium for identification, including plant material fresh from Kew, from the Apothecaries' Garden at Chelsea and from well-known gardeners of the period: James Lee, Dr Fothergill, the Earl of Bute, etc. The entries are mainly by Solander and Dryander; many of them are accompanied by an answer to the sender's queries or by a request for further or better material. Banks's writing appears only on p. 20 and Britten has made a marginal note to this effect. On pp. 10, 42 and 61 Britten has, however, misidentified the handwriting, his pencilled marginal note stating it to be the handwriting of Bacstrom. The writing is in fact that of the unknown amanuensis (D) (Fig. 55) responsible for the copying of Thunberg's *Flora Capensis* as mentioned above.

Appendix 1: Manuscripts in the Department of Botany

Lists of the manuscripts, etc., in the Department of Botany where the handwriting of Banks and his staff and amanuenses are to be found. An asterisk (*) indicates an original description of a plant in manuscript.

Joseph Banks

'*MS. Notes on Useful Plants.*' Fig. 3. Most of the notes are by Banks but the following notes are by Solander: 6, 8, 11, 19, 22, 23, 24, 28, 31, 32, 34.

MS lists (Bound)

'*Plants of Newfoundland.*' 1766.

MS lists (Unbound)

Systematic Catalogue of the plants collected at Madeira, Brazil, Tierra del Fuego and the Society Islands.' The names of the plants collected by Banks and Solander have been listed in systematic order by Banks. References to the second edition of Linnaeus's *Species Plantarum* are given to all previously published species. Also given is the number of the bundle or 'book' in which each specimen was placed and the number of specimens collected.

Included in '*Plantae Australiae*' (New Zealand) is a catalogue of the contents of the numbered bundles of plants. The contents of bundles XLVIII–LXIII have been catalogued by Banks.

List of 38 New Guinea plants included in '*Index Plantarum Novae Hollandae*' (Solander).

'*Catalogue of the plants sent over by the brethren of the unitas Fratrum residing at Tranquebar received Sept. 1775.*' (First 23 entries on p. 1 verso and all recto are by S. Bacstrom.) Fig. 1.

Catalogue of plants headed '*Koenig 1776*'. Fig. 2.

'*Catalogue of Plants* (*Bobart*) *1689*'.

Solander's Manuscript Slip Catalogue, **20** : 519–521. Endorsements on the reverse sides of many herbarium sheets formerly in the Banksian Herbarium. Fig. 4.

Daniel Carl Solander

* Solander's Manuscript Slip Catalogue. Solander's handwriting is the most prevalent throughout the twenty-four volumes. Figs 5–7. Perhaps nearly as many descriptions, etc., are by his successor Jonas Dryander. There are also numerous entries by amanuenses.

Solander's determinations in the Sloane Herbarium. **H.S. 74** and **246:** (bound together) Maryland Plants, Jones, Kreig and Vernon. **H.S. 75:** plants gathered by Dr Hermann at the Cape of Good Hope. **H.S. 77** and **78:** (bound together) Meerseveen, Plants of the Cape of Good Hope. **H.S. 156:** Oldenland. Hortus Siccus Capensis. **H.S. 158:** Petiver. Hortus Siccus Americ. **H.S. 212:** Catesby. Carolina Plants. **H.S. 214–218:** Kiggelaer's Cape Plants (including Van der Stell). **H.S. 225–226:** Kiggelaer's collection. **H.S. 261:** Desmaret's plants from Cape of Good Hope.

'*MS Notes on Useful Plants.*' Most of the notes are by Banks, but the following notes are by Solander: 6, 8, 11, 19, 22, 23, 24, 28, 31, 32, 34. Fig. 12.

Endorsements on the reverse sides of many herbarium sheets formerly in the Banksian Herbarium. Fig. 15.

* '*Plantae Terra del Fuego.*'

* '*Plantae Otaheitenses*', * '*Plantae Insularum Oceani Pacifici*'. These two separate volumes of Solander's descriptions are bound into a single volume and are followed by two alphabetical indexes and two catalogues. The first index, in Solander's and Spöring's handwriting, lists the plants described from Otaheiti (George Land) and from the neighbouring islands of Huahine and Ulhietea (Raiatea). According to a note by Solander at the end of this index, a symbol in the form of a short horizontal line preceding some of the plant names is an indication that those plants were 'found' at Huahine and Ulhietea. Only 25 plants are described from these two islands yet the symbol is against most of the entries in the index. This seems to indicate that many of the plants collected on the island of Otaheiti were found or observed on the neighbouring islands but not collected from them. The second alphabetical index, completely in Spöring's handwriting, is a combined index listing the plants described from both Otaheiti and the neighbouring islands, with references to page numbers. The first catalogue lists the plants of Otaheiti, giving the botanical

name followed by the vernacular name and gives page numbers. The second catalogue lists the contents of the numbered bundles of dried specimens.

* '*Plantae Australiae*' (New Zealand). Solander's Vols **1** and **2** bound into a single volume with an alphabetical index. Fig. 11. Also included is a catalogue of the contents of the numbered bundles of dried specimens, the last few pages of the catalogue in Banks's handwriting (Books XLVIII–LXIII).

* '*Plantae Novae Hollandiae*'. Solander's Vols **1** and **2** bound in one volume. Vol. **2** includes systematic and alphabetical indexes with some of the writing in the former by Spöring. A simplified index has been included in more recent times. Interpolated between the two original indexes is a list of 38 New Guinea plants in Banks's writing. Also included is a catalogue of the contents of the numbered bundles of dried specimens.

* '*Plantae Javanenses.*' (Includes a systematic index and a more recent alphabetical index.)

'*Flora Capensis.*'

'*Index Plantarum Capensium*', * '*Plantae Capenses.*' (Bound in one volume.)

'*Plantae Capenses non adhuc rite cognitae sed quarum figurae extant.*' Fig. 8.

* '*Plantae Insulae Stae. Helenae.*'

* '*Plantae Islandicae et Notulae Itinerariae.*' Fig. 9.

'*Florula Indiae Occidentalis.*' This systematic list includes plants from northern South America as well as Panama and the West Indies. Pp. 1–10 and 17–194 are by Solander; pp. 11–15 and 194–231 are by Dryander. Included is an appendix and a supplement entirely by Dryander. The catalogue has brief notes about the plants, an occasional locality name, and collectors' names abbreviated mostly to an initial letter.

'*Florula Capenses.*' This is similar in layout to '*Florula Indiae Occidentalis*' and seems to be a complete list of all the South African plants contained in the herbaria of Joseph Banks and Francis Masson.

MS lists (Bound)

'*Catalogue of Plants collected on Capt. Cook's Third Voyage.*' Plantae Insula Desolationis, Plantae Terra Diemens, Plantae Novae Zealandae, Plantae Insulae Modoo, Plantae Insularum Otakootaia and Palmerston, Plantae Insulae Amicorum, Plantae Insularum Societatis, Plantae Tzchutski, Plantae Kamscatkenses, Plantae Macao (incomplete), Plantae Pulo Condore.

'*Catalogue Hort. Reg. Paris.*' 1777. Figs 13, 14. Concluding 21 pages only are in Solander's handwriting, the first 68 pages being by Dryander.

'*Flora Islandica.*' Popular names and numbering by Solander; scientific names in Bacstrom's writing.

MS list (Unbound)

* '*Seeds from the South Sea 1780.*' This is a list of the seeds collected on Captain Cook's Third Voyage. It is in two parts; a list of 27 recipients of seed, followed by a list of numbers (1–386) against which are many plant names. The list is divided under geographical headings so that all gatherings from each collecting area are grouped together.

'*Madera Plants collected 1776 by Mr. Francis Masson and sent home in July.*'

Jonas Dryander

Catalogus Bibliothecae Historico-Naturalis Josephi Banks 1798. This interleaved copy has many annotations and additional entries by Dryander.

*Solander's Manuscript Slip Catalogue. A considerable proportion of the catalogue slips are written by Dryander. Fig. 18.

MS lists (Bound)

'*Index to the Species of the Larger Genera in Willdenow's Edition of Linnaeus's Species Plantarum.*' 1797–1810. Fig. 17.

Index to an interleaved copy of R. Brown's *Prodromus Novae Hollandiae*. 1810.

'*Catalogus Hort. Reg. Paris.*' 1777. The first 68 pages are in Dryander's handwriting, concluding 21 pages by Solander.

'*Florula Indiae Occidentalis.*' Fig. 19. See Solander.

'*Index to the species described by Nikolaus von Jacquin.*' This index lists in systematic order the species described and illustrated in the following works: *Enumeratio Stirpium Plerarumque, quae Sponte Crescunt in Agro Vindobonensi, Montibusque confinibus*, 1762; *Observationum Botanicarum Iconibus ab Auctore Delineatis Illustratarum*, 1764–71; *Hortus Botanicus Vindobonensis, seu Platarum rariorum quae in Horto Botanico Vindobonensi*, 1770–76; *Florae Austriacae, sive Plantarum Selectarum in Austriacae Archiducatu sponte crescentium, icones*, 1773–78; *Miscellanea Austriaca ad Botanicam, Chemiam et Historiam Naturalem Spectantia*, 1778–81. Dryander's index gives no. of volume, page no. where species are described and the illustration numbers. In *Flora Austriacae* Dryander has pencilled the names of the species beneath each illustration.

'*Drawings and MSS. of Jacquin.*' Dryander has pencilled the species name in the margins of the pages in this folio volume.

MS lists (Unbound)

List and notes in Vol. **1**, '*Hermann's Herbarium*'.

'*Plants sent by Prof. Pallas, 1779.*'

'*Plants collected in Africa Septentrionalis by Fr. Masson, 1783.*'

'*Plants collected in Lusitania and Hispania by Fr. Masson, 1783.*'

List of the genus *Erica*.

List '*Massonii Flora Maderensis*'.

Critical notes on *Amomum, Kaemferia*, etc.

Notes on '*Swartz's Observationis Botanicae quibus Plantae Indiae Occidentalis*'. 1791.

Notes on C. F. Gmelin's C. a Linne *Systema Vegetabilium* **1**. 1796.

Descriptions and notes on *Pelargonium anceps* Hort. Kew, *Protea mellifera* Hort. Kew, and *Nemesia chamaedrifolia* Hort. Kew.

Notes entitled '*Parasites on roots*'.

Included in the '*Catalogue of Drawings of Plants of Cook's First Voyage*' is a list in Dryander's handwriting of drawings 'Engraved' and 'to be engraved'.

Transcript

Caroli Petri Thunberg '*Flora Capensis*'.

Endorsements on the reverse sides of many herbarium sheets formerly in the Banksian Herbarium. Fig. 21.

'*Resé – Journal 1773–1810.*' This small octavo diary written in Swedish by Dryander lists in chronological date order, very briefly, places visited between the years 1773–1810. The diary is divided into four parts. The first lists the places visited in Sweden from January 1773–July 1777 and his first two years in London; the three other parts list places in and around London and the home counties.

ROBERT BROWN

* Robert Brown's Manuscript Slip Catalogue contained in 77 'Solander Cases'. This catalogue contains Brown's original descriptions of specimens in his own herbarium and many of the specimens in the Banksian collection. Fig. 26.

MS lists (Bound)

* '*Manuscript descriptions of plants in the Edinburgh Botanic Garden etc. 1792–1793.*' Fig. 22.

* '*Observations made in a Botanical journey to the Highlands 1793.*'

'*Gaelic Names of British Plants.*'

* '*Descriptions of Plants 1794–1798.*'

* '*R. Brown's Diary 1800–1801.*' Figs 23–25.

'*Diary of Flinder's Voyage 1801–1805.*'

* '*Descriptionum Plantarum Novae Hollandiae.*'

'*Herbarium Novae Hollandiae.*'

'*Lists of Tasmanian Plants.*'

* '*Descriptions of Kents Islands Plants.*'

'*Introduced Plants to Port Jackson.*'

'*Plantae Rariores Port Phillip.*'

'*Primitiae Florulae Vicinitatis Fluvii Derwent.*'

'*Flora Occidentalis Portus Jackson N.C. Australia & Hunter River.*'

* '*Timor Plants.*'

'*Flora Madeira.*'

* '*Species Filicinum.*'

* '*Arctic and Antarctic Plants.*' (Descriptions and lists.)

* '*Contents of The Sherard Herbarium.*'

* '*Notes on the Collections of Oudney & Clapperton.*'

* '*Notes on the Collections of Salt in Abyssinia.*'

* '*Notes on the Collections of Sturt.*'

* '*Notes on Smith's Congo Collection.*'

'*Herbier de Loureiro.*'

'*Observations on the Class Tetradynamia of the Linnean Herbarium.*'

'*Memoranda Respecting the Banksian Herbarium and Library Copied from Notes in Sir Joseph Banks's Writing in a Folio Book which he Began in the Year 1777.*'

* '*Descriptionis Plantarum Capentes b. Spei.*'

* '*Notes on Horsfield's Java Plants.*' (Includes descriptions.)

'*Horsfield. Papers on the Flora of Java.*' Included in this bound folio are four lists in Brown's handwriting of Javanese plants presented by Thomas Horsfield to Sir Joseph Banks during the years 1814–16.

MS lists (Unbound)

List of sketches of Plants and Animals made during the Voyage of His Majesties Ship Investigator and subsequently at Port Jackson and Norfolk Island by Ferdinand Bauer.'

'*Primitae Florulae Terra Del Fuego.*'

'*Dr. Russels Abysinian Plants.*'

'*East India Plants from Dr. Roxburgh.*'

List entitled '*Mungo Park*'.

'*T. E. Bowdich. List of Plants from Ashante and Gabon.*'

Two manuscript lists: '*Filices in Herb. Mus. Brit*', '*Palmae in Herb. Mus. Brit.*' (i.e. the herbarium of Sir Hans Sloane).

Three manuscript lists of the '*Plants collected by George Caley in Australia, 1799–1810.*' 1. '*Mr. George Caley's New Holland Plants (including Norfolk Island) bought at the Sale of his Plants and Books. 19th June 1829 (by Christie).*' 2. '*Plants receiv'd to be kept and paid for.*' 3. '*Plants to M. Delessert.*'

Included in the '*Catalogue of Drawings of Plants of Cook's First Voyage*' is a list in Brown's handwriting entitled '*Catalogue of Engraved Copper Plates in the Presses in the Engravers Room (under the inner Library or Herbarium).*'

'*The Banksian Department Accessions and Donations Register 1836–1869.*' 260 pp. Brown's writing is only on pp. 5–11 of this bound folio register of manuscript entries. The remainder of the entries in the first half of the book are in the handwriting of Brown's assistant J. J. Bennett, who succeeded Brown as Keeper of Botany in 1859.

Transcripts

'*Plantae Novae Hollandiae.*' Transcription of Solander's '*Plantae Novae Hollandiae*' (2 Vols). Transcribed from Solander's descriptions. A selection only, with some descriptions incomplete.

'*Primitiae Florulae Terrae Del Fuego.*'

Sigismund Bacstrom

Transcripts

'*Primitiae Florae Nova Zealandiae.*' Transcribed from Solander's MSS. Fig. 33.

'*Lightfoot's Journal of a Botanical excursion in Wales 1773.*'

'*Samuel Brewer's Botanical Journey through Wales 1726.*'

Raii Historia Plantarum. 1686–1704. (Banks's copy.) Annotations transcribed from those in Sir Hans Sloane's copy. Vol. **1** : 60–364. Fig. 35. (The last few entries at bottom of p. 364 and remainder of Vol. **1** transcribed by amanuensis C.)

Annotated books

Linnaeus's *Species Plantarum*, 2nd ed., 1762–63. Occasional entries in both volumes. Fig. 36.

MS lists

'*Flora Islandica.*' Scientific plant names only.

'*Catalogus Plantarum in America observatarum W. M. Houston.*' (Lower half of p. 35 is Bacstrom's handwriting.)

'*Catalogue of Plants sent over by the brethren of the unitas Fratrum residing at Tranquebar. Received Sept 1775.*' (All of page 1 recto and first 23 entries on verso. Remainder scripsit J. Banks.)

'*Catalogue of Drawings of Plants of Cook's 1st. Voyage.*' (Plant names only; insertions and corrections by Solander and Dryander).

Solander's Manuscript Slip Catalogue. **1** : 718–719, 751. **2** : 375, 384–386, 440, 456–457, 461–462. **3** : 577–580. **5** : 643–645. **7** : 84–85, 316–319. **8** : 150, 306–307, 319–321, 324–325, 794–795. **12** : 57–60, 69A–70. **14** : 243–250, 280–281, 511–516. **15** : 413–424. **18** : 237–242, 251–262, 283–286, 585–600. **19** : 267–269, 285–292, 297–305, 311–316.

'*Plants of Cook's First Voyage.*' 1768–71. This large volume contains representative material of plants collected on the voyage. The plant names are in the handwriting of Bacstrom, with only a few by Solander.

Endorsements on the reverse sides of many herbarium sheets formerly in the Banksian Herbarium, and identifications on such sheets. Fig. 37.

Three letters addressed to Sir Joseph Banks dated June 1786, June 1791 and August 1791 respectively. (Xerox copies. Originals in Royal Botanic Gardens, Kew.)

Samuel Törner

Annotated books

Reichard's *Linné Systema Plantarum. Ed. Nov.* 1779–80. (All three volumes.) Fig. 46.

Endorsements on the reverse sides of many herbarium sheets formerly in the Banksian Herbarium. Fig. 47.

Letter dated 14 November 1793 addressed to Per. Fabian Aurvillius in Sweden. (Xerox copy. Original in the Library of the University of Uppsala.) Fig. 45.

Herman Diedrich Spöring

Transcripts

'*Primitiae Florae Maderensis, Brasiliensis, Terra del Fuego.*' Fig. 30.

'*Primitiae Florae Insularum Oceani Pacifici.*' (Both of the above transcribed from Solander's MSS.)

'*Solander Descriptions of Plants.*' Fig. 28.

Solander's Manuscript Slip Catalogue. Fig. 29. **1** : 220, 226–228, 284, 322–325, 373, 376–377. **2** : 116–117, 152–153. **3** : 172, 368–369. **5** : 116–117, 230–232. **6** : 81, 524–525, 724–725. **7** : 600–603, 620–621. **8** : 40–41, 44–45, 680–681. **9** : 156–157, 494–495. **10** : 106, 180–181, 208–209, 234–235, 268–269, 436–439. **12** : 5–7, 15–18, 53–56, 127–129, 343–346. **13** : 476–478. **14** : 102–103. **15** : 359–360. **16** : 304–305. **17** : 232–233. **18** : 142–145, 368, 534–536. **19** : 85–87. **20** : 66–71, 460–463, 466–467. **21** : 232–235, 428–431, 433–437.

Annotated books

Linnaeus's *Species Plantarum*. 2nd ed. 1762–63. Throughout both volumes. Fig. 31.

MS lists

Two alphabetical indexes included in Solander's '*Plantae Otaheitenses*' 1. '*Index Speciminum Plantarum Insulae Otaheite reliquarumque Insularum Oceani Pacifici.*' (Spöring's and Solander's handwriting.) 2. '*Index Speciminum Plantarum Insulae Otaheite.*' (All Spöring's handwriting.)

Alphabetical index included in Solander's '*Plantae Novae Hollandiae*'. '*Index Plantarum Novae Hollandiae*'. (All Spöring's handwriting.)

John Swan

MS lists

'*Index Manuscr. Koenigii*'. (A list of the subjects treated, followed by a list (incomplete) of genera and species.) Fig. 43.

Annotated books

Reichard's *Linné Systema Plantarum. Ed. Nov.* 1779–80. Fig. 41.
2 : 41, 56, 59, 94, 350, 452, 454, 603, 665, 666. **3** : 23, 39, 41, 70, 107, 125, 126, 141, 183, 184, 219, 233, 253, 261, 274, 283, 351, 425, 494, 514, 528, 565, 568, 623, 649, 653, 664, 674, 676, 696, 772, 792. **4** : 33, 35–41, 129, 134, 182, 185, 186, 503, 504, 507.

Willdenow's edition of Linnaeus's *Species Plantarum.* 1797–1810. Fig. 42.
1 (1) : 285, 310, 328, 344, 360, 402, 408, 424, 427, 455, 460. **1** (2) : 552, 556, 646, 781, 874, 898, 1098, 1176, 1240, 1336, 1390, 1431, 1480, 1512, 1536. **2** : 12, 16, 46, 76, 209, 211, 216, 310, 316, 317, 348, 414, 448, 480, 520, 570, 610, 616, 640, 705, 728, 960, 1320, 1323.

Amanuensis A

Transcripts

'*Plantae Novae Hollandiae*.' Transcribed from Solander's MSS **1** : 1–238. Fig. 48. (Latter part of **1** and all of **2** is by amanuensis B.)

Amanuensis B

Annotated books

Linnaeus's *Species Plantarum*. 2nd ed. 1762–63. A few entries at beginning of Vol. **1**.

Transcripts

'*Plantae Novae Hollandiae*' Transcribed from Solander's MSS **1** : 239–270; all of **2**. Fig. 50. (First 238 pages in Vol. **1** are by amanuensis A.)

'*Plantae Javanenses*.' Transcribed from Solander's MSS.

'*Plantae Capenses*.' Fig. 51. Transcribed from Solander's MSS.

Solander's Manuscript Slip Catalogue. Fig. 49. **1** : 53. **3** : 564–565, 674–675. **4** : 414–415. **5** : 563. **12** : 5–7, 15–18, 128–129. **14** : 289. **15** : 600–601. **16** : 54. **20** : 532–534.

All of the handwriting in volume entitled '*Solander MSS. transcribed by S. Bacstrom*'.

Amanuensis C

Solander's Manuscript Slip Catalogue. Fig. 52. **1** : 775, 788. **2** : 56E, 694, 757, 762. **3** : 613. **4** : 328, 376. **5** : 238, 298, 418. **6** : 340, 391, 462. **7** : 234, 327. **8** : 682. **11** : 172. **12** : 78, 258, 289–292. **13** : 114, 400, 686, 696. **15** : 78, 134, 218, 342, 381, 435, 440. **16** : 252, 360, 386, 484, 670. **17** : 512, 670. **18** : 39. **19** : 615, 617. **20** : 183. **21** : 257–263. **22** : 180.

Annotated books

Raii Historia Plantarum. 1686–1704. (Banks's copy.) Annotations transcribed from those in Sir Hans Sloane's copy. **1** : 364–983. (The last four entries at bottom of page 364 to end of volume.) Fig. 53.

Amanuensis D

MS lists

'*Herbarium ex Insula Maderensis*.'

'*Day Book Banks Herbarium*', p. 42 (18 August 1777) (Fig. 55), p. 61 (5 July 1777), p. 10 (first 4 entries).

Transcripts

'*Flora Capensis*' transcribed from a MS draft of C. P. Thunberg's *Flora Capensis*. Fig. 54.

Amanuensis E

Solander's Manuscript Slip Catalogue. Fig. 56. **1** : 782. **2** : 522–523. **4** : 457–459. **5** : 144, 148, 344, 502, 506, 511–514, 524, 582, 692, 720. **6** : 12, 118, 124, 126, 204. **7** : 106–107, 224–225. **9** : 180–181. **10** : 44–45, 538. **11** : 227, 404, 582, 642.

Amanuensis F

Annotated books

Willdenow's edition of Linnaeus's *Species Plantarum*. 1797–1810. Fig. 57. **1** (1) : 8, 12, 19, 20, 24, 36, 58, 96, 100, 110, 112, 135, 168, 169, 176, 193, 250, 260, 282, 296, 344, 365, 366, 376, 427, 481.

Amanuensis G

Annotated books

Willdenow's edition of Linnaeus's *Species Plantarum.* 1797–1810. Fig. 58. **3** (1) : 128, 142, 143, 144, 145, 187, 252, 295, 296, 297, 384, 430, 442, 488, 552, 554, 596, 609, 795, 818, 832, 833.

Amanuensis H

Annotated books

Willdenow's edition of Linnaeus's *Species Plantarum.* 1797–1810. Fig. 59. **2** : 246. **3** (2) : 945, 953, 954, 968, 1012, 1046, 1117, 1196. **3** (3) : 1547, 1564, 1592, 1596, 1606, 1646, 1661, 1662, 1664, 1707, 1726, 1764, 1791, 1806, 1850, 1854, 1867, 1948, 2022, 2025, 2026, 2054, 2067, 2087, 2122, 2171.

Amanuensis I

Banks's copy of '*Plants of Newfoundland.*' Fig. 60.

Amanuensis J

MS lists

Index to Willdenow's edition of Linnaeus's *Species Plantarum.* 1797–1810. Fig. 61.

Willdenow's edition of Linnaeus's *Species Plantarum*, 1797–1810

1 (1) : 1–495 (1797). Annotated by J. Dryander, J. Swan and amanuensis F.
1 (2) : 497–1568 (1798). Annotated by J. Dryander, J. Swan and amanuensis F.
2 : 1–1340 (1799–1880). Annotated by J. Dryander and J. Swan.
3 (1) : 1–850 (1800). Annotated by J. Dryander and amanuensis G.
3 (2) : 850–1470 (1802). Annotated by J. Dryander and amanuensis H.
3 (3) : 1470–2409 (1803). Annotated by J. Dryander and amanuensis H.
4 (1) : 1–630 (1805). Annotated by J. Dryander.
4 (2) : 631–1157 (1806). Annotated by J. Dryander.
5 (1) : 1–542 (1810). [Not annotated.]

Supplement: Zoology

There are few examples of the handwriting of Sir Joseph Banks and his staff in the Department of Zoology. Details of these in the same form as has been adopted in the main paper are given in this supplement.

Joseph Banks

The handwriting of Banks has been found only on a few slips in the Solander Manuscript Slip Catalogue of animals, mainly in the volume relating to Mammalia.

Daniel Carl Solander

Handwriting of Daniel Solander is dominant throughout the 27 volumes of his bound Manuscript Slip Catalogue of animals and also in his '*Descriptions of Animals Collected on Capt. Cook's First Voyage*'. Lysaght (1959 : 259) recognized that a fair copy of the detailed descriptions was included among the zoological manuscripts. This fair copy is in the handwriting of amanuensis B. All the zoological manuscripts believed to be by Solander were at the time given Sol. Z numbers, Sol. Z1 to Sol. Z10. These numbers were used by Beaglehole (1962 : 150) and other workers on Banks's collections.

Jonas Dryander

In Solander's Manuscript Slip Catalogue of plants there are numerous entries by Dryander throughout all of the 24 volumes, but in the Solander Manuscript Slip Catalogue of animals there are only a few slips that bear his handwriting. On p. 120 of the volume dealing with Mammalia, Dryander records the presence in 1781 of a bottle-nosed whale *Hyperoodon ampullatus* (Forster) [*Balaena rostrata*] in the Thames above London Bridge, 24 feet (7·5 m) in length.

In an interleaved copy of Linnaeus's *Systema Naturae Regnum Animale* there are a few scattered annotations, and also in Dryander's handwriting is a bound octavo volume that catalogues the drawings of animals in the Banksian collections. On some of the drawings Dryander has pencilled an identification of the species illustrated.

Sigismund Bacstrom

In the Department of Botany there are numerous examples of the handwriting of Sigismund Bacstrom who was engaged by Banks as an amanuensis; his handwriting is to be found in annotations, transcripts lists, etc. In the Department of Zoology there is one manuscript list in his writing, a few of the slips contained in Solander's Manuscript Slip Catalogue of animals, and entries in the interleaved copy of Linnaeus's *Systema Naturae Animale*.

Herman Diedrich Spöring

The annotations in an interleaved copy of Linnaeus's *Systema Naturae Regnum Animale*, like those in the second edition of *Species Plantarum*, consist only of short diagnoses of species transcribed from various sources, many with habitat notes and localities added. By far the greater part of these entries are by Herman Diedrich Spöring, naturalist, draughtsman and secretary to Sir Joseph Banks and who accompanied him on Captain Cook's First Voyage. These entries are not by Solander as stated in *A Catalogue of the Works of Linnaeus Preserved in the Libraries of the British Museum* (*Bloomsbury*) *and the British Museum* (*Nat. Hist.*) (*South Kensington*) 2nd ed., p. 11, ref. no. 63 (1933). As Spöring's death occurred on the homeward voyage of the *Endeavour* in 1771, the inclusion of diagnoses of specimens collected on the voyage establishes conclusively that this copy of the *Systema Naturae* was taken by Banks on the voyage; all other entries in Spöring's writing must therefore have been made before the voyage.

G. Wilkins (1955) states that in the Solander Manuscript Slip Catalogue of animals the 'molluscan slips are in Solander's writing and were evidently written at different periods, some neatly, others hurriedly'. The neat writing in Vol. **14** (Corallina) is that of Spöring. During the voyage Spöring made several sketches of fishes and crabs and these are included in the drawings of animals formerly in the library of Sir Joseph Banks. At the British Museum there are his sketches of war canoes and several of parts of the coastline of New Zealand.

Amanuenses B and E

It is regretted that it has not been possible to trace the name of another of Banks's prolific amanuenses here referred to as amanuensis B. His work seems to be concerned mainly with transcripts of Solander's original descriptions of both plants and animals collected on Captain Cook's First Voyage; these transcripts were of course made after the voyage.

Another handwriting that has been recognized in the Solander Manuscript Slip Catalogue of animals is that of amanuensis E who has written just a few slips in the volume *Aves*. The handwriting of this amanuensis is scattered throughout Solander's Manuscript Slip Catalogue of plants; all entries are concerned with species collected in the West Indies.

The annotations in an interleaved copy of Linnaeus's *Systema Naturae Regnum Animale* (1766–67)

Jonas Dryander

380, 405, 431, 464, 502, 504, 516, 522, 532.

Herman Diedrich Spöring

143, 166, 200–261, 264, 276, 334, 337, 364, 373, 392, 395, 398–404, 413, 425, 447, 453, 458, 461, 462, 465, 469–480, 482, 486–494, 509, 529–531, 542–602, 605–608, 610–624, 626–670, 672–674, 676–744, 809–839, 842–868, 901–915, 922–934, 936–948, 950–959, 965–999, 1005–1040, 1051–1054, 1056, 1059–1083, 1089–1098, 1246, 1295, 1296.

SIGISMUND BACSTROM

33, 39, 41, 62, 65, 70, 74, 78, 79, 81, 88, 89, 137, 141, 147, 148, 179, 187, 189, 210, 262, 271, 274, 283, 290, 307, 331, 333, 344, 350, 352, 353, 354, 378, 497, 511, 521, 523, 603, 745, 746, 748, 749, 756, 766, 788, 790, 799, 801, 802, 803, 805, 869, 917, 963, 1003, 1042, 1047, 1055, 1056, 1087, 1108, 1114, 1121, 1131, 1133, 1135, 1136, 1139, 1151, 1159, 1173, 1192, 1196, 1197, 1205, 1212, 1213, 1222, 1223, 1233, 1255, 1259, 1319.

Some pages have more than one handwriting. Sequence from the tops of pages: Spöring, Dryander, Bacstrom: 481. Spöring, Dryander, Spöring: 493. Spöring, Bacstrom, Spöring: 541, 671, 935, 949, 1109. Bacstrom, Spöring: 226, 542, 609, 610, 625, 675, 840, 960. Spöring, Bacstrom: 35. Spöring, Dryander: 396, 485. Dryander, Spöring: 441, 495, 1058. Dryander, Bacstrom: 456. Dryander, Spöring and Bacstrom: 397.

Appendix 2: Manuscripts in the Department of Zoology

Lists of the manuscripts, etc., in the Department of Zoology where the handwriting of Banks and his staff and amanuenses are to be found. An asterisk (*) indicates an original description of an animal in manuscript.

JOSEPH BANKS

* Solander's Manuscript Slip Catalogue of animals. (Sol. Z8.) *Mammalia*: 25, 65, 72–73, 101–104. *Pisces*, Vol. **1**: 193–194, 200–203. *Diptera & Aptera*: 113–125, 192–195, 204. *Neuroptera & Hymenoptera*: 198–201, 233–234. *Hemiptera*: 2. *Coleoptera*: 139.

DANIEL CARL SOLANDER

* Solander's Manuscript Slip Catalogue of animals. Solander's handwriting is manifest throughout the 27 volumes of bound manuscript slips. There are, however, some slips written by amanuenses.

'*Descriptions of the Animals Collected by Sir Joseph Banks and D. C. Solander during Capt. Cook's First Voyage.*' (Sol. Z1.) This single quarto-size volume contains five separate parts: 1, *Pisces Australiae* (New Zealand); 2, *Pisces etc. Novae Hollandiae*; 3, *Pisces and Anim. caetera Oceani Pacifici*; 4, *Animalia Javanensea & Capensia*; 5, *Pisces Islandica* (Banks's visit to Iceland 1772).

JONAS DRYANDER

Catalogus Bibliothecae-Historico Naturalis Josephi Banks. (Mounted copy, folio.) Additional manuscript entries and annotations by Dryander are throughout the two volumes of tom. **2**, zoology, 1796.

MS lists

'*Catalogue of the Drawings of Animals in the Library of Sir Joseph Banks.*' (Octavo, bound.)

'*Catalogue of W. W. Ellis's and J. Webber's Drawings of Birds and Fishes made during Capt. Cook's Third Voyage.*' (Unbound.) (Sol. Z6.)

'*Catalogue of Bird (skins) including those from Banks's Voyage to Labrador in 1766, from Capt. Cook's Voyages, and Masson's Journeys in South Africa, 1772–1775.*' (Unbound.) (Sol. Z4.)

SIGISMUND BACSTROM

Solander's Manuscript Slip Catalogue of animals. (Sol. Z8.) *Mammalia*: 83–87, 105–106, 111–113. *Aves*: 46–48, 85–86, 134–135, 153–156, 216, 230–233.

MS lists

Manuscript notes and emendanda to Ray's *Synopsis Avium* and the mammals in Buffon's *Histoire Naturelle.* (Sol. Z7.)

HERMAN DIEDRICH SPÖRING

Solander's Manuscript Slip Catalogue of animals. (Sol. Z8.) *Mammalia*: 98–110. *Aves*: 185–186. *Pisces*, Vol. **2** : 101–104. *Mollusca* (Corallina), Vol. **14** : 72, 77, 81, 83, 85, 87, 90, 92, 95, 97, 99, 101, 104, 106, 108, 111, 113, 115, 117, 119, 121, 124, 128, 132, 134.

MS lists

Two alphabetical indexes included in Solander's '*Descriptions of the Animals Collected by Sir Joseph Banks and D. C. Solander during Capt. Cook's First Voyage.*' Index to part 1. '*Pisces Australiae*' is completely by Spöring; the first two pages of the '*Index to Pisces and Anim caetera Oceani Pacifici*' (Part 3) are in Solander's handwriting, and the remainder by Spöring.

AMANUENSIS B

Copies of Solander's '*Descriptions of Animals made during Capt. Cook's First Voyage*'. This manuscript of 512 pages (octavo and unbound) was loosely tied together until the 1950s and deals with both invertebrates and vertebrates collected from the *Endeavour*. Many sheets are obviously missing.

Solander's Manuscript Slip Catalogue of animals. (Sol. Z8.) *Mammalia*: 91–95. *Amphibia*: 207–208, 214–215, 217.

Transcripts

The first three parts of Solander's '*Descriptions of the Animals collected during Capt. Cook's First Voyage 1768–1771*' transcribed into a single quarto-size volume.

AMANUENSIS E

Solander's Manuscript Slip Catalogue of animals. (Sol. Z8.) *Aves*: 43–45, 56–57, 218–219.

Acknowledgements

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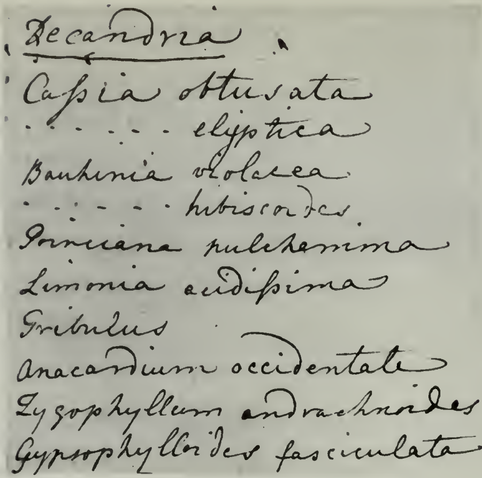
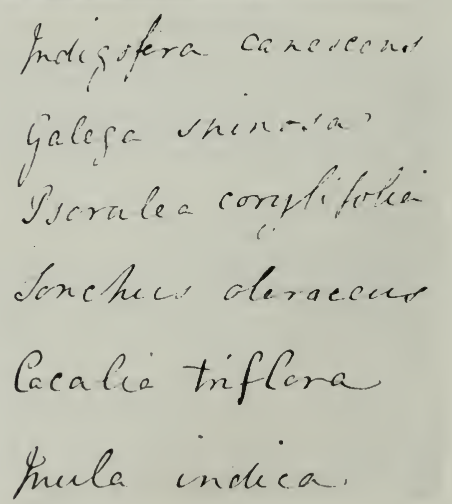

Decandria
Cassia obtusata
. . . . . . elliptica
Bauhinia violacea
. . . . . . hibiscoides
Poinciana pulcherrima
Limonia acidissima
Tribulus
Anacardium occidentale
Zygophyllum andrachnoides
Gypsophylloides fasciculata

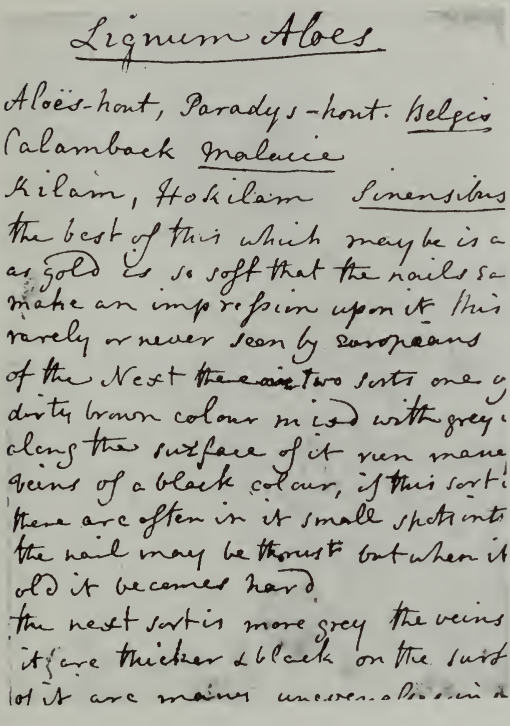
1


Indigofera canescens
Galega spinosa
Psoralea corylifolia
Sonchus oleraceus
Cacalia triflora
Inula indica.

2

Fig. 1 Joseph Banks's handwriting in a list entitled '*Catalogue of the plants sent over by the brethren of the unitas Fratrum residing at Tranquebar received Sept. 1775*'.

Fig. 2 Joseph Banks's handwriting in a catalogue of plants headed '*Koenig 1776*' (with Koenig MSS).


Lignum Aloes

Aloës-hout, Paradys-hout. Belgis
Calamback Malaccie
Kilam, Hokilam Sinensibus
the best of this which may be is a
as gold is so soft that the nails sa
make an impression upon it this
rarely or never seen by Europeans
of the Next there are two sorts one o
dirty brown colour mixed with grey
along the surface of it run many
veins of a black colour, of this sort
there are often in it small spots into
the nail may be thrust but when it
old it becomes hard
the next sort is more grey the veins
it are thicker & black on the surf
lot it are mainy [illegible]

Fig. 3 Joseph Banks's handwriting in '*MS. Notes on Useful Plants*'.

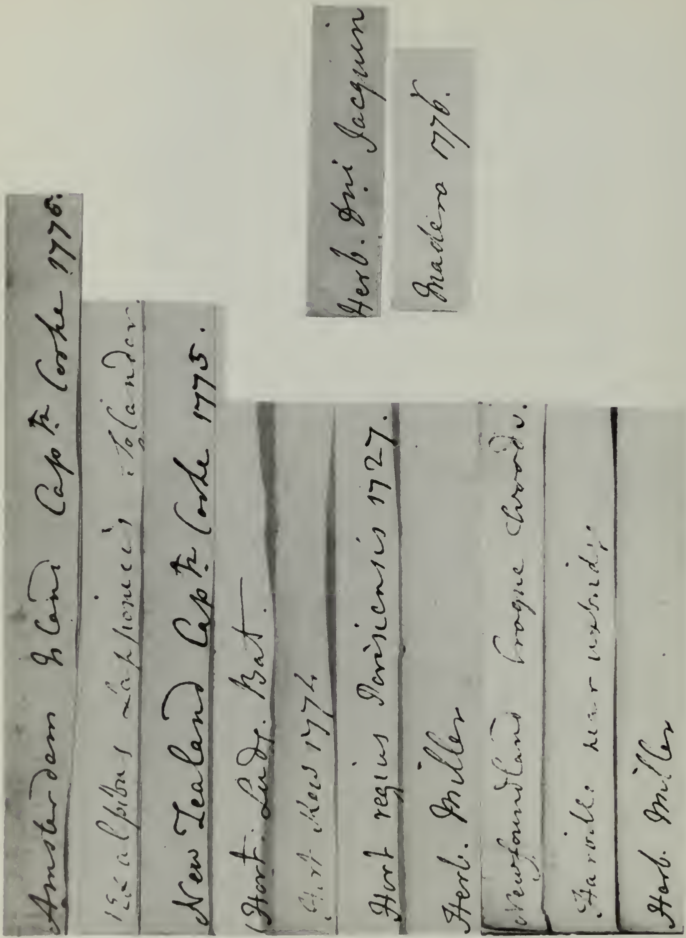
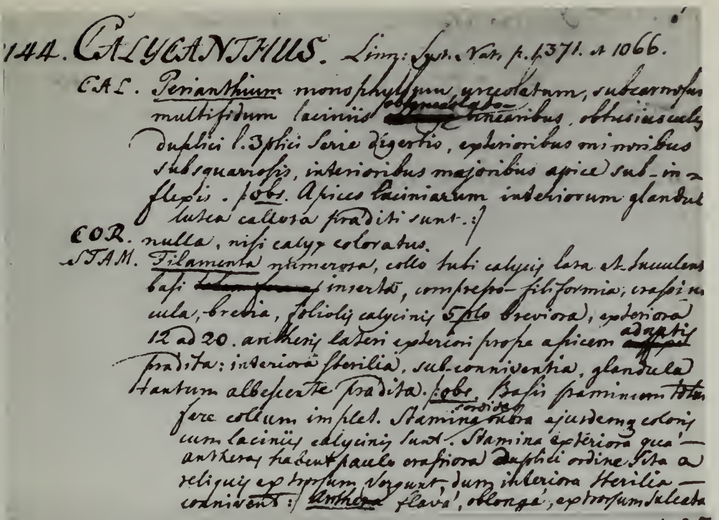
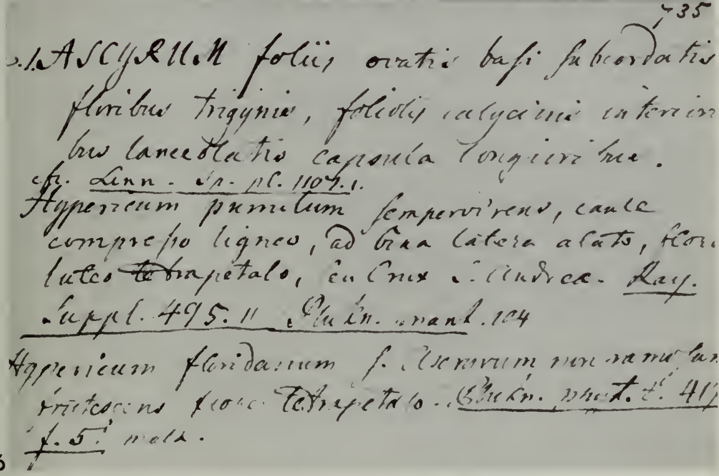


Fig. 4 Joseph Banks's endorsements on the reverse sides of herbarium sheets.



144. CALYCANTHUS. Linn: Syst. Nat. p. 1371. n 1066.
CAL. Perianthium monophyllum, urceolatum, subcarnosum multifidum laciniis lanceolatis linearibus, obtusiusculis duplici l. 3plici Serie digestis, exterioribus minoribus subsquamosis, interioribus majoribus apice sub-inflexis. (obs. Apices laciniarum interiorum glandula lutea callosa praediti sunt.)
COR. nulla, nisi calyx coloratus.
STAM. Filamenta numerosa, collo tubi calycis lata et succulenta basi inserta, compresso-filiformia; crassiuscula, brevia, foliolis calycinis 5plo breviora; exteriora 12 ad 20. antheris latere exteriori prope apicem adnatis praedita: interiora sterilia, sub-conniventia, glandula tantum albescente praedita. (obs. Basis staminum totum fere collum implet. Stamina sordida ejusdem coloris cum laciniis calycinis sunt. Stamina exteriora quae antheras habent paulo crassiora duplici ordine sita a reliquis extrorsum vergunt, dum interiora sterilia conniventia.) Antherae flavae, oblongae, extrorsum sulcatae

5

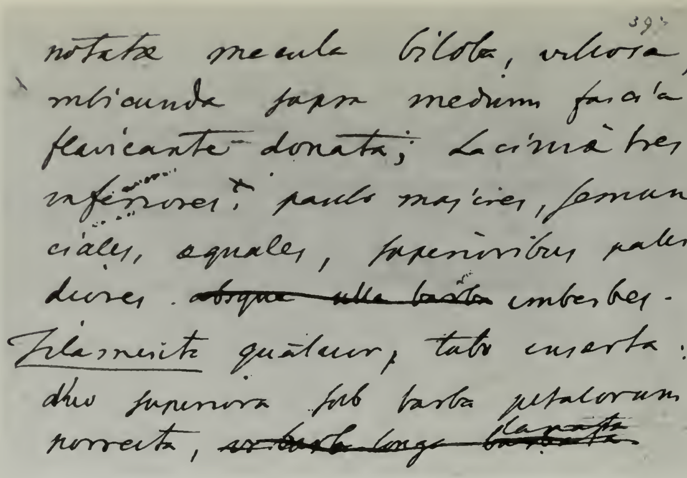


735
1. ASCYRUM foliis ovatis basi subcordatis floribus trigynis, foliolis calycinis interioribus lanceolatis capsula longioribus.
cfr. Linn. Sp. pl. 1107. 1.
Hypericum pumilum sempervirens, caule compresso ligneo, ad bina latera alato, flore luteo ~~te~~ tetrapetalo, e Crux S. Andreae. Ray. Suppl. 495. 11 Pluk. mant. 104
Hypericum floridanum f. Ascyrum non ramosum fruticescens flore tetrapetalo. Pluken. mant. t. 41? f. 5. mala.

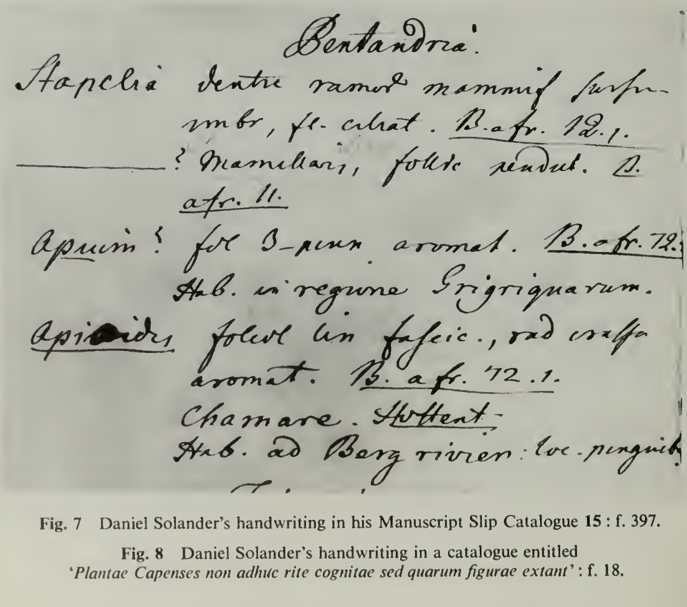
6

Fig. 5 Daniel Solander's handwriting in his Manuscript Slip Catalogue **12** : f. 219.

Fig. 6 Daniel Solander's handwriting in his Manuscript Slip Catalogue **13** : f. 735.


397
notatae macula biloba, villosa,
rubicunda supra medium fascia
flavicante donata; Laciniae tres
inferiores paulo majores, semun-
ciales, aequales, superioribus palli-
diores. ~~absque ulla barba~~ imberbes.
Filamenta quatuor, tubo inserta:
duo superiora sub barba petalorum
porrecta, ~~[illegible] longa [illegible]~~

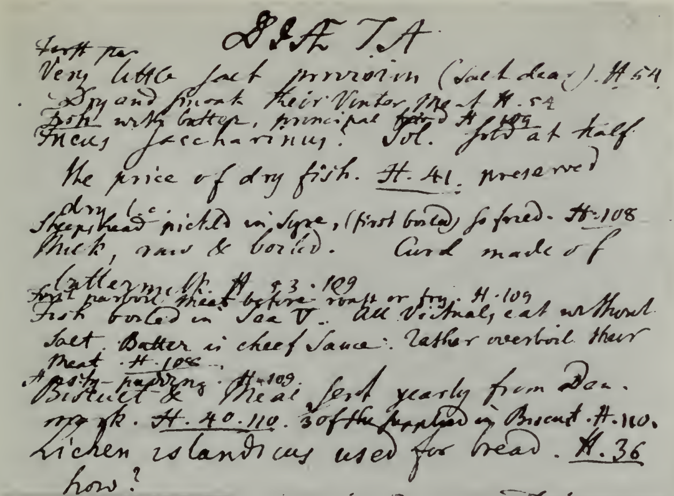
7


Pentandria.
Stapelia dentic ramos mammis super-
umbr, fl. ciliat. B. afr. 12.1.
——— ? Mamillaris, foliis pendul. B.
afr. 11.
Apium? fol 3-pinn. aromat. B. afr. 72.
Hab. in regione Grigriquarum.
Apioides foliol lin fascic., rad crassa
aromat. B. afr. 72.1.
Chamare. Hottent.
Hab. ad Berg rivier: loc. pinguib.

8

Fig. 7 Daniel Solander's handwriting in his Manuscript Slip Catalogue **15** : f. 397.

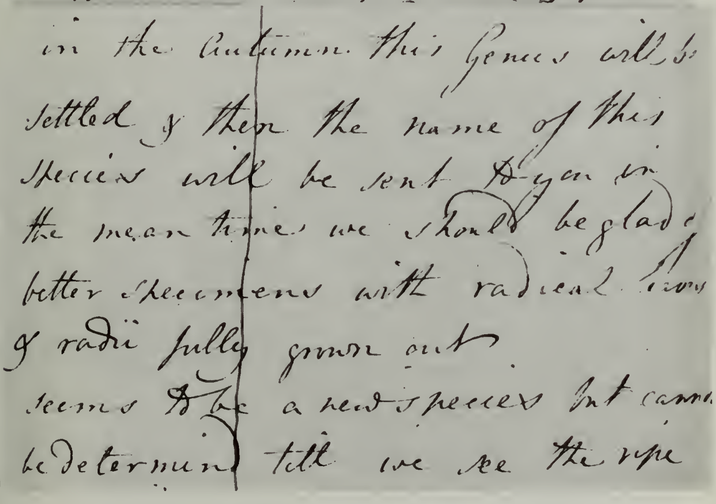
Fig. 8 Daniel Solander's handwriting in a catalogue entitled *'Plantae Capenses non adhuc rite cognitae sed quarum figurae extant'* : f. 18.



DIÆTA

Very little salt provision (salt dear). H. 54.
Dry and smoak their Winter Meat H. 54
Fish with butter, principal food H. 109
Fucus saccharinus. Tol. sold at half
the price of dry fish. H. 41. preserved
dry &c
Sheepshead pickled in Syre, (first boiled) so fried. H. 108
Milk, raw & boiled. Curd made of
buttermilk. H. 43. 109
First parboil meat before roast or fry. H. 109
Fish boiled in Sea W. All Victuals eat without
Salt. Butter is cheef Sauce. Rather overboil their
Meat. H. 108.
A gritty pudding. H. 109.
Bisquet & Meal sent yearly from Den-
mark. H. 40. 110. 3 of the [illegible] in Biscuit. H. 110.
Lichen islandicus used for bread. H. 36
how?

9



in the Autumn this Genus will be
settled & then the name of this
Species will be sent to you in
the mean time we should be glad of
better Specimens with radical leaves
& radii fully grown out.
seems to be a new species but cannot
be determined till we see the ripe

10

Fig. 9 Daniel Solander's handwriting in '*Plantae Islandicae et Notulae Itinerariae*' : f. 46.

Fig. 10 Daniel Solander's handwriting in '*Day Book Banks Herbarium*' : f. 42 (30 August 1777).

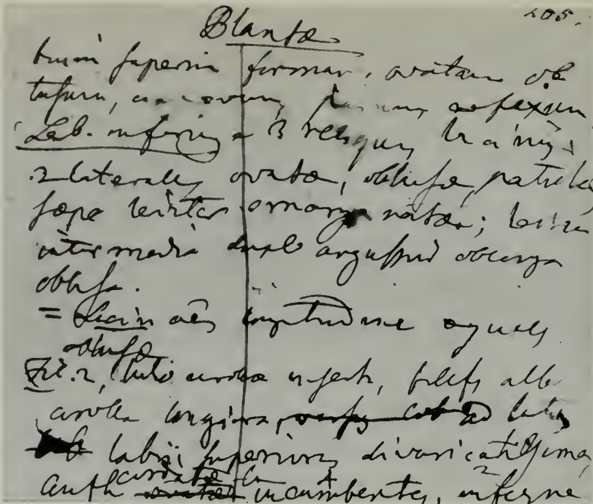
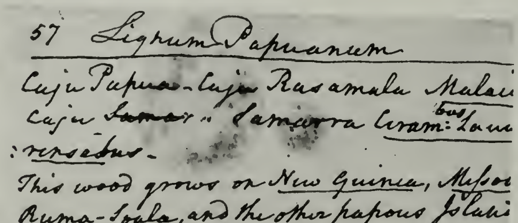
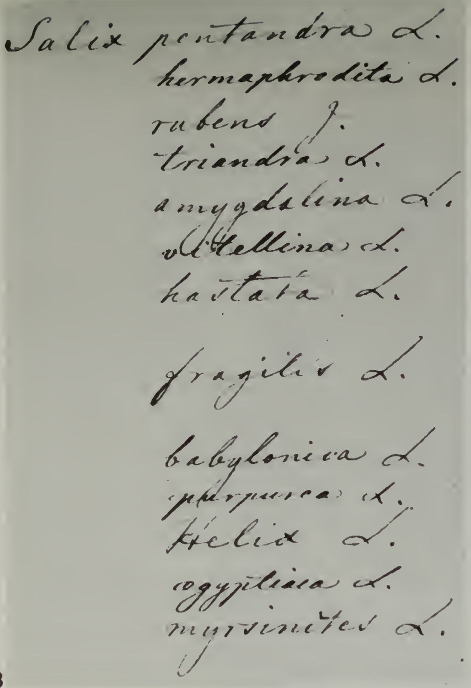


Fig. 11 Daniel Solander's handwriting in '*Plantae Australiae*' (New Zealand) 2 : f. 265. (Part of Solander's description of *Veronica floribunda* from Admiralty Bay.)



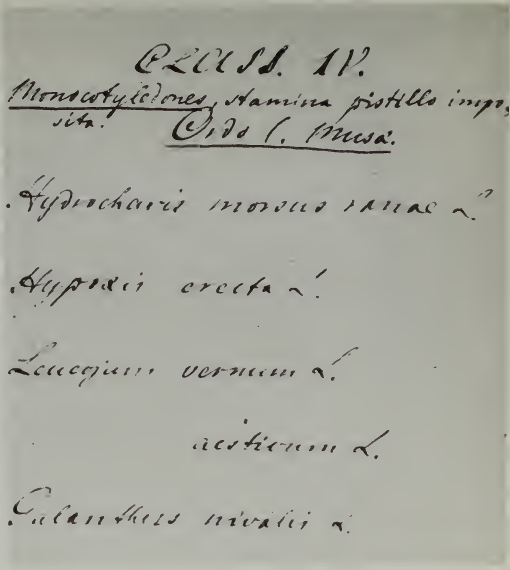
57 Lignum Papuanum
Caju Papua - Caju Rasamala Malai
Caju ~~Samar~~ .. Samarra Ceram: Lau-bas
:rersabus -
This wood grows on New Guinea, Mysol
Ruma-Soala, and the other papous Islan
It is also brought to Java from Ceylon &
Malabar Coast. — 15 or 20 lb for a Rix do
There are two sorts, a white or very dilute y
:low, the one; the other of a honey colour mix
with a staining of ash: the first is in sm
pieces, like those of yellow Saunders of th
Smoaky coloured Ebony, agreeing with th
in smell, harder than the saunders, but lik

Fig. 12 Daniel Solander's handwriting in '*MS. Notes on Useful Plants*'.



Salix pentandra L.
hermaphrodita L.
rubens J.
triandra L.
amygdalina L.
vitellina L.
hastata L.
fragilis L.
babylonica L.
purpurea L.
helix L.
aegyptiaca L.
myrsinites L.

13



CLASS. IV.
Monocotyledones, stamina pistillo imposita. Ordo I. Musae.
Hydrocharis morsus ranae L.
Hypoxis erecta L.
Leucojum vernum L.
aestivum L.
Galanthus nivalis L.

14

Fig. 13 Daniel Solander's handwriting in '*Hort. Reg. Paris*' : f. 12.

Fig. 14 Daniel Solander's handwriting in '*Hort. Reg. Paris*', 2nd sequence : f. 17.

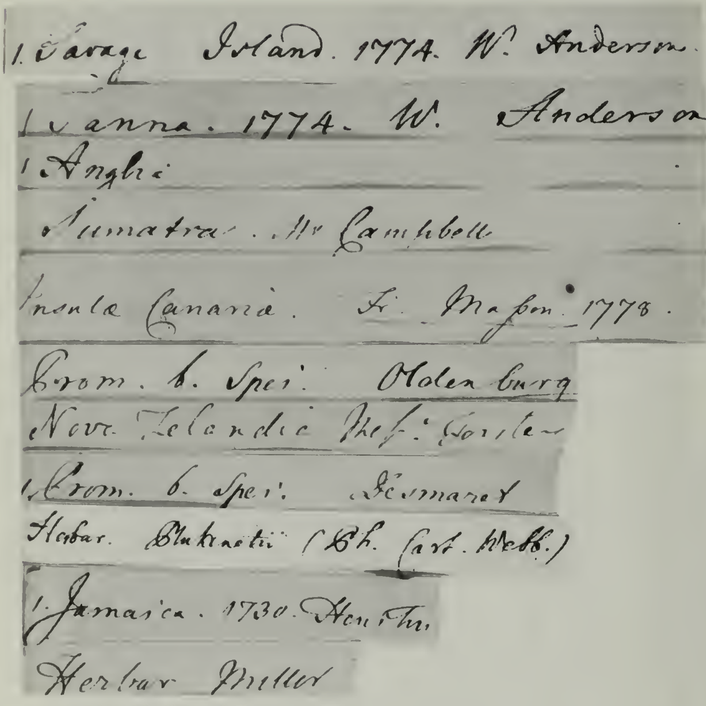
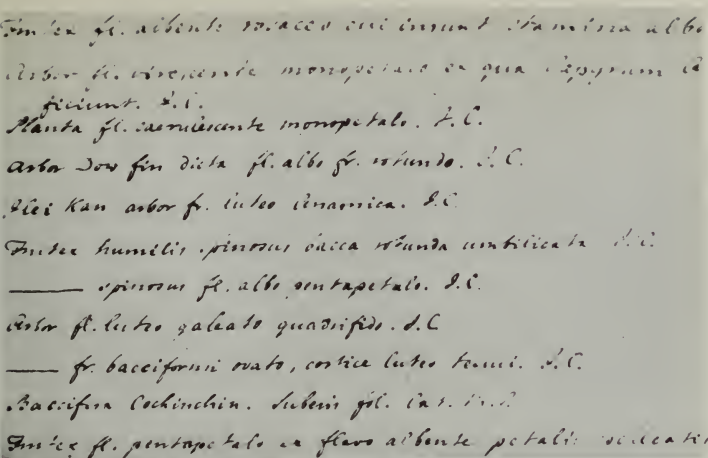


Fig. 15 Daniel Solander's endorsements on reverse sides of herbarium sheets.

16


Frutex fl. albente rosaceo cui insunt stamina alba

Arbor fl. virescente monopetalo ex qua [illegible] ficiunt. D.C.

Planta fl. caerulescente monopetalo. D.C.

Arbor Dou fin dicta fl. albo fr. rotundo. D.C.

Hei Kan arbor fr. luteo [illegible]. D.C.

Frutex humilis spinosus bacca rotunda umbilicata D.C.

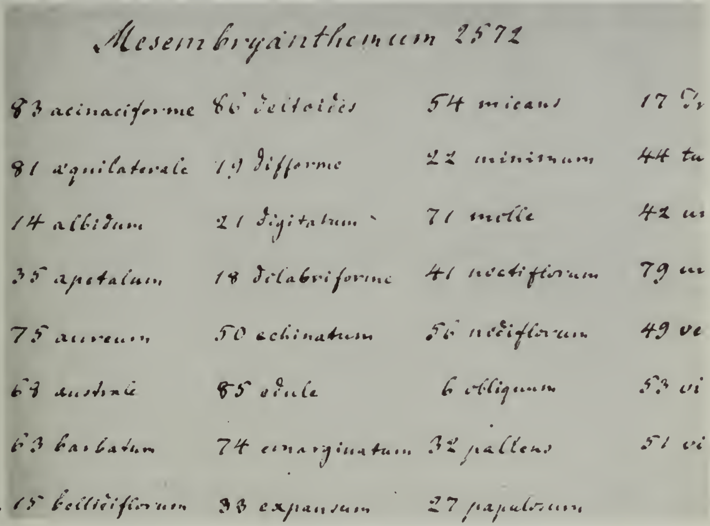
—— spinosus fl. albo pentapetalo. D.C.

Arbor fl. luteo galeato quadrifido. D.C

—— fr. bacciformi ovato, cortice luteo tenui. D.C.

Baccifera Cochinchin. Suberis fol. Cat. [illegible]

Frutex fl. pentapetalo ex flavo albente petalis sulcatis

17


Mesembryanthemum 2572

83 acinaciforme	86 deltoides	54 micans	17 [illegible]
81 aequilaterale	19 difforme	22 minimum	44 tu
14 albidum	21 digitatum	71 molle	42 un
35 apetalum	18 dolabriforme	41 noctiflorum	79 un
75 aureum	50 echinatum	56 nodiflorum	49 ve
68 australe	85 edule	6 obliquum	53 vi
63 barbatum	74 emarginatum	32 pallens	51 vi
15 bellidiflorum	33 expansum	27 papulosum	

Fig. 16 Jonas Dryander's handwriting in Banks's copy of *Raii Historia Plantarum* appendix : p. 230.

Fig. 17 Jonas Dryander's handwriting in his '*Index to the Species of the Larger Genera in Willdenow's Edition of Linnaeus's Species Plantarum*'.

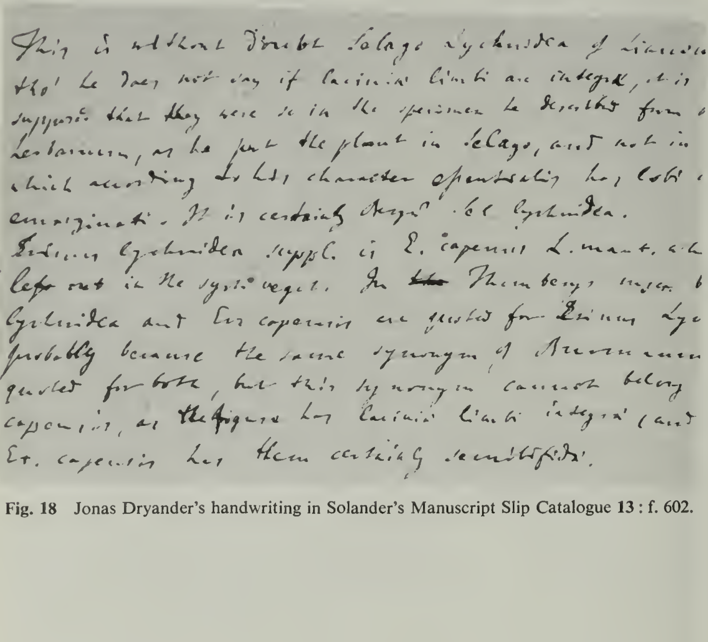
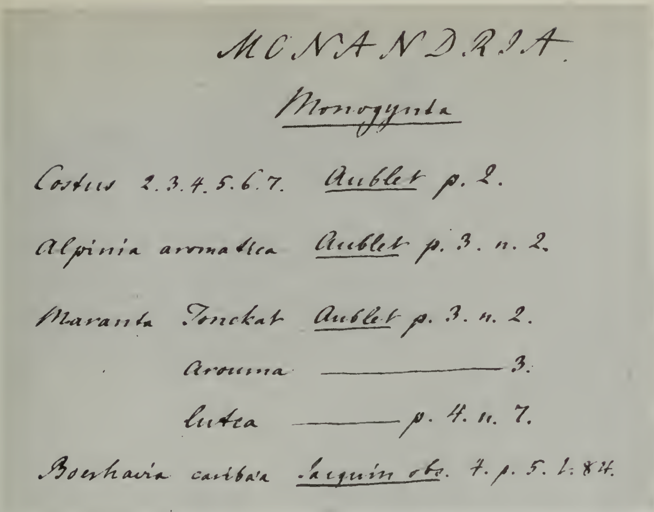

This is without doubt Selago cylindrica of Linnaeus
tho' he does not say if laciniae limbi are integrae, it is
supposed that they were so in the specimen he described from [illegible]
Herbarium, as he put the plant in Selago, and not in [illegible]
which according to his character [illegible] has lobi [illegible]
emarginati. It is certainly [illegible] Sel. cylindrica.
Erinus cylindricus suppl. is E. capensis L. mant. which
left out in the syst. veget. In ~~the~~ Thunbergs [illegible]
cylindrica and Er. capensis are quoted from Linnaeus [illegible]
probably because the same synonym of [illegible]
quoted for both, but this synonym cannot belong
capensis, as the figure has laciniae limbi integrae (and
Er. capensis has them certainly [illegible].

Fig. 18 Jonas Dryander's handwriting in Solander's Manuscript Slip Catalogue **13** : f. 602.


MONANDRIA.

Monogynia

Costus 2.3.4.5.6.7. Aublet p. 2.

Alpinia aromatica Aublet p. 3. n. 2.

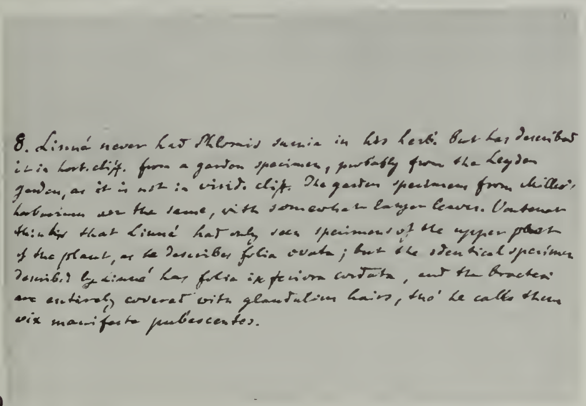
Maranta Tonckat Aublet p. 3. n. 2.

Arouma ——— 3.

lutea ——— p. 4. n. 7.

Boerhavia caribaea Jacquin obs. 4. p. 5. t. 84.

19


8. Linné never had Phlomis samia in his herb. But has described it in hort. cliff. from a garden specimen, probably from the Leyden garden, as it is not in virid. cliff. The garden specimens from Miller's herbarium are the same, with somewhat larger leaves. Ventenat thinks that Linné had only seen specimens of the upper part of the plant, as he describes folia ovata; but the identical specimen described by Linné has folia inferiora cordata, and the bracteae are entirely covered with glandulous hairs, tho' he calls them vix manifeste pubescentes.

20

Fig. 19 Jonas Dryander's handwriting in '*Florula Indiae Occidentalis*', supplement : f. 1.

Fig. 20 Jonas Dryander's handwriting in Banks's interleaved copy of Willdenow's edition of *Species Plantarum* 3 : 120.

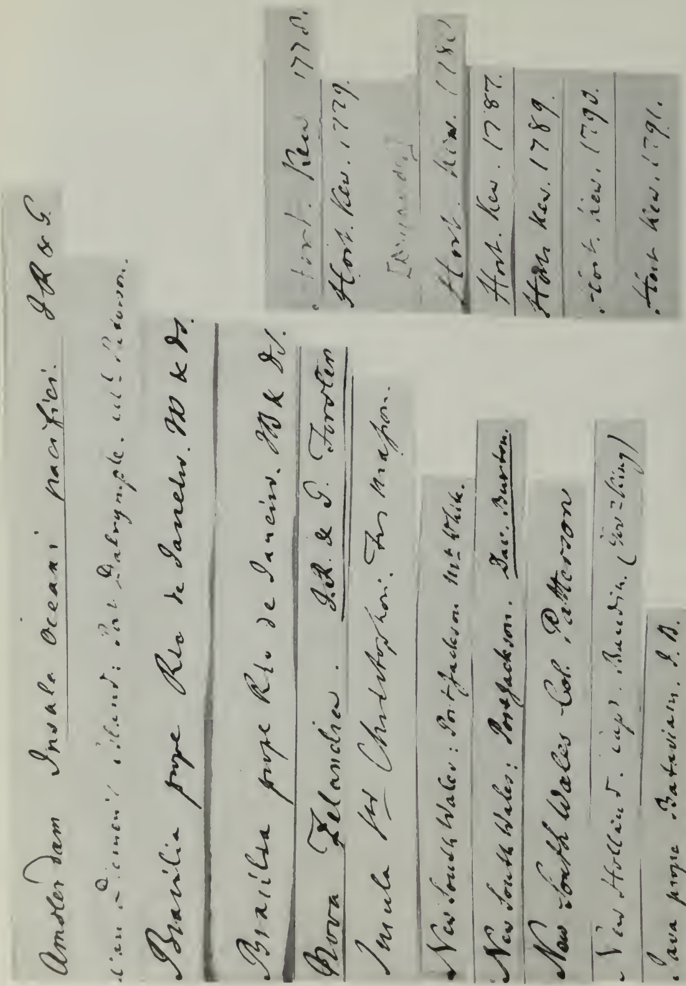


Fig. 21 Jonas Dryander's endorsements on reverse sides of herbarium sheets.

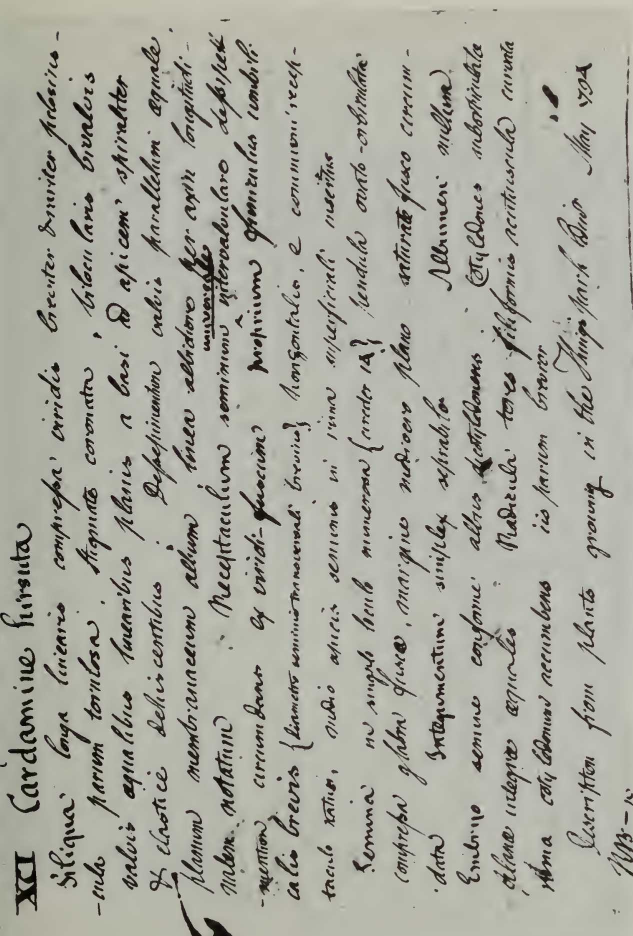
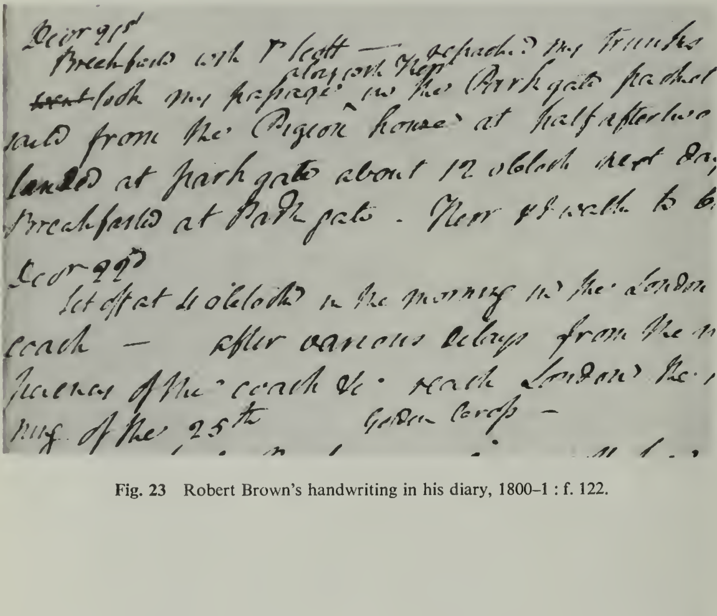
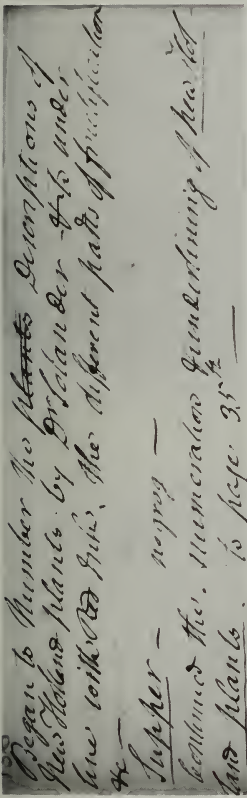


Fig. 22 Robert Brown's handwriting in his *'Manuscript descriptions of plants in the Edinburgh Botanic Garden etc.'* 1792–93 : f. 160.



Decr 21st
Breakfasted with Dr Scott — dispatched my trunks [illegible]
~~sent~~ took my passage in the Parkgate packet
sailed from the Pigeon house at half after two
landed at Parkgate about 12 o'clock next day
breakfasted at Parkgate - [illegible] walked to [illegible]
Decr 22d
set off at 4 o'clock in the morning in the London
coach — after various delays from the [illegible]
[illegible] of the coach &c. reach London the [illegible]
ning of the 25th Golden Cross —

Fig. 23 Robert Brown's handwriting in his diary, 1800–1 : f. 122.



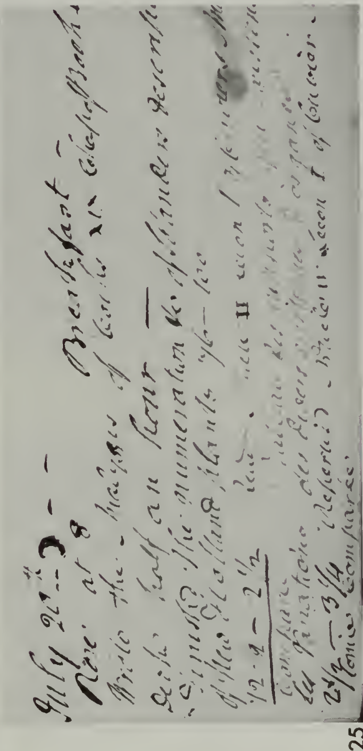
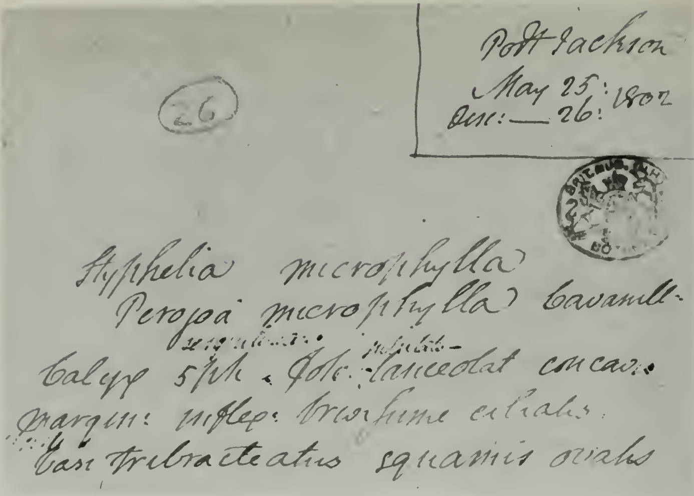
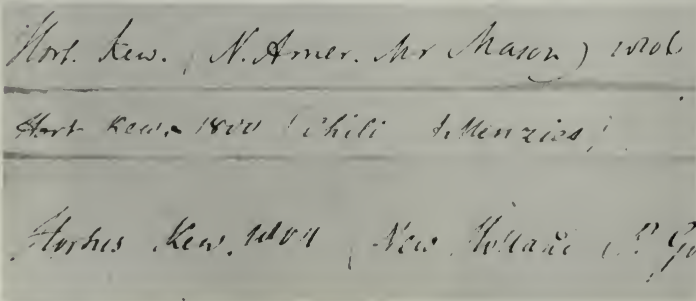


Fig. 24 Robert Brown's handwriting in his diary, 1800–1 : f. 136.

Fig. 25 Robert Brown's handwriting in his diary, 1800–1 : f. 139.


Port Jackson
May 25: 1802
Obs: — 26:
(26)
Styphelia microphylla
Persoonia microphylla Cavanill.
Calyx 5phy. Fol. lanceolat concav.
margin: inflex: brevissime ciliatis.
Basi tribracteatus squamis ovalis

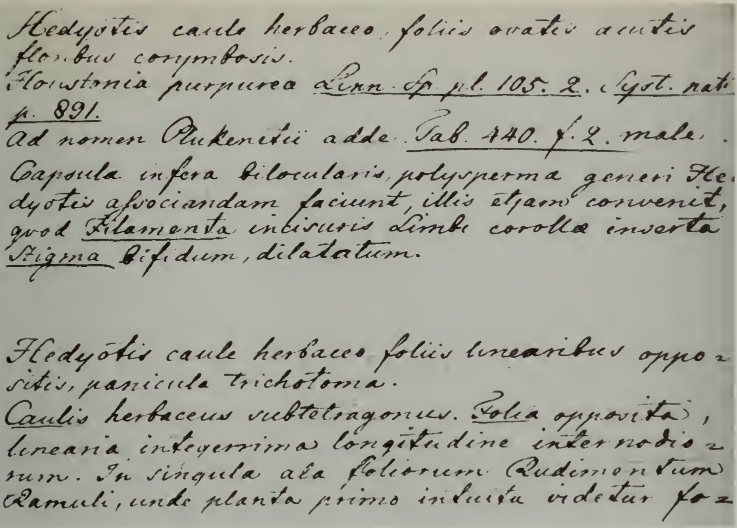
26


Hort. Kew. (N. Amer. Mr Mason) 1806
Hort. Kew. 1800 (Chili D. Menzies)
Hortus Kew. 1804 (New Holland

27

Fig. 26 Robert Brown's handwriting in his Manuscript Slip Catalogue.

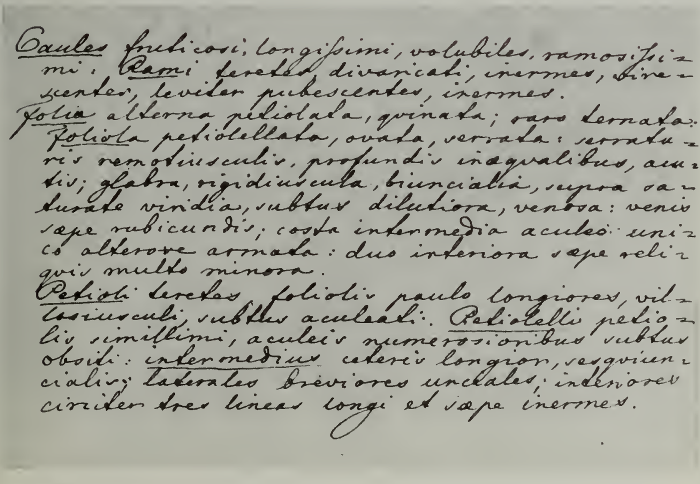
Fig. 27 Robert Brown's endorsements on reverse sides of herbarium sheets.



Hedyotis caule herbaceo, foliis ovatis acutis
floribus corymbosis.
Houstonia purpurea Linn. Sp. pl. 105. 2. Syst. nat.
p. 891.
Ad nomen Plukenetii adde Tab. 440. f. 2. male.
Capsula infera bilocularis, polysperma generi He-
dyotis associandam faciunt, illis etiam convenit,
quod Filamenta incisuris Limbi corollæ inserta
Stigma bifidum, dilatatum.

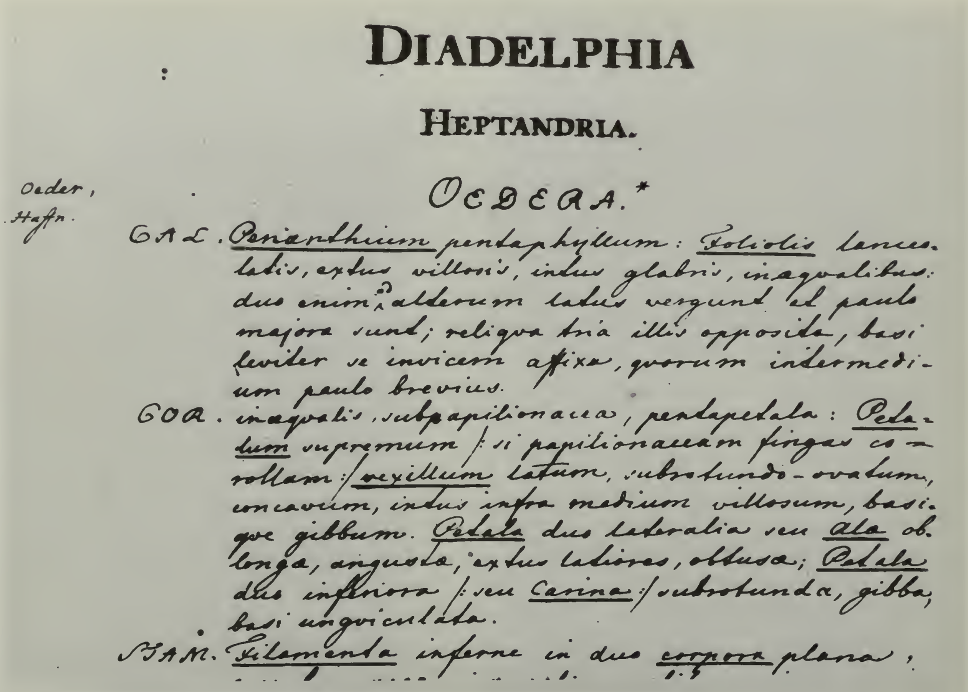
Hedyotis caule herbaceo foliis linearibus oppo-
sitis, panicula trichotoma.
Caulis herbaceus subtetragonus. Folia opposita,
linearia integerrima longitudine internodio-
rum. In singula ala foliorum Rudimentum
Ramuli, unde planta primo intuitu videtur fo-

Fig. 28 Herman Spöring's handwriting in MS entitled '*Solander Descriptions of Plants*' : f. 13.



Caules fruticosi, longissimi, volubiles, ramosissi-
mi. Rami teretes, divaricati, inermes, vire-
scentes, leviter pubescentes, inermes.
Folia alterna petiolata, quinata; raro ternata.
Foliola petiolellata, ovata, serrata: serratu-
ris remotiusculis, profundis inaequalibus, acu-
tis; glabra, rigidiuscula, biunciatia, supra sa-
turate viridia, subtus dilutiora, venosa: venis
sæpe rubicundis; costa intermedia aculeo uni-
co alterove armata: duo inferiora sæpe reli-
quis multo minora.
Petioli teretes, foliolis paulo longiores, vil-
losiusculi, subtus aculeati. Petiolelli petio-
lis simillimi, aculeis numerosioribus subtus
obsiti: intermedius ceteris longior, sesquiun-
cialis; laterales breviores unciales, inferiores
circiter tres lineas longi et sæpe inermes.

Fig. 29 Herman Spöring's handwriting in Solander's Manuscript Slip Catalogue.



DIADELPHIA

HEPTANDRIA.

Oeder, Hafn.

OEDERA.*

CAL. Perianthium pentaphyllum: Foliolis lanceolatis, extus villosis, intus glabris, inaequalibus: duo enim, alterum latus vergunt et paulo majora sunt; reliqua tria illis opposita, basi leviter se invicem affixa, quorum intermedium paulo brevius.

COR. inaequalis, subpapilionacea, pentapetala: Petalum supremum /: si papilionaceam fingas corollam :/ vexillum latum, subrotundo-ovatum, concavum, intus infra medium villosum, basique gibbum. Petala duo lateralia seu Alae oblonga, angusta, extus latiores, obtusa; Petala duo inferiora /: seu Carina :/ subrotunda, gibba, basi unguiculata.

STAM. Filamenta inferne in duo corpora plana;

Fig. 30 Herman Spöring's handwriting in '*Primitiae Florae Brasiliensis*' : f. 103. (A fair copy of Solander's descriptions.)

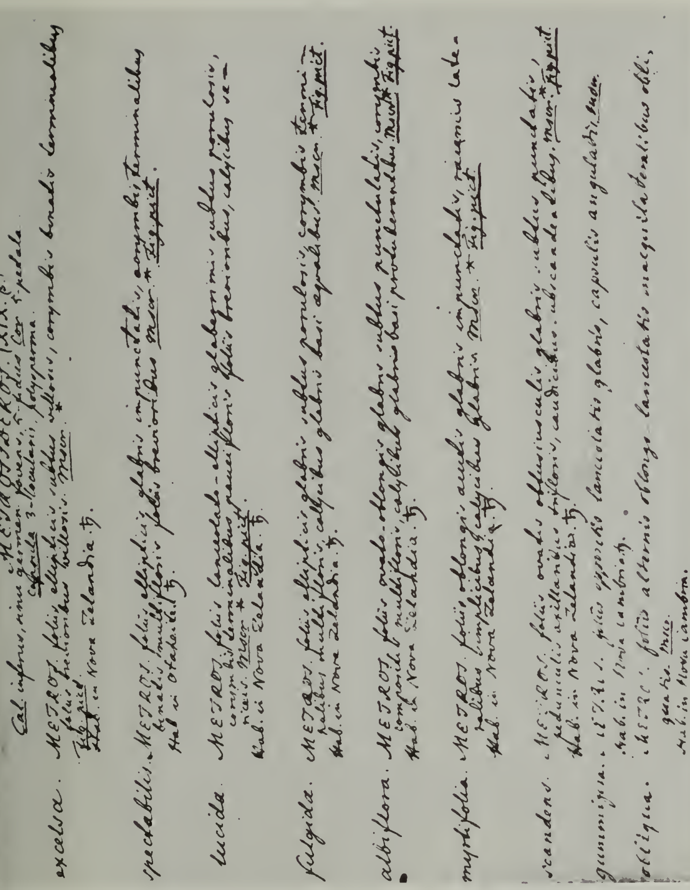
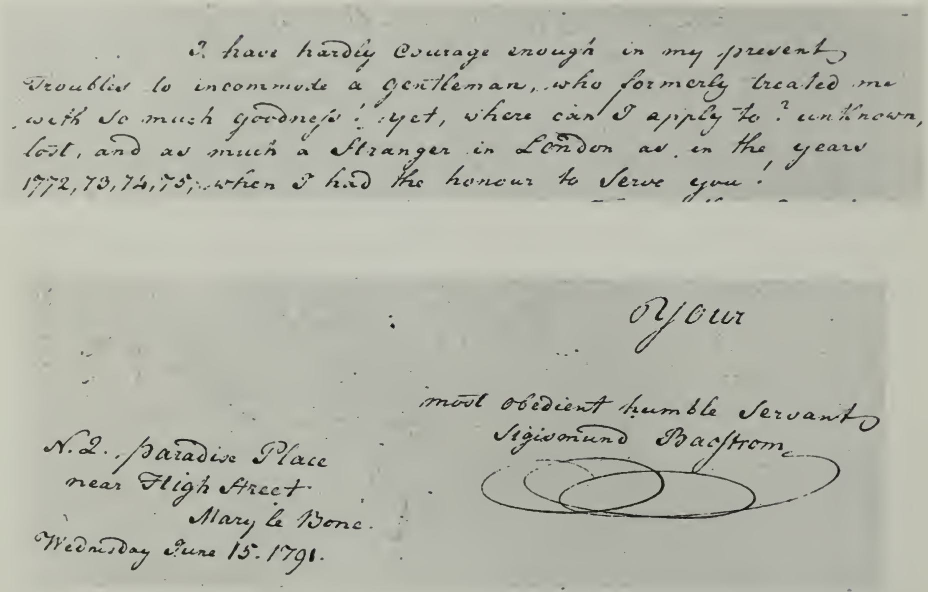


Fig. 31 Herman Spöring's handwriting in an interleaved copy of Linnaeus's second edition of *Species Plantarum* (1762–63).

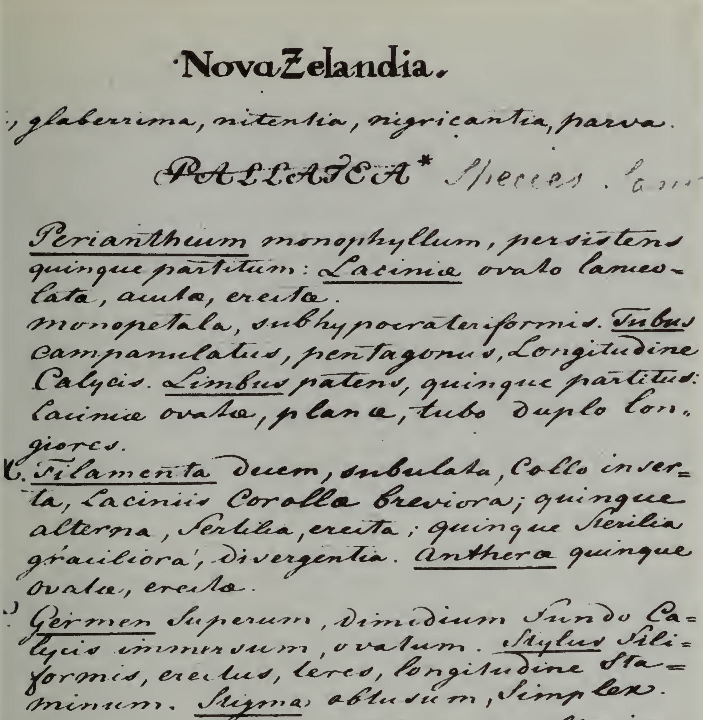


I have hardly Courage enough in my present Troubles to incommode a gentleman, who formerly treated me with so much goodness! yet, where can I apply to? unknown, lost, and as much a Stranger in London as in the years 1772, 73, 74, 75; when I had the honour to serve you!

Your
most obedient humble Servant
Sigismund Bacstrom

N. 2. Paradise Place
near High Street
Mary le Bone.
Wednesday June 15. 1791.

Fig. 32 Extract from a letter sent to Joseph Banks written by Sigismund Bacstrom.



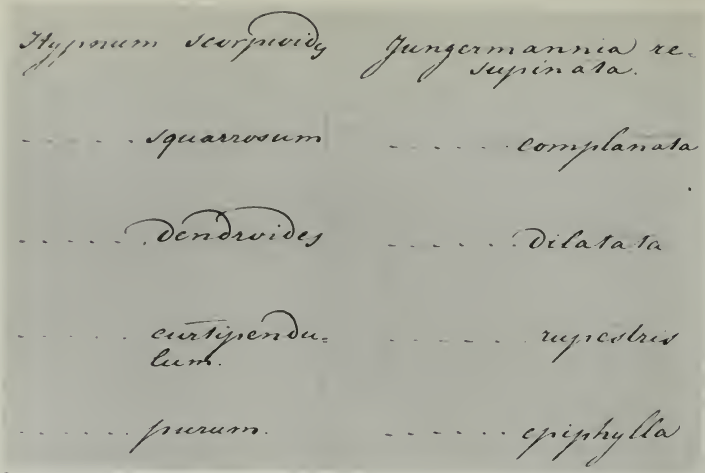
Nova Zelandia.

; glaberrima, nitentia, nigricantia, parva.

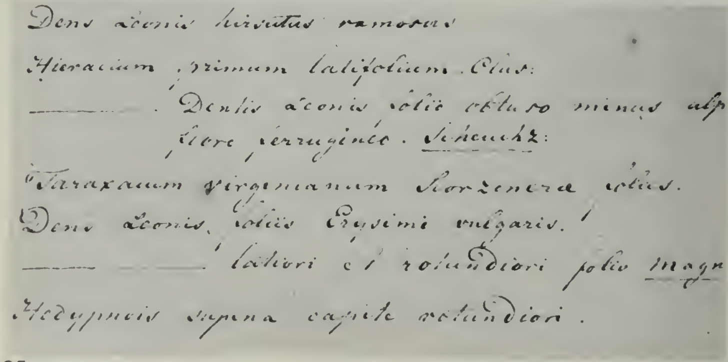
PALLATEA* Species. Sam

Perianthium monophyllum, persistens
quinque partitum: Laciniæ ovato lanceo-
lata, acutæ, erectæ.
monopetala, subhypocrateriformis. Tubus
campanulatus, pentagonus, Longitudine
Calycis. Limbus patens, quinque partitus:
laciniæ ovatæ, planæ, tubo duplo lon-
giores.
C. Filamenta decem, subulata, Collo inser-
ta, Laciniis Corollæ breviora; quinque
alterna, Fertilia, erecta; quinque Sterilia
graciliora, divergentia. Antheræ quinque
ovatæ, erectæ.
Germen Superum, dimidium Fundo Ca-
lycis immersum, ovatum. Stylus Fili-
formis, erectus, teres, longitudine Sta-
minum. Stigma obtusum, Simplex.
Capsula ovata, receptaculo Corollæ in
medio Cincta, basi calyci adnata, Laci-
niis calycinis superne tecta, unilocula-
ris, quinque Valvis.
plurima, subrotunda, minuta. Concep-
taculum centrale, globosum, pedicella-
tum.

Fig. 33 Sigismund Bacstrom's handwriting in '*Primitiae Florae Nova Zealandiae*'. (A fair copy prepared from Solander's '*Plantae Australiae*'.)


Hypnum scorpioides — Jungermannia resupinata.
- - - - squarrosum — - - - - complanata
- - - - dendroides — - - - - dilatata
- - - - curtipendulum. — - - - - rupestris
- - - - purum. — - - - - epiphylla

34


Dens Leonis hirsutus ramosus
Hieracium primum latifolium. Clus:
——— Dentis Leonis folio obtuso minus alp.
flore ferrugineo. Scheuchz:
Taraxacum virginianum Scorzonera foliis.
Dens Leonis, foliis Erysimi vulgaris.
——— latiori et rotundiori folio magn
Hedypnois supina capite rotundiori.

35

Fig. 34 Sigismund Bacstrom's handwriting in '*Flora Islandica*'.

Fig. 35 Sigismund Bacstrom's handwriting in Banks's copy of *Raii Historia Plantarum* **1** : 244

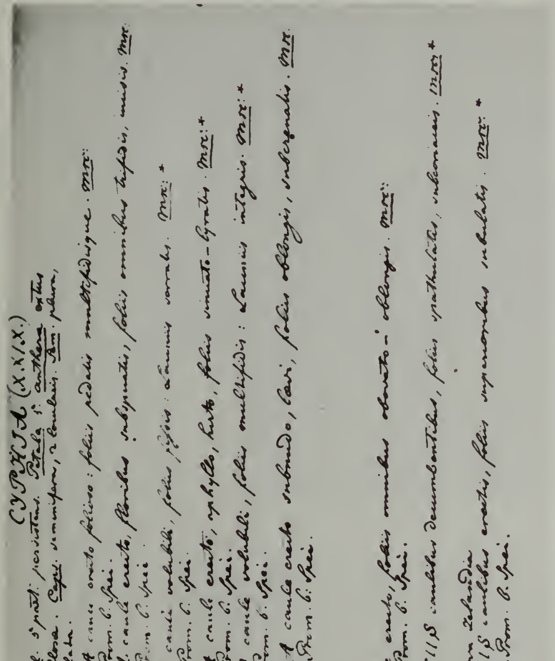
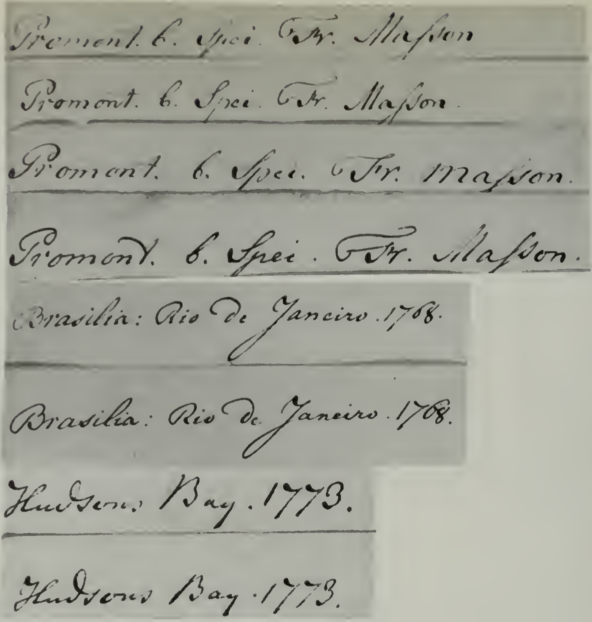
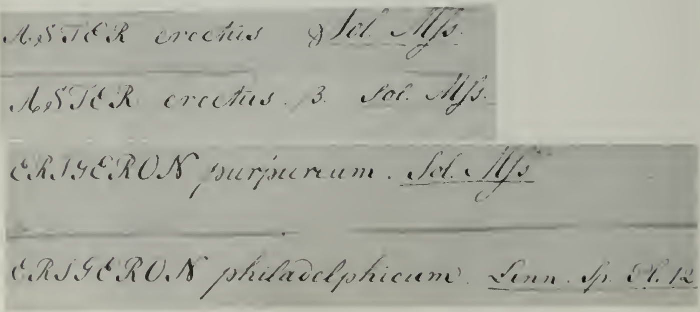


Fig. 36 Sigismund Bacstrom's handwriting in an interleaved copy of Linnaeus's second edition of *Species Plantarum* **1** : 60 (1762).



37



38

Fig. 37 Sigismund Bacstrom's endorsements on reverse sides of herbarium sheets.

Fig. 38 Identifications written in ink by Sigismund Bacstrom on herbarium sheets formerly in the Banksian Herbarium.

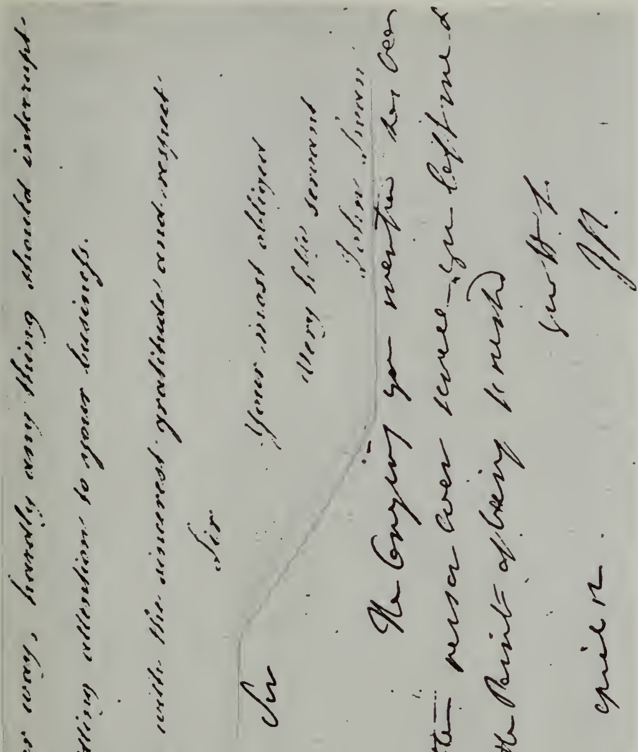
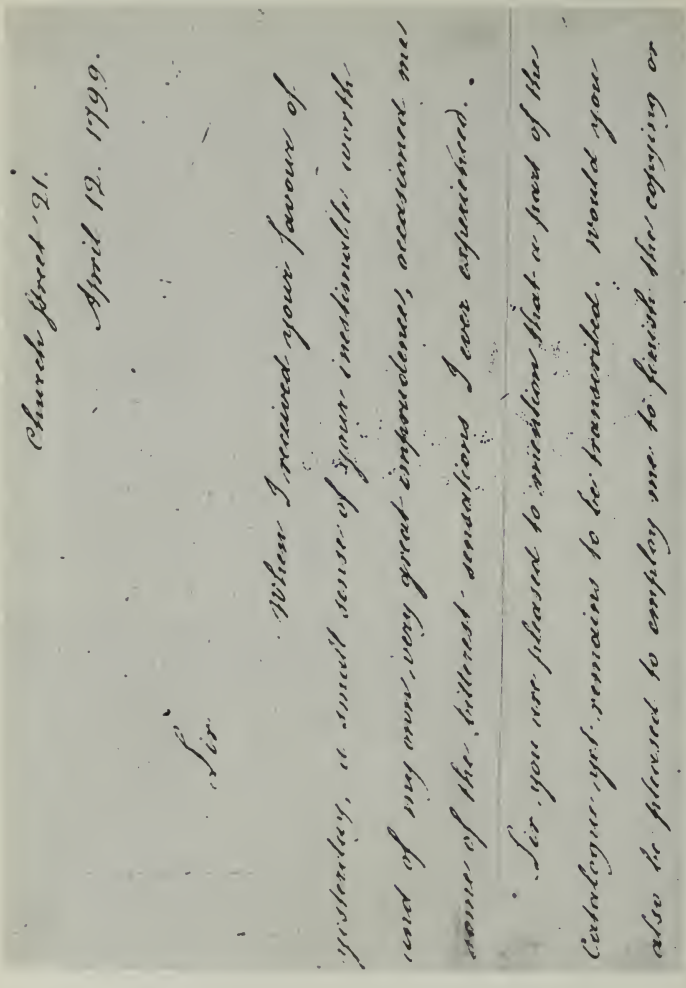

in any other way, hardly any thing should interrupt
my unremitting attention to your business.
I am with the sincerest gratitude and respect
Sir
Your most obliged
Very hble servant
John Swan

Fig. 39 Letter written by John Swan to Joseph Banks.



Church Street '21.

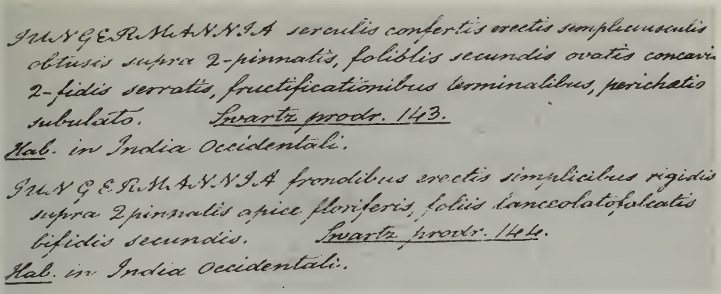
April 12. 1799.

Sir

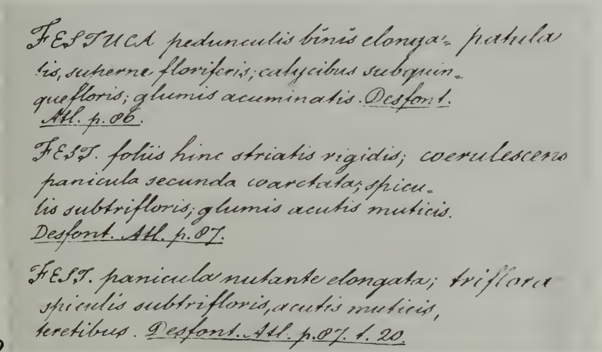
When I received your favour of yesterday, a small sense of your inestimable worth and of my own, very great imprudence, occasioned me some of the bitterest sensations I ever experienced.

Sir, you are pleased to mention that a part of the Catalogue yet remains to be transcribed. Would you also be pleased to employ me to finish the copying or

Fig. 40 Letter written by John Swan to Joseph Banks.


JUNGERMANNIA surculis confertis erectis simpliciusculis
obtusis supra 2-pinnatis, foliolis secundis ovatis concavi-
2-fidis serratis, fructificationibus terminalibus, perichaetio
subulato. Swartz prodr. 143.
Hab. in India Occidentali.
JUNGERMANNIA frondibus erectis simplicibus rigidis
supra 2pinnatis apice floriferis, foliis lanceolatofalcatis
bifidis secundis. Swartz prodr. 144.
Hab. in India Occidentali.

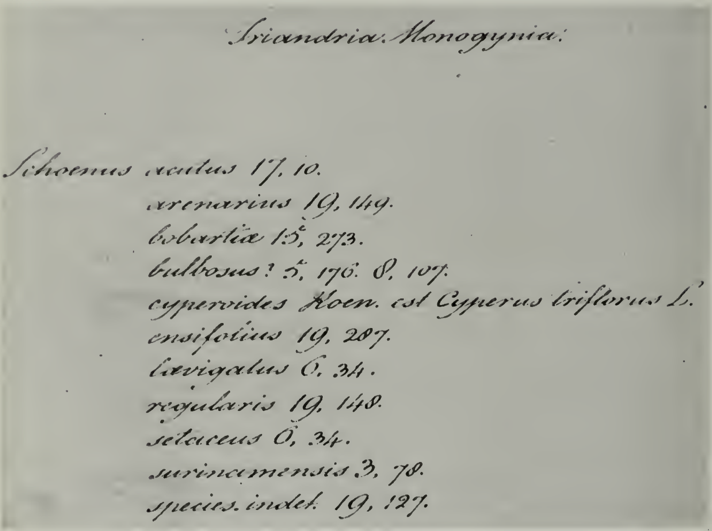
41


FESTUCA pedunculis binis elonga- patula
tis, superne floriferis; calycibus subquin-
quefloris; glumis acuminatis. Desfont.
Atl. p. 86.
FEST. foliis hinc striatis rigidis; coerulescens
panicula secunda coarctata; spicu-
lis subtrifloris; glumis acutis muticis.
Desfont. Atl. p. 87.
FEST. panicula nutante elongata; triflora
spiculis subtrifloris, acutis muticis,
teretibus. Desfont. Atl. p. 87. t. 20.

42

Fig. 41 John Swan's handwriting in an interleaved copy of Reichard's *Linné Systema Plantarum* **4** : 507 (1780).

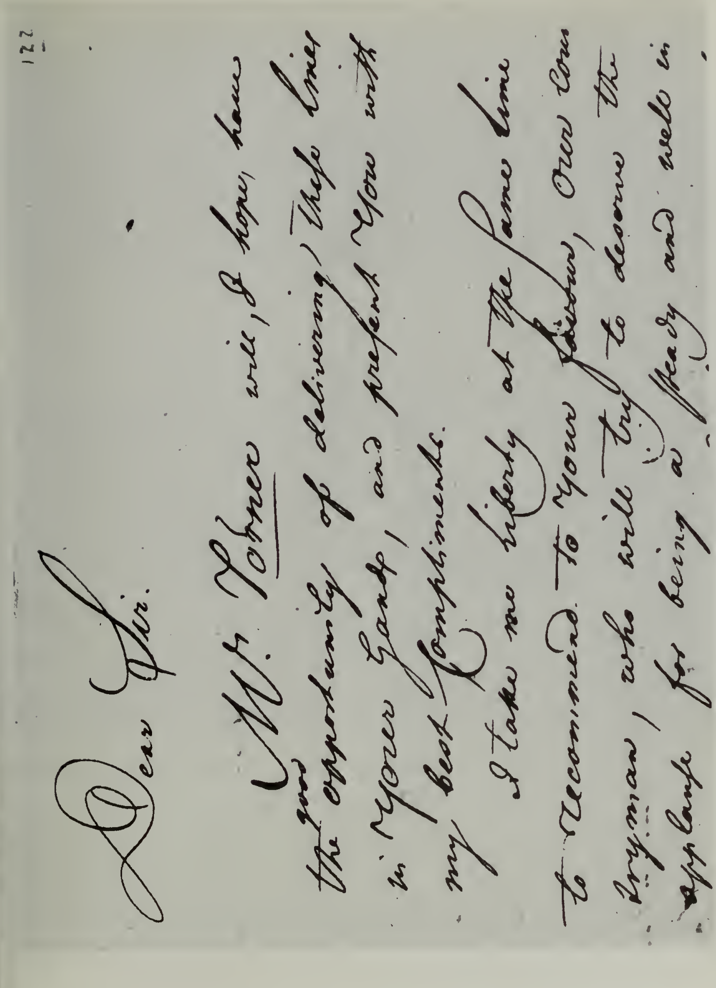
Fig. 42 John Swan's handwriting in Joseph Banks's interleaved copy of Willdenow's edition of Linnaeus's *Species Plantarum* **1** : 424 (1797).



Triandria Monogynia.

Schoenus acutus 17, 10.
arenarius 19, 149.
bobartia 15, 273.
bulbosus? 5, 176. 8, 107.
cyperoides Koen. est Cyperus triflorus L.
ensifolius 19, 287.
laevigatus 6, 34.
regularis 19, 148.
setaceus 6, 34.
surinamensis 3, 78.
species. indet. 19, 127.

Fig. 43 John Swan's handwriting in an incompleted index to the '*Koenig Manuscripts*'.

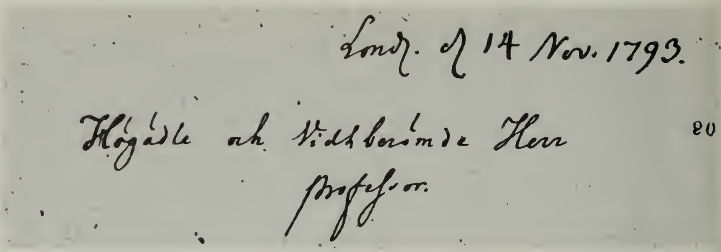

122

Dear Sir.

Mr. Törner will, I hope, have
the you opportunity of delivering these lines
in Your hands, and present You with
my best Compliments.

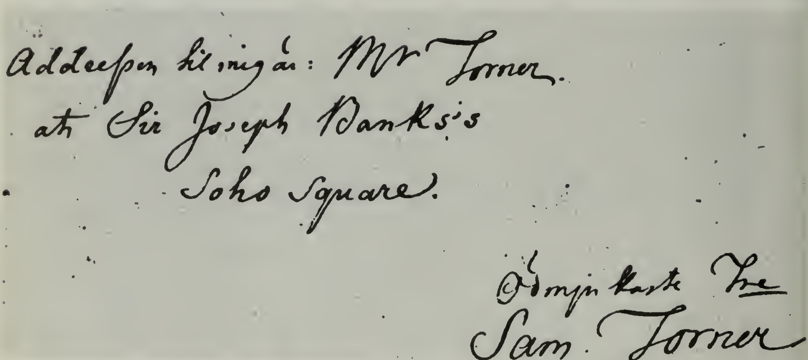
I take me liberty at the same time
to recommend to Your favour, Our Coun-
tryman, who will try to deserve the
applause for being a steady and well in-

Fig. 44 Part of the letter written by O. Swartz to Dryander in which he introduces Samuel Törner.



Lond. d. 14 Nov. 1793.

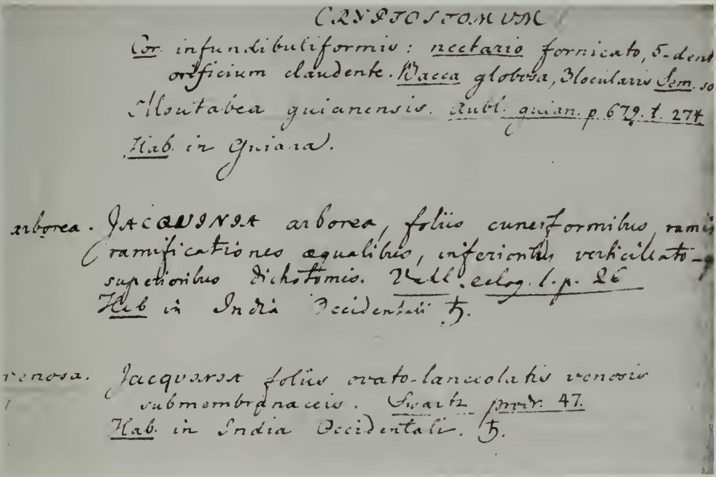
Högädle och Vidtberömde Herr Professor. 20



Addressen till mig är: Mr Torner.
at Sir Joseph Banks's
Soho Square.

Ödmjukaste Tjenare
Sam. Torner

Fig. 45 Two extracts from a letter sent to Per Fabian Aurivillius in Sweden written by Samuel Törner.



CRYPTOSTOMUM
Cor. infundibuliformis: nectario fornicato, 5-dent orificium claudente. Bacca globosa, 3locularis Sem. so
Moutabea guianensis. Aubl. guian. p. 679. t. 274
Hab. in Guiana.

arborea. JACQUINIA arborea, foliis cuneiformibus, ramis ramificationes aequalibus, inferioribus verticillato-superioribus dichotomis. Vahl. eclog. 1. p. 26
Hab in India Occidentali ♄.

venosa. Jacquinia foliis ovato-lanceolatis venosis submembranaceis. Swartz prodr. 47.
Hab. in India Occidentali. ♄.

Fig. 46 Samuel Törner's handwriting in an interleaved copy of Reichard's *Linné Systema Plantarum* **1** : 527 (1780).

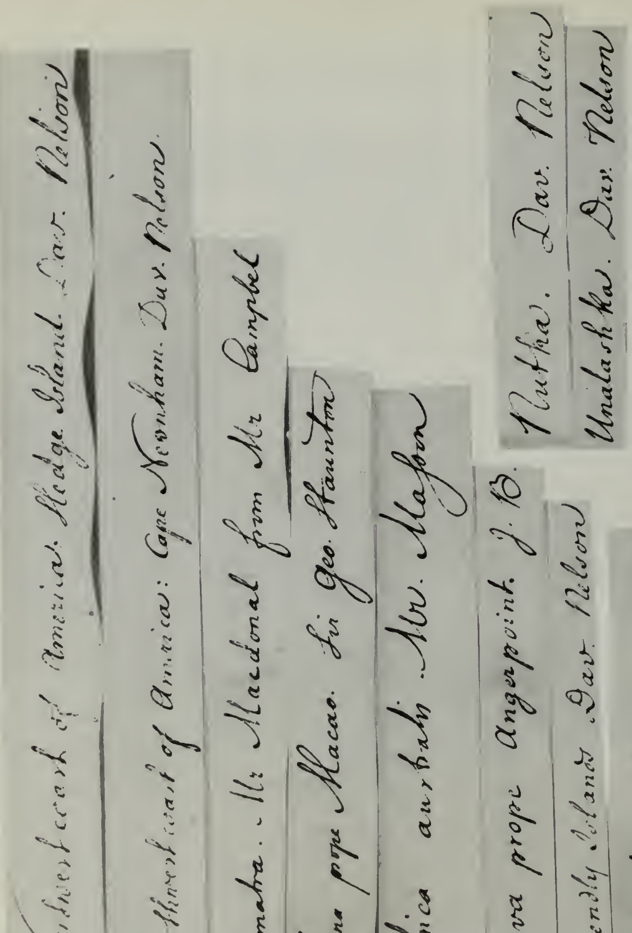
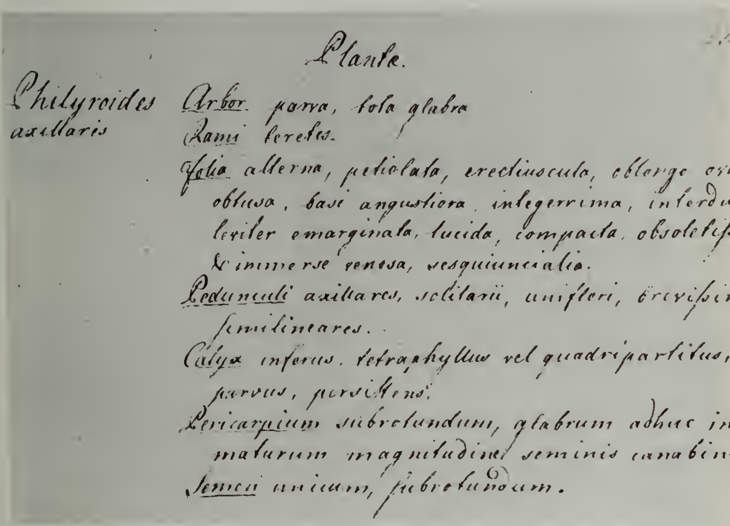


Fig. 47 Samuel Törner's endorsements on the reverse sides of herbarium sheets.

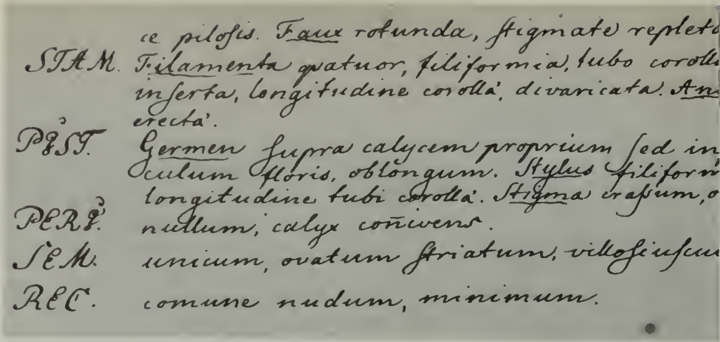


Plantae.

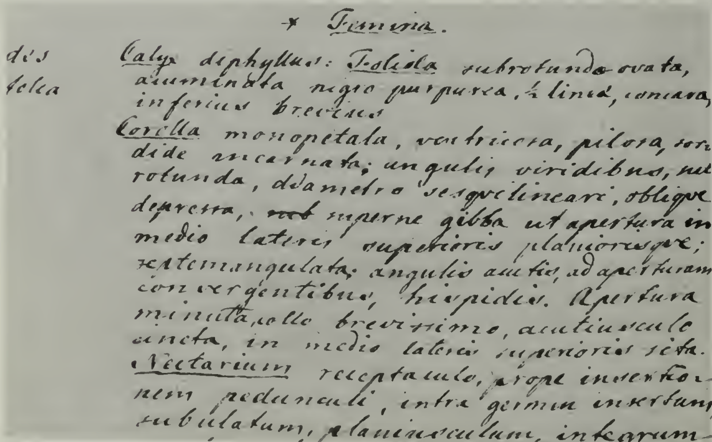
Philyroides axillaris

Arbor parva, tota glabra
Rami teretes.
Folia alterna, petiolata, erectiuscula, oblongo ova
obtusa, basi angustiora, integerrima, interdu
leviter emarginata, lucida, compacta, obsoletis
& immerse venosa, sesquiuncialia.
Pedunculi axillares, solitarii, uniflori, brevissi
semilineares.
Calyx inferus, tetraphyllus vel quadripartitus,
parvus, persistens.
Pericarpium subrotundum, glabrum adhuc in
maturum magnitudine seminis canabini
Semen unicum, subrotundum.

Fig. 48 The handwriting of amanuensis A in '*Plantae Novae Hollandiae*' **1** : 237.
(Transcribed from Solander's MSS.)


ce pilosis. Faux rotunda, stigmate repleta
STAM. Filamenta quatuor, filiformia, tubo corollæ
inserta, longitudine corollæ, divaricata. An
erecta.
PIST. Germen supra calycem proprium sed in
oculum floris, oblongum. Stylus filiform
longitudine tubi corollæ. Stigma crassum, o
PERI. nullum, calyx conivens.
SEM. unicum, ovatum striatum, villosiusculum
REC. comune nudum, minimum.

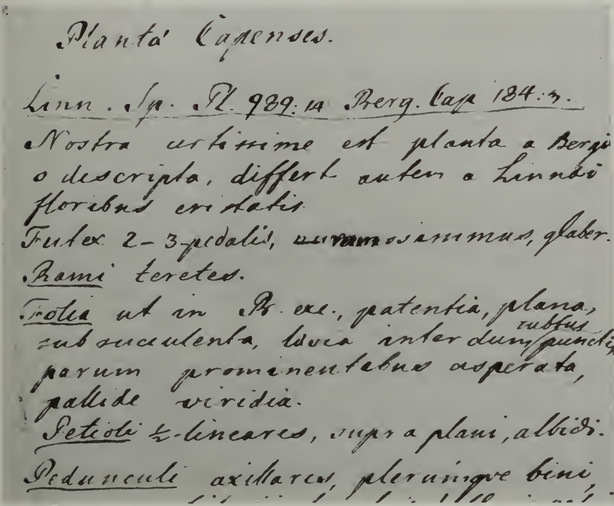
49


* Fœminea.
Calyx diphyllus: Foliola subrotundo-ovata,
acuminata nigro purpurea, ½ lineæ, concava,
inferius brevius
Corolla monopetala, ventricosa, pilosa, sor-
dide incarnata; ungulis viridibus, sub-
rotunda, diametro sesquilineari, oblique
depressa, ~~sed~~ superne gibba ut apertura in
medio lateris superioris planiorisque;
sextemangulata, angulis acutis, ad aperturam
convergentibus, hispidis. Apertura
minuta, collo brevissimo, acutiuscule
cincta, in medio lateris superioris sita.
Nectarium receptaculo, prope insertio-
nem pedunculi, intra germen insertum,
subulatum, planiusculum, integrum.

50

Fig. 49 The handwriting of amanuensis B in Solander's Manuscript Slip Catalogue, **4** : f. 415.

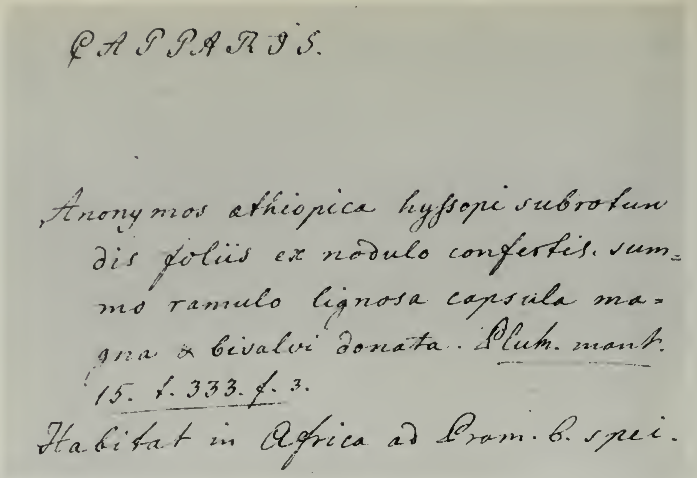
Fig. 50 The handwriting of amanuensis B in '*Plantae Novae Hollandiae*', **2** : f. 452.
(Transcribed from Solander's MSS.)



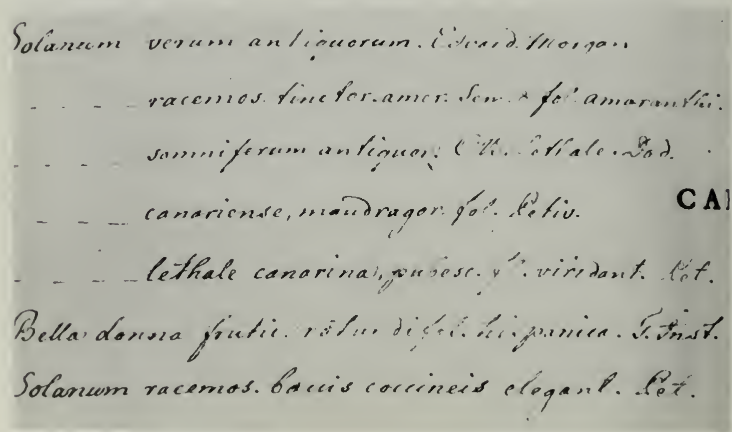
Plantae Capenses.

Linn. Sp. Pl. 989: 14 Berg. Cap. 184: 3.
Nostra certissime est planta a Bergio descripta, differt autem a Linnaei floribus cristatis.
Frutex 2–3-pedalis, ramosissimus, glaber.
Rami teretes.
Folia ut in Pl. exc., patentia, plana, subsucculenta, laevia interdum subtus punctis parum prominentibus asperata, pallide viridia.
Petioli ½-lineares, supra plani, albidi.
Pedunculi axillares, plerumque bini,

Fig. 51 The handwriting of amanuensis B in '*Plantae Capenses*'. (Transcribed from Solander's MSS.)



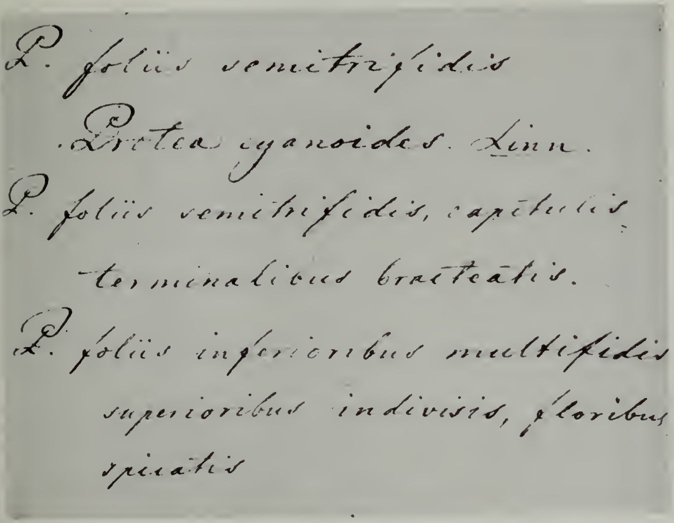
52



53

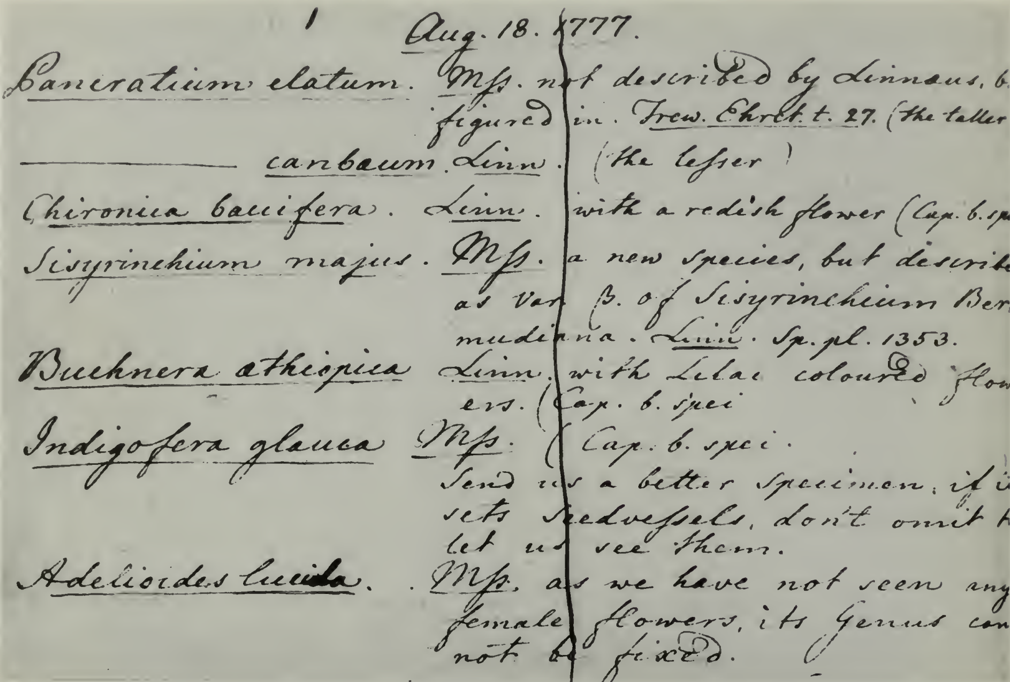
Fig. 52 The handwriting of amanuensis C in Solander's Manuscript Slip Catalogue, **5** : f. 258.

Fig. 53 The handwriting of amanuensis C in *Raii Historia Plantarum* **1** : 680 (1686). (Banks's copy with annotations transcribed from Sir Hans Sloane's copy.)



P. foliis semitrifidis
Protea cyanoides. Linn.
P. foliis semitrifidis, capitulis
terminalibus bracteatis.
P. foliis inferioribus multifidis
superioribus indivisis, floribus
spicatis

Fig. 54 The handwriting of amanuensis D in a transcription of a MS draft of Thunberg's '*Flora Capensis*' : f. 9.



1 Aug. 18. 1777.

Pancratium elatum. Mss. not described by Linnaeus, b.
figured in. Trew. Ehret. t. 27. (the taller
——— caribaeum. Linn. (the lesser)
Chironica baccifera. Linn. with a redish flower (Cap. b. sp
Sisyrinchium majus. Mss. a new species, but describ
as Var β. of Sisyrinchium Ber
mudianna. Linn. Sp. pl. 1353.
Buchnera aethiopica Linn. with Lilac coloured flow
ers. (Cap. b. spec
Indigofera glauca Mss. (Cap. b. spec.
Send us a better Specimen; if i
sets Seedvessels, don't omit t
let us see them.
Adelioides lucida. . Mss. as we have not seen any
female flowers, its Genus can
not be fixed.

Fig. 55 The handwriting of amanuensis D in '*Day Book Banks Herbarium*' : f. 42 (18 August 1777).

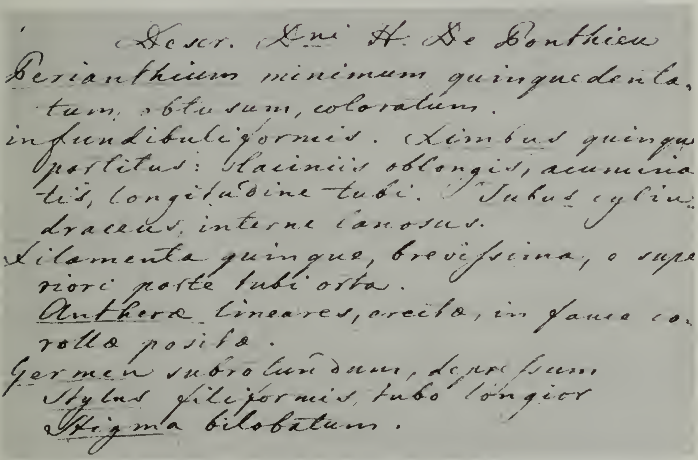
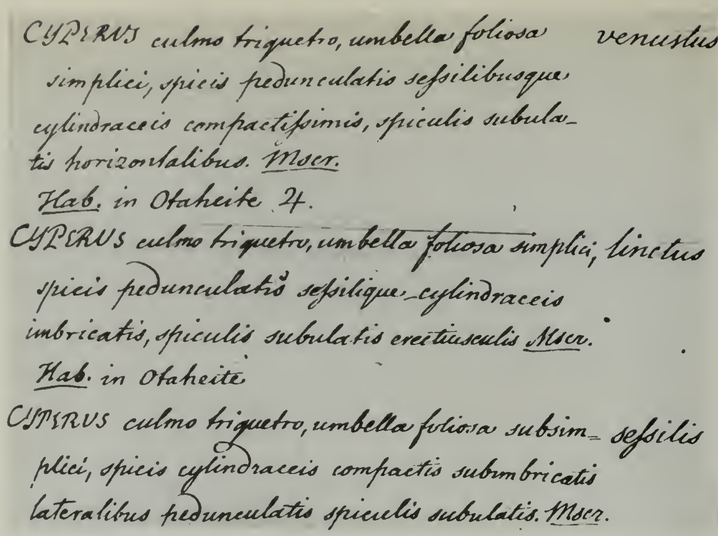
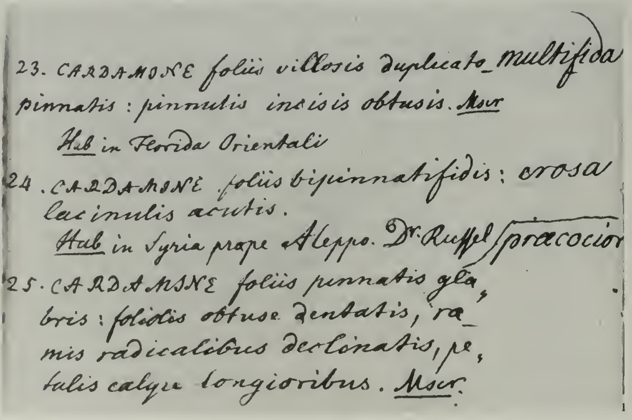

Descr. Dni H: De Ponthieu
Perianthium minimum quinquedenta-
tum, obtusum, coloratum.
infundibuliformis. Limbus quinque-
partitus: laciniis oblongis, acumina-
tis, longitudine tubi. Tubus cylin-
draceus, interne lanosus.
Filamenta quinque, brevissima, e supe-
riori parte tubi orta.
Antherae lineares, erectae, in fauce co-
rollae positae.
Germen subrotundum, depressum
Stylus filiformis, tubo longior
Stigma bilobatum.

Fig. 56 The handwriting of amanuensis E in Solander's Manuscript Slip Catalogue.


CYPERUS culmo triquetro, umbella foliosa venustus
simplici, spicis pedunculatis sessilibusque
cylindraceis compactissimis, spiculis subula-
tis horizontalibus. Mscr.
Hab. in Otaheite. 2+.
CYPERUS culmo triquetro, umbella foliosa simplici, linctus
spicis pedunculatis sessilique cylindraceis
imbricatis, spiculis subulatis erectiusculis Mscr.
Hab. in Otaheite
CYPERUS culmo triquetro, umbella foliosa subsim- sessilis
plici, spicis cylindraceis compactis subimbricatis
lateralibus pedunculatis spiculis subulatis. Mscr.

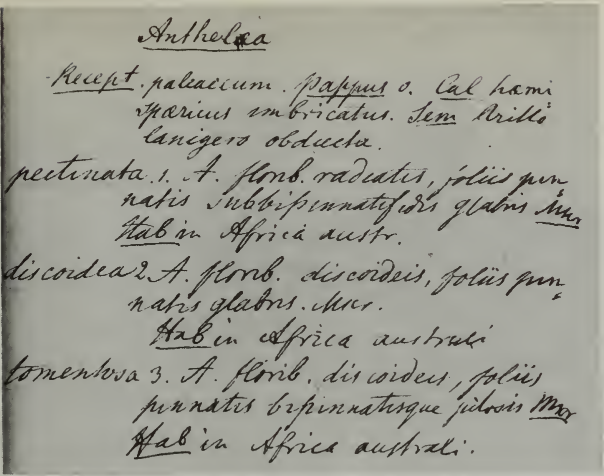
57


23. CARDAMINE foliis villosis duplicato_ multifida
pinnatis: pinnulis incisis obtusis. Mscr
Hab in Florida Orientali
24. CARDAMINE foliis bipinnatifidis: erosa
lacinulis acutis.
Hab in Syria prope Aleppo. Dr. Russel praecocior
25. CARDAMINE foliis pinnatis gla-
bris: foliolis obtuse dentatis, ra-
mis radicalibus declinatis, pe-
talis calyce longioribus. Mscr.

58

Fig. 57 The handwriting of amanuensis F in Banks's interleaved copy of Willdenow's edition of *Species Plantarum* **1** : 282.

Fig. 58 The handwriting of amanuensis G in Banks's interleaved copy of Willdenow's edition of *Species Plantarum* **3** : 488.



Anthelea

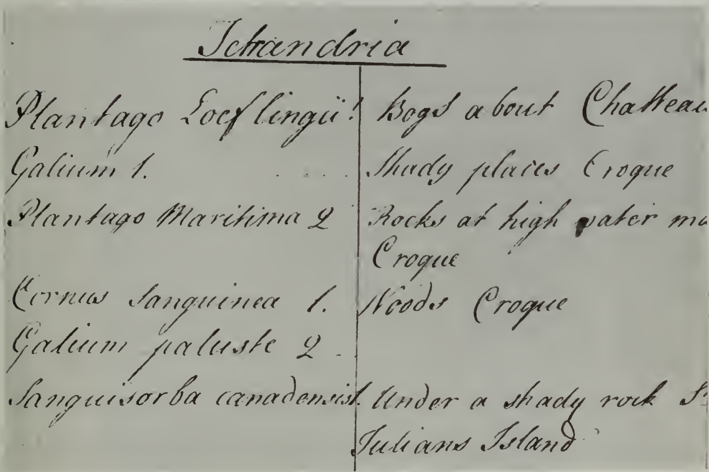
Recept. paleaceum. Pappus 0. Cal hemisphaericus imbricatus. Sem Arillo lanigero obducta.

pectinata 1. A. florib. radiatis, foliis pinnatis subbipinnatifidis glabris Mer
Hab in Africa austr.

discoidea 2. A. florib. discoideis, foliis pinnatis glabris. Mer.
Hab in Africa australi

tomentosa 3. A. florib. discoideis, foliis pinnatis bipinnatisque pilosis Mer
Hab in Africa australi.

59



Tetrandria

Plantago Loeflingii!	Bogs about Chateau
Galium 1.	Shady places Croque
Plantago Maritima 2	Rocks at high water ma Croque
Cornus Sanguinea 1.	Woods Croque
Galium paluste 2.	
Sanguisorba canadensis	Under a shady rock S Julians Island

60

Fig. 59 The handwriting of amanuensis H in Banks's interleaved copy of Willdenow's edition of *Species Plantarum* 3 : 2171.

Fig. 60 The handwriting of amanuensis I in Banks's '*Plants of Newfoundland*' : f. 3a. (A copy of Banks's holograph list.)

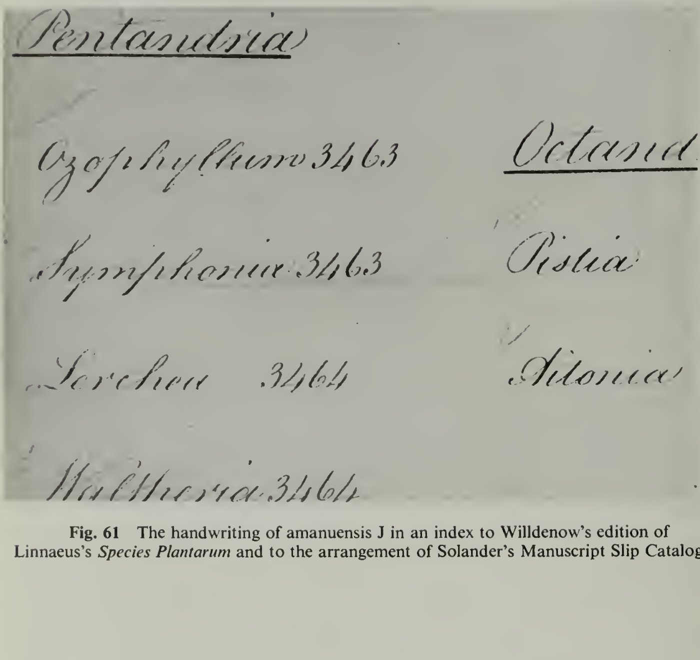


Fig. 61 The handwriting of amanuensis J in an index to Willdenow's edition of Linnaeus's *Species Plantarum* and to the arrangement of Solander's Manuscript Slip Catalogue.

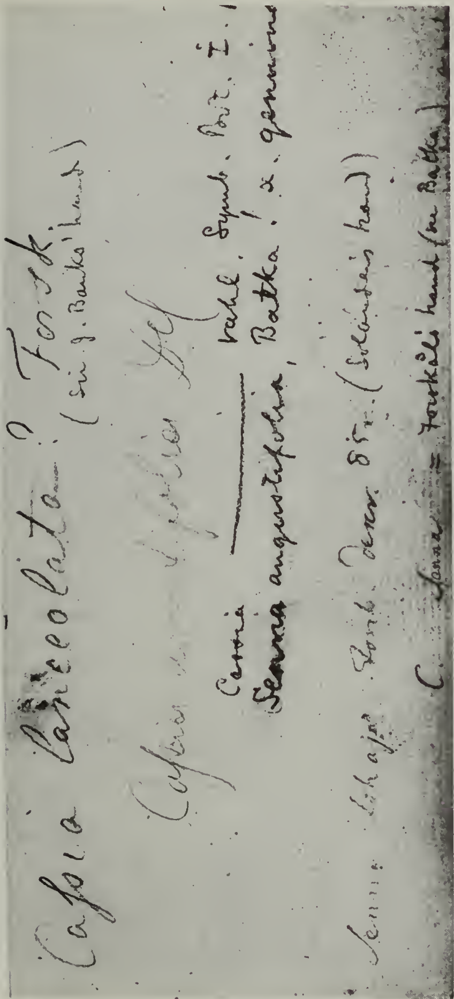
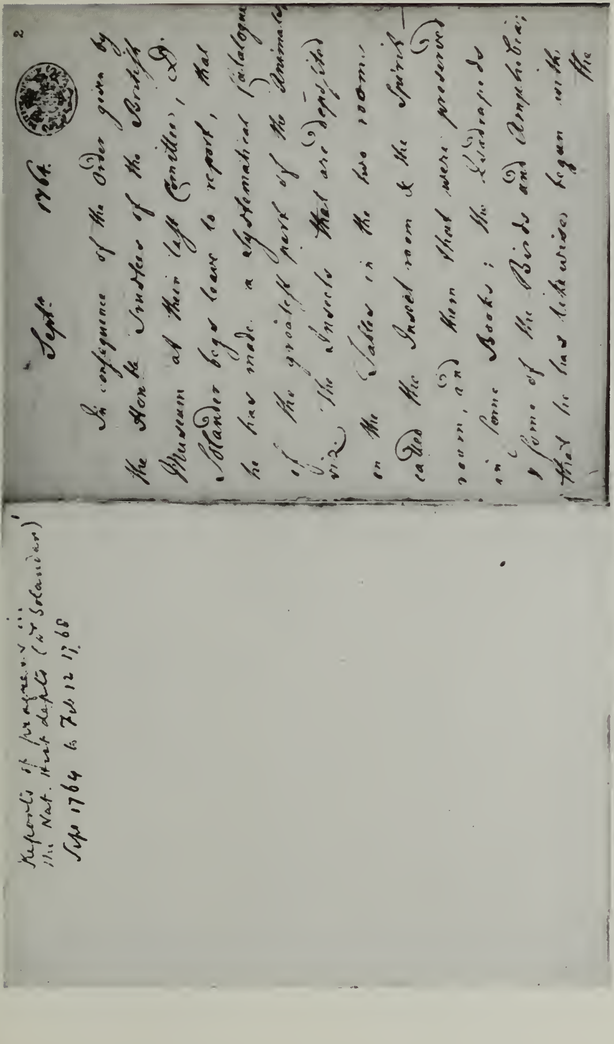


Fig. 62 Pencilled identifications on a herbarium sheet formerly in the Banksian Herbarium.

Dr Solander's '*Reports and Diary of Occurrences*'
September 1764–February 1768

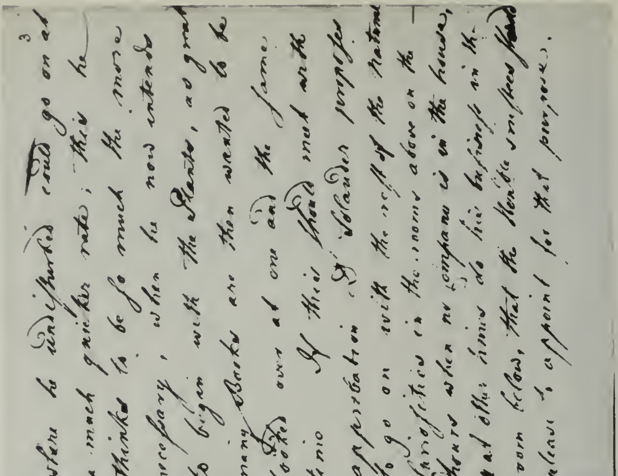
(Reproduced by permission of the British Library Board.)


Reports of progress in the Nat. Hist. depts (Dr Solander)
Sept 1764 to Feb 12 1768

2

Sept. 1764.

In consequence of the Order given by the Honble Trustees of the British Museum at their last Committee, Dr. Solander begs leave to report, that he has made a Systematical Catalogue of the greatest part of the Animals viz. the Insects that are deposited on the Tables in the two rooms called the Insect room & the Spirit-room, and them that were preserved in some Books; the Quadrupeds & some of the Birds and Amphibia; that he has likewise begun with the

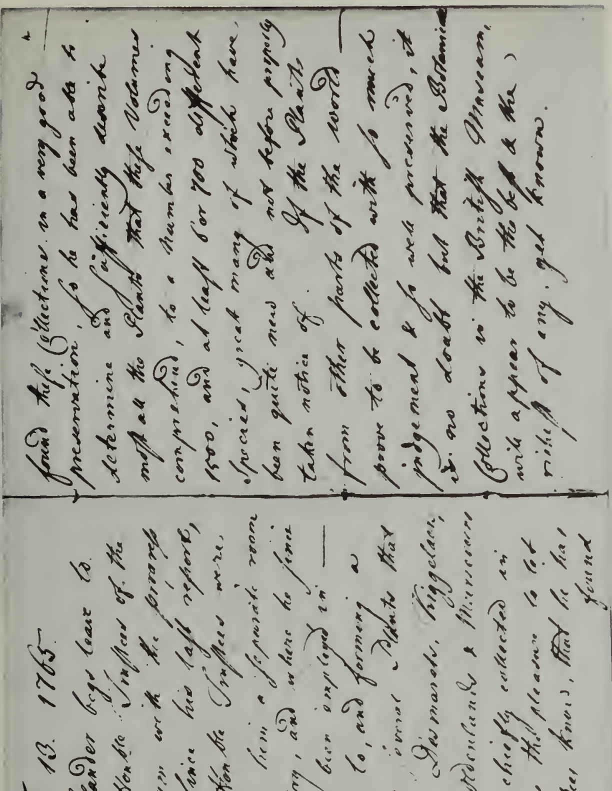


the figured Fossils on the Tables in the
little room, that he has allways
given particular attention to, and taken
compleat Descriptions of every thing
that has been new and not before
properly known; whereof he has
found a great number.

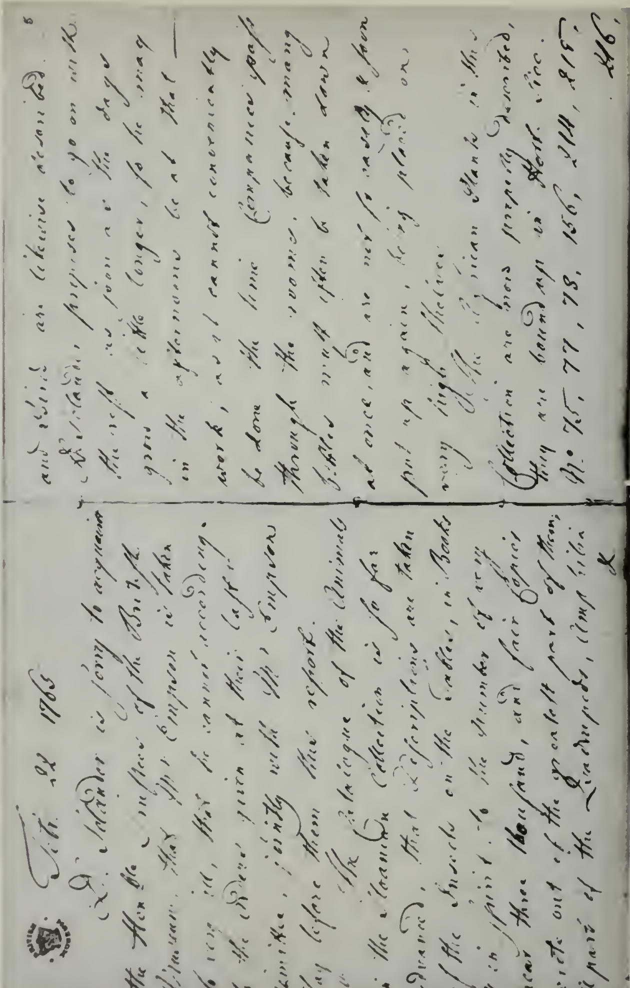
Dr. Solander at the same
time begs leave to tell the Honble
Trustees, that he has been very much
interrupted & hindered by the
Companies passing three times a day
through the rooms where he has
been at work, and therefore humbly
proposes if a room in the back-Story
could not be appropriated for him,
where

3

where he undisturbed could go on at
a much quicker rate; this he
thinks to be so much the more
necessary, when he now intends
to begin with the Plants, as great
many Books are then wanted to be
looked over at one and the same
time. If this should meet with
approbation Dr. Solander proposes
to go on with the rest of the Natural
Curiosities in the rooms above on the
hours when no company is in the house,
& at other times do his business in the
room below, that the Honble Trustees shall
please to appoint for that purpose.



Febr. 13. 1765.
D. Solander begs leave to
acquaint the Honble Trustees of the
British Museum with the progress
he has made since his last report,
whereupon the Honble Trustees were
pleased to order him a separate room
in the base. Story, and where he since
that time has been employed in —
writing Names to, and forming a
Catalogue of the several Plants that
are contained in Desmarets, Higgelaer,
Hermannus, Oldenlands & Mercerons
Hortus siccus, chiefly collected in
Africa, and has the pleasure to let
the Honble Trustees know, that he has
found
these Collections in a very good
preservation, so he has been able to
determine and sufficiently describe
most all the Plants that these Volumes
comprehend, to a Number exceeding
1500, and at least 6 or 700 different
Species, great many of which have
been quite new and not before properly
taken notice of. If the Plants
from other parts of the world
prove to be collected with so much
judgement & so well preserved, it
is no doubt but that the Botanical
Collections in the British Museum,
will appear to be the best & the
richest of any yet known.



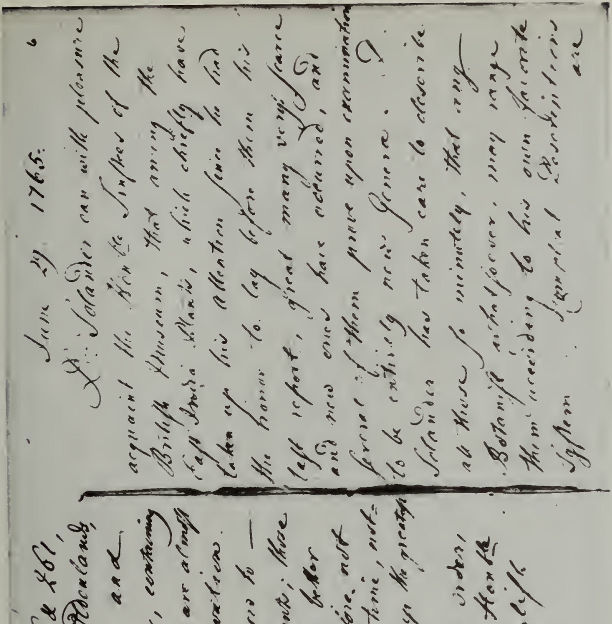
Feb. 22 1765

Dr. Solander is sorry to acquaint the Hon.ble Trustees of the British Museum, that Mr Empson is taken so very ill, that he cannot according to the Orders given at their last Comittee, jointly with Mr Empson lay before them their report.

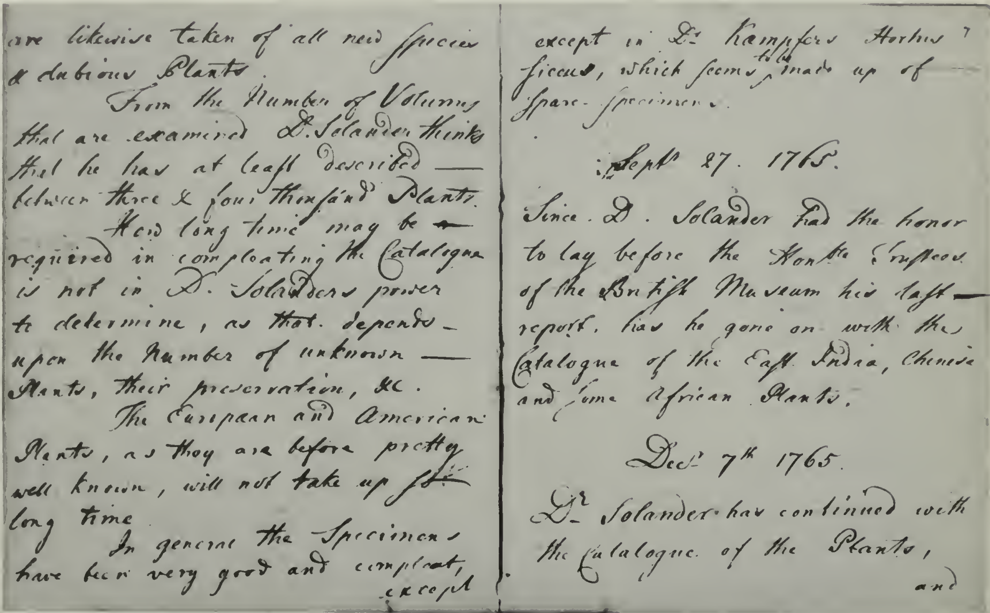
The Catalogue of the Animals in the Sloanian Collection is so far advanced, that Descriptions are taken of the Insects on the Tables, in Books & in Spirit, to the Number of very near three thousand, and fair Copies wrote out of the greatest part of them; a part of the Quadrupeds, Amphibia & Birds are likewise described. 5

Dr. Solander proposes to go on with the rest as soon as the days grow a little longer, so he may in the afternoons be at that work, as it cannot conveniently be done the time Company passes through the rooms, because many bottles must often be taken down at once, and are not so easily & soon put up again, being placed on very high shelves.

Of the Egyptian Plants in this Collection are now properly described, they are bound up in Hort. Sicc. No. 75, 77, 78, 156, 214, 215, 216,


216, 217, 218, 225, 226 & 261,
being Dr. Hermannus's, Oldenland's,
Piggelaers, Bosmiarets and
Meerseveens Herbariums, containing
above 1500 Plants; they are almost
all in very good preservation.
Dr. Solander proposes now to —
begin with the East India Plants; those
from America & Europe being better
known & described will therefore not
require so much attention and time, not=
withstanding that they make up the greatest
part of that Collection.
In consequence of the orders,
given at a Comittee of the Honble.
Trustees a part of the English
fossils are also described.

June 29. 1765. 6
Dr. Solander can with pleasure
acquaint the Honble. Trustees of the
British Museum, that among the
East India Plants, which chiefly have
taken up his attention since he had
the honour to lay before them his
last report, great many very scarce
and new ones have occurred, and
several of them prove upon examination
to be entirely new Genera. Dr.
Solander has taken care to describe
all those so minutely, that any
Botanist whatsoever, may range
them according to his own favorite
System. Compleat Descriptions
are



are likewise taken of all new Species & dubious Plants.

From the Number of Volumns that are examined Dr. Solander thinks that he has at least described between three & four thousand Plants.

How long time may be required in compleating the Catalogue is not in Dr. Solanders power to determine, as that depends upon the Number of unknown Plants, their preservation, &c.

The European and American Plants, as they are before pretty well known, will not take up so long time.

In general the Specimens have been very good and compleat, except

except in Dr. Kampfers Hortus siccus, which seems to be made up of spare-specimens.

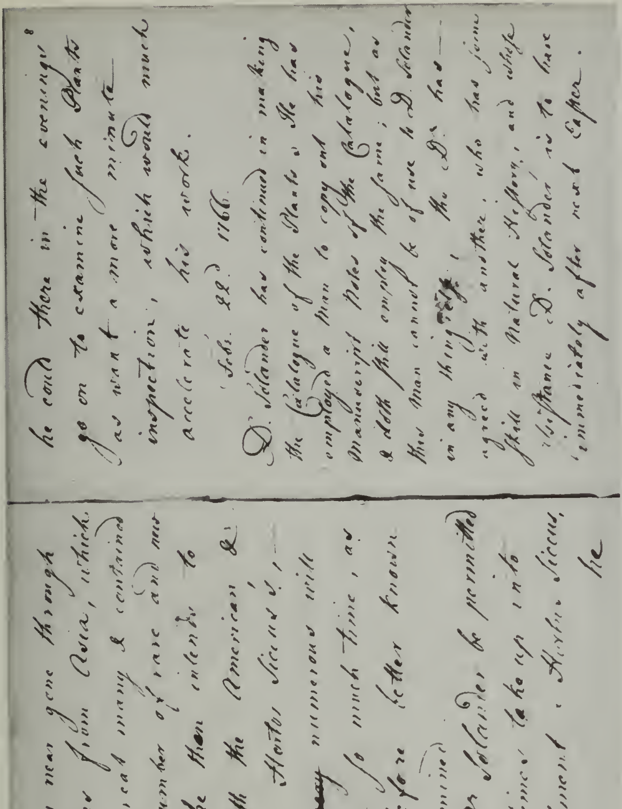
Sept. 27. 1765.

Since Dr. Solander had the honor to lay before the Honble Trustees of the British Museum his last report, has he gone on with the Catalogue of the East India, Chinese and some African Plants.

Decr. 7th 1765.

Dr. Solander has continued with the Catalogue of the Plants,

and

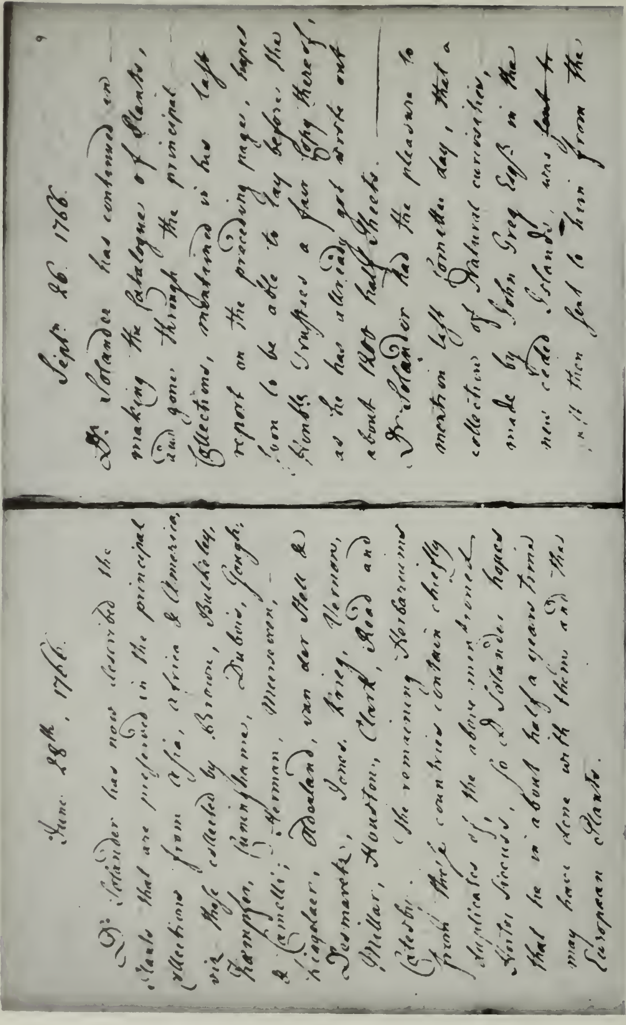


and has very near gone through
the Collections from Asia, which
have been great many & contained
a great number of rare and new
Plants; he then intends to
proceed with the American, &
European Hortus Siccus's, —
who tho' ~~very~~ numerous will
not require so much time, as
they are before better known
and determined.
Should Dr Solander be permitted
to some times take up into
his Apartment a Hortus Siccus,
he

he could there in the evenings[8]
go on to examine such Plants
as want a more minute
inspection, which would much
accelerate his work.

Febr. 22.d 1766.

D. Solander has continued in making
the Catalogue of the Plants. He has
employed a Man to copy out his
Manuscript Notes of the Catalogue,
& doth still employ the same; but as
this Man cannot be of use to D. Solander
in any thing else, the Dr has —
agreed with another, who has some
skill in Natural History, and whose
assistance D. Solander is to have
immediately after next Easter.



9

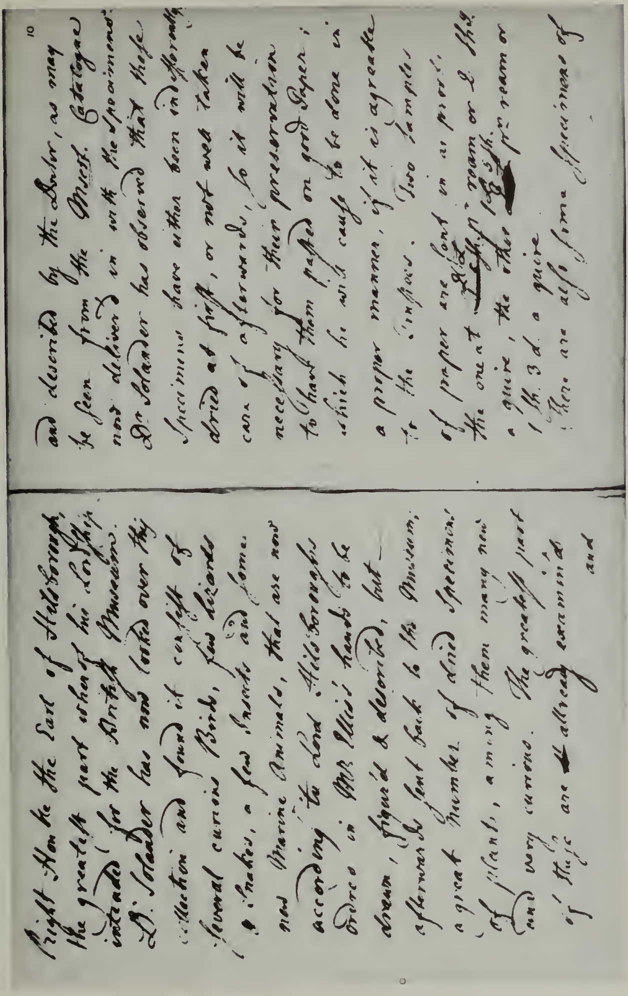
June 28th, 1766.

Dr Solander has now described the Plants that are preserved in the principal collections from Asia, Africa & America, viz those collected by Brown, Bulkeley, Kaempfer, Cuninghame, Dubois, Gough; & Camelli; Herman, Meerseveen, Kiggelaer, Oldenland, van der Stell & Desmaretz, Jones, Krieg, Vernon, Millar, Houston, Clark, Read and Catesby. The remaining Herbariums from these countries contain chiefly duplicates of the above mentioned Hortis Siccus's, so Dr Solander hopes that he in about half a years time may have done with them and the European Plants.

Sept. 26. 1766.

Dr Solander has continued in making the Catalogue of Plants, and gone through the principal Collections, mentioned in his last report on the preceding pages, hopes soon to be able to lay before the Honble Trustees a fair Copy thereof, as he has allready got wrote out about 1200 half Sheets. ——

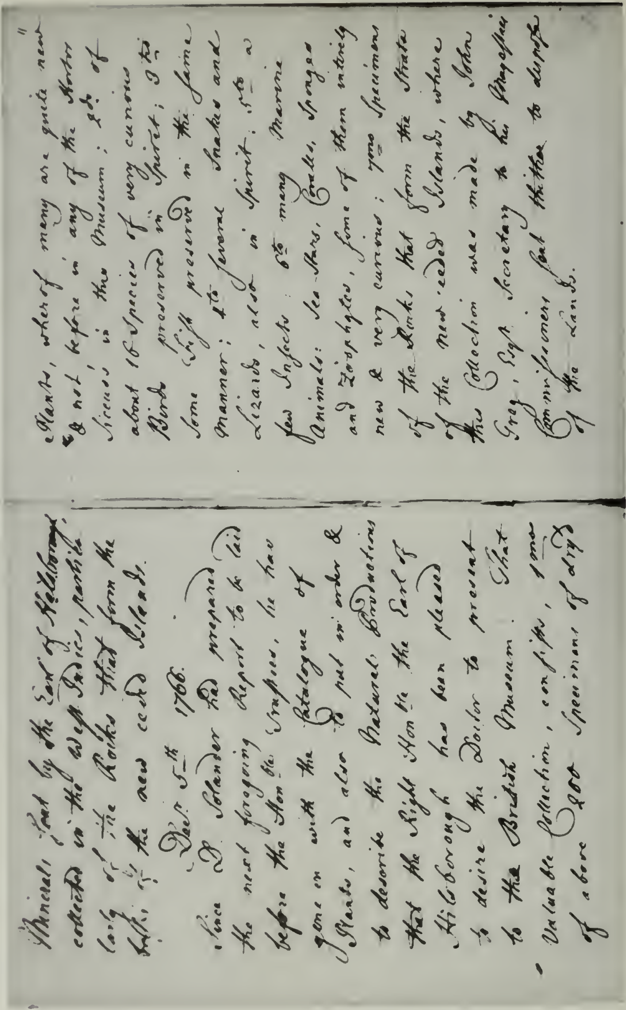
Dr Solander had the pleasure to mention last Committee day, that a collection of Natural curiosities, made by John Greg Esqr in the new ceded Islands, was ~~sent to~~ until then sent to him from the



Right Hon-ble the Earl of Hillsborough, the greatest part whereof his Lordship intended for the British Museum. Dr. Solander has now looked over this collection and found it consist of several curious Birds, few Lizards & Snakes, a few Insects and some new Marine Animals, that are now according to Lord Hillsborough's Orders in Mr. Ellis's hands to be drawn, figur'd & described, but afterwards sent back to the Museum; a great Number of dried Specimens of plants, among them many new and very curious. The greatest part of these are allready examin'd and

10

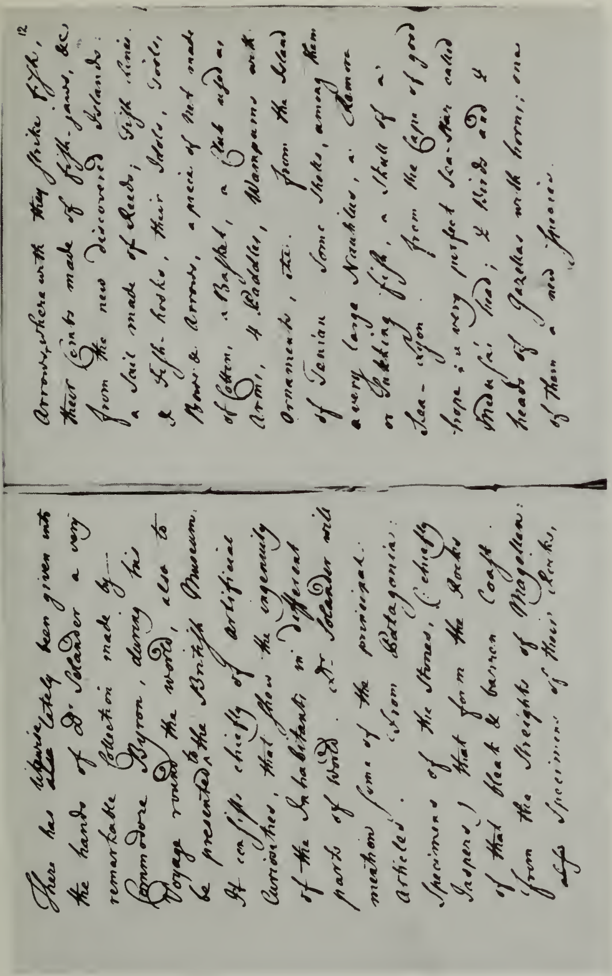
described by the Doctor, as may be seen from the Msest. Catalogue now deliver'd in with the Specimens: Dr. Solander has observed that these Specimens have either been indifferently dried at first, or not well taken care of afterwards, so it will be necessary for their preservation to have them pasted on good Paper; which he will cause to be done in a proper manner, if it is agreable to the Trustees. Two Samples of paper are sent in as proofs. the one at 2£ pr ream or 2 Sh. a quire, the other 1£ 5sh. pr ream or 1 Sh. 3 d. a quire. There are also some Specimens of



Minerals sent by the Earl of Hillsborough, collected in the West Indies, particularly of the Rocks that form the bulk of the new ceded Islands.

Decr. 5th 1766.

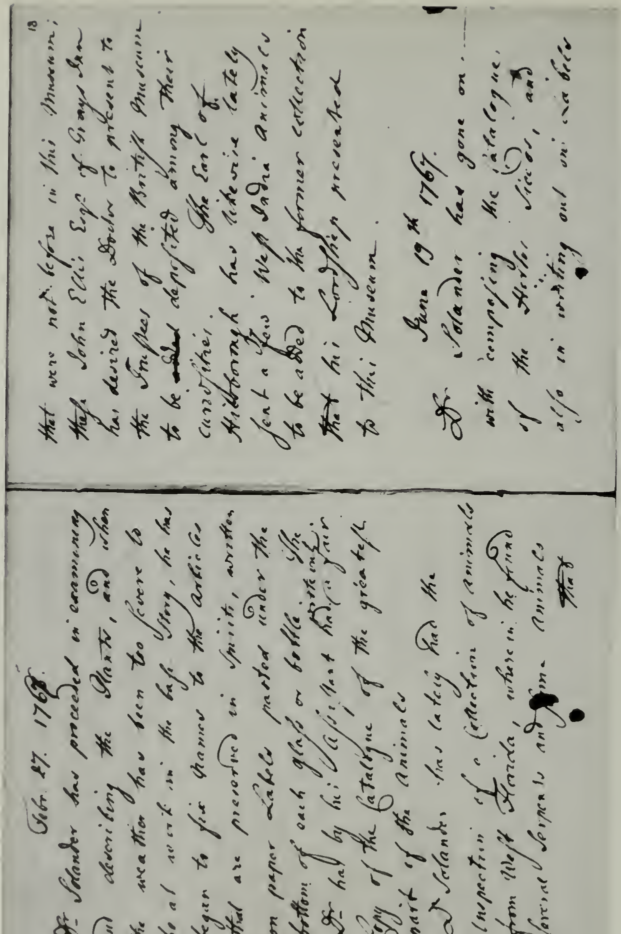
Since Dr. Solander had prepared the next foregoing Report to be laid before the Honble. Trustees, he has gone on with the Catalogue of Plants, and also to put in order & to describe the Natural Productions that the Right Honble. the Earl of Hillsborough has been pleased to desire the Doctor to present to the British Museum. That Valuable Collection, consists, 1mo of above 200 Specimens of dryd Plants, whereof many are quite new & not before in any of the Hortus Siccus's in the Museum; 2do. of about 16 Species of very curious Birds preserved in Spirit; 3tio Some Fish preserved in the same manner; 4to several Snakes and Lizards, also in Spirit; 5to a few Insects; 6to many Marine Animals: Sea-Stars, Coralls, Sponges and Zoophytes, some of them intirely new & very curious; 7mo Specimens of the Rocks that form the Strata of the new-ceded Islands, where this Collection was made by John Greg, Esqr. Secretary to his Majesties Commissioners sent thither to dispose of the Lands.



There has likewise lately been given into the hands of Dr Solander a very remarkable Collection made by— Commodore Byron, during his Voyage round the world, also to be presented to the British Museum. It consists chiefly of artificial Curiosities, that shew the ingenuity of the Inhabitants in different parts of world. Dr Solander will mention some of the principal articles. From Patagonia: Specimens of the Stones, (chiefly Jaspers) that form the Rocks of that bleak & barren Coast. From the Streights of Magellan: Specimens of their Rocks,

12

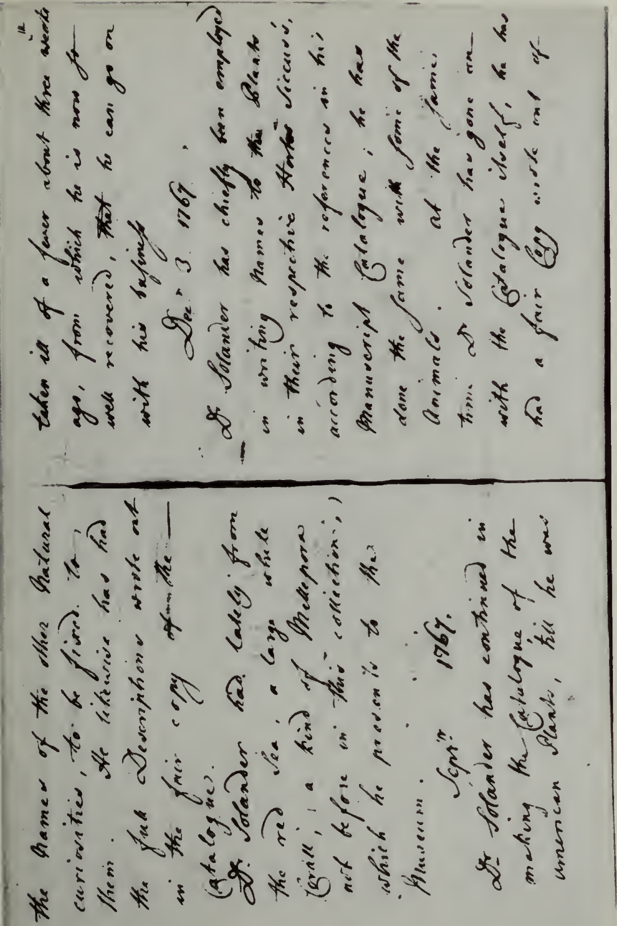
Arrows, wherewith they strike fish, their Points made of fish-jaws, &c. From the new discovered Islands: a Sail made of Reeds; Fish lines & Fish-hooks, their Idols, Tools, Bows & Arrows, a piece of Net made of Cotton, a Basket, a Club used as Arms, 4 Paddles, Wampums with Ornaments, etc. From the Island of Tenian Some Shells, among them a very large Nautilus, a Remora or Sukking fish, a Skull of a Sea-Lyon. From the Cape of good hope: a very perfect Sea-Star called Medusa's head; 2 Birds and 4 heads of Gazellas with horns; one of them a new species.



Feb. 27. 1767.
Dr Solander has proceeded in examining
and describing the Plants, and when
the weather has been too severe to
be at work in the base Story, he has
begun to fix Names to the Articles
that are preserved in Spirits, written
on paper Labels pasted under the
bottom of each glass or bottle. The
Dr had by his Assistant had a fair
Copy of the Catalogue of the greatest
part of the Animals
Dr Solander has lately had the
Inspection of a Collection of Animals
from West Florida, wherein he finds
several Serpents and some Animals
that

13
that were not before in this Museum;
these John Ellis Esqr of Grays Inn
has desired the Doctor to present to
the Trustees of the British Museum
to be ~~added~~ deposited among their
curiosities. The Earl of
Hillsborough has likewise lately
sent a few West India Animals
to be added to the former collection
that his Lordship presented
to this Museum.

June 19th 1767.
Dr Solander has gone on
with composing the Catalogue
of the Hortus Siccus, and
also in writing out in a [illegible]



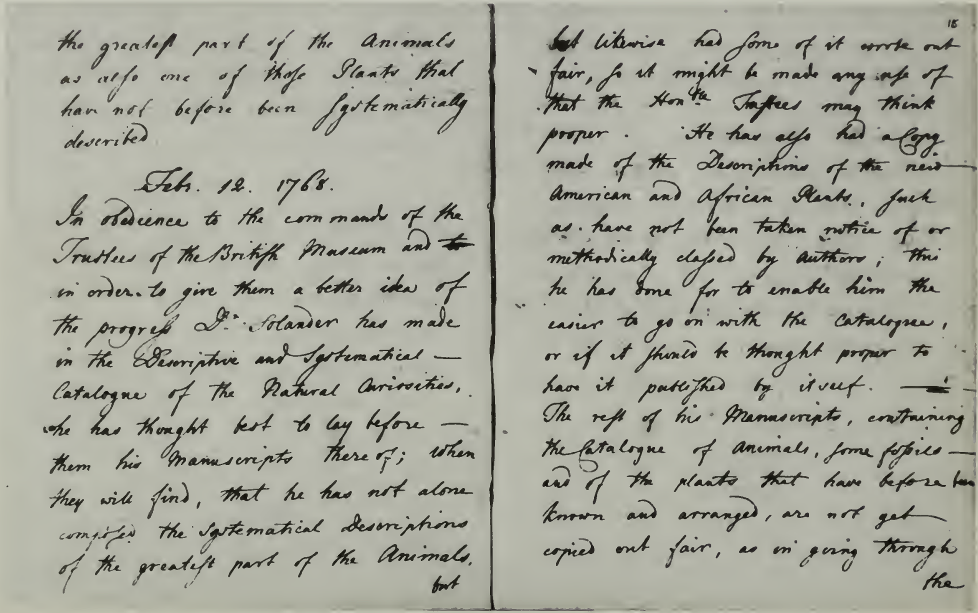
the Names of the other Natural
curiosities, to be fixed to
them. He likewise has had
the full Descriptions wrote out
in the fair copy of the
Catalogues.
Dr Solander had lately from
the red Sea, a large white
Corall, a kind of Millepora
not before in this collection,
which he presents to the
Museum.

Septr 1767.

Dr Solander has continued in
making the Catalogue of the
American Plants, till he was
taken ill of a fever about three weeks
ago, from which he is now so
well recovered, that he can go on
with his business

Decr 3. 1767.

Dr Solander has chiefly been employed
in writing Names to the Plants
in their respective Hortus Siccus's,
according to the references in his
Manuscript Catalogue; he has
done the same with some of the
Animals. At the same
time Dr Solander has gone on
with the Catalogue itself, he has
had a fair Copy wrote out of



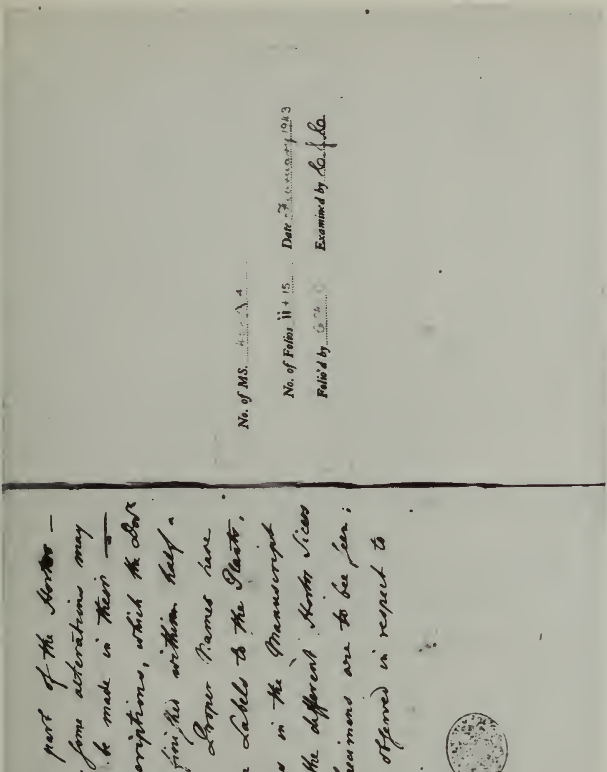
the greatest part of the Animals
as also one of those Plants that
have not before been systematically
described

Febr. 12. 1768.

In obedience to the commands of the
Trustees of the British Museum and ~~to~~
in order to give them a better idea of
the progress Dr. Solander has made
in the Descriptive and Systematical —
Catalogue of the Natural Curiosities,
he has thought best to lay before —
them his Manuscripts thereof; when
they will find, that he has not alone
compiled the Systematical Descriptions
of the greatest part of the Animals,
but

15

but likewise had some of it wrote out
fair, so it might be made any use of
that the Honble Trustees may think
proper. He has also had a Copy
made of the Descriptions of the new
American and African Plants, such
as have not been taken notice of or
methodically classed by Authors; this
he has done for to enable him the
easier to go on with the Catalogue,
or if it should be thought proper to
have it published by itself. —
The rest of his Manuscripts, containing
the Catalogue of Animals, some fossils —
and of the plants that have before been
known and arranged, are not yet
copied out fair, as in going through
the


the remaining part of the Hortus —
Siccus's Sticks, some alteration may
be necessary to be made in their —
respective Descriptions, which the Dr
hopes to have finished within half a
years time. Proper Names have
been wrote on Labels to the Plants,
with references in the Manuscript
Catalogue to the different Hortus Siccus
where the Specimens are to be seen;
The same is observed in respect to
the Animals.
No. of MS.
No. of Folios ii + 15
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Date February 1943
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Seaweeds of the western coast of tropical Africa and adjacent islands: a critical assessment. II Phaeophyta. By J. H. Price, D. M. John & G. W. Lawson.

The lichenicolous Hyphomycetes. By D. L. Hawksworth.

The species of *Chisocheton* (Meliaceae). By D. J. Mabberley.

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Seaweeds of the western coast of tropical Africa and adjacent islands: a critical assessment. II. Phaeophyta

J. H. Price, D. M. John & G. W. Lawson

Botany series Vol 6 No 2 21 December 1978

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Botany series
Vol 6 No 2 pp 87–182

Issued 21 December 1978

Seaweeds of the western coast of tropical Africa and adjacent islands: a critical assessment. II. Phaeophyta

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G. W. Lawson
Department of Biological Sciences, University of Lagos, Nigeria

Contents

Synopsis

This paper assembles and, so far as is possible without extended field and herbarium studies, examines critically the validity of records of marine and brackish-water Phaeophyta (brown algae) for the western coast of tropical Africa. The whole mainland coastline from the northern boundary of former Spanish Sahara southwards to the southern boundary of South West Africa, the oceanic islands from the Salvage Islands southwards to Ascension, and all islands close to the African mainland coast are included in the area covered. Each species entry includes all traced records for the species, the names which have previously been applied to it for the area and additional comments or evaluation, as necessary. Comments have also been made at generic level in certain difficult cases. The new combination *Cystoseira humilis* var. *myriophylloides* (Sauv.) Price & John is established.

Introduction

The area dealt with in this part is the same as that covered by part I (Lawson & Price, 1969) and such country name changes as have occurred since then are incorporated in the legend for the coastline map of west Africa (Fig. 1). As before, both genera and constituent species are listed in alphabetical order. Each main entry consists of three, sometimes four, principal parts:

(i) *The major bold heading*, which represents the accepted species name and authorities.

(ii) *Subsidiary italicised headings, in square brackets*. These represent the different ways in which the species has been cited by authors publishing records of relevance. The manner of citation by species names, even when manifestly incorrect, has been maintained unless the original author's intent required clarification for comprehension; there will thus be no doubt as to which record we attribute to which accepted species.

(iii) *The distributional data*, within which the countries are arranged in alphabetical order and more generalized statements of distribution appear after the specific countries. The latter statements are included *verbatim* as it is not always clear for precisely which countries they establish records. The numbers given in parentheses after each country name or generalized statement of distribution refer to the corresponding numbers in the references. Works cited in the present list of Phaeophyta have been newly numbered so that a given number here does not, except by accident, correspond to that given to the same reference in part I. It should

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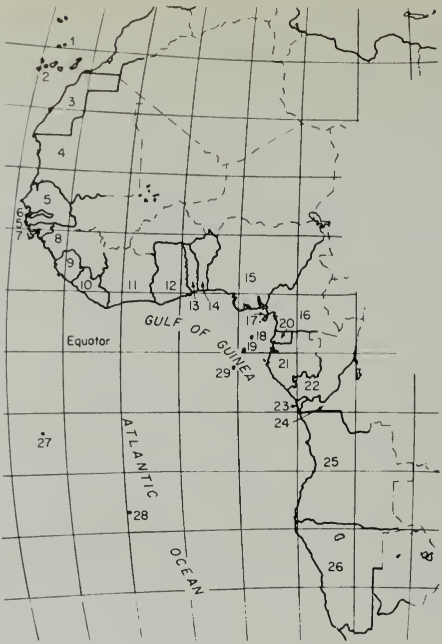

Fig. 1 The coastline of tropical west Africa and the offshore islands.
1, Salvage Islands; 2, Canary Islands; 3,* former Spanish Sahara [= Western Sahara, Spanish West Africa] (includes the often quoted Rio de Oro, the southern region of the country, but excludes Ifni); 4, Mauritanie; 5, Sénégal; 6, Gambia; 7, Guinea-Bissau [= Portuguese Guinea]; 8, Guinée; 9, Sierra Leone; 10, Liberia; 11, Côte d'Ivoire; 12, Ghana; 13, Togo; 14, Benin [= Dahomey]; 15, Nigeria; 16, Cameroun; 17,† Macias Nguema Biyogo [= Fernando Póo]; 18, Príncipe; 19, São Tomé; 20,† Equatorial Guinea [= Spanish Guinea]; 21, Gabon; 22,‡ Republic of the Congo; 23, Cabinda; 24, Zaire [= Congo Republic]; 25, Angola; 26, South West Africa [Namibia]; 27, Ascension Island; 28, Saint Helena; 29, Pagalu [= Annobon]. The Cape Verde Islands, which lie immediately to the west of Dakar (Sénégal), have been omitted from this map but are included in the species list that follows.

* The former colony of Spanish Sahara no longer officially exists, the territory it once covered being divided, by agreement, between Morocco and Mauritanie. The effective date of the division, Spain concurring, was 28 February 1976, although guerilla opposition delayed matters until a formal agreement on 14 April 1976. The attempt to maintain the territory as the Democratic Saharan Arab Republic has apparently entered the 'realm of myth' (Gretton, 1976). The authors' citation terminology is maintained throughout the records.

† Nos 17 (Macias Nguema Biyogo) and 20 (Spanish Guinea, = Rio Muni) on the original map (part I) are now jointly administered as Equatorial Guinea.

‡ Loango, a name much used by early collectors such as Welwitsch, was formerly a coastal region of west Africa. Its application appears to have included much of the coastline of the Republic of the Congo (22), as well as of Cabinda (23) and Zaire (24). Because by far the longest and rockiest part of the Loango coast lies now within the Republic of the Congo we have attributed all marine algal records from Loango to the Congo.

be stressed, therefore, that lists of references are not interchangeable and must be used only with the part to which they are appended. When the letters 'p.p.' (*pro parte*) follow a cited reference number, it may be taken that reassessment has shown the original material or concept to have been heterogeneous. Citation of numbers suffixed A, B, C and so on has been necessary in a few cases; these represent data acquired after preparation of the full text was too advanced to permit numerical reorganization.

New records, based either on recent field observations or on herbarium studies by various workers, appear principally with the word 'unpublished', in parentheses, following them. An exception has been made in the case of reference number 287; Mr R. H. Simons kindly provided us with many records collected in South West Africa during an expedition in 1957.

(iv) *Additional notes* were necessary in the case of many species; these notes are inset immediately below the entry concerned. Citation of references in the explanatory notes takes one of two forms. Where a cited work does not contain records and is therefore not numbered, the authors' name(s), date of publication and, where necessary, page numbers are quoted. Otherwise, the names of authors are followed by two figures, in parentheses and separated by a colon; the first figure is the number in the terminal list of references, and the second the relevant page(s) in the work.

Species nomenclature has been revised as far as possible and the complete author citation is given for each accepted combination. Discarded combinations under which records for the area have previously been published are also included as entries in the list, but only as cross-references to the currently accepted names. We previously (Lawson & Price, 1969 : 281) emphasized the preliminary nature of part I of this list; although in the intervening nine years there has been considerable advance in knowledge of taxonomy, floristics and distribution along the coastlines of many countries within the area, that original statement remains true for the present part. A supplement, designed to up-date part I of the list so as to be directly comparable in completeness to part II, is currently in preparation and will appear after publication of the text concerning the Rhodophyta. The list of Phaeophyta in part II includes all known publications, together with completed and submitted texts of papers, up to the end of 1976. Certain later data of importance are also incorporated.

Once again, we would welcome amendments or additional data where errors and/or omissions are detected in the present text. We are grateful to Mr R. Ross, Keeper of Botany, British Museum (Natural History), for the provision of research facilities and for help in matters of nomenclature.

Species List

Acinetospora crinita (Carm. ex Harv. in Hook.) Kornm.
'Atlantique nord (de l'Angleterre aux Canaries; . . .)' (13).
[As *Ectocarpus pusillus* Griff.]
Canaries (32; 92).

Note. Kornmann (1953), Parke & Dixon (1964; 1968), Parke *et al.* (1976), Cardinal (1964) and Clayton (1974) have all commented on the possibility that *Feldmannia lebelii* (Aresch. ex Crouan frat.) Hamel and *F. padinae* (Buffh.) Hamel represent the haploid phase of *Acinetospora crinita*. Kornmann actually observed the development of spores (from unilocular sporangia in *Acinetospora*) to form haploid plants resembling *Feldmannia lebelii* and *F. padinae*. Knoepffler-Péguy (1972; 1974) concluded that *Acinetospora* is an environmentally induced morphological state of either *Feldmannia* or *Giffordia*, and later (1977) restricted this to *Feldmannia* alone. See the generic note to *Ectocarpus*.

Aglaozonia canariensis Sauv.
See *Lobophora variegata* (Lamour.) Womersley.

Aglaozonia reptans Kütz.
See *Cutleria multifida* (Sm.) Grev.

Aglaozonia sp.
See *Cutleria* sp.

Ascocyclus magnusii Sauv.
See *Myrionema magnusii* (Sauv.) Lois.

Ascocyclus orbicularis (J. Ag.) Magnus
See *Myrionema magnusii* (Sauv.) Lois.

Ascophyllum nodosum (L.) Le Jol.
Canaries (259).
[As *Fucus nodosus* L.]
Canaries (40).

Note. John (1974) reassessed the distribution of *Ascophyllum* in the warmer parts of the Atlantic Ocean and could find no justification for Bouvier's (40 : 36) assumption that plants are '. . . arrachés certainement aux rivages des Canaries, de Madère ou des Açores'. It appears that all reports from these offshore islands are of drift plants which may be found floating as far south as the Equator. This applies also to the recent Santos, Acuña & Wildpret (259) record, not considered by John (1974). That record stated only 'Playa de Puerto Naos, . . .', the authors indicating elsewhere (p. 27) that they were unable then to establish whether *Ascophyllum* grew locally on the shores observed or not, although 'trozos del alga' [= pieces of the alga] were collected on the west-facing shore concerned.

Asperococcus bullosus Lamour.
See *Asperococcus turneri* (Sm.) Hook.

Asperococcus clathratus J. Ag.
See *Hydroclathrus clathratus* (C. Ag.) Howe.

Asperococcus compressus Griff. ex Hook.
[As *Asperococcus compressus* Griff.]
Canaries (32; 92).
[As *Asperococcus echinatus* (Mert.) Grev.]
Canaries (208).
[As *Asperocoecus* [sic!] *echinatus* Grev.]
Canaries (21).

Asperococcus echinatus (Mert.) Grev.
See *Asperococcus compressus* Griff. ex Hook.

Asperococcus intricatus (Kütz.) J. Ag.
See *Rosenvingea intricata* (J. Ag.) Børg.

Asperococcus sinuosus *auct.*
See *Colpomenia sinuosa* (Roth) Derb. & Sol.

Asperococcus turneri (Sm.) Hook.
[As *Asperococcus bullosus* Lamour.]
Canaries (92; 308).
'From Norway southwards to the Canary Islands . . .' (32).
'Atlantique (de la Norvège aux Canaries) . . .' (13).
'. . . de Norvège aux Canaries . . .' (37).
'. . . da Noruega e Suécia às Canárias . . .' (256).
[As *Encoelium mac-gregorii* Suhr ex Kütz.]
Canaries (173).

Bachelotia antillarum (Grun.) Gerl.
Angola (158; 191).
Côte d'Ivoire (147; 148).
Gabon (148; 153).

Gambia (148; 155).
Ghana (148).
Liberia (61; 148).
Mauritanie (189).
Nigeria (148; 244; 294).
São Tomé (148; 294).
Sierra Leone (148; 154).
'Atlantique: espèce meridionale qui remonte jusque sur la côte basque . . .' (101).
'. . . countries both to north and south of Angola . . .' (158).
'. . . Atlantique (de Roscoff au Maroc et Canaries; . . .)' (13).
'. . . Tropical to warm temperate Atlantic Ocean (to N. France) . . .' (314).
[As *Bachelotia fulvescens*]
Ghana (187).
Nigeria (187; 293).
Sénégal (187).
[As *Bachelotia fulvescens* (Schousb. ex Born.) Fox]
Canaries (99).
Ghana (99).
Nigeria (99).
Sénégal (99).
Sierra Leone (99).
[As *Bachelotia fulvescens* (Schousb.) Kuck.]
Sénégal (289).
[As *Bachelotia*]
Ghana (157).
[As *Pylaiella fulvescens* (Schousb.) Born.]
Canaries (32; 92; 95).
Ghana (183; 295).
'African west coast . . .' (194).
[As *Pylaiella fulvescens* Thur.]
Canaries (308).

Note. S. M. Price (244), from culture studies, cast considerable doubt on the validity of many of the morphological characteristics used for separating the genus *Bachelotia* from *Pilayella*. She suggested (p. 28) that '. . . further detailed examination of plants from varying environments in different areas is required before any firm decision can be made'. Subsequently, Clayton (1974) presented evidence suggesting that spore behaviour, and therefore life-history, are probably both capable of wide variation over the distribution range of the species. Both Price (244) and Magne (1976) have commented on some of the unusual cytological characteristics of *Bachelotia*, notably the stellate arrangement of the chloroplasts, the form and structure of the apparatus being shared only with *Asteronema* Delépine & Asensi, of the brown algae.

Bachelotia fulvescens *auct.*
See *Bachelotia antillarum* (Grun.) Gerl.

Basispora africana John & Lawson
Angola (191).
Cameroun (152).
Côte d'Ivoire (148; 152).
Gambia (155).
Ghana (152).
Liberia (61; 148; 152).
? Sénégal (152).
Sierra Leone (152; 154).
[As *Hapalospongidium spongiosum* Saunders]
Ghana (147; 187).

Sénégal (147; 187).
Sierra Leone (147; 187).
Note. The records for Ghana, Sénégal and Sierra Leone given in (187) are qualified by a question mark.
[As ? *Mesospora* sp.]
Cameroun (147; 182).
Ghana (147; 183).
Sierra Leone (147; 184).
Note. All the above records of *Hapalospongidium* and *Mesospora* are given with reservations and the latter was always recorded with a question mark. It has not been possible to locate any material to substantiate the record of this plant having been found in Sénégal.

Bifurcaria bifurcata R. Ross
Spanish Sahara (189).
[As *Bifurcaria bifurcata* (Vell.) Ross]
'Atlântico: da Mancha ao Cabo da Boa Esperança [Cape of Good Hope]' (256).
[As *Bifurcaria tuberculata* (Huds.) Stackh.]
Spanish Sahara [Rio de Oro] (289).
'. . . Atlantique: depuis les côtes anglaises jusqu'au Cap de Bonne Espérance' (107).
'. . . l'existence paraît au moins assez générale sur le littoral ouest-africain, du Maroc à la Guinée française' (289).
[As *Bifurcaria tuberculata*]
Spanish West Africa (245).
[As *Pycnophycus tuberculatus* (Huds.) Kütz.]
'In oceano atlantico ad oras . . . Africae borealis et australis' (171).
Note. Fischer-Piette (96) originally indicated the presence of this species in Mauritanie, based on a supposed record by Sourie (289). Afterwards (97 : 206), Fischer-Piette indicated that he had misinterpreted Sourie's data, the record actually being for Rio de Oro. Nevertheless, see the above general distribution statement by Sourie.

Bifurcaria tuberculata (Huds.) Stackh.
See *Bifurcaria bifurcata* R. Ross.

Capea biruncinata Mont.
See *Ecklonia biruncinata* (Bory) Papenf.

Capea exasperata Mont.
See *Ecklonia biruncinata* (Bory) Papenf.

Chnoospora atlantica J. Ag.
See *Chnoospora minima* (Hering) Papenf.

Chnoospora fastigiata J. Ag.
See *Chnoospora minima* (Hering) Papenf.

Chnoospora fastigiata J. Ag. var. **atlantica** J. Ag.
See *Chnoospora minima* (Hering) Papenf.

Chnoospora minima (Hering) Papenf.
Benin (148; 151).
Côte d'Ivoire (148).
Ghana (61; 148; 150; 157; 187; 300).
Liberia (61; 147; 148).
Nigeria (148; 187).
São Tomé (148; 294).
Sierra Leone (148; 154).
Togo (148; 151).

[As *Chnoospora minima* Hering]
Cape Verde Islands (99).
Nigeria (99).
Pagalu (99).
[As *Chnoospora minima* Hering in Papenf.]
Cape Verde Islands (294).
Ghana (294).
Nigeria (294).
Pagalu (294).
São Tomé (294).
[As *Chnoospora minima*]
Ascension (243B).
Nigeria (293).
[As *Chnoospora atlantica*]
Ghana (187).
[As *Chnoospora fastigiata* J. Ag.]
? Cape Verde Islands (16; 210).
Pagalu (242).

Note. Montagne's (210 : 219) doubt about the Cape Verde Island material is expressed as '. . . Alga sterilis, inde maximis dubiis vexata'. Askenasy (16) was repeating Montagne's data.

[As *Chnoospora fastigiata* J. Ag. var. *atlantica* J. Ag.]
Cape Verde Islands (117).

Chorda filum Lamour.
See *Scytosiphon lomentaria* (Lyngb.) Link.

Chordaria flagelliformis (O. F. Müll.) C. Ag.
South West Africa (75).

Note. In the absence of other records or specimen data to support the presence of this species in South West Africa, it is possible that the record should really relate to *Chordariopsis capensis* (q.v.).

Chordaria sordida Bory
See *Levringia sordida* (Bory) Kylin.

Chordariopsis capensis (C. Ag.) Kylin
South West Africa (225; 287).

Note. See remarks under *Chordaria flagelliformis* (O. F. Müll.) C. Ag.

Cladosiphon natalensis (Hering) Born. in Asken.
See *Levringia natalensis* (Kütz.) Kylin.

Cladostephus bolleanus Mont.
See *Cladostephus spongiosus* (Huds.) C. Ag. forma *verticillatus* (Lightf.) P.v.R.

Cladostephus spongiosus (Huds.) C. Ag. forma **spongiosus**
[As *Cladostephus spongiosus* (Huds.) C. Ag.]
'. . . de la Norvège aux Canaries . . .' (97).
[As *Cladostephus spongiosus* C. Ag.]
Canaries (136; 228).
'De la Norvège aux Canaries . . .' (37).
[As *Cladostephus spongiosus* (Lightf.) C. Ag.]
Canaries (63).
'Von . . . den Canarischen Inseln bis Nordlanden in Norwegen . . .' (116).

Note. Sauvageau (273 : 590) remarked of *C. spongiosus* C. Ag., '. . . Sa présence aux Canaries est douteuse . . .'. Levring (195 : 30) stated '. . . not recorded from the Canaries or Morocco . . .'.

Cladostephus spongiosus (Huds.) C. Ag. forma **verticillatus** (Lightf.) P.v.R.
[As *Cladostephus spongiosus* C. Ag.]
Canaries (208; 273).

Note. Montagne (208) expressed doubt about this record. Sauvageau (273), who saw the material on which Montagne based the Canary Islands record, believed it to be referable to *Cladostephus verticillatus* (now *C. spongiosus* forma *verticillatus*). See note below.

[As *Cladostephus bolleanus* Mont.]

Canaries (63; 172; 209; 228; 273).

Note. According to Reinke (250) and Sauvageau (273 : 485, 486), Montagne's specimens from the Canary Islands are all referable to *Cladostephus verticillatus* (now *C. spongiosus* forma *verticillatus*). De Toni (63 : 514) had earlier questioned the validity of *C. bolleanus*.

[As *Cladostephus verticillatus* C. Ag.]

Canaries (228; 308).

'De la Grande-Bretagne aux Canaries . . .' (27).

[As *Cladostephus verticillatus* (Lightf.) C. Ag.]

Canaries (63; 161; 277; 294).

[As *Cladostephus verticillatus* (Lightf.) Lyngb.]

Canaries (32; 92; 195; 282).

'. . . de la Grande-Bretagne aux Canaries . . .' (97).

'. . . Atlantique, de l'Ecosse aux Canaries . . .' (88).

'Atlantique (de l'Irlande aux Canaries: . . .)' (13).

'da Escócia, Noruega e Suécia às Canárias . . .' (256).

[As *Cladostephus verticillatus* Lyngb.]

Canaries (271; 273).

'Océan Atlantique: des Orcades et d'Helgoland jusqu'aux Canaries, . . .' (273).

[As *Cladostephus verticillatus*]

Canaries (160; 269).

[As *Cladostephus*]

Canaries (21)

Note. Based on data of Montagne (208).

Overall Note. Prud'homme van Reine (1972) combined *Cladostephus spongiosus* and *C. verticillatus* into a single species, recognizing that there is clinal variation in the characters which have in the past been used to separate them. He established a number of formae (*spongiosus*, *verticillatus*, *laxus*, *hedwigioides*), commenting (p. 142) on the first two of these that: 'They are, however, in most cases easily recognised in the field, and for that reason I like to keep them separate as forms.' Steentoft (294) has mistakenly reported secondarily this species from São Tomé, having apparently mis-translated the somewhat ambiguously arranged statements of Sampaio (1962) in which he mentioned (p. 24) that this species of *Cladostephus* is often the substratum of *Hydrocoleum lyngbyaceum* (= *Microcoleus lyngbyaceus sensu* F. Drouet) in other areas. He added afterwards that the variety of *H. lyngbyaceum* (var. *typica*) referred to 'não é conhecida na flora da Africa Portuguesa'.

Colpomenia

The characters used to separate the species *Colpomenia peregrina* and *C. sinuosa* were previously discussed in some detail by Blackler (1964; 1967) and by Womersley (313). Employing these distinctions, it would seem that *C. peregrina* is of widespread distribution, whereas *C. sinuosa* is more typically present in warm temperate and tropical seas. More recently, however, Clayton (1976a) has employed a hybrid index method and analysis of variance to study morphological and anatomical variation in *Colpomenia* in Australia. She has shown that most characteristics commonly used elsewhere to distinguish subgeneric taxa are variable and therefore do not provide a basis for taxonomic discrimination. Sorus shape and presence of a cuticle on plurilocular sporangia are the only two reliable characters. Clayton has established that Australian and European material of *C. peregrina* (Sauv.) Hamel is characterized by extensive sori lacking a cuticle, whilst Australian, European and North American material of *C. sinuosa* (Roth) Derb. & Sol. is homogeneous in its punctate or punctiform sori with a distinct cuticle. She also provides good evidence that the species differ in the number of layers of colourless medullary cells present, *C. peregrina* having three or four and *C. sinuosa* commonly four to six, at least in respect to

Australian material. In southern Australia, the commonest form of *C. peregrina* is epilithic and has an irregular convoluted appearance. The globular epiphytic form is usually the most common in Europe, but the other form is quite widespread and the latter's morphological resemblance to *C. sinuosa* has been commented on earlier (Sauvageau, 279). In view of this recent reassessment of character validity, it is clearly necessary to re-examine all available specimens and data on *Colpomenia* for the region concerned here.

Colpomenia peregrina (Sauv.) Hamel
Canaries (161).
Liberia (61).
Note. It should be emphasized that this latter is the furthest southern record in our area.

Colpomenia sinuosa (Roth) Derb. & Sol.
Angola (158; 191; 282; 294).
Ascension (243B).
Canaries (3; 22; 32; 92; 190; 201; 258; 259; 271; 282; 294).
Cape Verde Islands (92; 294).
Côte d'Ivoire (147; 148).
Gabon (148; 153).
Ghana (74; 148; 183; 294; 295).
Mauritanie (187; 189; 294).
São Tomé (42; 148; 294).
Sénégal (23; 187; 213; 294).
South West Africa (287).
Togo (148; 151).
'Atlantique nord (depuis la côte cantabrique jusqu'au Maroc, Canaries, Cap Vert) . . .' (13).
'. . . an der ganzen Westküste Afrikas und den atlantischen Inseln . . .' (116).
'West coast, Africa' (205).
'West Africa' (187).
[As *Colpomenia sinuosa* Derb. & Sol.]
Angola (18; 19).
Canaries (37; 278; 279; 308).
Cape Verde Islands (16).
'. . . Afrique méridionale . . .' (16).
'. . . Mers chaudes en général . . .' (16).
[As *Colpomenia sinuosa* (Mert.) Derb. & Sol.]
Canaries (2; 80).
Mauritanie (289).
Sénégal (54; 289; 290).
'. . . Atlantic Ocean (African . . . coasts . . .) . . .' (80).
Pantropical (289).
[As *Colpomenia sinuosa*]
Canaries (267; 270).
[As *Colpomenia* sp. (? *C. sinuosa*)]
South West Africa (287).
[As *Asperococcus sinuosus* Bory]
Cape Verde Islands (288).
Mauritanie (68).
'. . . from Vogel, gathered in tropical Africa . . .' (136).
[As *Asperococcus sinuosus* Roth]
Cape Verde Islands (68).
[As *Asperococcus sinuosus* (Roth) Bory]
Cape Verde Islands (210).

[As *Hydroclathrus sinuosus* (Roth) Zanard.]
Ascension (15).
[As *Stilophora sinuosa* C. Ag.]
Canaries (21; 208).

Colpomenia spp.
Canaries (160).
Gambia (155).
Ghana (159).
Note. In view of the reference to *C. peregrina* Sauv. in the later publication (161), the record in Johnston (160) probably is also attributable to this species, provided that the 1969 determination is maintained. See the generic note.

Compsonema gracile Kuck.
See *Compsonema minutum* (C. Ag.) Kuck. in Kuck. & Kornm.

Compsonema minutum (C. Ag.) Kuck. in Kuck. & Kornm.
Canaries (169).
[As *Compsonema gracile* Kuck.]
Canaries (32; 92; 120; 205; 282).
'. . . elle se rencontrera probablement sur nos côtes africaines [Mauritanie; Sénégal] . . .' (120).
'West coast, Africa' (205).

Compsonema sp.
Canaries (100).
Sénégal (289).
Note. These citations most probably refer to *Compsonema minutum*, the only species of the genus reported from the Canaries.

Conferva breviarticulata Suhr
See *Elachista globulosa* (C. Ag.) J. Ag.

Conferva pennata Huds.
See *Sphacelaria cirrosa* (Roth) C. Ag.

Cutleria multifida (Sm.) Grev.
Salvage Islands (103).
São Tomé (133; ? 294).
[As *Aglaozonia reptans* Kütz.]
São Tomé (123; 131; 132).
Note. Steentoft (294 : 116) considered that the determination of this plant from the island of São Tomé must remain uncertain as the material is in such a state of preservation as not to permit examination. The diploid phase of this species was formerly allotted to a different genus, as *Aglaozonia parvula* (Grev.) Zanard. [= *A. reptans*].

Cutleria sp.
[As *Aglaozonia* sp.]
Príncipe (42; 294).
Note. The Carpine (42) record as *Aglaozonia* sp. is very likely to relate to *A. parvula* [= *Cutleria multifida* (Sm.) Grev.], although the matter has not been checked.

Cystoseira
Roberts (1967), in the first of her series of papers on the genus *Cystoseira* in the British Isles, discussed in some detail the taxonomy, morphology and development of the thallus, reproductive organs, and distribution. It appears that of the 'about 44 species', 25 are restricted to the Mediter-

ranean/Adriatic, 9 are found only in the Atlantic and 4 species are common to both. In view of recent taxonomic works in the Mediterranean (papers mentioned throughout this note), these figures will now require some amendment.* Roberts commented on the distribution of the genus in the north Atlantic, stating that it '. . . extends from the Cape Verde Islands in the south, through the Canaries, Madeira and Azores, along the coasts of Morocco, Spain and France to the English Channel and up the west coast of the British Isles to the north.' By contrast, Giaccone & Bruni (114 : 61) indicated that 'Per il genere *Cystoseira* tutti i dati concordano nel fissare l'area de differenziazione sulle coste dell'Atlantico tra le isole britanniche e le isole Canarie.' In any event, one of the major centres of distribution of *Cystoseira* is the Mediterranean Sea, and species present have recently been the subject of various analyses. Whilst these have some bearing on the situation outside the confines of the Mediterranean (*cf.* the distribution summary from Roberts, quoted above, and the observation by Giaccone & Bruni (113 : 64) that '. . . la flora algale del Mediterraneo è in massima parte di origine atlantica'), the genus really requires co-ordinated study on the basis of its whole range of distribution. That this is not a matter to be undertaken lightly is clear from the recent study on Mediterranean species of *Cystoseira* by Giaccone & Bruni (113), in which the application of numerical taxonomy resulted in the authors proposing to reunite the five nomenclatural species recognized into a single superspecies (*C. ericaefolia*: operative and not taxonomic nomenclature), with three phenotypes [or phenons], *C. tamariscifolia*, *C. mediterranea* and *C. stricta*, which represent three genetic lines. Giaccone & Bruni (114), in a continuation of their numerical taxonomic approach, reduced the remaining nomenclatural species of *Cystoseira* to three taxonomic entities ('groups'): *C. crinito-selaginoides; C. spinifero-opuntioides;* and *C. discors-abrotanifolioides*. From 1973 (p. 60), it appears that Giaccone & Bruni utilize the terms 'superspecies' (1971) and 'group' (1973) interchangeably, since they refer there to the earlier superspecies *C. ericaefolia* as a 'group.. Membership within these 'groups' of individual taxonomic species is here commented on under the species concerned. Certain conventional synonymic and nomenclatural changes were proposed by Giaccone & Bruni in the 1973 work (114). Where appropriate, these also are noted under individual species. Roberts (1967), using the term 'group' in a slightly different way, had earlier presented an interesting analysis of the validity of species criteria hitherto employed. Her opening comments, which take account of previous observations by Sauvageau (269), Hamel (120) and Ercegović (1952), provide an apt summary of the overall situation. 'Whilst the genus falls readily into a small number of groups of species separated by easily determined features of gross morphology . . ., final separation into species is a much more difficult problem as it is dependent on details of morphology, ecological preferences and features of reproductive morphology . . . features of a specimen caused by season or environment . . . [must be] . . . taken into account. . . . Further, the range of form of closely related species overlaps so much that it may be difficult to determine one of these species with any certainty unless a range of material is available. If, as suggested by both Sauvageau and Ercegović, the genus is still in the process of active speciation, such a confused situation is inevitable and careful consideration of the criteria employed is needed.' The extent to which such a fluid situation can lead to dissatisfaction with existing species concepts is shown by the recent description (Gerloff & Nizamuddin, 1976) of yet further new species from the Mediterranean. It is debatable whether continued establishment of new species is the best solution to a complex problem or whether it merely further complicates the task of subsequent full generic revision. Both the extent of available data, and the evolutionary/speciation possibilities deduced from it, are considered in Roberts (254A).

Cystoseira abies-marina (S. Gmel.) C. Ag.
Canaries (4; 63; 104; 195; 201; 207).
Cape Verde Islands (195).
Salvage Islands (104; 195).
[As *Cystoseira abies-marina* (Gmel.) J. Ag.]
Canaries (113; 190; 214).
[As *Cystoseira abies-marina* (Gmel.)]

* More accurate figures are being presented in Roberts (254A).

Canaries (198).
Salvage Islands (198; 228).
[As *Cystoseira abies-marina* C. Ag.]
Canaries (21; 208; 262; 271; 308).
Cape Verde Islands (18; 19; 271; 310).
[As *Cystoseira abies-marina* (Turn.) C. Ag.]
Canaries (2; 9; 32; 120; 161; 162; 167; 200; 203; 204; 228; 230; 233; 258; 259; 271; 277).
Cape Verde Islands (92; 229; 257; 271; 288; 297).
Salvage Islands (228; 239; 277).
[As *Cystoseira abies-marina* (Turn.) J. Ag.]
Cape Verde Islands (51; 54; 210).
Salvage Islands (103).
Sénégal (51; 54).
Note. Dangeard's (51 : 203; 54 : 254) comments on the basis of Montagne (210) are misleading, since he indicates the latter's records as '. . . provenant de la presqu'île du Cap Vert et des îles voisines, mais il s'agit sans doute de fragments flottés . . .'. This is merely the general situation outlined in Montagne's introduction, whereas the specific locality for *C. abies-marina* is given as '. . . ins. Sancti Nicolai, locis de *Prainha* et *Praya branca* dictis.' Hence, there is no real reason why Dangeard should have invoked drift material when the records are only from the Cape Verde Islands. The many other records from there provide good support for the attached presence of this species. There is no other basis for the statements by Dangeard that *C. abies-marina* had been reported from Sénégal and those records should therefore be discounted. Indeed Dangeard stated that he knew of no finds of the species in Dakar or nearby.
[As *Cystoseira abies-marina* Turn.]
Cape Verde Islands (68).
[As *Cystoseira abies-marina* J. Ag.]
Canaries (16; 228).
Cape Verde Islands (16; 262; 271).
[As *Cystoseira abies-marina* (Thur.) C. Ag.]
Canaries (92).
Rio de Oro (92).
[As *Cystoseira abies-marina*]
Canaries (257; 270A).
[As *Fucus abies marina* Gmel.]
Canaries (305).
[As *Phyllacantha moniliformis* Kütz.]
Canaries (170; 171; 174).
Note. Sauvageau (271 : 102) had reservations about the attribution here by J. Agardh (9 : 228) of this name, primarily because the branch illustrated by Kützing (174 : pl. 32, III) was tophular.
[As *Treptacantha gracillima* Kütz.]
Canaries (170; 171; 174).
[As *Treptacantha montagnei* Kütz.]
Canaries (171; 174; 271).
Note. The synonymy for this species is largely taken from De Toni (63). See also *Cystoseira sonderi* (Kütz.) Picc. Santos, Acuña & Wildpret (259) indicated that *C. abies-marina* is constant over the whole of the littoral of the Isla de la Palma (Canaries), being the most characteristic species and also occupying the most wave-exposed localities. Using numerical methods, Giaccone & Bruni (114) recognized *C. abies-marina* to belong to the group *C. crinito-selaginoides*.

Cystoseira abrotanifolia C. Ag.
See *Cystoseira compressa* (Esp.) Gerl. & Nizam. and *C. foeniculacea* (L.) Grev.

Cystoseira abrotanoides *sensu* Santos *et al.*
See *Cystoseira compressa* (Esp.) Gerl. & Nizam.

Cystoseira baccata (S. Gmel.) Silva
Mauritanie (189; 253; 271).
Salvage Islands (228).
Western Sahara (189).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).
'Atlantique nord (de l'Irlande à la Mauritanie)' (13).
[As *Cystoseira fibrosa* C. Ag.]
Canaries (14; 21; 208; 296; 297).
Mauritanie (253).
'. . . des côtes d'Irlande et d'Angleterre jusqu'en Mauritanie' (271).
[As *Cystoseira fibrosa* (Huds.) C. Ag.]
Canaries (124).
Mauritanie (124; 271).
[As *Cystoseira fibrosa*]
Rio de Oro [Spanish Sahara] (289).

Note. Giaccone & Bruni (114) indicated that *Cystoseira baccata*, from the morphology of the stem apex and the development of the embryo, is much nearer to the genus *Halidrys*. They suggested that a more detailed study than they were able to carry out would probably show that this species should be excluded from the genus *Cystoseira*. They further commented that, since the species is so common on the European Atlantic coast, it could well form a basis from which to establish the area of origin and the centre of spread of the various genera of the tribe Cystoseireae. This area could have been the more westerly part of the ancient Mesozoic basin known as Tethys. Fischer-Piette (96) initially recorded this species from Mauritanie on the supposed basis of observations by Sourie (289); later (97), Fischer-Piette indicated that he had mis-interpreted Sourie's Rio de Oro record.

Cystoseira barbata *auct.*
See *Cystoseira humilis* Kütz. var. *humilis*.

Cystoseira barbata C. Ag. var. **pumila** Mont.
See *Cystoseira humilis* Kütz. var. *humilis*.

Cystoseira canariensis Sauv.
See *Cystoseira humilis* Kütz. var. *humilis*.

Cystoseira compressa (Esp.) Gerl. & Nizam.
[As *Cystoseira abrotanifolia* C. Ag. (= *Cystoseira fimbriata*)]
Canaries (282).
[As *Cystoseira abrotanoides*]
Canaries (259).
[As *Cystoseira fimbriata* (Desf.) Bory]
Canaries (92; 161; 162; 167; 214; 228; 258).
'. . . Atlantico de Cadiz a Canarias . . .' (286).
'Atlantique (de la côte basque au Maroc, Canaries . . .)' (13).
[As *Cystoseira fimbriata* (Desf.) Børg.]
Canaries (195).
Salvage Islands (Ilhas Selvagens) (195).
[As *Cystoseira fimbriata* Lamour.]
Canaries (171; 174).
[As *Cystoseira* cf. *fimbriata*]
Canaries (258).

Note. Gerloff & Nizamuddin (1975) have recently pointed out that the correct name for *Cystoseira fimbriata* (Desf.) Bory and *C. abrotanifolia* C. Ag. should be *C. compressa*, as the earliest legitimate name for this taxon is *Fucus compressus* Esper. Without giving reasons, Santos Guerra (258 : 93) gave *Cystoseira abrotanifolia* C. Ag. as a synonym of *C. fimbriata* (Desf.) Bory [= *C. compressa*]. Roberts (1968a) had already shown that it is only *sensu* J. Agardh (Mediterranean and Adriatic material) that the name *C. abrotanifolia* relates to the same alga as the name *C. fimbriata* (Desf.) Bory. Since *C. abrotanifolia sensu* C. Agardh is generally considered [Roberts, 1968a; 1968b] to be a synonym of *C. foeniculacea* (L.) Sauv., it is difficult to ascertain whether Santos Guerra was concerned with Canaries material that would be attributable to *C. foeniculacea* or to *C. compressa*. Giaccone & Bruni (114) came to a similar conclusion about the equivalence of *C. abrotanifolia* and *C. compressa* (as *C. fimbriata*); from their numerical studies, they identified two main 'clusters' in their *C. discors-abrotanifolioides* group, to which both *C. foeniculacea* and *C. compressa* (as *C. fimbriata*) are stated to belong. *C. compressa* forms a 'cluster' with *C. myriophylloides* and *C. humilis* (q.v.). See the generic note to *Cystoseira*. One cluster (see above) includes the *Cystoseira compressa* phenotype, the other is the *C. discors* phenotype. *C. discors* C. Ag. has frequently been accepted as a synonym of *C. foeniculacea*, at least as regards the type material of C. Agardh and as regards records established from the Atlantic. However Mediterranean records, established under the name *C. discors*, were said to relate to a different taxon and the latter needed a new name (Roberts, 1968a : 259; 1968b : 562). Subsequently, Roberts (254A) modified her firmly stated opinion, indicating that further experimental and detailed shore work are both required before any firm decision can be made on the recognition of both *C. discors* and *C. foeniculacea*, or of *C. foeniculacea* alone. Giaccone in Giaccone & Bruni (114 : 72) has already provided the name *C. ercegovicii*. Thus, although the nomenclatural statements by Santos Guerra and Giaccone & Bruni regarding *C. abrotanifolia*/*C. compressa* (as *C. fimbriata*) may be at fault, they may not affect the actual status of the records for our area, depending on the point of view adopted.

Cystoseira concatenata *auct.*
See *Cystoseira foeniculacea* (L.) Grev.

Cystoseira crinita Bory
[As *Cystoseira crinita*]
Canaries (259).
[As *Cystoseira* cf. *crinita*]
Canaries (258).

Note. It is difficult to be sure of the nature of these records. No authors' names are given for the combination used, although the alga itself is referred to as 'común' on Isla de la Palma (Santos *et al.*, 259). Santos Guerra (258) first mentioned *Cystoseira* cf. *crinita* (p. 89) from scarce supralittoral pools on La Gomera, but later (pp. 100–101) elaborated this for the same habitat to '. . . *Cystoseira* spc. (habría que determinar si se trata de *C. discors*, *C. canariensis*, o *C. crinita*, observando en que medida lo hace cada una).' As can be seen from this present work, many species of *Cystoseira* are relatively common on Canary Island shores. Giaccone & Bruni (114), considering that *Cystoseira crinita* belongs to the *C. crinito-selaginoides* group, reiterated the opinion expressed by Sauvageau (271 : 258) that Valiante (1883 : 18) had reunited under the name *C. crinita* Duby two species of which neither could be the *C. crinita* of Bory. Authors both before and since Sauvageau have attempted to attribute the name *C. crinita* Duby to the synonymy of a wide variety of different species of *Cystoseira*. The above demonstrates how impossible it is to arrive at a satisfactory conclusion, in the absence of material, on the identity of these Canaries records.

Cystoseira discors *auct.*
See *Cystoseira foeniculacea* (L.) Grev.

Cystoseira ercegovicii Giacc. in Giacc. & Bruni
See note to *Cystoseira compressa* (Esp.) Gerl. & Nizam.

Cystoseira ericoides *auct.*
See *Cystoseira tamariscifolia* (Huds.) Papenf.

Cystoseira fibrosa *auct.*
See *Cystoseira baccata* (S. Gmel.) Silva

Cystoseira fimbriata (Desf.) Bory
See *Cystoseira compressa* (Esp.) Gerl. Nizam.

Cystoseira foeniculacea (L.) Grev.
Canaries (161).
Mauritanie (189).
Spanish Sahara (189).
[As *Cystoseira abrotanifolia* C. Ag.]
Canaries (2; 32; 95; 228; 258; 271).
Cape Verde Islands (234).
Salvage Islands (103).
'. . . in the Atlantic from Cadiz southwards to the Canary Islands' (32).
'Du golfe de Gascogne aux Canaries . . .' (37).
'. . . l'existence paraît au moins assez générale sur le littoral ouest-africain, du Maroc à la Guinée française' (289).
Note. For comment on the Santos Guerra (258) Canaries record, see *Cystoseira compressa* (Esp.) Gerl. & Nizam.
[As *Cystoseira abrotanifolia* (L.) C. Ag.]
Canaries (228).
Cape Verde Islands (229).
Salvage Islands (228).
Note. De Toni (63 : 170) suggested that Piccone's (228) Canaries specimens (e.g. *C. abrotanifolia*) may well belong to *C. barbata* (Good. & Woodw.) C. Ag. [= *C. humilis* Kütz. var. *humilis*].
[As *Cystoseira abrotanifolia* J. Ag.]
Cape Verde Islands (16).
'Du Golfe de Gascogne aux Canaries . . .' (16).
[As *Cystoseira abrotanifolia* (Stackh.) J. Ag.]
Canaries (271; 277).
Cape Verde Islands (271).
'Du Golfe de Gascogne aux Canaries . . .' (16).
[As *Cystoseira abrotanifolia* (Stackh.) C. Ag.]
Canaries (63).
Cape Verde Islands (63).
[As *Cystoseira abrotanifolia*]
Spanish Sahara (289).
[As *Cystoseira concatenata* C. Ag.]
Cape Verde Islands (51; 54; 234).
Sénégal (51; 54; 210).
'. . ., du Portugal au cap Vert' (37).
Note. Although there existed other records under this name for Cape Verde Islands, there was no basis in Montagne (210), whose records Dangeard (51; 54) was discussing, to suggest that material from elsewhere than Cap Vert Peninsula, Sénégal, had been available to Montagne at that time. He indicated firmly that *Cystoseira concatenata* was 'Ad littora promontorii Viridis a cl. Schmidt lecta.' Dangeard's quotations from Montagne's (210) introduction were of a sentence designed to cover all the material he was discussing in 1860, not that specific location for *C. concatenata*. Thus the implied Dangeard (51; 54) records for Cape Verde Islands should be discounted. Dangeard goes on to say that, to his knowledge, *C. concatenata* had never again been collected in the Dakar area and that Montagne probably had floating material. Since there is nothing in Montagne's text to establish that the material collected by Hooker and Bolle was attached, and there are no other original records of *C. foeniculacea* or *C. usneoides* (to one of which these records of *C. concatenata* should probably be referred) from Sénégal, we are prepared to accept that in this statement Dangeard was probably correct. The terminal note to this entry explains the *C. usneoides*/*C. foeniculacea* situation.

[As *Cystoseira concatenata* J. Ag.]
Canaries (16).
Cape Verde Islands (16).
[As *Cystoseira concatenata* (L.) C. Ag.]
Canaries (9; 63; 201; 228; 271).
Cape Verde Islands (229).
Salvage Islands (228).
Sénégal (271).
'Atlântico: da Biscaia às ilhas de Cabo Verde . . .' (256).
'. . . du Golfe de Gascogne aux îles du Cap Vert . . .' (271).
[As *Cystoseira concatenata* (L.)]
Cape Verde Islands (236).
[As *Cystoseira concatenata*]
Canaries (275).
Sénégal (275).
'. . . il descend au Sud jusqu'au Cap Vert . . .' (260).
[As *Cystoseira discors* C. Ag.]
Canaries (21; 92; 167; 254A; 262; 308).
[As *Cystoseira discors* C. Ag. emend. Sauv.]
Canaries (32; 88; 271; 277; 282).
? Mauritanie (271).
'. . . aux Canaries et peut-être jusqu'en Mauritanie' (277).

Note. See note regarding the Hariot (124) records under *Cystoseira discors* (L.) C. Ag. below.

[As *Cystoseira discors* (L.) C. Ag.]
Canaries (9; 63; 88; 116; 124; 195; 201; 208; 271; 286).
Mauritanie (? 124; 282).

Note. Hariot (124 : 439) stated that his 'Echantillon en mauvais état, se rapportant très probablement à cette espèce.' This doubtful determination was acknowledged as being made by Sauvageau; comments by the latter in the same text indicate that the specimen was too incomplete for certain determination.

[As *Cystoseira discors*]
Canaries (161).
[As *Cystoseira discor* (sic!)]
Canaries (1).

Note. Santos Guerra (258) may also be establishing a record for the Canaries under this name. See the note to *Cystoseira crinita* Bory.

[As *Fucus abrotanifolius* L.]
Canaries (38).

Note. Roberts (1968a; 1968b) recently rationalized available data on most aspects of this Atlantic species of *Cystoseira*, but made no mention of its occurrence along the west African coast. It should be stressed that the distribution presented above is based principally on application of Roberts's nomenclatural synonymy; material has not been critically re-examined. The nature of the specimens on which African records were based under the name *Cystoseira concatenata* (L.) C. Ag. or J. Ag. requires checking. The type of *Fucus concatenatus* L. belongs to *C. foeniculacea* (L.) Grev. and on this basis the records are included here. However, Roberts (1968a) has explained the circumstances by which Linnaeus added to his herbarium, after 1753, a specimen of *Fucus usneoides* L. [= *Cystoseira usneoides* (L.) Roberts], mislabelling it *F. concatenatus* and thereby misleading C. Agardh (4) in his application of the name *Cystoseira concatenata* (L.) C. Ag. Since most subsequent authors have followed C. Agardh, the records attributed here may conceal data more correctly placed with *C. usneoides* (L.) Roberts. On the general relationship between *C. foeniculacea* and *C. discors* C. Ag., see the note to *C. compressa* (Esp.) Gerl. & Nizam.

Cystoseira granulata *auct.*
See *Cystoseira nodicaulis* (With.) Roberts.

Cystoseira humilis Kütz. var. **humilis**
Mauritanie (189).
[As *Cystoseira humilis* Schousb. in Kütz.]
Canaries (63; 195; 271).
Cape Verde Islands (195).
Salvage Islands (Ilhas Selvagens) (195).
'. . . Atlantique (de l'Angleterre à la Mauritanie, Canaries, Cap Vert, . . .)' (13).
[As *Cystosira* (sic!) *humilis* (Schousb.) Kütz.]
Canaries (37).
[As *Cystoseira barbata* C. Ag.]
Canaries (21).
[As *Cystoseira barbata* (L.) C. Ag.]
Salvage Islands (228).

Note. According to Sauvageau (277 : 50), the Salvage Islands specimen from Piccone (228) was in such a poor state that it could have been *Cystoseira discors* [= *C. foeniculacea*], although he thought it was probably *C. canariensis* [= *C. humilis*].
[As *Cystoseira barbata* J. Ag.]
Salvage Islands (103).
[As *Cystoseira barbata* (Good. & Woodw.) J. Ag.]
Canaries (63; 208).

Note. See the note to *Cystoseira barbata* var. *pumila*, below. The note to *C. abrotanifolia* (L.) C. Ag.-named specimens attributed under *C. foeniculacea* (L.) Grev. should also be consulted.
[As *Cystoseira barbata* C. Ag. var. *pumila* Mont.]
Canaries (208; 228).

Note. Sauvageau (271 : 263; 334–335; 339–340) saw the *Cystoseira barbata* of Montagne and believed it to be referable to *C. canariensis* [= *C. humilis* var. *humilis*]. Neither Sauvageau nor Børgesen (32 : 102) were able to trace any Piccone specimens of the variety. Sauvageau (p. 335) implied that he believed the var. *pumila* also to be *C. canariensis*, stating '. . . Je doubte . . . de la présence du *C. barbata* dans les îles africaines . . .'. Later (277 : 50), Sauvageau was able to confirm this from a specimen in Herb. De Toni. Levring (195 : 45), who saw Piccone material in Copenhagen (C), also confirmed that the plants were all the same taxon (*C. humilis*). As in the case of *C. canariensis*, Giaccone & Bruni (114) considered *C. barbata* J. Ag. to belong to the *C. crinito-selaginoides* group. For overall accepted synonymy, see the terminal note (below) to *C. humilis* var. *humilis*.
[As *Cystoseira canariensis* Sauv.]
Canaries (1; 3; 32; 92; 104; 161; 208; 228; 270B; 270C; 271; 277; 282).
Salvage Islands (103; 104).

Note. Santos Guerra (258) may also have been establishing a record for this taxon in the Canaries; see the note to *Cystoseira crinita* Bory. Giaccone & Bruni (114 : 63) thought that *C. canariensis* Sauv. probably belongs in their group *C. crinito-selaginoides*. See the generic introduction to *Cystoseira*.
[As *Cystoseira pumila* Mont.]
Canaries (174; 201; 208; 277).

Note. Although Schousboe was apparently the first to describe (in MS) this species (as *Fucus humilis* and *Phymatosera humilis*), he did not publish a description. Since Kützing (174 : 18–19, tab. 50) neither took up in its entirety Schousboe's name, nor, according to available evidence, used precisely the latter's description, the modern tendency to cite the authorities as 'Schousboe in Kützing' is in error. Giaccone & Bruni (114) allotted this species to their group *Cystoseira discors-abrotanifolioides*; see the generic note to *Cystoseira* and the note to *C. compressa*. On a more conventional taxonomic basis, Giaccone in Giaccone & Bruni (114) considered that *C. humilis* is more correctly placed as a variety of *C. myriophylloides* Sauv.; Giaccone (p. 75) quoted inaccurately the name and authorities to be used in this level-transfer as 'v. *humilis* (Schousboe) n. comb. Giaccone'. Bornet (37), Sauvageau (271), Hamel (120), Dangeard (53) and Ardré (13) had earlier expressed doubt as to the distinctness of *C. humilis* as a species, considering it to be a dwarf form of the algae known hitherto as *C. myriophylloides* (Ardré; Dangeard; Hamel; Sauvageau) or as *C. discors* C. Ag. [usually considered a synonym of *C. foeniculacea*]. Sauvageau (271 : 340) established that the *C. discors* then referred to by Bornet was actually the alga currently called *C. myriophylloides*. As Ardré (13 : 321–322; 377) and Levring (195 : 44) have pointed out, *C. humilis* antedates as the correct name if *C. humilis* and *C. myriophylloides* are considered conspecific. Levring (195 : 42–45) has reduced *C. myriophylloides* to the synonymy of *C. humilis*.

We believe that, on the basis of present information, varietal distinction is a useful means of reflecting the form differences and environmental/geographical characteristics involved, and the required new varietal combination is therefore made below. The synonymy accepted here derives from Levring (195, *loc. cit.*) who concluded that *Cystoseira barbata* var. *pumila*, *C. pumila* and *C. canariensis* all relate to material that, at least for the Canary Islands and Madeira plants, is representative of *C. humilis* var. *humilis*, larger plants (var. *myriophylloides*) not being found there. Levring examined authentic material in Herb. Sonder (MEL), in Herb. Kützing (L), in Hamburg (HBG), in Copenhagen (C), and from Sauvageau, in arriving at this conclusion.

Cystoseira humilis var. **myriophylloides** (Sauv.) Price & John, **var. nov.**
[Basionym: *Cystoseira myriophylloides* Sauvageau, *Bull. Stn biol. Arcachon* **14** : 455 (1912).]
[As *Cystoseira myriophylloides* Sauv.]
Mauritanie (189).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).

Note. See the explanation presented above, under *Cystoseira humilis* var. *humilis*.

Cystoseira mauritanica Sauv. in Hariot
Mauritanie (50; 51; 53; 54; 124; 189; 271; 282).
[As *Cystoseira tingitana* Sauv.]
Mauritanie (277).

Note. According to Giaccone & Bruni (114), *Cystoseira mauritanica* lies within the group *C. spinifero-opuntioides*, as recognized by them (see the generic note to *Cystoseira*). They included *Cystoseira nodicaulis* (With.) Roberts in the same group, suggesting that there can be distinguished within the group two phyletic lines with a probable common ancestor of the *C. nodicaulis* type. *C. mauritanica* is stated to be a species of southern distribution, south of Gibraltar, with *C. usneoides* of the same 'cluster' dominating in the north; both can be considered to be derived from *C. nodicaulis*. Dangeard (51; 54), in repeating Sauvageau's earlier data for Mauritanie, noted collection of a female specimen from another location there (50), but only from the drift. Sauvageau (277 : 121) indicated that, in being dioecious, *C. mauritanica* differs from all other *Cystoseira* spp. See comments by Roberts (1967 : 355–357) on this latter point. She later (254A) also commented on Dangeard's opinion as to the whole taxon *C. mauritanica*.

Cystoseira myriophylloides Sauv.

Note. Giaccone & Bruni (114) allotted this species to their group *Cystoseira discors-abrotanifolioides*. See the generic note to *Cystoseira* and the notes to *C. compressa* and *C. humilis*. Records of this taxon appear under *C. humilis*.

Cystoseira nodicaulis (With.) Roberts
Mauritanie (189).
'Atlantique (de l'Ecosse au Maroc, et peut-être jusqu'au Cap Vert)' (13).
[As *Cystoseira granulata* (L.) C. Ag.]
Canaries (9).
Cape Verde Islands (63).
Mauritanie (51; 54; 285).
Sénégal (45).

Note. Dangeard's (51; 54) comments indicated that he had found '. . . rejeté sur la plage de la baie de Cansado . . . quelques autres espèces plus ou moins déterminables, dont un petit individu de *Cystoseira granulata* . . .'. The presence of *C. nodicaulis* on Mauritanian shores, or rather just off them since the material was dredged from considerable depths off-shore south of Cap Blanc, has subsequently been confirmed by Seoane-Camba (284). Reservations remain – the general uncertainty is expressed in the terminal note below.

[As *Cystoseira granulata* J. Ag.]
Cape Verde Islands (16).
[As *Cystoseira granulata* C. Ag.]
Cape Verde Islands (234).
[As *Cystoseira granulata* (Turn.) C. Ag.]
Cape Verde Islands (229).
[As *Cystoseira granulata* Grev.]
Cape Verde Islands (271; 277).
Sénégal (271).
[As *Cystoseira granulata* (Turn.)]
Cape Verde Islands (236).
[As *Cystoseira granulata*]
Mauritanie (53).
Sénégal (275).

Note. Sauvageau (275) indicated that specimens were '. . . manifestement ramassés à la côte . . .'.

Overall Note. According to Roberts (1967; 1968a), this is the species commonly known as *Cystoseira granulata* (L.) C. Ag., but that name is illegitimate and its type does not belong to the species. The original combination *C. granulata* in C. Agardh (4) is almost certainly not based on material of *C. nodicaulis* (Roberts 1968a); the first clear account of the latter was by Greville (1830). However, Agardh's var. ϵ *setacea* (4; English Channel) may well refer to *C. nodicaulis*. The material on which the present records are based therefore requires further study to confirm placement here. Sauvageau (277 : 37) found a Piccone (Cape Verde Islands) plant in Herb. De Toni to be almost certainly *C. ericoides* [= *C. tamariscifolia*], although named *C. granulata*. According to Giaccone & Bruni (114 : 66) '. . . Appartiene a questo gruppo [*C. spinifero-opuntioides*] anche *C. nodicaulis* (With.) Roberts delle coste atlantiche a nord di Gibilterra'. They also indicated that they consider a *C. nodicaulis*-type plant to have been the common ancestor of phyletic lines within the group. See the note to *C. mauritanica* Sauv. in Hariot.

Cystoseira pumila Mont.
See *Cystoseira humilis* Kütz. var. *humilis*.

Cystoseira selaginoides (Wulf.) Nacc.
See *Cystoseira tamariscifolia* (Huds.) Papenf.

Cystoseira senegalensis P. Dang.
Sénégal (28; 51; 54; 55; 213; 289; 290).

Note. According to Bodard & Mollion (28 : 198), this species and *Ecklonia muratii* are the only two brown algae endemic to Sénégal. However, see the entry for *Ecklonia muratii*. In describing *Cystoseira senegalensis*, Dangeard (51 : 204; 54 : 258) commented that its location at Dakar, and along the Cap Vert Peninsula near Dakar, was near the southern limit for the genus. He also stated: '. . . c'est la seule espèce que nous ayons trouvée dans cette région où elle couvre les rochers, dans certaines baies, à faible profondeur . . .'.

Cystoseira sonderi (Kütz.) Picc.
Cape Verde Islands (63; 229; 231; 232).
[As *Cystoseira sonderi* (Kütz.)]
Cape Verde Islands (16; 234; 236; 271; 288).
[As *Cystoseira sonderi* Picc.]
? Cape Verde Islands (277).
[As *Treptacantha sonderi* Kütz.]
Cape Verde Islands (174).

Note. Sauvageau (277) believed this species to be perhaps no more than a local and more robust form of *Cystoseira abies-marina*. Essentially similar, but less specific, comments were made earlier, in 1912 (Sauvageau, 271) on the basis of previous remarks by Piccone (229; 236).

Cystoseira spinosa Sauv.
[As *Cystoseira spinosa*]
Canaries (259).
Note. In separates of this work received by the present authors, the entry on p. 27 printed as '*Cistoseira spinosa*' has been altered in MS to read '*Cistoseira abies-marina*'. Since the list on p. 22 of the work includes *Cystoseira abies-marina* but does not give *C. spinosa*, the printed statement of record is included here for completeness; the record has also been placed under *C. abies-marina*.

Cystoseira tamariscifolia (Huds.) Papenf.
Canaries (161; 254; 254A).
Mauritanie (189; 254; 254A).
Spanish Sahara (189).
'. . . de Inglaterra a Canarias . . .' (286).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).
'Atlântico: das costas da Inglaterra a Marrocos e às Canárias . . .' (256).
'. . . comune nelle isole britanniche e sulle coste europee della Manica e si estende poco sulle coste africane a sud dello Stretto di Gibilterra' (114).
'Atlantique (de l'Angleterre à la Mauritanie; Canaries . . .)' (13).
[As *Cystoseira ericoides* J. Ag.]
Cape Verde Islands (16; 234; 262).
[As *Cystoseira ericoides* (L.) J. Ag.]
Cape Verde Islands (229).
[As *Cystoseira ericoides* C. Ag.]
Canaries (21; 96; 97; 208; 262; 271; 282).
Cape Verde Islands (96; 277).
Mauritanie (271).
Spanish Sahara [Rio de Oro] (289).
'. . . des côtes d'Angleterre et d'Irlande jusqu'en Mauritanie . . .' (271).
Note. Sauvageau's Cape Verde record (277) results from a redetermination of a Piccone specimen identified by the latter as *Cystoseira granulata* (q.v.). Sauvageau expressed uncertainty as to whether the material was attached or drifting when collected.
[As *Cystoseira ericoides* (L.) C. Ag.]
Canaries (3; 32; 52; 92; 124; 282).
Cape Verde Islands (124).
Mauritanie (32; 124; 282).
'Von den Kapverdischen Inseln bis Schottland . . .' (116).
Note. Dangeard (52) indicated that *Cystoseira ericoides* [= *C. tamariscifolia*] was '. . . d'une rareté extrême aux Canaries . . .'.
[As *Cystoseira ericoides*]
Canaries (1; 263).
'. . . de l'Irlande aux îles du Cap Vert' (263).
'. . . de la Bretagne jusqu'aux Canaries' (263).
'. . . de l'Angleterre jusqu'en Mauritanie' (272).
[As *Cystoseira ericoides* (L.) C. Ag. var. *selaginoides* C. Ag.]
Canaries (32; 208; 262).
[As *Cystoseira selaginoides* (Wulf.) Nacc.]
Cape Verde Islands (63).
[As *Fucus ericoides* Gmel.]
Canaries (38).
[As *Fucus ericoides* L.]
Canaries (304).
Note. Giaccone & Bruni (114) considered this to be one of the three phenotypes recognizable within the superspecies *Cystoseira ericaefolia*; see the introductory generic note. Fischer-Piette initially (96) recorded *C. tamariscifolia* (as *C. ericoides*) from Mauritanie, on the basis of drift

material noted by Sourie (289); afterwards (97 : 208), Fischer-Piette indicated that he had been in error, Sourie's record being for Spanish Sahara (Rio de Oro).

Cystoseira thunbergii (Mert. in Roth) C. Ag.
Canaries (21; 208).
[As *Fucus thunbergii* Roth]
Canaries (303).
Note. Montagne (208 : 138), commenting on the Canaries material, stated that 'il est probable qu'elle y aura été apportée par les courans ou de quelque autre façon'.

Cystoseira tingitana Sauv.
See *Cystoseira mauritanica* Sauv.

Cystoseira usneoides (L.) Roberts
'Atlantique (depuis la côte basque aux Canaries; Cap Vert) . . .' (13).
Note. See the notes to *Cystoseira mauritanica* Sauv. in Hariot and *C. foeniculacea* (L.) Grev.

Cystoseira spp.
Angola (311).
Canaries (3; 34; 46; 78; 160; 201).
Cape Verde Islands (92).
Mauritanie (187; 189; 203; 204; 289; 291; 295).
Sénégal (55; 57; 187; 203; 204; 213; 289; 295; 301).
Spanish West Africa (245).
Spanish Sahara (189).
'On the coast of West Africa . . . especially on the coasts of Sénégal and Mauritania' (215).
'. . . divers *Cystoseira*, s'étendent jusqu'au Rio-de-Oro' (93).
'. . . de l'Angleterre au Sénégal' (92).
'. . . si abondants . . . sur les côtes atlantiques . . . du nord-ouest de l'Afrique . . .' (90).
Note. If Dangeard's (51; 54) comments are correct, the records from Sénégal presumably must relate to *Cystoseira senegalensis* P. Dang.; see the note to the latter for explanation.

Desmarestia firma Skottsberg
[As *Desmarestia firma*]
South West Africa (287).
Note. Since no authorities were quoted in the data available to us from South West Africa, we have assumed that the name has been applied, as is the usual practice, to the entity resembling *Desmarestia ligulata* Lamour. that occurs in the southern hemisphere. It is not possible to refer, as Chapman (1972 : 1) and most earlier authors do, to '*Desmarestia ligulata* (Lightf.) Lamour.' because the *Fucus ligulatus* of Lightfoot (1777 : 946–947), which is the first description of the entity and presents an accurate figure (pl. XXIX), is a later homonym of *Fucus ligulatus* S. Gmelin, 1768 [the alga now known as *Calliblepharis ciliata* (Huds.) Kütz.] (Article 64, *Int. Code Bot. Nomenclature*). As new combinations cannot be based on illegitimate names, *Desmarestia ligulata* Lamouroux (1813 : 25) must be regarded as a new name (Article 72, *Int. Code Bot. Nomenclature*).

In our experience, it is highly probable that the southern form referred to as *Desmarestia firma* is conspecific with *D. ligulata* Lamour. from the northern hemisphere. Chapman (1972 : 19) seemed to have concluded similarly when he stated: 'The range of morphology of this species [*D. firma*] appears to overlap with that of the wider entity in the sympatric population pairs of *D. ligulata* var. *ligulata* as described in this study.' Previous treatments of ligulate *Desmarestia* species from various parts of the world have involved much use of the epithet *firma* at varietal level; Chapman so employed it and has considered most of the appropriate background data, not repeated here. Skottsberg (1907 : 21) concluded that the entity known to C. Agardh (5 : 261) as *Sporochnus herbaceus* β *firma* and to J. Agardh (9 : 169) as *Desmarestia ligulata* γ *firma* was worthy of specific rank as *D. firma* Skottsberg. Even at that time, however, Skottsberg clearly had reservations as to the reality of the differences between *D. firma* (southern hemisphere) and *D. ligulata* (northern hemisphere). In 1921 (p. 21), Skottsberg finally reduced both *D. distans* (C. Ag.) J. Ag.

(Falkland Islands) and his own *D. firma* to synonymy with *D. ligulata* Lamour. Despite this, there has been a continuing tendency to apply the name *D. firma* Skottsberg to southern hemisphere material, culminating in the recent study of ligulate *Desmarestia* spp. on the western coast of North America by Chapman (1972), who observed generally that 'The taxonomic relationships of the [southern] entity now known as *D. firma* need further investigation.'

Desmarestia ligulata Lamour.
See *Desmarestia firma* Skottsberg.

Dictyopteris delicatula Lamour.
Cape Verde Islands (16; 28; 92; 99).
Côte d'Ivoire (147; 148).
Gabon (153).
Gambia (155).
Ghana (74; 99; 106; 125; 148; 157; 159; 179; 183; 185; 187; 216; 295).
Liberia (61; 147; 148).
Mauritanie (189).
Nigeria (99; 148; 187; 295).
Sénégal (24; 26; 27; 28; 54; 99; 187; 206; 289; 290; 295; 301).
Sierra Leone (154).
'Gulf of Guinea . . .' (158; 191).
[As *Haliseris delicatula* J. Ag.]
'In oceano atlantico tropico . . .' (173).
[As *Haliseris delicatula* (Lamour.) C. Ag.]
Cape Verde Islands (210).
[As *Halyseris delicatula* (Lamour.) C. Ag.]
Cape Verde Islands (288).

Dictyopteris membranacea (Stackh.) Batt.
Canaries (80; 92; 161).
Mauritanie (189; 285).
'. . . Atlantic Ocean (. . . African . . . coasts . . .) . . .' (80).
'Atlantique (de l'Irlande à la Mauritanie; . . .)' (13).
'. . . Atlantique, d'Helgoland aux Canaries . . .' (88).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).
'. . . de Heligoland e costas da Inglaterra às Canárias . . .' (256).
'West coast, Africa' (205).
'West Africa' (283).
[As *Dictyopteris polypodioides* (Desf.) Lamour.]
Canaries (32; 258; 259; 282).
'From Heligoland and the English coast down to the Canary Islands . . .' (32).
'. . . costas inglesas a la Canarias . . .' (286).
[As *Dictyopteris polypodioides* Lamour.]
Canaries (308).
'D'Angleterre aux Canaries . . .' (37).
[As *Haliseris polypodioides* (Desf.) C. Ag.]
Canaries (9; 63; 208).
'. . . In mari Atlantico . . . ad Africae . . .' (4).
[As *Halyseris polypodioides* C. Ag.]
Canaries (21; 228).
Note. See also the entry for *Haliseris dichotoma* Suhr.

Dictyopteris polypodioides *auct.*
See *Dictyopteris membranacea* (Stackh.) Batt.

Dictyopteris sp.
Canaries (160).
'. . . African west coast . . .' (194).
Note. In view of the later (161) reference to *Dictyopteris membranacea* (Stackh.) Batt. by Johnston, the Canaries record should probably be attributed to that species.

Dictyota
'Species' and infraspecific taxa in this genus are very variable in morphological characteristics; the recognition of such taxa is often based only on slight variations in branching habit. Earle (1969 : 153) has observed that 'Until members of the genus *Dictyota* are studied in culture and under various ecological conditions, there will continue to be confusion regarding the delineation of species and varieties.' We concur in this opinion.

Dictyota bartayresii Lamour.
Ascension (243B).
Cameroun (148).
Côte d'Ivoire (81).
Ghana (44; 47; 148; 159).
Liberia (61; 148).
? Mauritanie (189).
Príncipe (148).
São Tomé (148).
Spanish Sahara (189).
[As *Dictyota bartayresiana* Lamour.]
Cameroun (241; 255; 294).
Cape Verde Islands (16; 68; 92; 210; 237; 238; 282; 288; 294).
Ghana (72; 183; 255; 294).
Pagalu (242; 294).
Príncipe (255; 294).
São Tomé (42; 124 p.p.; 133 p.p.; 255; 294).
'. . . shores of the Atlantic Islands . . .' (128).
'West coast, Africa' (205).
'Probably pantropical' (294).
[As *Dictyota ciliata* J. Ag.]
São Tomé (123 p.p.; 131 p.p.; 132 p.p.).
Note. The recording of *Dictyota ciliata* by Henriques (131; 132) has been reassessed by Hariot (124). See also the note to *D. dichotoma*. There seems to be no previous published information to substantiate Egerod's (81 : 150) citation of Côte d'Ivoire in the distribution pattern.

Dictyota bartayresiana Lamour.
See *Dictyota bartayresii* Lamour. and *D. cervicornis* Kütz. forma *pseudobartayresii* W. R. Taylor.

Dictyota bartayresiana Lamour. forma β **denticulata** Kütz.
See *Dictyota crenulata* J. Ag.

Dictyota bartayresiana Lamour. var. β **divaricata** J. Ag.
See *Dictyota divaricata* Lamour.

Dictyota brongniartii J. Ag.
See notes to *Dictyota mertensii* (Mart.) Kütz.

Dictyota cervicornis Kütz.
Gambia (155).
Ghana (159).
Note. Richardson (252) has commented that in the West Indies (Trinidad) *Dictyota cervicornis*, growing alongside *D. dichotoma*, was readily distinguishable in the fresh state because it was much darker. Dried specimens were nothing like so easy to distinguish and separation of these two species may be difficult unless the form of *D. cervicornis* present actually has cervicorn branching.

Essentially the same opinion as that contained in the last phrase was expressed by Earle (1969); see the note to *D. dichotoma* (Huds.) Lamour.

Dictyota cervicornis Kütz. [var. **cervicornis**] forma **curvula** W. R. Taylor
Côte d'Ivoire (148).
Gabon (153).
Gambia (155).
Ghana (148).
Liberia (61).
São Tomé (148).

Note. The São Tomé record is based on a small plant found on one of two sheets from Herb. Fox Nielson (BM). Although this collection by C. Thorold (No. 237) had been labelled '*D. bartayresii* Lam.', we regard the material, with some reservations, as being representative of Taylor's forma *curvula*. The value of recognizing formae within this species is debatable. See the terminal note.

[As *Dictyota pardalis* Kütz.]
Sénégal (54; ? 287).

Note. Growth forms of *Dictyota* with reflexing of one arm of the dichotomies are very variable and application of names has been similarly inconsistent. There has been a tendency to call the reflexed form by the species name *Dictyota pardalis* (e.g. Jaasund, 1970). We cannot agree that a growth form of this kind, appearing to an overlapping extent on different specimens which otherwise bear characteristics of different species, is generally worthy of specific recognition. It may be locally as distinct as stated by Jaasund for Tanzania and adjacent areas, but from material available to us it does not appear to be so on a more widespread basis. W. R. Taylor (1928; 1960; 1969) has modified his opinion with time in connection with the recognition of formae within this species, and indeed the whole genus of *Dictyota*. Although uncertain as to the precise allocation of formae to species, Taylor originally (1928) described three formae within *D. cervicornis* and later (1960) concluded that these formae were of doubtful value. Yet later (1969) he recognized what is clearly the growth form to which we refer as forma *curvula* of *D. cervicornis* var. *cervicornis*. On strictly utilitarian grounds we have considerable sympathy for this later view, as it appears more accurately to reflect the fact that the variant concerned is of no major taxonomic import (nor indeed in our view should be given conventional nomenclatural status) but can occur to a variable morphological degree on a greater or lesser part of the branching systems of individuals, possibly of several species. Thus, we have accepted Taylor's usage of the name, particularly in the light of his statement (p. 159) that '. . . Even in a genus with species as variable as in this, form names are useful to call attention to features of variation otherwise disregarded and forgotten.' The name as recognized here has no other currently authenticable status.

Dictyota cervicornis Kütz. forma **pseudobartayresiana** W. R. Taylor
See *Dictyota cervicornis* Kütz. forma *pseudobartayresii* W. R. Taylor.

Dictyota cervicornis Kütz. forma **pseudobartayresii** W. R. Taylor
Angola (191).
Gabon (153).
Gambia (155).
São Tomé (255).
Sierra Leone (154).
[As *Dictyota cervicornis* Kütz. forma *pseudobartayresiana* W. R. Taylor]
São Tomé (294).
[As *Dictyota bartayresiana* Lamour.]
São Tomé (123 p.p.; 133 p.p.).
[As *Dictyota ciliata* J. Ag.]
São Tomé (123 p.p.; 131 p.p.; 132 p.p.).

Dictyota ciliata *auct.*
See *Dictyota bartayresii* Lamour., *D. cervicornis* Kütz. forma *pseudobartayresii* W. R. Taylor, *D. ciliolata* Sonder ex Kütz. and *D. crenulata* J. Ag.

Dictyota ciliolata Sonder ex Kütz.
Cameroun (unpublished).
Côte d'Ivoire (148).
Gabon (153).
Gambia (155).
Ghana (148; 159).
Liberia (61).
Mauritanie (189).
Nigeria (148).
São Tomé (148).
Sénégal (148; 289).
Sierra Leone (154).
Spanish Sahara (189).
[As *Dictyota ciliolata*]
Côte d'Ivoire (147).
Ghana (185).
Sénégal (284).
[As *Dictyota ciliata* J. Ag.]
Ghana (72; 99; 187; 255; 294).
Nigeria (99; 255; 294).
São Tomé (99; 123 p.p.; 131 p.p.; 132 p.p.; 255 p.p.; 294).
Sénégal (54; 294).
'West coast, Africa' (205).
'Probably pantropical' (294).
[As *Dictyota ciliata* C. Ag.]
São Tomé (133 p.p.)
[As *Dictyota ciliata*]
Ghana (183; 185).

Note. For comments on *Dictyota ciliolata* Kütz., see the note to *D. dichotoma* (Huds.) Lamour. *D. ciliolata* Sonder ex Kütz. (Kützing, 173 : 12) is the earliest legitimate name for this taxon. The often-used *D. ciliata* J. Ag. (J. Agardh, 8 : 5) is a later homonym of *D. ciliata* Lamour. (Lamouroux, 1809 : 331), itself an illegitimate name change in a taxon [*Fucus pseudociliatus* Lamour. (Lamouroux, 1805)] now accepted in the synonymy of *Taonia atomaria* (Woodw.) J. Ag. *Dictyota ciliata* C. Ag. must therefore be rejected.

Dictyota crenulata J. Ag.
Canaries (161; 228).
Cape Verde Islands (87; 92; 294).
Mauritanie (93; 189).
Pagalu (242; 294).
Príncipe (294).
São Tomé (294).
Sénégal (282; 294).
Atl[antique] trop[ical] (282).
[As *Dictyota crenulata* J. Ag. var. *canariensis* Grun. in Picc.]
Canaries (32; ? 63; 242).

Note. The doubt expressed by De Toni (63 : 270–271) was as to generic attribution.

[As *Dictyota bartayresiana* Lamour. forma β *denticulata* Kütz.]
Cape Verde Island[s] (173).
[As *Dictyota ciliata* C. Ag.]
São Tomé (133 p.p.).

[As *Dictyota ciliata* J. Ag.]
São Tomé (123 p.p.; 255 p.p.).
[As *Dictyota dichotoma* Lamour.]
Príncipe (18; 19).

Dictyota crenulata J. Ag. var. **canariensis** Grun.
See *Dictyota crenulata* J. Ag.

Dictyota dentata Lamour.
See *Dictyota mertensii* (Mart.) Kütz.

Dictyota dichotoma (Huds.) Lamour.
Angola (191).
Canaries (1; 63; 78; 80; 92; 160; 161; 162; 190; 201; 208; 214; 228; 229; 258; 259; 294).
? Côte d'Ivoire (148).
Gabon (122; ? 153).
Gambia (155).
Ghana (? 148; 159).
? Liberia (61).
Mauritanie (189).
Príncipe (? 42; 148; 294).
Salvage Islands (Ilhas Selvagens) (195).
São Tomé (42; 123; 133; 134; 148; 294).
Sénégal (28).
Sierra Leone (154).
Togo (? 148; ? 151; 241).
'From Norway southwards to the Canary Islands . . .' (32).
'. . . De la Norvège aux Canaries . . .' (37).
'. . . Atlantic Ocean . . . African . . . coasts . . .' (80).
'. . . Atlantique nord, de la Norvège aux Canaries . . .' (88).
'. . . Atlantico de Norvega a las islas Canarias . . .' (286).
'. . . Atlantique, jusqu'en Mauritanie . . .' (109).
'Atlantique (de la Norvège à la Mauritanie; . . .)' (13).
'. . . an der ganzen westafrikanischen Küste . . .' (116).
'West coast, Africa' (205).
[As *Dictyota dichotoma* Kütz.]
São Tomé (? 130)
[As *Dictyota dichotoma* Lamour.]
Canaries (21; 228; 308).
Gabon (122).
[As *Dictyota dichotoma* (Huds.) Lamour. var. *dichotoma* and var. *intricata* (C. Ag.) Grev.]
'. . . das costas da Noruega, Suécia e Inglaterra às Canárias . . .' (256).
[As *Dictyota dichotoma* (Huds.) Lamour. var. *implexa* C. Ag.]
Sénégal (143).
[As *Dictyota dichotoma* (Huds.) Lamour. var. *implexa* J. Ag.]
'. . . De la Norvège aux Canaries . . .' (37).
[As *Dictyota naevosa* Suhr]
Canaries (21 p.p.; 208 p.p.).

Note. Børgesen (32 : 84–85), who examined Canary Islands specimens from the Paris Museum, believed that the *Dictyota naevosa* Suhr mentioned by Montagne (208) most probably belonged to *D. dichotoma*. The statement made by Montagne regarding the occurrence of the plants in the Canaries suggested that he also had some other material which was not seen by Børgesen; without examination of this additional material it is not possible to be sure (although the likelihood is strong) that it also is representative of *D. dichotoma*. In an extremely variable genus (see above), *D. dichotoma* is possibly the most variable 'species'. Earle (1969) commented that in the eastern

Gulf of Mexico, *D. dichotoma*, *D. bartayresii*, *D. indica*, and *D. linearis* form a graded series on blade width, internode length, and branching angle; *D. volubilis* is principally recognizable from the characteristic twisting of the blades (laminae), and *D. ciliolata* is characterized by marginal dentations and proliferations. The regular twisting of *D. volubilis* is only an extreme condition of a feature commonly found in many *Dictyota* spp. Marginal teeth and proliferations of *D. ciliolata* are very variable features and, when few are present, show considerable overlap with characteristics of some forms of *D. dichotoma*; De May *et al.* (61) commented that plants referred by them to *D. dichotoma* could have been young forms of *D. ciliolata* in which marginal spines had not yet developed. There is also considerable overlap in the form of branching and width of blades, features used to separate *D. dichotoma* from *D. bartayresii*, *D. cervicornis*, *D. divaricata*, *D. indica* and *D. linearis*. Earle (1969 : 159) indicated that 'many plants are difficult to name with certainty'; hence the presence of interrogation marks in some of the records listed above, although others relate to the establishment of records on the basis of drift material only and to the consequent doubt about the status of *D. dichotoma* as an element in the flora.

Dictyota dichotoma (Huds.) Lamour. var. **implexa** *auct.*
See *Dictyota dichotoma* (Huds.) Lamour.

Dictyota dichotoma (Huds.) Lamour. var. **intricata** (C. Ag.) Grev.
See *Dictyota dichotoma* (Huds.) Lamour.

Dictyota divaricata Lamour.
Canaries (16; 63; 228).
Cape Verde Islands (16; 63; 157; 229; 234).
Gabon (154).
Gambia (155; 156).
Ghana (157; 159).
Sénégal (16; 54; 157).
Senegambia (63; 155).
'De la Norvège aux Canaries . . .' (37).
[As *Dictyota bartayresiana* Lamour. var. β *divaricata* J. Ag.]
'. . . ad oras . . . Senegambiae' (9).
Note. See the notes to *Dictyota dichotoma* (Huds.) Lamour. and *D. linearis* (C. Ag.) Grev. The Piccone (228) Canaries record possibly should be attributed to *Dictyota linearis*.

Dictyota fasciola *auct.*
See *Dilophus fasciola* (Roth) Howe.

Dictyota implexa Lamour.
See *Dictyota linearis* (C. Ag.) Grev.

Dictyota indica Sonder
See the note to *Dictyota dichotoma* (Huds.) Lamour.

Dictyota ligulata *auct.*
See *Dilophus spiralis* (Mont.) Hamel.

Dictyota linearis (C. Ag.) Grev.
Canaries (31; 32; 37; 44; 63; 92; 161; 195).
Salvage Islands (63; 195)
'African and American coasts, Canary Islands' (80).
'. . . Atlantique, de Cadiz aux Canaries . . .' (88).
'In mari atlantico ad Gades, oras Americae tropicae et Africae' (171).
[As *Dictyota linearis* C. Ag.]
Canaries (228; 308).
Salvage Islands (228).
[As *Dictyota implexa* Lamour.]
Canaries (21; 208).

Note. Børgesen (32 : 85) remarked that '. . . *Dictyota implexa* Lamx . . . is, to judge from Montagne's description, referable to this species [*Dictyota linearis*]'. He also suggested that Piccone's (228 : 25–26) *D. divaricata* Lamour. from the Canaries was probably *D. linearis* (C. Ag.) Grev. See the entry for *D. divaricata* and the note to *D. dichotoma* (Huds.) Lamour.

Dictyota martensii (Mart.) Kütz.
See *Dictyota mertensii* (Mart.) Kütz.

Dictyota mertensii (Mart.) Kütz.
Cape Verde Islands (68).
Gabon (154).
São Tomé (123).
[As *Dictyota martensii* (Mart.) Kütz.]
São Tomé (133).
[As *Dictyota dentata* Lamour.]
Cape Verde Islands (16; 237; 238; ? 294).
São Tomé (63; 123; 131; 132; 133; 255; 294).
'. . . ex oceano atlantico orientali ad Ins. Thomé lectam (ex Herb. Hort. Bot. Coimbr.) . . .' (12).

Note. Dictyota dentata Lamour. is a superfluous name for Gmelin's (1768 : 125) *Fucus atomarius*, itself the basionym of *Taonia atomaria* (Woodw.) J. Ag., even though biologically these species are now recognized as being distinct. *Dictyota dentata*, as accepted at the present time, is readily distinguishable from *Taonia* although it is not possible to comment on the interpretation given by earlier workers without individual reference to the original material on which they based their determinations. This and two other species (*Dictyota mertensii, D. brongniartii*) were placed by De Toni (63) in the same tribe, based upon the apparent alternation of the branches; the taxa are distinguished largely on the form of the branch tips. Examination of recent collections of *Dictyota dentata* reveals that there is much variation in the degree to which the branch tips are rounded or toothed, even on the same plant, and this has already been the subject of comment by a number of workers (see Taylor, 259; Steentoft, 294). Although De Toni (63) kept the three species separate, Hauck (1888 : 466) had earlier considered them all under *D. dentata*, accepting the form of the branch tip to be an unreliable character. Material of *D. dentata* identified by Hauck suggests that his concept of that species was in agreement with current acceptance. We concur with Hauck that characters formerly used to separate the three species (*D. dentata, D. mertensii* and *D. brongniartii*) are too variable to be of practical use; the 'species' are therefore here considered to represent only one taxon or biological entity. This grouping must be considered still to be provisional, as examination of type material of all three species might finally reveal other characters, such as the presence of surface spines or rings of vegetative cells at the base of the sporangia (see Jaasund, 1970), that could be used as a basis for their separation. The nomenclatural position is complicated by the fact that *D. dentata* is an illegitimate name and so cannot be used. It is unfortunate that C. Agardh (1822), in describing *Zonaria dentata*, included both *Dictyota dentata* and *Fucus atomarius* Gmel. in his synonymy, even though he expressed doubt regarding the latter. The earliest specific epithet otherwise relating to alternately divided *Dictyota* species is [*Ulva*] *mertensii*, described and illustrated by Martius (1828 : p. 5, pl. 1). Reference is made in the 1828 publication to '*Flora Brasil*, 1. p. 21'; it must be assumed that Martius had already then seen page proofs of this work (he explains in his later preface the long delay from autumn 1826 until publication) because the part dealing with the algae was not published until 1833. In this 1833 publication (pp. 21–22) he referred to the earlier descriptions of *Zonaria dentata* by C. Agardh (1822; 1824), making the comment (p. 21) 'quoad habitum valde similis' and omitting entirely any reference to the earlier synonymy suggested by Lamouroux. We therefore agree with Richardson (252) in taking up the Kützing (173 : p. 15 and pl. 36, fig. 2) combination *Dictyota mertensii* as the earliest legitimate combination applicable to any part of this specific group, and in reducing to synonymy *D. dentata* Lamour. (*sensu* Lamouroux) and *D. brongniartii* J. Ag.

Steentoft's (294) expressed doubt as to the presence of this plant in the Cape Verde Islands appears to be on the basis of her erroneous belief that Dickie's (68) was the only record from there.

Dictyota naevosa (Suhr) Mont.
[As *Dictyota naevosa* (Suhr) J. Ag.]
Sénégal (54; ? 289).
[As *Dictyota naevosa* Suhr]
Canaries (21 p.p.; 208 p.p.).
[As *Dictyota polycarpa* (Sond.) Kütz.]
Sénégal (28).
[As *Dictyota variabile* (Fig. & De Not.) Crouan in Mazé & Schramm]
Sénégal (28).

Note. See the note at *Dictyota dichotoma* (Huds.) Lamour.; the record of *D. naevosa* in the Canaries is included here *pro parte* only on the basis of reasoning presented in that note. It is possible, indeed likely, that the whole of Montagne's (208) material really related to *D. dichotoma*; J. Agardh (9 : 95) thought so. Børgesen himself (32 : 84–85) was more reserved about dismissal of the Canaries records of *D. naevosa*, but Dangeard (54), quoting Børgesen as basis, observed 'Il [*D. naevosa*] n'existe pas, semble-t-il, aux îles Canaries, malgré la mention qu'en a faite Montagne . . .'.

There is similarly a degree of doubt about all the Sénégal records of the species, apart from the fact that Dangeard's (54) material was collected (in good condition) from the drift. Sourie (289 : 116) indicated that J. Feldmann had doubts about the specific attribution in the recording of *Dictyota naevosa*, although no further details were given. Dangeard (54 : 245–248) indicated that the characteristics of his specimens were in agreement with those described by J. Agardh (9 : 95) and De Toni (63 : 266–267) for *D. naevosa*, except in two aspects. Firstly, the nature of the spotting of the thallus differs (oogonia, in Dangeard's specimens; presence of dark bodies in the large median cell, in the earlier descriptions); secondly, both J. Agardh and (following him) De Toni, refer to the 'margine integerrima', whereas certain of Dangeard's plants had small dentations marginally, although rather rarely, whilst other specimens had the margins entirely lacking dentation. Although Dangeard does not say so, it seems likely that the noted dentations were early stages in development of the very well-developed and abundant marginal proliferations he observed on several specimens. Despite such variations, Dangeard continued to use the name *D. naevosa* for all plants otherwise falling within the morphological confines of that species as previously described. He did *not* state, as reported by Bodard & Mollion (28 : 197), that his determination was contradictory in character, nor did he directly indicate doubt as to use of the name *D. naevosa*. In view of this, and in the light of the current uncertainty regarding data on morphological characteristics and species limits in *Dictyota* [see the generic note, and comments under *D. dichotoma* (Huds.) Lamour.], we see little point in the action of Bodard & Mollion in invoking the use of yet other (later) names for what may well be the same taxon. This is particularly the case in that they confuse the situation further by using *D. polycarpa* (Sond.) Kütz. [correctly, Sond. ex Kütz.] in their text (p. 197), on the grounds that the earlier *D. variabile* (Fig. & De Not.) Crouan in Mazé & Schramm has as its type material of a legitimate taxon in *Spatoglossum*, whilst using *Dictyota variabile* (Fig. & De Not.) Crouan in all their tabular data (pp. 204; 210; 211; 212) but those on p. 207, where *D. polycarpa* again appears. Critical re-examination of type material is required before the name *D. naevosa* is discarded.

Dictyota pardalis Kütz.
See *Dictyota cervicornis* Kütz. forma *curvula* W. R. Taylor.

Dictyota patens J. Ag.
? São Tomé (11; 63).

Note. It is not clear to which St. Thomas [Caribbean or Gulf of Guinea] J. Agardh (11) was referring in stating '. . . in oceanis calidioribus, in atlantico ad St. Thomas . . .'. De Toni's record (63) is secondary. The entry is included for completeness. The species is clearly near *Dictyota dichotoma* (Huds.) Lamour. (q.v.).

Dictyota pinnatifida Kütz.
[As *Dictyota pinnatifida* Kütz. var. *rigida* Grun. in Picc.]
Canaries (63; 228).

Dictyota pinnatifida Kütz. var. **rigida** Grun. in Picc.
See *Dictyota pinnatifida* Kütz.

Dictyota polycarpa (Sond.) Kütz.
See *Dictyota naevosa* (Suhr) Mont.

Dictyota prolifera Suhr
See *Dilophus suhrii* (Kütz.) Papenf.

Dictyota repens J. Ag.
See *Dilophus fasciola* (Roth) Howe.

Dictyota variabile (Fig. & De Not.) Crouan in Mazé & Schramm
See *Dictyota naevosa* (Suhr) Mont.

Dictyota volubilis Kütz. *sensu* Vickers
See the note to *Dictyota dichotoma* (Huds.) Lamour.

Dictyota spp.
Angola (158)
Ascension (15; 243A).
Cameroun (182; 251; 282; 291; 295).
Canaries (78; 137; 160).
Gabon (143; 144; 153).
Gambia (155)
Ghana (150; 156; 157; 159; 183; 291; 295).
Guinée (187; 199; 289).
Liberia (61).
Mauritanie (187; 189; 289; 291).
São Tomé (42; 294).
Sénégal (25; 27; 54; 83; 182; 206; 213; 289; 290; 301).
Sierra Leone (154).
Togo (151).
'West Africa' (188).

Note. Askenasy (15 : 29) expressed the opinion that his material, small fragments only, was perhaps referable to either *Dictyota bartayresiana* Lamour. [probably *D. bartayresii* Lamour.] or *D. cervicornis* Kütz. Material collected by De May *et al.* (61) was also of very small plants less than 2 cm high.

Dilophus fasciola (Roth) Howe
Canaries (32; 88; 92; 107; 177; 195; 286).
Salvage Islands (Ilhas Selvagens) (195).
'Atlantique nord (de la Bretagne – var. *repens* – aux Canaries); . . .' (13).
[As *Dilophus fasciola* (Roth) Howe var. *fasciola*]
'Atlântico: Canárias . . .' (256).
[As *Dictyota fasciola* Lamour.]
Canaries (16; 308).
Cape Verde Islands (16; 234).
'. . . Afrique méridionale . . .' (16).
[As *Dictyota fascicola* [sic!] (Roth) Howe]
Canaries (282)
[As *Dictyota fasciola* (Roth) Lamour.]
Canaries (63; 104; 210; 228; 230; 233).
Cape Verde Islands (16; 63; 229).
Salvage Islands (103; 104).
[As *Dictyota repens* J. Ag.]
Canaries (37).

Note. Piccone (228 : 25), in establishing what is apparently one of the earliest Canaries records, indicated that he was reserved about the determinations because he had only a few imperfect specimens. He added comments indicating also that the polymorphism of the species with depth and with other environmental characteristics had to be considered.

Dilophus guineensis (Kütz.) J. Ag.
Note. Despite its name and the comments by Murray (211 : 361), this plant is unknown for the region. See remarks in Steentoft (294 : 118).

Dilophus ligulatus (Kütz.) J. Feldm.
See *Dilophus spiralis* (Mont.) Hamel.

Dilophus spiralis (Mont.) Hamel
Mauritanie (189).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).
'Atlantique nord (du sud de l'Angleterre à la Mauritanie); . . .' (13).
'Atlântico: das costas meridionais da Inglaterra e norte da França às Canárias . . .' (256).
[As *Dilophus ligulatus* (Kütz.) J. Feldm.]
Canaries (92; 107).
'. . ., Atlántico (del sur de Inglaterra a Canarias)' (286).
[As *Dictyota ligulata* J. Ag.]
Canaries (308).
[As *Dictyota ligulata* Kütz.]
Canaries (32; 282).
'From south of England to the Canary Islands' (32).

Dilophus suhrii (Kütz.) Papenf.
[As *Dictyota prolifera* Suhr]
Cape Verde Islands (16; 210).
'. . . Afrique méridionale . . .' (16).
Note. The nomenclature of this plant is discussed in some detail by Papenfuss (1940a : 206–207).

Dilophus sp.
Canaries (34).

Ecklonia
According to Hoppe (137 : 160–161), species of this genus occur mainly in the southern hemisphere. Many of the records listed hereunder, therefore, require substantiation, since they may possibly involve misdetermination, misinterpretation of early records or misunderstanding of distribution limits.

Ecklonia biruncinata (Bory) Papenf.
Mauritanie (189).
[As *Ecklonia exasperata* J. Ag.]
Canaries (70; 126; 260).
[As *Ecklonia exasperata* (Turn.) J. Ag.]
'. . . ad insulas Canarias et adjacentem oram Africae' (9).
[As *Ecklonia radiata* (Turn.) J. Ag.]
Canaries (49; 127; 282).
Cape Verde Islands (282).
Mauritanie (282).
Sénégal (49).
'Canary Island, Cape de Verde Islands and adjacent coast of Africa, Cape, Algoa Bay . . .' (32).
'. . . auf den Cap Verden wie an der afrikanischen Küste vertreten . . .' (282).
[As *Ecklonia radiata* (Turn.) J. Ag. forma *exasperata* Turn.]

Canaries (54).
Sénégal (54).
'ad insulas Fortunatas [Canaries] (*Despreaux*), Gorgoneas [Cape Verde Islands] (*Leprieur*) et adjacentem oram Africae (*Montagne*)' (62; 63).
[As *Ecklonia radiata* (Turn.) J. Ag. var. *exasperata* (Turn.)]
Mauritanie (124).
[As *Ecklonia polymorpha*]
Canaries (124).
Cape Verde Islands (124).
Sénégal (124).
[As *Capea biruncinata* Mont.]
Canaries (21; 171; 208).
? Cape Verde Islands (208).
[As *Capea exasperata* Mont.]
Canaries (209).
Sénégal (54; 209; 210).

Note. We have accepted the statement of Papenfuss (1940a : 209) that 'De Toni (1889, p. 786; 1895, p. 354), in agreement with Turner, places *Ecklonia exasperata* [= *E. biruncinata*] (fig. 9) as a form of *E. radiata* (fig. 8). It seems necessary, however, to regard these two plants as different species, as was done by J. Agardh (1848, p. 146).' In view of J. Feldmann's opinion (see the note to *E. muratii*) that *E. exasperata* should probably be regarded as only from the Southern Hemisphere, this does not strongly affect the present situation in that, whatever name was used by the author publishing the record, the specimen can only have been of *E. biruncinata* or (more likely) of *E. muratii* (q.v.). Hariot (124 : 444) mentioned *E. polymorpha* in his table on the distribution of the various West African plants known also from Mauritanie. It seems that this is a mistake for *E. radiata* var. *exasperata* [= *E. biruncinata*] which is mentioned previously (p. 441) in the same text. For additional comments on the attribution of some earlier records of *E.* [*Capea*] *biruncinata*, *E. exasperata* and *E. radiata* from the Canaries and Sénégal, see the notes at *E. muratii* J. Feldm. Some of the records attributed here should, therefore, very probably appear under *E. muratii*, but re-examination of specimens should establish this fact with certainty.

Ecklonia buccinalis *auct.*
See *Ecklonia maxima* (Osbeck) Papenf.

Ecklonia exasperata (Turn.) J. Ag.
See *Ecklonia biruncinata* (Bory) Papenf. and *E. muratii* J. Feldm.

Ecklonia maxima (Osbeck) Papenf.
[As *Ecklonia maxima*]
South West Africa (287).
[As *Eclonia* (sic!) *buccinalis*]
St Helena (65).
[As *Ecklonia buccinalis* L.]
St Helena (202).
[As *Ecklonia buccinalis* Hornem.]
St Helena (129).
[As *Ecklonia buccinalis* (L.) Hornem.]
South West Africa (76; 282).

Note. It seems that all reports of this plant from St Helena are, as stated by both Dickie (65) and Mellis (202), of drift material that probably derived from attached populations growing on South African shores. Hoppe (137 : 160–161) mentioned that *Ecklonia maxima* is known from the west coast of South Africa '. . . abundant from Cape Agulhas to the West Coast. Prefers warmer waters. The quantities occurring are estimated to amount to thousands of millions of tons . . .'.

Ecklonia muratii J. Feldm.
Canaries (55; 89; 92).

Cape Verde Islands (54).
Mauritanie (28; 54; 55; 89; 93; 187; 189; 203; 204; 289; 290; 295).
Senegambia (89; 155).
Sénégal (28; 54; 55; 89; 93; 187; 203; 204; 213; 289; 290; 295).
Spanish Sahara [Rio de Oro] (89; 92; 93; 187; 189).
'. . . de la côte N.W. de l'Afrique et des Canaries . . .' (92).
'. . . sur la côte occidentale d'Afrique . . .' (91).
'. . . dont l'aire se limite au golfe du Bénin et à la Mauritanie' (28).

Note. J. Feldmann (89 : 326) expressed doubt regarding some of the earlier records of '*Ecklonia exasperata*', stating that 'Il est probable que les *Ecklonia* des Canaries et du Sénégal rapportés jusqu'ici à l'*Ecklonia exasperata* (Turn.) J. Ag., devront être attribués à l'*Ecklonia Muratii*, le véritable *Ecklonia exasperata* restant localisé dans l'Hémisphère austral.' Dangeard (54 : 242–243) reached a similar conclusion. If these statements, and the other records quoted extra-Sénégal, are correct, the assessment of Bodard & Mollion (28 : 198) is likely to be in error as regards *E. muratii*. They indicated that 'Les deux seules algues brunes endemiques [to Sénégal] sont donc *Cystoseira senegalensis* et *Ecklonia muratii*.' It is, however, not clear what they meant by 'endémiques' in that context, since later (28 : 202) they commented that 'Il faut également classer quelques espèces dont l'aire se limite au golfe du Bénin et à la Mauritanie: . . . [*inter alia*] *Ecklonia Muratii* . . .'.

Ecklonia polymorpha
See *Ecklonia biruncinata* (Bory) Papenf.

Ecklonia radiata (Turn.) J. Ag.
See *Ecklonia biruncinata* (Bory) Papenf.

Ecklonia radiata (Turn.) J. Ag. forma **exasperata** Turn. and var. **exasperata** (Turn.).
See *Ecklonia biruncinata* (Bory) Papenf.

Ecklonia spp.
Canaries (210).
Guinée (199).
Mauritanie (189; 291).
Sénégal (57; 187; 210).

Ectocarpus

Ectocarpus, and those allied genera so far reported from west Africa (see *Acinetospora; Bachelotia; Feldmannia; Giffordia; Kuetzingiella; Pilayella; Spongonema*), are particularly plastic in form and most of the morphological characters used to separate them are known to be subject to environmental modification. For this reason, Ravanko (1970) concluded on the basis of culture studies that some genera were merely developmental stages of others, or that their mature form was merely a response of another genus to the environment. Clayton (1974 : 745) has suggested that, whether or not Ravanko's views be accepted, '. . . there remains an obvious need for more comprehensive critical studies in the order [Ectocarpales], particularly studies of variation employing culturing techniques. Using such methods, existing taxonomic characters may be tested, additional ones may possibly be discovered and, hopefully, the status of many genera may be clarified.' More recently, Wynne & Loiseaux (1976) have concluded that '. . . Although contemporary workers . . . would agree [with Ravanko] that probably many species that have been described represent complexes which cannot be clearly subdivided, these workers defend the integrity of such genera as *Feldmannia*, *Giffordia*, and others, since, they argue, genetically based differences do exist.'

Within the genus *Ectocarpus*, as currently understood, Russell (1966) showed that of the many species previously described from Great Britain only *Ectocarpus fasciculatus* Harv. and *E. siliculosus* (Dillw.) Lyngb. were of value, and even then only as opposing extremes of a completely clinal variation in morphology. Clayton (1974) has concluded that a precisely similar situation pertains in Australia, with extremes of the cline being recognizable occasionally, but large numbers of plants being intermediate in form. In all probability, therefore, specimens recorded for west Africa under such names as *E. elachistaeformis*, *E. speciosus* and *E. virescens* will on re-examination prove to fall within the morphologically indistinct intermediate variation pattern between *E. fasciculatus* and *E. siliculosus*.

The work by Clayton (1974), already referred to, presents a useful summary of aspects of the current taxonomic and biological situations in the Ectocarpales. We believe, with Clayton, that a prime requirement in this and other orders is the need for greater flexibility than is provided by traditional concepts of the algal species and by existing rigid, artificial schemes of classification.

Ectocarpus arctus Kütz.
See *Ectocarpus siliculosus* (Dillw.) Lyngb.

Ectocarpus battersii Born.
See *Kuetzingiella battersii* (Born.) Kornm.

Ectocarpus battersii Born. var. **mediterranea** Sauv.
See *Kuetzingiella battersii* (Born.) Kornm.

Ectocarpus breviarticulatus J. Ag.
Benin (148; 151).
Cape Verde Islands (99).
Côte d'Ivoire (148).
Ghana (99; 148; 157; 183; 295).
Liberia (61; 147; 148).
Nigeria (99; 148; 293).
Togo (147; 151).
'. . . Africa (west and south-east coasts)' (205).
[As *Ectocarpus hamatus* Crouan in Mazé & Schramm]
Cape Verde Islands (16).
Note. Askenasy (16 : 161) indicated that the material was determined by Bornet.

Ectocarpus confervoides (Roth) Le Jol.
See *Ectocarpus siliculosus* (Dillw.) Lyngb.

Ectocarpus coniferus Børg.
See *Giffordia rallsiae* (Vickers) W. R. Taylor.

Ectocarpus elachistaeformis Heydr.
Ghana (150).
Note. Earle (1969 : 133) has summarized the distribution of this species in the Gulf of Mexico and the western Atlantic, northern hemisphere. She indicated that the species is '. . . tropical in general distribution . . .'. Pham-Hoang (227), and following him Islam (142), have placed this species in *Feldmannia*, since it is reported to possess unbranched vegetative filaments with a long meristematic zone near the base. We have not followed them because of doubts on the validity of this record for west Africa; see the generic note for details.

Ectocarpus fasciculatus Harv.
Canaries (161).
[As *Ectocarpus fasciculatus* (*pygmaeus*) ?]
'Atlantique, jusqu'au Canaries; . . .' (13).
Note. Ardré (13 : 233–234) recognized forms in this polymorphic species solely for descriptive convenience, attributing to them, as suggested by Russell (1967), no taxonomic significance. The same is true for forms reported under the other 'species', *Ectocarpus siliculosus* (q.v.). The 'young stage' *pygmaeus* was reported by her from Portugal with '?', and its distribution noted to include the Canaries; she makes it clear that the doubt attaches not to its existence there as a recognizable entity, but to the question of to which 'species' her material should be attributed. In view of what was stated above (see *Ectocarpus* genus) regarding the clinal variation between *Ectocarpus fasciculatus – E. siliculosus*, and since Russell (1966) considered that this *pygmaeus* is a developmental stage common to both *E. siliculosus* and *E. fasciculatus*, the matter of its attribution to one 'species' or the other is not of critical significance.

Ectocarpus globifera Kütz. ['*globifer*']
See *Feldmannia globifera* (Kütz.) Hamel.

Ectocarpus granulosus (Engl.) C. Ag.
See *Giffordia granulosa* (Suhr) Hamel.

Ectocarpus hamatus Crouan
See *Ectocarpus breviarticulatus* J. Ag.

Ectocarpus indicus Sond.
See *Feldmannia indica* (Sond.) Womersley & Bailey.

Ectocarpus irregularis Kütz.
See *Feldmannia irregularis* (Kütz.) Hamel, and remarks under *Giffordia rallsiae* (Vickers) W. R. Taylor.

Ectocarpus mitchellae Harv.
See *Giffordia mitchelliae* (Harv.) Hamel.

Ectocarpus paradoxus Mont.
See *Feldmannia paradoxa* Hamel.

Ectocarpus pusillus Griff.
See *Acinetospora crinita* (Carm. ex Harv.) Kornm.

Ectocarpus rallsiae Vickers
See *Giffordia rallsiae* (Vickers) W. R. Taylor.

Ectocarpus rhodochortonoides Børg.
Canaries (32; 34; 92; 142; 150; 205; 282).
Côte d'Ivoire (148).
Ghana (148; 150).
Pagalu (151; 242).
Note. According to Jaasund (1969) there is a good case for transferring this taxon to the genus *Giffordia*, as the chloroplasts are rod-shaped or take the form of elongate plates. However, see the general comments to *Ectocarpus* for remarks on generic distinctions in the group.

Ectocarpus sandrianus Zanard.
See *Giffordia sandriana* (Zanard.) Hamel.

Ectocarpus siliculosus (Dillw.) Lyngb.
Canaries (124; 161; 201; 259).
Mauritanie (124; 189; 282).
[As *Ectocarpus siliculosus* Lyngb.]
Canaries (136; ? 308).
'. . . (from Faroe to Cape of Good Hope and Cape Horn)' (211).
'. . . Atlantic (from Faroe to Cape Horn) . . .' (17).
Note. Doubt expressed by Vickers (308 : 301) was because the only available specimens were sterile.
[As *Ectocarpus siliculosus* C. Ag.]
Canaries (21; 208).
[As *Ectocarpus siliculosus* (Dillw.) Endl.]
Canaries (92).
[As *Ectocarpus siliculosus* (Dillw.) Lyngb. var. *confervoides* (Roth) Kjellm.]
'Atlantique (du Labrador au Maroc et Canaries)' (13).
[As *Ectocarpus siliculosus* (Dillw.) Lyngb. var. *siliculosus*]
'Atlantique (du Labrador au Maroc et Canaries; . . .)' (13).
[As *Ectocarpus siliculosus* (Dillw.) Lyngb. forma *arcta* (Kütz.) Kuck.]
Canaries (32).

[As *Ectocarpus confervoides* (Roth) Le Jol.]
Canaries (3; 32; 92; 282; 286).
'. . . das costas da Suécia e da Inglaterra a Marrocos e às Canárias . . .' (256).

Note. Ardré (13 : 229) indicated that, following Russell (1966; 1967) and as a means of indicating the different forms found amongst Portuguese material, she was using varietal names merely as descriptive adjectives without taxonomic validity.

Ectocarpus siliculosus (Dillw.) Lyngb. forma **arcta** (Kütz.) Kuck.
See *Ectocarpus siliculosus* (Dillw.) Lyngb.

Ectocarpus siliculosus (Dillw.) Lyngb. var. **confervoides** (Roth) Kjellm.
See *Ectocarpus siliculosus* (Dillw.) Lyngb.

Ectocarpus siliculosus (Dillw.) Lyngb. var. **siliculosus**
See *Ectocarpus siliculosus* (Dillw.) Lyngb.

Ectocarpus simpliciusculus *auct.*
See *Feldmannia irregularis* (Kütz.) Hamel.

Ectocarpus speciosus (Børg.) Kuck.
Canaries (32; 92; 164).

Note. See comments under the genus *Ectocarpus*.

Ectocarpus terminalis Kütz.
See *Spongonema tomentosum* (Huds.) Kütz.

Ectocarpus virescens Thur. ex Sauv.
Canaries (280; 308).
Sénégal (45).

Note. See comments under the genus *Ectocarpus*. Fox (99 : 622), Schmidt & Gerloff (282 : 724) and Earle (1969 : 138) considered this taxon to be identical with *Giffordia mitchelliae* (q.v.). Although Børgesen (31; 32) maintained separately the two taxa, he was quite expecting that further studies would eliminate the few remaining differences. The nature of the specimens on which the west African records are based needs confirmation, since Børgesen (33 : 165) finally concluded that *G. mitchelliae* [referred to by him as *Ectocarpus mitchellae*] included material from the Canaries that he had previously named *E. virescens*.

Ectocarpus spp.
Canaries (2; 201; 259).
Côte d'Ivoire (147).
Ghana (157).
Sénégal (289).
Sierra Leone (154; 184).
South West Africa (287)

Elachista breviarticulata (Suhr) Aresch.
See *Elachista globulosa* (C. Ag.) J. Ag.

Elachista globulosa (C. Ag.) J. Ag.
'. . . in mari atlantico a littore Galliae usque ad insulas Canarias' (9).
'. . . in oceano Atlantico a littore Galliae usque ad insulas Canarias' (63).
[As *Elachista breviarticulata* (Suhr) Aresch.]
Canaries (14).
[As *Conferva breviarticulata* Suhr]
Canaries (296; 297).

Note. There is doubt, already expressed by both J. Agardh (9 : 11) and De Toni (63 : 445–446), as to the relationship between this species and *Conferva curta* of Dillwyn. If the latter, considered by De Toni to be nearer to *Elachista flaccida* (Dillw.) Aresch., were conspecific with *E. globulosa*, a name change would be required as the epithet *curta* antedates *globulosa*. Areschoug (1843 : 262) indicated his belief that material from the Channel area, but not that from the Canaries, was hardly different from *E. flaccida*; thus he effectively excluded the possibility of applying the name *E. curta* (Dillw.) Aresch. to the Canaries specimens without further typification and anatomical studies. The material mentioned by Suhr (296; 297) was growing on *Cystoseira fibrosa* C. Ag. [= *C. baccata* (S. Gmel.) Silva], and Ardré (13 : 251) has already discussed the complexities of other *Elachista* spp. (*E. intermedia* Crouan; *E. neglecta* Kuck.) reported on European *C. baccata*. All these reported *Elachista* spp. require re-examination and rationalization.

Encoelium mac-gregorii Suhr ex Kütz.
See *Asperococcus turneri* (Sm.) Hook.

Feldmannia

This genus is usually recognized as distinct on the basis of the occurrence of all branches and sporangia below the meristematic regions. See, however, the comments under *Ectocarpus* and *Acinetospora*. Ravanko (1970), after culture studies, declined to accept any subgeneric taxa in *Feldmannia*, deeming the whole genus to be the result of environmental effects on a plastic phenotype and its development processes. A synoptic nomenclatural and taxonomic history has been provided by Clayton (1974).

Feldmannia globifera (Kütz.) Hamel
'Atlântico: da Inglaterra às Canárias . . .' (256).
'Atlantique nord (de l'Angleterre au Maroc et Canaries; . . .)' (13).
[As *Ectocarpus globifera* Kütz.]
Canaries (48).
[As *Ectocarpus globifer* Kütz.]
Canaries (32; 92; 259; 280).

Note. Clayton (1974 : 754–761) has concluded that in Australia and probably elsewhere in the distributional range of the species, *Feldmannia globifera* and *F. simplex* are not distinct species but are linked by intermediate forms. She indicated that there remains the need to establish the status of the species complex on a world-wide basis. The specific epithet is often written, incorrectly, '*globifer*'; Hamel (120 : xvii–xviii), who established *Feldmannia* and made the combination, used the form *globifera*, thereby showing his intent that *Feldmannia* should be treated as a feminine noun.

Feldmannia indica (Sond.) Womersley & Bailey
Gambia (155).
[As *Ectocarpus indicus* Sond.]
Cameroun (241; 282).
Nigeria (99).
[As *Giffordia indica* (Sond.) Papenf. & Chihara]
Gabon (153).

Note. Womersley & Bailey (314 : 288–289) have examined and corrected past views of the type, type description and taxon here accepted as *Feldmannia indica*. They concluded that *Ectocarpus indicus* in the concepts of Setchell (1924) and Abbott (1947) was almost certainly *Giffordia mitchelliae*. Clayton (1974) added that the same applies to the concepts of Askenasy (1888; 1894) and Børgesen (36). Womersley & Bailey gave good reason as to why, provided only that the extant generic concepts be accepted, *Ectocarpus indicus* should be placed in *Feldmannia*, not in *Giffordia*. *Ectocarpus indicus* shows the presence of distinct basal growth regions in long, unbranched filaments, sporangia mostly sessile but occasionally with a basal cell and borne below the growth regions, and cells with numerous discoid chloroplasts. Richardson (252) has not accepted the evidence provided and maintains the combination *Giffordia indica* (Sond.) Papenf. & Chihara. On the subject of acceptance and validity of extant generic concepts in the Ectocarpales, see the comments above to the genera *Ectocarpus* and *Feldmannia*. The assumption that the records here cited represent *Feldmannia indica* may not be justified; it depends on the basis on which the determinations were made. *Giffordia mitchelliae* may perhaps be involved.

Feldmannia irregularis (Kütz.) Hamel
Canaries (161; 195; 227; 312).

Mauritanie (189).
'Atlantique (de l'Angleterre aux Canaries; . . .)' (13).
[As *Feldmannia irregularis* (Kütz.) Hamel formae *conifera* (Børg.) and *rallsiae* (Børg.)]
Sénégal (289).
[As *Ectocarpus irregularis* Kütz.]
Canaries (32; 36; 92; 205; 280; 282; 308).
'From the English coast southwards to the Canary Islands . . .' (32).
'. . . côtes atlantiques d'Europe, de l'Angleterre aux Canaries . . .' (88).
'. . . vom Schwarzen Meere und den Kapverdischen Inseln bis Südengland und Westschottland . . .' (116).
[As *Ectocarpus simpliciusculus* J. Ag.]
Cape Verde Islands (16).
[As *Ectocarpus simpliciusculus* C. Ag.]
Cape Verde Islands (17; 68).

Note. Clayton (1974 : 779) has made some interesting comments on the generic placement of this species. Additionally, she indicated that there is doubt concerning the identity of the species, since the type material has not been located and illustrations of the type specimen (Kützing, 1855; pl. 62) possess insufficient detail. She continued (p. 779) '. . . Perhaps partly as a result of this confusion, there is disagreement regarding the nomenclature and synonymy of the species. The plants from Australia fit clearly into the genus *Giffordia* as older specimens have diffuse growth and therefore lack the characteristic growth form of *Feldmannia*. However, it remains possible that the original specimen belonged to the genus *Feldmannia*. It is also certain that several collections referred to by other workers in fact have the basal branching and the single meristematic zone of a *Feldmannia*. This problem requires further investigation.' From this, it follows that each of the records here reported for west Africa requires reassessment on an individual basis. See also the note to *Giffordia rallsiae* (Vickers) W. R. Taylor.

Feldmannia irregularis (Kütz.) Hamel formae **conifera** (Børg.) and **rallsiae** (Børg.)
See *Feldmannia irregularis* (Kütz.) Hamel.

Feldmannia lebelii (Aresch. ex Crouan frat.) Hamel
See the note to *Acinetospora crinita* (Carm. ex Harv. in Hook.) Kornm.

Feldmannia padinae (Buffh.) Hamel
See the note to *Acinetospora crinita* (Carm. ex Harv. in Hook.) Kornm.

Feldmannia paradoxa (Mont.) Hamel
Canaries (286; 313).
[As *Ectocarpus paradoxus* Mont.]
Canaries (32; 88; 92).

Note. Clayton (1974 : 746) has concluded that *Feldmannia paradoxa* is probably a good species with constant and reliable taxonomic characteristics, especially as regards the genetically-based, typical mucilage production. She dismissed Ravanko's (1970) criticism of the use as a taxonomic characteristic of mucilage production in *F. paradoxa*.

Feldmannia rallsiae (Vickers) Hamel
See *Giffordia rallsiae* (Vickers) W. R. Taylor.

Feldmannia simplex (Crouan frat.) Hamel
See *Feldmannia globifera* (Kütz.) Hamel.

Fucus abrotani-folius L.
See *Cystoseira foeniculacea* (L.) Grev.

Fucus bulbosus L.
See *Saccorhiza polyschides* (Lightf.) Batt.

Fucus comosus Lamarck & Poiret
See *Sargassum desfontainesii* (Turn.) C. Ag.

Fucus desfontainesii Turn.
See *Sargassum desfontainesii* (Turn.) C. Ag.

Fucus ericoides *auct.*
See *Cystoseira tamariscifolia* (Huds.) Papenf.

Fucus lendigerus L.
See *Sargassum vulgare* C. Ag.

Fucus limitaneus *auct.*
See *Fucus spiralis* L.

Fucus nodosus L.
See *Ascophyllum nodosum* (L.) Le Jol.

Fucus platycarpus *auct.*
See *Fucus spiralis* L.

Fucus platycarpus Thur. and forma **nana** Born.
See *Fucus spiralis* L.

Fucus serratus L.
[As *Fucus serratus*]
Canaries (165).

Fucus siliquosus L.
See *Halidrys siliquosa* (L.) Lyngb.

Fucus spiralis L.
Canaries (32; 57; 92; 161; 190; 217; 243; 258; 281).
Rio-de-Oro (93; 203).
Spanish West Africa (245).
Spanish Sahara (204).
Western Sahara (189).
'Along the West coast of Europe down to the Canary Islands' (32).
'Atlantique nord (de la Norvège au Maroc et aux Canaries; . . .)' (13).
Note. Santos Guerra (258) stated '. . . *Fucus spiralis* no ha sido localizado aún en la isla [La Gomera], pero debe admitirse como componente raro de esta zona . . . [supralittoral].'
[As *Fucus spiralis* L. forma *limitaneus* (Mont.) Børg.]
Canaries (120; 243; 286).
Note. Powell (243) suggested employment of the northern name f. *nanus*, both formae being morphologically indistinguishable.
[As *Fucus spiralis* L. forma *platycarpus* (Thur.) Powell]
Canaries (243).
[As *Fucus spiralis* L. var. *platycarpa* (Thur.) Børg.]
Canaries (2).
[As *Fucus spiralis* L. emend. Batt. var. *platycarpa* (Thur.) Batt. and its forma *limitanea* (Mont.) Børg.]
Canaries (32).
[As *Fucus spiralis* L. var. *platycarpus* (Thur.) Batt. forma *limitaneus* (Mont.) Børg.]
'Atlântico: . . . costa de Marrocos e Ilhas Canárias . . .' (256).
[As *Fucus limitaneus* Mont.]
Canaries (174; 209).
[As *Fucus platycarpus* Thur.]
'. . . de la Norvège aux Canaries' (37).
[As *Fucus platycarpus*]
Canaries (1; 96; 271; 272; 308).
Spanish Sahara [Rio de Oro] (289).

[As *Fucus platycarpus* Thur. forma *nana* Born. (*Fucus limitaneus* Mont.)]
Canaries (308).
[As *Fucus vesiculosus* L.]
Canaries (9; 21; 63; 116).
[As *Fucus vesiculosus* L. var. *limitaneus* Mont.]
Canaries (63; 82; 208).

Note. The early reports of this plant as being *Fucus vesiculosus* were apparently based on misidentifications (Børgesen, 32). Acuña Gonzãlez (2 : 5) noted that at Las Galletas, Tenerife, 'solo se ha encontrado un pie de planta'; the many other reports for the Canaries make this of less than critical importance.

Fucus spiralis L. forma **limitaneus** (Mont.) Børg.
See *Fucus spiralis* L.

Fucus spiralis L. forma **platycarpus** (Thur.) Powell
See *Fucus spiralis* L.

Fucus spiralis L. var. **platycarpa** (Thur.) Børg.
See *Fucus spiralis* L.

Fucus spiralis L. emend. Batt. var. **platycarpa** (Thur.) Batt. forma **limitanea** (Mont.) Børg.
See *Fucus spiralis* L.

Fucus spiralis L. var. **platycarpus** (Thur.) Batt. forma **limitaneus** (Mont.) Børg.
See *Fucus spiralis* L.

Fucus thunbergii Roth
See *Cystoseira thunbergii* C. Ag.

Fucus tomentosus Huds.
See *Spongonema tomentosum* (Huds.) Kütz.

Fucus vesiculosus L.
Canaries (56; 57; 58; 137; 161; 243).
'Atlantique nord (du Groenland aux Canaries; . . .)' (13).
'. . . Atlantique, du Groenland jusqu'aux Canaries qui constituent la limite méridionale de l'espèce.' (109).

Note. See also *Fucus spiralis* L. Davy de Virville & Denizot (58) suggested that this is a relatively recent southward extension in range.

Fucus vesiculosus L. var. **limitaneus** Mont.
See *Fucus spiralis* L.

Fucus spp.
Spanish West Africa (245).
Spanish Sahara (204).
Western Sahara (189).

Giffordia

Following Hamel (120), this genus is usually considered to include species of Ectocarpaceae with discoid chloroplasts and sessile plurilocular sporangia, but lacking basal or near basal meristems and colourless hairs. *Feldmannia* is said to differ from *Giffordia* in having primarily basal, or near basal, meristematic regions. On the validity of this distinction, see the comments under *Ectocarpus*. Ravanko (1970) considered that both *Giffordia* and *Feldmannia* are the result of environmental influences on development of a plastic phenotype.

Giffordia conifera (Børg.) W. R. Taylor
See *Giffordia rallsiae* (Vickers) W. R. Taylor.

Giffordia granulosa (Sm.) Hamel
Mauritanie (189).

[As *Giffordia granulosa* (Engl. Bot.) Hamel]
Mauritanie (282).
[As *Ectocarpus granulosus* (Engl. Bot.) C. Ag.]
Mauritanie (124; 282).
Note. Clayton (1974 : 773) has reported what was apparently the first successful culturing of *Giffordia granulosa*.

Giffordia indica (Sond.) Papenf. & Chihara
See *Feldmannia indica* (Sond.) Womersley & Bailey.

Giffordia mitchelliae (Harv.) Hamel ['*mitchellae*']
Benin (150; 151).
Cameroun (99; 150).
Canaries (41; 99; 150; 161; 205; 282).
Gambia (155).
Ghana (150; 159).
Liberia (61).
Mauritanie (189).
Nigeria (99; 150).
São Tomé (294).
Sénégal (99; 150; 289).
Togo (150; 151).
'. . . West and east coasts of Africa' (205).
'Atlantique (de l'Angleterre au Maroc, Canaries, . . .)' (13).
'Atlantic Ocean (from England to Canary Islands)' (80).
'. . . known from many parts of the Guinea coast . . . Apparently pantropical' (294).
Note. The Cameroun recording of this plant by Fox (99) is based solely on the interpretation of the description given by Pilger (241) of his material under the name *Ectocarpus indicus*. Since we have not examined the plants concerned, we prefer to maintain Pilger's record as *Feldmannia indica* (Sond.) Womersley & Bailey, pending clarification.
[As *Giffordia mitchellae* (Harv.) Batt.]
Sénégal (54).
[As *Ectocarpus mitchellae* Harv.]
Canaries (33; 36; 88; 92).
[As *Ectocarpus virescens* Thur.]
Canaries (32).
Note. The incorrect rendering of the specific epithet as '*mitchellae*' is often encountered. See also the comments to *Ectocarpus virescens* and *Feldmannia indica*; there may be additional west African records of *Giffordia mitchelliae* concealed under these names.

Giffordia rallsiae (Vickers) W. R. Taylor
Angola (191).
Benin (148; 151).
Canaries (150).
Ghana (148; 150).
Liberia (61; 148).
Togo (148; 151).
Spanish Sahara (189).
[As *Ectocarpus rallsiae* Vickers]
Canaries (32; 34; 84; 280).
[As *Feldmannia Ralfsiae* [sic!] (Vickers) Hamel]
Sénégal (54).
Note. There is some doubt as to whether *Ectocarpus rallsiae* and other closely-related 'species' (e.g. *E. coniferus* Børg.) more fully accord with currently accepted characteristics of *Feldmannia* (an essentially basal meristem) or of *Giffordia* (diffuse growth). At present, it seems best to leave these species in the latter genus rather than to propose new combinations in *Feldmannia*. Sum-

maries of the position regarding the doubts expressed above are given in Earle (1969 : 135–136) and Islam (142 : 28–29); Woelkerling (312 : 8–9) comments on the relationships between, *inter alia*, *Giffordia rallsiae* and *Feldmannia irregularis*, the conspecificity of these taxa still being a subject of some disagreement. At a time (1941) when both epithets were still combined in the genus *Ectocarpus*, Børgesen (36 : 23–31) had already concluded that *E. coniferus* Børg., *E. irregularis* Kütz. and *E. rallsiae* Vickers were all conspecific; this conclusion was based principally on data provided by Sauvageau (280).

Giffordia sandriana (Zanard.) Hamel
[As *Ectocarpus sandrianus* Zanard.]
Sénégal (45).
Note. Clayton (1974 : 785) presented much interesting information on the characteristics of life-history and development pattern found in culture.

Giffordia spp.
Côte d'Ivoire (147; 148).
Ghana (157).
Togo (151).

Gymnosorus variegatus *auct.*
See *Lobophora variegata* (Lamour.) Womersley.

Hafgygia digitata Kütz. forma **membranacea** Kütz.
See *Laminaria hyperborea* (Gunn.) Fosl.

Halidrys siliquosa (L.) Lyngb.
Canaries (9; 21; 63; 208; 262; 263).
'. . . im östlichen Atlantischen Ocean von den Kanarischen Inseln nordwärts . . .' (166).
[As *Fucus siliquosus* L.]
Canaries (38; 304).
Note. Sauvageau (262; 263) mentioned Montagne's record for the Canaries, but doubted that *Halidrys* really grew attached in the littoral anywhere south of the Gironde. Børgesen (32 : 99) also doubted the validity of the reports of this plant from the Canaries. The original record by Bory (38), in Turner (304), and in Montagne (208 : 139) cannot be substantiated as the material has not thus far been located; in any case, Bory's record was of drift. It is interesting to consider the bearing on these records of the recent suggestion by Giaccone & Bruni (114) that *Cystoseira baccata* (Gmel.) Silva is much nearer to the genus *Halidrys* than to *Cystoseira*. Perhaps the morphological similarity to *Halidrys* is at times so close that confusion in field determinations is possible in the Canaries. Apart from that, drift material may have formed the basis for *all* previous reports; Van Goor (116 : 56–57) indicated that '. . . Vielleicht beziehen sich auch die anderen Angaben für Spanien, Portugal und die Canarischen Inseln ebenfalls auf ausgeworfene Pflanzen.' Sauvageau (263, see above) earlier indicated similarly.

Haligenia Belvisii (C. Ag.) Endl.
See *Saccorhiza polyschides* (Lightf.) Batt.

Haliseris delicatula *auct.*
See *Dictyopteris delicatula* Lamour.

Haliseris dichotoma Suhr
Canaries (63).
Note. De Toni's (63) citation ('. . . an eadem species ex ins. Fortunatis? (LIEBETRUTH)') suggests that the material, which we have not attempted to trace, probably represents *Dictyopteris membranacea* (Stackh.) Batt.

Haliseris polypodioides (Desf.) C. Ag.
See *Dictyopteris membranacea* (Stackh.) Batt.

Halopteris filicina (Grat.) Kütz.
Canaries (32; 35; 92).

Salvage Islands (Ilhas Selvagens) (195).
'Atlantique (de l'Irlande aux Canaries) . . .' (13).

Halopteris scoparia (L.) Sauv.
Canaries (1; 2; 32; 34; 78; 92; 99; 160; 162; 190; 203; 204; 214; 259; 271; 282).
Nigeria (99).
Salvage Islands (99; Ilhas Selvagens, 195).
'. . . Atlantique, du Kattegat aux îles du cap Vert' (88).
'Atlantique (de la Suède aux îles du Cap Vert; . . .)' (13).
'. . . das costas da Suécia e Inglaterra às ilhas de Cabo Verde . . .' (256).
'From Great Britain down to the Cape de Verde Islands . . .' (32).
[As *Halopteris scoparia* (Kütz.) Sauv.]
Canaries (267).
Cape Verde Islands (267).
[As *Halopteris scoparia* (L.) Lamour.]
Canaries (161).
[As *Sphacelaria scoparia* Lyngb.]
Canaries (9; 21; 208; 209).
'. . . ab oris Britanniae ad insulas Canarias . . .' (6).
[As *Sphacelaria scoparia* (L.) Lyngb.]
Canaries (5; 228).
Cape Verde Islands (210).
[As *Sphacelaria scoparia* C. Ag.]
Cape Verde Islands (288).
[As *Sphacelaria scoparia* Lyngb. formae *aestivalis* J. Ag. and *hiemalis* J. Ag.]
Canaries (9).
[As *Sphacelaria scoparia* var. *disticha* (Lyngb.) and var. *virgata* (Harv.)]
Canaries (228).
[As *Sphacelaria scoparium* Kütz.]
Canaries (17).
[As *Stypocaulon scoparium* (L.) Kütz.]
Canaries (63; 250; 286).
Salvage Islands (103).
[As *Stypocaulon scoparium* Kütz.]
Canaries (17; 37; 258; 308).
Cape Verde Islands (16).
'. . . De la Norvège aux Canaries . . .' (16).
[As *Stypocaulon scoparium*]
Canaries(264).
[As *Stypocaulon scoparium* Kütz. var. δ *distichum* (Lyngb.) Kütz.]
Canaries (171).
'. . . In mari atlantico, ad oras . . . Africae borealis et meridionalis . . .' (171).

Halyseris polypodioides C. Ag.
See *Dictyopteris membranacea* (Stackh.) Batt.

Hapalospongidium spongiosum Saunders
See *Basispora africana* John & Lawson.

Hecatonema floridanum (W. R. Taylor) W. R. Taylor
See *Hecatonema* sp.

Hecatonema terminale (Kütz.) Kylin
See *Spongonema tomentosum* (Huds.) Kütz.

Hecatonema sp.
Gambia (155).

Note. John & Lawson (155 : 293) commented that '. . . In many . . . dimensions this plant corresponds to the little known *Hecatonema floridanum* (W. R. Taylor) W. R. Taylor originally described as *Phycocelis floridana* by Taylor . . .'.

Hydroclathrus cancellatus Bory
See *Hydroclathrus clathratus* (C. Ag.) Howe.

Hydroclathrus clathratus (C. Ag.) Howe
Gabon (153).
[As *Hydroclathrus clathratus* (Bory) Howe]
Canaries (13; 32; 84; 92; 161; 258; 277).
Cape Verde Islands (87; 92).
Salvage Islands (Ilhas Selvagens) (195).
'Seems to occur in all warmer seas' (32; 195).
[As *Hydroclathrus clathratus*]
Angola (282).
Canaries (282).
Cameroun (282).
Fernando Póo [Macias Nguema Biyogo] (282).
Pagalu (282).
[As *Hydroclathrus cancellatus* Bory]
Angola (17; 19).
Canaries (16; 21; 37; 104; 201; 208; 271).
Cape Verde Islands (16).
Salvage Islands (103; 104).
Sénégal (104).
'. . . Afrique méridionale . . .' (16).
'. . . Seems to occur in all warmer seas' (31).
[As *Asperococcus clathratus* J. Ag.]
'Warm Atlantic' (211).

Hydroclathrus sinuosus (Roth) Zanard.
See *Colpomenia sinuosa* (Roth) Derb. & Sol.

Kuetzingiella

On the general topic of generic distinctions in the Ectocarpales, see the comments under *Ectocarpus*. Clayton (1974) considered *Kuetzingiella* to be close to *Herponema* (J. Ag.) Hamel, the latter including species with an endophytic base, the former those species with an extensive, frequently fertile, pseudoparenchymatous and epilithic prostrate system. From culture studies, Clayton (1974) concluded that the substratum on which the plants grew had little taxonomic significance, since early development stages were the same whether the plants were endophytic or epilithic. She provisionally recognized both epilithic and endophytic plants from Australia as species of *Kuetzingiella*, but added (p. 798) 'it is evident that the genus and its close relatives, in particular *Herponema*, are in need of revision'.

Kuetzingiella battersii (Born. in Sauv.) Kornm. in Kuck.
'Atlantique (de l'Angleterre aux Canaries); . . .' (13).
'. . . Gr. Britain to Canaries . . .' (195).
[As *Ectocarpus battersii* Born.]
Canaries (92).
[As *Ectocarpus battersii* Born. var. *mediterranea* Sauv.]
Canaries (84; 88).
[As *Ectocarpus battersiae* Born. var. *mediterranea* Born. in Sauv.]
Canaries (32; 271).

Laminaria belvisii C. Ag.
See *Saccorhiza polyschides* (Lightf.) Batt.

Laminaria digitata Lamour.
See *Laminaria ochroleuca* Pyl.

Laminaria digitata (L.) Edm., **various formae**
See *Laminaria digitata* (Huds.) Lamour. forma *ensifolia* (Kütz.) Fosl.

Laminaria digitata (Huds.) Lamour. forma **ensifolia** (Kütz.) Fosl.
South West Africa (77).
[As *Laminaria digitata* (L.) Edm. forma *ensifolia* prox.]
South West Africa (98).

Note. The material on which this Dinter (77) record was based has not been located and examined. Possibly *Laminaria pallida* or *L. schinzii* were involved. However, the record may simply be derived secondarily from Foslie (98), who states that of eight specimens collected at Walvis Bay, October 1890, by Dr Hans Schinz, two were representative of *Laminaria digitata* (L.) Edm., probably nearest to forma *ensifolia*, or between forma *ensifolia* and forma *genuina*. The remaining six specimens were of the new species *L. schinzii* Fosl. (q.v.).

Laminaria hyperborea (Gunn.) Fosl.
[As *Hafgygia digitata* Kütz. forma *membranacea* Kütz.]
Canaries (171).
'In oceano atlantico ad oras . . . Africae australis . . .' (171).

Note. The material upon which this record is based has not been checked, but it seems likely that it might be more correctly referred to *Laminaria ochroleuca*.

Laminaria iberica (Hamel) Lami
See *Laminaria ochroleuca* Pyl.

Laminaria lejolisii Sauv.
See *Laminaria ochroleuca* Pyl.

Laminaria ochroleuca Pyl.
Canaries (92; 97; 112; 282).
Mauritanie (189; 204).
Rio de Oro (94; 203).
Spanish Sahara (189; 204).
Spanish West Africa (29; 245).
'Atlantico de Inglaterra a Canarias; . . .' (286).
'Atlantique nord (du sud de l'Angleterre au Rio de Oro; . . .)' (13).
'. . . sa limite méridionale [se situe], au sud du Maroc' (109).
[As *Laminaria digitata* Lamour.]
Canaries (21; 208).
[As *Laminaria iberica* (Hamel) Lami]
Canaries (86; 178).
[As *Laminaria lejolisii* Sauv.]
'. . . vit . . ., comme il est probable, aux îles Canaries' (49).
[As *Laminaria pallida* Grev.]
Canaries (37; 49; ? 63; 192; 260; 274).
South West Africa (60).
'Southern Atlantic shore of Europe, Morocco, Canary Islands, Cape' (32).
[As *Laminaria pallida* (Grev.) J. Ag. ? var. *iberica* Hamel]
Canaries (85).

Note. See also *Laminaria hyperborea* (Gunn.) Fosl. Feldmann's (85) doubt concerns the varietal attribution: '. . . si la plante des Canaries appartient à la var. *iberica* ou à la forme du Cap'.

Laminaria pallida Grev.
South West Africa (60; 282; 287).

Note. These records appear to represent the most northerly extension of a species hitherto well known from the western coast of South Africa. See also *Laminaria ochroleuca* Pyl. and *L. digitata*

(L.) Lamour. forma *ensifolia* (Kütz.) Fosl.; previously, *L. pallida* was misapplied to Canaries specimens of the former.

Laminaria pallida Grev. var. **iberica** Hamel
See *Laminaria ochroleuca* Pyl.

Laminaria schinzii Fosl.
South West Africa (17; 63; 77; 92; 98; 158; 191; 226; 240; 282; 287).
[As *Laminaria schinzii* Fosl. formae *typica* Fosl. and *cuneata* Fosl.]
South West Africa (98).
Note. See also *Laminaria digitata* (L.) Lamour. forma *ensifolia* (Kütz.) Fosl.

Laminaria schinzii Fosl. formae **typica** Fosl. and **cuneata** Fosl.
See *Laminaria schinzii* Fosl.

Laminaria spp.
Mauritanie (189; 289).
Rio de Oro (289).
South West Africa (43; 60; 212; 225).
Spanish West Africa (245).
Spanish Sahara (189).
'. . . l'existence paraît au moins assez générale sur le littoral ouest-africain, du Maroc à la Guinée française' (289).

Leathesia difformis (L.) Aresch.
Mauritanie (189).
? South West Africa (287).
'Atlantique nord (de l'Arctique à la Mauritanie); . . .' (13).
'. . . Atlantique nord, jusqu'en Mauritanie . . .' (109).

[As *Leathesia marina* (C. Ag.) Endl.]
Canaries (230; 233).
Note. Solely on the basis of nomenclature, the Piccone (230; 233) records should be attributed to *Leathesia difformis* (L.) Aresch. However, there are no other Canary Islands records of *L. difformis*, and the material may have been misdetermined *Colpomenia*, frequently recorded for the islands. The original material requires re-examination to clarify this.

Levringia
Taxonomy and nomenclature of species currently recognized as belonging within this genus are complex and lacking clarity. Bory de St Vincent (39) provided a rather inconclusive description of his *Chordaria sordida*, indicating that it had been collected in poor condition by D'Urville at Ascension Island. Bory explained the difficulty of isolating material in reasonable condition from the original degenerating intertwined clump. The lack of unequivocal description and illustration led Montagne (1846 : 28–29) to express doubt when suggesting *Chordaria sordida* as a synonym of his *Mesogloea brasiliensis*, although indicating the possibility that the correct name for the taxon could prove to be *M. sordida*. Harvey (in Hooker, 126) indicated some doubt in attributing *Chordaria sordida* Bory (39 : 139) and *Mesogloea brasiliensis* Mont. (1843 : 304–305) to the synonymy of the form that *he* was calling *Chordaria sordida* Bory. He also placed in that synonymy, *inter alia*, *Mesogloea natalensis* Kütz. (1847) [= *Thorea americana* β *natalensis* in Kütz., 1849] and *Nemalion natalense* Hering (1842; 1846, in Krauss), observing of the taxon '. . . A widely dispersed plant, if, as we have good reason to believe, all the above-quoted synonyms belong to it . . .'; he clearly appreciated the extent of variation in gross morphology with age. In 1860, Montagne (210) described (p. 218) a collection by Bolle from the Cape Verde Islands as var. *natalensis* Mont. of his earlier (1843) *Mesogloea brasiliensis*, referring the variety back to *Nemalion natalense* of Hering. Askenasy (16 : 159) named plants from the same island group as *Cladosiphon natalensis* Born. *in litt.*; collections involved those by Bolle (some determinatory doubt being indicated) and Cardoso. Synonymy of *C. natalensis* according to Askenasy included *Nemalion natalense* Hering; *Mesogloea brasiliensis* var. *natalensis*; and *Mesogloea natalensis* Kütz.

Levring (193) indicated that he believed the amalgamation of *Chordaria sordida* Bory [= *Myriogloia sordida* (Bory) Levring] and *Mesogloea/Nemalion natalensis(-se)* to be in error since the form and size of the plurilocular sporangia were so different between these taxa. However, since he had seen no material of it and in the absence of Montagne figures, *Mesogloea brasiliensis* seemed to Levring perhaps to be legitimately placed in synonymy of *Myriogloia sordida*. He suggested also that, on the basis of form and distribution, *M. atlantica* J. Feldm. was at least closely related to *M. sordida*.

The genus *Levringia* was introduced into the situation by Kylin (176), when he both described the genus and transferred into it the previous *Myriogloia atlantica* J. Feldm., *M. sordida* (Bory) Levring and *Mesogloea natalensis* Kütz. Kylin appears to have treated *M. natalensis* Kütz., described from Port Natal, South Africa, as the basionym of *Levringia natalensis*, indicating no knowledge of a previous description of *Nemalion natalense* by Hering (1842 : 92) based on material from the same locality. Unless Kylin believed *N. natalense* to relate to a different taxon, it is difficult to understand how its existence can have been overlooked. Harvey in Hooker (126) and Bornet in Askenasy (16) had long before indicated the existence of the name *N. natalense* Hering, the former placing it together with *Mesogloea natalensis* Kütz. in the synonymy of the form he named *Chordaria sordida* Bory. Bornet in Askenasy treated *Nemalion natalense* Hering as the basionym of *Cladosiphon natalensis* (Hering) Born. in Askenasy. It would appear, then, that the combination of the name [*Nemalion*] *natalense* Hering in the genus *Levringia*, where all evidence indicates it correctly belongs, has never been made, since none of the subsequent treatments (Feldmann, 92; Feldmann in Dangeard, 54; Joly, 163) made reference to works earlier than Kützing (*Mesogloea natalensis*, 1847).

Apart from the conflicting opinions on valid species within *Levringia* already indicated above, Kylin (176) seems, by default, to have accepted Levring's (193) suggestion of conspecificity of *L.* (*Mesogloea*) *brasiliensis* and *L.* (*Myriogloia*) *sordida*, at the same time accepting the distinctness of *L.* (*Myriogloia*) *atlantica* and *L.* (*Cladosiphon*) *natalense(-is)*. Kylin mentioned Levring's (193) paper but omitted the species *L. brasiliensis*. Joly (163) finally made the combination of Montagne's *Mesogloea brasiliensis* in *Levringia*, indicating that he believed there to be two species groups, one based on long sporangia [*L. sordida*, *L. atlantica*, *L. brasiliensis* (also broad, to 25·6 μm in diameter), and *L. Decaryii*, all except the last from the south Atlantic] and the other based on relatively short, somewhat broad, sporangia [*L. natalensis*, *L. filiformis*, *L. Borgesenii*]. Rationalized attribution of the records falling within our area therefore requires prior monographing of the genus on a broad geographical basis, aside from the establishment of accepted limits for *Levringia* and adjacent genera. Until that time the records are retained under the specific attribution of the publishing authors, unless there has been clear misinterpretation.

Levringia atlantica (J. Feldm.) Kylin
Mauritanie (108; 189).
Rio de Oro (54; 92; 93; 109; 176).
Sénégal (54; 93; 154; 163; 291).
Spanish Sahara (189).
'. . . von Rio de Oro an der atlantischen Küste Afrikas.' (176).
[As *Myriogloea atlantica* J. Feldm.]
Rio de Oro (91).
[As *Myriogloia atlantica* J. Feldm.]
'. . . Nordwestafrika, Rio de Oro . . .' (193).

Levringia brasiliensis (Mont.) Joly
Ghana (154).
Sénégal (108; 154).
[As *Levringia brasiliensis* (Mont.) J. Feldm.]
Sénégal (289).
'Atl[antique] trop[ical]' (289).

Note. See the entry for *Levringia sordida* (Bory) Kylin.

Levringia natalensis (Kütz.) Kylin
Cape Verde Islands (54; ? 92).
[As *Cladosiphon natalensis* (Hering) Born. in Asken.]
Cape Verde Islands (16).
'. . . communes aux îles du Cap Vert et à l'Afrique méridionale . . .' (16).
[As *Mesogloia brasiliensis* Mont.]
Cape Verde Islands (68).

Note. Dickie's record (68) is almost certainly secondarily based on that in Montagne (210), but makes no mention of the variety *natalensis*. See the overall note below.
[As *Mesogloea brasiliensis* Mont. var. *natalensis* Mont.]
Cape Verde Islands (210).

Note. It would appear that, pending rationalization within the genus, the Cape Verde Islands plants should be referred to *Levringia natalensis* (Kütz.) Kylin, provided that the determinations were correct. We regard records of this species from the Cape Verde Islands with some reservations, in view of their creation of a disjunct distribution; the matter can only be resolved by examining the collections made by Cardoso and Bolle. Essentially the same taxonomic conclusion had been reached by Feldmann (92 : 428); the question-mark shown above reflects his doubt as to whether the Cape Verde Islands material should be reported as *Levringia atlantica* (q.v.) or not.

Levringia sordida (Bory) Kylin
Ascension (54; 163; 176).
[As *Chordaria sordida* Bory]
Ascension (9; 39; 129).
Senegambia (126).
'. . . Native of . . . west coast of Africa . . .' (126).
[As *Myriogloia sordida* (Bory) Levr.]
Ascension (193).

Note. The status of this species is being investigated by two of us (J. H. P.; D. M. J.) in the light of collections recently made on Ascension Island. There is considerable overlap in dimensions of the plurilocular sporangia between *L. sordida* and *L. brasiliensis* (q.v.); these taxa may, as suggested earlier, be conspecific, although there are form and locular differences in the respective sporangia.

Levringia spp.
Sénégal (54; 163; 213).

Note. Dangeard (54 : 234–235) quotes the opinion of J. Feldmann that two species of *Levringia*, *L. atlantica* and a probably new species, exist in the Dakar region. The relationship between the *Levringia* sp. in the Feldmann description quoted by Dangeard, and the other species of *Levringia* described for Sénégal and elsewhere in the area, is not clear. Feldmann (in Dangeard, 54 : 237) made some observations on that matter. Joly (163 : 41) believed Feldmann to have suggested correctly that the species was possibly identical with Montagne's *Mesogloea brasiliensis* var. *natalensis* [= *Levringia natalensis*], earlier recorded from Sénégal.

Lobophora variegata (Lamour.) Womersley
Angola (191).
Ascension (243B).
Cameroun (148).
Canaries (190).
Ghana (148; 159).
Liberia (61; 147; 148).
Mauritanie (189).
Príncipe (148).
Sierra Leone (154).
Spanish Sahara (189).

[As *Lobophora*]
Ascension (243A).
[As *Aglaozonia canariensis* Sauv.]
Canaries (30; 31; 32; 34; 59; 92; 140; 259; 266; 282).
[As *Gymnosorus variegatus* J. Ag.]
Canaries (16; 308).
Cape Verde Islands (16).
'Warm Atlantic' (111).
[As *Gymnosorus variegatus* (Lamour.) J. Ag.]
Canaries (63).
[As *Padina lobata* Grev.]
Canaries (21p.p.; 208 p.p.).
Gabon (143; 144).

Note. Børgesen (32) pointed out that Montagne was not clear on the distinction between *Lobophora variegata* and *Stypopodium zonale*, so that material mentioned by him (Montagne, 208) as *Padina lobata* from the Canary Islands included both these species.

[As *Pocockiella variegata* (Lamour.) Papenf.]
Cameroun (182).
Canaries (80; 161; 162; 214; 224; 255).
Gabon (153).
Ghana (74; 183; 187; 255; 295).
Mauritanie (289).
Salvage Islands (Ilhas Selvagens) (195).
Sénégal (54; 255; 289).
Sierra Leone (181; 184; 255).
'. . . Atlantic Ocean (African . . . coasts . . .) . . .' (80).
'West coast, Africa' (210).
'In most warmer seas' (195).
[As *Stypopodium fissum* Kütz.]
'Ad oras Guineae superioris. Embouchure de la rivière de Gabon: Lenormand' (173, based on Lenormand, no. 218, *Padina lobata*).
[As *Stypopodium laciniatum* Kütz.]
Canaries (173, based on Montagne, *Padina lobata*).

Note. See the note to *Padina lobata* records in this species entry. For the same reason, the record by Kützing (173) under the present name is also attributed *pro parte* to *Stypopodium zonale* (Lamour.) Papenf.

[As *Zonaria variegata* Lamour.]
Canaries (9; 67; 70).
[As *Zonaria variegata* (Lamour.) C. Ag.]
Canaries (32; 92; 139; 140; 228; 229; 235; 282)
[As *Zonaria variegata* (Lamour.) Mart.]
Canaries (15).
Cape Verde Islands (210).
[As *Zonaria variegata* (Lamour.) Mert.]
Canaries (31).
Cape Verde Islands (92).
'Seems to be common in all warmer seas' (31).
[As *Zonaria variegata* Kütz.]
São Tomé (133).
[As *Zonaria variegata* C. Ag.]
Cape Verde Islands (283).
[As *Zonaria variegata* Mart.]
Canaries (228).

[As *Zonaria variegata* Mert.]
Sénégal (143).
[As *Zonaria variegata*]
Canaries (34; 266; 271).
[As *Zonaria* cf. *variegata* (Lamour.) C. Ag.]
Canaries (258).

Note. Papenfuss (1977: 281) has proposed *Pocockiella* Papenf., 1943, for conservation against the earlier but comparatively little employed *Lobophora* J. Ag. The species variously known as *P. variegata* (Lamour.) Papenf., *L. nigrescens* J. Ag., or *L. variegata* (Lamour.) Womersley, is the type of both genera; its name will revert to *P. variegata* if the proposal is successful.

Macrocystis

The historical distribution and the general taxonomy of this genus have been examined in detail by North (218) and by Womersley (1954). The first description by Linnaeus (196 : 311) refers to material 'swimming' in the Oceanus Aethiopicus: '. . . e profundissimo mari saepe enatans insulaque quasi formans. Koenig MSS 42'. North, who published (p. 7) an old chart of Blaeuw (1591–1638) that indicated Oceanus Aethiopicus, stated (p. 8) that 'According to Womersley (1954), insufficient material was preserved to identify Linnaeus' specimens as a presently recognised species (holdfasts are now necessary for separating the species).' The probable geographical location of the origin of the Linnean specimens has been much debated, but general agreement is lacking. The problem currently cannot be resolved with certainty because of (a) the possibility that the specimens may have been carried by the Antarctic Circumpolar Current, and (b) the imprecision of the name 'Oceanus Aethiopicus'. Womersley (1954 : 113) considered that it was somewhere in the south Atlantic Ocean. The general position of the Oceanus Aethiopicus in relation to Africa seems to lend some support to the contention of Papenfuss (1940b) that the *Macrocystis* beds off South Africa were likely to be the source. Womersley (1954), however, thought it improbable that floating Agulhas Bank material or South African plants were derived from attached South African material, because the required bulk of deeper water beds was not present there. On the basis of current systems, Womersley suggested subantarctic islands as the source. According to North (218 : 9) '. . . indications that drift plants are carried north along the west coast of Africa came from Hooker (l.c.)* who mentions that the Agulhas Current . . . "swarms" with *Macrocystis*, and from C. A. Agardh (1839) [p. 299], who recorded *M. planicaulis* from near the Canary Islands [based on material presented by Desfontaines], presumably drifting.' The Agulhas Current is the main current that passes east to west, and a component then turns north, around the southern tip of South Africa. In the north-going component, water derived from the Agulhas Current meets and for a time moves in parallel with the cold Benguela Current, further out from the coast. The latter, and its warmer inshore derivative, pass out from the Skeleton Coast of South West Africa across the Walvis Ridge and into the Angola Basin, thus penetrating the general area most likely covered by the name Oceanus Aethiopicus.

Macrocystis planicaulis C. Ag.
See *Macrocystis pyrifera* (L.) C. Ag.

Macrocystis pyrifera (L.) C. Ag.
'In mari Aethiopico . . .' (4; 5).
'Habitat in oceano Aethiopico' (218).
[As *Macrocystis communis* Bory]
'Habitat in oceano Aethiopico . . .' (39).
[As *Macrocystis pirifera* [sic!] (Turn.) C. Ag.]
'. . . an eadem ex insulis Fortunatis seu Canariis?' (63).
[As *Macrocystis planicaulis* C. Ag.]
Canaries (7; ? 9; ? 17; 21; ? 32; ? 208; 218).

* Hooker (136 : 465) actually states: '. . . With regard to the South African habitat, it is difficult to account for so vast a quantity as the Agulhas Bank exhibits, for these waters, 130 miles in breadth, flowing with a rapid stream from the N.E. or Indian Ocean, literally swarm with *Macrocystis*, which possibly is taken up from the northern edge of the westerly Polar current (which flows along the parallel of 45°S) by the Indian (or N.E.) current in question.'

[As *Fucus pyriferus* L.]
'Habitat in oceano Aethiopico . . .' (196).

Note. According to most authors (identified by a question mark above), plants from the Canary Islands were surely cast up drift specimens. It is believed that the early material referred to here and in the generic comments above was all representative of this species, although it must be a rare occurrence for plants to reach the Canary Islands. De Toni's (63) doubtful attribution to *Macrocystis pyrifera* is based on his acceptance of the conspecificity of *M. pyrifera* and *M. planicaulis*. Børgesen (32), who continued to use the epithet *planicaulis*, also accepted that conspecificity.

Marginaria boryana
See *Sargassum vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag.

Mesogloea brasiliensis Mont. var. **natalensis** Mont.
See *Levringia natalensis* (Kütz.) Kylin.

Mesogloia brasiliensis Mont.
See *Levringia natalensis* (Kütz.) Kylin and the notes to *L. sordida* (Bory) Kylin.

Mesospora sp.
See *Basispora africana* John & Lawson.

Myriogloea atlantica J. Feldm.
See *Levringia atlantica* (J. Feldm.) Kylin.

Myriogloia atlantica J. Feldm.
See *Levringia atlantica* (J. Feldm.) Kylin.

Myriogloia sp. ['*Myriogloea*']
South West Africa (287).

Myrionema

Species of this genus are epiphytes on larger algae and on marine monocotyledonous plants. They tend to be small plants, relatively easily overlooked and therefore seldom reported. They may well be common, at least in some parts of the area concerned here. For general biological details and differences between the species of the genus, see Loiseaux (1967a; 1967b; 1968a; 1968b); for a summary of many of these data and their significance in the life-history, see Wynne & Loiseaux (1976). The latter authors suggest that elucidation of Myrionemataceae life-histories, enigmatic in their possession of heteroblasty of zoid germination, may provide '. . . the key to a more enlightened concept of the evolution of life history in the brown algae . . .'.

Myrionema magnusii (Sauv.) Lois.
[As *Ascocyclus magnusii* Sauv.]
Canaries (92).
[As *Ascocyclus orbicularis* (J. Ag.) Magnus]
Canaries (32; 195; 205).
'West coast, Africa' (205).

Note. Of the taxonomic and nomenclatural problems in this genus, the confusion between *Myrionema magnusii*, from the North Sea, and *Ascocyclus orbiculare* (J. Ag.) De Toni, from the Mediterranean, has been one of the most troublesome. The general background up to 1964 was reported by Dixon & Russell and is not repeated here. Since then, Loiseaux (1967a; 1967b; 1968a; 1968b) has examined in considerable detail the general biology and interrelationships in many of the allied forms; she concluded that there were insufficient grounds for retaining the separate genus *Ascocyclus* and returned *A. orbiculare* to *Myrionema* as *M. orbiculare* J. Ag. She also established that there was good reason to retain as distinct species the forms known as *Myrionema magnusii* and *M. orbiculare*, since the former retains in culture its much smaller overall dimensions, whatever the age of the culture or conditions to which it is subjected. There is, nevertheless, considerable biological similarity between these two species, in that both rarely produce unilocular sporangia and even those produced seem, in nature or culture, not to lead to the gametangial cycle. This is the extreme case of the general Myrionemataceae phenomenon, in which the 'sexual cycle' seems much less important to the survival of the species.

From dimensions deduced from Borgesen's figure (32 : fig. 63), from his comments, and from the fact that Feldmann (88) had prior to 1946 provided a detailed description of *Myrionema orbiculare* (as *A. orbicularis*), outlining the differences he accepted between it and *M. magnusii*, it seems that each had an accurate idea of the concept he was applying. Misra (205), in reporting *Ascocyclus orbicularis* from 'Canary Island', was apparently unaware of any problem of distinction between species, since the distribution he cited for this taxon included N.E. America; Bermuda; Europe; U.K.; and the Mediterranean. We have attributed all these few area records to *Myrionema magnusii* with fair certainty of being correct; it should, however, be appreciated that we have not re-examined original material determined by Børgesen, Feldmann or Levring.

Myrionema strangulans Grev.
[As *Myrionema strangularis* (sic!) Grev.]
Canaries (92).
[As *Myrionema vulgare* Thur.]
Canaries (32).

Note. These records are attributed here on the basis of modern beliefs (Kylin, 1947; Ardré, 13; Rodrigues, 256) in the conspecificity of at least elements of the species *Myrionema vulgare* Thur. in Le Jol. with *M. strangulans*. The probable correctness of this as regards the present area is heightened by the restriction of known records to the Canaries, although we have not critically checked the appropriate material. Feldmann (92) seems to have reached a similar conclusion, in that his record is almost certainly secondarily based on the previous report.

Myrionema vulgare Thur.
See *Myrionema strangulans* Grev.

Myriotrichia canariensis Kütz.
Canaries (63; 172).

Note. The recognition of species in the genus *Myriotrichia* requires reassessment. According to Hauck (1885 : 337) 'Steht *M. canariensis* Kütz . . . sehr nahe [to *M. adriatica* Hauck] . . .'.

Nemacystus erythraeus (J. Ag.) Sauv.
Canaries (32; 120; 271).

Nemacystus hispanicus (Sauv.) Kylin
Canaries (92; 195).

Note. According to Levring (195 : 37), the known distribution of this species is N. Spain, Madeira and the Canaries.

Nemoderma tingitana Schousb. in Born.
Canaries (32; 34; 190; 268; 271; 282).
[As *Nemoderma tingitanum* Schousb.]
Canaries (88; 92).
[As *Nemoderma tingitanum*]
Canaries (46).
[As *Nemoderma* sp.]
Canaries (100).

Nereia filiformis (J. Ag.) Zanard.
Canaries (32; 63; 80; 88; 90; 92; 166; 228).
'. . . Atlantic Ocean (. . . African coasts, . . .) . . .' (80).
'. . . in oceano Atlantico ad oras Africae septentrionalis . . .' (63).
[As *Desmarestia filiformis* nov. sp.]
'. . . in mari Atlantico ut Senegambiae . . .' (8).

Note. Feldmann (90 : 291 *et seq.*) records *Nereia filiformis* as amongst the Mediterranean–Lusitanian–African distribution element, naming the Canaries and such west African countries as Mauritanie as within the distribution pattern for the element, but not specifically for this species.

Nereia sp.
'. . . west coast Africa' (100).
Note. Very probably this is a reference to *Nereia filiformis*, the only species of *Nereia* so far reported from the Canary Islands and west Africa.

Padina atomaria Mont.
See *Taonia atomaria* (Woodw.) J. Ag.

Padina australis Hauck
Angola (191).
Cameroun (148).
? Côte d'Ivoire (148).
Gabon (148; 153).
'West and South-east coasts of Africa; . . .' (205).
Note. Doubts indicated in John (148) relate to the small and fragmented state of the few available specimens from Côte d'Ivoire.
[As *Padina gymnospora* (Kütz.) Vickers]
Cameroun (241).
Pagalu (242).
? Sénégal (54).
Note. Doubt expressed by Dangeard (54) regarding the Sénégal material arose because of the rather equivocal characteristics manifest by some of the specimens.

Padina boryana Thivy in W. R. Taylor
[As *Padina tenuis* Bory]
'. . . Tropical . . . eastern Atlantic Ocean . . .' (314).
[As *Padina commersonii* Bory]
São Tomé (294).
'. . . West and south-east coasts of Africa' (205).
Note. Papenfuss (1977: 275–277) has shown that both *Padina tenuis* (C. Ag.) Bory and *P. commersonii* Bory are synonyms of *Lobophora variegata* (Lamour.) Womersley, and therefore that the plants to which both epithets were applied require a new name. Thivy has provided the necessary new combination.

Padina commersonii Bory
See *Padina boryana* Thivy in W. R. Taylor.

Padina dubia Hauck
? Sénégal (54)
Note. Suggested, with some doubt, by Dangeard (54) on the basis of rather equivocal material.

Padina durvillei Bory ['*durvillaei*']
[As *Padina durvillaei* Bory].
Ghana (74).
[As *Padina durvilliae* Bory]
? Liberia (61).
Sierra Leone (154).
? Togo (151).
Note. Some of the plants found in population samples from the region are rather unusual in having the margins of the fronds less than four cells in thickness or in being almost prostrate, although in all other respects they possess features characteristic of the species. For this reason, De May *et al.* (61) and John & Lawson (151) have respectively expressed doubts as to the validity of their Liberia and Togo records. See comments under *Padina vickersiae* in Steentoft (294 : 119) for possible additional records from Príncipe and São Tomé.

Padina glabra Gaillard
Sénégal (101).

Padina gymnospora (Kütz.) Vickers
See *Padina australis* Hauck.

Padina lobata Grev.
See *Lobophora variegata* (Lamour.) Womersley and *Stypopodium zonale* (Lamour.) Papenf.

Padina mexicana Dawson
Ghana (74).
Note. For possible additional records of *Padina mexicana* from Príncipe and São Tomé, see comments in Steentoft (294 : 119) under *P. vickersiae* Hoyt.

Padina pavonica (L.) Lamour. ['*pavonia*']
Angola (18).
Canaries (28; 39; 63; 124; 160; 161; 162; 203; 204; 208; 214; 259; 282).
Cape Verde Islands (18; 124; 248).
Mauritanie (63; 124; 189; 282).
Sénégal (45; 124).
Senegambia (155).
'. . . in Atlantico hinc oras Angliae, illinc Senegambiam et Canarias attingens . . .' (9; 63).
'. . . an der ganzen Westküste Afrikas und den Atlantischen Inseln . . .' (116).
'. . . West coast, Africa' (205).
[As *Padina pavonia* L.]
Canaries (2).
Cape Verde Islands (68).
St Helena (65; 202).
'Tropical Atlantic and Indian Oceans' (66).
[As *Padina pavonia* Gaillon]
Angola (19).
Ascension (15).
Canaries (21; 104; 228; 308).
Cape Verde Islands (16; 19).
Congo (121 ; 122).
Gabon (122).
St Helena (129).
Salvage Islands (103; 104).
'De la Grande-Bretagne aux Canaries . . .' (37).
'. . . Atlantic Ocean (African . . . coasts . . .) . . .' (80).
[As *Padina pavonia* (L.) Gaillon]
Canaries (32; 92; 195; 200; 228; 258).
Cape Verde Islands (210).
Salvage Islands (Ilhas Selvagens) (195).
'Atlantique, du sud de la Grande-Bretagne aux Canaries' (88).
'Atlantique nord, du sud de la Grande-Bretagne jusqu'en Mauritanie . . .' (109).
'Atlantique nord (de l'Angleterre à la Mauritanie . . .)' (13).
'. . . Atlántico desde Inglaterra a Canarias' (286).
'Along the Atlantic coast from Great Britain to the Canary Islands . . .' (32).
[As *Padina pavonia* Grev.]
Canaries (201).
[As *Padina pavonia* (C. Ag.) Grev.]
Cape Verde Islands (288).
[As *Padina pavonica* (L.) Thivy]
Canaries (190).
'Atlântico: das costas meridionais da Inglaterra às Canárias . . .' (256).

'West coast, Africa' (205).
[As *Padina pavonia*]
São Tomé (123).
[As *Ulva pavonia* L.]
Canaries (38; 309).
[As *Zonaria pavonia* C. Ag.]
'In mari atlantico ad oras Galliae, Angliae, Hispaniae et zonae tropicae' (171).

Note. It has proved necessary to discount many of the reports of this plant from the region; see, for example, *Padina vickersiae* Hoyt in Howe in Britton & Millspaugh. Bodard & Mollion (63 : 198) stated firmly: '. . . On ne retrouve pas au Sénégal *Padina Pavonia* encore présente aux Canaries et en Mauritanie, elle est remplacée par *P. vickersiae* (atlantique tropical) et *P. tetrastromatica* (espèce indienne et de la Mer Rouge).' If this is correct, there will need to be made wholesale transfer of large numbers of records to *Padina vickersiae* from the above. Retention of the specific epithet in the form '*pavonica*' rather than '*pavonia*' is based on reasoning presented in Price, Tittley & Richardson (1979), as is the citation of authorities accepted.

Padina tenuis Bory
See *Padina boryana* Thivy in W. R. Taylor.

Padina tetrastromatica Hauck
Angola (191).
Côte d'Ivoire (147; 148).
Gambia (155; 156).
Ghana (74; 102; 148; 159; 183; 185; 187; 295).
Liberia (61).
Mauritanie (189).
Sénégal (54; 102).
Sierra Leone (154).
Togo (148; 151).

Padina tournefortii Lamour.
See *Zonaria tournefortii* (Lamour.) Mont.

Padina variegata (Kütz.) Vickers
See *Padinae vickersiae* Hoyt in Howe in Britton & Millspaugh.

Padina vickersiae Hoyt in Howe in Britton & Millspaugh.
Angola (191).
Ascension (243B).
Cameroun (148; 255; 294).
Canaries (32; 34; 92; 282; 294).
Côte d'Ivoire (147; 148).
Gabon (153).
Gambia (155).
Liberia (61; 147; 148).
Mauritanie (189).
Príncipe (148; 255; 294).
São Tomé (148; 255; 294).
Sénégal (206; ? 294).
Sierra Leone (154).
[As *Padina pavonia* (L.) Lamour.]
São Tomé (133).
[As *Padina variegata* (Kütz.) Vickers]
São Tomé (123).
[As *Pocockiella variegata* (Lamour.) Papenf.]
São Tomé (255).

Note. Steentoft (294), after examining the São Tomé material determined by Rodrigues (255), believed that the plants he cited were all misidentified.
[As *Zonaria pavonia* C. Ag.]
São Tomé (131; 132).
[As *Zonaria variegata* Kütz.]
São Tomé (133).

Note. It is possible that many of the records currently reported under *Padina pavonica* (L.) Lamour. are actually based on material of *P. vickersiae*; see the note to *P. pavonica* for explanation.

Padina spp.
Angola (158).
Ascension (243A).
Cameroun (182; 251; 282; 295).
Gabon (153).
Ghana (157; 295).
Guinée (187; 199; 289).
Liberia (61; 147).
Mauritanie (187; 189; 289).
São Tomé (42).
Sénégal (25; 26; 54; 206; 213; 289).
Sierra Leone (154; 184; 194).
'. . . African west coast . . .' (194).
'West Africa . . .' (187; 188; 247).

Note. Carpine (42 : 77) stated that the São Tomé plant was '. . . vraisemblablement *P. gymnospora* (Kütz.) Vickers . . .'.

Papenfussiella gracilis Kylin
[As *Papenfussiella gracilis*]
South West Africa (287).

Petalonia

According to Wynne (1969 : 17–18) the nomenclatural type of this genus is *Petalonia debilis* (C. Ag.) Derb. & Sol., but since *Fucus fascia* O. F. Müll. is the oldest applicable epithet then the correct name of that species is *Petalonia fascia* (O. F. Müll.) O. Kuntze. He points out that three species are generally recognized [*P. fascia*, *P. filiformis* (Batt.) O. Kuntze, *P. zosterifolia* (Reinke) O. Kuntze], although some workers have preferred to accept only one species, *P. fascia*, and to attribute to it a number of formae.

Petalonia debilis (C. Ag.) Derb. & Sol.
See *Petalonia fascia* (O. F. Müll.) O. Kuntze.

Petalonia fascia (O. F. Müll.) O. Kuntze
Sénégal (289).
[As *Petalonia debilis*]
South West Africa (287).

Note. There are previous records of the genus *Petalonia* from South Africa, so that the attribution of this report is only problematical as concerns the use of the specific epithet. See the generic note.

There is much recent evidence to suggest that at least some forms currently placed in the Ralfsiaceae (or Ralfsiales) are the sporophytic stages of certain of the Scytosiphonales (e.g. *Petalonia*) and Dictyosiphonales. *Ralfsia expansa* is reported from Sénégal, as well as from many other countries in west Africa, although *Petalonia fascia* is so far only known in the region from Sénégal and South West Africa. Since some forms of *Ralfsia* lack the kind of stage relationship outlined above, showing entirely ralfsioid life-histories, it is probable that the records reported under the names *R. expansa* (q.v.) and *Ralfsia* sp. (q.v.) are based on material that is not biologically homogeneous. For recent interesting comments on morphological expression and interrelationships in brown algal crusts, see Ravanko (1975). The complexities of life-histories in the orders often currently known as Scytosiphonales and Ralfsiales have been summarized recently by Wynne & Loiseaux (1976).

Phycocelis floridana W. R. Taylor
See *Hecatonema* sp.

Phycopteris interrupta Kütz.
See *Zonaria subarticulata* (Lamour.) Papenf.

Phyllacantha moniliformis Kütz.
See *Cystoseira abies-marina* (Gmel.) J. Ag.

Phyllaria purpurascens (C. Ag.) Rostafinski ex Born.
Canaries (112; 260).
Note. Although Giaccone's (112) record is stated to be based on Feldmann (86), the latter (p. 170) actually stated '. . . Elle [*P. purpurascens*] paraît faire défaut aux Canaries où elle n'est pas signalée . . .'.

Phyllaria reniformis (Lamour.) Rostafinski ex Born.
Spanish Sahara (189).
'. . . jusqu'au Rio-de-Oro . . .' (93).
Note. Norton (*pers. comm.*) proposes to recombine species of this genus in *Saccorhiza*; apparently no adequate generic diagnosis of *Phyllaria* has ever been published and it is not possible to distinguish morphologically between the two genera on any currently known basis. Feldmann (86) stated positively '... Il n'a pas été observé aux Canaries . . .' for *Phyllaria reniformis*.

Pilayella
For comments on generic distinctions in Ectocarpales, see the remarks under *Ectocarpus*.

Pilayella littoralis (L.) Kjellm. ['*Pylaiella*']
Angola (158; 191).
Mauritanie (189).
'. . . Atlantique nord jusqu'en Mauritanie . . .' (109).
'[West African coast] . . . north of the Gulf of Guinea' (191).

Pocockiella variegata (Lamour.) Papenf.
See *Lobophora variegata* (Lamour.) Womersley and *Padina vickersiae* Hoyt in Howe in Britton & Millspaugh.

Pycnophycus tuberculatus (Huds.) Kütz.
See *Bifurcaria bifurcata* R. Ross.

Pylaiella fulvescens *auct.*
See *Bachelotia antillarum* (Grun.) Gerl.

Ralfsia bornetii Kuck.
Salvage Islands (Ilhas Selvagens) (195).
'Probably cosmopolitan' (195).

Ralfsia expansa (J. Ag.) J. Ag.
Angola (191).
Benin (148; 151).
Cameroun (148).
Côte d'Ivoire (147; 148).
Gabon (153).
Gambia (155).
Ghana (148; 157; 295).
Liberia (61; 147; 148).
Mauritanie (189).
Sierra Leone (154).

Togo (148; 151).
'. . . a number of countries [West Africa] including some of those bordering the Gulf of Guinea' (152).
[As *Ralfsia expansa* J. Ag.]
Cape Verde Islands (16; 71; 92).
Guinée (289).
Mauritanie (289).
Sénégal (54; 57; 213; 289; 290).
South West Africa (287).
Pantropical (289).
[As *Ralfsia expansa*]
Angola (158).
Cameroun (187).
Ghana (183; 187; 295).
Guinée (187).
Sénégal (54; 187).
South West Africa (287).

Note. The material on which records under this name are based is in all probability not representative of a single biological entity. See the remarks to *Petalonia fascia* (O. F. Müll.) O. Kuntze and *Scytosiphon lomentaria* (Lyngb.) Link.

Ralfsia verrucosa (Aresch.) J. Ag.
Canaries (46; 152; 195).
'. . . Atlantique, de la Norvège aux Canaries . . .' (88).
'. . . Atlantico de Norvega a Canarias . . .' (286).
'. . . Atlântico: da Noruega às Canárias . . .' (256).
'. . . probably almost cosmopolitan . . .' (195).
'West coast, Africa' (205).
[As *Ralfsia verrucosa* Aresch.]
Canaries (32; 84; 92).

Ralfsia spp.
Cameroun (182; 295).
Guinée (289).
Sénégal (289; 291).

Note. See the remarks under *Petalonia fascia* (O. F. Müll.) O. Kuntze.

Rosenvingea floridana (W. R. Taylor) W. R. Taylor
Angola (unpublished).

Note. This record is given with some reservations, as it is based on a single specimen.

Rosenvingea intricata (J. Ag.) Børg.
Cameroun (157).
Ghana (157; 159).
'. . . Atlantic Ocean (African coast . . .) . . .' (80).
[As *Asperococcus intricatus* (Kütz.) J. Ag.]
Cameroun (241).

Note. Earle (1969) suggested that the diverse forms assigned to this species are related to ecological conditions.

Saccorhiza bulbosa *auct.*
See *Saccorhiza polyschides* (Lightf.) Batt.

Saccorhiza polyschides (Lightf.) Batt.
Ghana (219; 220).
Mauritanie (189; 204).
Rio de Oro (203; 219).
Spanish Sahara (189; 204; 219A).

Spanish West Africa (29).
'. . . Atlantique, jusqu'au Rio de Oro' (109).
'Atlantique (de la Norvège au Rio de Oro; golfe de Guinée) . . .' (13).
'Si extiende de Norvega a Marruecos, parece no existir en Canarias aunque ha sido citada más al sur de golfo de Guinea' (286).
'. . . on the west coast of Africa' (219; 220).
[As *Saccorhiza bulbosa* Pyl.]
Ghana (276).
'. . . depuis les côtes de Norvège jusque dans le golfe de Guinée . . .' (275).
'Océan Atlantique . . . de la Norvège au golfe de Guinée . . .' (37; 96).
'. . . jusqu'au Rio-de-Oro . . .' (93).
[As *Saccorhiza bulbosa* (Huds.) Pyl.]
'. . . vive desde Noruega hasta el Golfo de Guinea . . .' (306).
'. . . vive en el Golfo de Guinea' (307).
'. . . in oceano Atlantico ab oris Norvegiae . . . usque ad littora Guineae' (63).
'. . . In oceano Atlantico ab oris Norvegiae et insulis Foeroensum usque ad littora Guineae' (9).
'. . . Golfe de Guinée . . .' (86).
[As *Saccorhiza bulbosa*]
Spanish West Africa (245).
[As *Fucus bulbosus* L.]
Ghana (176A).
[As *Haligenia Belvisii* (C. Ag.) Endl.]
'Ad litora regni Oware [Ghana]' (171).
[As *Laminaria belvisii* C. Ag.]
Ghana (220).
'. . . Ad litora regni Oware [Ghana] . . .' (4; 5).
[As *Ulva bulbosa* Beauv.]
Ghana (20; 220).
[As *Ulva tuberosa* Beauv.]
Ghana (20).

Note. This plant was first reported [textually] as *Ulva bulbosa* from the Gulf of Guinea by Beauvois (20 : 20–21), growing on rocks 'à Shama, sur la côte de Guinée [now Ghana]'; his illustration is somewhat misleadingly labelled *Ulva tuberosa*. Norton & Burrows (220) comment (p. 47) as follows on the occurrence of this species in the region: 'The southernmost limit of the species would appear to be on the west coast of Africa. The species is recorded from Morocco . . . and from Shama, Ghana . . . There is no record other than that of Beauvois (1805) . . . substantiated by a specimen of *S. polyschides* (in the Hornemann herbarium at Copenhagen) which was sent by Beauvois from the coast of Guinea . . .'. The essentials of this comment are repeated in Norton (219). Despite the presence of this authenticated plant, the occurrence of the species in the Gulf of Guinea must be considered currently doubtful. *Saccorhiza polyschides* has not been found in recent searches (Sourie in Fischer-Piette, 96 : 69; present authors) of the Ghanaian locality cited or of adjacent rocky shores, and it is normally considered a plant of cold and warm temperate regions. It is most unlikely that there have been biological, floristic or physiographic changes, within less than two hundred years, adequate to explain such a permanent change in distribution range as is implied by acceptance of the early record. Ephemeral occurrences within the few cooler water areas further south than former Spanish Sahara cannot be ruled out, and the Shama record may be one. Ardré (13 : 283) has commented on the absence of the species from the Canaries, from Cap Vert peninsula, and from elsewhere in Sénégal, but believed that the Shama record (Beauvois) of 1786 could be accepted in view of the known discontinuities and variations in abundance of the alga, even much further north and fully within the more normally accepted range.

Sargassum

The statement by Setchell (1931 : 241) that 'The identification of Sargassums is a task of no small magnitude, nor is it one to be undertaken without due concern for the probable uncertainty of its outcome' applies equally well to the present area and time. Therefore, the genus cannot here be treated in anything like a satisfactory manner; a world or widespread revision of the genus *Sargassum* is urgently required. Many of the characters accepted by earlier workers as sufficiently stable to be used taxonomically are now known to undergo marked variation as a response to local environmental conditions. For example, the form of the foliar appendages, now generally recognized to be highly variable, remains of considerable importance as a character on the basis of which generic subdivision is achieved. Taylor (299) gave a useful summary of the present state of understanding of *Sargassum* in the warmer waters of the Americas. He indicated that accurate determination, so far as it is possible, requires a knowledge of the variation shown in different habitats, age and reproductive status. For the area of Africa that we here cover, it is extremely difficult to recognize or accept as valid many of the formae or other subsidiary taxa described there, or described elsewhere and subsequently recorded for western Africa. The work of Grunow (118; 119) presents some of the worst complications and it has rightly been said (Taylor, 299 : 283) that checking his reference materials is impracticable. We have thus done little more than marshal his immense numbers of subsidiary taxa into the species to which, in the light of later knowledge and our own restricted examination of the representative material available, the reports seem probably to have related. We may, in so doing, have glossed over Grunow's or other authors' data that do represent something new for the area in this genus. Like Taylor, we can find little in either the descriptions of the taxa or the nature of material examined to suggest that this is probable.

Srinivasan (292) has reviewed existing data on the *Sargassum* flora of Indian waters. He has found that the closer affinity of that flora is to the *Sargassum* flora of Australasia, rather than to that of the Atlantic Ocean. Apparently, about 57% of Indian taxa are also known from Australasia, whilst only about 4% occur in both Indian waters and the Atlantic. Although increase in knowledge may modify this picture, the order of difference is too great to conclude that the pattern he presents is completely false.

Sargassum acinarium (L.) C. Ag.
Mauritanie (189).
Senegambia (155).
[As *Sargassum acinaria* (Turn.) C. Ag.]
Canaries (39).
[As *Sargassum linifolium* C. Ag.]
Canaries (211).
Senegambia (128).
[As *Sargassum linifolium* J. Ag.]
Canaries (17).
Cape Verde Islands (? 16; 229).

Note. Askenasy (16 : 164) cites this species from the Cape Verde Islands with reservations, stating that the Cardoso specimens seen by Piccone (229) were 'trop incomplets pour permettre une détermination exacte'. Barton (17) indicated that the species was rare.

[As *Sargassum linifolium* Turn.]
Canaries (67).
[As *Sargassum linifolium* (Turn.) C. Ag.]
Canaries (124).
Cape Verde Islands (124).
Mauritanie (124).
[As *Sargassum linifolium* (Turn.) J. Ag.]
'. . . rarius usque ad Canarias rejecta . . .' (9).

Sargassum affine J. Ag.
See *Sargassum filipendula* C. Ag.

Sargassum albertisii Picc.
Salvage Islands (63; 228).

Note. De Toni (63 : 18) commented that '. . . Forsan sistit varietatim *Sargassi Desfontainesii*'. Grunow (119 : 137), without acknowledgement, actually described a variety ? *albertisii* of *Sargassum desfontainesii*, which appears to be based on material from the same collection by D'Albertis from the Salvage Islands, but he also cites the Canaries. We have been unable to resolve the doubt as to the status of the taxon, and the records are therefore maintained as originally named by the authors. See also *S. desfontainesii* var. ? *albertisii*.

Sargassum bacciferum *auct*.
See *Sargassum natans* (L.) Gaillon.

Sargassum boryanum Mont.
See *Sargassum vulgare* C. Ag. and *S. vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag.

Sargassum cheirifolium Kütz.
See *Sargassum vulgare* C. Ag.

Sargassum cheirifolium Kütz. var. **cordatum** Kunth
See *Sargassum vulgare* C. Ag.

Sargassum comosum Mont.
See *Sargassum desfontainesii* (Turn.) C. Ag.

Sargassum cymosum C. Ag.
Gabon (63; 122; 153).
Sierra Leone (154).
'. . . in Oceano Atlantico calidiore, ad oras Brasiliae et Africae mediae' (63).
'. . . in mari atlantico calidiore, ad oras Brasiliae et Africae mediae' (9).
'. . . régions chaudes de l'Atlantique, du Brésil et sur la côte d'Afrique' (122).
[As *Sargassum cymosum* C. Ag. var. *dichotomum* Mont.]
'Warm Atlantic (Brazil and Africa)' (211).
[As *Sargassum cymosum* J. Ag.]
Cape Verde Islands (16).
'Atlantique tropicale en Amérique et Afrique' (16).

Note. *Sargassum cymosum* has been reported from the Hawaiian Islands, but the name appears to have been applied to what is now recognized in Hawaii as *S. obtusifolium* J. Ag. From the available descriptions, *S. cymosum* and *S. obtusifolium* are possibly Atlantic and Pacific forms of the same species, but until types and field collections can be compared no decision can be made as to their relationship (de Wreede & Jones, 1973). See remarks under *S. vulgare* regarding numbers of taxa, described (?) on material from Gabon, which were formerly placed by De Toni (63) in the synonymy of *S. cymosum*.

Sargassum cymosum C. Ag. forma β. **latifolium** C. Ag.
See *Sargassum vulgare* C. Ag.

Sargassum cymosum J. Ag. var. **esperi** (Sieber) Grun. formae **cheirifolia** (Kütz.) Grun., **cordifolia** (Kütz.) Grun., and **hapalophylla** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum cymosum J. Ag. var. **lendigerum** (Turn.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum cymosum J. Ag. var. **lendigerum** (Turn.) Grun. formae **dichocarpa** (Kütz.) Grun. and **fissifolia** (? Kütz.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum cymosum J. Ag. var. **microphylla** (Webb & Desp.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum cymosum J. Ag. var. **stenophylla** (Mart.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum desfontainesii (Turn.) C. Ag.
Canaries (2; 9; 32; 34; 63; 92; 104; 143; 195; 201; 228; 252; 258; 282; 299).
Salvage Islands (103; 104; 143; 195; 228).
'In oceano insularum fortunatarum [= Canaries region]' (4).
'In mari Atlantico ad insulas Canarias . . .' (5).
[As *Sargassum desfontainesii* C. Ag.]
Canaries (228; 308).
[As *Sargassum desfontainesii* (Turn.) J. Ag. var. ? *albertisii* Grun.]
Canaries (119).
Salvage Islands (119).
Note. See the remarks under *Sargassum albertisii* Picc. The doubt expressed by Grunow (119) concerns the position and status of the taxon.
[As *Sargassum desfontainesii* (Turn.) J. Ag. var. *genuina* Grun.]
Canaries (119).
[As *Sargassum desfontainesii* (Turn.) J. Ag. var. *genuina* Grun. formae *chaetophylla* (Mert.) Grun., *intricata* (Webb & Desp.) Grun. and *linearis* Grun.]
Canaries (119).
[As *Sargassum desfontainesii* (Turn.) J. Ag. var. *hispida* Grun.]
Canaries (119).
[As *Sargassum comosum* Mont.]
Canaries (21; 32; 171; 175; 208; 209).
[As *Fucus comosus* Lamarck & Poiret]
Canaries (176A).
[As *Fucus desfontainesii* Turn.]
Canaries (304).
Note. See entry for *Sargassum albertisii* Picc.

Sargassum desfontainesii (Turn.) J. Ag. var. ? **albertisii** Grun.
See *Sargassum desfontainesii* (Turn.) J. Ag.

Sargassum desfontainesii (Turn.) J. Ag. var. **genuina** Grun.
See *Sargassum desfontainesii* (Turn.) J. Ag.

Sargassum desfontainesii (Turn.) J. Ag. var. **genuina** Grun. formae **chaetophylla** (Mert.) Grun., **intricata** (Webb & Desp.) Grun. and **linearis** Grun.
See *Sargassum desfontainesii* (Turn.) J. Ag.

Sargassum desfontainesii (Turn.) J. Ag. var. **hispida** Grun.
See *Sargassum desfontainesii* (Turn.) J. Ag.

Sargassum dichocarpum Kütz.
See *Sargassum vulgare* C. Ag.

Sargassum diversifolium *auct.*
See *Sargassum vulgare* C. Ag.

Sargassum filipendula C. Ag.
Gabon (153).
Ghana (150; 157; 159).
[As *Sargassum affine* J. Ag.]
Canaries (128).

Sargassum fissifolium *auct.*
See *Sargassum vulgare* C. Ag.

Sargassum fissifolium (Mert.) J. Ag. formae **canariense** Kütz. and **senegalense** Kütz.
See *Sargassum vulgare* C. Ag.

Sargassum hystrix J. Ag.
Sénégal (28).

Note. In view of the comment by Bodard & Mollion (28 : 198) that *Sargassum hystrix* is from the tropical Atlantic and that its '. . . répartition est sûrement très vaste en tenant compte d'une détermination difficile . . .', it is strange that there are no other records by that name for the large area here treated.

Sargassum ilicifolium (Turn.) C. Ag. var. **venusta** Grun.
'West and south-east coasts of Africa . . .' (205).
Note. The source of the statement by Misra (205) cannot be traced, but it must be taken as a secondary citation. He makes no mention of the presence of this species in west Africa in his introductory section on geographical distribution, but only in the later systematic account. Until the report can be substantiated, directly or through an earlier citation, it is advisable to regard it as of uncertain status.

Sargassum lendigerum *auct.*
See *Sargassum vulgare* C. Ag.

Sargassum lendigerum C. Ag. varieties **fissifolium** Grun. and **foliis pinnatifida** J. Ag.
See *Sargassum vulgare* C. Ag.

Sargassum linifolium *auct.*
See *Sargassum acinarium* (L.) C. Ag.

Sargassum linifolium C. Ag. var. **amygdalifolium** Mont.
See *Sargassum vulgare* C. Ag.

Sargassum natans (L.) Gaillon
Canaries (200).
Cape Verde Islands (200).
Note. For geographical clarification, see the record in this entry under *Fucus natans* L.
[As *Sargassum natans* (L.) Meyen]
Salvage Islands (Ilhas Selvagens) (195).
[As *Sargassum bacciferum* Mont.]
'. . . à peu près au Sud de ces îles [Canaries] et au Nord-Ouest des îles du cap Vert par le vingtième degré . . .' (38).
[As *Sargassum bacciferum* C. Ag.]
Gabon (143; 144).
[As *Sargassum bacciferum* (Turn.) C. Ag.]
Canaries (105; 228).
Salvage Islands (103; 239).
'. . . In navigazione tra l'isola Grande Salvage e la Canarie . . .' (228).
'. . . à peu près au Sud de ces îles et au Nord-Ouest des îles du cap Vert par le vingtième degré . . .' (39).
'. . . in Oceano Atlantico inter Grad. Latit. 22–58 distributa; prata sic dicta Atlantica praecipue in vicinia Insularum Canariensium constituens . . .' (9).
'. . . in Oceano Atlantico magna copia natans (raro fructif.), prata sic dicta Atlantica, praecipue in vicinia Insularum Canariensium constituens . . .' (63).
[As *Sargassum bacciferum* (Turn.)]
Salvage Islands (198; 228).
[As *Fucus natans* L. *pro parte*]
'. . . se encuentra una estendida pradería de sargazo [F. natans L.] en la superficie de este mar Atlántico entre nuestras islas Canarias y las de Cabo-verde . . .' (309).
[As *F.[ucus]* sp. e cohorte *F.[ucus] natantis* L.]
Ghana (138).
Note. This is a pelagic plant which seems to be sporadically cast ashore in the region. Since *Fucus natans* L. is usually taken to relate to *Sargassum natans*, we have with reservations attributed here the Hornemann (138) record. Martin Aguado (200 : 39–40) indicated that both his own secondary considerations and Viera y Clavijo's (309) primary statements concerned some plants

that were attached and others that were floating. In Viera y Clavijo's day, it appears that both were often referred to as *Fucus natans* L., so that Martin Aguado considered Viera y Clavijo's *F. natans* to include both *Sargassum natans* (L.) Gaillon and *S. vulgare* C. Ag. Primary records for the latter also are given in Martin Aguado (200), but his reporting of *S. natans* is entirely secondary.

Sargassum obtusatum Bory
See *Sargassum salicifolium* (Berth.) J. Ag. var. *obtusata* (Bory) Grun.

Sargassum platycarpum Mont.
Cape Verde Islands (15; 16; 210).
[As *Sargassum platycarpum* Mont. var. ? *lenormandii* Grun.]
Cape Verde Islands (118).
Note. Grunow (118 : 389) based his taxon and record on a Lenormand herbarium specimen.

Sargassum platycarpum Mont. var. ? **lenormandii** Grun.
See *Sargassum platycarpum* Mont.

Sargassum polycystum C. Ag. var. **onusta** J. Ag.
Canaries (9; 118).
Note. These records are included here on the basis of comments by both authors regarding the specimens seen in Herb. Mus. Paris. Presumably, but not certainly, both authors saw the same specimen. We have not examined the material and are unable to comment further on its attribution. Both Setchell (1935) and Srinivasan (290) comment on the possible indistinctness of *Sargassum polycystum*.

Sargassum rigidulum Kütz.
Cape Verde Islands (15; 68).
Note. We have followed Taylor (299 : 272) in considering this as a species separate from *Sargassum cymosum*, although De Toni (63), Askenasy (16) and others believed them to be conspecific.

Sargassum salicifolium (Berth.) J. Ag. var. **obtusata** (Bory) Grun.
[As *Sargassum obtusatum* Bory]
Cape Verde Islands (229; 234).
Note. Since the available material was small, Piccone (229 : 57) expressed doubt as to the determination.

Sargassum tenue *auct*.
See *Sargassum vulgare* C. Ag.

Sargassum tenue J. Ag. var. **gabonensis** Grun. and forma **intermedia** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum turneri (Kütz.) Mont.
Cape Verde Islands (210).
[As *Sargassum turneri* Mont.]
Cape Verde Islands (16).
[As *Treptacantha turneri* Kütz.]
Cape Verde Islands (130; 134).
Note. *Sargassum turneri* was first described as a species by Kützing (171 : 624) under the name *Carpacanthus turneri*; the genus *Carpacanthus* is a Kützing segregate from *Sargassum*. The use of the epithet *turneri* at specific level within *Sargassum* seems first to have been proposed by Montagne (210 : 220), who referred back directly to the Kützing source of the epithet. Montagne's (210) Cape Verde Islands record under his new combination is also the first we have traced from there. It is based on Bolle material – 'Inter rejectamenta maris ad oras de *Prainha*. Bolle.' Askenasy (16) may or may not have been referring to the same species when he added the record 'S. Vicente' to his repetition of Montagne's 'Prainha, Bolle.' The record of Henriques (130), which may well represent yet a third different taxon, was incidentally established in a work otherwise concerned with São Tomé; the nomenclature employed, *Treptacantha turneri* Kütz., raises problems since

this name is equated (albeit with ?) by De Toni (63 : 164) to *Cystoseira selaginoides* (Wulf.) Nacc. There is no other record of *Cystoseira selaginoides* from the region, but *Cystoseira* as a genus is variously recorded from the Cape Verde Islands and could be to what Henriques was referring. Since we have not been able to check the Montagne, Askenasy or Henriques relevant material, we are unable to comment further or more firmly on the identity of specimens on which these records are based.

Sargassum vulgare C. Ag.
Angola (191).
Ascension (170; 243A; 243B).
Cameroun (137; 182; 282; 295).
Canaries (2; 21; 92; 107; 120; 124; 160; 161; 190; 200; 208; 228; 255; 258; 259; 260; 282; 286; 308; 309).
Cape Verde Islands (68; 110; 111; 124; 210; 237; 238; 288).
Côte d'Ivoire (147; 148).
Gabon (153).
Gambia (155).
Ghana (64; 106; 125; 145; 150; 157; 180; 183; 185; 186; 187; 204; 295).
Liberia (61; 147; 148).
Mauritanie (124; 137; 189; 285).
São Tomé (123; 133; 255; 298).
Sénégal (28; 45; 54; 107; 124; 213; 255; 295).
Senegambia (9; 155).
Sierra Leone (154; ? 184; ? 194; 197; 203; 204; 295).
Spanish Sahara (189).
'. . . In Oceano Atlantico ad littora Africae . . .' (63).
'. . . known from all countries bordering the Gulf of Guinea from which collections have been made . . .' (148).
'. . . West Coast of Africa (Mauritania, Camerouns)' (194).
'. . . abundant in the Gulf of Guinea . . .' (191).
'Tropical and subtropical coast of Atlantic . . .' (66).
'Tropical and subtropical Atlantic' (68; 69; 70; 129).
'. . . said to occur at nearly all subtropical and tropical shores of the Atlantic Ocean; . . . Africa . . .' (31).
'Warm Atlantic' (111).
Note. De Wreede (64 : 176), in repeating data from Lawson (185) for Ghana, has cited the correct information but the wrong reference. Lawson (184) concerns Sierra Leone, not Ghana.
[As *Sargasse Atlantique* = *S. vulgare auct.*]
'. . . sur nos rivages, depuis le quarante-cinquième degré Nord jusque vers les Canaries . . .' (39).
[As *Sargassum vulgare* C. Ag. forma *furcatum* Kütz.]
Canaries (201).
[As *Sargassum vulgare* C. Ag. var. *diversifolium* C. Ag.]
Canaries (271; 308).
Note. Vickers (308 : 302) recorded only drift material.
[As *Sargassum vulgare* C. Ag. var. *diversifolium* J. Ag.]
Salvage Islands (103).
[As *Sargassum vulgare* C. Ag. var. *furcata* (Kütz.) J. Ag. forma *humilis* Grun.]
Canaries (59; 119).
Salvage Islands (119).
[As *Sargassum vulgare* C. Ag. var. ? *glandulipes* Grun.]
Canaries (32; 59; 119).
Cape Verde Islands (15; 88; 111; 210; 238; 288).
[As *Sargassum vulgare* C. Ag. var. *lanceolata* J. Ag. forma *diversifolia* Grun.]
Canaries (32; 308).

[As *Sargassum vulgare* C. Ag. var. *linearifolium*]
Canaries (32).
[As *Sargassum vulgare* C. Ag. var. *megalophylla* (Mont.) Grun. formae *diversifolia* (? Turn.) Grun., *fissifolia* (Kütz.) Grun., *lanceolata* J. Ag., *pinnatifida* Grun.]
Canaries (119).
[As *Sargassum vulgare* C. Ag. var. *megalophylla* (Mont.) Grun. forma *leptophylla* Grun.]
Canaries (59; 119).
[As *Sargassum vulgare* C. Ag. var. *megalophyllum* (Mont.)]
Canaries (308).
[As *Sargassum vulgare* C. Ag. var. *megalophyllum* (Mont.) Grun.]
Canaries (32; 80).
'Atlântico: da costa portuguesa até às Canárias . . .' (256).
[As *Sargassum vulgare* C. Ag. var. *megalophyllum* (Mont.) Grun. formae *fissifolia* (Kütz.) Grun., *flavifolia* (Kütz.) Grun. and *leptophylla* Grun.]
Canaries (32).
[As *Sargassum vulgare* C. Ag. var. *trachyphylla* (Kütz.) Grun.]
Canaries (119).

Note. Grunow (119 : 43) quotes the record as 'Formas rigidissimas, humiles, nigrescentes dedit Piccone . . . ad insulas Canarienses lectas . . .'

[As *Sargassum vulgare* C. Ag. var. *typica* Børg.]
Canaries (32).
[As *Sargassum vulgare* C. Ag. var. *vulgare*]
? Cameroun (294).
? Gabon (294)
Ghana (294).
Mauritanie (294)
São Tomé (294).
Sénégal (294).
? Sierra Leone (294).
'. . . da costa de Portugal a Marrocos e às Canárias . . .' (256).
[As *Sargassum* 'groupe *vulgare*']
Sénégal (289).
Pantropical (289).
[As *Sargassum vulgare* J. Ag.]
Cape Verde Islands (16; 87).
'. . . Afrique méridionale' (16).
'. . . Mers chaudes atlantiques . . .' (16).
[As *Sargassum vulgare*]
Spanish West Africa (245).
[As *Sargassum boryanum* Mont.]
Cape Verde Islands (130 p.p.).
São Tomé (123 p.p.; 131 p.p.; 132 p.p.).
[As *Sargassum cheirifolium* Kütz.]
Senegambia (175; 211; 294).
'Ad oras Senegambiae (in ostio fluvii Gabon) . . .' (171).

Note. There is confusion concerning the attribution of *Sargassum cheirifolium* to the synonymy of *S. cymosum* by De Toni (63), as well as in regard to the localities from which the former has been collected in the region. *S. cheirifolium* was described by Kützing (171 : 613), who gave the type locality as 'Ad oras Senegambiae (in ostio fluvii Gabon)' and the type specimen as Lenormand 214. This plant was illustrated in a later publication by Kützing (175 : pl. 21, figs a–d) and the type locality was then given merely as Senegambia, with no mention of the Gabon River. There are two specimens in capsules on a single sheet in the Leiden Herbarium with the upper capsule labelled '214. Embouchure de la riviere de Gabon, Guinée' (MS Lenormand) and '*Sargassum cheirifolium* Kg.' (in pencil). This specimen, like the rest of the sheet under this number, is not labelled as type. The material is fruiting and its wide foliar appendages are mostly obovate in shape, with the margins varying from smooth to markedly dentate. The specimen in the lower capsule has no associated Lenormand label, but does have a Kützing label which reads '50. *Sargassum cheirifolium* Kg. Guinea. Lenormand.' This specimen has wider foliar appendages than the other but shows a similar variation in the degree to which the margins are dentate. Steentoft (294) pointed out the close resemblance between the São Tomé plants of Moller and the illustration of *S. vulgare* var. *vulgare* in Taylor (299 : pl. 38, fig. 1; pl. 40, fig. 5), and between both of these and *S. cheirifolium* 'from the mouth of the Gabon River'. The absence of smooth and undulate margins to the foliar appendages of *S. cheirifolium* suggests that this plant should be placed in the synonymy of *S. vulgare*, rather than in that of *S. cymosum* as was done by De Toni (63).

[As *Sargassum cheirifclium* Kunth]
Sénégal (143).

[As *Sargassum cheirifolium* Kunth var. *cordatum* Kunth]
Sénégal (143).

Note. This is provisionally placed under *Sargassum vulgare*, although we have not seen the material on the basis of which the variety was established.

[As *Sargassum cheirifolium* Kütz. β. *cordifolium* Kütz.]
Senegambia (175).
'Ad oras Senegambiae (in ostio fluvii Gabon)' (171).

Note. See the notes under *Sargassum cheirifolium* Kütz., above, and *S. cymosum* forma β. *latifolium* C. Ag., below.

[As *Sargassum cymosum*]
'. . . In mari Atlantico, ad litora . . . Africae . . .' (5).

[As *Sargassum cymosum* C. Ag.]
Senegambia (155).

[As *Sargassum cymosum* C. Ag. forma β. *latifolium* C. Ag.]
'In mari Atlantico ad Sierra Leone' (4).

Note. Agardh's (4) Sierra Leone material was provided by Afzelius. This form of *Sargassum cymosum* has been transferred by Kützing (171 : 613) to *S. cheirifolium* as the forma β. *cordifolium*. There is a Lenormand specimen in the Leiden Herbarium; the sheet is labelled as being of this form although the number is not the same as that cited by Kützing (171 : 613, where 'Lenormand. No. 215' is indicated). This sheet bears the following labels: '219. Embouchure de la rivière de Gabon, Guinée.' [MS Lenormand], '*Sargassum cheirifolium* β. *cordifolium*' [MS Kützing, in pencil] and '50. *Sargassum cheirifolium* β. *cordifolium*. Guinea. Lenormand.' [MS Kützing, in ink]. There is again little resemblance between this form and *S. cymosum*, especially in that the foliar appendages have an obviously denticulate margin. See the notes on *S. cheirifolium* Kütz. under *S. vulgare* C. Ag. for comments on localities in the region.

[As *Sargassum cymosum* J. Ag. var. *esperi* (Sieber) Grun. forma *cheirifolia* (Kütz.) Grun.]
'ad litora Guineae (Herb. Kützing.)' (119).

Note. See remarks under *Sargassum cheirifolium* records in this *S. vulgare* entry.

[As *Sargassum cymosum* J. Ag. var. *esperi* (Sieber) Grun. forma *cordifolia* (Kütz.) Grun.]
'ad litora Guineensia (Herb. Kützing.)' (119).

Note. See remarks made under *Sargassum cheirifolium* forma β. *cordifolium* in this *S. vulgare* entry.

[As *Sargassum cymosum* J. Ag. var. *esperi* (Sieber) Grun. forma *hapalophylla* Grun.]
'. . . ad ostia fluminis Gabon Africae occidentalis (leg. Franquet)' (119).
'Africa' (59).

[As *Sargassum cymosum* J. Ag. var. *lendigerum* (Turn.) Grun.]
Ascension (119).
Canaries (119).
São Tomé (119).
Senegambia (119).

[As *Sargassum cymosum* J. Ag. var. *lendigerum* (Turn.) Grun. forma *dichocarpa* (Kütz.) Grun.]
Senegambia (119).

[As *Sargassum cymosum* J. Ag. var. *lendigerum* (Turn.) Grun. forma *fissifolia* (? Kütz.) Grun.]
Canaries (119).
Senegambia (119).
[As *Sargassum cymosum* J. Ag. var. *microphylla* (Webb & Desp.) Grun.]
Canaries (119).
[As *Sargassum cymosum* J. Ag. var. *stenophylla* (Martius) Grun.]
Canaries (119).
Senegambia (119).
[As *Sargassum dichocarpum* Kütz.]
Senegambia (171; 175; 211).

Note. There is a specimen in the Leiden Herbarium which is obviously to be considered the type of *Sargassum dichocarpum*. The sheet concerned has two labels – '213. Embouchure de la rivière de Gabon, Guinée.' [MS Lenormand] and '51. *Sargassum dichocarpum* Kg. Guinea. Lenormand'. There is no label actually on the specimen mount, other than the Herbarium Kützing stamp, although a capsule containing a broken off fragment is annotated '51. Herb. Suringar. *Sargassum dichocarpum* Kg. Guinea'. The material is luxuriantly in fruit and the linear–lanceolate foliar appendages show a great deal of variation in the form of the margin, some being smooth, others slightly dentate, and a few having pronounced teeth. We consider that this form should be placed in the synonymy of *S. vulgare*, which it closely resembles, and not in that of *S. cymosum* as was done by De Toni (63).

[As *Sargassum dichocarpum* Kunth]
Sénégal (143).
[As *Sargassum diversifolium* C. Ag.]
Canaries (21; 171; 208).
[As *Sargassum diversifolium* Kütz.]
Canaries (211).
[As *Sargassum fissifolium* (Mert.) C. Ag.]
Canaries (5; 9; 228).
Salvage Islands (103; 228).
'. . . In mari Atlantico prope Cap. Vir. (J. D. Hooker) . . .' (310).

Note. J. Agardh (9 : 340–341) questioned the status of this species as regards the Canary Island plants and believed them to be referable to *Sargassum lendigerum*. This latter species is now considered conspecific with *S. vulgare*. We have therefore decided to place all records for *S. fissifolium* from the list area under *S. vulgare* C. Ag.

[As *Sargassum fissifolium* (Mert.) J. Ag.]
Canaries (117).
[As *Sargassum fissifolium* C. Ag.]
Canaries (19; 21; 208; 228).
Cape Verde Islands (210).
[As *Sargassum fissifolium* C. Ag. forma α. *canariense* Kütz.]
Canaries (171).
[As *Sargassum fissifolium* C. Ag. β. *senegalense* Kütz.]
Senegambia (171).
[As *Sargassum lendigerum* C. Ag.]
Ascension (128; 129).
[As *Sargassum lendigerum* (L.) C. Ag.]
Ascension (4; 15; 39; 139; 140; 171).
Canaries (15).
Senegambia (15).
'. . . in mari Atlantico ad insulam Adscensionis (Herb. Linn.), ad littora Senegambiae (Binder!), ad Teneriffam (Webb!) [Canaries]' (9).
[As *Sargassum lendigerum* (L.) Kütz.]
Ascension (44).
Canaries (31; 44).

[As *Sargassum lendigerum* (Turn.) C. Ag.]
Ascension (5).
[As *Sargassum lendigerum* (Turn.) Kütz.]
Ascension (63; 175).
Canaries (63).
Sénégal (63).

Note. The De Toni (63) text actually states '. . . ad insulas Oceani Atlantici, in rupibus magis expositis imprimis ad Nivariam (Teneriffa) et Senegaliae oras; . . . ad insulam Ponapiam [Ascension Island] (ASKENASY) . . .'.

[As *Sargassum lendigerum*]
Canaries (122).
Cape Verde Islands (122).
Sénégal (122).
[As *Sargassum lendigerum* C. Ag. var. *fissifolium* Harv.]
Ascension (211).
Canaries (211).
Senegambia (211).
[As *Sargassum lendigerum* Kütz. var. *fissifolium* Grun.]
Canaries (16).
Cape Verde Islands (16).
Sénégal (16).
'. . . Afrique méridionale' (16).
[As *Sargassum lendigerum* (L.) Kütz. var. *fissifolium* Grun.]
Canaries (310).
[As *Sargassum lendigerum* var. *foliis pinnatifidis* J. Ag.]
Cape Verde Islands (288).
[As *Sargassum lentigerum* [sic!] (Turn.) Kütz.]
Ascension (170).

Note. In a note terminal to the section on *Sargassum*, Kützing (170 : 363) observed '. . . Im Berliner Herbarium liegt ein original exemplar des *Fucus lentigerus* von Esper selbst, welches an der Insel Ascension gesammelt ist; es stimmt genau mit denjenigen Exemplaren das *Sargassum vulgare* . . .'.

[As *Sargassum linifolium* J. Ag. var. *amygdalifolium* (Mont.)]
Canaries (308).

Note. Børgesen (32 : 108) believed that this variety '. . . mentioned by Mlle Vickers is most probably referable to this form [*Sargassum vulgare* var. *megalophyllum* forma *fissifolia*]'.

[As *Sargassum tenue* Kütz.]
'Ad ostium fluvii Gabon, Guineae . . .' (171; 175).
[As *Sargassum tenue* Kunth]
Sénégal (143).
[As *Sargassum tenue* J. Ag.]
'At the mouth of R. Gabon; Guinea . . .' (292).

Note. The type specimen is in the Leiden Herbarium and is labelled '212. Embouchure de la rivière de Gabon, Guinée' [MS Lenormand], '17' [ink: MS Kützing] and '*S. tenue*. Kg. Tab. phyc. XI. Tab. 7' [pencil: MS Kützing], whilst the sheet bears an overall label in MS Kützing '17. *Sargassum tenue*. Guinea'. The specimen appears to be part of a much larger plant and the linear-lanceolate foliar appendages have a very clear and obviously dentate margin; thus the plant is more closely related to *S. vulgare* than to *S. cymosum*. There is also confusion regarding the type locality as Guinea is usually taken as referring to present day Ghana or Guinée, whilst the 'rivière de Gabon' is almost on the Equator. This confusion is further exacerbated by Srinivasan (292), whose record is secondary; he placed a semi-colon between the citation of the River Gabon and Guinea. The placement of *S. tenue*, forms of *S. cheirifolium*, and *S. dichocarpum* in the synonymy of *S. vulgare* must be regarded as provisional, pending a revision of the group for the Atlantic Ocean as a whole.

[As *Sargassum tenue* J. Ag. var. *Gabonensis* Grun.]
'. . . ad oras occidentales Africae, in ostio fluminis Gabon Guineae (Herb. Kützing)' (118).
'. . . West Africa . . .' (59).
[As *Sargassum tenue* J. Ag. var. *Gabonensis* Grun. forma *intermedia* Grun.]
'ad ostia fluminis Gabon Guineae (leg. Franguet)' (118).
[As *Fucus lendigerus* L.]
Ascension (176A; 302).
[As *Fucus lendigerus*]
Ascension (221; 222; 223).
[As *Fucus natans* L., *pro parte*]
Canaries (309).
Note. For explanation of this attribution, see the terminal note to *Sargassum natans* (L.) Gaillon.

Sargassum vulgare C. Ag. var. **diversifolium** *auct.*
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **foliosissima** J. Ag.
See *Sargassum vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag.

Sargassum vulgare C. Ag. var. **foliosissimum** (Lamour.) J. Ag.
? Benin (151; 294).
Cameroun (241; 294).
? Cape Verde Islands (294).
? Nigeria (294).
Príncipe (294).
São Tomé (294).
Sénégal (294).
Togo (151).
'. . . probably on all tropical and subtropical shores of the Atlantic' (44).
[As *Sargassum vulgare* C. Ag. var. *foliosissimum* J. Ag.]
São Tomé (123).
[As *Sargassum vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag. forma *pteropus* (Kütz.) Grun.]
? Benin (294).
? Nigeria (294).
São Tomé (255).
[As *Sargassum vulgare* C. Ag. var. *foliosissima* J. Ag.]
Sénégal (9; 45; 54).
[As *Sargassum vulgare* C. Ag. forma *foliosissimum* (Lamour.) J. Ag.]
Cape Verde Islands (248).
[As *Sargassum vulgare* C. Ag. forma *foliosissima* (Lamour.)]
'Warm Atlantic' (211).
[As *Sargassum boryanum* Mont.]
Cape Verde Islands (130 p.p.; 132 p.p.; 134 p.p.).
São Tomé (123 p.p.; 131 p.p.; 132 p.p.).
Note. For remarks on the São Tomé material and previous records see Steentoft (294 : 120).
[As *Sargassum* sp.]
São Tomé (18).
[As *Marginaria boryana* (Rich.) Mont.]
São Tomé (133).
Note. The question marks used above to express doubt mostly reflect the taxonomic views of the original authors; in other cases, floristic doubts are due to the availability of only drift material.
Overall note to Sargassum vulgare. In any genus that presents much complexity and variation between infrageneric taxa, both variably recognized and of variable validity in different parts of

the world, there has to be a general 'dumping ground' for difficult material. *Sargassum vulgare* has frequently served in that capacity for the genus *Sargassum*, which accounts for the wide variety of names of formae and varieties under which west African records have previously been established. That there has equally frequently been random recognition, actively or in ignorance of relationships, under different specific epithets of material better placed as *S. vulgare* is also clear from the above list. The general situation of the species *S. vulgare* in the tropical Atlantic has been aptly and shortly summarized by Bodard & Mollion (28 : 198), who state '. . . Les deux *Sargassum*, *S. vulgare* et *S. hystrix* sont des atlantiques tropicales dont la répartition est sûrement très vaste en tenant compte d'une détermination difficile'. There is some doubt as to the correct epithet for this taxon; nomenclatural study is in progress.

Sargassum vulgare C. Ag. forma **foliosissimum** (Lamour.) J. Ag.
See *Sargassum vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag.

Sargassum vulgare C. Ag. var. **foliosissimum** (Lamour.) J. Ag. forma **pteropus** (Kütz.) Grun.
See *Sargassum vulgare* C. Ag. var. *foliosissimum* (Lamour.) J. Ag.

Sargassum vulgare C. Ag. var. **furcata** (Kütz.) J. Ag. forma **humilis** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. ? **glandulipes** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **lanceolata** J. Ag. forma **diversifolia** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **linearifolium**
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **megalophylla** (Mont.) Grun. formae **diversifolia** (? Turn.) Grun., **fissifolia** (Kütz.) Grun., **lanceolata** J. Ag., **leptophylla** Grun. and **pinnatifida** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **megalophyllum** (Mont.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **megalophyllum** (Mont.) Grun. formae **fissifolia** (Kütz.) Grun., **flavifolia** (Kütz.) Grun. and **leptophylla** Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **trachyphylla** (Kütz.) Grun.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **typica** Børg.
See *Sargassum vulgare* C. Ag.

Sargassum vulgare C. Ag. var. **vulgare**
See *Sargassum vulgare* C. Ag.

Sargassum spp.
Angola (158; 311).
Cameroun (180; 182; 187; 203; 204; 282; 291).
Canaries (3; 160; 161; 162; 167; 215; 228).
Cape Verde Islands (87; 92; 282).
Gabon (153).
Gambia (155).
Ghana (137; 141; 157; 180; 186; 187; 203; 204; 291).
Guinée (199).
Mauritanie (189; 285; 291).
Sénégal (26; 27; 57; 180; 187; 203; 204; 206; 289; 290; 294; 301).
Sierra Leone (180; 181; 184; 187; 197; 203; 204).

'. . . African west coast . . .' (194).
'Gulf of Guinea' (158; 191).
'West Africa' (187; 188; 215).

Note. Feldmann (87 : 1070) indicated that his (Chevalier) record from the Cape Verde Islands involved drift material of the section Acanthocarpicae.

Scytosiphon lomentaria (Lyngb.) Link
'Atlântico: do Árctico às Canárias . . .' (256).
[As *Scytosiphon Lomentaria* J. Ag.]
Canaries (308).
[As *Scytosiphon lomentaria* (Lyngb.) Endl.]
Canaries (32; 92; 286; 308).
[As *Scytosiphon lomentarius* (Lyngb.) Link]
South West Africa (287).
[As *Chorda filum* Lamour.]
Canaries (21; 208).

Note. This genus is in need of re-appraisal; it has been found at least occasionally to be the gametophyte stage in a life-history also involving members of the Myrionemataceae (e.g. *Microspongium gelatinosum*). The note to *Petalonia fascia* (O. F. Müll.) O. Kuntze presents additional data on the subject of crustose brown thalli forming stages in the life-histories of otherwise erect brown algae. Clayton (1976b), who considered at length the life-history of *Scytosiphon lomentaria*, has recently shown that the complanate and cylindrical forms of the plant represent different linking stages in a life-history that also involves plethysmothalli.

Scytosiphon lomentarius (Lyngb.) Link
See *Scytosiphon lomentaria* (Lyngb.) Link.

Spatoglossum

Western African records of the two species commonly reported from this region show that the Gulf of Guinea and adjacent coasts form an area of overlap in biogeographic distribution. This presupposes acceptance of the distinctness of the species. On the basis of existing data, *Spatoglossum solierii* is generally of more northerly distribution, being common in the Mediterranean and the warmer temperate parts of the eastern Atlantic north to Brittany (Ardré, 13; Hamel, 120). By contrast, currently available reports of *S. schroederi* place its northern limit of distribution in Spanish Sahara (eastern Atlantic) and Bermuda and North Carolina (western Atlantic; Taylor, 299), thus showing it to be a species of widespread occurrence in the tropics and subtropics. It would be logical to expect additional reports from the Canaries and perhaps Morocco. We do not find it easy to understand the distinctions usually given between the species *S. solierii* and *S. schroederi*, and probably the records from west Africa reflect similar confusion in the minds of reporting authors. De Toni (63 : 248–250) invokes characteristics of the superficial appearance of cells, margins and the surfaces of the frond in distinguishing between *S. solierii* and *S. schroederi*, *inter alia*. Many forms referred to *S. schroederi* are more delicate in texture than *S. solierii* but *S. areschougii* J. Ag., referred to by De Toni and usually considered to be conspecific with *S. schroederi*, is specifically described by De Toni as with '. . . Frond firmer than in *S. schroederi* . . .'. Thus, this clinal characteristic is not reliable. To a lesser degree, inconsistency is also shown by the nature and extent of marginal teeth. *S. schroederi* (highly dentate) and *S. solierii* (margin usually almost entire) can often readily be distinguished on these grounds; however, occasional individuals in both 'species' have more or less evident dentations than normally noted, so that accurate determination to one or other is difficult.

The Atlantic situation in *Spatoglossum* is therefore directly analogous to that noted for Pacific forms in Dawson, Acleto & Foldvik (1964 : 20–21). Commenting on *Spatoglossum veleroe sensu* W. R. Taylor, *S. crispatum* Howe and *S. howellii* Setchell & Gardner, Dawson *et al.* concluded that '. . . There is now a strong suggestion that all of these may be a single variable species ranging from Baja California, Mexico, to Nicaragua, the Galapagos Islands and to Peru. The collections in the Hancock Foundation from the Galapagos Islands show a considerable range of variability from strongly crisped and crenulate forms to quite plain ones. Others show strong dentation of the upper parts of blades, and width of blade seems exceedingly variable. If similar variability is recognised among the Peruvian plants, it will be necessary to use the name *S. crispatum* to designate the entire assemblage.' We strongly suspect that similar conspecificity applies to the *S. schroederi*/*S. solierii* records from the eastern Atlantic, to all of which the earlier name *S. schroederi* (C. Ag.) Kütz. will have to be applied if this proves to be correct.

Spatoglossum schroederi (C. Ag.) Kütz.
Cameroun (unpublished).
Gabon (153).
Gambia (155).
Ghana (159).
Mauritanie (189).
Sierra Leone (154).
Spanish Sahara (189).
[As *Spatoglossum schroederi* (Mert.) J. Ag.]
Ghana (73).
[As *Spatoglossum schroederi* (Martens) J. Ag.]
Sénégal (289).

Note. Remarks made by Martius (1828 : 5; 1833 : 21) indicate that the plants on which this taxon is based were collected by Schroeder in Brasil and then passed on to Mertens, who in turn sent specimens to both C. Agardh and Martius, suggesting that the name *Ulva schroederi* be applied. C. Agardh (5 : 265–266) gave a very brief description of the plant, placing it in *Zonaria* as a new species. The first fully adequate description appeared in Martius (1833 : 21), who accepted the whole combination first suggested by Mertens. In making the first combination of the epithet in the genus *Spatoglossum*, Kützing (173 : pl. 51) had before him material from the West Indies (Vera Cruz). Many (e.g. De Toni, 63 : 250) would consider this material to have been representative of *Spatoglossum areschougii* J. Ag., although the two taxa are frequently thought to be conspecific. We so consider them, which means that there is no necessity to exclude the description by Kützing; in any case, the combination is validly made by him in *Spatoglossum* (Art. 55, *Int. Code Bot. Nomenclature*). See the generic note above.

Spatoglossum solierii (Chauv. ex Mont.) Kütz. ['*solieri*']
[As *Spatoglossum solierii* Kütz.]
Gabon (122).
Mauritanie (28; 189).
Sénégal (54; ? 289; ? 301).
'. . . du Sud de la Bretagne au Gabon (?) . . .' (301).
'Atlantique nord . . . depuis Brest jusqu'à Dakar [Sénégal] . . .' (13).

Note. The basionym involved here is *Dictyota solierii*, but there is doubt about the earliest publication of that name and therefore about the form of citation. Chauvin in Montagne (1836) or Montagne (1836) are usually the forms quoted; although an adequate characterization of the plant is there provided, the text nevertheless implies that there is a still earlier description by Chauvin in *Mém. Soc. linn. Normandie*, reference to which Montagne derived from a list and specimens sent by Solier to the Paris Museum. Hamel (120 : 335) makes a direct statement to the same effect. In neither case are the year, volume number or pagination quoted for the supposed earlier work, suggesting that neither Solier, nor Montagne, nor Hamel had actually ever seen the text. A careful search through all available data sources, including the journal itself from inception up to the end of 1840, has failed to reveal the paper. It would seem likely, therefore, that Chauvin suggested the name *Dictyota solierii* to Solier, sent him material, and at the same time led him to believe that he (Chauvin) was about to validate this new taxon, thus causing Solier to note down the data subsequently quoted by Montagne, although in the end a description was never actually published until that in Montagne (1836 : 321–322). On this basis, the correct citation of authorities must be (Chauvin ex Montagne) Kützing. See also the generic note above. Doubt expressed by Feldmann in Trochain (301) as to the Sénégal material he determined relates to the few layers of medullary cells and the consequent possibility that the material was either a young *Spatoglossum solierii* or a new species.

Spatoglossum spp.
Sénégal (55; 187; 213; 290).

Note. For reasons stated above in the generic note, it is not possible to be sure of the correct attribution of these records. Acceptance of the conspecificity of *Spatoglossum schroederi* and *S. solierii* will obviously lead to incorporation of all the records into the list for the former species.

Sphacelaria bipinnata (Kütz.) Sauv.
Canaries (228).

Note. This seems likely to be a mis-identification, or possibly a mis-transcription of data passed from Grunow to Piccone. Prud'homme-van Reine (246 : 174) commented that the species is '. . . not known outside Europe'. Børgesen (32 : 74–75) and Sauvageau (261 : 196; 262 : 383; 263 : 313) had earlier concluded that Piccone's determination was doubtful.

Sphacelaria brachygonia Mont. ['*brachygona*']
Ghana (146; 149).
Sénégal (146; 289).
'West Africa' (246).
[As *Sphacelaria elliptica* Dickins.]
Ghana (72; 183; 295).

Sphacelaria caespitula Lyngb.
See *Sphacelaria furcigera* Kütz., terminal note.

Sphacelaria cirrosa (Roth) C. Ag. ['*cirrhosa*']
Canaries (32; 63; 92; 228; 286).
Cape Verde Islands (63; 116; 229; 234).
'From the Faeröes down to the Canary Islands . . .' (32).
'. . . Atlántico (de Noruega a las Canarias) . . .' (286).
'. . . Atlantique (de la Norvège aux Canaries) . . .' (88).
'Atlantique (de l'Arctique aux Canaries; . . .)' (13).

Note. Piccone's (228) early Canaries records were based on fragments mixed with other algae; he established the records '. . . con esitazione . . .'.

[As *Sphacelaria cirrosa* C. Ag.]
Canaries (161; 208).

Note. Børgesen (32 : 74), taking into account the opinion of Sauvageau (261 : 174; 262 : 382) that the Canaries material named *Sphacelaria cirrosa* by Montagne (208) was like *S. hystrix*, mentioned it under the latter name. He did not see material to establish this and the record is therefore left here for now. See the terminal note below.

[As *Sphacelaria cirrosa* J. Ag.]
Cape Verde Islands (16; 262).
[As *Sphacelaria cirrosa* (Roth) C. Ag. var. *subsecunda* Grun. in Picc.]
Canaries (63).
[As *Sphacelaria cirrhosa* C. Ag.]
Canaries (21; 262; 308).
Cape Verde Islands (234).
[As *Sphacelaria cirrhoza* Kütz.]
Canaries (260).
[As *Sphacelaria cirrhosa* (L.) Lyngb.]
Canaries (201).
[As *Sphacelaria cirrhosa* (Roth) C. Ag. var. *subsecunda* Grun. in Picc.]
Canaries (228).

Note. Børgesen (32 : 77) indicated, without having seen specimens, that the material recorded in Piccone (228) most probably belonged to *Sphacelaria hystrix*. The record is maintained here for now; see the terminal note below.

[As *Sphacelaria pennata* (Huds.) Lyngb.]
Cape Verde Islands (15).
[As *Sphacelaria pennata* (Huds.) Lyngb. var. *pennata* forma *meridionalis* (Sauv.) D. E. G. Irvine]
'. . . no Atlântico e o seu limite sul situa-se nas Canárias . . .' (256).
[As *Conferva pennata* Huds.]
Canaries (38).

Note. Prud'homme-van Reine (246) has suggested that *Sphacelaria cirrosa* is perhaps identical with *S. hystrix* Suhr in Reinke; see the note to *S. hystrix*. *S. cirrosa* is often to be found in texts as '*S. cirrhosa*'.

Sphacelaria cirrhosa (Roth) C. Ag. var. **subsecunda** Grun. in Picc.
See *Sphacelaria cirrosa* (Roth) C. Ag.

Sphacelaria cirrosa (Roth) C. Ag. var. **subsecunda** Grun. in Picc.
See *Sphacelaria cirrosa* (Roth) C. Ag.

Sphacelaria elliptica Dickins.
See *Sphacelaria brachygonia* Mont.

Sphacelaria furcigera Kütz.
Angola (191).
Benin (148; 150).
Cmaeroun (148; 150).
Canaries (32; 82; 135; 150; 261; 262).
Cape Verde Islands (15; 16; 150).
Côte d'Ivoire (148).
Gabon (153).
Gambia (155).
Ghana (146; 148; 151; 157; 159).
Liberia (148).
Mauritanie (189).
Sierra Leone (154).
Togo (151).
'. . . All warm and temperate seas as far north as Heligoland and the Faeröes . . .' (31).

Note. Prud'homme-van Reine (246 : 174) considered that *Sphacelaria fusca* (Huds.) S. F. Gray is merely 'Closely related to *Sph. furcigera*, but the filaments have larger dimensions', and the 1976 version of the *Check-list of British Marine Algae* (Parke *et al*., 1976) records the species as a separate entity. Previously (Parke & Dixon, 1968) these and other described taxa had been regarded as conspecific. It is not clear to what extent the above records can be reliably assumed to represent *Sphacelaria furcigera*, despite the use of that name, since many were established in the period between 1968 and 1976 when *S. fusca* and *S. furcigera* were considered conspecific. Both species have propagules with long cylindrical arms, lacking a terminal hair. The life-history of *S. furcigera* has been followed through in culture (van den Hoek & Flinterman, 135; Colijn & van den Hoek, 1971); it is the only species in the genus for which such data exist. Widespread in temperate and tropical seas. See also *S. fusca* (Huds.) S. F. Gray. The record established by Sauvageau (261) for the Canaries was based on Montagne material (Paris) labelled [MS Montagne]: '*Sphacelaria caespitula*! Lyngb., ad Fucos majores, Canaries an *S. squamosa ?* Webb ded. ?'

Sphacelaria fusca (Huds.) S. F. Gray
[As *Sphacelaria fusca* (Huds.) C. Ag.]
Liberia (61).
'. . . Atlantique (de la Hollande aux Canaries; . . .)' (13).
[As *Sphacelaria fusca* C. Ag.]
Canaries (32; 92; 271).

Note. For some background explanation of the *Sphacelaria fusca*/*S. furcigera* position, see the entry for the latter. There remains similar doubt about the provenance of records referred to *S. fusca*.

Sphacelaria hancockii Dawson
Ghana (146; 150; 157).
'. . . Gulf of Guinea' (146).
Note. Prud'homme-van Reine (*pers. comm.*) now believes these records to be more correctly attributed to *Sphacelaria tribuloides* (q.v.).

Sphacelaria hystrix Suhr in Reinke
Canaries (32; 63; 92; 120; 190; 244; 246; 250; 258; 259; 262; 263; 271; 281).
Salvage Islands (103; 195).
'From the Atlantic coast of France down to the Canary Islands' (32).
'. . . de la Bretagne jusqu'aux Canaries' (263).
'. . . il exist probablement partout où croît le *C. ericoides*, c'est-à-dire du Cap Vert [Sénégal] jusqu'en Ecosse' (262).
'Atlantique (de la Bretagne aux Canaries) . . .' (13).
'. . . Atlantique (de la Bretagne aux Canaries) . . .' (88).
'. . . Atlantico (de la Bretaña a las islas Canarias)' (285).
'From the Atlantic coasts of France southward to the Canaries . . .' (195).
Note. It is worth quoting the brief comments by Prud'homme-van Reine (246 : 173) on this taxon: '. . . southern [European] species, its area is closely correlated with that of the *Cystoseira*-species on which it grows. Perhaps identical with *Sph. cirrosa*. Extra-european: especially common on the Canary Islands.' See also the various notes and details given in the entry for *Sphacelaria cirrosa* (Roth) C. Ag. The Canaries record in Sauvageau (262) was partly based on a Despréaux specimen determined by Kützing as *S. irregularis* Kütz. (Herb. Lenormand, Caen).

Sphacelaria irregularis Kütz.
See *Sphacelaria hystrix* Suhr in Reinke.

Sphacelaria novae-hollandiae Sonder
Ascension (unpublished).

Sphacelaria pennata (Huds.) Lyngb.
See *Sphacelaria cirrosa* (Roth) C. Ag.

Sphacelaria pennata (Huds.) Lyngb. var. **fusca** (Huds.) D. E. G. Irvine
See the note to *Sphacelaria fusca* (Huds.) C. Ag.

Sphacelaria pennata (Huds.) Lyngb. var. **pennata** forma **meridionalis** (Sauv.) D. E. G. Irvine
See *Sphacelaria cirrosa* (Roth) C. Ag.

Sphacelaria scoparia (L.) Lyngb.
See *Halopteris scoparia* (L.) Sauv.

Sphacelaria scoparia varieties **disticha** (Lyngb.) and **virgata** (Harv.)
See *Halopteris scoparia* (L.) Sauv.

Sphacelaria scoparia Lyngb. formae **aestivalis** J. Ag. and **hiemalis** J. Ag.
See *Halopteris scoparia* (L.) Sauv.

Sphacelaria scoparium Kütz.
See *Halopteris scoparia* (L.) Sauv.

Sphacelaria squamosa
See *Sphacelaria furcigera* Kütz., terminal note.

Sphacelaria tribuloides Menegh.
Canaries (32; 92; 150).
Cape Verde Islands (16; 150).
Côte d'Ivoire (147).
Ghana (146; 148; 150).
Liberia (61; 147; 148).
Pagalu (150; 242).

Salvage Islands (Ilhas Selvagens) (195).
Sénégal (54; 150; 213).
Togo (148; 151).
'. . . nas águas quentes e temperadas do Atlântico, das Canárias até à Escocia e Suécia' (256).
'. . . All warm and temperate seas as far north as Scotland in the Atlantic' (31).
'Atlantique (de la Scandinavie aux Canaries, . . .)' (13).
'. . . Mers chaudes en général' (16).
'Gulf of Guinea . . .' (146).

Note. Probably more widely distributed in the region than the records suggest. Prud'homme-van Reine (246 : 173) stated: '. . . has been found all around the world, especially in warmer seas'. Levring (195 : 28) gave a similar distribution. Most authors are in accord on this pattern. See also *Sphacelaria hancockii*.

Sphacelaria spp.
Ascension (243B).
Cameroun (182; 251; 294; 295).
Gambia (155).
Ghana (159; 187; 294).
Pagalu (294).
São Tomé (294).
Sierra Leone (154; 184).
Togo (151).

Splachnidium rugosum (L.) Grev.
South West Africa (225).

Spongonema
For comments on generic distinctions in Ectocarpales, see the remarks under *Ectocarpus*.

Spongonema tomentosum (Huds.) Kütz.
[As *Ectocarpus terminalis* Kütz.]
Canaries (32; 92; 169).
Cape Verde Islands (? 15; ? 16; 237; 238).

Note. Askenasy's (15; 16) doubts concerned the specific determination of the material.
[As *Fucus tomentosus* Huds.]
Ghana (138).
[As *Hecatonema terminale* (Kütz.) Kylin]
Canaries (205).
'West coast, Africa' (205).

Sporochnus bolleanus Mont.
Canaries (32; 34; 37; 63; 92; 139; 161; 162; 173; 195; 209; 228; 282).

Note. See also *Sporochnus* sp. Piccone (228) indicated that he had only a tattered piece of an old specimen, collected by Bolle in 1852.

Sporochnus sp.
Canaries (166).

Note. This record, which is secondary, probably relates to *Sporochnus bolleanus*, since only that species is reported from the Canaries.

Stilophora sinuosa C. Ag.
See *Colpomenia sinuosa* (Roth) Derb. & Sol.

Stypocaulon scoparium *auct.*
See *Halopteris scoparia* (L.) Sauv.

Stypocaulon scoparium Kütz. var. δ **distichum** (Lyngb.) Kütz.
See *Halopteris scoparia* (L.) Sauv.

Stypopodium fissum Kütz.
See *Lobophora variegata* (Lamour.) Womersley.

Stypopodium flavum (C. Ag.) Kütz.
See *Zonaria tournefortii* (Lamour.) Mont.

Stypopodium fuliginosum Kütz.
See *Stypopodium zonale* (Lamour.) Papenf.

Stypopodium laciniatum Kütz.
See *Lobophora variegata* (Lamour.) Womersley.

Stypopodium lobatum Kütz.
See *Stypopodium zonale* (Lamour.) Papenf.

Stypopodium zonale (Lamour.) Papenf.
Canaries (78; 79; 161; 162; 205; 214; 259).
Ghana (73).
'West coast, Africa' (205).
[As *Stypopodium fuliginosum* Kütz.]
Canaries (171).
[As *Stypopodium laciniatum* Kütz.]
Canaries (171 p.p.).
Note. See the remarks under *Lobophora variegata* (Lamour.) Womersley.
[As *Stypopodium lobatum* Kütz.]
Canaries (16; 110; 111; 308).
Cape Verde Islands (16).
'. . . Afrique méridionale . . .' (16).
'. . . in oceano Atlantico ad Caput Bonae Spei . . . usque ad Canarias . . .' (63).
[As *Padina lobata* Mont.]
Canaries (208 p.p.).
Note. See remarks under *Lobophora variegata* (Lamour.] Womersley.
[As *Padina lobata* Grev.]
Canaries (21 p.p.).
[As *Zonaria lobata* C. Ag.]
Canaries (2; 3; 5; 9; 10; 17; 31; 32; 66; 68; 92; 105; 128; 211; 266).
[As *Zonaria lobata* J. Ag.]
Canaries (228).
[As *Zonaria lobata*]
Canaries (160; 266).
Note. Other probable records for this taxon appear under *Zonaria zonalis* (Lamour.) Howe, the name applied when the records were established.

Taonia atomaria (Woodw.) J. Ag.
Canaries (3; 9; 32; 63; 84; 88; 92; 100; 115; 160; 168; 195; 258; 259; 282).
Mauritanie (187; 189; 289; 295).
Sénégal (28; 289; 295).
'. . . Atlantique, de l'Angleterre aux Canaries . . .' (88).
'. . . Atlantico de Inglaterra a islas Canarias . . .' (286).
'. . . Atlântico: da costa inglesa a Marrocos e às Canárias . . .' (256).
'Atlantique nord (de l'Angleterre à la Mauritanie) . . .' (13).
'Atlantique nord, jusqu'en Mauritanie . . .' (109).
'De la Grande-Bretagne aux Canaries . . .' (37).
'From Great Britain to the Canary Islands . . .' (32).
[As *Taonia atomaria* J. Ag.]
Canaries (308).
[As *Padina atomaria* Mont.]
Canaries (21; 208).

Note. See also *Taonia* sp. Material from Sénégal reported earlier by Sourie (289; 290) and then by Bodard (25) was presumably of the same taxon as that identified by Sourie (289) and by Bodard & Mollion (28) as *Taonia atomaria*. Since Sourie (289) reported *T. atomaria* from as far north in Mauritanie as Nouadhibou, it is probable that the species is also to be found in Spanish Sahara.

Taonia sp.
Sénégal (25; 187; 289; 290).
Note. Presumably this material, if correctly identified, represents *Taonia atomaria*.

Treptacantha gracillima Kütz.
See *Cystoseira abies-marina* (S. Gmel.) C. Ag.

Treptacantha montagnei Kütz.
See *Cystoseira abies-marina* (S. Gmel.) C. Ag.

Treptacantha sonderi Kütz.
See *Cystoseira sonderi* (Kütz.) Picc.

Treptacantha turneri Kütz.
See *Sargassum turneri* (Kütz.) Mont.

Ulva bulbosa Beauv.
See *Saccorhiza polyschides* (Lightf.) Batt.

Ulva pavonia L.
See *Padina pavonica* (L.) Lamour.

Ulva tuberosa Beauv.
See *Saccorhiza polyschides* (Lightf.) Batt.

Zonaria flava *auct.*
See *Zonaria tournefortii* (Lamour.) Mont.

Zonaria interrupta *auct.*
See *Zonaria subarticulata* (Lamour.) Papenf.

Zonaria lobata *auct.*
See *Stypopodium zonale* (Lamour.) Papenf.

Zonaria pavonia C. Ag.
See *Padina pavonica* (L.) Lamour. and *Padina vickersiae* Hoyt in Howe in Britton & Millspaugh.

Zonaria subarticulata (Lamour.) Papenf.
[As *Zonaria interrupta* C. Ag.]
Canaries (17).
[As *Zonaria interrupta* Lamour.]
Canaries (9).
[As *Phycopteris interrupta* Kütz.]
Canaries (171).
[As *Phycopteris interrupta* (Lamour.) Kütz.]
Canaries (170).

Zonaria tempta
? South West Africa (287).
Note. Simons (in litt., 287) indicated that both the rendering of the name and the determination of the specimens remain in doubt. Material therefore requires to be re-located and critically re-examined.

Zonaria tournefortii (Lamour.) Mont.
Canaries (2; 3; 32; 35; 92; 161; 190; 195; 258; 259).
Cape Verde Islands (92).
Salvage Islands (195; 239).

'From Cadiz to the Canary Islands . . .' (32).
'Atlantico de Cadiz a Canarias . . .' (286).
[As *Zonaria tournefortii* Lamour.]
Canaries (15).
Cape Verde Islands (15).
Salvage Islands (198; 228).
[As *Zonaria tournefortii* Mont.]
Cape Verde Islands (16).
'De Cadiz aux Canaries . . .' (37).
'Atlantique de Cadiz aux Canaries . . .' (16).
[As *Zonaria flava* (Clem.) C. Ag.]
Canaries (9; 63; 235; 266).
[As *Zonaria flava* C. Ag.]
Canaries (228; 308).
Salvage Islands (104).
[As *Padina tournefortii* Lamour.]
Canaries (21; 208).
[As *Stypopodium flavum* (C. Ag.) Kütz.]
Canaries (170).

Zonaria variegata *auct.*
See *Lobophora variegata* (Lamour.) Womersley and *Padina vickersiae* Hoyt in Howe in Britton & Millspaugh.

Zonaria zonalis (Lamour.) Howe
Canaries (44; 139; 140).
Cape Verde Islands (92).

Note. The Chapman (44) record from the Canaries is secondary, the original source being apparently Howe (139; 140), although that author gives the impression of quoting from elsewhere; it is probable that the records should really be referred to *Stypopodium zonale* (Lamour.) Papenf., as the synonymy quoted would indicate, but examination of material (if any is available) should be the first step.

Zonaria sp.
Canaries (3; 78; 271).

Note. Johnston (161) reported *Zonaria tournefortii* from the Canaries. Although no specific epithet is quoted by Duffus & Johnston (78), it is therefore probable that *Z. tournefortii* is the species in question.

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190. —— **& Norton, T. A.** 1971. Some observations on littoral and sublittoral zonation at Teneriffe (Canary Isles). *Botanica mar.* **14** : 116–120.

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191. —— **John, D. M. & Price, J. H.** 1975. The marine algal flora of Angola: its distribution and affinities. *Bot. J. Linn. Soc.* **70** : 307–324.

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Note. This is stated to be the 'second edition' of this work; the first was, apparently, published in 1854 in *Nova Acta Acad. Caesar. Leop. Carol.* **25** : 529–591. Le Jolis indicated also that a summary of that 'first edition' appeared in *C. r. hebd. Séanc. Acad. Sci. Paris* **40,** of 26 February 1855 (French); in *Ann. Mag. nat. Hist.* **15** : 316, April 1855 (English); and in *Flora, Jena* **1855** : 363, June 1855 (German). Since the Canaries record in the 'second edition' is merely secondary, the earlier versions have not been checked; they would add no significant information.

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195. —— 1974. The marine algae of the archipelago of Madeira. *Bolm Mus. munic. Funchal* **28** : 1–111.

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Note. See also no. 309.

Martius, K. F. P. von 1828–1834. *Icones Selectae Plantarum Cryptogamicarum quas in Itinere per Brasiliam Annis MDCCCXVII–MDCCCXX Jussu et Auspiciis Maximiliani Josephii . . .* [8] + 138 pp. Monachii.

Note. Although the principal title-page is dated 1827, there is a second title-page that bears the correct dates of publication, 1828–1834. From available data, the four fascicles of the work appeared in 1828 (fasc. 1: 1–28 [prob. 30], pls I–XIV) and 1834 (the remainder).

—— 1833. Orao primus. Algae, Roth. [1–50 pp.]. *In* K. F. P. von Martius, F. Eschweiler & C. G. Nees von Esenbeck, *Flora Brasiliensis seu Enumeratio Plantarum in Brasilia tam sua Sponte quam Accedente Cultura Provenientium*, . . . 1. Pars prior, Algae, Lichenes. Hepaticae. Exposierunt Martius, Eschweiler, Nees ab Esenbeck, IV + 390 pp. Stuttgartiae et Tubingae.

Note. Martius explains in his preface that the work on algae, lichens and hepatics first went to press in the autumn of 1826 and, through delays, was more than six years in appearing. The preface is dated 28 April 1833.

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Note. The calcareous algae in this work are acknowledged as being determined by Heydrich; the rest are identifications by Reinbold.

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204. —— 1975. *Seaweed Resources of the Ocean*. FAO Fisheries Technical Paper, No. 138. v + [1] + 127 pp. Rome.

205. **Misra, J. N.** 1966. *Phaeophyceae in India*. I.C.A.R. Monographs on Algae. [10] + 203 pp. New Delhi.

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Note. For detailed consideration of the bibliography of this work see Stearn in *J. Soc. Biblphy nat. Hist.* **1** : 49–63 (1937).

—— 1843. Quatrième centurie de Plantes cellulaires exotiques nouvelles. *Annls Sci. nat.* (Bot.) sér. 2, **20** : 294–306.

—— 1846. Cryptogames cellulaires. Algues, Lichens, Hépatiques et Mousses. [pp. i–xi + 1–163 + 205–314]. *In* [J. F.] C. Montagne, J. H. Léveillé & A. F. Spring, *Voyage Autour du Monde Exécuté Pendant les Années 1836 et 1837 sur la Corvette La Bonite . . ., Botanique . . .* **1** *Cryptogames Cellulaires et Vasculaires* (*Lycopodinées*). [2] + xi + [1] + 355 pp. Paris.

Note. Although the overall title-page for the Tome Premier gives 1844–1846, previous workers have established that Montagne's statements in the introduction are correct. Montagne sent the completed MS to the editor in December 1843, proof pages were sent to Berkeley in 1844, and the latter translated certain data for publication in English in July 1844. The complete text finally appeared in French in 1846.

209. **Montagne, J. F. C.** 1856. *Sylloge Generum Specierumque Cryptogamarum quas in Variis Operibus Descriptas Iconibusque Illustratas* . . . XXIV + 498 pp. Paris.

210. **Montagne, [J. F.] C.** 1860. Florula Gorgonea seu enumeratio plantarum cellularium quas in promontorio Viridi (*cap Vert*) insulisque adjacentibus a diversis botanicis et imprimis Cl. Bolle, berolinensi, hucusque collectas, recognovit descripsitque. *Annls Sci. nat.* (Bot.) sér. 4 **14** : 210–225.

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220. —— **& Burrows, E. M.** 1969. Studies on marine algae of the British Isles. 7. *Saccorhiza polyschides* (Lightf.) Batt. *Br. phycol. J.* **4** : 19–53.

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222. —— 1765. *Herrn Peter Osbeck . . . Reise nach Ostindien und China . . . Aus dem Schwedischen Übersetz von J. G. Georgi . . .* [vi] + xxiv + 552 + [28] pp. Rostock.

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229. —— 1886. *Alghe del Viaggio di Circumnavigazione della Vettor Pisani.* 97 pp. Genova.
Note. See Piccone (1887) (234) for repeated data.

230. —— 1886. Pugillo di alghe Canariensi. *Nuovo G. bot. ital.* **18** : 119–121.
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231. —— 1886. Nota sulle raccolte algologiche fatte durante il viaggio di circumnavigazione compinto dalla R. corvetta Vettor Pisani. *Giorn. Soc. Lett. Conversaz. scient. Genova*, March 1886.
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270. —— 1909 ['1908']. Sur l'apparition, l'envahissement et la disparition du *Colpomenia sinuosa*. *C. r. hebd. Séanc. Mém. Soc. Biol., Paris* **65** : 751–753.

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Note. This concerns the session of 29 December 1913; BM(NH) copy received 10 January 1914. Publication date is perhaps therefore 1914.

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Note. This is one part of a complex work; some other parts of the same work (cf. Sauvageau 261; 262; 265) first appeared in *J. Bot. Paris*. For details of the whole text see Dixon, Irvine & Price in *Br. phycol. Bull.* **3** : 87–142 (1966).

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—— 1935. The Templeton Crocker Expedition to Western Polynesian and Melanesian Islands, 1933 No. 21 Some marine plants of south-eastern Melanesia. *Proc. Calif. Acad. Sci.* ser. 4, **21** : 259–276.

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Skottsberg, C. 1907. Zur Kenntnis der subantarktischen und antarktischen Meeresalgen. I. Phaeophyceen. *In* O. Nordenskjöld, *Wissenschaftliche Ergebnisse der schwedischen Südpolar-Expedition* 1901–1903 . . . vol. **4** I (6) : 1–172. Stockholm.

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288. **Sonder, [O. W.]** 1852. Algae [pp. 125–127]. *In* J. A. Schmidt, *Beiträge zur Flora der Cap Verdischen Inseln. Mit Berucksichtigung aller bis jetzt daselbst bekannten wildwachsenden und kultivirten Pflanzen. Nach eigenen Untersuchungen und mit Benutzung der gewonnenen Resultate anderer Reisenden.* [2] + viii + 356 + [1] pp. Heidelberg.
Note. The algal material was sent to Sonder in Hamburg; he worked on the plants and provided both the determinative data and text as printed.

289. **Sourie, R.** 1954. Contribution a l'étude écologique des côtes rocheuses du Sénégal. *Mém. Inst. fr. Afr. noire* **38** : 1–342 + [1].
Note. From the note on p. 117, it is clear that the algae were worked on mainly by J. Feldmann, but that Sourie took account of some of the views of Dangeard as expressed in the latter's memoir on the Cap Vert (Dakar) peninsula algae. Since the exact contribution of the various people involved is in doubt, we have left the reference in the name of Sourie, who seems to have exercised overall authorship.

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Stafleu, F. A. *et al.* 1972. *International Code of Botanical Nomenclature adopted by the Eleventh International Botanical Congress, Seattle, August 1969*, 426 pp. Utrecht. *Regnum Vegetabile* **82.**

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295. **Stephenson, T. A. & Stephenson, A.** 1972. *Life between Tidemarks on Rocky Shores.* xii+[2]+425 pp. + Errata page. San Francisco.

296. **Suhr, J. N. v[on]** 1836. Beitrage zur Algenkunde. Nr. 2. *Flora Jena* **19** : 337–350.

297. **Suhr, J. N. von** 1837. Matériaux pour servir à l'étude des Algues. *Annls Sci. nat.* (Bot.) sér. 2, **7** : 171–176.

Note. This appears to be a direct translation into French of the text of the previous work, with no mention of the person who undertook the translation.

298. **Tandy, G.** 1944. Algae [p. 386, Appendix I]. *In* A. W. Exell, *Catalogue of the Vascular Plants of S. Tomé* (*with Principe and Annobon*). xi+[1]+428 pp. London.

Taylor, W. R. 1928. The marine algae of Florida with special reference to the Dry Tortugas. *Publs Carnegie Instn Washington*, **379** [*Pap. Tortugas Lab.*, 25] [6]+219+[37] pp.

299. —— 1960. *Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas.* ix+[3]+870 pp. Ann Arbor.

—— 1969. Notes on the distribution of West Indian marine algae particularly in the Lesser Antilles . . . *Contr. Univ. Mich. Herb.* **9** : [2]+125–203.

300. **Townsend, C. & Lawson, G. W.** 1972. Preliminary results on factors causing zonation in *Enteromorpha* using a tide simulating apparatus. *J. exp. mar. Biol. Ecol.* **8** : 265–276.

301. **Trochain, J.** 1940. Contribution a l'étude de la végétation du Sénégal. *Mém. Inst. fr. Afr. noire* **2** : [1–6]+1–433+[63].

Note. J. Feldmann clearly had a great deal to do with the main determinations on which the algal list (pp. 108–110) was based; since the extent to which the data were accepted or amended by Trochain is not clear, and since there are other parts to the text which seem definitely to have been attributable to Trochain, we have accepted the latter as overall author. For individual comments on species, the more correct authorship citation would undoubtedly be 'Feldmann, J., in Trochain, J.,' etc.

302. **Turner, D.** 1806–1808. *Fuci* . . . **1**. pp. [6]+1–164. London.

Note. This work, like others of a similar type in the nineteenth century, was first produced in fascicles of plates (mostly 6 per fascicle) and associated text. They seem to have been rather irregularly published, but W. T. Stearn (*pers. comm.*) has established that at least the first ten were produced before the end of 1806.

303. —— 1807–1809. *Fuci* . . . **2**. pp. [2]+1–162+[2]. London.

304. —— 1811. *Fuci* . . . **3**. pp. [2]+1–148+[2]. London.

305. —— 1819. *Fuci* . . . **4**. pp. [4]+1–153+[2]+7. London.

306. **Uriarte, L. Bellón** 1925. Nota sobre una *Saccorhiza bulbosa* (Huds.) La Pyl. de Melilla (Mediterraneo Occidental). *Nuova Notarisia*, Fasc. Commem. **1925** : 217–221.

307. —— 1929. Sobre la presencia accidental de la '*Saccorhiza bulbosa*' (Huds.) La Pyl. en el puerto de Málaga. *Rapp. P.-v. Réun. Commn int. Explor. scient. Mer Méditerr.* N.S., **4** : 149–159.

Valiante, R. 1883. Le Cystoseirae del golfo di Napoli. *Fauna und Flora des Golfes von Neapel . . ., VII. Monographie.* 1–30 pp. Leipzig.

308. **Vickers, A.** 1897 ? ['1896']. Contribution a la flore algologique des Canaries. *Annls Sci. nat.* (Bot.) sér. 8, **4** : 293–306.

Note. The date is somewhat difficult to cite as there is some confusion regarding the dates of various issues. It does seem possible that pre-prints were issued in 1896 and this is the date usually cited (see Lawson & Price, 1969 : 345–346).

309. **Viera y Clavijo, J. de** 1866; 1869. *Diccionario de Historia natural de las Islas Canarias, . . .* Tomo I [A–G], LXXXI+[1]+344 pp. (1866). Tomo II [H–Z], 311 pp. (1869). Las Palmas.

Note. See also no. 200 [Martin Aguado, 1957]. The MS was completed in 1799, with the title *Diccionario de Historia Natural de las Canarias*, but was not published until the above dates.

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Womersley, H. B. S. 1954. The species of *Macrocystis* with special reference to those on southern Australian coasts. *Univ. Calif. Publns Bot.* **27** : 109–132.

313. —— 1967. A critical survey of the marine algae of southern Australia II. Phaeophyta. *Aust. J. Bot.* **15** : 189–270.

314. —— **& Bailey, A.** 1970. Marine algae of the Solomon Islands. *Phil. Trans. R. Soc.* ser. B, **259** : 257–352.

Wynne, M. J. 1969. Life history and systematic studies of some Pacific North American Phaeophyceae (brown algae). *Univ. Calif. Publns Bot.* **50** : [6] + 1–88.

—— **& Loiseaux, S.** 1976. Recent advances in life history studies of the Phaeophyta. [Phycological Reviews **5**]. *Phycologia* **15** : 435–452.

Note added in proof:

During the printing of our paper, Aleem (1978) published a short list of marine algae of Sierra Leone (*Botanica mar.* **21** : 397–399). The records given are not included here and critical comment will be required for several listed species in appropriate subsequent parts and supplements of this series.

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D. L. Hawksworth

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The lichenicolous Hyphomycetes

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Contents

Synopsis

This paper presents a revision of all known obligately or primarily lichenicolous Hyphomycetes (Fungi, Deuteromycotina); no comprehensive survey of these fungi has previously been attempted. Forty-four species belonging to 23 genera are accepted and keys to these are provided. Of these, one genus and 17 species are described as new, one new name is introduced, and four new combinations are made. In addition, a new ascomycete genus, *Ascohansfordiellopsis*, is described to accommodate the perfect states of two *Hansfordiellopsis* species. Sixty taxa are excluded for a variety of reasons and combinations transferring four of these to other genera are made. A list of Hyphomycetes fortuitously occurring on lichens is included, and indexes to both the lichen hosts and the fungi growing on them are provided.

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Introduction

Lichenicolous fungi (i.e. fungi growing on lichens) are commonly encountered during the routine examination of lichen material both in the field and in the herbarium. They are frequently a source of some confusion either because they are mistaken for a part of their hosts or because they lead to deformations, discolourations, or other modifications of the infected thalli. In the absence of modern monographic surveys of these fungi it is both impossible for lichenologists to interpret easily what they encounter, and for mycologists to render them assistance.

In the course of my investigations of lichenicolous fungi, which started in *c.* 1971, it has become clear that the existing literature on most groups of lichenicolous fungi is totally inadequate, and not uncommonly quite unreliable with regard to the characters of the fungi involved, their systematic position, and the identifications of the host lichens. Particularly unsatisfactory are the studies on many of the Deuteromycotina (Fungi imperfecti) occurring on lichens and in this group the only way to be certain that a recently collected species, apparently restricted to lichens, had not previously been recognized, proved to be to revise all related fungi so far described. As the numbers of lichenicolous Deuteromycotina already present in the literature are considerable, to treat all in a single work would be a massive undertaking. The conidial fungi are generally divided into two major groups: the Hyphomycetes in which conidia are borne from hyphae or aggregations of hyphae, but not in delimited sporocarps, and the Coelomycetes where the conidia are borne in either flask-shaped (pycnidia) or disc-like (acervuli) sporocarps. As the Hyphomycetes are now a much better known group than the Coelomycetes (see, for example, the generic survey of Kendrick & Carmichael, 1973) these were selected for consideration first. When further progress in the taxonomy of the Coelomycetes as a whole has been made it will also be expedient to produce a revision of the lichenicolous fungi belonging to this group.

The main aim of the present contribution, therefore, has been to provide a survey of all known obligately or primarily lichenicolous Hyphomycetes based on the collections from which they were originally described. These data have, however, been supplemented by information from recent collections where these have been available, and the opportunity is taken to describe a number of such fungi for the first time.

The earliest name that has been interpreted as a lichenicolous hyphomycete appears to be *Lichen roseus* Schreb. (Schreber, 1771 : 140), although some considerable doubt now surrounds the interpretation of that name (see p. 280). Since that time lichenicolous Hyphomycetes have been described sporadically by both lichenologists and mycologists, but few authors have made a special study of them. Indeed, the only author to pay particular attention to their description and illustration in the nineteenth century was the Scottish lichenologist W. L. Lindsay (e.g. Lindsay, 1869*b*). Lists of the then known lichenicolous fungi and their hosts have been presented by several authors (Lindsay, 1869*a*; Arnold, 1874; Zopf, 1896) but these were largely uncritical compilations.

The first author to attempt a thorough survey of the world's lichenicolous fungi, including keys and descriptions of the species, was l'Abbé L. Vouaux; regrettably he was shot by invading troops in 1914, the year the last part of his study was published (Vouaux, 1914). Vouaux accepted 49 species of lichenicolous Hyphomycetes ranged amongst 25 genera. Unfortunately Vouaux saw little type material and was forced to rely heavily on the often hopelessly inadequate descriptions of many of his predecessors. A considerable number of imperfect lichenicolous fungi were described as new to science by Vouaux, but as most of his herbarium is lost (Rondon, 1970), the application of many of his names remains uncertain; it is regrettable that he published only descriptions and no illustrations of these fungi. Karl von Keissler (1930) produced a major survey of the lichenicolous fungi in continental Europe for *Rabenhorst's Kryptogamen-Flora* in which 36 species of Hyphomycetes, placed in 23 genera, were accepted. Keissler, in common with Vouaux, studied very few original collections.

More recently Deighton (1960, 1965) and Batista & Cavalcanti (1964), in particular, carried out pioneering studies on the Hyphomycetes restricted to the lichens that occur on the leaves of trees in the tropics (foliicolous lichens); these fungi had been almost unrecognized before, although two such species were discussed in detail by Hughes (1952).

I have described and revised a number of lichenicolous Hyphomycetes in some previous publications (Hawksworth & Punithalingam, 1973; Hawksworth, 1975*a*, 1977*a*) and the present paper represents a continuation of these investigations.

Some mention must also be made of the work of Clauzade & Roux (1976) who attempted to compile keys to all lichenicolous fungi described throughout the world. Again this was largely an uncritical compilation, as the authors themselves stressed, necessarily drawing heavily on the inadequate work of earlier authors and omitting some taxa described since the compilations of Vouaux (1912–14) and Keissler (1930). These authors treated 53 species of lichenicolous Hyphomycetes distributed amongst 30 genera; as an indication of the paucity of our knowledge on this ecologically fascinating group of fungi even at such a late date, the fates of these taxa are summarized in Table 1.

Table 1 Disposition of the 53 species of lichenicolous Hyphomycetes treated by Clauzade & Roux (1976) in the present revision

	Number of species
Accepted here	10
Synonyms of species accepted here	4
Fungi fortuitously present on lichens	11
Fungi not on lichens	3
Lichenized fungi	3
Lichenicolous fungi other than Hyphomycetes	5
Not fungi (i.e. algae, bacteria, etc.)	5
Names of uncertain application	12
Total	53

Note: 14 species described prior to 1976, additional to those listed as accepted above, are also accepted in the present revision.

Although the available information on the world's lichenicolous Hyphomycetes is reviewed here, this contribution is *not* to be considered as a definitive monograph of all such fungi. Lichenicolous fungi are so rarely collected by mycologists and lichenologists that there can be little doubt that the bulk of such fungi which occur in nature still remain to be discovered and described. Some support for this thesis may perhaps be derived from the number of new taxa introduced in the present paper. This revision is consequently rather to be viewed as providing a basis for future studies by (*a*) presenting keys based on the examination of original material and not merely published descriptions, and (*b*) discussing the application of all names so far proposed for these fungi. I also hope that this publication will stimulate both mycologists and lichenologists to look for and study lichenicolous Hyphomycetes.

Lastly, it should be emphasized that, with few exceptions (e.g. Gams, 1971; Hawksworth, 1975*b*), little work has been carried out in recent years on the behaviour of lichenicolous fungi in culture, *or* the isolation of sterile mycelium into culture to facilitate determination, *or* surface sterilization and isolation from unhealthy thalli, *or* the keeping of sterile material in damp chambers so as to stimulate sporulation. Exploration of all these avenues will undoubtedly contribute substantially to our knowledge of lichenicolous fungi in the future. With the existence of pure cultures the possibility of inoculation experiments in order to determine the pathogenicity of the fungi would also exist.

Biological and taxonomic concepts

Biological concepts

The foremost aim of this revision was to consider the obligately lichenicolous Hyphomycetes now known. While in most cases there is little doubt that the restriction to lichenized fungi is obligate, it is important to appreciate that (*a*) some may persist on the substrate after the death of the host (e.g. *Refractohilum achromaticum*, possibly *Monodictys lepraria*), (*b*) some may be primarily associated with the alga in the lichen and not the fungal partner (e.g. *Ampullifera pirozynskii*, *Leightoniomyces phillipsii*) and (*c*) some fungi currently known only from lichenized fungi may not really be restricted to them, but simply not yet known from other substrates (e.g. *Acremonium antarcticum*, *A. rhabdosporum*, *Dendrodochium subeffusum*, *Endophragmiella hughesii*, *Monodictys anaptychiae*). One or two fungi accepted here as lichenicolous might perhaps prove to be the same as some non-lichenicolous recognized species if they were grown in pure culture (e.g. *Trimmatostroma lichenicola*), but I am not convinced that the lichenicolous habit *per se* can account for the marked divergences found between lichenicolous and non-lichenicolous species of the same genus, particularly as many fungi occurring occasionally on lichens by chance have their characters unmodified.

Table 2 Summary of Hyphomycetes fortuitously occurring on lichenized fungi

Acremonium strictum W. Gams
Aspergillus candidus Link ex Link group
A. glaucus Link
Cladosporium sphaerospermum Penz.
Corynespora sp.
Cryptocoryneum rilstonii M. B. Ellis
Cylindrocarpon janthothele var. *majus* Wollenw.
C. lichenicola (C. Massal.) D. Hawksw.
Epicoccum purpurascens Ehrenb. ex Schlecht.
Gliocephalis pulchella (Penz. & Sacc.) D. Hawksw.
Oidiodendron rhodogenum Robak
Penicillium claviforme Bain.
Raffaelea barbatum (Ellis & Everh.) D. Hawksw.
Stemphylium botryosum Wallr.
Taeniolella breviuscula (Berk. & Curt.) S. Hughes
T. scripta (P. Karst.) S. Hughes
Trichothecium roseum (Pers. ex Fr.) Link ex Fr.
Verticillium lecanii (Zimm.) Viégas

Note: Most of the above taxa are discussed under Excluded species below; records of the remainder are supported by material in IMI.

It might be anticipated that a wide range of saprophytic Hyphomycetes would occur, occasionally at least, on lichen thalli. Although a number of such cases are known (compiled in Table 2), such fungi are much less commonly encountered in the field on lichens than on decaying or unhealthy phanerogams, pteridophytes and bryophytes. In Table 2 note particularly the absence of *Botrytis*, and the very few taxa in *Aspergillus*, *Cladosporium*, *Penicillium*, etc. listed. It is also of interest that many genera of plant pathogenic fungi have few or no species able to attack lichenized hosts, even though they may be able to grow on large numbers of vascular plants. Hale (1967 : 119) emphasized this point and also related it to the long life spans of many lichens. The lichen products (phenolic compounds encrusting lichen hyphae) have been considered as possibly the cause of this phenomenon but remarkably little experimental work on the effects of lichen acids on other fungi has been carried out. The only pertinent paper of which I am aware is the study of Henningsson & Lundström (1970) in which ground lichen thalli, lichen extracts and usnic acid reduced or inhibited the growth of six fungi tested (*Allescheria terrestris*, *Chaetomium globosum*, *Lenzites betulina*, *L. sepiaria*, *Polyporus abietinus* and *Stereum sanguinolentum*).

With the possible exception of the species occurring on some foliicolous lichens (see below), most obligately or primarily lichenicolous fungi, accepted in the main body of the present work, appear to have restricted host ranges, to judge from the material so far available; the restriction is sometimes to single genera or species. This restriction was not always apparent from the extant literature, as in the case of *Sclerococcum sphaerale* where 15 hosts from several genera are mentioned in print, although the fungus proves to be restricted to two (or possibly three) closely allied *Pertusaria* species (see Hawksworth, 1975*a* : 225). Some of the obligately lichenicolous Hyphomycetes are pathogens and can cause the death of the host (e.g. *Illosporium carneum*), but most cause relatively little damage (e.g. *Leightoniomyces phillipsii*, *Milospium graphideorum*, *Sclerococcum sphaerale*). In infections by *Refractohilum* species, galls are characteristically formed. Such deformations are, however, rather rarely caused by Hyphomycetes, although not uncommonly by some ascomycetes growing on lichens (see, for example, Hawksworth, 1975*b*, 1978*b*). In cases where the apothecia are invaded (e.g. *Bispora christiansenii*, *Pseudocercospora lichenum*, *Trimmatostroma lichenicola*, *Xanthoriicola physciae*) severe infections inevitably interfere with ascosporogenesis, and where extensive growths occur over thallus surfaces photosynthetic ability is also presumably reduced. Interestingly, no lichenicolous hyphomycete is known to produce the clearly delimited black-bordered necrotic patches recalling those formed by some Coelomycetes on *Parmelia* thalli (see Hawksworth & Punithalingam, 1973; Hawksworth, 1976, 1977*b*).

In the cases of invasions of foliicolous lichens, specificity and host relations proved almost impossible to work out. Many of the fungi concerned are so minute that they are generally encountered by accident, especially while producing 'Necol' mounts, or when the hosts are so heavily infected that determination is precluded, or on algae in early stages of lichenization which are still sterile and indeterminate. Even though the hosts could not be recognized in many instances, on individual leaves the fungi generally were restricted to particular thalli and not present irrespective of the host on the leaves; not uncommonly several determinable thalli free from the fungus would occur on a leaf and the fungus be restricted to an additional indeterminate type. Except in the case of *Hansfordiellopsis lichenicola* (and perhaps some other species of its genus), which appears to be adapted to foliicolous lichens with setae (the fungus often spreading up the setae), I suspect that many of such fungi may eventually prove to be restricted to either particular lichens or particular algae which can be lichen phycobionts (algal partners). Surprisingly, Santesson (1952 : 39) reported finding only 10 Fungi imperfecti on foliicolous lichens, of which nine belonged to the coleomycete genus *Pyrenotrichum* Mont. (syn. *Chlorocyphella* Speg.), but these did show a high degree of host specificity; 15 foliicolous lichenicolous Hyphomycetes are accepted below.

My investigations have been primarily concerned with the taxonomy of the fungi and I have made no attempt to determine the nutritional relationships between the bionts in the lichenized condition and the invading fungus. This is clearly a field in which ultrastructural work is required but none so far appears to have been carried out. As emphasized elsewhere (Santesson, 1967; Hawksworth, 1978a) a wide range of types of relationships exists between lichenicolous fungi and their hosts and it may well be that some of the lichenicolous Hyphomycetes, which are scarcely or not pathogenic, are more correctly interpreted as parasymbionts (i.e. symbiotic* with a pre-existing symbiosis) or, adopting Poelt's (1977) terminology, constituting a three-membered symbiosis.

Few of the lichenicolous Hyphomycetes have known perfect (teleomorphic) states. These are *Hansfordiellopsis elongata* and *H. lichenicola* with perfect states in the newly described genus *Ascohansfordiellopsis*, and *Illosporium carneum* with *Nectriella robergei* as its perfect state. *Niesslia cladoniicola* ascospores produce an imperfect *Monocillium* state in pure culture, but the conidial state has not itself been found on the host (Hawksworth, 1975*b*).

It might perhaps be expected that some lichen-forming fungi would have hyphomycete imperfect states but the evidence for this is meagre and in need of a critical examination. Hale (1957) claimed that ascospores ejected from *Buellia stillingiana* Steiner gave rise to *Sporidesmium folliculatum* (Corda) Mason & S. Hughes; while the identity of the fungus is not in doubt (deter-

* 'Symbiosis' is used here in its original sense of dissimilar organisms living together, and does not imply that the association is mutualistic.

mined by Dr S. J. Hughes; DAOM 43340, IMI 69050), it is difficult to accept that this was not a contaminant, because ascospores of other lichens have failed to give rise to comparable imperfect states. Furthermore, *S. folliculatum* is a widespread species in Europe as well as in North America, although the *Buellia* is restricted to North America, and attempts to repeat Hale's work have been unsuccessful (Ahmadjian, 1965). Perhaps more reliable are reports of the production of conidia by the isolated fungal components of *Phaeographina fulgurata* (Fée) Müll. Arg. and *Lecidea erratica* Körb. (Ahmadjian, 1963) but these do not appear to resemble any known fungi or lichenicolous taxa considered here, and must be regarded as exceptional in view of the large number of mycobionts (fungal components of lichens) now known in culture. Riedl's (1976*a*) report of an imperfect state recalling *Coniothecium toruloides* Corda in *Bacidia chlorococca* (Stenh.) Lett. appears dubious on the basis of his illustrations, and requires re-investigation; *Coniosporium aeroalgicola* Turian, described as partially lichenized and occurring on corticolous green algae (Turian, 1977), should also be considered further.

Mention must also be made of the erect, peltate, but partly synnematous, structures termed 'hypophores' recently recognized in a few foliicolous lichens belonging to the genera *Echinoplaca* and *Tricharia* (Vězda, 1973, 1975; Sérusiaux, 1977). These hypophores superficially recall the parasymbiont coelomycete genus *Pyrenotrichum* and are of unknown function, but, according to Vězda (1973), are definitely a part of the lichen and not an invading lichenicolous fungus. As true flask-shaped pycnidia are unknown in both *Echinoplaca* and *Tricharia* (Santesson, 1952) it is perhaps conceivable that these structures have a spermatial role, but thorough ontogenetic studies are required to establish their function.

Some lichenized Hyphomycetes and Coelomycetes have been described (e.g. Batista, 1961; Batista & Maia, 1965; Funk, 1973) which have no known ascospore-producing phase but these are currently very imperfectly known, regarded with some scepticism by many lichenologists, and largely ignored in recent accounts of lichen systematics (e.g. Henssen & Jahns, 1973; Poelt, 1974). Numerous lichens are, however, known to produce pycnidia (see Smith, 1921 : 192–208) but little attention has been paid to these structures this century by either lichenologists or mycologists. As some lichenized taxa chiefly occur only as their pycnidial state (e.g. *Catillaria griffithii* (Sm.) Malme, *Opegrapha vermicellifera* (Kunze) Laund.), some coelomycete lichens lacking the ability to ever form ascospore-producing structures were perhaps to be anticipated; further, the ability of conidia from the pycnidia of several lichens to germinate and grow in pure culture (and in one case to form a pycnidium-like primordium) has recently been demonstrated (Vobis, 1977). That no lichens with hyphomycete imperfect states are currently recognized in nature (see p. 187) does not, however, mean that consistently lichenized Hyphomycetes might not be expected to occur, as lichenization is best viewed as a repeatedly evolving nutritional state (Hawksworth, 1978*a*). Nevertheless, it is possible that some of the conidial lichens so far described represent sterile thalli of other lichens infected with lichenicolous fungi. A critical revision of these associations is urgently required, but this a major undertaking falling outside the scope of this present work.

Taxonomic concepts

The criteria used for the classification of the Hyphomycetes at the generic level have undergone a traumatic re-thinking, mainly during the last 25 years, with paramount importance now being accorded to the precise mode of conidiogenesis (see, for example, Ellis, 1971; Kendrick, 1971; Subramanian, 1972; Kendrick & Carmichael, 1973). The typification of the genera of Hyphomycetes has also been rather thoroughly investigated compared with many other groups of fungi (Hughes, 1958; Kendrick & Carmichael, 1973). This enormous progress has taken place after most of the lichenicolous Hyphomycetes were last studied (in fact most had not been examined since their original description), and it was therefore not surprising to find that many taxa had been placed in genera which, according to modern concepts, are quite inappropriate.

As an example of the extent of revisionary work required, the case of the six species accepted by Keissler (1930) in *Coniothecium* might be mentioned. Hawksworth (1975*a*) found that these comprised two monotypic genera of Hyphomycetes (two of the previously accepted species being conspecific in one of these), a lichenicolous coelomycete, a member of a genus of saprophytic Hyphomycetes, and even a lichenized ascomycete (in which the ascospores were mistaken for conidia).

In the taxonomic treatments adopted here, the generic concepts currently accepted by specialists in the Hyphomycetes have been followed, the obligately lichenicolous genera of which are distinguished both from each other, and from non-lichenicolous allies, by conidiogenesis, pigmentation (although this is not a valid generic criterion in all groups of Hyphomycetes) and the types of conidia. The size and degree of septation of the conidia is used at the specific level, usually combined with other features, to provide the species concept. As I have pointed out elsewhere, for me species should ideally be separated from one another by discontinuities in several unrelated characters (Hawksworth, 1974 : 42); this approach has been followed here wherever possible. Occurrences on different hosts are not in my opinion sufficient to justify the recognition of separate species unless they are correlated with differences in the characters of the fungi themselves. In an earlier study on *Lichenoconium* (Hawksworth, 1977*b*), when the taxa were delimited without regard to the host, some proved to be restricted to particular hosts whilst others did not; this has also proved to be true amongst the lichenicolous Hyphomycetes.

In the present contribution, Hyphomycetes that prove to be saprophytes apparently only fortuitously present on lichens are merely compiled in Table 2; those previously mentioned in the literature are also treated under Excluded species (pp. 266–289). This approach was adopted because an adequate literature for the determination of most commonly encountered ubiquitous saprophytic fungi already exists (see Kerrich *et al.*, 1978, for references) and the number of such fungi that might be found by diligent searching is perhaps very large. The keys and detailed taxonomic treatments presented below deal only with the obligately or primarily lichenicolous Hyphomycetes. If a fungus is found on an unhealthy or decayed lichen the extensive literature on other Hyphomycetes must be consulted in addition to this compilation before deciding that the organism represents a new taxon.

Methods

In order to ascertain the Hyphomycetes that had been described from lichens, the host indexes available to the following standard compilations of fungal names were abstracted: Saccardo (1882–1931; host-index in manuscript at CMI), Petrak (1930–44, 1950) and the *Index of Fungi* (1940 on; inclusive of *A Supplement to Petrak's Lists 1920–1939*, 1969). These data were supplemented by works prepared specifically for lichenicolous fungi (Lindsay, 1869*a*; Arnold, 1874; Zopf, 1896; Vouaux, 1912–14; Keissler, 1930; Clauzade & Roux, 1976) and also some regional listings that also covered fungi occurring on lichens (e.g. Oudemans, 1919; Viégas, 1961). Further data were obtained from the study of a large number of individual papers both by mycologists and lichenologists. As it has been found that several lichenicolous fungi were not in fact recognized as such even by eminent mycologists describing them as new (e.g. *Chaetosphaeria insectivora* Hansf. described as on scale insects, *Periconia phillipsii* Berk. & Leight. described as on soil) it is inevitable that some names will nevertheless have been overlooked. The importance of studying mycological literature as a whole in the determination of lichenicolous fungi, and not only works specifically covering these, will thus be evident.

The specimens supporting the various published reports were then traced wherever possible and re-examined, supplemented by other collections available. As stressed in the Introduction no attempt to revise all material in the world's herbaria has been made in this study. Type or authentic material was obtained from the following herbaria: B, BM, CBS, E, FH, H, IMI, K, LINN, LPS, MA, NY, PAD, UPS, URM, S, VER, W and herb. Vouaux (with Prof. Y. Rondon at Marseille); herbarium abbreviations follow Holmgren & Keuken (1974). An exclamation mark (!) indicates that I have examined the specimen cited.

For routine examination lactophenol cotton-blue (20 g phenol : 20 g lactic acid : 40 g glycerine : 20 g water : a few drops of cotton-blue) was employed; it should be noted that using this reagent slides need to be heated to almost boiling to ensure maximum absorption of stain and reduce the possibilities of structures tending to shrink slightly in size. Slides made with this mountant sealed with Glyceel are semi-permanent and those prepared from most specimens examined in this study are preserved in IMI. For particularly dark structures, lactophenol without cotton-blue is more satisfactory. In order to work out details of conidiogenesis, particularly with almost or entirely hyaline species, a temporary erythrosin mountant (0·5 g erythrosin : 100 ml 10% ammonia) proved most satisfactory.

Where necessary, sections of 10–20 μm in thickness prepared with the aid of a freezing microtome were also examined.

The scanning electron micrographs in Figs 13, 19, 24 and 42 were taken with an ISI–60 SEM using air-dried specimens coated with gold.

Key to the genera

This artificial key is to the genera treated in the following section of this work, i.e. the obligately or primarily lichenicolous Hyphomycetes, and does not include Hyphomycetes fortuitously occurring on lichenized hosts (see Table 2). In the case of genera, including lichenicolous species, which are not described in detail in the following section (as they have been discussed by me elsewhere) fuller information is provided here than for the other taxa. It should be stressed that this key is designed only for the lichenicolous species of genera treated, and does not necessarily also allow for the total ranges of non-lichenicolous species belonging to them.

1	Conidia hyaline or pinkish at maturity	2
–	Conidia pale brown to dark brown at maturity	7
2(1)	Conidiogenous cells phialidic	3
–	Conidiogenous cells annellidic or blastic	6
3(2)	Conidia subglobose, ellipsoid or cylindrical, not curved, 0–1 septate	4
–	Conidia curved, with a heel-like basal cell, to 5-septate	**Fusarium** (p. 217)
4(3)	Conidiophores mononematous, not forming compact sporodochia	5
–	Conidiophores forming compact applanate sporodochia	**Dendrodochium** (p. 211)
5(4)	Conidiogenous cells very delicate and thin-walled throughout	**Acremonium** (p. 192)
–	Conidiogenous cells delicate above but the basal parts with thickened and refractive walls	**Monocillium** (p. 239)
6(2)	Conidiogenous cells annellidic; conidiophores monqnematous; conidia 0–3 septate, ellipsoid, with a highly refractive basal hilum	**Refractohilum** (p. 248)
–	Conidiogenous cells monoblastic or polyblastic; conidiophores indistinct, forming flesh coloured, orange or reddish compact convex sporodochia; conidia non-septate, globose or angular, without a refractive hilum	**Illosporium** (p. 231)
7(1)	Conidiophores mononematous	8
–	Conidiophores forming distinct synnemata; to 250 μm tall; conidiogenous cells annellidic, ampulliform; conidia globose, non-septate, dark brown, coarsely verrucose, (8–)9–12(–14) μm	**Leightoniomyces phillipsii** (p. 238)
8(7)	Conidiogenous cells annellidic, blastic or tretic	9
–	Conidiogenous cells phialidic with broad collarettes; conidiophores immersed; conidia globose, non-septate, verrucose, 3·5–6 μm diam	**Xanthoriicola physciae** (p. 266)
9(8)	Superficial mycelium with mucronate-hyphopodia or hyphopodium-like cells	10
–	Superficial mycelium lacking hyphopodia	12
10(9)	Conidia formed in acropetal chains, 0–3 septate, cells ±concolorous	**Ampullifera** (p. 195)
–	Conidia formed singly, 3-many septate or muriform, the apical cell elongated and paler than the basal cells	11
11(10)	Conidiogenous cells arising singly and vertically from repent hyphae	**Hansfordiellopsis** (p. 220)
–	Conidiogenous cells in chains and horizontally arranged	**Dictyophyrnella** (p. 213)

12(9) Conidia globose, ellipsoid, doliiform or obclavate 13
– Conidia palmate, comprising to *c.* 50 radiating multiseptate slightly arcuate arms **Psammina** (p. 244)

13(12) Conidia all non-septate at maturity 14
– Conidia 1-many septate at maturity or multicellular 16

14(13) Conidia subglobose or doliiform 15
– Conidia irregularly lobed, the outer walls becoming unevenly thickened, dark brown, smooth-walled, mainly 6–17(–20) × 5–10 μm . . . **Milospium graphideorum** (p. 238)

15(14) Conidiophores macronematous; erect; conidia doliiform, forming long chains **Ampullifera** (p. 195)
– Conidiophores semi-macronematous, sporodochial; conidia subglobose **Sclerococcum** (p. 249)

16(13) Conidia muriform or multicellular 17
– Conidia with transverse septa only 20

17(16) Conidiophores semi-macronematous, not percurrently proliferating 18
– Conidiophores macronematous, percurrently proliferating and leaving distinct annellations on the conidiophores; conidia obclavate with a pale elongate apical cell and 1–3 basal appendages . . . . **Teratosperma** (p. 260)

18(17) Conidiophores superficial 19
– Conidiophores ± entirely immersed in the host; conidia very variable, multicellular, mainly elongate-ellipsoid . . . . **Trimmatostroma** (p. 264)

19(18) Conidiophores scattered or loosely aggregated; conidiogenous cells simple, much narrower than the conidia they give rise to; conidia smooth or verrucose . **Monodictys** (p. 241)
– Conidiophores arranged in compact sporodochia; conidiogenous cells often complex, ± same width as the conidia they give rise to; conidia smooth . . **Sclerococcum** (p. 249)

20(16) Conidia 2-many septate when mature 21
– Conidia 1-septate when mature, sometimes separating with difficulty 25

21(20) Conidiogenous cells percurrently proliferating 22
– Conidiogenous cells not percurrently proliferating 23

22(21) Conidia obclavate, the apical cell elongate and paler . . . . **Teratosperma** (p. 260)
– Conidia clavate, the basal cell paler. . . . . . . **Endophragmiella** (p. 215)

23(21) Conidiogenous cells monoblastic; conidia with the apical cell paler 24
– Conidiogenous cells polyblastic; conidia even in colour . . **Pseudocercospora** (p. 246)

24(23) Conidiogenous cells arranged in chains creeping over the surface of the host with the conidia borne from their dorsal side . . . . . . **Sessiliospora** (p. 250)
– Conidiogenous cells arising singly, vertical . . . . . **Hansfordiellopsis** (p. 220)

25(20) Conidiophores semi-macronematous; conidiogenous cells monoblastic. 26
– Conidiophores macronematous; conidiogenous cells polyblastic . . **Cladosporium** (p. 209)

26(25) Conidia very pale brown, ellipsoid with rounded ends, readily separating . **Bispora** (p. 207)
– Conidia brown to dark brown, doliiform with truncated thin-walled ends, separating with great difficulty . . . . **Taeniolella** (p. 253)

Accepted species

The accepted genera and species have been arranged alphabetically for ease of reference. In the case of genera comprising more than a single obligately lichenicolous species, keys to the species are included after the account of the genus itself. Descriptions and full synonymies for taxa treated by me in previous publications are omitted, but references to the publications in which they are discussed are provided and the diagnostic characters included in the keys. For genera comprising lichenicolous and non-lichenicolous species, the generic diagnoses cover the genus as a whole.

I. ACREMONIUM Link ex Fr.

Syst. mycol. **1** : xliv (1821).

See Gams (1971 : 38) for synonyms of this generic name.

Colonies usually effuse; mycelium usually superficial, irregularly branched, hyaline or slightly pigmented, smooth or somewhat verruculose, sometimes forming pigments in the medium when grown in artificial culture. Stroma, setae and hyphopodia absent. Conidiophores micronematous, semi-macronematous or macronematous, arising singly or in loose sporodochia, sometimes arising from ropes of hyphae (plectonematogenous), hyaline or pigmented, simple or sparsely branched. Conidiogenous cells phialidic, discrete, terminal, narrowly subulate and tapering to the apex, hyaline or pigmented. Conidia solitary, either catenate or adhering in a slimy mass, subglobose to ellipsoid, rounded or truncated at one or both ends, more rarely subcylindrical, simple or 1-septate, hyaline or pigmented, smooth or slightly verruculose.

Type species: *Acremonium alternatum* Link ex Gray.

Number of species: About 105 are now recognized, of which 96 are described in detail by Gams (1971, 1975). Four species are so far known only from lichens or may be primarily lichenicolous, and a fifth may be fortuitously lichenicolous.

Perfect state: *Acremonium*-like imperfect states are known in about 17 genera of Sphaeriales (see Gams, 1971 : 19–21; Samuels, 1976).

Key to the lichenicolous species

1 Conidia less than 10 μm long. 2
– Conidia 12–18 × 2–2·5 μm . . . . **Acremonium rhabdosporum** (p. 194)

2 Conidiophores not or sparsely branched, smooth-walled 3
– Conidiophores branched and forming lax sporodochial tufts, verruculose; conidia simple, 4–6 × 2–3 μm . . . . **Acremonium spegazzinii** (p. 195)

3 Conidia all simple 4
– Conidia becoming 1-septate, 5–9·5 × 1·5–2·5 μm . . . . **Acremonium lichenicola** (p. 194)

4 Conidiogenous cells 20–40(–65) μm tall; conidia mainly 3·5–5·5 × 1–2 μm, length : breadth ratio 2·5–4; fortuitously lichenicolous (?) . . . . **Acremonium strictum** W. Gams (p. 269)
– Conidiogenous cells 15–20 μm tall; conidia 4–5·5(–6) × 1·5–2·5(–3) μm, length : breadth ratio 2–2·5 . . . . **Acremonium antarcticum** (p. 192)

1. **Acremonium antarcticum** (Speg.) D. Hawksw. **comb. nov.**
(Fig. 1A)

Sporotrichum antarcticum Speg., *An. Mus. nac. B. Aires* **20** : 416 (1910).
Type: Antarctic Islands, South Orkney Islands, on *Caloplaca* cf. *regalis* (Vain.) Zahlbr., January 1908, *C. Spegazzini* (LPS 21677—holotype!).

Colonies effuse, superficial, felted, white, arising on the host thallus; mycelium mainly superficial and only scarcely penetrating the cortex of the host, hyphae flexuose, thin-walled, hyaline, 1–2 μm wide. *Conidiophores* semi-macronematous, mononematous or loosely aggregated, unbranched or with one branch at the base, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, 15–20 μm tall, *c.* 2 μm wide at the base but tapering to 1–1·5 μm at the apex. *Conidia* solitary, adhering in a slimy mass, ellipsoid, rounded at the apices, simple, hyaline, smooth-walled, 4–5·5(–6) × 1·5–2·5(–3) μm (length : breadth ratio 2–2·5).

Host: The host was given as *Teloschistes* by Spegazzini (*loc. cit.*) but in fact represents a subfruticose pulvinate *Caloplaca* (of the type placed by Dodge (1973) in *Polycauliona* Hue), probably *C. regalis* (Vain.) Zahlbr., but the host is in a fragmentary condition.

Distribution: South Orkney Islands. Known only from the type collection.

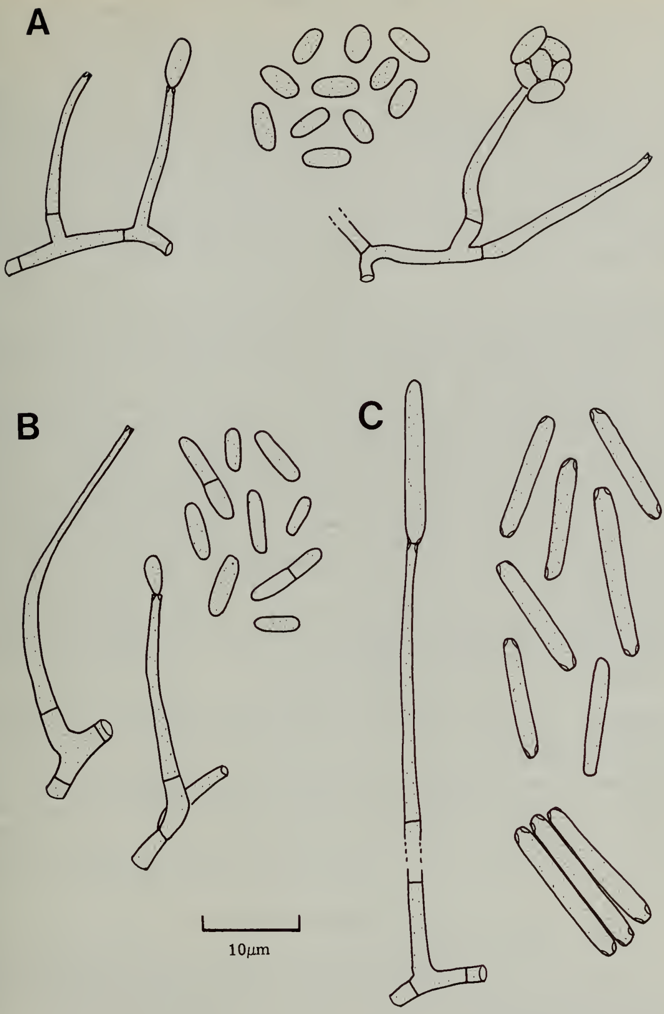

Fig. 1 A, *Acremonium antarcticum* (LPS 21677—holotype). **B,** *A. lichenicola* (IMI 225007). **C,** *A. rhabdosporum* (IMI 223813—isotype).

Observations: This species shows some affinity with both *A. charticola* (Lindau) W. Gams and *A. strictum* W. Gams but it differs from *A. charticola* in the shorter conidiogenous cells and less rounded conidia, and from *A. strictum* in the shorter conidiogenous cells and relatively broad conidia (3·3–5·5(–7) × 0·9–1·8 μm; length : breadth ratio 2·5–4(–4·9) *fide* Gams, 1971).

The host in the type collection is also infected with a second fungus, most probably belonging in *Polycoccum*, with brown 1-septate echinulate fusoid ascospores about 16 × 5 μm; the specific identity of this fungus is uncertain at present. As the *Acremonium* is largely superficial it is probable that it is an opportunist colonizing thalli already adversely affected by the *Polycoccum*. *Acremonium antarcticum* should therefore be searched for on non-lichen hosts and substrates.

When further fresh material becomes available, this species should be studied in culture to ascertain whether the diagnostic short conidiogenous cells remain in the same size range or not; if they do not and the conidia also become more rounded the fungus should be subsumed with *A. charticola*.

2. Acremonium lichenicola W. Gams, Cephalosporium-*art. Schimmelpilze*: 134 (1971). (Fig. 1B)

Type: Germany, Plön District, Schuttbrehm, isol. ex *Betula* litter, May 1965, *W. Gams* (CBS 425.66—holotype; IMI 224426—isotype!).

Colonies only known in culture, reaching 6–10 mm diam in 10 days on malt agar at room temperature, slightly pulverulent or moist and slimy, at first pale pinkish or yellowish but later becoming ochraceous or greyish-brown; mycelium partly immersed in the agar and partly superficial, hyphae flexuose, abundantly branched, thin-walled, hyaline, mainly 1·5–2·5 μm wide. *Conidiophores* semi-macronematous, mononematous, unbranched, usually with a short basal cell which can be slightly chromophilic, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, 30–65 μm tall, 2–3 μm wide at the base but tapering to 1–1·5 μm at the apex. *Conidia* solitary, adhering in a slimy mass, subcylindrical, rounded at the apices, 0–1 septate, hyaline, smooth-walled, 5–9·5 × 1·5–2(–2·5) μm (length : breadth ratio 3–4·4).

Hosts: Reported by Gams (1971 : 135) as isolated from an unnamed *Cladonia*, unnamed lichen apothecia, an unnamed lichen, lichens overgrowing a *Stereum* species, algal-covered bark, *Alnus* bark, *Betula* litter and *Phaeobulgaria inquinans* (Fr.) Nannf.

Distribution: Belgium, Germany and The Netherlands.

Observations: It is not clear whether this is primarily a lichenicolous species or a saprophyte fortuitously occurring on lichens. The ecology of this fungus and its effects on lichenized hosts require further investigation.

Additional specimens (see also Gams, 1971): **Germany**: Plön District, Schüttbrehm, isol. ex *Phaeobulgaria inquinans* on *Quercus*, October 1965, *W. Gams* (CBS 776.69, IMI 225008!); *loc. cit.*, isol. ex algal-covered bark, October 1965, *W. Gams* (CBS 777.69, IMI 225007!).

3. Acremonium rhabdosporum W. Gams, Cephalosporium-*art. Schimmelpilze*: 136 (1971). (Fig. 1C)

Type: Austria, Innsbruck, near Aldranser Alm, isol. ex *Cladonia* sp., October 1965, *M. Gams* (CBS 438.66—holotype; IMI 223813—isotype!).

Colonies only known in culture, reaching 8 mm diam in 10 days on malt agar at room temperature, rather slimy, greyish, reverse slightly yellowish; mycelium partly immersed in the agar and partly superficial, hyphae flexuose, abundantly branched, thin-walled, hyaline, mainly 1·5–2·5 μm wide. *Conidiophores* semi-macronematous, mononematous, unbranched, usually with a distinct short basal cell, hyaline. *Conidiogenous cells* phialidic, discrete, terminal, narrowly subulate, hyaline, thin-walled, smooth-walled, 40–80 μm tall, 2·5–3 μm wide at the base but tapering to 1–1·5 μm at the apex. *Conidia* solitary, adhering in a slimy mass often arranged parallel to each other, elongate-cylindrical, the apices with annular thickenings of the wall, simple, hyaline, smooth-walled, 12–18 × 2–2·5 µm (length : breadth ratio 6·4–7·5).

Host: Isolated from a *Cladonia* species.

Distribution: Austria. Known only from the original isolation.

Observations: This species occupies a rather isolated position in *Acremonium* by virtue of the very long and narrow conidia with characteristic annular thickenings at their ends.

4. Acremonium spegazzinii D. Hawksw. **nom. nov.**
(Fig. 2)

Verticillium lichenicola Speg., *Boln Acad. nac. Cienc. Córdoba* **11** : 612 [p. 234 of reprint] (1889); as '*lichenicolum*'.
Type: Brazil, on decayed thallus of *Leptogium andinum* P. M. Jørg., 1880, *J. Puiggari 127* (LPS 11.339—holotype!).
Non *Acremonium lichenicola* W. Gams ex anno 1971.

Colonies discrete, mainly superficial, tufted, white, arising on decayed parts of the host thallus; mycelium partly immersed, hyphae flexuose, thin-walled, smooth-walled to verruculose, hyaline, rather variable in thickness, mainly 2–4 µm wide. *Conidiophores* semi-macronematous, aggregated into lax sporodochial-like tufts 200–400 µm diam, branched but irregularly so and not clearly verticillate, hyaline, verruculose, mainly 3–5 µm wide. *Conidiogenous cells* phialidic, discrete, terminal, subulate, hyaline, thin-walled, inconspicuously to clearly verruculose, 20–60 µm tall, mainly 3–3·5 µm wide at the base but tapering to 1·5–2·5 µm at the apex. *Conidia* solitary, adhering in a slimy mass, elongate-ellipsoid, rounded at the apices, simple, hyaline, apparently smooth-walled but perhaps very minutely verruculose, 4–6 × 2–3 µm (length : breadth ratio 2·5–4).

Host: Spegazzini originally gave the habitat as 'In margine apotheciorum *Physciae* et *Peltigerae*' but neither of these genera is present in the type material. The decayed thallus of a *Leptogium* species, which from its ascospores appears to be the recently recognized *L. andinum* P. M. Jørg., known from Bolivia and Colombia but not previously reported from Brazil (Jørgensen, 1975 : 439), predominates and is heavily infected by a member of the *Aspergillus glaucus* group. The *Acremonium* is restricted to the *Leptogium* but occurs scattered over the thallus and not only in the vicinity of the apothecia. Some fronds of *Heterodermia leucomelos* (L.) Poelt, perhaps the basis of Spegazzini's reference to *Physcia*, are also present but not infected by the *Acremonium*.

Distribution: Brazil. Known only from the type collection.

Observations: This fungus is probably most suitably accommodated in *Acremonium* sect. *Nectrioidea* W. Gams which already contains some verruculose species, for example *A. butyri* (van Beyma) W. Gams (conidial state of *Nectria viridescens* C. Booth) verruculose only at the base of the phialides, and both *A. trachycaulon* W. Gams and the *Acremonium* state of *Nectria freycineteae* G. Samuels which are verruculose throughout but have larger conidia than *A. spegazzinii*.

In view of the decayed condition of the host, it is possible that *A. spegazzinii* is not an obligately lichenicolous fungus but rather an opportunist.

II. AMPULLIFERA Deight.

Mycol. Pap. **78** : 36 (1960).
Ampulliferella Bat. & Caval., *Port. Acta Biol.* B, **7** : 348 (1964).
Ampulliferopsis Bat. & Caval., *Port. Acta Biol.* B, **7** : 349 (1964).

Colonies effuse; mycelium superficial, adpressed, irregularly branched, brown, usually with abundant mucronate hyphopodia. Stroma and setae absent. Conidiophores macronematous, mononematous, erect, usually unbranched but sometimes becoming almost penicillate apically, brown to dark brown, smooth-walled, in some species with lobed foot cells. Conidiogenous cells monoblastic, integrated, terminal, sometimes percurrent, each apical cell in turn often acting as a

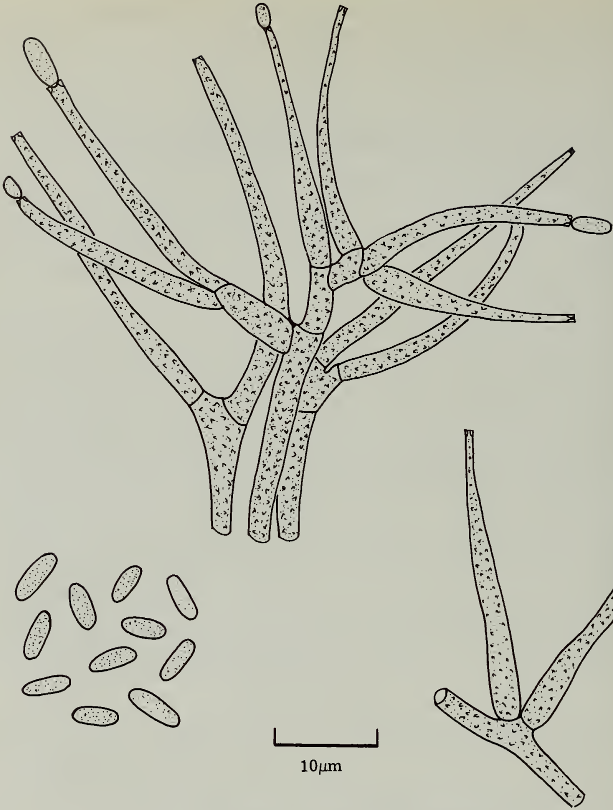

Fig. 2 *Acremonium spegazzinii* (LPS 11.339—holotype).

conidiogenous cell. Conidia catenate or sometimes solitary, dry, ellipsoid, obclavate, subcylindrical or lemoniform, brown to dark brown, non-septate or transversely septate.

Type species: *Ampullifera foliicola* Deight.

Perfect state: ? *Teratoschaeta* Bat. & Fonseca; see under *A. amoeboides*.

Number of species: Six species are accepted here, one of which is newly described. All occur as obligately lichenicolous fungi on foliicolous lichens with the possible exception of *A. pirozynskii*. The species of this genus often occur intermixed with other lichenicolous Hyphomycetes, particularly *Hansfordiellopsis* species, and also with each other.

Observations: This genus was originally described by Deighton (1960) for three fungi with hyphopodiate mycelia and non-septate conidia borne in acropetal chains. The concept of the genus was subsequently expanded by Deighton (1965) to embrace a species with transversely septate conidia. Batista & Cavalcanti (1964) introduced two genera for species with septate conidia: *Ampulliferella* characterized by lobate 'hyphopodia' in addition to the mucronate type, and *Ampulliferopsis* which lacked the lobate 'hyphopodia'. These authors considered the conidial chains in their new genera to arise basipetally. Sutton (1969 : 614–615) tabulated the reported differences between these genera and noted (*loc. cit.* : 613) that if the conidia were really basipetal Batista & Cavalcanti's genera might be distinct from *Ampullifera*. In the course of my observations and those of Deighton (*in litt.*), no evidence for basipetal conidiogenesis was found; as the lobate 'hyphopodia' appear to be foot-cells of conidiophores from which the conidiophores have been broken or not yet originated, and as I concur with Deighton (1965) in not accepting conidial septation as a generic criterion *per se*, these genera are united.

The species accepted within *Ampullifera* are mainly distinguished by the shape, size and septation of the conidia, which in most cases proved to be correlated with other characters, such as the nature of the hyphopodia, conidiophore length, and type of conidiophore foot-cells. It does not, however, appear to be possible to distinguish with certainty several of the species in the absence of conidiophores and conidia, and in other instances parts of so many microfungi occur in a single preparation, that a connection between a conidium and its supporting conidiophore can only be firmly established if they are seen attached; collections falling into these doubtful categories are compiled separately under *Ampullifera* spp. below (p. 207).

Key to the species

1 Conidia septate at maturity 2
– Conidia remaining non-septate at maturity 4

2 Hyphopodia subglobose, mainly under 5 μm diam 3
– Hyphopodia ampulliform, 5–7 × 2–3 μm; conidia mainly 2-septate, 14–25 × 3–4 μm **A. pirozynskii** (p. 203)

3 Conidia 1–3(–6) septate, the first formed septa near the ends of the cell (not median), (9–)12–15 × 3·5–5·5 μm; lobate foot-cells absent . . . **A. hippocrateacearum** (p. 201)
– Conidia 1(?–3) septate, the first formed septum median, (11–)14–20 × 5–6 μm; lobate foot-cells present . . . . **A. amoeboides** (p. 197)

4 Conidia ellipsoid or lemoniform; hyphopodia abundant 5
– Conidia subcylindrical or barrel-shaped, 8–11 × 3–4 μm; hyphopodia rare . **A. leonensis** (p. 203)

5 Hyphodia elongate-ampulliform, 7–14 × 2·5–4 μm; conidia lemoniform, abruptly truncated at the apices, (8–)10–14(–14·5) × 4–6(–7) μm . . . . **A. ugandensis** (p. 205)
- Hyphopodia subglobose, mainly 2·5–4 μm diam; conidia ellipsoid, gradually truncated at the apices, (6–)7–13(–15) × 4–6 μm . . . . **A. foliicola** (p. 199)

1. Ampullifera amoeboides (Bat. & Caval.) D. Hawksw. **comb. nov.**
(Fig. 3)

Ampulliferella amoeboides Bat. & Caval., *Port. Acta Biol.* B, **7** : 348 (1964).
Type: Brazil, Amazonas, Manaus, Reserva Ducke, on *Mazosia* sp., 28 February 1961, *A. C. Batista* (URM 27512—holotype non vidi).
Ampulliferopsis myriapoda Bat. & Caval., *Port. Acta Biol.* B, **7** : 351 (1964).
Type: Brazil, Amazonas, Manaus, km 55 Rodonia AM–1, on *Mazosia* sp. on Palmae sp., 28 August 1961, *J. Maria* (URM 27525—holotype non vidi).

Icones: Batista & Cavalcanti, *Port. Acta Biol.* B, **7** : 350 fig. 1, 352 fig. 2 (1964).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, smooth-walled, pale brown to brown, slightly constricted at the septa, cells mainly 7–15 μm long and 3–4·5 μm wide; hyphopodia abundant, commonly unilateral, generally arising towards the distal end of the cell, often in pairs on opposite sides of the hyphae, subglobose to ampulliform below, base mainly 3–4 μm diam, sometimes elongated to about 10 μm, paler than the hyphae on

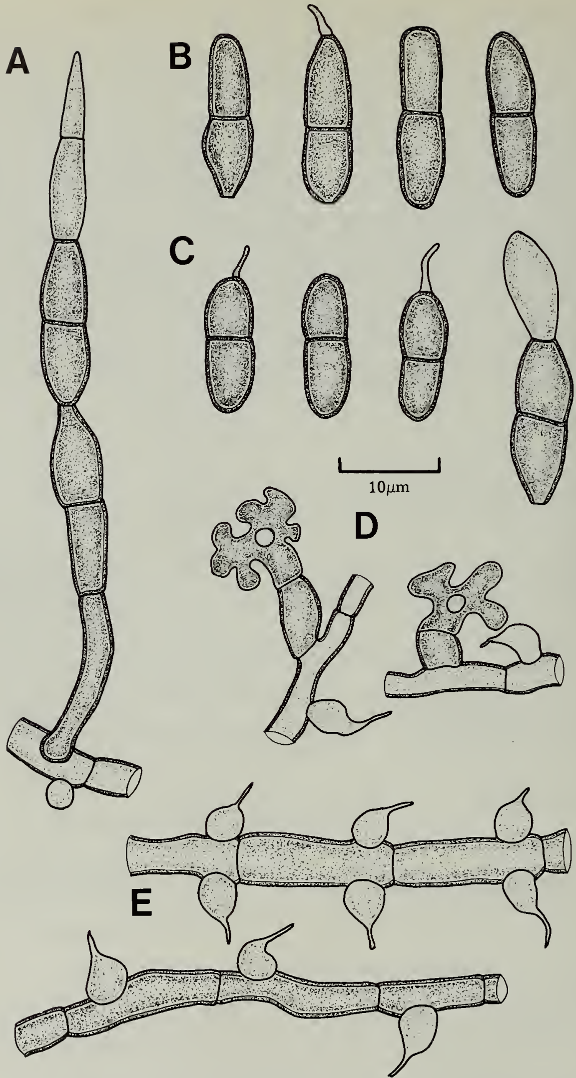

Fig. 3 *Ampullifera amoeboides*. **A**, Conidiophore with attached conidia. **B–C**, Conidia. **D**, Lobate foot cells. **E**, Mycelium with hyphopodia. A, B and E IMI 113850*a*; C IMI 113851; and D IMI 83230*c*.

which they arise, distinctly mucronate, the neck straight to flexuose, variable in length and about 0·5 µm wide; lobate cells often also produced, dark brown, 7–10 µm wide, often subtended by a short stalk-cell, sometimes very rare or absent. *Conidiophores* macronematous, mononematous, erect, mainly unbranched but rarely with subpenicillate heads, thick-walled, smooth-walled, dark brown, septate, slightly constricted at the septa, 10–20 µm tall and 5–6 µm wide, the foot rounded and originating directly from the mycelium or from characteristic lobed cells (see above) which may also occur without conidiophores. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell probably in turn acting as a conidiogenous cell. *Conidia* arising in single short and apparently acropetal chains, rarely adhering in chains after separation from the conidiophore, dry, 1–septate (? sometimes to 3-septate), the septum median, generally slightly constricted at the septum, dark brown, smooth-walled, elongate-ellipsoid, gradually truncated at the apices, (11–)14–20 × 5–6 µm, scar often indistinct, 1–2 µm diam.

Perfect state: ? *Teratoschaeta rondoniensis* Bat. & Fonseca. This monotypic genus was described with a conidial state very similar to *A. amoeboides*; it has setose perithecia recalling those of *Ascohansfordiellopis* but with 1-septate ascospores (Batista & Fonseca, 1967).

Hosts: On *Mazosia* species and some unidentified foliicolous sterile lichens.

Distribution: Brazil.

Observations: Although the original collections of this species were not available for study, collections authentic for the names were: URM 39393 (slides IMI 113851!) for *Ampulliferella amoeboides* and URM 36881 (slides IMI 113850*a*!) for *Ampulliferopsis myriapoda.* The latter species was described as having conidia which could be up to 3-septate, and longer conidiophores, rather triangular hyphopodia, and no lobate foot-cells; URM 36881, however, agreed in all respects with the description given above for *A. amoeboides*, but in view of these discrepancies it is possible that the holotype of *A. myriapoda* may eventually prove to be conspecific with *A. hippocrateacearum* rather than *A. amoeboides* as indicated here. These two species commonly grow together on the same host thallus and this is also true for the holotype of *Ampullifera brasiliensis* Deight. (see p. 201), the original description of which included some features from intermixed *A. amoeboides*.

The conidia in *Ampulliferella amoeboides* and *Ampulliferopsis myriapoda* were interpreted as originating basipetally by Batista & Cavalcanti (1964). Few conidial chains still intact were seen on the collections examined, but it seems more probable that they arise acropetally as in other species of *Ampullifera*. The isthmus-like cells connecting conidia in chains figured for *A. myriapoda* by Batista & Cavalcanti (*loc. cit.*: 353) almost certainly represent young conidia or germ-tube blow-outs, united into chains by artistic licence.

Ampullifera amoeboides is a distinctive taxon readily separable from other species of the genus by the very dark conidia with a single median septum, and also by the dark lobate foot-cells, which may not always be present.

Additional specimens: **Brazil**: Rondonia, Ariquenes, on indet. lichens on Oleaceae sp., February 1962, *Õ. Fonesca* (URM 39393, IMI 113851!); Rondonia, on indet. lichens on Moraceae sp., 8 February 1963, *L. Fernandas* (URM 39427 p.p., IMI113853!); Rondonia, Est. da Penitenciaria P. Velho, on indet. lichens on Palmae sp., March 1962, *Õ. Fonesca* (URM 36881, IMI 113850*a*!); Pernambuco, Recife, Dois Irmãos, on indet. lichens on *Gustavia augusta*, 13 March 1960, *O. Soaves* (URM 18794*a* p.p., IMI 83230*c*!).

2. Ampullifera foliicola Deight., *Mycol. Pap.* **78**: 36 (1960).
(Fig. 4)

Type: Ghana, Aburi, on *Tricharia* sp. on *Cola verticillata*, 5 April 1953, *T. W. Tinsley* (IMI 55448*d*—holotype!).

Icones: Deighton, *Mycol. Pap.* **78** : 37 fig. 20 (1960).—Ellis, *Demat. Hyphom.* : 96 fig. 59 (1971).—Kendrick & Carmichael, *in* Ainsworth *et al.*, *The Fungi* **4A** : 478 fig. 43G (1973).

Colonies dispersed, superficial, brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched (most commonly at about right angles), flexuose,

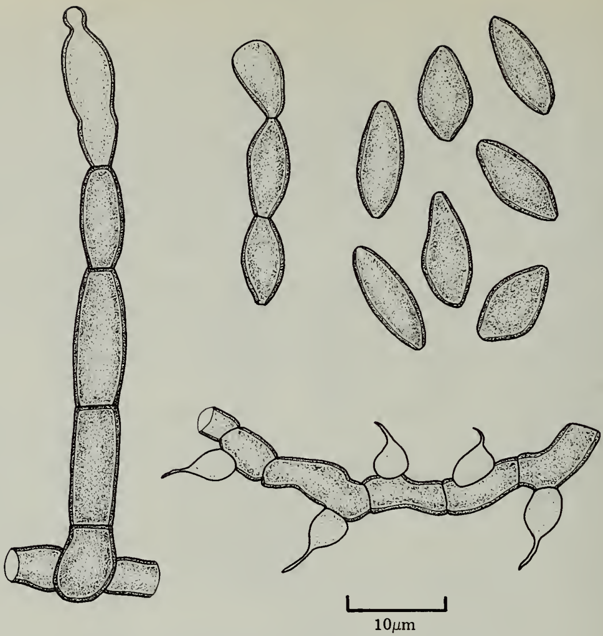

Fig. 4 *Ampullifera foliicola* (IMI 55448*d*—holotype).

hyphae relatively thin-walled, smooth-walled, pale brown to brown, septate, not or slightly constricted at the septa, cells very variable in length, mainly 7–12 μm long and 3–4·5 μm wide; hyphopodia abundant, alternate or opposite, generally arising towards the distal end of the cell, usually only one per cell but exceptionally more, subglobose below, base mainly 2·5–4 μm diam, paler than the hyphae on which they arise, distinctly mucronate, the neck straight to flexuose and to 7×0·5 μm. *Conidiophores* macronematous, mononematous, erect, mainly unbranched but exceptionally with subpenicillate heads, thick-walled, smooth-walled, dark brown, septate, becoming constricted above at the septa, 30–40 μm tall and mainly 5–6 μm wide, the foot-cell rounded and somewhat swollen (to 7 μm wide) but not lobed. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell. *Conidia* arising in single acropetal chains, often adhering in chains after separation from the conidiophore, dry, non-septate, brown, slightly paler than the conidiophores, smooth-walled, ellipsoid, gradually truncated at the apices, (6–)7–13(–15)×4–6 μm, scar 1–2 μm diam.

Hosts: In the original collection the fungus occurs on the thallus of a sterile *Tricharia* species, while in the material from Brazil it grows over thalli also infected with *Pyrenotrichum splitgerberi* Mont. (syn. *Chlorocyphella aeruginascens* (Karst.) Keissl.) which most probably belong to a species of either *Lopadium* or *Tapellaria* to judge from the host range of that fungus (see Santesson, 1952 : 40).

Distribution: Brazil and Ghana. Deighton's (1960 : 39) reports of collections from the Dominican Republic, Singapore and Sierra Leone, together with those of Ellis (1971 : 96) from Sabah and Sarawak, were based only on sterile mycelium and must be rejected, as pointed out by Deighton (1965 : 31), because of possible confusion with *A. hippocrateacearum*.

Observations: This species is similar to *A. ugandensis* in its conidial dimensions, but the conidia of that species are lemoniform and the hyphopodia much larger. The sterile mycelium cannot be certainly separated from that of *A. hippocrateacearum* and sometimes also *A. amoeboides* which are, however, readily distinguished from *A. foliicola* by the shape and septation of their conidia.

Additional specimen: **Brazil**: Rio de Janeiro, Jardin Botanico, on lichen thalli infected with *Pyrenotrichum splitgerberi* on *Buxus sempervierens*, 1947, *C. T. Rizzini 11b* (UPS non vidi, IMI 85642!).

3. Ampullifera hippocrateacearum (Bat. & Caval.) D. Hawksw. **comb. nov.**
(Fig. 5)

Ampulliferopsis hippocrateacearum Bat. & Caval., *Port. Acta Biol.* B, **7** : 353 (1964).
Type: Brazil, Manaus, Rondonia, Am–1 km 55, on *Mazosia* sp. on Hippocrateaceae sp., 23 August 1961, *J. Maria* (URM 28638—holotype non vidi).
Ampullifera brasiliensis Deight., *Mycol. Pap.* **101** : 28 (1965).
Type: Brazil, Pernambuco, Recife, Dois Irmãos, on indet. lichens on *Gustavia augusta*, 13 March 1960, *O. Soaves* (URM 18794*a*—holotype non vidi, IMI 83230*b*—slides!).

Icones: Batista & Cavalcanti, *Port. Acta Biol.* B, **7** : 354 fig. 3 (1964).—Deighton, *Mycol. Pap.* **101** : 30 fig. 12 (1965).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched (usually at wide angles), flexuose, hyphae relatively thin-walled, smooth-walled, pale brown to brown, not or slightly constricted at the septa, cells very variable in length, mainly 7–12 µm long and 2–3·5 µm wide; hyphopodia abundant, commonly unilateral but sometimes alternate, generally arising towards the distal end of the cell, usually one per cell, subglobose to ampulliform below, mainly 3–4 µm diam but to 7–8 µm occasionally, concolorous with or paler than the hyphae on which they arise, distinctly mucronate, the neck usually flexuose, to $5 \times 0{\cdot}5$ µm. *Conidiophores* macronematous, mononematous, erect but commonly bent near the base, unbranched, thick-walled, smooth-walled, dark brown, septate, not or slightly constricted at the septa, mainly 50–100 µm tall and 3·5–5 µm wide, the foot cell often slightly swollen but apparently not lobate. *Conidiogenous* cells monoblastic, not differentiated from the conidiophores and each cell acting in turn as a conidiogenous cell. *Conidia* arising in single short acropetal chains, rarely adhering in chains of more than 2 cells after separation from the conidiophore, dry, mainly 1–2 septate but rarely to 6-septate, the first-formed septa not arising medianly but near the ends of the conidia, not or slightly constricted at the septa, pale brown, smooth-walled, ellipsoid to elongate-ellipsoid, gradually truncated at the apex and more abruptly so at the base, (9–)12–$15 \times 3{\cdot}5$–5·5 µm, basal scar 1–1·5 µm diam.

Hosts: On *Mazosia* species and unidentified foliicolous lichens.

Distribution: Brazil.

Observations: Deighton (*in litt.*) at first thought two *Ampullifera* species were involved in the collection designated as the holotype of *A. brasiliensis*, but prior to the publication of the name considered that the species was simply rather more variable than others of its genus and consequently accorded it a single name. Examination of collections which have become available subsequently leave no doubt that URM 18794*a* comprised two species, that described above predominating, with lesser amounts of *A. amoeboides* intermixed with it; this latter element has been designated as IMI 83230*c*. Deighton's (1965) drawing of lobate foot-cells and his description of 'abnormal conidia' refer to the *A. amoeboides* element.

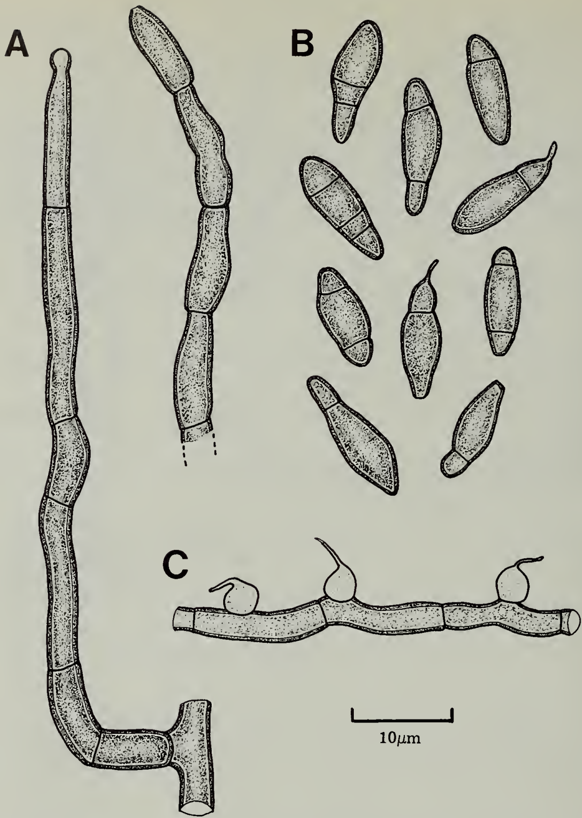

Fig. 5 *Ampullifera hippocrateacearum* (IMI 83230*b*). **A**, Conidiophores. **B**, Conidia. **C**, Hyphopodia.

Although the original collection of *Ampulliferopsis hippocrateacearum* was not available, a collection authentic for the name (URM 38140) was studied. No conidia attached to the conidiophores were seen, but the conidia themselves and the mycelial characters, taken together with the illustrations of Batista & Cavalcanti (1965 : 354) leave little doubt that this fungus is conspecific with *Ampullifera brasiliensis*; these two taxa are consequently united under the earlier epithet.

The conidia of this species were indicated to be basipetally formed by Batista & Cavalcanti (*loc. cit.*) but this is certainly not so for IMI 83230*b*, and no evidence to the contrary was obtained from the other collections seen.

Additional specimens: **Brazil**: Rondonia, on indet. lichens on Moraceae sp., 8 February 1963, *L. Fernandas* (URM 39427 p.p., IMI 113853*c*!); Rondonia, Est. do IATA km 33, Guajará Mirim, on indet. lichens on Apocynaceae sp., 8 February 1963, *J. Oliveira* (URM 38140, IMI 113849!).

4. Ampullifera leonensis Deight., *Mycol. Pap.* **78**: 41 (1960).
(Fig. 6)

Type: Sierra Leone, Pujehun (Panga-Kaponde), on lichens on *Homalium letestui*, 11 April 1939, *F. C. Deighton M2010* p.p. (IMI 7664*b*—holotype!).

Icones: Deighton, *Mycol. Pap.* **78**: 42 fig. 22 (1960).

Colonies dispersed, superficial, pale brown to olivaceous or dark brown, arising on the surface of the host lichen and persisting when the host is in a severely damaged state; mycelium superficial, adpressed, irregularly branched and flexuose, hyphae rather thin-walled, smooth-walled, almost hyaline to pale brown, septate, not or slightly constricted at the septa, cells very variable in length, mainly 2·5–4 μm wide; hyphopodia extremely rare and absent on many hyphae, ampulliform, subhyaline to pale brown, mainly about 9 × 3·5 μm, excluding the mucronate neck which extends apically apparently entering the host tissue. *Conidiophores* macronematous, mononematous, erect, unbranched, sometimes arising in groups, thick-walled, smooth-walled, dark brown, septate, becoming constricted above at the septa, 70–120 μm tall and 3–5 μm wide, the foot-cell rounded and somewhat swollen (to 6 μm wide) but not becoming lobed. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell. *Conidia* arising in single acropetal chains, often adhering in chains after separation from the conidiophore, dry, non-septate, pale brown, smooth-walled, subcylindrical or barrel-shaped, broadly truncate at both ends, 8–11 × 3–4 μm, scar 1·5–2 μm diam.

Host: In the original collection the fungus occurs on foliicolous lichen thalli which are so heavily infected by it that they cannot be named with any certainty. *Strigula elegans* (Fée) Müll. Arg. and *Tricharia vainioi* R. Sant. occur on the type collection in the uninfected condition.

Distribution: Sierra Leone. Known only from the type collection.

Observations: *Ampullifera leonensis* occupies a rather isolated position within the genus by virtue of its subcylindrical conidia and the scarcely hyphopodiate mycelium. The presence of occasional hyphopodia precludes its inclusion in *Xylohypha* (Fr.) Mason, a genus not known to include any lichenicolous fungi.

5. Ampullifera pirozynskii D. Hawksw. **sp. nov.**
(Fig. 7)

Fungus lichenicola vel algicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis, plerumque 8–14 μm longis et 2·5–3·5 μm latis, cum cellulis hyphopodiis ampulliformibus et mucronatis usque 5–7 × 2–3 μm. Conidiophora macronemata, mononemata, recta, simplicia, septata, atrobrunnea, 30–40 × 3–4 μm, cum cellulis podiiformibus lobatis instructa. Cellulae conidiogenae monoblasticae, integrate, non bene distinctae. Conidia breviter catenulata, sicca, (1–)2-septata, levia, atrobrunnea, elongato-ellipsoidea, 14–25 × 3–4 μm.

Typus: Tanzania, Kigoma, Kakombe, in lichenibus foliicolis vel algis ad *Garcinia huillensis*, 7.ii.1964, *K. A. Pirozynski M403*d (IMI 106630*d*—holotypus!).

Colonies dispersed, superficial, spreading rather widely over the host thalli and leaf surface, olivaceous brown; mycelium superficial, adpressed, irregularly branched, usually at wide angles, flexuose, hyphae relatively thin-walled, smooth-walled, pale brown, slightly constricted at the septa, cells mainly 8–14 μm long and 2·5–3·5 μm wide; hyphopodia common but not on every cell, often alternate, generally arising towards the distal end of the cell, sometimes in pairs on opposite sides of the hyphae, ampulliform below, base mainly 5–7 × 2–3 μm, distinctly mucronate, the neck straight to flexuose and to about 6 × 0·5 μm. *Conidiophores* macronematous, mononematous, erect but often bent near the base, unbranched, thick-walled, smooth-walled, dark brown, septate, not or slightly constricted at the septa, 30–40 μm tall and 3–4 μm wide, the foot cell lobate and 6–8 μm wide. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell, rarely laterally as well as apically. *Conidia* arising in single short acropetal chains, rarely adhering in chains after separation from the conidiophore, dry (1–)2–septate, usually slightly constricted at the septa, brown,

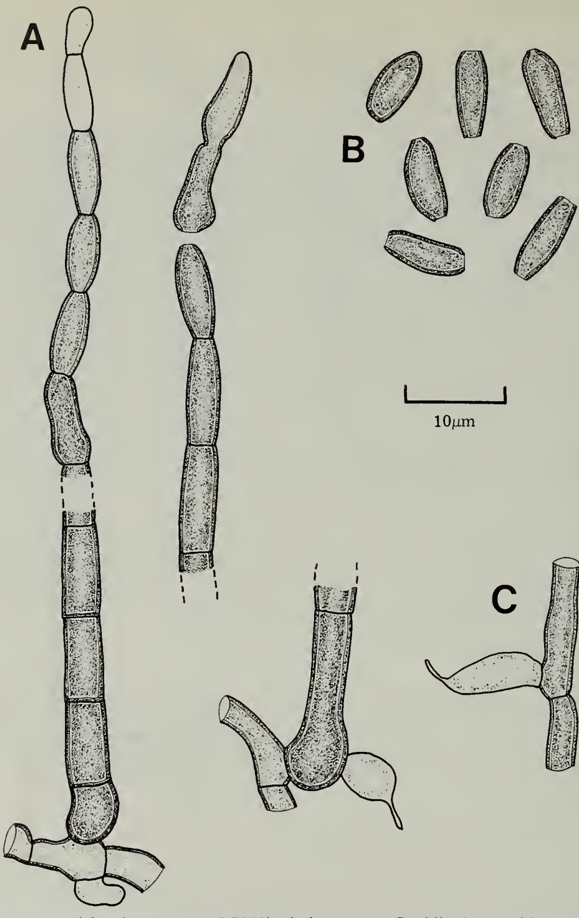

Fig. 6 *Ampullifera leonensis* (IMI 7664*b*—holotype). **A**, Conidiophores with attached conidia. **B**, Conidia. **C**, Hyphopodia.

the apical cell in 2-septate conidia often slightly paler in colour, elongate-ellipsoid to obclavate, gradually truncated at the apex but more abruptly truncated at the base, 14–25 × 3–4 μm, basal scar 1–2 μm diam.

Host: Some superficial algae, perhaps in a very early stage of lichenization, appear to be the primary substrate in the original collection, but the colonies are wide spreading and may well be at least partly truly lichenicolous.

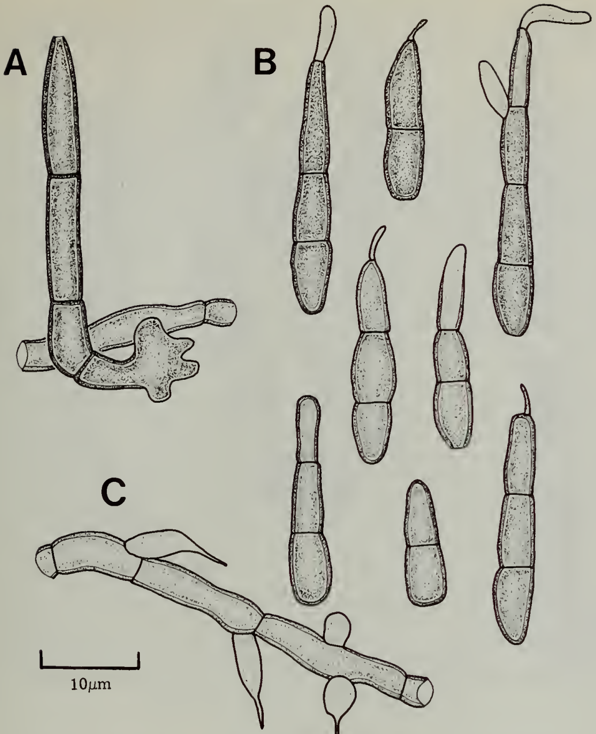

Fig. 7 *Ampullifera pirozynskii* (IMI 106630*d*—holotype). **A,** Conidiophore. **B,** Conidia. **C,** Mycelium with hyphopodia.

Distribution: Tanzania. Known only from the type collection.

Observations: This species is perhaps most closely allied to the Brazilian *Ampullifera amoeboides* from which it is distinguished by the preponderance of 2-septate conidia which also tend to be somewhat narrower.

6. Ampullifera ugandensis Deight., *Mycol. Pap.* **78** : 39 (1960). (Fig. 8)

Type: Uganda, Masaka Road, associated with lichens and algae on *Mitragyna stipulosa*, December 1940, *C. G. Hansford 2951* p.p. (IMI 25518*d*—holotype!).

Icones: Deighton, *Mycol. Pap.* **78** : 40 fig. 21 (1960).

Colonies dispersed, superficial, pale brown; mycelium superficial, adpressed, rather irregularly branched and flexuose, hyphae smooth-walled, pale brown to brown, septate, not markedly

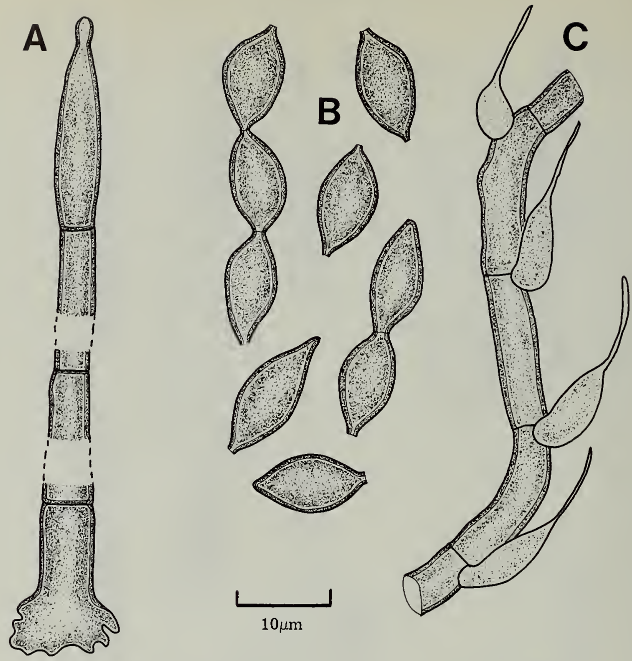

Fig. 8 *Ampullifera ugandensis* (IMI 25518*d*—holotype). **A**, Conidiophore. **B**, Conidia. **C**, Mycelium with hyphopodia.

constricted at the septa, cells very variable in length, mainly 3–6 μm wide; hyphopodia abundant, arising laterally near the distal septum on almost all cells, mainly singly and alternate but sometimes opposite, pale brown, paler than the hyphae from which they arise, elongate-ampulliform, mainly 7–14 × 2·5–4 μm, excluding the mucronate neck which may be as much as 20 × 1 μm. *Conidiophores* macronematous, mononematous, erect, unbranched, thick-walled, smooth-walled, dark brown, septate, becoming somewhat constricted above at the septa, 75–100 μm tall and 4–6 μm wide, the foot cell becoming swollen and lobate and to 10 μm wide. *Conidiogenous cells* monoblastic, not differentiated from the conidiophores and each apical cell in turn acting as a conidiogenous cell, sometimes percurrently. *Conidia* arising in single acropetal chains, sometimes adhering in short chains after separation from the conidiophores, dry, non-septate, pale brown, smooth-walled, lemoniform, (8–)10–14(–14·5) × 4–6(–7) μm, scar 1–2 μm diam.

Host: This species was originally described as 'associated with lichens and algae' but, somewhat surprisingly, as hypophyllous. IMI 25518*d* comprises only slides; the material from which these were made, now kept as IMI 25518*a* (sub *Meliola mitragynicola* var. *ugandensis* Deight.), supports a wide range of fungi and algae, but the *Ampullifera* was not re-located on these leaves. The identity of the host consequently remains uncertain.

Distribution: Uganda. Known only from the type collection.

Observations: *Ampullifera ugandensis* resembles *A. foliicola* in the size and shape of the conidia but is sharply separated from that species on the basis of the much larger and differently shaped hyphopodia.

Ampullifera spp.

Deighton (1960 : 38–39) mentioned that sterile hyphae figured by Arnaud (1954 : 273 fig. 3P) under the name *Uncigera cordae* Sacc. & Berl. might be *Ampullifera foliicola*; while this may be so in the case of the fungus Arnaud had, the hyphopodia-shaped structures in *Uncigera cordae* are phialides producing cylindrical conidia which recall *Gonytrichum* Nees ex Wallr. Deighton also compared the hyphopodia in *Ampullifera foliicola* to those described by Ciferri & Batista (1956) in *Parapodia intermedia* Cif. & Bat.; their material has been studied by Hughes (1976 : 795) who found the reported hyphopodia to be phialides and the species to belong to *Triposporiopsis* Yamamoto.

The specimens listed below, apart from the two from Tanzania in which the material is very much fragmented, lack conidiophores and conidia but produce mycelium very like that seen in this genus; some of these collections were listed by Deighton (1960 : 39) as discussed above (p. 201) but cannot now be referred with confidence to any particular species.

All are on sterile foliicolous lichens.

Specimens: **Dominican Republic**: Santo Domingo, Cordillera Central, Prov. La Vega, Rio Maimom, on *Omphalea pauciflora*, 18 December 1930, *E. L. Ekman*, Cif., *Mycofl. Dom. exs.* no. 269 p.p. (IMI 59260*d*!).—**Nigeria**: Benin, on *Caryota mitis*, 10 August 1961, *A. G. Bailey 872* (IMI 99552*b*!).—**Sabah**: on *Achras sapota*, comm. 2 May 1961, *T. H. Killiaeus PP 98/60* (IMI 86608*b*!).—**Sarawak**: Balingian, on *Hevea braziliensis*, [no further data], *FH 151* (IMI 96189*a*!); Batu Kawa, on *Nephelium lappaceum*, 23 March 1962, *G. J. Turner FH 80* (IMI 93315*b*!).—**Sierra Leone**: Njala (Kori), on *Raphia hookeri*, 10 February 1954, *F. C. Deighton M5638* p.p. (IMI 56449*b*!), on *Funtumia africana*, 22 January 1936, *F. C. Deighton M954* p.p. (IMI 6059*b*!), on *Homalium letestui*, 5 March 1937, *F. C. Deighton M1332* p.p. (IMI 25611*b*!); Mange (Bure), on *Parinari excelsa*, 7 February 1939, *F. C. Deighton M1918* p.p. (IMI 8928*e*!), on *Blighia unijugata*, 17 February 1928, *F. C. Deighton M1590* p.p. (IMI 25670*b*!); Tonkoli Forest Reserve, on *Newtonia aubrevillei*, 19 June 1954, *D. Small M6107* p.p. (IMI 57450*e*!); Pujehun (Panga-Kaponde), on *Homalium letestui*, 11 April 1939, *F. C. Deighton M2010* p.p. (IMI 7664*c*!); near Rokupr (Magbema), on *Pentadesma butyracea*, 2 February 1939, *F. C. Deighton M1859* p.p. (IMI 9992*e*!).—**Singapore**: on *Ficus urophylla*, *Baker*, *Fungi mal.* no. 455 (BO 15867 non vidi, IMI 73820*b*!).—**Tanzania**: Kigoma, Kasekela, on *Monanthotaxis poggei*, 8 February 1964, *K. A. Pirozynski M412g* (IMI 106639*g*!); Kigoma, Mkenke, on *Baphia kirkii*, 28 March 1964, *K. A. Pirozynski M891l* (IMI 107199*l*!).

III. BISPORA Corda

Icon. Fung. **1** : 9 (1837).

Colonies dispersed, effuse or aggregated into small tufts, brown to black; mycelium immersed but sometimes partly superficial. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous, mononematous or caespitose, straight or flexuose, generally unbranched, brown, smooth-walled. Conidiogenous cells monoblastic, integrated, terminal, determinate, subcylindrical. Conidia arising in long acropetal chains, dry, acrogenous, brown to dark brown, doliiform or subcylindrical, usually 1-septate, the septum often broad and very darkly pigmented, usually scarcely or not constricted at the septum, smooth-walled.

Type species: *Bispora antennata* (Pers. ex Pers.) Mason.

Number of species: About 14 species are currently accepted (including the one described as new below), most of which are saprophytes occurring on the bark or wood of deciduous trees.

1. Bispora christiansenii D. Hawksw. sp. nov.
(Fig. 9)

Fungus lichenicola. Mycelium immersum, ex hyphis subhyalinis vel pallide brunneis, 2–3·5 μm latis, Conidiophora semi-macronemata, mononemata, recta, simplicia vel ad apicem vel basim sparse ramosa.

pallide brunnea, levia, 15–35 × 2·5–4 μm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia catenata, sicca, acrogena, ellipsoidea vel doliiformia, 1-septata, levia, pallidissime brunnea, 5–8(–9) × 4–6(–7) μm.

Typus: Dania, Sjælland, Vridsløselille, in *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia) ad lignum, 20.vii.1944, *M. Skytte Christiansen 11.704* (hb. Christiansen 552—holotypus!).

Exsiccatae: Räsänen, Lich. Fenn. no. 347 p.p. (BM!, IMI 228050!, hb. Christiansen; sub *Didymocyrtis consimilis* Vain.).

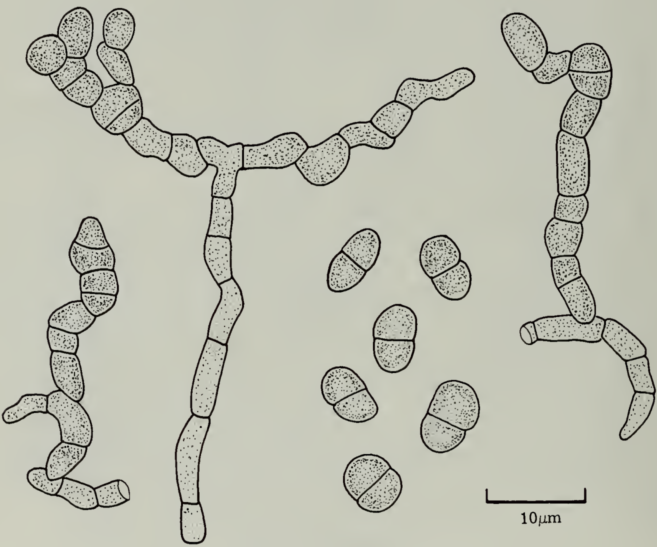

Fig. 9 *Bispora christiansenii* (hb. Christiansen 552—holotype).

Colonies discrete, arising in the tissues of the host, filling apothecia or associated with deformations, dark brown to black; mycelium immersed, originating deep in the thallus, often amongst phycobiont cells, composed of subhyaline or very pale brown flexuose hyphae, hyphae thin- and smooth-walled, septate, often markedly constricted at the septa, mainly 2·5–4 μm wide, becoming inflated near algal cells. *Conidiophores* semimacronematous, mononematous, straight to flexuose, unbranched or branched sparsely either near the base or close to the apex, pale brown, smooth-walled, thicker-walled than the mycelial hyphae, septate, scarcely to markedly constricted at the septa, sometimes appearing almost torulose, 15–35 × 2·5–4 μm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, pale brown, not clearly defined and the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, dry, acrogenous, ellipsoid to doliiform, very pale brown, 1-septate, not or slightly constricted at the septum, the septum not broadened and thickened, smooth- and rather thin-walled, 5–8(–9) × 4–6 μm.

Hosts: *Caloplaca citrina* (Hoffm.) Th. Fr. (apothecia), *C. cerina* var. *cyanolepra* (DC.) Kickx (apothecia), *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia), *Lecanora carpinea* (L.) Vainio (apothecia), *L. chlarotera* Nyl. (apothecia), *L. dispersa* (Pers.) Sommerf. (apothecia), and *Phaeophyscia orbicularis* (Neck.) Moberg (thallus). Infected *Caloplaca*, *Candelariella* and *Lecanora* apothecia become brownish and are eventually destroyed by this fungus. On the *Phaeophyscia*, however, the fungus is associated with dark brown gall-like convex swellings 0·5–1 mm diam caused by an unknown agent*. On *Caloplaca cerina* it is associated with *Tichothecium lichenicola* (Sommerf. ex Fr.) R. Sant.

Distribution: British Isles, Denmark, Finland, Germany and Italy.

Observations: The generic disposition of this fungus presented several problems as it obviously has some similarity with *Trimmatostroma lichenicola*, but cannot be included in the accepted circumscription of that genus because of the separate 1-septate conidia as opposed to multicellular complex conidia. Although the type species of *Bispora* and many of the other taxa referred to it have broad thickened septa (see, for example, illustrations in Ellis, 1971 : 91) in the conidia, all do not show this feature, for example *B. catenula* (Lév.) Sacc. (Ellis, 1976 : 55). A further characteristic of *Bispora*, the regular acropetal septation of the conidia, is departed from in *B. pusilla* Sacc. which has been studied by Sutton (1969 : 614). If *B. catenula* and *B. pusilla* are to be retained in *Bispora*, *B. christiansenii* can also be placed here since it includes both these departures from the nucleus of the genus.

The hyphae of *Bispora christiansenii* were regularly found to stretch down to cells of the phycobiont, even those below the hypothecium in *Candelariella vitellina*, and to form large swollen hyphae that might well serve as absorptive organs around parts of or juxtaposed to algal cells. It is consequently possible that this fungus might be more accurately interpreted as algicolous rather than lichenicolous.

One specimen was received as a pure culture, isolated from *Lecanora dispersa* apothecia. The colonies reached only 7–10 mm diam after four weeks on a range of agar media (MA, MCZ, OA and PDA) at *c.* 20°C, were mounded and somewhat fluted, dark grey-brown, with a black margin and reverse. The characteristics of the species on the natural host were retained in culture.

This species is named in honour of Dr M. Skytte Christiansen (Copenhagen) in recognition of the important contribution he has made to the present monograph by making his collections and observations available to me.

Additional specimens: **British Isles**: Hertfordshire, Hatfield Polytechnic roof, isol. ex *Lecanora dispersa* (apothecia) on asbestos-cement panels, 21 February 1978, *A. O. Lloyd* (IMI 227584!); North Essex, Colchester, on *Caloplaca citrina* (apothecia) on city walls, 4 April 1978, *J. F. Skinner* (CLR 1013!).—**Denmark**: Aarby, 'Ashaes Forskov' wood, on *Lecanora chlarotera* (apothecia) on *Fraxinus*, 19 August 1968, *M. Skytte Christiansen* (hb. Christiansen!); Zealand, Jungshoved, on *Phaeophyscia orbicularis* (thallus) on *Populus virginiana*, 12 August 1966, *M. Skytte Christiansen* (IMI 225003!, hb. Christiansen).—**Finland**: Ostrobottnia borealis, Simo, Harvakari, on *Caloplaca cerina* var. *cyanolepra* (apothecia) on *Sorbus aucuparia*, 6 July 1933, *V. Räsänan*, Lich. Fenn. no. 347 p.p. (BM!, IMI 228050!, hb. Christiansen).—**Germany**: Hamburg, Gr. Buchned, on *Lecanora chlarotera* (apothecia), 8 May 1902, *O. Jaap 142* p.p. (B!).—**Italy**: Südtirol, Mendelgebirge, Penegal SW von Bozen, lockerer Lärchenwald, 1650–1730 m, on *Lecanora carpinea* (apothecia), 20 October 1975, *J. Hafellner* (hb. Hafellner 1092!).

IV. **CLADOSPORIUM** Link ex Fr.

Syst. mycol. **1** : xlvi (1821).

See Hughes (1958 : 750) for synonyms of this generic name.

Colonies usually effuse, olivaceous, brown, grey or black; mycelium immersed and also often superficial. Stroma, setae and hyphopodia absent. Conidiophores macronematous or more rarely semi-macronematous, mononematous, straight or flexuose, unbranched below but in many species with branching occurring near the apex so as to form a conidiiferous head, olivaceous to brown,

*These symptoms, due to a discoloration of the host cortical hyphae, are seen in several other collections of this host (hb. Christiansen 602, 603, 604, 606, 607) and are not caused by the *Bispora*. The fungus responsible for these symptoms remains obscure.

smooth or verrucose. Conidiogenous cells polyblastic, ± integrated, terminal or lateral, sometimes sympodial, cylindrical, often with conidial scars readily visible. Conidia arising in acropetal chains, dry, acropleurogenous, subglobose to subcylindrical, simple to 5 or more septate, scarcely constricted at the septa, often with well-marked scars, very pale brown to dark brown, smooth-walled or verrucose-echinulate.

Type species: *Cladosporium herbarum* Pers. ex Gray.

Number of species: Approximately 550 species have been described in this genus of which 43 are treated by Ellis (1971 : 308–319, 1976 : 325–344). Most are saprophytes or parasites of vascular plants occurring on leaves, wood and stems; *C. herbarum* is probably one of the most widespread fungi in the world and is exceptionally common. Only a single obligately lichenicolous species is accepted here.

Perfect state: Perfect states are unknown for most *Cladosporium* species but a few are known to have ones in *Amorphotheca* Parbery, *Mycosphaerella* Johansen, or *Venturia* Sacc.

Observations: Two *Cladosporium* species, in addition to *C. arthoniae* treated below, have been described from lichens: *C. lichenicola* Linds. which is probably based only on torulose mycelium (see p. 269) and *C. lichenum* Keissl. which is most satisfactorily placed in *Pseudocercospora* (see p. 246). One fortuitously lichenicolous species, *C. sphaerospermum* Penz., has also been noted (see p. 287).

Key to the lichenicolous species

1 Conidia subglobose, non-septate, coarsely warted, mainly 3–4·5 μm diam; fortuitously lichenicolous . . . . **Cladosporium sphaerospermum** Penz.
– Conidia ellipsoid, usually 1-septate, verruculose, 6–10 × 4–5 μm . **Cladosporium arthoniae** (p. 210)

1. Cladosporium arthoniae M. S. Christ. & D. Hawksw. **sp. nov.**
(Fig. 10)

Fungus lichenicola. Mycelium immersum, ex hyphis pallide brunneis vel subhyalinis, 2–3 μm latis. Conidiophora macronemata, recta, simplicia sed ad apicem ramosa, brunnea, verruculosa, 30–50 × 3–4 μm. Cellulae conidiogenae polyblasticae, integratae, cylindricae. Conidia catenata, sicca, acropleurogena, ellipsoidea, usque 1-septata, brunnea vel pallide brunnea, verrucosa, 6–10 × 4–5 μm.

Typus: Suecica, Skåne, Genarp, Häckeberga, in *Arthonia impolita* (Hoffm.) Borr. (apothecia) ad *Quercum*, 24.iv.1946, *M. Skytte Christiansen 12.967a* (hb. Christiansen 570—holotypus!).

Colonies dispersed over infected apothecia of the host, brown; mycelium immersed, rather scant, composed of pale brown or subhyaline hyphae, hyphae thin-walled, smooth-walled to slightly verrucose, septate, 2–3 μm wide. *Conidiophores* macronematous, mononematous or loosely aggregated, erect, unbranched below but repeatedly branching towards the apex, brown, verrucose, moderately thick-walled, septate, somewhat constricted at the septa, 30–50 × 3–4 μm. *Conidiogenous cells* polyblastic, integrated, cylindrical, pale brown to brown, not well-defined with the terminal cells in turn acting as conidiogenous cells, lacking distinct scars. *Conidia* adhering in acropetal chains, dry, acropleurogenous, ellipsoid, rounded at the apices, not distinctly scarred, brown, 0–1 septate, slightly constricted at the septum, verrucose, moderately thick-walled, 6–10 × 4–5 μm.

Host: *Arthonia impolita* (Hoffm.) Borr., apothecia. The infected apothecia appear to be destroyed by the invasion of this fungus.

Distribution: Sweden. Known only from the type collection.

Observations: The habit of the conidiophores, polyblastic conidiogenous cells and catenate verrucose conidia clearly indicate that this fungus should be referred to *Cladosporium*. The only major character indicating that this might not be appropriate is the absence of clearly visible scars on the conidiogenous cells and conidia. However, in view of the degree of agreement in other features too much emphasis should not be placed on this difference.

Fig. 10 *Cladosporium arthoniae* (hb. Christiansen 570—holotype).

In the original collection *Taeniolella delicata* is intermixed with the *Cladosporium*. *Taeniolella verrucosa* occurred on a different portion of the same specimen.

V. DENDRODOCHIUM Bonord.

Handb. Allgem. Mykol.: 135 (1851).

Colonies orbicular or effuse; mycelium mainly superficial, irregularly branched, hyaline or pale shades. Stroma, setae and hyphopodia absent. Conidiophores macronematous, forming sporodochia, compacted, ± hyaline, branched, method of branching variable but often subverticillate. Conidiogenous cells phialidic, discrete, terminal, subcylindrical to subulate, ± hyaline. Conidia solitary, slimy in mass, hyaline singly but sometimes with pale colours in mass, simple, ellipsoid to clavate, rounded at the apex, rounded or distinctly truncate at the base.

Type species: *Dendrodochium aurantiacum* Bonord.

Number of species: About 60 species are described, but many may not be congeneric with *Dendrodochium aurantiacum* and a revision of the group is required. Most species are saprophytes or weak plant parasites and only one is known to be lichenicolous.

1. Dendrodochium subeffusum Ellis & Galw., *J. mycol.* **6**: 33 (1890). (Fig. 11)

Type: U.S.A., New York, Farmington, on *Physcia millegrana* and *Candelaria concolor* on trunk of a pear tree, August 1889, *E. Brown*, Ellis & Everh., N. Am. Fungi, ser. 2, no. 2394 (K—2 isotypes!).
Dendrodochium effusum Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30**: 315 (1914); lapsus, nom. inval. (Art. 34).

Exsiccatae: Ellis & Everhart, N. Am. Fungi, ser. 2, no. 2394 (K!).

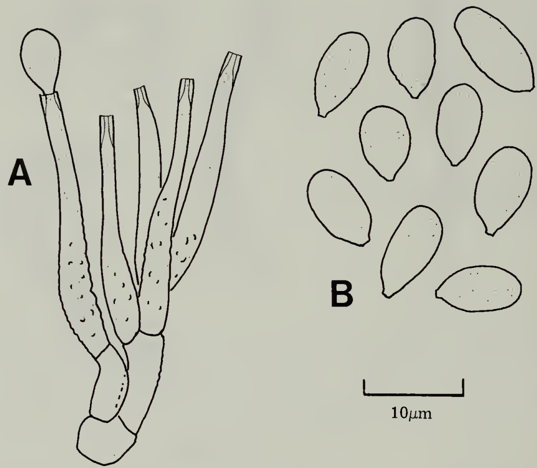

Fig. 11 *Dendrodochium subeffusum* (K—isotype). **A**, Conidiogenous cells. **B**, Conidia.

Colonies spreading, ± superficial, white to very pale orange, arising in dying areas of the host thalli; mycelium partly superficial and partly penetrating the upper layers of the host, hyphae flexuose, thin-walled, hyaline, mainly 2·5–4 µm wide. *Conidiophores* macronematous, forming translucent, applanate, irregular, gelatinized sporodochia mainly 300–500 µm across and pale orange, compacted, individually hyaline, branched, irregularly subverticillate with only 2–3 phialides at each node. *Conidiogenous cells* terminating at about the same level, phialidic, discrete, terminal, subcylindrical to subulate, hyaline, thin-walled, generally distinctly roughened below, 20–30(–35) µm tall, mainly 3–4·5 µm wide at the base but tapering to 2–3 µm wide at the tip. *Conidia* abundantly produced, solitary, slimy in mass, broadly ellipsoid, rounded at the apex but with a peg-like narrowly truncated base, simple, hyaline singly but pale orange in mass, ± smooth-walled but occasionally rather uneven in outline, (6–)7–9(–9·5) × 4·5–6 µm.

Host: *Physcia millegrana* Degel., thallus; also spreading on to adjacent thalli of *Candelaria concolor* (Dicks.) Stein in the type collection.

Distribution: U.S.A. Known only from the type collection.

Observations: The genus *Dendrodochium* has been used in the past for a wide range of sporodochial fungi. Tulloch (1972 : 5–6), however, considered that it could be regarded as separated from *Myrothecium* Tode ex Fr. by the pale and not dark conidial mass. An entirely satisfactory circumscription of *Dendrodochium* requires a monographic study, but at the moment it can be asserted that *D. subeffusum* is congeneric with the type species of the genus, *D. aurantiacum* Bonord.

Dendrodochium subeffusum appears to be primarily a pathogen of *Physcia millegrana*, but some doubt must remain in the absence of further collections. Its hosts do not appear to have previously been determined; it was originally described as 'on thallus of some foliaceous lichen'.

VI. **DICTYOPHRYNELLA** Bat. & Cavalcanti

Port. Acta Biol. B, **7** : 356 (1964); as '*Dictyoprhynella*'.

Colonies effuse; mycelium superficial, adpressed, sparsely regularly branching at right angles, brown, the cells giving rise to subglobose mucronate hyphopodia. Stroma and setae absent. Conidiophores micronematous, mononematous, prostrate, simple, dark brown, smooth-walled. Conidiogenous cells probably monotretic, integrated, intercalary, often catenate, determinate, subcylindrical or doliiform, dark brown, with one (or rarely two) oval lateral scars. Conidia solitary, dry, acrogenous, obclavate, submuriform with 3–4(–5) transverse septa and 0–2 oblique septa, basal cells brown to dark brown, apical cell markedly elongated, beak-like and subhyaline.

Type species: *Dictyophrynella bignoniacearum* Bat. & Cavalcanti.

Number of species: Monotypic.

1. Dictyophrynella bignoniacearum Bat. & Cavalcanti, *Port. Acta Biol.* B, **7** : 356 (1964). (Figs 12-13)

Type: Brazil, Amazonas, Manáus, Rondonia AMI-km 55 Manáus, on indet. lichen on leaves of Bignoniaceae sp., 23 August 1961, *J. Maria* (URM 28007 [20.144]—holotype!).

Icones: Batista & Cavalcanti, *Port. Acta Biol.* B, **7** : 357 fig. 4 (1964).

Colonies dispersed, superficial, dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching approximately at right angles, hyphae at first pale brown, flexuose and rather thin-walled but later becoming brown to dark brown, thick-walled, smooth-walled, cells mainly 3·5–5(–6) µm wide and 5–10 µm long, slightly constricted at the septa; hyphopodia arising rather irregularly, frequent, lateral, most often near the distal cell septum, one per cell, subglobose, brown, slightly thinner walled than the hyphae, mainly 3·5–5 µm diam, with flexuose mucronate necks 2–6 µm long and about 0·5 µm wide. *Conidiogenous* cells probably monotretic (rarely polytretic), integrated, intercalary, often forming chains, remaining prostrate, determinate, subcylindrical to doliiform, identical in size to the vegetative hyphae from which they are distinguishable only by attached conidia or 1(–2) distinct lateral scars, the scars oval, subhyaline, 1–2 µm diam. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–4(–5) transverse and 0(–2) oblique septa, portion excluding the apical cell 14–20 µm long and 5–7 µm wide, dark brown, the basal cell not or only slightly truncated, the scar usually ill-defined, subterminal cell paler than the basal cells or concolorous with the apical cell, apical cell markedly elongated, pale brown to subhyaline, mainly 14–16 µm long but variable, tapering to 1–2 µm wide near the apex, overall length 25–45 µm.

Host: On an undeterminable sterile foliicolous lichen. The fungus is restricted to the lichen thallus and does not spread on to adjacent areas of the leaf.

Distribution: Brazil. Known only from the type collection.

Observations: The conidia of this species are remarkably similar to those of some *Hansfordiellopsis* species, so that for some time (before I was able to examine the type in URM) I wondered whether it might be based on mycelium of an *Ampullifera* mixed with *Hansfordiellopsis* conidia.

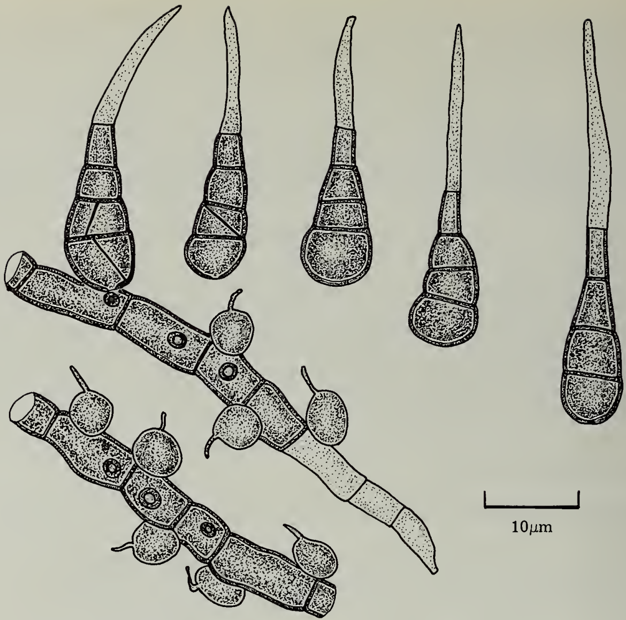

Fig. 12 *Dictyophrynella bignoniacearum* (URM 28007—holotype).

A study of the original material by both light and scanning electron microscopy left no doubt as to the accuracy of Batista & Cavalcanti's (1964) description and illustration. *Dictyophrynella* appears superficially like a *Hansfordiellopsis* in which the role of the vertical conidiogenous cells has been taken over by the cells subtending them. If this were so the merits of retaining *Dictyophrynella* as a distinct genus might be doubted, but in addition to the arrangement of the conidiiferous structures two other differences must be considered: the regular presence of functional (i.e. mucronate) hyphopodia, and, more importantly, the difference in the conidial scars (Fig. 13B–C) left on the conidiogenous cells. These latter lack the flattened rim characteristic of *Hansfordiellopsis* conidiogenous cells (compare with Fig. 19C). It is possible that its conidiogenesis is monoblastic, not monotretic, but transmission electron microscopy will be necessary to establish this fact.

The habit of *Dictyophrynella bignoniacearum* shows a remarkable resemblance to *Sessiliospora bicolor*, but the latter is kept in a distinct genus in view of its complete lack of hyphopodia or hyphopodium-like cells, the differently shaped conidia which are always only transversely septate, and, most importantly, the scars on the conidiogenous cells and conidia which have the flattened rim like region seen in *Hansfordiellopsis* but not *Dictyophrynella*. A small amount of the *Sessiliospora* was mounted for scanning electron microscopy but unfortunately proved to comprise only sterile mycelium; in view of the scant material no more was used and so a detailed account of its method of conidiogenesis must await further collections of the fungus.

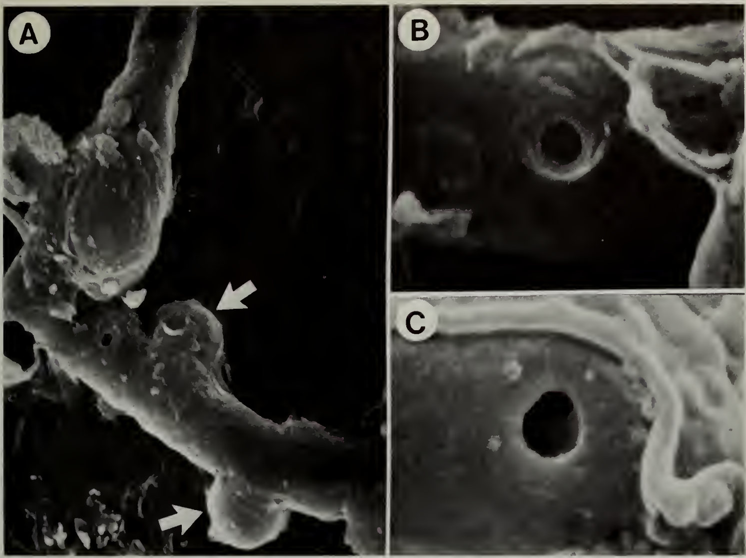

Fig. 13 *Dictyophrynella bignoniacearum* (URM 28007—holotype). **A,** Mycelium with hyphopodia (arrows) and conidium ($\times 3500$). **B–C,** Scars left by the secession of conidia ($\times 12\,000$). A–C Scanning electron micrographs.

VII. ENDOPHRAGMIELLA B. Sutton

Mycol. Pap. **132** : 58 (1973).

Colonies effuse, dark brown or black; mycelium immersed or sometimes partly superficial, irregularly branched, brown. Stroma sometimes developed but absent in most species. Setae and hyphopodia absent. Conidiophores macronematous, mononematous, erect, unbranched in most species but branched several times, particularly towards the base, in others, septate, pale to dark brown, smooth-walled, thick-walled but the wall somewhat unequal in thickness due to the method of proliferation, lacking a specialized foot cell. Conidiogenous cells monoblastic, integrated, terminal, usually percurrently proliferating (often many times) with the proliferation occurring from the distal septum of the penultimate cell of the conidiophore (or its successive proliferations). Conidia usually solitary, dry, acrogenous, rather variable in shape but mostly ellipsoid to clavate, pale to dark brown, the cells often unequally pigmented, 1–5 septate, smooth-walled or rarely slightly verrucose, each septum generally with a central pore, the base truncate and with a small portion of the conidiogenous cell adhering as a short frill in most species.

Type species: *Endophragmiella pallescens* B. Sutton.

Number of species: Four species were accepted by Ellis (1976 : 143–145) but several have been recognized since and many taxa formerly placed in the genus *Endophragmia* Duvernoy & Maire are currently being transferred to it by Hughes (unpublished), so that the actual number of species in the genus is about 30. Most species are saprophytes but some appear specific to particular hosts.

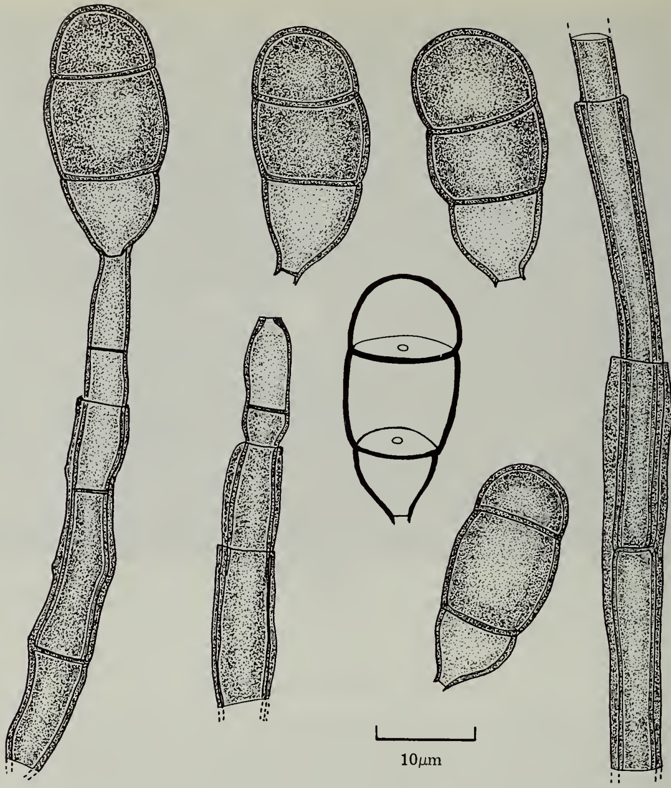

Fig. 14 *Endophragmiella hughesii* (IMI 217271—holotype).

Observations: Hughes (unpublished) is changing the concept of *Endophragmiella* considerably, and regards its key characters as the peculiar method of percurrent proliferation of the conidiogenous cells and the rhexolytic secession of the conidia.

1. Endophragmiella hughesii D. Hawksw. **sp. nov.**
(Fig. 14)

Fungus lichenicola. Mycelium immersum, ex hyphis pallide brunneis, plerumque 3–4 μm latis. Conidiophora macronemata, mononemata, recta, non ramosa, atrobrunnea, plerumque 80–150 × 5–8 μm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae, proliferatae. Conidia solitaria, sicca, acrogena, late-clavata, 2-septata, levia, cellulis atrobrunneis sed cellula basi subhyalina vel pallide brunnea, 25–30(–40) × 11–13 μm.

Typus: Magna Britannica, Scotia, Kintyre, *c.* 7 km SW e Crinan, insula N e Carsaig Island, in *Lobaria pulmonaria* (L.) Hoffm. (thallus emortuus) ad saxa, 14.viii.1977, *N. Brandt* (IMI 217271—holotypus!; DAOM—isotypus!).

Colonies dispersed, effuse, arising on the surface of the host lichen; mycelium immersed, irregularly branched, rather sparse, composed of irregularly branched hyphae, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, mainly 3–4 μm wide. *Conidiophores* macronematous, mononematous, erect, unbranched, thick-walled, smooth-walled, rather uneven in diameter due to the method of proliferation of the conidiogenous cells, dark brown, mainly 80–150 × 5–8 μm. *Conidiogenous cells* monoblastic, integrated, subcylindrical, often rather uneven in thickness due to the method of proliferation, percurrently proliferating many times with the proliferations arising from the distal septum of the penultimate cell of the conidiophore (or its successive proliferation), sometimes proliferating atypically, the method of proliferation giving the impression of multilayered walls to both the conidiophores and conidiogenous cells. *Conidia* solitary, dry, acrogenous, broadly clavate, 2-septate, slightly but clearly constricted at the septa, each septum with a central pore visible in optical sections or not fully pigmented spores, smooth-walled, the upper two cells dark brown to almost black at maturity, the basal cell remaining subhyaline or pale brown, base truncate with a scar usually 2–3 μm wide and a frill of tissue produced during rhexolytic secession from the conidiogenous cells, 25–30(–40) × 11–13 μm.

Host: *Lobaria pulmonaria* (L.) Hoffm., decaying thallus. The fungus is abundant on dead thalli of the host in the type collection, but it is also infected by several other lichenicolous fungi (including *Cornutispora lichenicola* D. Hawksw. & B. Sutton) and it is by no means clear that *Endophragmiella hughesii* was the cause of death. It is possible that this is not an obligately lichenicolous species, but might be a more catholic saprophyte still to be found on other substrates.

Distribution: British Isles. Known only from the type collection.

Observations: This species is named after Stanley J. Hughes who has laid the foundations of modern hyphomycete systematics over the last 25 years. The present fungus was examined by Dr Hughes (*in litt.*) who confirmed it as undescribed. *Endophragmiella hughesii* is distinguished from other species in the genus by the shape, size and pigmentation of the conidia.

The method of percurrent proliferation leading to the appearance of multilayered walls in the upper parts of conidiophores and lower parts of the conidiogenous cells is particularly characteristic of this genus, and is a useful aid for the separation of this species from all other known lichenicolous Hyphomycetes.

The type collection was sent to me in a moist condition by Mr B. J. Coppins in the hope that it might be possible to isolate the *Endophragmiella* into pure culture. Two attempts to do this were made, but only common fast-growing saprophytes (particularly species of *Penicillium*) were obtained.

VIII. **FUSARIUM** Link ex Fr.

Syst. mycol. **1** : xli (1821).

See Kendrick and Carmichael (1973 : 368) and Subramanian (1972 : 657) for synonyms of this generic name.

Colonies usually effuse; mycelium usually superficial but sometimes partly immersed, irregularly branched, hyaline but sometimes forming yellowish, greyish, pinkish, reddish or purplish pigments in the medium when grown in artificial culture. Stroma, setae and hyphopodia absent. Conidiophores macronematous, usually forming sporodochia but sometimes scattered amongst the mycelium, ± hyaline, simple or richly branched, often verticillately so. Conidiogenous cells phialidic, discrete, terminal, usually subulate, ± hyaline. Conidia solitary, slimy in mass, hyaline, of two types: microconidia which are usually simple, subglobose to ellipsoid, rounded at the apices, not known in all species; macroconidia which are usually 3-many transversely septate, fusiform to falcate or arcuate, characteristically with apices rounded and the base with a heel-like foot-cell.

Type species: *Fusarium roseum* Link ex Fr.

Number of species: About 50 species are currently accepted, of which 44 were treated in the monograph of Booth (1971). Only one obligately lichenicolous species is known.

Perfect state: Perfect states, where known, are all in the Hypocreaceae de Not. (Pyrenomycetes —Sphaeriales) and include ones in the genera *Calonectria* de Not., *Gibberella* Sacc., *Micronectriella* Höhn. and *Nectria* Fr.

Observations: Only a single species is accepted as obligately lichenicolous here, but attention is drawn to the treatments of *Fusarium sampaioi* and *Selenosporium* below (see also p. 237) which may also be based on species of this genus.

1. Fusarium peltigerae Westend., *Herb. crypt. Belg.*, fasc. 9, no. 414 (1849). (Fig. 15)

Type: Belgium, Courtrai, on old lobes of *Peltigera rufescens*, October, *G. D. Westendorp, Herb. crypt. Belg.*, fasc. 9, no. 414 (K—isotype!).

Fusarium ciliatum var. *majus* Wollenw., Fusarium *autogr. delin.*, no. 872 (1930); nom. nov. for *Fusarium peltigerae* Westend.

Exsiccatae: Westendorp, *Herb. crypt. Belg.*, fasc. 9, no. 414 (K!).

Colonies compact, erumpent, convex, gelatinous, pale pinkish orange, mainly 150–200 µm diam, arising in small discoloured brownish patches on the surface of aged lobes; mycelium ramifying within the cortical and algal layers of the host, hyphae flexuose, thin-walled, hyaline, 1–1·5 µm wide. *Conidiophores* macronematous, forming sporodochia, densely crowded and difficult to distinguish separately, hyaline, very irregular in shape, mainly 5–10 × 2–3 µm. *Conidiogenous cells* arranged ± parallel to one another, phialidic, discrete, terminal, collarette indistinct, subcylindrical or slightly curved, hyaline, thin-walled, very variable in length, mainly 10–18(–25) µm tall, 2–3 µm wide. *Microconidia* attached to conidiogenous cells not seen, ellipsoid, slightly attentuated basally, hyaline, smooth-walled, 3·5–5·5 × 2–3 µm. *Macroconidia* abundantly produced, solitary, arcuate, tapered at the apex but with a characteristic heel-like base, simple when first formed but with up to 5 septa when mature, hyaline, smooth-walled, (60–)70–120 × 2–3·5 µm.

Host: *Peltigera rufescens* (Weiss) Humb., thallus.

Distribution: Belgium. Known only from the type collection.

Observations: This species was treated as a synonym of *Fusarium aquaeductum* Lagerh., the conidial state of *Nectria purtonii* (Grev.) Berk., by Booth (1971) in his monograph of *Fusarium* Link ex Fr. In that species, however, the conidia are generally only 1-septate and 15–45 × 3–3·5 µm. Booth based his opinion as to the identity of this fungus on the treatment of it as an infraspecific taxon within *F. ciliatum* Link by Wollenweber (C. Booth, personal communication) and did not examine Westendorp's material. There can be no doubt that this is a distinct species of *Fusarium* because none of the taxa with long conidia accepted by Booth (1971) have such narrow spores. Modern *Fusarium* taxonomy is largely based on the study of species in pure culture and the reliable placing of *F. peltigerae* within the currently accepted sectional divisions of the genus is therefore difficult. It may perhaps be most appropriately placed in either sect. *Arthrosporiella* Wollenw. & Reink. or sect. *Sporotrichiella* Wollenw., depending on the manner in which the microconidia are produced; this could not be determined in the Westendorp collection studied.

As no *Fusarium* corresponding to *F. peltigerae* has been detected during the very extensive studies on the genus carried out over the last 65 years, it seems probable that this may be an obligately lichenicolous species. The fungus does, however, occur on aged lobes of the thallus, so it is possible that it is a saprophytic rather than a pathogenic species. A firm opinion as to its status in this regard must await fresh collections.

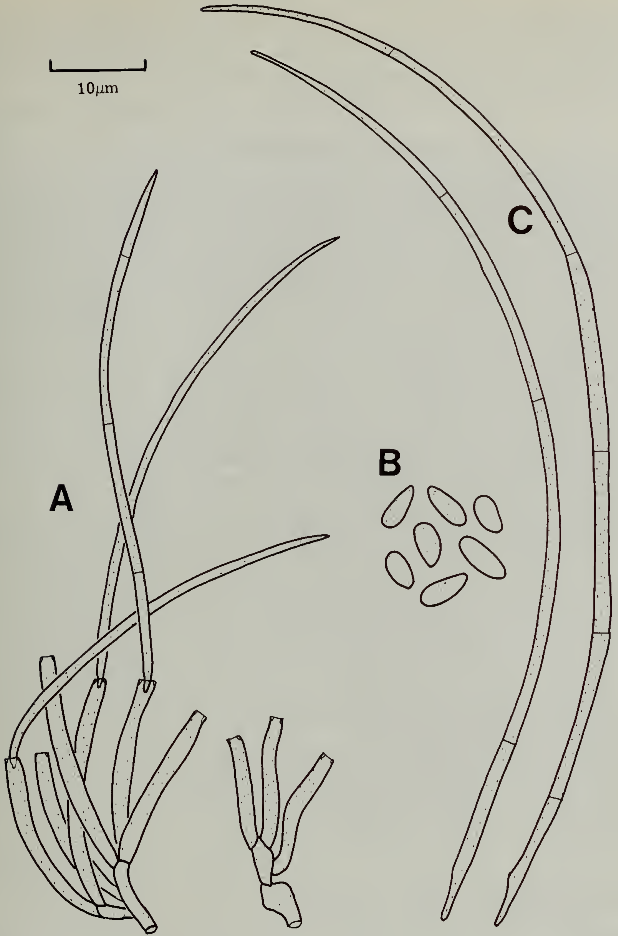

Fig. 15 *Fusarium peltigerae* (K—isotype). **A**, Conidiogenous cells with attached conidia. **B**, ? Microconidia. **C**, Macroconidia.

The epithet '*peltigerae*' is generally cited as being published in 1851, but that work (Westendorp, 1852 : 407) did not appear until 1852; the latter date is clearly printed on the paper cover of the journal, although the issue was for 1851. The exsiccatum label, which is reproduced word-for-word in Westendorp (*loc. cit.*), was, however, published in 1849 (Sayre, 1969 : 56) and so the epithet must be considered to date from then as a description was provided.

Wollenweber (1930) gave the maximum length of the conidia as 80 μm but in the K isotype many exceed this figure; the isotype he examined was evidently sporing less abundantly. Westendorp (*loc. cit.*) stated that the conidia included '. . . 10 à 15 sporules globuleuses et hyalines'; it is probable that these were merely guttules or oil drops, as it is most unlikely that he would have seen the fewer very thin septae present in them.

IX. HANSFORDIELLOPSIS Deight.

Mycol. Pap. **78** : 33 (1960).

Colonies effuse; mycelium superficial, adpressed, regularly branching, brown, in most species near the distal cell septa a pair of lateral hyphopodium-like hemispherical cells are produced; these rarely produce mucronate haustoria. Stroma, setae and true hyphopodia (?) absent. Conidiophores macronematous, mononematous, erect, unbranched, brown, smooth-walled. Conidiogenous cells monotretic, integrated, terminal, determinate, subcylindrical to almost ampulliform. Conidia solitary, dry, acrogenous, obclavate, usually submuriform with 3–5 transverse septa and 0–2 oblique septa, basal cells brown to dark brown, apical cell markedly elongated, beak-like and subhyaline.

Type species: *Hansfordiellopsis lichenicola* (Bat. & Maia) Deight. (syn. *H. aburiensis* Deight.).

Perfect state: *Ascohansfordiellopsis* D. Hawksw., known in *H. elongata* and *H. lichenicola* only.

Number of species: Five species are accepted here, four of which are newly described. All are obligately lichenicolous fungi occurring on foliicolous lichens in the tropics, although a few may spread from lichen colonies on to immediately adjacent areas of leaf.

Observations: This genus was originally considered by Deighton (1960 : 35) to have some affinity with *Clasterosporium* Schw. and *Sporidesmium* Link ex Fr. in the method of conidiogenesis which was described as blastic. Ellis (1971 : 126), following Deighton, referred to the conidiogenesis as monoblastic. Subsequent observations by Deighton (*in litt.*) and myself leave little doubt that the conidia are monotretically produced (see Fig. 19C). The genus consequently seems to occupy a rather isolated position amongst the Hyphomycetes, a not uncommon situation amongst the obligately lichenicolous fungi.

Hansfordiellopsis species generally produce pairs of lateral cells which are almost hemispherical in shape. Deighton (1960 : 35) did not consider them to be attachment organs and their function is unclear. In some instances they were found to produce mucronate haustorium-like extensions during the present study (Figs 18Aa, 20 and 22B), but these occur so irregularly that it is difficult to accept that this is their primary role.

The overall size of the conidia and their septation proved to be rather variable characters for species delimitation in the genus, and in the treatment adopted here emphasis has been placed on the conidiogenous cells and the mycelium; in several instances these were found to be correlated with other differences, particularly in the conidia.

Hansfordiellopsis species do not, as far as is known, actually kill their hosts, but when abundant they must surely inhibit photosynthesis by reducing the surface area exposed to sunlight. In this respect it is of interest to note that ascocarps are often not, or only sparingly, produced in foliicolous lichens attacked by fungi of this genus.

Key to the species

1	Conidiogenous cells less than 30 μm tall	2
–	Conidiogenous cells (30–)35–40(–45) μm tall	**H. elongata (p. 221)**
2	Conidia mainly exceeding 5 μm in width; hyphopodium-like cells abundant	3
–	Conidia 3·5–5 μm wide; hyphae 3–4 μm wide; hyphopodium-like cells generally absent	**H. tenuissima (p. 229)**
3	Conidiogenous cells mainly less than 10 μm tall	4
–	Conidiogenous cells 10–20(–25) μm tall	**H. lichenicola (p. 224)**

4 Conidia 5–6 μm wide, the first two subterminal cells ± concolorous with the basal cell, basal cell generally somewhat attenuated . . . . **H. minuta** (p. 227)
– Conidia 6–7·5 μm wide, the first two subterminal cells distinctly paler than the basal cell, basal cell not markedly attenuated . . . . **H. variegata** (p. 231)

1. Hansfordiellopsis elongata D. Hawksw. **sp. nov.**
(Fig. 16)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 5–10 μm longis et 7–8 μm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 5 μm diam. Cellulae conidiogenae monotreticae, integratae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, (30–)35–40(–45) × 4–5·5 μm. Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 4-transverse septata, 0–2 oblique septata, 24–30 × 5·5–7·5 μm, cellulis brunneis sed cellula apicali in rostro subhyalino.

Typus: Kenya, South Western Mau Forest Reserve, 35°18′30″ E et 0°36′30″ S, in lichenibus foliicolis (*Porina trichothelioides* R. Sant.) ad *Culcasiam* sp., 14.viii.1949, *R. A. Maas Geesteranus 5794*b (IMI 85643—holotypus!; UPS—isotypus).

Colonies dispersed, superficial, olivaceous brown to dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, slightly constricted at the septa, cells mainly 5–10 μm long and 7–8 μm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 5 μm diam. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering only very slightly from the base, brown, smooth-walled, terminated by a single truncate scar, (30–)35–40(–45) × 4–5·5 μm. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 4 transverse septa and 0–2 oblique septa, portion excluding the terminal cell 12–16 × 5·5–7·5 μm, brown, basal cell truncated with a scar usually 2 μm wide, apical cell markedly elongated, subhyaline, mainly 10–20 μm long but variable in length, tapering to 1–2 μm wide near the apex, overall length of the conidia 24–30 μm.

Perfect state: *Ascohansfordiellopsis deightonii* D. Hawksw.*

Hosts: On thalli of *Porina trichothelioides* R. Sant in the type collection but also seen on a sterile foliicolous lichen thallus which was indeterminable.

Distribution: Kenya and Sierra Leone.

Observations: *Hansfordiellopsis elongata* is a distinctive species in the genus clearly distinguished by its wide and rather short-celled hyphae, very abundant hyphopodia-like cells, and more particularly by the elongated conidiogenous cells which the specific epithet recalls. In the type collection, the fungus is strictly confined to thalli of *Porina trichothelioides* and does not spread on to adjacent areas of lichen-free leaf. In the Sierra Leone collection, in which it occurs on sterile foliicolous lichen thalli, it is of interest that it does not occur on *Tricharia* colonies on the same leaf. These very preliminary observations perhaps suggest that *H. elongata* has a different host

*__Ascohansfordiellopsis__ D. Hawksw. **gen. nov.**
Genus lichenicola, ad Sphaeriales vel Pseudosphaeriales incertae sedis pertinens. Perithecia ex mycelio cum cellulis similibus hyphopodiis orientia, subglobosa, ostiolata, atrobrunnea, sparse setosa. Paraphyses non distinctae. Asci tenuissimo-tunicati, clavati, octospori. Ascosporae distichae, ellipsoideae, brunneae, laeves, 3-septatae. Status imperfectus ad genus *Hansfordiellopsis* Deight. pertinens.—Species holotypica est *Ascohansfordiellopsis deightonii* D. Hawksw.

Ascohansfordiellopsis deightonii D. Hawksw. **sp. nov.**
(Fig. 17A–C)
Perithecia dispersa, superficialia, globosa vel subglobosa, atrobrunnea, ostiolata, 70–100 μm diam, setosa cum setis arcuatis atrobrunneis et laevibus 20–50 × 6–8 μm; peridium e 3–4 stratis cellularum brunnearum pseudoparenchymaticarum, 15–20 μm crassum. Paraphyses non distinctae. Asci tenuissimo-tunicati, clavati, octospori, 40–45 × 8–10 μm. Ascosporae distichae, ellipsoideae, brunneae, laeves, 3-septatae, 11·5–14 × 5–6·5 μm. Status imperfectus est *Hansfordiellopsis elongata* D. Hawksw.—Holotypus: Kenya, South Western Mau Forest, 35°18′30″ E et 0°36′30″ S, in lichenibus foliicolis (*Porina trichothelioides* R. Sant.) ad *Culcasiam* sp., 14.viii.1949, *R. A. Maas Geesteranus 5794*b (IMI 85643!).

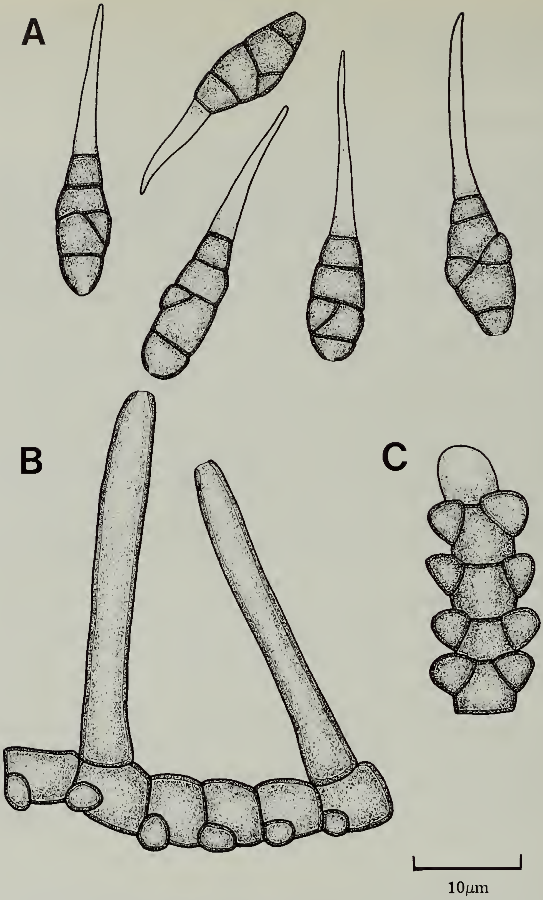

Fig. 16 *Hansfordiellopsis elongata* (IMI 85643—holotype). **A,** Conidia. **B,** Mycelium and attached conidiogenous cells. **C,** Mycelium in surface view showing arrangement of the hyphopodia-like cells.

range to *H. lichenicola*, but any categoric statement would be premature in the absence of further material.

Perithecia are abundantly developed from mycelia of *Hansfordiellopsis elongata* in the type collection and some perithecia were also noted on IMI 52353*c*, although in that material they were effete. The perfect state is clearly congeneric with *Chaetosphaeria insectivora* Hansf. (see p. 224), the perfect state of *H. lichenicola*, from which it differs in the slightly larger ascospores

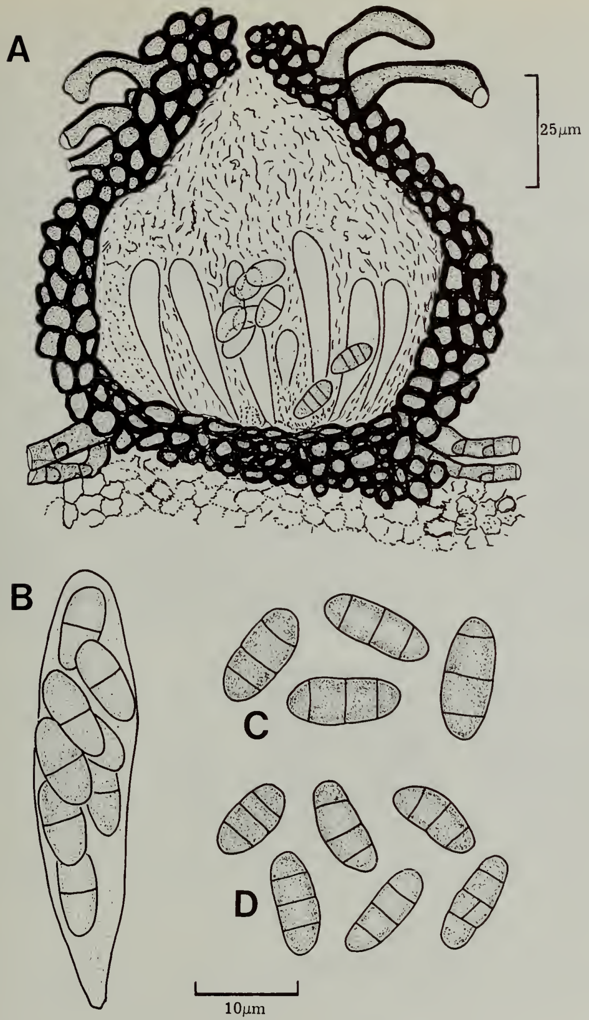

Fig. 17 A–C *Ascohansfordiellopsis deightonii* (IMI 85643—holotype). **A,** Vertical section of perithecium. **B,** Immature ascus. **C,** Ascospores. **D,** *A. insectivora* (IMI 4249—holotype) ascospores.

(11·5–14 × 5–6·5 µm) as well as the very different conidial states. The limits of *Chaetosphaeria* Tul. have been the subject of considerable controversy in recent years but Gams and Holubová-Jechová (1976 : 8) restrict it to taxa with hyaline ascospores and phialidic imperfect states. The rather scant material precludes a thorough anatomical investigation of the perfect state without destroying it, but nevertheless there can be little doubt that the perfect states of *H. elongata* and *H. lichenicola* represent a hitherto unrecognized genus for which the generic name *Ascohansfordiellopsis* is introduced here. While the position of this genus remains uncertain at the present time, it is of interest to note that it has at least some superficial similarity to *Phaeophragmiella* Hansf., also an imperfectly understood genus, which is parasitic on *Meliola* species (Hansford, 1946*a* : 94–101) but differs in the much larger ascospores and the absence of any known imperfect state, and further to *Teratoschaeta* Bat. & Fonseca, possibly the perfect state of *Ampullifera* (see p. 199).

Additional specimen: **Sierra Leone**: Njala (Kori), on indet. lichens on *Blighia sapida*, 16 March 1953, *F. C. Deighton M5184* (IMI 52353*c*!).

2. Hansfordiellopsis lichenicola (Bat. & Maia) Deight., *Mycol. Pap.* **101** : 31 (1965). (Figs 18–19)

Hansfordiella lichenicola Bat. & Maia, *Publçoẽs Inst. Micol. Recife* **283** : 27 (25 September 1960).
Type: Brazil, Pernambuco, Recife, Dois Irmãos, on *Setomyces giganteae* Bat. & Bez. on *Gustavia augusta*, 13 March 1960, *O. Soares da Silva* (URM 18781—holotype!).
Hansfordiellopsis aburiensis Deight., *Mycol. Pap.* **78** : 34 (28 September 1960).
Type: Ghana, Aburi, on lichens on *Cola verticillata*, 5 April 1953, *T. W. Tinsley* (IMI 55448*c*—holotype!).
Hansfordiellopsis deightonii Bat. & Herr., *in* Batista and Cavalcanti, *Port. Acta Biol.* B, **7** : 358 (1964).
Type: Brazil, Pará, Bragança, on *Setomyces orchidae* Bat. & Peres on Leguminosae leaves, 4 October 1961, *C. T. Vasconcelos* (URM 28063—holotype non vidi).

Icones: Batista, Bezerra & Maia, *Publçoẽs Inst. Micol. Recife* **283** : 28 fig. 10 (1960).—Batista & Cavalcanti, *Port. Acta Biol.* B, **7** : 357 fig. 5 (1964).—Deighton, *Mycol. Pap.* **78** : 35 fig. 19 (1960).—Ellis, *Demat. Hyphom.* : 128 fig. 83 (1971).—Kendrick & Carmichael, *in* Ainsworth *et al.*, *The Fungi* **4A** : 472 Pl. 37A (1973).

Colonies dispersed, superficial, olivaceous brown to dark brown or almost black, arising on the surface of the host lichens but also spreading on to adjacent parts of the leaf surface, commonly also extending up the sterile setae of setose hosts; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, pale brown to dark brown, septate, slightly constricted at the septa, cells mainly 6–12 µm long, 4–6(–7) µm wide; hyphopodia-like cells arising, usually in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, brown, mainly 3–5 µm diam, exceptionally becoming mucronate with a subhyaline haustorium-like hypha 2–4 µm long. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical but tapering from the base, arising singly on the mycelium, exceptionally with a septum in the lower third, brown, smooth-walled, 10–20(–25) µm tall, 4–6 µm wide at the base and 2–3 µm wide at the apex which is terminated by a single truncate scar. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–5 transverse septa and (0–)1–3 oblique septa, portion excluding the terminal cell 12–18 µm long and 5–7(–8·5) µm wide, brown, basal cell truncated with a scar mainly 2–3 µm wide, subterminal cell slightly paler brown, apical cell markedly elongated, paler brown to subhyaline, mainly 10–30 µm long but very variable, tapering to 1–2 µm wide near the apex, overall length of the conidia 18–50 µm.

Perfect state: **Ascohansfordiellopsis insectivora** (Hansf.) D. Hawksw. **comb. nov.** (basionym: *Chaetosphaeria insectivora* Hansf., *Proc. Linn. Soc. Lond.* **157** : 185, 1946; type: Uganda, Entebbe Road, on *Gyalectidium rotuliforme* on *Aristolochia dorsivenia*, March 1944, *C. G. Hansford 3381*, IMI 4249—holotype!).

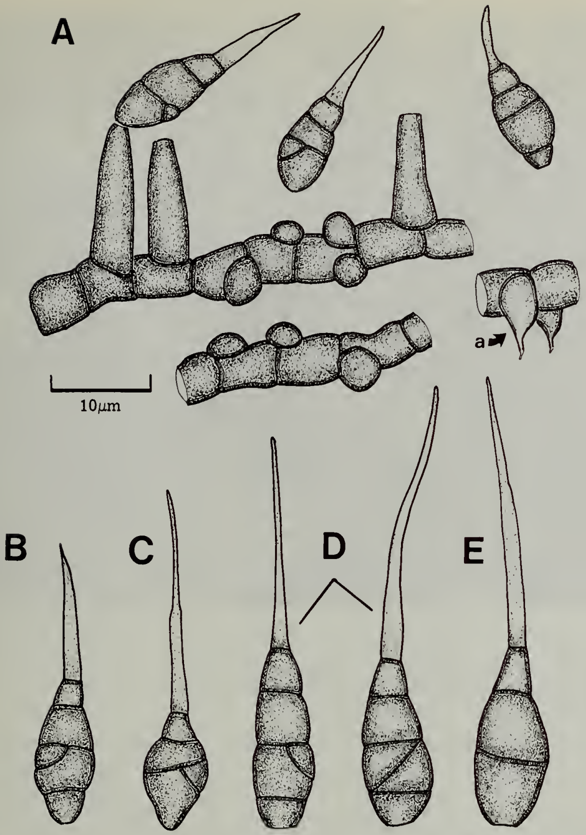

Fig. 18 *Hansfordiellopsis lichenicola*. **A,** Conidiogenous cells, conidia and mycelium with hyphopodia-like cells. **B–E,** Conidia. A IMI 55448*c*, a′ URM 18781 (holotype), B IMI 106122*e*, C IMI 99552*a*, D IMI 89824*a* and E IMI 81812.

Hosts: On foliicolous lichens, particularly *Gyalectidium aspidotum* (Vain.) R. Sant., *G. rotuliforme* Müll. Arg., *Setomyces giganteae* Bat. & Bez., *S. orchidae* Bat. & Peres, and *Tricharia* species. Ascocarp formation in the hosts is apparently often inhibited by the presence of this fungus rendering host determination difficult.

Distribution: Apparently pantropical as are its hosts. Collections have been seen by me from Brazil, the Congo, Jamaica, Malaya, Nigeria, Puerto Rica, Sarawak, Sierra Leone, Tanzania, Trinidad and Uganda.

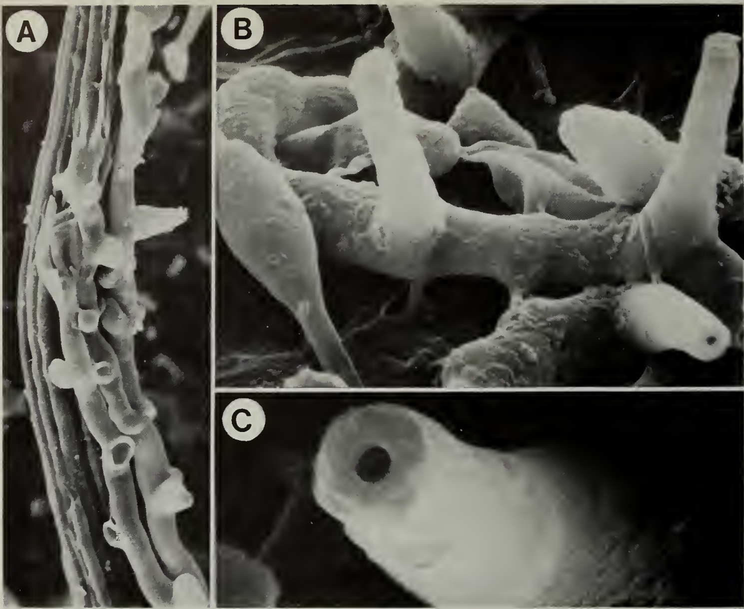

Fig. 19 *Hansfordiellopsis lichenicola*. **A,** Seta of *Tricharia* sp. with hyphae of the lichenicolous fungus growing up it (IMI 52353*b*, ×1300). **B,** Conidiogenous cells, mycelium and conidia (IMI 106122*a*, ×3600). **C,** Apex of conidiogenous cell showing scar left by conidium secessation (IMI 106122*a*, ×12 000). A-C Scanning electron micrographs.

Observations: *Hansfordiellopsis lichenicola* is evidently not an uncommon species although it has rarely been mentioned in the literature. The mycelial characters are generally constant, apart from the rare production of haustoria by the hyphopodia-like cells which was seen in a single collection (URM 18781), and these, together with the length of the conidiogenous cells, serve to distinguish it from the other species of its genus. The septation of the conidia and also their overall length are very variable (Fig. 18), but because of the range of conidium types which occurs within single colonies, this appears to be of minor importance and is perhaps due merely to environmental factors.

A particularly interesting trait seen in this fungus is its ability to entwine itself around the setae present on its hosts (e.g. Fig. 19A); in some collections it is even largely confined to the setae, with little mycelium on the thallus itself. Although it is able to spread on to adjacent areas of leaf from lichen colonies and also from them over epiphyllous liverworts, in no case has it been found on an area of leaf unattached to a lichen.

The imperfect and perfect states of this fungus were apparently first described by Hansford (1946*b* : 185) but he did not appreciate that it was lichenicolous and reported it '. . . in insectis parasiticum' and '. . . always associated with what appears to be the same insect, probably a scale or aleyrodid'; the structures he was interpreting as insect in origin were in fact the convex thalli of *Gyalectidium rotuliforme* which even has apothecia in Hansford's holotype. The perfect state is evidently rare and rather few mature perithecia are present on *Hansford 3381*; a few also occur in *Hansford 3495*, collected in the type locality. The perithecia are 80–110 μm diam, with 2–6 arcuate setae 40–70 × 7–8 μm, asci 40–50 × 10–12 μm, and ascospores 3-septate when mature, pale brown, 9–11 × 4–5 μm (*not* 11–13 μm long as stated by Hansford, *loc. cit.*).

Although the type of *Hansfordiellopsis deightonii* was not obtained from URM, study of a specimen authentic for the name supplied (IMI 113850*b*!) and the original illustrations leave little doubt that it represents *H. lichenicola* as interpreted here.

Additional specimens: **Brazil**: Rondonia Province, on indet. lichens on Palmae, March 1962, *O. Fonseca* (IMI 113850*b*!, URM).—**Congo**: Semliki Valley, on indet. lichen on *Phoenix reclinata*, *Hendrickx 2737* (IMI 5721!).—**Jamaica**: Portland, Ecclesdown, on indet. lichen on *Lobelia grandifolia*, 29 March 1961, *R. I. Leather CB 442* (IMI 87776!).—**Malaya**: Selangor, Serdang, Federal Experimental Station, on indet. lichen on *Lansium domesticum* var. *dukii*, 11 November 1949, *A. Johnston 478 p.p.* (IMI 41011*b*!); *loc. cit.*, on *Tricharia* sp. on *Lansium domesticum*, 2 January 1955, *A. Johnston 1244* (IMI 56061*b*!).—**Nigeria**: Benin, on *Tricharia* setae on *Caryota mitis*, 10 August 1961, *A. G. Bailey 872* (IMI 99552*a*!).—**Puerto Rico**: Rio Piedras, Agricultural Experimental Station, on indet. lichen on *Garcinia mangostana*, 4 April 1962, *F. A. Wellman 3622* (IMI 94767!).—**Sarawak**: Balingian, on *Gyalectidium aspidotum* on *Coffea robusta*, 27 August 1962, *G. J. Turner FH 154* (IMI 96192*c*!); Kucking, on indet. lichen on *Cinnamomum zeylanicum*, 28 July 1965, *G. J. Turner FH 270* (IMI 115461*c*!).—**Sierra Leone**: Njala (Kori), on *Tricharia* sp. on *Blighia sapida*, 16 March 1953, *F. C. Deighton 5184* (IMI 52353*b*!); *loc. cit.*, on *Tricharia* setae on *Parinari excelsa*, 15 July 1953, *F. C. Deighton M5364 p.p.* (IMI 53373*b*!); Gegbwema (Tunkia), on indet. lichen on *Voacanga thouarsii*, 4 April 1939, *F. C. Deighton M1970 p.p.* (IMI 23413*b*!).—**Tanzania**: Kigoma, Mkenke, on indet. lichen on *Baphia kirkii*, 28 March 1964, *K. A. Pirozynski M891k* (IMI 107199*k*!); Kigoma, Kasekela, on *Tricharia* sp. on *Monanthotaxis poggei*, 8 February 1964, *K. A. Pirozynski M412f* (IMI 106639*f*!); Kigoma, Kakombe, on indet. lichen on *M. poggei*, 28 December 1963, *K. A. Pirozynski M112b* (IMI 105932*b*!); Kigoma, Mkenke, on *Tricharia* setae on *Tiliacora funifera*, 9 January 1964, *K. A. Pirozynski M241e* (IMI 106122*e*!).—**Trinidad**: Aripo savanna, on *Tricharia* sp. on indet. leaf, 27 September 1960, *C. L. A. Leakey 25* (IMI 86315*a*!).—**Uganda**: Entebbe Road, on *Gyalectidium aspidotum* on *Artabotrys nitidus*, November 1943, *C. G. Hansford 3245* (IMI 89824*a*!); *loc. cit.*, on *G.* sp. on *Aristolochia dorsivenia*, May 1944, *C. G. Hansford 3495* (IMI 4731!); Kampala, on *G. aspidotum* on *Coffea excelsa*, *C. G. Hansford 849* (IMI 81812!); *loc. cit.*, on *G. aspidotum* on *C. liberica*, September 1930, *C. G. Hansford 1354* (IMI 96606!).

3. **Hansfordiellopsis minuta** D. Hawksw. **sp. nov.**
(Fig. 20)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 7–10 μm longis et 5–7 μm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 3–4 μm diam. Cellulae conidiogenae monotreticae, integratae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, 7–9(–10) × 4–5 μm. Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 2–4 transverse septata, 0–1 oblique septata, 20–40 × 5–6 μm, cellulis brunneis sed cellula apicali in rostro subhyalino, cellula basi plerumque angustata.

Typus: Sierra Leone, Njala (Kori), in lichenibus foliicolis, ad *Parinari excelsa*, 15.viii.1953, *F. C. Deighton M*5364 *p.p.* (IMI 53373*c*—holotypus!).

Colonies dispersed, superficial, olivaceous brown to brown, arising on the surface of the host lichen; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, not or slightly constricted at the septa, cells mainly 7–10 μm long and 5–7 μm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 3–4 μm diam but sometimes with mucronate haustorium-like hyphae 3–5 μm long originating from them. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering from the base, somewhat to almost ampulliform, brown, smooth-walled, terminated by a single truncate scar, 7–9(–10) × 4–5 μm. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 2–4 transverse septa and 0–1 oblique septa, portion excluding the terminal cell 12–18 × 5–6 μm, brown, basal cell often rather markedly narrowed and truncated with a scar 1–1·5 μm wide, subterminal cell pale brown, apical cell markedly elongated, subhyaline, 10–20 μm long but very variable in length, tapering to 1·5–2 μm wide near the apex, overall length of the conidia 20–40 μm.

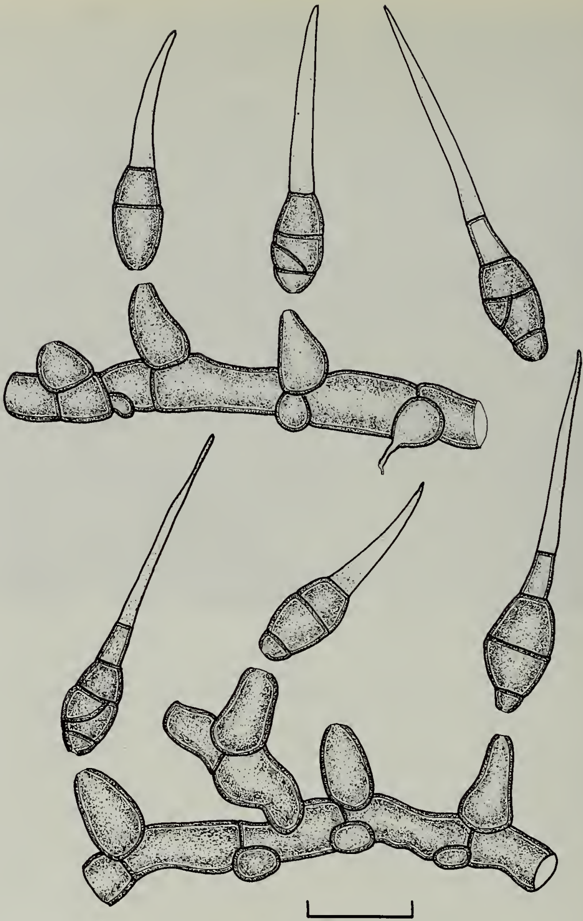

Fig. 20 *Hansfordiellopsis minuta* (IMI 53373*c*—holotype).

Hosts: On indeterminate foliicolous lichen thalli.

Distribution: Ghana and Sierra Leone.

Observations: In the holotype collection, *Hansfordiellopsis minuta* occurs on the same leaf as *H. lichenicola* but is present on different lichen thalli and maintains its distinctness. *H. minuta*

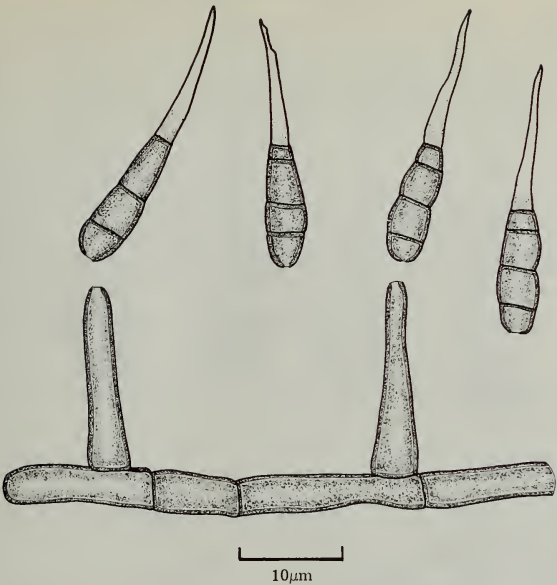

Fig. 21 *Hansfordiellopsis tenuissima* (IMI 99086*b*—holotype).

recalls *H. variegata* in having very short conidiogenous cells, but differs from that species in the coloration of the conidia and shape of the basal cell of the conidia.

Additional specimen: **Ghana**: Aburia, on indet. lichens on *Cola verticillata*, 5 April 1953, *T. W. Tinsley* (IMI 53448*e*!).

4. Hansfordiellopsis tenuissima D. Hawksw. **sp. nov.**
(Fig. 21)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 10–22 μm longis et 3–4 μm latis, plerumque sine cellulis similibus hyphopodiis. Cellulae conidiogenae monotreticae, integratae, subcylindricae, ex cellulis hypharum singulariter orientes, brunneae, 18–20 × 3·5–5 μm. Conidia solitaria, sicca, acrogena, obclavata, levia, 3–4 septata, 20–25(–28) × 3·5–5 μm, cellulis brunneis sed cellula apicali in rostro subhyalino.

Typus: Ghana, Aburi, in lichenibus foliicolis ad *Ananas sativus*, 1.x.1953, *F. C. Deighton CB 1001* (IMI 99086*b*—holotypus!).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen but sometimes spreading on to adjacent parts of the leaf; mycelium superficial, adpressed, sparsely branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, not or slightly constricted at the septa, cells mainly 10–22 μm long and 3–4 μm wide; hyphopodia-like cells generally absent but rare swellings which could be these or young branches 3·5–4 μm diam were seen on a few hyphae. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical, tapering slightly from the base, smooth-walled, terminated by a single truncate

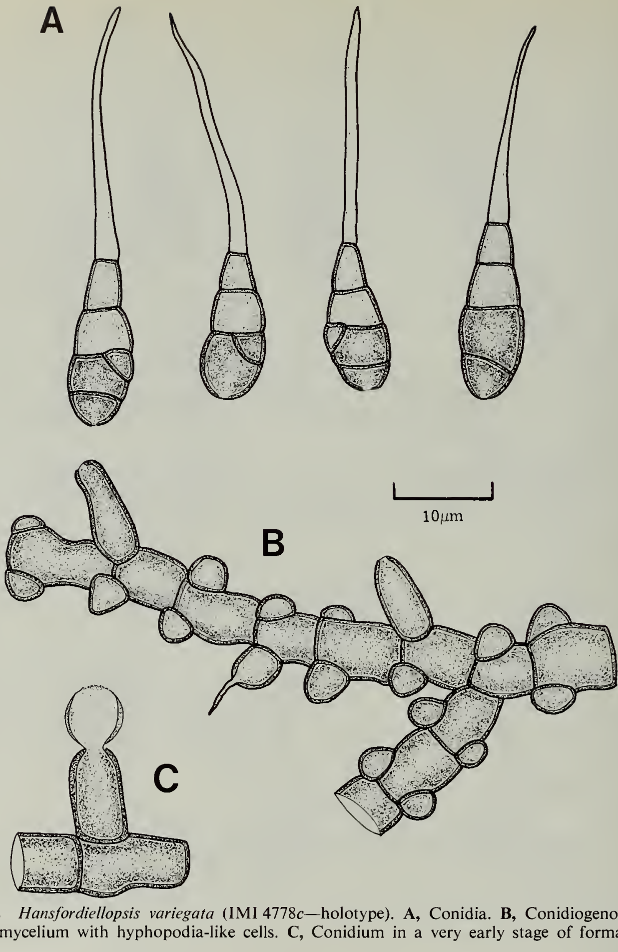

Fig. 22 *Hansfordiellopsis variegata* (IMI 4778*c*—holotype). **A,** Conidia. **B,** Conidiogenous cells and mycelium with hyphopodia-like cells. **C,** Conidium in a very early stage of formation.

scar, 18–20 × 3·5–5 μm. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, 3–4(–5) septate, portion excluding the terminal cell 12–15 × 3·5–5 μm, brown, basal cell truncated with a scar 1–1·5 μm wide, apical cell markedly elongated, subhyaline, mainly 10–12 μm long but variable in length, tapering to 1–2 μm wide near the apex, overall length of the conidia 20–25(–28) μm.

Host: On indeterminate foliicolous lichen thalli.

Distribution: Ghana. Known only from the type collection.

Observations: This distinctive species is readily separable from the other species of *Hansfordiellopsis* accepted here by the narrower conidia, which are also only transversely septate, the narrow mycelial hyphae, and furthermore by the absence of abundant hyphopodia-like cells. (A few rare cells which possibly were hyphopodiiform were seen, see above.)

5. Hansfordiellopsis variegata D. Hawksw. **sp. nov.**
(Fig. 22)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis brunneis plerumque 7–9 μm longis et 4–6 μm latis, cum cellulis similibus hyphopodiis subhemisphaericis plerumque 3–4 μm diam. Cellulae conidiogenae monotreticae, integratae, subcylindricae vel ampulliformae, ex cellulis hypharum singulariter orientes, brunneae, 8–12 × 4–5 μm. Conidia solitaria, sicca, acrogena, obclavata, levia, submuriformia, 3–4 transverse septata, 0–1 oblique septata, 35–40 × 6–7·5 μm, cellulis brunneis sed cellula apicali in rostro hyalino.
Typus: Uganda, Entebbe Road, in lichenibus foliicolis (*Gyalectidium aspidotum* (Vain.) R. Sant.) ad *Ficus urceolaris*, xi. 1943, *C. G. Hansford 3260* (IMI 4778*c*—holotypus!).

Colonies dispersed, superficial, pale olivaceous brown, arising on the surface of the host lichen but sometimes spreading somewhat on to adjacent areas of the leaf; mycelium superficial, adpressed, regularly branching at wide angles, hyphae fairly thick-walled, smooth-walled, brown, septate, slightly constricted at the septa, cells mainly 7–9 μm long and 4–6 μm wide; hyphopodia-like cells arising in pairs on opposite sides of the mycelium, near the distal cell septa, subhemispherical, mostly 3–5 μm diam, sometimes becoming mucronate with a subhyaline to hyaline haustorium-like projection to 6 μm long. *Conidiogenous cells* monotretic, integrated, terminal, determinate, subcylindrical to almost ampulliform, brown, smooth-walled, terminated by a single truncate scar, 8–12 × 4–5 μm. *Conidia* solitary, dry, acrogenous, obclavate, smooth-walled, submuriform with 3–4 transverse and 0–1 oblique septa, portion excluding the terminal cell 14–18 × 6–7·5 μm, the lower two cells in 4-septate and the lower cell in 3-septate spores dark brown, the median two cells pale brown, basal cell truncated with a scar about 1·5–2 μm wide, apical cell markedly elongated, subhyaline, mainly 15–20 μm long, tapering to 1–2 μm wide near the apex, overall length of the conidia 35–40 μm.

Host: On thalli of *Gyalectidium aspidotum* (Vain.) R. Sant.

Distribution: Uganda. Known only from the type collection.

Observations: This collection was cited by Hansford (1946*b* : 185) as an imperfect state collection of *Chaetosphaeria insectivora*, and Deighton (1960 : 35) listed it under *Hansfordiellopsis aburiensis* without a critical study of this specimen (Deighton, *in litt.*). *H. variegata* is, however, quite distinct from *H. lichenicola*, the two cells below the apical one having a distinctly paler shade than the one (or two) cells below them. On more careful examination it is also seen to differ in the much shorter conidiogenous cells. *H. minuta* resembles *H. variegata* in having short conidiogenous cells, but differs in the cells in the body of the spore being concolorous and the basal cell of the conidia somewhat attenuated.

X. ILLOSPORIUM Mart. ex Ficinus & Schubert

Fl. Dresd. **2**: 259 (1823); Fr., *Syst. mycol.* 3(1) : 258 (1829).
Illosporium Mart., *Fl. crypt. Erlang.* : 325 (1817); nom. inval. (Art. 13).

Colonies usually discrete, sometimes becoming confluent and effuse; mycelium immersed, very irregular, hyaline. Stroma, setae and hyphopodia absent. Conidiophores mononematous, forming compact convex subgelatinous sporodochia which are often brightly coloured, very irregularly branched and difficult to distinguish from the vegetative hyphae. Conidiogenous cells monoblastic or polyblastic, integrated, terminal or intercalary, subcylindrical to subglobose or irregular, hyaline. Conidia catenate, adhering in compact irregular masses, hyaline singly but usually pale pink or rose in mass, simple, subglobose but often angular due to compression by adjacent cells, smooth or indistinctly verruculose, lacking any distinct scar.

Type species: *Illosporium carneum* Fr. (syn. *I. roseum* Mart. ex Ficinus & Schubert).

Perfect state: *Nectriella* Nitschke, known in one species (*I. carneum*).

Number of species: This generic name has been employed for considerable numbers of non-lichenicolous taxa, most of which are probably not congeneric with *Illosporium carneum*. A thorough revision is needed. Although Keissler (1930 : 629–635) accepted four lichenicolous species and one variety in Europe, only two are here, and one of these is in need of further investigation.

Observations: This generic name has not been investigated by mycologists in recent years. Kendrick & Carmichael (1973 : 378), for example, considered it as probably a *nomen dubium*. Subramanian (1972 : 615), however, provided a short diagnosis and included one non-lichenicolous species 'with hesitation'. The type species of the genus has generally been cited as '*Illosporium roseum* Mart. ex Fries' but such a name does not appear to exist. Fries (1829 : 258–260) accepted four species in the genus: *I. roseum* (Schreb.) Fr., *I. carneum* Fr., *I. coccineum* Fr. and the non-lichenicolous *I. persicinum* Fr. If *I. roseum* (Schreb.) Fr. were considered the type species then the generic name would be of uncertain application in view of the uncertainties surrounding that epithet (see p. 280). Martius (1817 : 325), however, introduced the generic name *Illosporium* for a single species which he called *I. roseum* 'mihi' but made no reference to Schreber's epithet. Fries (*loc. cit.*) did not specifically designate a type species for the generic name but he firmly attributed it to Martius; in view of this he can be considered as using the name in Martius' sense and so the species concept of '*I. roseum* Mart.', not '*I. roseum* (Schreb.) Fr.', must be regarded as the type of the generic name even though the correct name for that species is in fact *I. carneum* (see below).

Attention is also drawn here to a fungus macroscopically very similar to *Illosporium* but which has compacted helicoid conidia and is known now from two collections (**Canada**: Ontario, Peel County, W. of Palgrave, on *Physcia stellaris* (L.) Nyl., 6 November 1955, *R. F. Cain*, IMI 73146!, TRTC 31698; **Italy**: Bresica, Idro, shore of lake 'Lago d'Idro', on *Candelaria concolor* (Dicks.) Stein on *Populus*, 4 September 1977, *M. Skytte Christiansen*, IMI 226836!). This fungus is currently being studied further but appears to be closely allied to the genus *Hobsonia* Berk.

Key to the lichenicolous species

1 Sporodochia irregular above, pale pink; conidia mainly (4–)6–7 μm diam, indistinctly verruculose, separating . . . . **I. carneum** (p. 232)
– Sporodochia strongly convex and regularly delimited above, orange to bright pink or rose; conidia 6–10 μm diam, smooth, separating only with extreme difficulty . **I. corallinum** (p. 236)

1. Illosporium carneum Fr., *Syst. mycol.* **3**(1) : 259 (1829).
(Figs 23–24)

Type: France, Lyon, on *Peltigera rufescens*, *Montagne* (UPS-Fries—lectotype!).

Illosporium roseum Mart., *Fl. crypt. Erlang.* : 325 (1817); nom. inval. (Art. 13).

Orig. coll.: Germany, Erlangen, 'in thallo lichenum nonnullorum terestrium, praesertim in *Capitulariarum* et *Peltidearum*, in ericetis'. Type: see below for neotypification.

Illosporium roseum Mart. ex Ficinus & Schubert, *Fl. Dresd.* **2** : 259 (1823); nom. illegit. (Arts. 13, 64). Non *Illosporium roseum* (Schreb.) Fr., *Syst. mycol.* **3**(1) : 258 (1829).

Exsiccatae: Arnold, *Lich. Monac.* no. 456 (K!).—Cooke, *Fungi Br. Exs.*, ed. 2, no. 535 (K!).—Jaap, *Fungi sel. Exs.* no. 450 (K!).—Karsten, *Fungi Fenn.* no. 66 (K!).—Libert, *Pl. crypt. Ard.* no. 383 (K!).—Lundell and Nannfeldt, *Fungi Exs. Suec.* no. 682 (K!).—Sydow, *Mycoth. march.* no. 4029 (K!).*

* Sydow, *Mycoth. Germ.* no. 547, distributed under this name, is *I. corallinum* (q.v.).

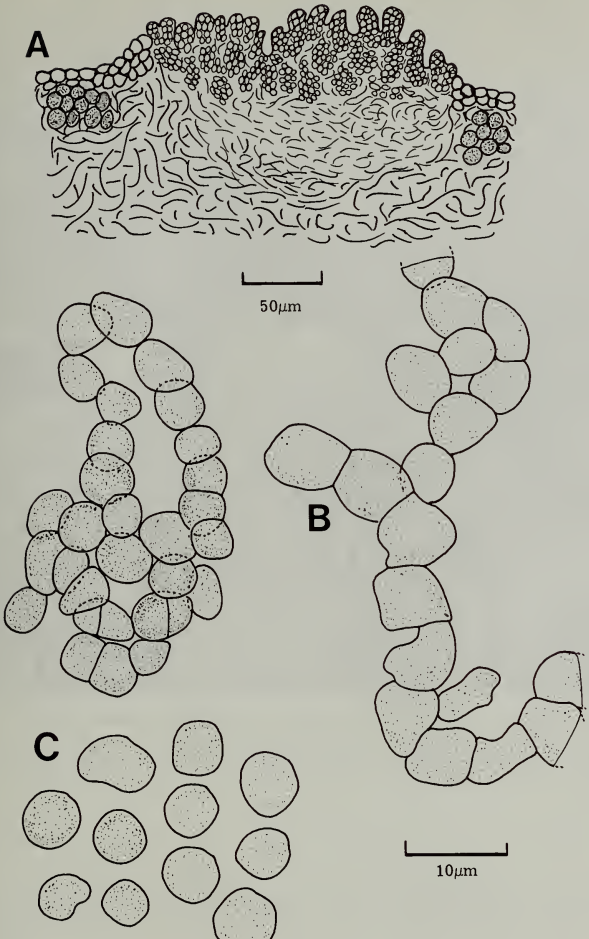

Fig. 23 *Illosporium carneum* (Jaap, *Fungi sel. Exs.* 450, K). **A,** Vertical section of sporodochium on a *Peltigera* thallus. **B,** Conidiogenous cells and chains of conidia. **C,** Conidia.

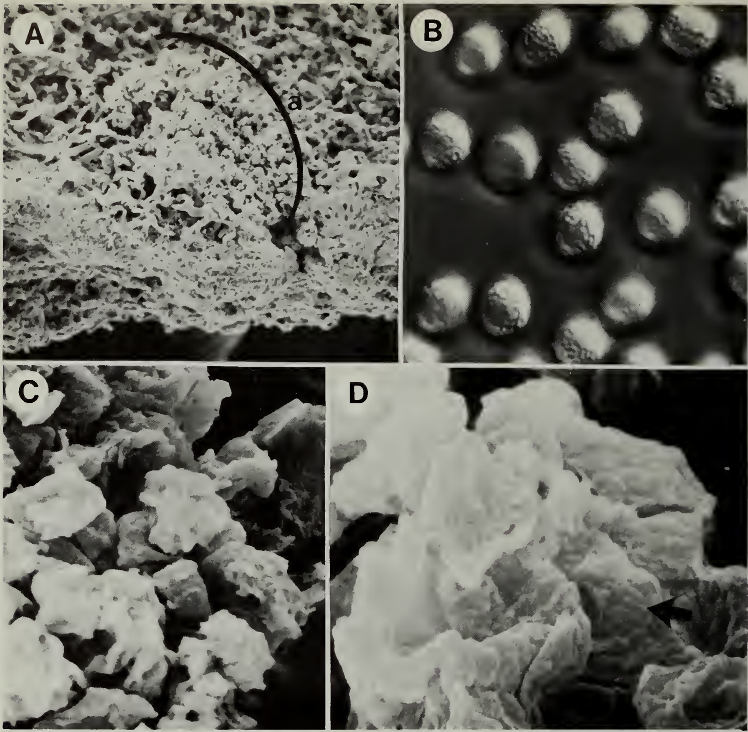

Fig. 24 *Illosporium carneum* (Jaap, *Fungi sel. Exs.* 450, K). **A**, Section through sporodochium on a *Peltigera* thallus (**a**, limit of sporodochium) (×250). **B**, Conidia showing verrucae (×1000). **C**, Conidia (×3000). **D**, Conidia showing verrucae (×12 000). A, C and D Scanning electron micrographs, B Differential interference contrast.

Icones: Corda, *Icon. Fung.* **3** : Pl. 1 fig. 1 (1839).—Killian & Werner, *Bull. trimest. Soc. mycol. Fr.* **41** : Pl. 8 fig. 1–4 (1925).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 630 fig. 131–132 (1930).

Colonies delimited, erumpent through the upper cortex of the host thallus, pale pink; mycelium immersed in the cortex and medulla of the host, hyphae flexuose, irregularly branched, hyaline, torulose, often markedly constricted at the septa, thin-walled, mainly 2·5–4 µm wide. *Conidiophores* micronematous, forming sporodochia, densely compacted, very irregular and difficult to distinguish, sporodochia very variable, mainly 200–300 µm wide, applanate to almost coremiiform. *Conidiogenous cells* probably monoblastic, sometimes evidently polyblastic, integrated, terminal or intercalary, irregular in shape, mainly ellipsoid to elongate-ellipsoid, hyaline. *Conidia* catenate, often adhering in compact masses 50–100 µm tall, hyaline singly but pale pink in mass, simple, subglobose but often rather angular due to compression by adjacent conidia, thin-walled, indistinctly verruculose (verrucae clearly seen by differential interference contrast microscropy; Fig. 24B), rather variable in size but mainly (4–)6–7 μm diam.

Perfect state: *Nectriella robergei* (Mont. & Desm.) Weese. The connection with the perfect state is based on circumstantial evidence and has not been proved by single ascospore cultures; this evidence is very strong (see Killian & Werner, 1924) as perithecia of this *Nectriella* are almost always found to be associated with this *Illosporium*.

Hosts: Apparently restricted to the thalli of *Peltigera* species. It is particularly common on *P. rufescens* (Weiss) Humb., but is also known from *P. canina* (L.) Willd., *P. horizontalis* (Huds.) Baumg., *P. malacea* (Ach.) Funck, *P. polydactyla* (Neck.) Hoffm. and *P. spuria* (Ach.) DC.

Distribution: Widespread and often common in Europe. There are reliable reports from at least the British Isles, Belgium, Finland, France, Germany, Italy, Spain and Sweden. I have also seen specimens from both Canada (Ontario) and the U.S.A. (New York). In the course of this revision it must be stressed that no exhaustive literature or hebarium searches were carried out; a study of the *Peltigera* folders in major herbaria would be expected to reveal numerous additional records.

Observations: This fungus has always been somewhat dubious to mycologists, although a survey of the lichenological literature suggests it is well known. This situation has arisen because, while the gross features are readily seen with a hand lens, the mode of conidiogenesis is difficult to work out. In many specimens the conidia adhere so tightly in almost pseudoparenchymatous masses that one might speculate whether the cells were really conidia at all; I consider that they are conidia and that this phase represents a developmental one, as in some collections a powder of dispersed conidia occurs around the main conidial mass. Cultural studies will perhaps be the only way to ascertain with certainty the development and conidiogenesis in it and are urgently required. The ornamentation on the conidia of *Illosporium carneum* has not previously been noted, but was confirmed by scanning electron microscopy (Fig. 24D).

Peltigera thalli infected by *Illosporium carneum* may become discoloured, usually pale brown, but it is perhaps not a serious pathogen as in some cases infected plants almost retain their normal colouration.

There is only a single specimen in Fries' herbarium under the name *Illosporium carneum*; this was probably a syntype and is consequently designated here as the lectotype for this name. Fries (1829 : 259) cited '*I. roseum. Mart. l.c.?*' as a synonym of *I. carneum* and evidently appreciated that Martius' name was nothing to do with *I. roseum* (Schreb.) Fr. (see p. 280). Martius (1817 : 325) clearly considered *Peltigera* (syn. *Peltidea*) species as host for his fungus and, as no other similar fungus is known from *Peltigera* thalli, there can be little doubt that his name is correctly placed. Although Martius' name was validated after 1821 (Art. 13) in 1823, six years before the combination *I. roseum* (Schreb.) Fr. was made, Fries' later homonym is accepted and Martius' name treated as illegitimate because of Art. 13(f) which protects the nomenclatural status of names used by Fries in the *Systema mycologicum*. This is fortunate as the name *I. roseum*, widely used for the taxon called *I. corallinum* in this paper, consequently does not have to be taken up for the well-known *I. carneum*.

No original material of *Illosporium roseum* Mart. could be traced in AWH (W. van den Bergh, *in litt.*), BR (A. Bienfait, *in litt.*) or M (H. Hertel, *in litt.*). I consequently designate the lectotype of *I. carneum* as neotype for Martius' name in order to fix its application, and so that of the generic name.

Additional specimens: **British Isles**: England, Berkshire, Hitchcopse Pit, on *Peltigera rufescens*, February 1973, *H. J. M. Bowen* (IMI 223936!); Lincolnshire, Risby Warren, on *P. rufescens*, 16 October 1971, *M. R. D. Seaward* (IMI 161341!).—**Canada**: Ontario, Mamatoulin Island, near Mamatouaw Mines, on *P. polydactyla*, 18 May 1974, *D. H. S. Richardson* (IMI 185310!).—**Sweden**: Halefållen, on *P. rufescens*, 6 June 1815, *J. Forsander* (UPS!).—**U.S.A.**: New York, on *P.* cf. *rufescens*, *C. H. Peck* (K!).

2. **Illosporium corallinum** Roberge, *in* Desmazières, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (1847). (Fig. 25)

Type: France, on *Physcia tenella, J. B. H. J. Desmazières*, Pl. crypt. Fr., Ed. 1, fasc. 32 no. 1551 (K—2 isotypes!).

Illosporium roseum var. *corallinum* (Roberge)Ferr., *Fl. ital. Crypt.* **1** : 43 (1910).

Lepra carnea Ehrh., *Pl. crypt. Linn.* no. 308 (1795); nom. inval. (Arts. 13, 32).

Type: Germany, Hannover, Herrenhausen, on *Physcia adscendens, J. F. Ehrhart*, Pl. crypt. Linn. no. 308 (LINN-Sm. 1720.21—isotype!).

Sclerotium granulatum b. *persicolor* Schumacher, *Enum. Pl. Sæll.* **2** : 186 (1803); nom. inval. (Art. 13).

Type: Denmark, Zealand, Copenhagen, on *Physcia* sp., *H. C. F. Schumacher*, MS 'Flora Hafniensis fungi delineati' **1** : 89 fig. 1 (C—lectotype!).

Illosporium aurantiacum Lasch, *in* Rabenhorst, *Fungi Eur.*, cent. I no. 74 (1859).

Type: Germany, near Driesen, on *Physcia adscendens* on *Pyrus malus, G. W. Lasch*, Rabenh. Fungi Eur., cent. I no. 74 (K—3 isotypes!).

Hymenobolus parasiticus Zukal, *Öst. bot. Z.* **43** : 73 (1893) *pro parte* (see p. 277).

Fusarium sampaioi Gonz. Frag., *Bolm Soc. broteriana* II, **2** : 50 (1924) *pro parte* (see p. 274); nom. illegit. (Art. 70).

Illosporium roseum auct. mult., non Mart. ex Ficinus & Schubert (1823), *nec* (Schreb.) Fr. (1829) (see p. 280).

*Exsiccatae**: Desmazières, *Pl. crypt. Fr*, Ed. 1, fasc. 32 no. 1551 (K!).—Ehrhart, *Pl. crypt. Linn.* no. 308 (LINN-Sm. 1720.21!; sub *Lepra carnea*).—Fuckel, *Fungi Rhen.* no. 240 (K!; sub *I. coccineum*).—Libert, *Pl. crypt. Ard.* no. 281 (K!; sub *I. coccineum*).—Rabenhorst, *Fungi Eur.*, cent. I no. 74 (K!; sub *I. aurantiacum*).—Sydow, *Mycoth. Germ.* no. 547 (IMI 16620!, K!; sub *I. carneum*).

Colonies delimited, erumpent through the upper cortex of the host or sometimes almost superficial, orange-red to bright pink or rose, convex and translucent; mycelium immersed in the cortex and medulla of the host or scarcely apparent, hyphae flexuose, irregularly branched, hyaline, torulose, generally constricted at the septa, thin-walled, mainly 5–7 μm wide. *Conidiophores* (?) micronematous, forming sporodochia, densely compacted into a translucent clearly delimited and sometimes almost corticate mass which is often constricted basally, convex to subglobose, and 100–300 μm diam, the masses arising singly or aggregated into small, sometimes confluent, groups. *Conidiogenous cells* (?) probably monobalstic to polyblastic, integrated, terminal or intercalary, very irregular in shape, mainly broadly ellipsoid, hyaline. *Conidia* (?) catenate, adhering in compact irregular masses, simple, subglobose to irregular, often angular due to compression by adjacent conidia, thin- and smooth-walled, very variable but mainly 6–10 μm.

Perfect state: It has been suggested that *Illosporium coccineum* Fr., a name which is not a lichenicolous fungus (see p. 278), is the imperfect state of *Nectriella coccinea*† Fuckel (e.g. Keissler, 1930 : 286). The name *I. coccineum* has, however, been generally misapplied and used for the species called *I. corallinum* here. Whether *N. coccinea* is really the perfect state of *I. corallinum* is dubious and in need of further investigation. Keissler (1930: 633) suggested the common bark saprophyte *Nectria coccinea* (Pers. ex Fr.) Fr. but that is most improbable.

Hosts: I have seen material from *Lecanora conizaeoides* Nyl. ex Cromb., *Parmelia glabratula* (Lamy) Nyl., *P. omphalodes* (L.) Ach., *P. saxatilis* (L.) Ach., *P. sulcata* T. Tayl., *Physcia adscendens* (Th. Fr.) Oliv., *P. semipinnata* (Gmelin) Moberg and *P. tenella* (Scop.) DC. Further hosts listed by Keissler (1930 : 632) for '*Illosporium roseum*' were: *Anaptychia ciliaris* (L.) Körb., *Hypogymnia physodes* (L.) Nyl., *Parmelia flaventior* Stirt., *P. olivacea* (L.) Ach., *P. pulla* Ach., *P. tiliacea* (Hoffm.) Ach., *P. subrudecta* Nyl., *Physcia stellaris* (L.) Nyl., *Physconia pulverulenta* (Schreb.) Poelt and *Xanthoria parietina* (L.) Th. Fr.; his mention of *Solorina saccata* (L.) Ach. was based on the type of *Illosporium globulatum* Nyl. which was nothing to do with *I. corallinum* (see p. 279).

* Arnold, *Lich. mon.* no. 1896 (K!), distributed as *Illosporium corallinum* on *Parmelia saxatilis* (L.) Ach., is only material of *P. sulcata* T. Tayl. in which the soredia (and parts of the thallus) have become reddened due to the breakdown of salazinic acid.

†i.e. *Nectriella tincta* (Fuckel) R. Sant.

Distribution: Probably widely distributed in Europe; I have seen material from the British Isles, Belgium, France, Germany and Portugal but have made no exhaustive search for material in other herbaria. There are also mentions of its occurrence in America (e.g. Vouaux, 1914 : 316).

Observations: I have found the circumscription and interpretation of this taxon extremely difficult to resolve satisfactorily, and the use of a single specific name and its retention in *Illosporium* are both matters for some conjecture. In the case of *I. carneum*, there is no doubt that the spherical cells formed are conidia as they are found scattered around infection spots on the surface of the host. This is not, however, so for *I. corallinum*, where the structures termed sporodochia above are discrete compact masses of cells often with some sort of limiting layer of cells

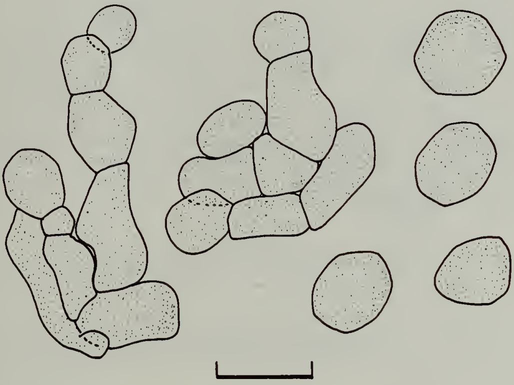

Fig. 25 *Illosporium corallinum* (K—isotype).

present; I was not able to convince myself that the rounded cells formed were really conidia in this case, and not simply rounded pseudoparenchymatous cells (perhaps even young *Nectriella* perithecia ?). The reports of *Fusarium*-like conidia in association with structures recalling *I. corallinum* (see under *F. sampaioi* and *Selenosporium lichenicola*) make me speculate as to whether these may eventually be formed; cultural studies might be expected to shed further light on this question. A further problem is whether the various colour shades, particularly orange as opposed to bright pink, represent stages or variants of a single taxon or more than one; a broad concept was adopted partly because of a lack of evidence for host specificity in the different colour types. These problems clearly merit more detailed investigations than has been possible during the present survey.

Illosporium corallinum is a pathogen of both *Parmelia* and *Physcia* species, infected thalli generally becoming decolourised, whitened and subsequently completely disintegrating.

With respect to the nomenclature presented above, it should be noted that the epithets *corallinum* and *aurantiacum* were both validly published on their exsiccati labels, as these had descriptions provided on them; these were issued prior to accounts appearing in journals (i.e. Desmazières, 1848; Schlechtendal, 1859).

Sclerotium granulatum b. *persicolor* was described 'In caudice *Pruni Cerasi*, & in ramis *Vaccinii uliginosi*' by Schumacher (1803 : 186). No herbarium material of this taxon is extant but Schumacher did refer to an illustration in Oeder (1799) under the name *Lichen roseus* Schreb. and in

C there is a painting by Schumacher of his *persicolor* in a manuscript volume annotated '*Sclerotium persicolor* m. *Lichen roseus* Fl. Dan. Tab. 1243 f.1. In caudice *Pruni Cerasi* nec non in ramis *Vaccinii uliginosi* semel inveni Hyeme viget'. Dr M. Skytte Christiansen sent me coloured transparencies of the painting in C which undoubtedly represents *Illosporium corallinum* as interpreted here and this painting is designated here as the lectotype for Schumacher's name. The drawing in Oeder (1799 : Pl. 1243 fig. 1) was indicated to be based on a collection of Schumacher's, but is different from that in Schumacher's manuscript because the pink masses appear as if they might be arising not from the foliose lichens figured (probably *Physcia* and *Xanthoria* species) but rather from bark between their thalli; this illustration might consequently be of some other organism (see p. 281). A few authors have incorrectly given Schumacher's epithet as '*versicolor*' (e.g. Vouaux, 1914 : 215), but as Schumacher used the spelling '*persicolor*' in his manuscript as well as in his publication, and compared the colour with the flowers of peach, '*persicolor*' is not to be regarded as a typographical error for '*versicolor*'.

Additional specimens: **British Isles**: England, Devon, Slapton, Duck Marsh, on *Parmelia glabratula* on *Salix*, 28 July 1977, *D. L. Hawksworth 4480* (IMI 215200!), eastern margin of Slapton Ley, on *Physcia tenella* on *Sambucus*, 1 November 1973, *D. L. Hawksworth 3569* (IMI 180128!); Surrey, Farnham, on *Lecanora conizaeoides*, February 1973, *H. J. M. Bowen* (IMI 224648!); Cumberland, Lazonby Fell, on *Parmelia omphalodes* and *P. sulcata*, 21 November 1975, *R. W. M. Corner* (IMI 199418!, 199419!, 199420!); Scotland, Argyll, Loch Drumbay, mainland opposite Tobermory, on *Parmelia saxatilis*, 12 August 1975, *S. M. Francis* (IMI 196190!).—**France**: Caen, on *Physcia tenella* on *Quercus*, *Roberge* (UPS-Fries!; authentic specimen).—**Germany**: Gipsel des Prudelberges bei Stonsdorf (Urschberg), on *Parmelia saxatilis*, 5 October 1848, *Flotow* (UPS-Fries!).

XI. LEIGHTONIOMYCES D. Hawksw. & B. Sutton

in Hawksworth, *Bot. J. Linn. Soc.* **75** : 199 (1977).

See Hawksworth (1977*a*: 199–200) for description and further discussion of this genus.

Type species: *Leightoniomyces phillipsii* (Berk. & Leight.) D. Hawksw. & B. Sutton.

Number of species: Monotypic.

1. **Leightoniomyces phillipsii** (Berk. & Leight.) D. Hawksw. & B. Sutton, *in* Hawksworth, *Bot. J. Linn. Soc.* **75** : 200 (1977).

See Hawksworth (1977*a* : 200–203) for synonymy, photomicrographs (including scanning electron micrographs) and description.

Hosts: Thalli of *Steinia geophana* (Nyl.) Stein and *Thrombium epigaeum* (Pers.) Wallr.; perhaps primarily associated with the *Leptosira* phycobiont these species have in common.

Distribution: Azores and the British Isles.

XII. MILOSPIUM D. Hawksw.

Trans. Br. mycol. Soc. **65** : 227 (1975).

See Hawksworth (1975*a*) for further information on this genus.

Type species: *Milospium graphideorum* (Nyl.) D. Hawksw.

Number of species: Monotypic.

1. **Milospium graphideorum** (Nyl.) D. Hawksw., *Trans. Br. mycol. Soc.* **65** : 228 (1975). (Fig. 26)

See Hawksworth (1975*a* : 228–231) for description, extensive synonymy, and further information on this species.

Hosts: On *Opegrapha* species, most commonly *O. lyncea* (Sm.) Borr. ex Hook. and less frequently on *O. atra* Pers.

Distribution: European, probably rather southern, reflecting the range of the major host. Reliably recorded at least from the British Isles, Czechoslovakia, France and Ireland.

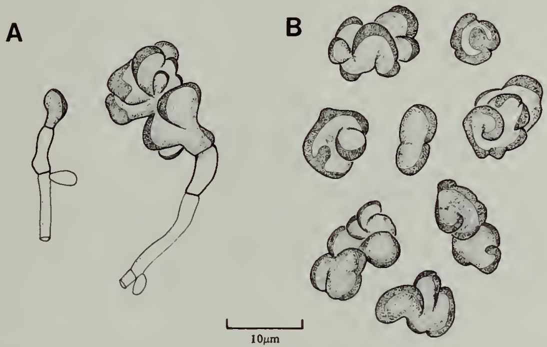

Fig. 26 *Milospium graphideorum* (IMI 186254). Reproduced from Hawksworth (1975*a* : 230).

XIII. **MONOCILLIUM** Saksena

Indian Phytopath. **8** : 9 (1955).

Colonies effuse; mycelium usually superficial, irregularly and frequently branched, hyaline or shades of pink. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous to macronematous, mononematous, ± hyaline, erect and unbranched or sparsely branched at the base, not or sparsely septate. Conidiogenous cells phialidic, discrete, terminal, subcylindrical, the lower portion characteristically with a thickened highly refractive wall, becoming thinner-walled above, sometimes not delimited from the conidiophores by a septum (orthophialides), hyaline, smooth-walled. Conidia solitary, catenate or adhering in a mass, slimy, hyaline, simple or 1-septate, ellipsoid to obpyriform or almost subglobose, not distinctly truncated basally in most species. Chlamydospores produced in a few species, generally in chains, subglobose, and brown.

Type species: *Monocillium indicum* Saksena.

Number of species: About 15. Twelve species were described and figured by Gams (1971 : 151–166) and are mainly saprophytes known from various decaying plant materials, wood and soil. Only one species may be lichenicolous.

Perfect state: Several of the species are known to have perfect states, all of them in *Niesslia* Auersw.

1. **Monocillium** state of **Niesslia cladoniicola** D. Hawksw. & W. Gams, *in* Hawksworth, *Kew Bull.* **30** : 194 (1975).

   (Fig. 27)

   Type: British Isles, Wales, Glamorgan, Merthyr Mawr, on aged podetia of *Cladonia rangiformis* in sand dunes, 15 September 1973, *M. C. Clark* (IMI 179266—holotype!; CBS 960.73—cultures).

Icones: Hawksworth, *Kew Bull.* **30** : 195 fig. 8 (1975).

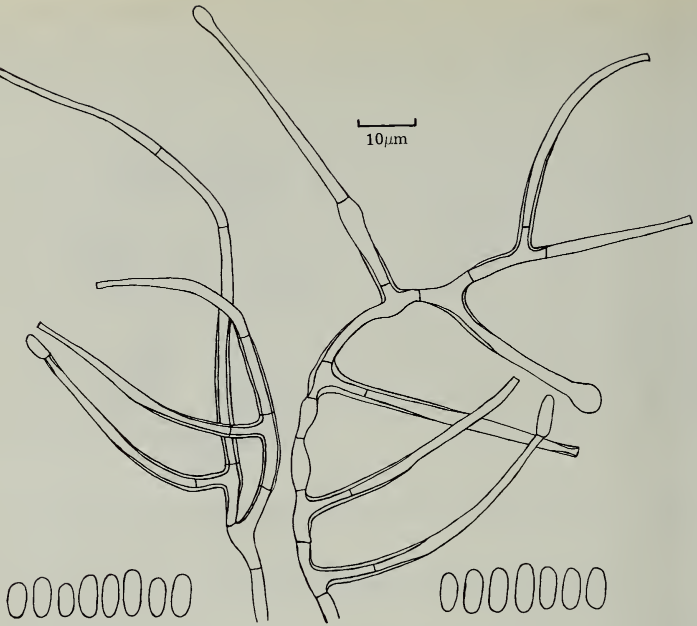

Fig. 27 *Monocillium* state of *Niesslia cladoniicola* (CBS 960.73). Reproduced from Hawksworth (1975*b* : 195).

Colonies only known in pure culture, growing rather slowly, pale rose, marginate; mycelium mainly superficial, hyphae flexuose, relatively thick-walled, hyaline, 1·5–2·5 µm wide. *Conidiophores* macronematous, mononematous, hyaline, erect, unbranched. *Conidiogenous cells* phialidic, orthotropic, discrete, terminal, subcylindrical, the lower part somewhat swollen and with a thickened refractive wall, becoming narrowed above, 25–37 µm long, 1·7–2·2 µm wide at the base and 0·7–1·2 µm wide at the apex. *Conidia* ellipsoid to subcylindrical, adhering in slimy heads, hyaline, simple, rounded at the apices, smooth- and thin-walled, 4–6 × 2–2·4 µm. *Chlamydospores* absent.

Host: *Cladonia rangiformis* Hoffm., aged podetia.

Distribution: British Isles. Known only from the type collection.

Observations: The *Monocillium* imperfect state was obtained from the culture of single ascospores, and has not yet been found growing on lichens in the field. This state is included here, because since the perfect state is lichenicolous, the imperfect state is also presumably able to grow on lichens and consequently may be encountered in the future. The imperfect state has not been accorded a separate binomial as this appears superfluous when it is unknown to occur in nature. *Niesslia cladoniicola* forms black superficial setose perithecia 100–150 µm diam and produces 1-septate hyaline ascospores 4·5–8 × 1·5–2 µm.

XIV. MONODICTYS S. Hughes

Can. J. Bot. **36** : 785 (1958).

Colonies effuse, very variable in colour, most commonly greenish-brown to dark brown; mycelium mainly superficial, sometimes scant. Stroma, setae and hyphopodia absent. Conidiophores micro- or semi-macronematous, mononematous, not or irregularly branched, usually flexuose, hyaline to pale brown, smooth-walled, the cells sometimes somewhat inflated. Conidiogenous cells monoblastic, integrated, terminal, determinate, subcylindrical to swollen and broadly ellipsoid or subglobose. Conidia solitary, dry, acrogenous, pale brown to dark brown or almost black, very variable in shape, always muriform when mature, smooth- or verrucose-walled, usually abundantly produced.

Type species: *Monodictys putredinis* (Wallr.) S. Hughes.

Number of species: About 15 species are currently accepted (Ellis, 1971 : 68–70, 1976 : 41–44). Most are lignicolous saprophytes or occur on decaying herbaceous stems. One species is only known on lichens (*Monodictys anaptychiae*), and a second is either primarily or regularly facultatively lichenicolous (*M. lepraria*). The genus appears heterogeneous as currently circumscribed, but *M. lepraria* is definitely congeneric with *M. putredinis* which has smooth-walled many-celled massive conidia. *M. anaptychiae*, however, belongs to another element in the genus, which includes species with verrucose, relatively few-celled and much smaller conidia; this latter element also includes *M. asperospera* (Cooke & Massee) M. B. Ellis, *M. castaneae* (Wallr.) S. Hughes and *M. fluctuata* (Tandon & Bilgrami) M. B. Ellis and might merit separation as a distinct genus.

Key to the lichenicolous species

1 Conidia 2–5(–6)-celled, distinctly verrucose when mature, 8–12 × 5–10 μm
Monodictys anaptychiae (p. 241)
– Conidia 50– or more celled when mature, smooth-walled, 25–50 μm diam to 100 × 50 μm
Monodictys lepraria (p. 241)

1. Monodictys anaptychiae (Lindau) D. Hawksw., *Trans. Br. mycol. Soc.* **65** : 220 (1975). (Fig. 28)

See Hawksworth (1975*a* : 220–221) for description and synonymy.

Host: *Anaptychia ciliaris* (L.) Körb., thalli. There are dubious reports of this fungus from several other hosts (see Hawksworth, *loc. cit.*).

Distribution: Known with certainty only from the type locality in Germany. The reports from France and the USSR (Bouly de Lesdain, 1910 : 280; Vouaux, 1914 : 313) are treated as dubious.

2. Monodictys lepraria (Berk.) M. B. Ellis, *More Demat. Hyphom.* : 44 (1976). (Fig. 29)

Sporidesmium lepraria Berk., *Kew J. Bot.* **5** : 43 (1853), nom. nov.
Lepraria nigra Turn. & Borr., *in* Smith, *Engl. Bot.*, tab. 2409 (1812); nom. inval. (Art. 13).
Lepraria nigra Turn. & Borr. ex Turn. & Borr., *Spec. Lich. Br.* : 21 (1839).
Type: England, ? Sussex, on gate posts, *W. Borrer* (K-Borr.—holotype!).
Non *Monodictys nigra* Matushima, *Icon. microfungi Matushima* : 98 (1975).
Sporidesmium cellulosum Sacc., *Syll. Fung.* **4** : 501 (1886); nom. illegit. (Art. 64).
Type: Italy, Padova, on *Pyrus communis*, *P. A. Saccardo* (PAD—lectotype non vidi; see Hughes, 1958 : 786).
Monodictys cellulosa S. Hughes, *Can. J. Bot.* **36** : 786 (1958), nom. nov.
Non *Sporidesmium cellulosum* (Corda) Rabenh., *Deutschl. Krypt.-Fl.* **1** : 31 (1844).
Sporidesmium lepraria var. *nigerrima* Berk., *Kew J. Bot.* **5** : 43 (1853).
Type: Canada, ? North West Territories, on wood, *loc. cit.* Pl. 3 fig. 9 (lectotype!).

Exsiccatae: Cooke, Fungi Br., Ed. 2 no. 631 (IMI 10428!).—Vize, Micro-fungi Br. no. 24 (IMI 57023!).

Icones: Berkeley, *Kew J. Bot.* **5**: Pl. 3 fig. 9 (1853).—Ellis, *More Demat. Hyphom.*: 43 fig. 27A (1976).—Saccardo, *Fungi Ital.* no. 907 (1881).

Colonies dispersed, superficial, dark brown to black, arising on the surface of the host lichen or on decorticate wood; mycelium scant, superficial, irregularly branched, hyphae relatively thin walled, smooth-walled, pale brown to brown, often markedly constricted at the septa, mainly 3–7 μm long and 2·5–4 μm wide. *Conidiophores* micronematous to semi-micronematous, mononematous, not or irregularly branched, flexuose, pale brown to brown or sometimes dark brown, smooth-walled, septate, often swollen between the septa, very variable in length, mainly 10–30 μm long. *Conidiogenous cells* monoblastic, integrated, terminal, determinate, subcylindrical to subglobose, brown to dark brown, mainly 4–7 μm wide and 4–6 μm tall. *Conidia* arising singly at the apices of the conidiogenous cells, dry, acrogenous, muriform, composed of 50 or more cells when fully developed, the individual cells mainly 5–10 μm diam, dark brown to black, even to uneven in outline, smooth-walled, thick-walled, very variable in size and shape, mainly subglobose and 25–50 μm diam or ellipsoid to elongate-ellipsoid and then to about 100×50 μm.

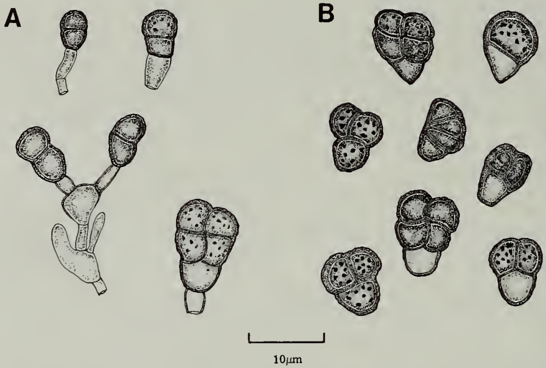

Fig. 28 *Monodictys anaptychiae* (HBG—isotype). **A**, Conidiogenous cells with attached conidia. **B**, Conidia. Reproduced from Hawksworth (1975*a*: 220).

Hosts: Most commonly collected from decorticate wood in xeric situations and on which it can thrive. This fungus is often found associated with lichen thalli (e.g. dead *Parmelia* cf. *subaurifera* Nyl. in the holotype, *Lecanora expallens* Ach. in Vize's exsiccatum) but appears to be a pathogen of *Lecanora conizaeoides* Nyl. ex Cromb.; in the latter species the fungus appears as black flecks over the thallus surface and apothecia and can even penetrate the hymenium to some extent. In IMI 224315 (with *L. conizaeoides*), the fungus also grows on the thallus of *Bacidia chlorococca* (Stiz.) Lett. and *Buellia pulverea* Coppins & P. James. Whether this species is primarily a lichenicolous fungus able to exist saprophytically on wood after the death of the host lichen, or whether it is a lignicolous saprophyte able to spread over lichens, remains uncertain.

Distribution: Canada and Europe. I have seen specimens only from the British Isles but the species is probably widespread.

Observations: I was in some doubt as to whether this fungus should be regarded as primarily lichenicolous or a saprophyte occasionally occuring on lichens. It is treated here and not under 'Excluded species' with some hesitation, principally because the species appears to have a predilection for *Lecanora conizaeoides* which it can kill.

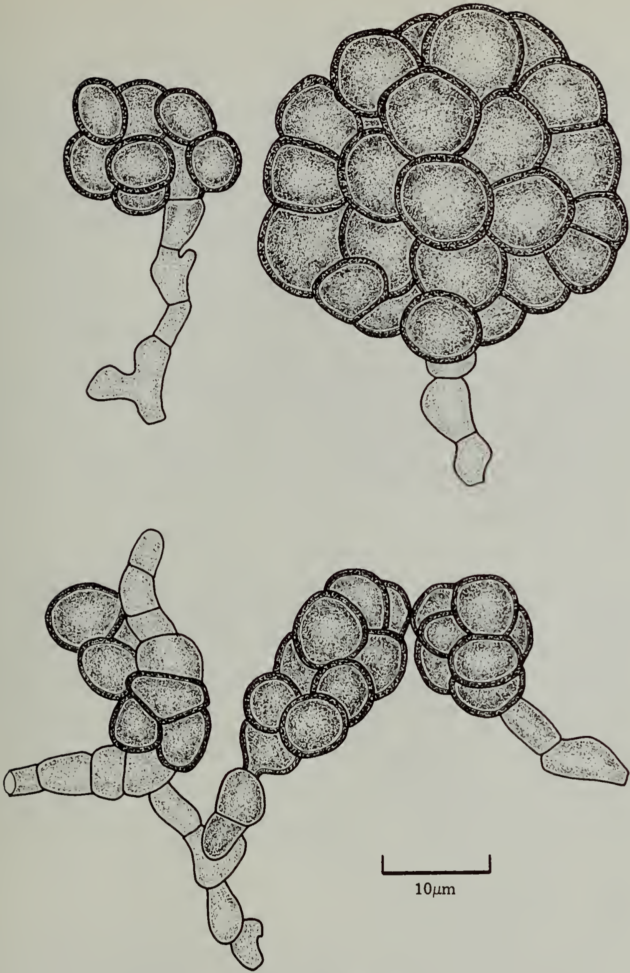

Fig. 29 *Monodictys lepraria* (IMI 224315).

The lichenicolous collections agree in all respects with material directly from lignum and their taxonomic separation cannot be justified. At first the conidia are almost globose and this shape predominates in IMI 224315; such conidia recall those of *Monodictys putredinis* (Wallr.) S. Hughes, which differs in that the conidia are only 20–30 × 15–25 µm. This type of conidium is illustrated in Fig. 29; for illustrations of elongate larger conidia see Ellis (1976 : 43).

As the full synonymy of this species does not appear to have been previously compiled it is presented here. *Spiloma microscopicum* Turn. & Borr. was considered to be '. . . a mere variety of the same species' by Berkeley (1853 : 43) but examination of the type material of that name (K-Borr.—holotype!) showed it to be a mixture of fungi best rejected under Art. 70 as based on discordant elements.

Additional lichenicolous specimens: **British Isles**: England, Warwickshire, Earlswood, Windmill Naps, on *Lecanora conizaeoides* on *Quercus*, 1 January 1973, *M. C. Clark MC1287* (IMI 171798!); Scotland, Fife, Devilla Forest, on *Lecanora conizaeoides*, etc. on dead *Calluna* stems, 9 May 1976, *B. J. Coppins 1770* (E, IMI 224315!).

XV. PSAMMINA Rouss. & Sacc.

Bull. Soc. r. Bot. Belg. **29** : 295 (1901).

Colonies discrete; mycelium mainly immersed, irregularly branched, subhyaline or pale brown. Stroma if present pseudoparenchymatous and poorly developed but sometimes appearing acervular. Setae and hyphopodia absent. Conidiophores semi-macronematous, mononematous, subhyaline, unbranched. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, subhyaline to pale brown. Conidia solitary, dry, acrogenous, almost hyaline to pale brown singly but distinctly brown in mass, multiseptate, palmate with numerous arms, arms transversely septate, slightly curved or straight, smooth to slightly and irregularly roughened.

Type species: *Psammina bommeriae* Rouss. & Sacc.

Number of species: Two, previously monotypic.

Observations: The type species of the genus is a saprophyte of *Ammophila* and *Juncus* culms and stems developing subepidermally. *Psammina* has generally been referred to the Melanconiales in the Coelomycetes (e.g. Sutton, 1973 : 556) because it can appear almost acervular even though the acervulum itself could be viewed as almost rudimentary. The discovery of a lichenicolous species developing mainly superficially and not enclosed by an epidermis at first prompts a reassessment of its position. That the lichenicolous species described below is congeneric with *P. bommeriae* cannot be doubted as the highly characteristic conidia and method of conidiogenesis are the same, and the species differ mainly in the sizes of parts of the complex conidia. As there is no evidence for an acervulum in *P. stipitata* it seems most appropriate to treat the genus as belonging to the Hyphomycetes and interpret the poorly delimited acervulum of *P. bommeriae* as only a rudimentary stroma appearing acervular in some cases due to modifications caused by the subepidermal habit. It would be of interest in this connection to study *P. bommeriae* in culture to see what form the stroma then assumed, but so far no isolates of it appear to have been obtained.

1. **Psammina stipitata** D. Hawksw. **sp. nov.**
(Fig. 30)

Fungus lichenicola. Mycelium plerumque immersum, ex hyphis cellulis subhyalinis, usque 3–4 µm latis. Conidiophora semi-macronemata, subhyalina, recta, non ramosa, usque 20–50 × 4–5 µm. Cellulae conidiogenae monoblasticae, integratae, cylindricae. Conidia solitaria, sicca, acrogena, multiseptata, palmata, ex circa 50 brachiis rectis vel leviter arcuatis, septatis, subhyalinis ad pallide brunneis, 25–50 × 3–3·5(–4) µm, levia vel irregulariter sparse rugosa, ubique 120–160 µm diam.

Typus: Magna Britannica, Anglia, Dorset, Chettle, in thallis *Schismatommae decolorantis* (Turn. & Borr. ex Sm.) Clauz. & Vězda ad *Quercum*, ii.1973, *H. J. M. Bowen* (IMI 225006—holotypus!).

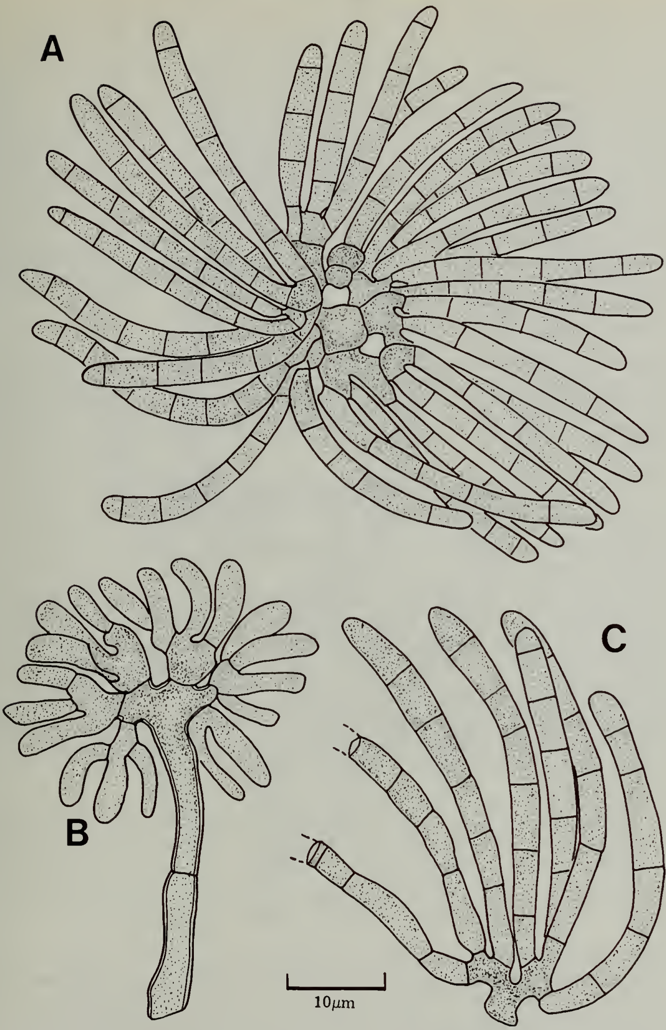

Fig. 30 *Psammina stipitata* (IMI 225006—holotype). **A,** Conidium. **B,** Conidiogenous cell with the arms of a conidium starting to develop. **C,** Detail of portion of a conidium.

Colonies discrete but sometimes becoming confluent and then appearing almost effuse, brown; mycelium mainly immersed, rather localised, composed of subhyaline to pale brown torulose hyphae mainly 3–4 µm wide, abundantly branched. *Conidiophores* semi-macronematous, tending to arise in small groups, erect, ± straight or slightly flexuose, unbranched, smooth-walled, septate, very variable in length but mainly 20–50 µm tall (inclusive of the conidiogenous cell) and 4–5 µm wide. *Conidiogenous cells* monoblastic, integrated, terminal, cylindrical, not or poorly delimited from the conidiophores. *Conidia* arising singly, dry, acrogenous, multiseptate, palmate, consisting of about 50 arms, each arm with 3–7 transverse septa and 25–50×3–3·5(–4) µm, subhyaline to pale brown, smooth-walled or irregularly sparsely rugose, the arms straight or slightly arcuate, generally somewhat uneven in diameter and tending to be swollen between some septa, overall 120–160 µm diam, clearly brown in mass.

Host: *Schismatomma decolorans* (Turn. & Borr. ex Sm.) Clauz. & Vězda, thallus. The fungus appears as small brownish granules on the surface of the thallus which is discoloured and killed in its presence. Adjacent thalli of *Enterographa crassa* (DC.) Fée in the type collection are not colonized by *Psammina stipitata*.

Distribution: British Isles. Known only from the type collection.

Observations: *Psammina stipitata* differs from *P. bommeriae* not only in the absence of an acervular stroma as mentioned above, but also in other features, in particular the more pronounced stalk-like conidiogenous cells and conidiophores, the very numerous arms of the conidia, and the longer and generally thicker arms (these latter mainly 1·5–3 µm wide in *P. bommeriae*).

XVI. **PSEUDOCERCOSPORA** Speg.

An. Mus. nac. Hist. nat. B. Aires **20** : 438 (1910).

See Deighton (1976 : 8–10) for synonyms of the generic name, a fuller description, and discussion of its relationships.

Colonies generally discrete, subhyaline to brown or dark brown; mycelium usually immersed. Stroma present or absent; setae and hyphopodia absent. Conidiophores macronematous, mononematous and arranged in caespitose tufts or in some species synnematous, unbranched, straight to flexuose, erect, subhyaline to dark brown, smooth-walled. Conidiogenous cells sympodially polyblastic and with unthickened conidial scars (monoblastic when very young), integrated, terminal, subcylindrical to geniculate. Conidia solitary, dry, acrogenous or acropleurogenous, subhyaline to brown, elongate and narrowly ellipsoid to filiform or subcylindrical, often with a distinctly truncated base, with 3-numerous transverse septa, exceptionally also with occasional longitudinal septa, smooth to slightly verruculose.

Type species: *Pseudocercospora vitis* (Lév.) Speg.

Number of species: 226 species were accepted by Deighton (1976) almost all of which are specific to the leaves of particular subtropical or tropical plants, often causing leaf-spots. Only the following lichenicolous species is known.

1. **Pseudocercospora lichenum** (Keissl.) D. Hawksw. **comb. nov.**
(Fig. 31)

Cladosporium lichenum Keissl., *Zentbl. Bakt. ParasitKde* II, **37** : 389 (1913).
Type: Austria, Steiermark, valle See-Aü am Leopoldsteiner See bei Eisenerz, alt. 700 m, on *Haematomma cismonicum* apothecia, July 1912, *K. von Keissler* (W 1912/117—holotype!).

Icones: Keissler, *Zentbl. Bakt. ParasitKde* II, **37** : 390 fig. 2 (1913).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 12 fig. 7, 610 fig. 127–128 (1930).

Colonies effuse, dark brown to black, eventually covering the entire disc of the host apothecia; mycelium ramifying through the epithecium and into the thecium of the host apothecia, hyphae

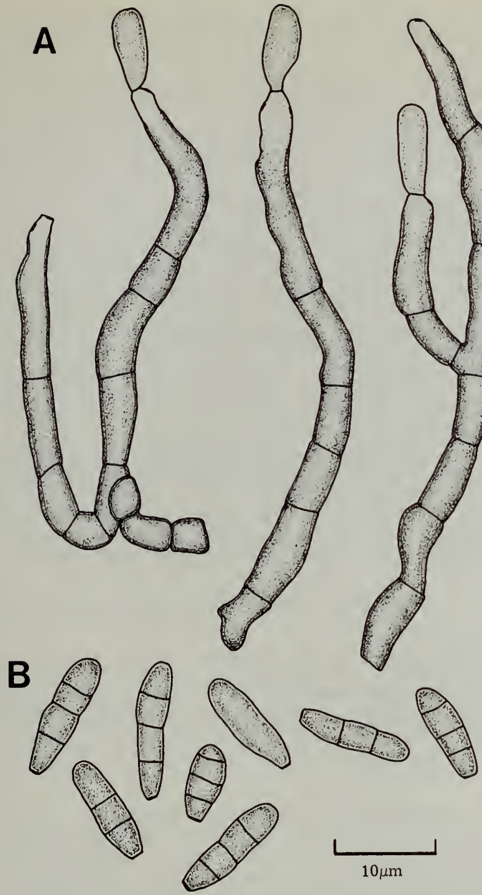

Fig. 31 *Pseudocercospora lichenum* (W 1912/117—holotype). **A,** Conidiophores, some with young conidia attached to the conidiogenous cells. **B,** Conidia.

flexuose, pale brown, relatively thin-walled, sometimes sparse, 1·5–3 μm wide. *Stroma* arising on the surface of the apothecial disc, very variable in extent, to 40 μm wide and 20 μm tall but structure often obscure due to mixture with the epithecial tissue and its granular pigments, composed of brown torulose hyphae with cells mainly 3–7 μm long. *Conidiophores* macronematous, mononematous, aggregated into fascicles of 2–3 or originating singly, divergent, usually unbranched, regularly septate, rather short-celled, not to slightly constricted at the septa, smooth-and thick-walled, brown to dark brown below but tending to become somewhat paler above, mainly 40–60 μm tall and 3–4 μm wide, straight to slightly geniculate. *Conidiogenous cells* integrated, terminal, generally monoblastic but becoming polyblastic on older conidiophores and then sympodial, paler than the conidiophores and thinner-walled, mainly 2·5–3·5 μm wide, variable in length, conidial scars unthickened and very inconspicuous to almost indistinguishable. *Conidia* arising singly, not catenate, dry, subcylindrical to obclavate, truncated at the base but rounded at the apex, simple at first but becoming 3-septate when mature, often constricted at the central septum, smooth-walled to slightly roughened, pale olivaceous brown to brown, 9–14 × 3–4 μm.

Host: *Haematomma cismonicum* Beltr., apothecia.

Distribution: Austria. Known only from the holotype collection.

Observations: The genus *Cladosporium* Link ex Fr. includes dematiaceous Hyphomycetes in which the conidia are borne in chains, not singly, and in which the conidial scars are generally thickened and so distinct (see Ellis, 1971). It is consequently clear that Keissler's fungus cannot be retained in *Cladosporium*. The most appropriate genus for this fungus appears to be *Pseudocercospora* Speg., which has been studied in some detail by Deighton (1976), and, as no previously accepted species in that genus appears to be conspecific with Keissler's fungus, *C. lichenum* is transferred to *Pseudocercospora* here. The conidiophores are less markedly fasciculate than is usual in most species of *Pseudocercospora*, the conidia are relatively small, and the conidial scars particularly difficult to discern.

Two other collections were tentatively referred to this species by Keissler (**France**: Deux Sevres, on *Cladonia* squamules, 1879, *Richard*, W 1932/1833! ex M; **Tanzania**: Öst-Usambara, Amani, alt. 800 m, on *Phyllopsora parvifolia* var. *granulosa* (Tuck.) Müll. Arg. apothecia, July 1909, *J. Brünnthaler*, W 1932/2998!) but in neither of these could the fungus present be reliably referred to a genus because of the poor nature of the material. Keissler's original slides prepared from the holotype of *Cladosporium lichenum* are preserved as W 1912/118(!).

XVII. REFRACTOHILUM D. Hawksw.

Bot. J. Linn. Soc. **75** : 204 (1977).

See Hawksworth (1977*a* : 204) for description and further information on this genus.

Type species: *Refractohilum galligenum* D. Hawksw.

Number of species: Three, all of which are lichenicolous although one may persist on wood or bark after the decay of the host.

Key to the species

1	Conidia non-septate	2
–	Conidia 3-septate when mature, (11–)13–15(–17) × 3·5–4·5(–6) μm	**Refractohilum achromaticum** (p. 248)
2	Conidia (8–)9–11(–14) × 3–3·5(–4) μm	**Refractohilum galligenum** (p. 249)
–	Conidia (15–)18–20(–25) × 6–7·5(–9) μm	**Refractohilum peltigerae** (p. 248)

1. Refractohilum achromaticum (B. Sutton) D. Hawksw., *Bot. J. Linn. Soc.* **75** : 205 (1977).

See Hawksworth (1977*a*) for description, illustration and synonymy.

Host: Probably primarily a parasite of *Parmelia* cf. *sulcata* T. Tayl. but able to persist on wood or bark for some time after the death of the host.

Distribution: Canada. Known from numerous collections made in Manitoba and Saskatchewan.

2. Refractohilum galligenum D. Hawksw., *Bot. J. Linn. Soc.* **75** : 207 (1977).

See Hawksworth (1977*a*) for description and illustration.

Host: *Nephroma laevigatum* Ach., thalli. Infected lobes have bullate gall-like deformations discoloured ochre-yellow to brownish from the surface of which the conidiophores project giving a frosted appearance.

Distribution: British Isles. Known only from the type collection from Devon.

3. Refractohilum peltigerae (Keissl.) D. Hawksw., *Bot. J. Linn. Soc.* **75** : 208 (1977).

See Hawksworth (1977*a*) for description, illustration and synonymy.

Hosts: *Peltigera* species, thalli. Particularly frequent on *P. rufescens* (Weiss) Humb. and *P. spuria* (Ach.) DC. on which it produces bullate gall-like deformations which are reddish-brown in colour and from the surface of which the conidiophores project giving a frosted appearance.

Distribution: Europe. Reliably reported from Austria, Bulgaria, Czechoslovakia, Finland and Sweden.

XVIII. SCLEROCOCCUM Fr. ex Fr.

Syst. orb. Veg. **1** : 173 (1825).

See Hawksworth (1975*a*) for further information on this genus.

Type species: *Sclerococcum sphaerale* (Ach. ex Ficinus & Schubert) Fr.

Number of species: Only one species was accepted by Hawksworth (1975*a*) but an additional species has since been discovered which is described below. Both are obligately lichenicolous.

Key to the species

1	Conidia 1(–2) celled, (3·5–)4–7(–8) μm diam	**Sclerococcum simplex** (p. 249)
–	Conidia 2–6(–9) celled, (8–)10–15(–17) μm diam . . .	**Sclerococcum sphaerale** (p. 250)

1. Sclerococcum simplex D Hawksw. **sp. nov.**
(Fig. 32)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis hyalinis ad pallide brunneis, usque 2–3 μm latis. Conidiophora semi-macronemata, in sporodochiis, simplicia ad sparse ramosa, hyalina ad pallide brunnea, 3–5 μm lata. Cellulae conidiogenae monoblasticae vel rarissimo polyblasticae, integratae, subglobosae ad ellipsoideae, usque pallide brunneae, non bene distinctae. Conidia catenata, sicca, acropleurogena, subglobosa, 0(–1) septata, levia, atrobrunnea, (3·5–)4–7(–8) μm diam.
Typus: Magna Britannica, Scotia, Westerness, Knoydart, in valle inter Creag Bheithe et Stob na Muicraidh, in thallo *Pertusariae* cf. *ophthalmizae* (Nyl.) Nyl. in *Betula*, 22.v.1976, *B. J. Coppins & F. Rose 2217* (E—holotypus!).

Colonies forming discrete patches mainly on the apothecial verrucae of the host but also occurring on the thallus, mycelium originating deep in the host tissues, dark brown to black; mycelium entirely immersed, composed of hyaline to pale brown flexuose hyphae mainly orientated vertically, hyphae thin- and smooth-walled, septate, generally somewhat constricted at the septa, irregularly branched, mainly 2–3 μm wide. *Conidiophores* semi-macronematous, meristematic, aggregated into dense tufted convex sporodochia (50–)100–300 μm diam, not or sparsely branched, hyaline or more usually pale brown, formed of swollen cells mainly 3–5 μm wide. *Conidiogenous cells* monoblastic or more rarely polyblastic, integrated, terminal, subglobose to ellipsoid, mainly pale brown, not very distinct. *Conidia* produced in short basipetal chains, separating rather easily, dry, acrogenous, subglobose, brown to dark brown, mainly non-septate but rarely 1-septate, smooth- and thick-walled, non-septate conidia (3·5–)4–7(–8) μm.

Host: *Pertusaria* cf. *ophthalmiza* (Nyl.) Nyl., apothecial verrucae and more rarely thallus. Apparently scarcely damaging the host and perhaps a parasymbiont.

Distribution: British Isles. Known only from the type collection.

Observations: The superficial appearance of this species is remarkably similar to that of *Sclerococcum sphaerale*, which is known to inhabit saxicolous but not corticolous *Pertusaria* species, but on microscopic examination proves to be readily distinguishable by the 0(–1) celled conidia and less complex conidiogenous apparatus. At first I wondered if *S. simplex* should be placed in the same genus as *S. sphaerale* but as they agree in most characters apart from the arrangement of the conidiogenous cells and the conidia not usually being multicellular in *S. simplex*, and further as they occur on allied hosts, it seems most prudent to enlarge the concept of *Sclerococcum* to include this species.

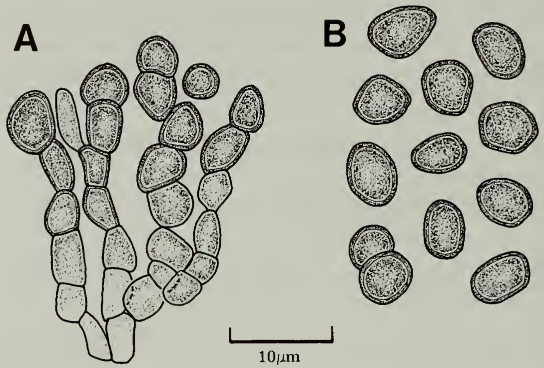

Fig. 32 *Sclerococcum simplex* (E—holotype). **A**, Conidiophores and conidia. **B**, Conidia.

2. Sclerococcum sphaerale (Ach. ex Ficinus & Schubert) Fr., *Syst. orb. veg.* **1** : 173 (1825). (Fig. 33)

See Hawksworth (1975*a* : 223–227) for description, extensive synonymy and further observations on this species.

Hosts: On saxicolous *Pertusaria* species, most commonly encountered on *P. corallina* (L.) Arnold thalli. There are erroneous and unsubstantiated reports from a wide range of other hosts (see Hawksworth, *loc. cit.*); to these can be added one reputedly on *Caloplaca saxicola* (Hoffm.) Nordin (Wheldon, 1923).

Distribution: Europe. Reliably recorded at least from Austria, the British Isles, Czechoslovakia, France, Germany, Iceland, Ireland, Italy, Portugal, Sweden and Switzerland.

Specimens (additional to those listed by Hawksworth, 1975*a*; all on *Pertusaria corallina* unless otherwise indicated): **Austria**: Steiermark, Schladminger Tauren, Lassachtal oberhalb der Breitlahnhütte in der Kleinsölk, alt. 1300–1500 m, 9 July 1973, *J. Poelt* (hb. Poelt!); Steiermark, Stubalpe, Oströcken des Speikkogel, alt. 1750–1800 m, on indet. white K– thallus, 24 June 1973, *J. Poelt 72333* (hb. Poelt!).—**British Isles**: England, Devon, Dartmoor, Rippon Tor, 30 August 1976, *D. L. Hawksworth 4341* (IMI 206383!); Scotland, W. Ross, Little Gruinard Bay, June 1977, *F. S. Dobson* (IMI 214675!); Wales, Caernarvonshire, Gwydyr Forest, 15 October 1977, *D. L. Hawksworth 4548* (IMI 217411!).—**France**: Pyrenées atlantiques, Vallée des Aldudes, Banca, vallon de la Hayra, alt. 400–500 m, 20 April 1972, *J. Vivant* (BM!).—**Italy**: Presanella–Gruppe, Trentino, W ober Madonna di Campiglio, alt. 1950–2100 m, 25 October 1976, *J. Hafellner* (hb. Hafellner 1821!).

XIX. SESSILIOSPORA D. Hawksw. gen. nov.

Genus lichenicola ad Hyphomycetes Dematiaceae s.l. pertinens. Stromata, setae et hyphopodia absentia. Conidiophora micronemata, mononemata, prostrata, simplicia vel ramosa, brunnea, levia.

Cellulae conidiogenae monotreticae, integratae, intercalares, determinatae, brevi-cylindricae, atrobrunneae, cum una cicatrice laterali, ovali et subhyalina instructae. Conidia solitaria, sicca, acrogena, elongata et obclavata, transverse septata, levia, cellulis brunneis sed cellula apicali in rostro subhyalino.

Colonies effuse; mycelium superficial, adpressed, branched. Stroma, setae and hyphopodia absent. Conidiophores micronematous, mononematous, prostrate, simple or branched, brown, smooth-walled. Conidiogenous cells monotretic, integrated, intercalary, determinate, short-cylindrical, dark brown, with a lateral oval subhyaline scar. Conidia solitary, dry, acrogenous, elongate-obclavate, transversely septate, smooth-walled, the lower cells brown but the apical cell elongated, beak-like and subhyaline.

Type species: *Sessiliospora bicolor* D. Hawksw. (holotypus).

Number of species: Monotypic.

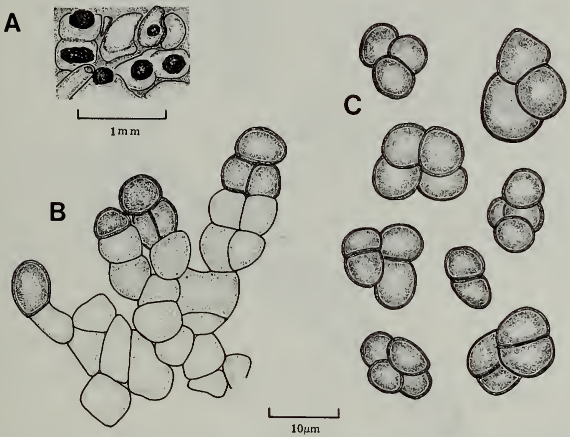

Fig. 33 *Sclerococcum sphaerale* (IMI 186244). **A,** Sporodochia on *Pertusaria corallina*. **B,** Conidiophores. **C,** Conidia. Reproduced from Hawksworth (1975*a* : 224).

1. Sessiliospora bicolor D. Hawksw. **sp. nov.**
(Fig. 34)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis pallide brunneis vel subhyalinis, 2·5–3·5 μm latis, cellulis hyphopodiis absentibus. Cellulae conidiogenae monotreticae, integratae, intercalares, determinatae, brevi-cylindricae, atrobrunneae, plerumque 8–10 μm longae et 4·5–6 μm latae, cum una cicatrice laterali, ovali, subhyalina et 1–1·5 μm diam instructae. Conidia solitaria, sicca, acrogena, elongato-obclavata, 3–4 transverse septata, levia, 30–35(–45) × 4–5·5 μm, cellulis atrobrunneis sed cellula apicali in rostro subhyalino, cellula basi truncata.

Typus: Malaya, Selangor, Serdang, Federal Experimental Station, in lichenibus foliicolis (*Lasioloma arachnoideum* (Kremp.) R. Sant. et indet.) ad *Lancium domesticum* var. *dukii*, 11.xi.1949, *A. Johnston 478* p.p. (IMI 41011*c*—holotypus!).

Colonies dispersed, superficial, brown to dark brown, arising on the surface of the host lichen; mycelium superficial, adpressed, irregularly branched, hyphae relatively thin-walled, smooth-walled, flexuose, pale brown to almost hyaline, septate, only slightly constricted at the septa, 2·5–3·5 μm wide; hyphopodia absent. *Conidiogenous cells* monotretic, integrated, intercalary and

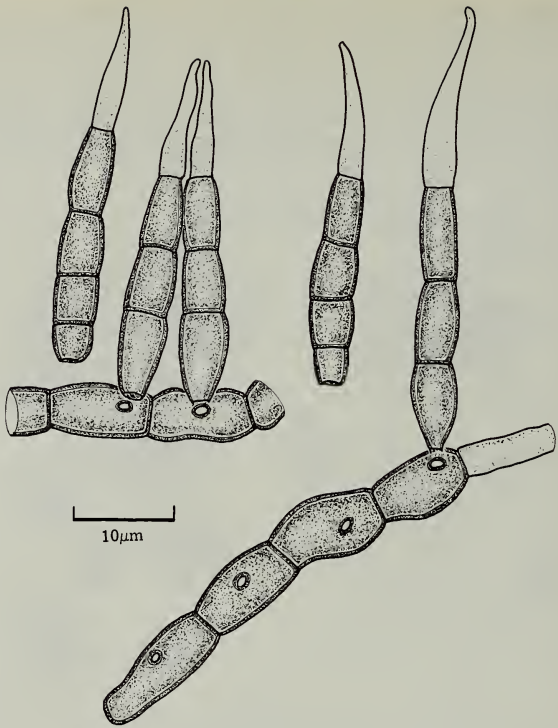

Fig. 34 *Sessiliospora bicolor* (IMI 41011*c*—holotype).

often forming long prostrate chains of 10 or more cells, determinate, short-cylindrical or barrel-shaped, dark brown, smooth-walled, mainly 8–10 μm long and 4·5–6 μm wide, with a distinct lateral scar on the dorsal face which is oval, subhyaline, and 1–1·5 μm diam. *Conidia* solitary, dry, pleurogenous, acrogenous, elongate-obclavate, 3–4 septate, smooth- and thick-walled, portion excluding the terminal cell dark brown and 18–25 μm long, basal cell abruptly truncated and apparently with a papillate depressed scar, apical cell elongated, subhyaline, tapering to 2–3 μm wide near the apex and thinner-walled, overall dimensions of the conidia 30–35(–45) × 4–5·5 μm.

Host: *Lasioloma arachnoideum* (Kremp.) R. Sant. (thallus) and a sterile indeterminate thallus are colonized and apparently damaged by this fungus. Several other foliicolous lichens are present on the leaf with the type of this species (e.g. *Gyalectidium aspidotum*, *Strigula nemathora* Mont., *Tricharia* sp.) but these are not attacked by it.

Distribution: Malaya. Known only from the type collection.

Observations: This genus is perhaps, at least superficially, most similar to *Dictyophrynella* Bat. & Cavalcanti; its distinction from that genus has been discussed above (p. 214) so is not repeated here. In addition *Sessiliospora bicolor* has some slight similarity to *Piricauda paraguayensis* (Speg.) R. T. Moore (see Ellis, 1971 : 369–370), a foliicolous tropical South American fungus, but that has much more irregularly arranged conidiogenous cells and almost subglobose to pyriform muriform basal parts to the conidia.

Hansfordiellopsis lichenicola is also present on the type collection of *Sessiliospora bicolor*.

XX. TAENIOLELLA S. Hughes

Can. J. Bot. **36** : 816 (1958).

Colonies dispersed, effuse or aggregated into tufts, brown to black; mycelium generally immersed but sometimes becoming superficial. Stroma, setae and hyphopodia absent. Conidiophores semi-macronematous, usually aggregated into small groups, erect, straight or flexuose, not or sparsely branched (particularly near the base), brown, smooth-walled or somewhat verrucose. Conidiogenous cells monoblastic, integrated, terminal, determinate, subcylindrical or doliiform. Conidia usually arising in long acropetal chains, dry, acrogenous, brown to dark brown, 1–24 or more septate depending on the species, subcylindrical to doliiform, usually constricted at the septa, often not separating easily with the outer walls becoming deformed, thick-walled, smooth-walled or verrucose.

Type species: *Taeniolella exilis* (P. Karst.) S. Hughes.

Number of species: 21 species, including those described below, have been recognized, of which four are so far known only from lichens. *Taeniolella* species are essentially saprophytes occurring on bark and wood or other decaying plant materials and at least two may be fortuitously found on lichen thalli: *T. breviuscula* (Berk. & Curt.) Hughes (see p. 288) and *T. scripta* (P. Karst.) S. Hughes (**British Isles**: Warwickshire, Oversley Wood, on *Lecanora conizaeoides* Nyl. ex Cromb. on *Corylus*, spreading from adjacent bark, 11 May 1973, *M. C. Clark MC1329*, IMI 173234!). Twelve species of the genus are described and illustrated in Ellis (1971 : 91–94, 1976 : 55–62).

Key to the lichenicolous species

1 Conidia mainly 1–3 septate 2
– Conidia 2–17 septate, 12–70 × 5–7 μm; fortuitously lichenicolous **Taeniolella scripta** (P. Karst.) S. Hughes

2 Conidia smooth-walled at maturity. 3
– Conidia coarsely verrucose at maturity due to the splitting and disintegration of the outer wall, 10–13 × 8–10 μm . . . . **Taeniolella verrucosa** (p. 258)

3 1-septate conidia exceeding 15 μm in length 4
– 1-septate conidia less than 15 μm in length 5

4 Conidia mostly 2–3 septate, 17–45 × 10–13 μm; fortuitously lichenicolous **Taeniolella breviuscula** (Berk. & Curt.) S. Hughes
– Conidia mostly 1-septate, 18–25 × 7–9 μm . . . . **Taeniolella phaeophysciae** (p. 255)

5 1-septate conidia 7–11 × 3·5–5(–6) μm . . . . **Taeniolella delicata** (p. 253)
– 1-septate conidia 10–12·5 × 6–9 μm . . . . **Taeniolella punctata** (p. 257)

1. Taeniolella delicata M. S. Christ. & D. Hawksw. sp. nov.
(Fig. 35)

Fungus lichenicola. Mycelium immersum ad superficiale, ex hyphis pallide brunneis, 2–3·5 μm latis. Conidiophora semi-macronemata, plerumque caespitosa, recta, non vel ad basim sparse ramosa, brunnea, 15–30(–50) × 3·5–6 μm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia plerumque catenata, sicca, acrogena, doliiformia, 1(–2) septata, levia, brunnea, 7–11 × 3·5–5(–6) μm.

Typus: Magna Britannica, Anglia, Buckinghamshire, Waddesdon Manor, in *Lecanora* cf. *chlarotera* Nyl. (apothecia) ad *Fraxinum*, 20.iv.1977, *D. L. Hawksworth 4457* (IMI 214396—holotypus!).

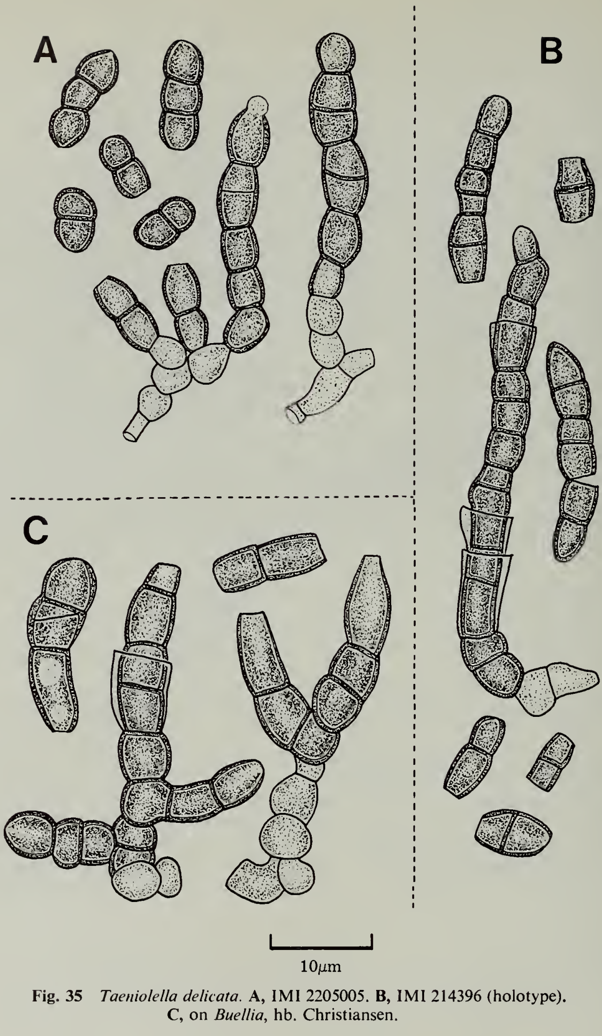

Fig. 35 *Taeniolella delicata.* **A,** IMI 2205005. **B,** IMI 214396 (holotype). **C,** on *Buellia*, hb. Christiansen.

Colonies scattered over the infected tissues of the host, or compacted and filling apothecia, dark brown to almost black; mycelium partly immersed and originating deep in the thallus but sometimes largely superficial, rather sparsely developed, composed of very pale brown flexuose hyphae, hyphae thin- and smooth-walled, septate, often constricted at the septa, mainly 2–3·5 μm wide. *Conidiophores* semi-macronematous, tending to arise in caespitose tufts, straight, not branched or with 1–3 branches at the base, brown, smooth-walled, thicker-walled than the mycelial hyphae, septate, becoming somewhat constricted at the septa, 15–30(–50) × 3·5–6 μm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, brown, not well-marked and with the terminal cells acting in turn as conidiogenous cells. *Conidia* mostly adhering in chains, separating only with difficulty, dry, acrogenous, doliiform, brown, 1(–2) septate, slightly or not constricted at the septa, smooth- and thick-walled, 7–11 × 3·5–5(–6) μm.

Hosts: *Arthonia impolita* (Hoffm.) Borr. (apothecia and thallus), *Buellia punctata* (Hoffm.) Massal. (thallus), *Candelariella vitellina* (Hoffm.) Müll. Arg. (apothecia), *Lecanora* cf. *chlarotera* Nyl. (apothecia), *L. campestris* (Schaer.) Hue (apothecia), *L. pallida* (Schreb.) Rabenh. (apothecia), *Physconia pulverulenta* (Schreb.) Poelt (thallus) and *Rhizocarpon obscuratum* (Ach.) Massal. (thallus). Evidently pathogenic to both apothecia and thalli of infected hosts which it can destroy. Infected apothecia soon become discoloured brown to dark brown or almost black, ascus production is inhibited, and the whole of the hymenium eventually becomes occupied by a mass of conidiophores. On *Physconia pulverulenta* infections first appear as dispersed black spots which later become confluent extending over large parts of the thallus.

Distribution: Austria, British Isles, Denmark, France and Sweden.

Observations: For some time I was uncertain as to whether all the collections treated under this name here should be regarded as conspecific because of variations in the shape and size of the conidia. However, as varying degrees of overlap occurred between the collections, and the amount of variation is less than that already known in some other species of the genus, separation into several species does not appear to be justifiable on the basis of the material currently available.

Taeniolella delicata appears to be quite distinct from other species referred to the genus, but nevertheless shows some similarity to *T. faginea* (Fuckel) S. Hughes which differs in the 3–5 septate larger (15–37 × 6–9 μm) conidia.

Additional specimens: **Austria**: Nördliche Kalkalpen, Steiermark, Gesäuse, *ca.* 2 km E von Gstatterboden, alt. 600–660 m, on *Lecanora pallida*, 2 October 1977, *J. Hafellner* (hb. Hafellner 2499 p.p.!). —**British Isles**: S. Devon, Slapton, Southgrounds Farm, on *Lecanora campestris* on wall, 28 August 1977, *D. L. Hawksworth 4478*b (IMI 215199*b*!).—**Denmark**: Zealand, Jungshoved, on *Buellia punctata* on *Populus*, 12 August 1966, *M. Skytte Christiansen* (hb. Christiansen!); Zealand, Vallo, on *Physconia pulverulenta* on *Tilia*, 31 May 1942, *M. Skytte Christiansen 8084* (IMI 226838!); Zealand, Kildebronde, on *Physconia pulverulenta* on *Fraxinus*, 22 September 1940, *M. Skytte Christiansen 5797* (IMI 226837!); Zealand, Bognæs, on *Physconia pulverulenta* on *Populus*, 20 September 1942, *M. Skytte Christiansen 9619* (hb. Christiansen 592!); East Jutland, Helgenæs, on *Candelariella vitellina* on boulder at shore of Begtrup Vig, 10 October 1976, *M. Skytte Christiansen 76.814* (hb. Christiansen 419!).—**France**: Eure, Les Andelys, along road to Val-St-Martin, on *Rhizocarpon obscuratum* on pebble, 7 May 1977, *M. Skytte Christiansen 77.085* (IMI 225005!, hb. Christiansen).—**Sweden**: Skåne, Genarp, Hackeberga, on *Arthonia impolita* on old *Quercus* at the lake, 24 April 1946, *M. Skytte Christiansen 12.967* p.p. (hb. Christiansen 569 p.p.!, 571!).

2. Taeniolella phaeophysciae D. Hawksw. **sp. nov.**
(Fig. 36)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, 2.5–4 μm latis. Conidiophora semi-macronemata, caespitosa, recta, non ramosa, atrobrunnea, 40–80(–150) × 7–9 μm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia catenata, sicca, acrogena, doliiformia, plerumque 1-septata, levia, atrobrunnea, guttulata, 18–25 × 7–9 μm.

Typus: Magna Britannica, Anglia, Devonia, Slapton, Slapton Ley, prope mare, in *Phaeophyscia orbicularis* (Neck) Moberg ad *Sambucus*, 11.v.1975, *D. L. Hawksworth 3999* (IMI 194016—holotypus!).

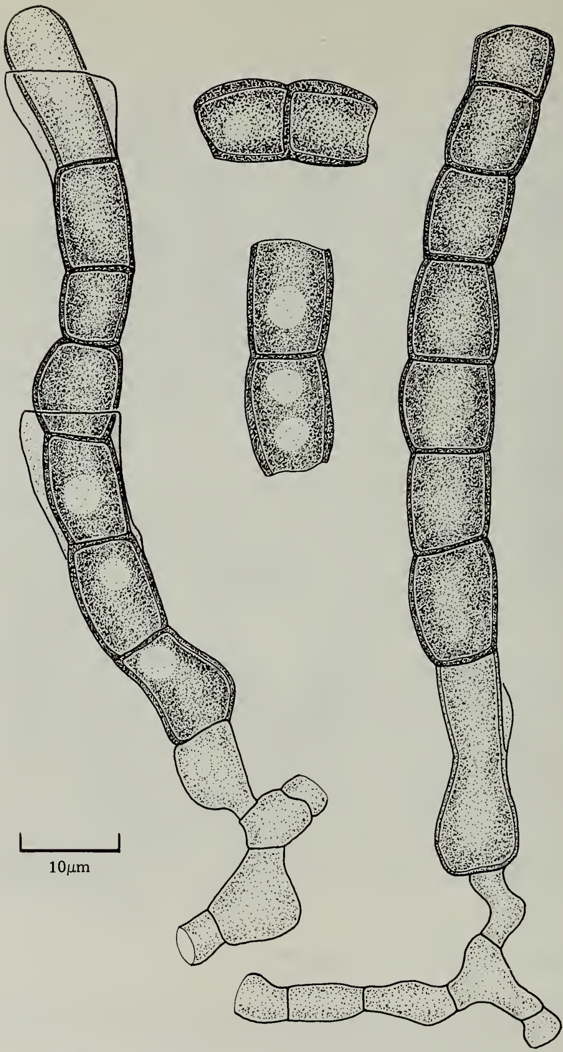

Fig. 36 *Taeniolella phaeophysciae* (IMI 194016—holotype).

Colonies usually discrete in strictly localized areas of the host thallus, more rarely somewhat scattered, dark brown to black and then often somewhat shiny; mycelium mainly immersed in the upper cortex of the host, composed of pale brown flexuose hyphae, hyphae thin-walled, smooth-walled, septate, not or slightly constricted at the septa, 2·5–4 µm wide. *Conidiophores* semi-macronematous, arising singly or in caespitose tufts, straight, unbranched, dark brown, septate, smooth- and thick-walled, constricted at the septa, very variable in height, 40–80(–150) × 7–9 µm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical to doliiform, dark brown, not well marked with the terminal cells acting in turn as conidiogenous cells. *Conidia* adhering in chains, separating with difficulty, dry, acrogenous, doliiform, dark brown, mostly 1-septate, only slightly constricted at the septum, frequently 1–2 guttulate, smooth- and thick-walled, 18–25 × 7–9 µm.

Hosts: *Phaeophyscia orbicularis* (Neck.) Moberg (thallus) and *Physconia pulverulenta* (Schreb.) Poelt (thallus). The caespitose dark brown to black tufts of conidiophores are easily seen with a hand lens. Infected lobes tend to become somewhat bleached suggesting that this species may be a pathogen.

Distribution: British Isles and Ireland.

Observations: This is a distinctive and rather constant species which is similar to *Taeniolella exilis* (P.Karst.) S. Hughes, a rather rare species of *Betula* bark and wood. *T. exilis* differs from *T. phaeophysciae* in the larger and broader conidia which are mostly 1–3 septate and 22–75 × 12–15 µm.

Additional specimens: **British Isles**: Huntingdonshire, Glatton, on *Phaeophyscia orbicularis*, 18 March 1977, *P. M. Earland-Bennett* (IMI 224497!); Wiltshire, Burderop Park, on *Phaeophyscia orbicularis* on *Fraxinus*, December 1972, *H. J. M. Bowen* (IMI 224496!).—**Ireland**: South Tipperary, Marlfield House, on *Physconia pulverulenta* on *Fraxinus*, 1 July 1974, *M. R. D. Seaward* (E!).

3. Taeniolella punctata M. S. Christ. & D. Hawksw. **sp. nov.**
(Fig. 37)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, usque 4–6 µm latis. Conidiophora semi-macronemata, caespitosa, recta, usque ad basim 1–3 ramosa, brunnea, 20–40(–60) × 5–8 µm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia catenata, sicca, acrogena, doliiformia, 1–2 septata, levia, brunnea, uniseptata est 10–12·5 × 6–9 µm.

Typus: Dania, Lolland, Ryde, in sylvae Kristianssæde Skov, in *Graphe scripta* (L.) Ach. (thallus) ad *Carpinum*, 24.vii.1977, *M. Skytte Christiansen 77.140* (IMI 225002—holotypus!; hb. Christiansen—isotypus).

Colonies scattered over the host thallus, punctate, brown; mycelium immersed, rather scant, extending into the host tissues intermixed with the periderm of the phorophyte, composed of subhyaline to pale brown flexuose torulose hyphae, hyphae thin-walled, smooth-walled, septate, generally markedly swollen between the septa, mainly 4–6 µm wide. *Conidiophores* semi-macronematous, arising in small caespitose tufts, erect, usually 1–3 branched at the base, dark brown, smooth-walled, thick-walled, septate, constricted at the septa, 20–40(–60) × 5–8 µm. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical, brown to dark brown, not well-defined with the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, separating only with difficulty, dry, acrogenous, doliiform, dark brown, 1–2 septate, not usually constricted at the septa, smooth- and thick-walled, 1-septate conidia 10–12·5 × 6–9 µm.

Host: *Graphis scripta* (L.) Ach., thallus. The fungus is limited to the lichen colonies in the type collection and does not occur on adjacent bark. The *Graphis* is abundantly colonized by the *Taeniolella* and in a degenerate condition, which, in view of the even distribution of the fungal infection punctae, is probably caused by this fungus.

Distribution: Denmark. Known only from the type collection.

Observations: *Taeniolella punctata* is most similar to *T. pulvillus* (Berk. & Br.) M. B. Ellis, a species of *Quercus* bark, but differs from that fungus in that *T. pulvillus* forms large compact

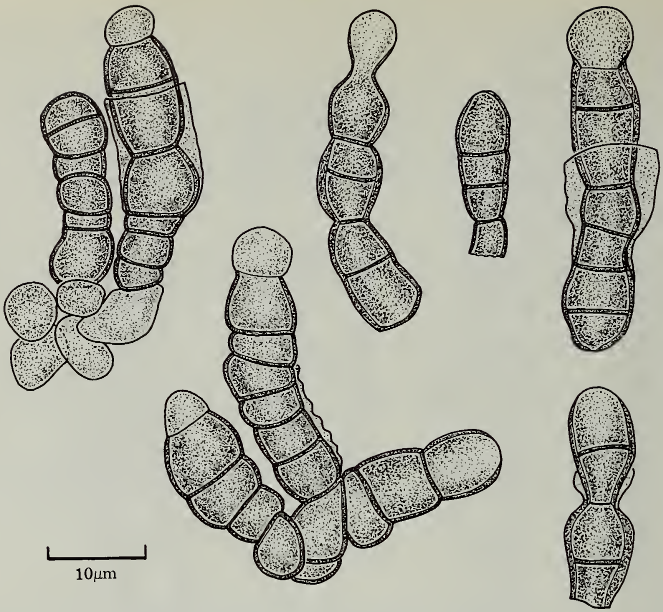

Fig. 37 *Taeniolella punctata* (IMI 225002—holotype).

tufts of very elongated conidiophores arranged more or less parallel to one another and conidia which are 2–11 septate and 25–90 × 7–9 µm. *T. punctata* appears to be primarily a lichenicolous species as it is strictly limited in the original collection to parts of the bark with *Graphis* thalli, even though microtome sections showed that it penetrated into the periderm layers, amongst which remnants of the lichen thallus were also to be found. It shows some similarity to *T. delicata* but that species has consistently narrower more delicate conidia and lighter pigmented conidiophores.

4. Taeniolella verrucosa M. S. Christ. & D. Hawksw. **sp. nov.**
(Fig. 38)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis brunneis, usque 4–7 µm latis. Conidiophora semi-macronemata, caespitosa, recta vel prostrata, usque ad basim 1–2 ramosa, atrobrunnea, usque 30–50 × 6–7 µm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae. Conidia catenata, sicca, acrogena, doliiformia, 0–1 septata, grosse verrucosa, atrobrunnea, uniseptata est 10–13 × 8–10 µm.

Typus: Suecia, Skåne, Genarp, Häckeberga, in *Arthonia impolita* (Hoffm.) Borr. (thallus) ad *Quercum*, 24.iv.1946, *M. Skytte Christiansen 12.967 p.p.* (hb. Christiansen 569—holotypus!).

Colonies scattered or loosely aggregated on the surface of the host thallus, dark brown to almost black; mycelium immersed, sparse, composed of brown mainly torulose hyphae, hyphae thin-walled, smooth-walled, septate, swollen between and markedly constricted at the septa, mainly 4–7 µm wide. *Conidiophores* semi-macronematous, arising in small caespitose tufts, erect or

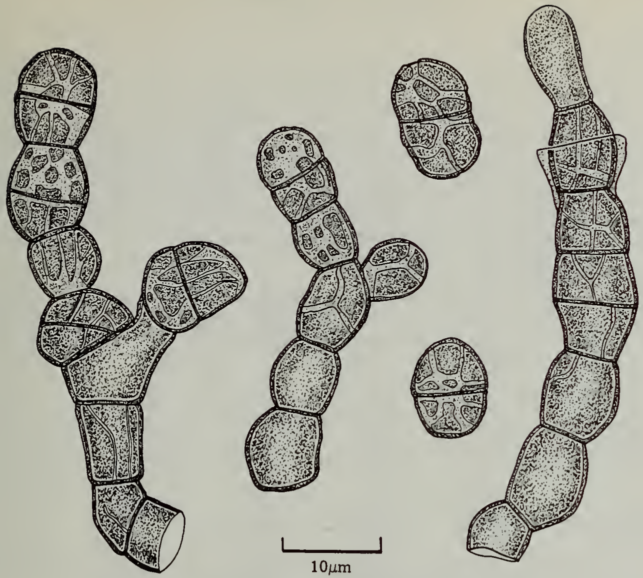

Fig. 38 *Taeniolella verrucosa* (hb. Christiansen 569—holotype).

almost prostrate, often 1–2 branched at the base, dark brown, smooth-walled at first but sometimes with the outer wall splitting to produce a coarsely verrucose ornamentation, thick-walled, septate, constricted at the septa, mainly $30–50 \times 6–7$ μm. *Conidiogenous cells* monoblastic integrated, terminal, subcylindrical, dark brown, not well-defined with the terminal cells in turn acting as conidiogenous cells. *Conidia* adhering in chains, separating only with great difficulty, dry, acrogenous, doliiform, dark brown, 0–1 septate, only slightly constricted at the septum, generally with a coarsely verrucose ornamentation produced by the splitting and breaking up of the outer wall of the conidia, thick-walled, 1-septate conidia $10–13 \times 8–10$ μm.

Host: *Arthonia impolita* (Hoffm.) Borr., thallus. The infected areas of the thallus are dark brown to black due to the conidiophores and conidia of the fungus, but show little sign of actual damage.

Distribution: Sweden. Known only from the type collection.

Observations: *Taeniolella verrucosa* is a distinctive species differing from all others referred to the genus in that the conidia become coarsely verrucose due to a splitting and disintegration of the outer wall of the conidia. Of the species treated here, in the shape and size of the conidia it most closely resembles *T. punctata* but can easily be separated by the sculpturing of the conidia. *T. delicata* is also present in the type collection of *T. verrucosa* and the species occur mixed with one another in a few places on the thallus; they do, however, always retain their individuality and are easily separable from each other.

XXI. TERATOSPERMA Syd.

Annls mycol. 7 : 127 (1909).

Colonies orbicular or effuse; mycelium superficial and/or immersed, irregularly branching, brown to dark brown. Stroma, setae and hyphopodia absent. Conidiophores macronematous, mononematous, erect, usually unbranched, brown to dark brown, smooth-walled, with a thickened irregularly lobate basal foot-cell in the lichenicolous species. Conidiogenous cells monoblastic, integrated, terminal, percurrently proliferating, with well-marked annellations. Conidia solitary, dry, acrogenous, pale to dark brown, transversely septate, obclavate, the basal cell generally with 1–4 paler appendages and the apical cell or other cells occasionally with appendages also, apical cell or cells paler in colour than the basal cells, acicular hyaline microconidia sometimes also produced from the appendages or apical cell in the lichenicolous species.

Type species: *Teratosperma singulare* Syd.

Number of species: Five species were accepted by Ellis (1957, 1971) and a further species is described here. Only two species are lichenicolous, three being saprophytes and occurring on decaying wood and leaves, and one occurring on colonies of blue-green algae on leaves (*T. appendiculatum* (S. Hughes) M. B. Ellis).

Key to the lichenicolous species

1 Conidia mainly 3-septate, with 1–2(–3) appendages on the basal cell, overall (17–)20–30(–35) × (4·5–)5–6·5(–7) µm . . . . **T. anacardii** (p. 260)
– Conidia mainly 2-septate, lacking appendages on the basal cell, overall 18–25 × 5–6 µm **T. lichenicola** (p. 262)

1. Teratosperma anacardii Hansf., *Proc. Linn. Soc. Lond.* **155** : 54 (1943). (Fig. 39)

Type: Uganda, Kampala, alt. 4000 ft, on *Strigula elegans* (Fée) Müll. Arg. on *Anacardia occidentale*, May 1936, *G. Chandler* [Hansford no. 1831.] (K—holotype!; IMI 10442—isotype!).
Podoconis anacardii (Hansf.) S. Hughes, *Mycol. Pap.* **48** : 65 (1952).

Icones: Ellis, *Mycol. Pap.* **69** : 7 fig. 5 (1957).—Ellis, *Demat. Hyphom.* : 134 fig. 88E (1971).—Hansford, *Proc. Linn. Soc. Lond.* **155** : 51 fig. 11 (1943).—Hughes, *Mycol. Pap.* **48** : 65 fig. 25 (1952).

Colonies dispersed, superficial, olivaceous brown to dark brown, arising on the surface of the host lichen but also sometimes spreading on to adjacent parts of the leaf surface; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, mainly 2–3 µm wide. *Conidiophores* macronematous, mononematous, erect, usually unbranched (see Hughes, 1952), thick-walled, smooth-walled, dark brown, septate, (25–)50–70(–100) µm tall and 3–5 µm wide, with a clearly demarcated foot cell which is irregularly lobate and mainly 7–10 µm diam. *Conidiogenous cells* monoblastic, integrated, terminal, percurrently proliferating to leave to 15 well-marked annellations, otherwise resembling the conidiophores. *Conidia* solitary, dry, acrogenous, obclavate, (2–)3(–4) septate, the basal two cells brown to dark brown, the upper cells subhyaline or pale brown, basal cell truncated with a scar 1·5–3 µm wide, basal cell bearing 1–2(–3) subhyaline appendages 2–10(–18) × 2–3 µm, a similar appendage also sometimes occurring from the sub-apical cell, overall dimensions (excluding appendages) (17–)20–30(–35) × (4·5–)5–6·5(–7) µm, appendages occasionally acting as conidiogenous cells and forming acicular hyaline microconidia 10–20 × 0·5 µm.

Hosts: On foliicolous lichens, particularly *Strigula elegans* (Fée) Müll. Arg.; it may be restricted to this single species (see below).

Distribution: Ghana, New Guinea, Nigeria, Sierra Leone and Tanzania.

Observations: *Teratosperma anacardii* was not recognized as being lichenicolous by Hansford (1943) who reported it only as 'in foliis'. Hughes (1952 : 65) was the first author to realize that this

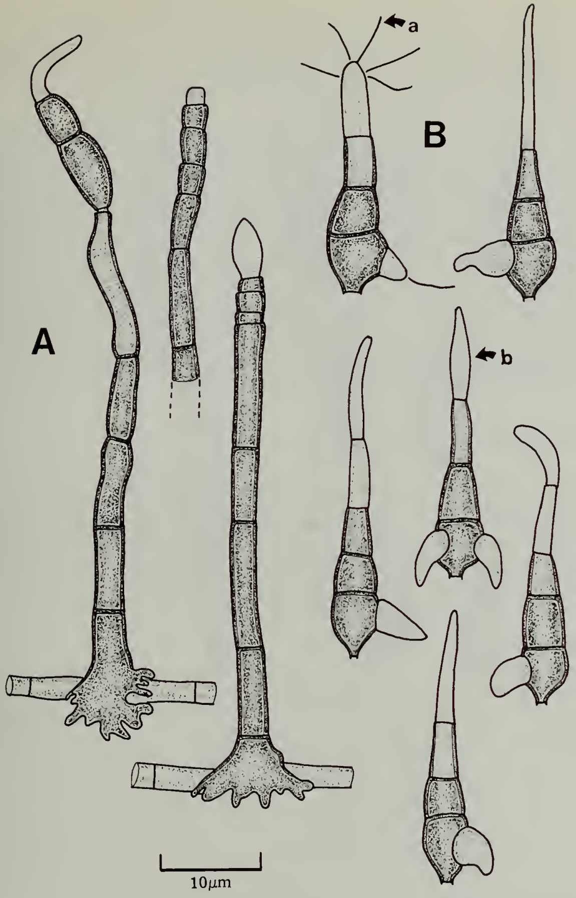

Fig. 39 *Teratosperma anacardii* (IMI 89537*b* except as indicated). **A,** Conidiophores. **B,** Conidia (**a**, secondary conidia; **b**, conidium from IMI 10442—isotype).

was a lichenicolous species and he further demonstrated that the acicular appendages on the apical and lateral cells figured by Hansford were in reality a kind of microconidia. Similar microconidia occur in *T. lichenicola* (p. 262) but are unknown in most species of the genus.

This fungus appears to be primarily a pathogen of *Strigula elegans* although determination of the host is often uncertain as ascocarps are not formed. The fungus can even attack colonies of *Cephaleuros* which are in the process of lichenization (e.g. IMI 56743*d*!) and it is most often found on either completely sterile thalli recalling *S. elegans* in their superficial appearance, or ones which only produce pycnidia of the lichen. The infected lichen thalli become discoloured brownish and are evidently eventually killed. Interestingly, *T. anacardii* does not seem to be able to spread onto adjacent colonies of *Gyalectidium aspidotum* even when it is very abundant on *S. elegans* on the same leaf (e.g. IMI 51718!); this supports the hypothesis that this fungus may be host specific.

Additional specimens (all on *Strigula elegans* or indeterminate thalli most probably of this species): **Ghana**: Aburi, on *Hura crepitans*, 24 May 1949, *S. J. Hughes 797* (IMI 44046*a*!); *loc. cit.*, on *Chrysobalanus orbicularis*, 24 May 1949, *S. J. Hughes 802* (IMI 43710*a*,*b*!), 3 May 1949, *S. J. Hughes 173* (IMI 43713*a*!); Togoland, Jasikan, on *Cola lateritia*, 27 May 1949, *S. J. Hughes 1026* (IMI 44501*j*!); Suhum, on *Discoglypremna caloneura*, 28 April 1949, *S. J. Hughes 101* (IMI 44151*b*!).—**New Guinea**: Popondetta, Belfields, on *Persea gratissima*, 24 August 1961, *D. E. Shaw 3298* (IMI 89537*b*!).—**Nigeria**: Ondo Province, Ado Ekiti, on *Theobroma cacao*, 2 May 1950, *C. A. Thorold 10* p.p. (UPS *non vidi*, IMI 85640!).—**Sierra Leone**: Gbesebu (Kumajei), on *Alchornea hirtella*, 27 April 1954, *F. C. Deighton M5908d* (IMI 56743*d*!); Pujehun (Panga-Kaponde), on *Homalium letestui*, 11 April 1939, *F. C. Deighton M2010* p.p. (IMI 7664*f*!); Njala (Kori), on *Homalium letestui*, 5 March 1937, *F. C. Deighton M1332* p.p. (IMI 25611*i*!); *loc. cit.*, on *Parinari excelsa*, 15 July 1953, *F. C. Deighton M5364a* (IMI 53373*a*!); *loc. cit.*, on *Kopsia fruticosa*, 4 February 1953, *F. C. Deighton M5105* (IMI 51718!); *loc. cit.*, on *Camellia sinensis*, 26 July 1953, *F. C. Deighton M5388* p.p. (IMI 53385*a*!).—**Tanzania**: Kigoma, Kakombe, on *Deinbollia fulvo-tomentella*, 7 January 1964, *K. A. Pirozynski M326iib* (IMI 106117*b*!).

2. **Teratosperma lichenicola** D. Hawksw. **sp. nov.**
(Fig. 40)

Fungus lichenicola. Mycelium superficiale, ex hyphis repentibus, cellulis pallide brunneis, 2–3 μm latis. Conidiophora macronemata, mononemata, recta, non ramosa, atrobrunnea, plerumque 60–80 × 3·5–5 μm, cum cellulis podiiformibus lobatis instructa. Cellulae conidiogenae monoblasticae, integratae, subcylindricae, annellidicae. Conidia solitaria, sicca, acrogena, obclavata, 2(–3) septata, levia, cellulis atrobrunneis sed cellula apicali subhyalina, appendices desunt sed cellulis apicalibus rarissimo microconidia filiformia et hyalina 5–10 × 0·5 μm productis, 18–25 × 5–6 μm.

Typus: Sierra Leone, Njala (Kori), in lichenibus foliicolis (*Strigula elegans*) ad *Homalium letestui*, 5.iii.1937, *F. C. Deighton M1332* p.p. (IMI 25611*h*—holotypus!).

Icones: Hughes, *Mycol. Pap.* **48** : 67 fig. 26 (1952).

Colonies dispersed, superficial, olivaceous brown, arising on the surface of the host lichen but sometimes spreading on to adjacent areas of the leaf; mycelium superficial, adpressed, irregularly branched, flexuose, hyphae relatively thin-walled, pale brown, smooth-walled, septate, not or slightly constricted at the septa, 2–3 μm wide. *Conidiophores* macronematous, mononematous, erect, usually unbranched (see Hughes, 1952), thick-walled, smooth-walled, dark brown, septate, mainly 60–80 × 3·5 μm, with a clearly demarcated foot cell which is irregularly lobate and mainly 7–10 μm diam. *Conidiogenous cells* monoblastic, integrated, terminal, percurrently proliferating to leave to 10 well-marked annellations, otherwise resembling the conidiophores. *Conidia* solitary, dry, acrogenous, obclavate, 2(–3) septate, the basal two cells brown to dark brown, the apical cell subhyaline or pale brown, basal cell truncated with a scar 1·5–2 μm wide, appendages absent in most specimens (a single apical appendage was figured by Hughes, 1952 : 67, from IMI 44156), overall dimensions 18–25 × 5–6 μm, the apical cell occasionally acting as a conidiogenous cell producing acicular hyaline microconidia 5–10 × 0·5 μm.

Hosts: On foliicolous lichens, particularly *Strigula elegans* (Fée) Müll. Arg.; it may be restricted to this single species (see discussion regarding the hosts of *Teratosperma anacardii* above).

Distribution: Ghana, Malaya and Sierra Leone.

Observations: This species was figured by Hughes (1952 : 67) who treated it as '*Podoconis* sp.'; he was hesitant to describe it as new in the absence of further collections particularly because the spores of *Teratosperma anacardii* may sometimes lack appendages and be only 2-septate. The discovery of further material which is clearly conspecific, and the constancy of the spore

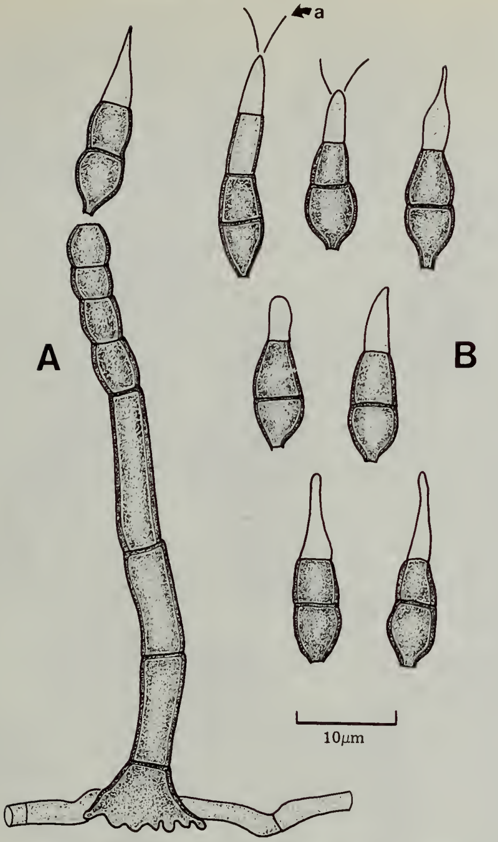

Fig. 40 *Teratosperma lichenicola* (IMI 25611*h*—holotype). **A**, Conidiophore. **B**, Conidia (**a**, secondary conidia).

characters in the taxon, now leave little doubt that it does represent a species distinct from *T. anacardii*.

This species is unlike the taxa hitherto placed in *Teratosperma* in that it lacks appendages on the basal cell. The only alternative genus for it would be *Sporidesmium* Link ex Fr., which is essentially separated from *Teratosperma* on the basis of this character, but currently comprises a heterogeneous assemblage of species. In view of the very close affinity of *T. lichenicola* and *T. anacardii* it is inconceivable to place them in different genera, even though the inclusion of *T. lichenicola* in *Teratosperma* broadens the concept of that genus considerably. Not only are the conidia similar, apart from the appendages, but they have the ability to form characteristic microconidia rarely seen in other species of *Sporidesmium* or *Teratosperma*, and characteristic stout conidiophores with lobate foot cells.

T. lichenicola is, like *T. anacardii*, probably a pathogen of *Strigula elegans*. It is readily distinguished from that species on the basis of the septation, size and lack of appendages on the conidia.

Additional specimens: **Ghana**: Bunsu, on indet. lichen on *Griffonia simplicifolia* (syn. *Bandeiraea simplicifolia*), 7 June 1949, *S. J. Hughes 1116* (IMI 44156!); Tafo, on indet. lichen on *Carapa procera*, 18 June 1949, *S. J. Hughes 1369* (IMI 44218*c*!).—**Malaya**: Serdang, Federal Experimental Station, on indet. lichen on *Lansium domesticum*, 2 January 1953, *A. Johnston 1244* p.p. (IMI 56061*c*!).

XXII. TRIMMATOSTROMA Corda

Icon. fung. **1** : 9 (1837).

Colonies usually appearing as pulvinate sporodochia but sometimes more effuse, dark brown; mycelium superficial and/or immersed, often sparse. Stroma characteristically present in the non-lichenicolous species, pseudoparenchymatous, brown; setae and hyphopodia absent. Conidiophores macronematous or semi-macronematous, meristematic, elongating by septation behind the apical cell and its subsequent growth, erect or prostrate, flexuose, not or occasionally branched, generally becoming compacted together, pale brown or brown, smooth-walled or verrucose. Conidiogenous cells monoblastic, integrated, terminal, subcylindrical, each apical cell in turn acting as a conidiogenous cell. Conidia solitary or in basipetal irregular chains, dry, schizogenous, brown or dark brown, multicellular and extremely variable in shape and degree of septation, almost always muriform.

Type species: *Trimmatostroma salicis* Corda.

Number of species: 17 species have been described of which five are figured by Ellis (1971 : 41–42, 1976 : 27–30). All are saprophytes, mainly occurring on bark, and no lichenicolous species have been hitherto described. The genus is in need of a monographic revision as its current limits appear extremely broad.

1. **Trimmatostroma lichenicola** M. S. Christ. & D. Hawksw. **sp. nov.**
(Fig. 41)

Fungus lichenicola. Mycelium immersum, ex hyphis cellulis pallide brunneis, 3–7 μm latis. Conidiophora macronemata, mononemata ad laxe aggregata, flexuosa, non vel sparse ramosa, brunnea, plerumque 70–120 × 4–6 μm. Cellulae conidiogenae monoblasticae, integratae, subcylindricae, non bene distinctae. Conidia solitaria vel irregulariter catenata, sicca, schizogena, subcylindrica vel irregulariter ellipsoidea, multi-septata, muriformia, levia, atrobrunnea, plerumque 18–25 × 6–12 μm sed valde variabilia.

Typus: Groenlandia, Insula Disko, Nordfjord, W. e Kugssinerssuaq, alt. 150 m, in apotheciis *Candelariellae vitellinae* ad ossea, 13.viii.1975, *V. Alstrup 91* (hb. Christiansen 553—holotypus!).

Colonies mainly immersed and dispersed through the hymenium of the host lichen, brown to dark brown, extending from the hypothecium and sporulating at the surface of the apothecium; mycelium immersed, mainly in the hypothecium, rather sparse, irregular and sometimes almost pseudoparenchymatous in places, very pale brown, flexuose, hyphae relatively thin-walled, smooth-walled, septate, generally constricted at the septa, cells rather short, mainly 3–7 × 3–7 μm. *Conidiophores* macronematous, mononematous or compacted, meristematic, erect, unbranched or sparsely branched and sometimes anastomosing, rather thick-walled, smooth-walled, brown, septate, many-celled, 70–120 μm tall, cells mainly 4–6 μm diam. *Conidiogenous cells* monoblastic, integrated, terminal, subcylindrical or doliiform, brown, not well marked and each terminal cell able to act in turn as a conidiogenous cell. *Conidia* solitary or adhering in irregular chains, dry, schizogenous, subcylindrical to irregularly ellipsoid, very variable in shape 2- to multi-septate to muriform, the individual cells markedly swollen, smooth- and thick-walled, dark brown, mainly 18–25 × 6–12 μm.

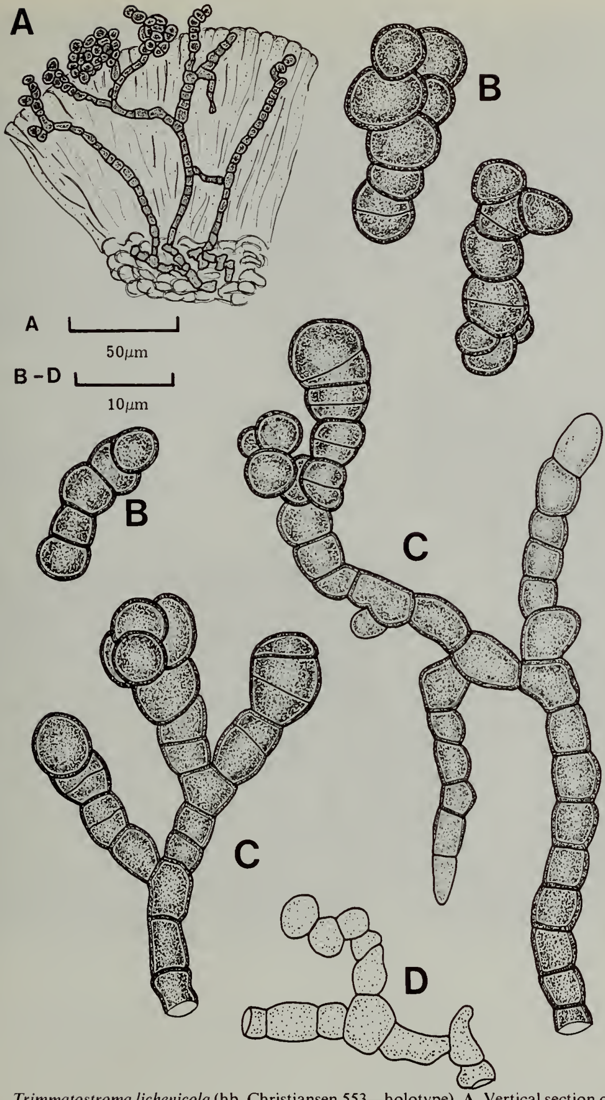

Fig. 41 *Trimmatostroma lichenicola* (hb. Christiansen 553—holotype). **A,** Vertical section of infected hymenium of *Candelariella vitellina*. **B,** Conidia. **C,** Conidiophores with attached maturing conidia. **D,** Mycelium from the hypothecium of the host.

Host: On *Candelariella vitellina* (Hoffm.) Müll. Arg., apothecia becoming blackened in the presence of the fungus. Mature normally developed asci and ascospores occur in close proximity to the invading fungus in some instances, but where the conidiophores are most abundant ascus production appears to be reduced.

Distribution: Greenland. Known only from the original collection.

Observations: This fungus is being placed in *Trimmatostroma* with some hesitation as the sporodochial habit characteristic of the genus is scarcely evident in *T. lichenicola*. Conidiogenesis, however, strongly resembles that in *T. betulinum* (Corda) S. Hughes, the conidia of which also show some similarity to those of *T. lichenicola*, although they are somewhat smaller and occasionally verrucose. In placing the fungus here, the sporodochial habit is presumed to have been lost in the process of adaptation to the lichenicolous hymenial habit, but the cellular to almost sometimes pseudoparenchymatous appearance of the hypothecial mycelium could be conceived as the remnants of a primitive stroma.

XXIII. XANTHORIICOLA D. Hawksw.

in Hawksworth & Punithalingam, *Trans. Br. mycol. Soc.* **61** : 66 (1973).

See Hawksworth & Punithalingam (1973 : 66–68) for further information on this genus.

Type species: *Xanthoriicola physciae* (Kalchbr.) D. Hawksw.

Number of species: Monotypic.

Xanthoriicola physciae (Kalchbr.) D. Hawksw., *in* Hawksworth & Punithalingam, *Trans. Br. mycol. Soc.* **61** : 67 (1973).
(Fig. 42)

See Hawksworth & Punithalingam (1973 : 67–68) for description, synonymy and further information on this species.

Hosts: *Xanthoria parietina* (L.) Th. Fr., apothecia.

Distribution: Probably widespread in Europe. Reliably recorded from the British Isles, France, Hungary, Spain and Sweden.

Observations: As my previous account of this fungus (Hawksworth & Punithalingam, 1973) was illustrated only by line drawings, the opportunity is taken here to show its features by photomicrographs and scanning electron micrographs (Fig. 42). Note particularly the ornamentation on the conidia which is much less coarse than that in *Leightoniomyces* (Hawksworth, 1977*a* : 203 Pl. 2), the verrucae being more similar to several *Lichenoconium* species (Hawksworth, 1977*b*: Pls 24A, 27C–D, 28H–I, 29G).

Excluded species

Taxa referred to the Hyphomycetes by their original or later authors which have been considered as lichenicolous, but which are not accepted in the preceding section, are compiled here alphabetically; obligate synonyms are listed only under their basionyms and not individually.

Aegerita carnea Pat., *Expl. scient. Tunisie, Cat. Pl. cell.* : 135 (1897).
Type: Tunisia, Tunis, on indet. crustose lichens on walls, December 1892, *N. Patouillard* (FH-Pat. 5762—holotype!).

The original collection is extremely fragmented and now largely powdered, but a few of the subtremelloid flesh-coloured structures described by Patouillard were eventually discovered. These proved to merely represent epiphytic colonies of an alga; the 36×20 µm structures described as conidia remained unstained in both cotton blue and iodine and appear to be cysts of either that alga or another intermixed with it.

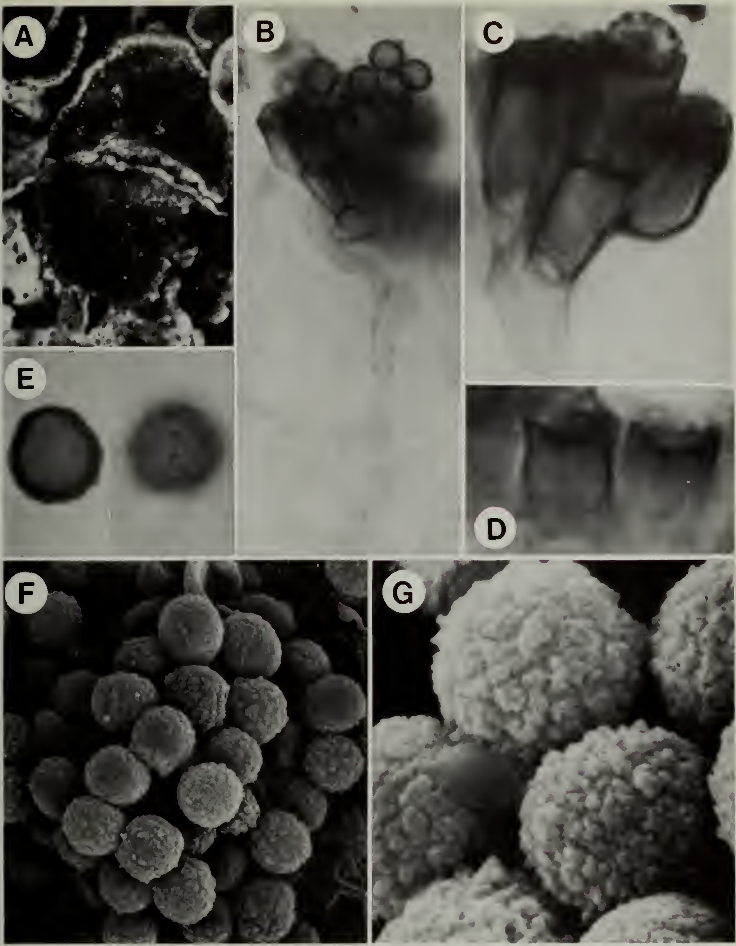

Fig. 42 *Xanthoriicola physciae*. **A**, Infected discoloured apothecia of *Xanthoria parietina* (×16). **B**, Conidiophores immersed in the thecium of the host (×1400). **C-D**, Conidiogenous cells (×3500). **E**, Conidium in optical section and surface view (×3500). **F**, Group of conidia (×3000). **G**, Conidia showing verrucose ornamentation (×11 000). A, F–G IMI 171822; B–E IMI 164974. F–G Scanning electron micrographs.

Aegerita mellea Berk. & Br., *J. Linn. Soc., Bot.* **14** : 101 (1873).

Type: Sri Lanka, Peradeniya, on cf. *Heterodermia* sp., December 1868, [collector not indicated] *1019* (K—holotype!).

This taxon was first described as forming 'small yellow tremelloid specks scarcely visible without a lens' on the lichen thallus but without further details. Petch (1927 : 177) studied the material and considered it a fungus producing 'pseudoconidia' which were ovate or globose and 10–16×7–12 μm. Many structures identical to the 'specks' described by the original authors still occur on the type collection; these 'specks' swell and become translucent-amber on wetting, are entirely superficial, floating off the lichen thallus in a drop of water, and their occurrence on the lichen must consequently be regarded as accidental. The cells of the 'specks' are very irregular in outline and densely compacted together but do not appear to be fungal. On mounting in Melzer's iodine some massive parietal structures recalling chloroplasts became apparent in some cells, and therefore this taxon is consequently referred to the algae.

Aegerita physciae Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 314 (1914).

This name was based on two collections of *Physcia adscendens*: one from Laitre-sous-Amance (Meurthe-et-Moselle) made by Vouaux, and one from Bergues sent to Vouaux by Bouly de Lesdain. Unfortunately this taxon is not represented amongst the remnants of Vouaux's herbarium (Rondon, 1970) and Bouly de Lesdain's collections were destroyed in 1940. The fungus was described as macroscopically recalling *Illosporium roseum* (i.e. the species treated as *I. corallinum* above), but producing non-septate hyaline conidiophores 25–35 μm long and 4–7 μm wide at the base, and conidia forming by budding, separating by a septum and then becoming detached. The conidia themselves were described as hyaline, simple, thin- and smooth-walled, with granular contents, exactly spherical and 10–15 μm diam. I have not so far seen a lichenicolous fungus agreeing with Vouaux's description but if the same species is collected again it should be possible to recognize it from the description and then establish its true position. *Aegerita* Pers. ex Fr. is unlikely to be appropriate for this fungus (see Kendrick & Carmichael, 1973).

Atractium flammeum Berk. & Rav., *in* Berkeley, *Ann. Mag. nat. Hist.* II, **13** : 461 (1854).

Type: U.S.A., South Carolina, on bark, peeping up beneath *Parmelia crinita* Ach., *H. W. Ravenel 976* (K—lectotype!).

Although this taxon was not described as lichenicolous but from bark on which lichens were present (see Keissler, 1930 : 624), Clauzade & Roux (1976 : 93) nevertheless give its habitat as 'sur thalles corticoles de *Parmelia*, *Xanthoria* et *Physcia*'. In the original diagnosis two collections were mentioned, one from the bark of living willows in Penzance, England, where it was collected by J. Ralfs, and the other 'peeping up beneath lichens' in South Carolina collected by H. W. Ravenel. The Ralfs' British specimen (K!) is associated with *Parmelia glabratula* (Lamy) Nyl. but few synnemata are now present and it is consequently not ideal for selection as the lectotype for this name. There are also five Ravenel specimens under this name in K from South Carolina; that selected as lectotype here comprises thalli of *Parmelia crinita* Ach., between the lobes of which synnemata of the fungus project abundantly, and includes a sketch by Berkeley with '*Sphaeria muscivora* ? Berk.' scored out, and the name '*Atractium flammeum*' inserted in Berkeley's hand.

This pale orange synnematous fungus has 4–6 septate subcylindrical conidia 70–75 μm long and is identical with *Microcera coccophila* Desm., the conidial state of *Sphaerostilbe flammea* Tul. (Hypocreales), which is parasitic on scale insects (Petch, 1921, 1938) and is not a lichenicolous fungus.

Campsotrichum bicolor Ehrenb. ex Pers., *Mycol. Eur.* **1** : 20 (1822).

Campsotrichum bicolor Ehrenb., *Jahrb. Gewächsk* **1** : 55 (1819); nom. inval. (Art. 13).

Type: Germany, Saxony, Vogtland district, on *Usnea* '*plicata*', *C. G. Ehrenberg* (L 90.0.H.910.262–776—lectotype non vidi).

Myxotrichum bicolor (Ehrenb. ex Pers.) Fr., *Syst. mycol.* **3**(2) : 351 (1832).

Although Keissler (1930 : 623) listed this species amongst the Dematiaceae, it is in reality an ascomycete belonging in the Gymnoascaceae. The taxon has been investigated in detail by Hughes

(1968) who found it to be conspecific with *Myxotrichum poluninii* Apinis which had been described subsequently from a species of *Cetraria* collected in Canada (Apinis, 1964); *M. bicolor* is consequently the correct name for *M. poluninii*. Keissler (1930) also listed *Ceratonema bicolor* Pers. as a tentative synonym of this taxon, but this is certainly a *lapsus* as that species is not lichenicolous.

Cephalosporium acremonium Corda, *Icon. fung.* **3** : 11 (1839).

This name has been extensively and incorrectly applied to the fungus now correctly called *Acremonium strictum* W. Gams (Gams, 1971 : 42) as well as to other species of that genus. *A. strictum* is an ubiquitous saprophyte and its occurrence on lichens is perhaps to be expected. Vouaux (1914 : 325) reported the presence of *Cephalosporium acremonium* on an aged *Pertusaria* thallus collected by Bouly de Lesdain in the Parc de Versailles, France, but whether this was really *A. strictum* cannot be established in the absence of Bouly de Lesdain's collection.

Ceratonema fucinum Wallr., *Fl. crypt. Germ.* **2** : 171 (1833).

Type: Germany, 'Hercyn. et Thuringo passim, inter tomentum spongiosum' *Pannaria rubiginosa* (Thunb. ex Ach.) Del.

Capillaria fucina (Wallr.) Sacc., *Syll. Fung.* **14** : 1184 (1899).

The original description of this taxon was 'rhabdis vage patentimque ramosis teretibus dein ligamentosis alternatim compressis, in strata mollia laxe congestis fusco-purpurascentibus'. No reply could be obtained from STR so it is not known whether the original material on which this name was based is present amongst Wallroth's herbarium today; no collections under this name were found in PRM (M. Svrček, *in litt.*) which has a few of his specimens (Hughes, 1958). It is possible that this name was based on rhizinae arising from the spongy hypothallus of *Pannaria rubiginosa*; such rhizinae occasionally arise in tufts from the upper as well as the lower surface in this species and superficially recall tufts of dematiaceous conidiophores. Final confirmation of this hypothesis must await examination of Wallroth's material if any is still extant.

Cladosporium lichenicola Linds., *Q. Jl. microsc. Soc.* II, **11** : 42 (1871); as '*lichenicolum*'.

Type: Scotland, S. Aberdeenshire, Falls of the Garrawalt, on thallus of *Peltigera aphthosa* (L.) Willd., August 1856, *W. L. Lindsay.*

The original collection on which this name was based was sent by Lindsay to M. C. Cooke at Kew but could not be located either in E (B. J. Coppins, *in litt.*) or K. Lindsay (*loc. cit.*) records that 'The only structure visible under power 380 of Nachet's microscope consists of brown articulated tubuli — the constituent cells of which are oblong, and either empty or contain atomic granules in roelike masses — with difficulty visible'. In view of these observations there can be little doubt that this name refers only to sterile mycelium. Lindsay (*loc. cit.*) was hesitant in introducing the name as he stated that the fungus '. . . if it is entitled to specific distinction, may be fitly denominated *C. lichenicolum*'. This name could perhaps be treated as not validly published under Art. 34, but it was accepted by Arnold (1874 : 155).

Coniosporium lecanorae Jaap, *in* Lindau, *Verh. bot. Ver. Prov. Brandenb.* **47** : 71 (1906).

Type: Germany, Prov. Brandenburg, Triglitz i. d. Prignitz, on *Lecanora chlarotera* apothecia on *Sorbus aucuparia*, 31 December 1901, *O. Jaap* (B—holotype!).

Although this fungus was thought to be a hyphomycete by Jaap and has been assumed to be such by all subsequent workers on lichenicolous fungi, it proved to have irregularly opening pycnidia about 60 µm diam, lined with phialides $5–7 \times 3–3{\cdot}5$ µm which formed brown globose conidia with verruculose walls mainly 3–4·5 µm diam. Jaap appears only to have observed discharged conidia on the surface of the apothecia and assumed that hyphae arising from germinating conidia were conidiophores. This fungus is conspecific with *Lichenoconium parasiticum* D. Hawksw., a species already known on *Lecanora chlarotera* (Hawksworth, 1977*b*). As Jaap's epithet predates *Lichenoconium parasiticum* by 71 years it must be taken up for that species; the new combination **Lichenoconium lecanorae** (Jaap) D. Hawksw. **comb. nov.** is consequently made here.

This interpretation of Jaap's name is supported by other collections in B which he referred to this taxon, although they also included various other fungi as well. Reports of this species by other workers may, however, refer to a variety of fungi and should not automatically be assumed to belong to *Lichenoconium lecanorae*.

Coniosporium lecanorae var. **arthoniae** Vouaux, *in* Bouly de Lesdain, *Rech. Lich. Dunkerque* : 278 (1910); nom. nud. (Art. 32).

This variety was introduced without any description but several collections, all from France, were listed as belonging to it: on *Arthonia radiata* (Pers.) Ach. (syn. *A. gregaria* (Weig.) Körb.) and *Opegrapha vulgata* (Ach.) Ach. (syn. *O. cinerea* Chev.) from Merckeghem, and on *A. tumidula* (Ach.) Ach. (syn. *A. astroidea* (Ach.) Ach.) from both Bollezeele and Rexpoëde. No material of this taxon exists amongst the remnants of Vouaux's herbarium (Rondon, 1970) and as Bouly de Lesdain's material was destroyed in 1940 it is not possible to firmly ascertain the position of this name.

Vouaux (1914 : 308) reconsidered this taxon and subsumed it under his, probably erroneous, concept of *Coniosporium lecanorae* categorically stating it did not merit varietal status. In placing the name as a synonym of *C. lecanorae*, Keissler (1930 : 606) was almost certainly copying Vouaux. I would, however, be most surprised if the var. *arthoniae* proved to be a *Lichenoconium* (as *Coniosporium lecanorae* is) for no *Lichenoconium* species are recorded on *Arthonia* or *Opegrapha* (Hawksworth, 1977*b*).

Coniosporium mildbraedii Lindau, *Wiss. Ergebn. dt. ZentAfr. Exped.* **2** : 110 (1911).

Type: Congo, Ruanda, Nyavarango west of Akanjaru-Einfluss, on thallus and apothecia of *Lecanora poliothallina* Lindau on 'Kandelabereuphorbien', August 1907, *G. W. J. Midbread 789* (B—holotype destroyed).

All the material collected by the German expeditions of 1907-8, 1910-11, 1913 and 1928 into central Africa was destroyed in World War II (Vegter, 1976 : 538). This was confirmed by B. Hein (*in litt.*) who also checked the general lichen herbarium as well as the fungal collections in B; no material was deposited in HBG either (I. Friederichsen, *in litt.*). This fungus was described as comprising fuscous-black to black hyphae 4–4·5 μm wide spreading over the areolae of the host thallus and more rarely occurring on the apothecial discs. The conidia arose singly or in chains of 2–3 at the apices of the hyphae and were ellipsoid, slightly pointed to rounded at the apex, at first slightly truncate at the base but becoming rounded, brown, smooth-walled, non-septate, and $7{\cdot}5$–$9{\cdot}5 \times 7$–$7{\cdot}5$ μm. No illustration was provided by Lindau (*loc. cit.*) and in the absence of further information as to the method of conidium formation, this fungus cannot be confidently assigned to any particular genus.

Coniosporium pertusariae Jaap, *Verh. bot. Ver. Prov. Brandenb.* **64** : 59 (1923); nom. nud. (Art. 32).

Type: Germany, 'Parasitisch auf *Pertusaria communis* DC. [i.e. *P. pertusa* (L.) Tuck.] an einer alten Eiche', 5 April 1906, *O. Jaap*.

This name was introduced without any description and no material of it could be found amongst Jaap's fungal and lichen collections in HBG (P. Wiemann, *in litt.*) or B (B. Hein, *in litt.*). It must consequently be treated as of uncertain application.

Coniosporium pulvereum Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 309 (1914).

Type: France, Ghyvelde Dunes, on stone, 'sur thalle stérile crustacé', *M. Bouly de Lesdain*.

Unfortunately no material of this taxon is present amongst the remnants of Vouaux's herbarium (Rondon, 1970) and Bouly de Lesdain's herbarium was destroyed in 1940. The identity of this fungus and its host consequently remain uncertain. The conidia were described as simple, brownish, more or less spherical, and 8–13 μm diam, and said to be produced without conidiophores in dusty heaps 50–100 μm diam.

Dactylium dendroides subsp. **lichenicola** P. Karst., *Meddn Soc. Fauna Flora fenn.* **14** : 107 (1887).
Type: Finland, nr Mustiala, 'in thallo putrescente *Parmeliarum*', September 1872, *P. A. Karsten*.
Dactylium lichenicola (P. Karst.) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 307 (1914).

The genus *Dactylium* Nees ex Fr. is typified by *D. candidum* Nees ex Pers., the epithet of which has been combined into *Candelabrella* Rifai & R. C. Cooke by Rifai (1968) despite uncertainties surrounding this name (Barron, 1968 : 145). *D. dendroides* (Bull. ex Mérat) Fr., the conidial state of *Hypomyces rosellus* (Alb. & Schwein. ex Fr.) Tul. (Hypocreales) which is not uncommon on decaying Agaricales, has been transferred to *Cladobotryum* Nees ex Steud. by Gams and Hoozemans (1970 : 103). *C. dendroides* was evidently known to Karsten as he noted it on agarics in the same paper in which subsp. *lichenicola* was described. The taxon was stated to differ from subsp. *dendroides* in having narrower conidia not apiculate at the base but the absence of an apiculate base to the conidia suggests his fungus may not have been a *Cladobotryum* species. Unfortunately, no material of Karsten's taxon could be located amongst his collections in H (T. Niemela, *in litt.*), BPI (P. D. Millner, *in litt.*) or UPS (R. Moberg, *in litt.*) so the identity of his fungus remains obscure. It should also be remembered that Karsten was not a lichenologist and has been known to confuse species of *Parmelia* and *Physcia* when describing lichenicolous fungi (Hawksworth, 1975*a* : 234). If this occurred in this instance, it is perhaps possible that his species was very similar to *Monacrosporium carestianum* Ferr. (see p. 282) described as having 1–3 septate conidia 21–26 × 7–8 μm; Karsten's 3-septate conidia were reported as 24–36 × 7–8 μm.

Diplosporium caudatum Speg., *An. Mus. nac. B. Aires* **6** : 334 (1899).
Type: Argentina, Parque de La Plata, on *Lobaria quercizans* Michx. (syn. *Ricasolia casarettiana* (de Not.) Nyl.) on *Melia azedarach*, April 1890, *C. Spegazzini*.

This fungus was described as forming superficial widely spreading pale rose colonies of 2–3 μm wide hyphae on the thallus of the host. The conidia appear to have been especially distinctive and were described as fusoid, 1-septate and 14–16 × 3 μm but with cauda at both ends; one 5–6 × 1 μm at the base, and one 14–16 × 1 μm at the apex. The conidia were said to be colourless and smooth-walled and in the original description Spegazzini suggested that the fungus might represent the imperfect state of *Nectria subimperspicuae* Speg. Unfortunately no material of this taxon could be located in LPS (I. J. Gamundí, *in litt.*) but from the description it clearly has nothing to do with *Diplosporium* Link, a synonym of *Oedemium* Link (Hughes, 1958), which is a member of the Dematiaceae forming chains of conidia only slightly apiculate at the apices and which is the imperfect state of *Thaxteria fusca* (Fuckel) C. Booth. Several genera of moniliaceous Hyphomycetes with bicaudate one-septate spores are known (e.g. *Leptodiscella* Papendorf, *Menisporiopsis* S. Hughes) and there are others with simple central cells which are bicaudate (e.g. *Neottiosporella* Höhnel ex Graniti) although none of these has such unequal-lengthed appendages or is known to be the imperfect state of any nectriaceous fungus. The identity of *Diplosporium caudatum* must consequently remain uncertain until either the type material is refound or further collections probably conspecific with it are made in order that the arrangements of the conidiophores and method of conidiogenesis can be established.

Epicoccum neglectum Desm., *Annls Sci. nat., Bot.* II, **17** : 95 (1842).

This species was reported by Vouaux (1914 : 320) from dead thalli of *Peltigera canina* collected at Plainfaing, Vosges, by Harmand; this record has been copied by Keissler (1930 : 639) and Clauzade & Roux (1976 : 98). The genus *Epicoccum* Link ex Schlecht. was studied in detail by Schol-Schwarz (1959) and *E. neglectum* found to be synonymous with the ubiquitous saprophyte now correctly called *E. purpurascens* Ehrenb. ex Schlecht. The occurrence of this fungus on *Peltigera* is consequently regarded as fortuitous.

Epicoccum parmeliarum Oliv., *Bull. internat. géogr. Bot.* **17** : 232 (1907).
Type: France, Orne, 'sur le thalle des *Parmelia caperata* (L.) et *sulcata* (Tayl.)'.
Phoma parmeliarum (Oliv.) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 196 (1914).

Even though this fungus was pycnidial and produced hyaline simple spores, it was originally placed in *Epicoccum* Link ex Schlecht. which is a genus of dematiaceous Hyphomycetes (see, for example, Ellis, 1971 : 72). In the absence of type material it is impossible to be certain as to the identity of this taxon. The conidia were indicated to be 6–9 × 5–7 µm, too wide for *Phoma cytospora* (Vouaux) D. Hawksw. which is found on the same hosts (see Hawksworth & Punithalingam, 1973 : 60–63), and to be stalked; Vouaux's (*loc. cit.*) suggestion that it might be the pycnidial state of *Abrothallus parmeliarum* (Sommerf.) Arnold is unlikely to be correct.

Epicoccum usneae Anzi, *Atti Soc. ital. Sci. nat.* **11**(4) : 181 [p. 25 of offprint] (1868).
Type: Italy, Cerdécco, 'in silvis Bormiensibus opacioribus', in apothecia of *Usnea filipendula* Stirt. aggr., *M. Anzi* [*Lich. rar. Langob. exs.* no. 523] (K—isotypes!).
Coniothyrium usneae (Anzi) Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 295 (1914).
Lichenoconium usneae (Anzi) D. Hawksw., *Persoonia* **9** : 185 (1977).

This is not a hyphomycete and is correctly placed in the genus *Lichenoconium* Petr. & Syd. (Sphaeropsidales) which has been revised elsewhere (Hawksworth, 1977*b*). Schol-Schwarz (1959 : 171) placed this name as a synonym of the species now called *Epicoccum purpurascens* Ehrenb. ex Schlecht. but presumably did not study Anzi's material.

Fusarium barbatum Ellis & Everh., *J. mycol.* **4** : 45 (1888).
Type: U.S.A., New Jersey, Newfield, associated with insect debris on *Usnea* sp., 8 January 1888 [?*J. B. Ellis*] (NY—holotype!).

The type collection is now in an extremely fragmented form and only with great difficulty were the greyish to orange applanate conidial areas described by Ellis & Everhart discovered. These were close to the base of the *Usnea*, associated with insect debris, and also occurred on the debris alone as well as directly on the lichen cortex. The conidiophores are hyaline, 20–30 × 2–3 µm, tapered above and sometimes with a few surface crystals, bearing conidia acropetally and sympodially; the conidia themselves were hyaline, non-septate, cuneiform to pyriform and 4·5–6(–7) × (2·5–)3–3·5 µm (Fig. 43). The fungus clearly belongs to the genus *Raffaelea* v. Arx & Henneb. which currently comprises 10 species, eight of which are associated with bark beetles. An examination of the descriptions of these, most of which are only known in pure culture, showed that all diverged from that of *Fusarium barbatum*; this fortuitously lichenicolous fungus is consequently transferred into *Raffaelea* here as **Raffaelea barbatum** (Ellis & Everh.) D. Hawksw. **comb. nov.** This species is most similar to *R. albimanens* Scott & Du Toit, which differs in remaining quite hyaline and in the ability to form much longer conidiophores; it would be of interest to grow *R. albimanens* on natural substrates to see if these features were then modified.

The lichen involved was determined as '*Usnea barbata*' by Ellis & Everhart, a name which has been used in different senses. The *Usnea* is somewhat attenuated at the base and not blackened, but is so fragmentary that it is difficult to envisage its true habit. The material is much decayed with most of the outer cortex torn away revealing the medulla which has become pinkish-red, presumably due to the breakdown of norstictic or salazinic acid (cf. p. 279). I suspect that the species involved may well have been *U. strigosa* (Ach.) Eaton which is common in eastern North America.

Booth (1971 : 189) listed *Fusarium barbatum* only as 'dubia fide Wollenw.' but it was accepted under that name by Clauzade & Roux (1976 : 96).

Fusarium lichenicola C. Massal., *in* Maire & Saccardo, *Annls mycol.* **1** : 223 (1903); as '*lichenicolum*'.
(Fig. 44)
Type: Italy, Verona, Tregnago, on *Candelaria concolor* (Dicks.) Stein, November 1902, *C. Massalongo* (PAD—holotype!).
Bactridium lichenicola (C. Massal.) Wollenw., Fusarium *autogr. delin.*, no. 456 (1916).

Icones: Wollenweber, Fusarium *autogr. delin.*, no. 456 (1916).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 637 fig. 134 (1930).

This fungus forms a loose weft of mycelium over the thallus surface but most of the lichen present retains its yellow colour and the fungus appears to be a saprophyte rather than a parasite. The conidia are ellipsoid, hyaline, 0–3 septate, have a short truncate base, and measure

(17–)19–26(–32) × 5–7·5 μm; these are borne on unbranched, or more rarely 1–3 branched, conidiophores which are very variable in length but mainly 50–70 × 2·5–3 μm; the conidiogenous cells are phialidic. This species proved to be conspecific with the taxon generally called *Cylindrocarpon tonkinense* Bugnicourt (e g. Booth, 1966) but as Massalongo's epithet predates Bugnicourt's by 36 years, the new combination **Cylindrocarpon lichenicola** (C. Massal.) D. Hawksw. **comb. nov.** is made for this species here. *C. lichenicola* is essentially a saprophytic species and has been isolated from diverse habitats; there are isolates in IMI from Colombia, India, Indo-China, Nigeria, Pakistan, Peru and the British Isles.

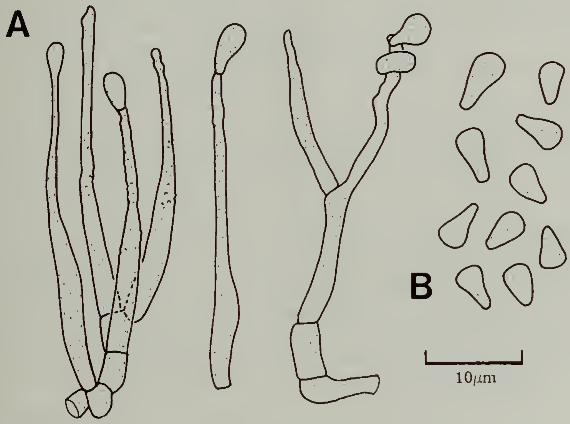

Fig. 43 *Raffaelea barbatum* (NY—holotype). **A**, Conidiophores and conidiogenous cells. **B**, Conidia.

Massalongo's original collection agrees in almost all details with the description of *Cylindrocarpon tonkinense* provided by Booth (1966 : 42–43) which was largely based on cultures. The only differences noted were that the chlamydospores tended to be slightly smaller (7–8 μm *vs* 7–11 μm diam) and the conidiophores somewhat longer, features scarcely meriting taxonomic separation in this group of fungi.

Topotype material, collected by Massalongo in '1905-1907', was distributed by Kabát & Bubák in their *Fungi imperf. exs.* no. 546; the example of this number in K(!), however, supported only sterile white mycelia, and no conidia identical with those of the holotype could be found on it.

Fusarium pallens Nees ex Link, *in* Willdenow, *Linn. Sp. Plant.*, Ed. 4, **6**(2) : 104 (1825).
Atractium pallens Nees, *Nova Acta Acad. Caesar. Leop. Carol.* **9** : 237 (1818); nom. inval. (Art. 13).

This taxon was reported by Vouaux (1914 : 320) from the thallus of *Lecanora dispersa* (Pers.) Sommerf. (syn. *L. hagenii* auct.) growing on *Alnus* at Malo-Terminus in France on the basis of a collection made by Bouly de Lesdain. Booth (1971 : 207) indicated that this name was a synonym of *Cylindrocarpon janthothele* var. *majus* Wollenw., the imperfect state of *Nectria mammoidea* Phil. & Plowr.; a detailed description and illustrations of this *Cylindrocarpon*, which is widespread on hardwood trees and other plant debris, are provided by Booth (1966 : 29–30). If Vouaux's determination was correct, the occurrence of this fungus on the *Lecanora* can only be regarded as fortuitous.

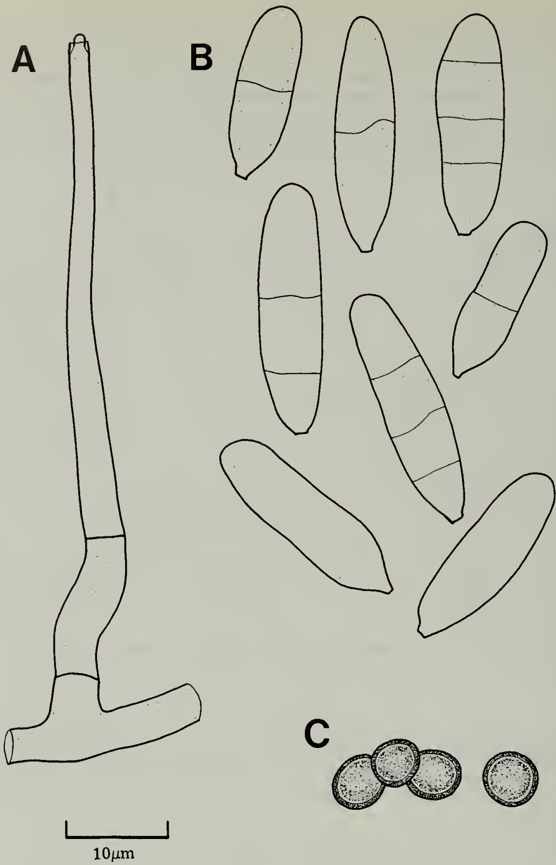

Fig. 44 *Cylindrocarpon lichenicola* (PAD—holotype). **A**, Conidiophore. **B**, Conidia. **C**, Chlamydospores.

Fusarium sampaioi Gonz. Frag., *Bolm Soc. broteriana* II, **2** : 50 (1924).

Type: Portugal, near Taboaço, on thalli of *Physcia semipinnata* (Gmelin) Moberg (syn. *P. leptalea* (Ach.)DC.), December 1922, *J. Macedo Pinto* (MA 5878—syntype!).

This taxon was described as having 0–3 septate conidia, 14–24 × 2–3·2 μm, which were curved and borne in fascicles. It was reported from two localities in the original description and from several hosts at each: on *Lasallia pustulata* (L.) Mérat, *Parmelia saxatilis* (L.) Ach. and *P. soredians* Nyl. near Gaia, Alto da Bandeira; and on *P. exasperata* (DC.) de Not., *Physcia semipinnata*, *P.*

tenella (Scop.) DC., *Phaeophyscia orbicularis* (Neck.) Moberg and *Physconia grisea* (Lam.) Poelt near Taboaço. Only the single syntype cited above was available from MA which supported numerous globose spordochia recalling those described by González Fragoso (*loc. cit.*) and associated with dead lobes of the host. These sporodochia, however, were of an *Illosporium* (see p. 236) and no conidia similar to those originally reported were present. I wrote to Barcelona (BC) in case they had further syntypes but received no reply. As the description of *Sporoschisma mirabile* var. *lichenicola* in the same publication (González Fragoso, 1924) was found to be reliable as regards dimensions and shapes (see below) it seems unlikely that Fragoso did not see conidia such as he described. The most probable explanation of Fragoso's description is that he saw superficially similar sporodochia on a wide range of hosts and presumed all would produce conidia like those he reported, and which he found on at least one of the hosts, further presuming that the *Illosporium* sporodochia were simply immature. I therefore consider that this name should be rejected as almost certainly based on discordant elements (Art. 70).

In his monograph of *Fusarium*, Booth (1971 : 213) only listed this taxon as 'not known in culture' and did not discuss it further.

Fusisporium kuehnii Fuckel, *Jb. nassau. Ver. Naturk.* **23/24** : 371 (1870); as '*kühnii*'.

Type: Germany, *sine loc.*, on thalli of *Physcia adscendens* (Th. Fr.) Oliv. and *Xanthoria parietina* (L.) Th. Fr., *K. W. G. L. Fuckel*, Fungi rhen. no. 1920 (K—3 isolectotypes!).

Fusarium kuehnii (Fuckel) Sacc., *Syll. Fung.* **4** : 714 (1886).

Fusisporium devastans Kühn, *Krankh. Culturgew.* : 32 (1858); nom. inval. (Art. 32).

Kühn (1858 : 32) described the damage this fungus caused to lichens but provided no description himself and for this reason a new name was introduced for the taxon by Fuckel. No material of Kühn's appears to be extant and, as in introducing the name *Fusisporium kuehnii* Fuckel also cited his own exsiccata, that is designated as the lectotype for this epithet here. The isolectotypes examined comprise either *Physcia adscendens* or *Xanthoria parietina*, or both these species, overgrown by white funiculose hyphae which are sterile. The superficial appearance of the material suggests that the species may be *Athelia arachnoidea* (Berk.) Jül., as was also proposed by Keissler (1930 : 524), but in the absence of sclerotia and basidia some doubt must remain.

Gliocladium pulchellum Penz. & Sacc., *Malpighia* **15** : 242 (1901).
(Fig. 45)

Type: Java, Tjibodas, 'in thallis *Lichenum* et surculis foliisque vivis *Muscorum*', 11 February 1897, *O. Penzig* (PAD—holotype!).

Icones: Penzig & Saccardo, *Icones fung. Javan.* : Pl. 57 fig. 4 (1904).

Conidiophores scattered on decaying lichen fragments, hyaline to whitish, arising singly; stalks of the conidiophores 1–1·5 mm tall and mainly 30–50 μm wide, straight to flexuose, hyaline, cylindrical below with walls 2–4 μm thick, non-septate, unbranched, smooth-walled, becoming slightly constricted to 20–25 μm wide subapically and then expanding into an hemispherical to subglobose columella-like head mainly 30–40 μm diam, this head bearing numerous prophialides which leave raised rounded scars on the surface of the head when broken off, head subhyaline to pale orange; prophialides densely packed over the columella-like area, hyaline, thin-walled, slightly rugose-walled, mainly 25–40 × 3–4 μm. *Conidiogenous cells* phialidic, arising at the apex of the prophialides, 2–4(?–5) on each prophialide, subcylindrical, hyaline, slightly rugose-walled, mainly 30–50 × 2–3 μm, densely packed together, very variable in length. *Conidia* arising singly at the apices of the conidiogenous cells, at first adhering in chains but later forming a subglobose slimy mass enveloping the whole head of the conidiophore, hyaline singly but the whole head assuming a glistening deep reddish coloration, ellipsoid, not septate, thin-walled, slightly rugose-walled, 3–5(–7) × 2·5–3·5 μm.

The type collection comprises fragments of dead lichen thalli and mosses and it was only with difficulty that the fungus described from it was found. The identity of the lichen could not be ascertained; it is a foliose species with a densely tomentose-rhizinate lower cortex suggestive of a member of the Stictaceae but no cyphellae or pseudocyphellae were noted on the fragments,

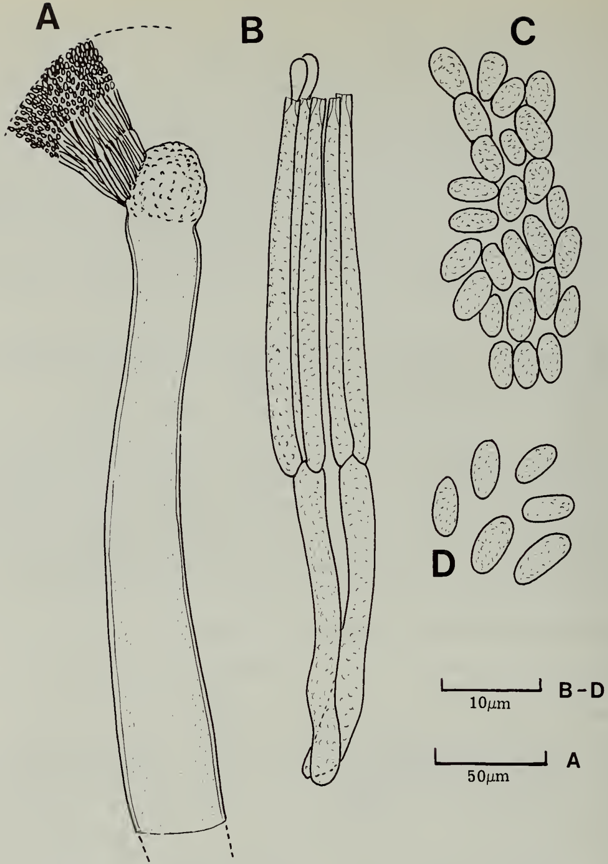

Fig. 45 *Gliocephalis pulchella* (PAD—holotype), **A**, Conidiophore apex. **B**, Arrangement of conidiogenous cells. **C–D**, Conidia.

which are discoloured brownish. As the fungus, superficially reminiscent of the Mucorales, occurred on only a single fragment, on its upper and lower surfaces, and was originally reported associated with adjacent mosses, I consider that it is a saprophyte which is not obligately lichenicolous and which arose secondarily on decaying thalli of the lichen; it is consequently treated here and not in the main part of this work.

It will be evident from the illustrations presented here that this fungus is not a species of *Gliocladium* Corda, as it has a columella-like head to the conidiophore stalk which recalls that of

Aspergillus Mich. ex Fr.; it does, however, differ from the last genus in that the phialides are not ampulliform and short, but the conidia are ellipsoid and non-globose, and form a massive slimy head which is not dry. The only suitable genus I have been able to locate for this fungus is the monotypic *Gliocephalis* Matr., once thought to belong in the Mucorales but now known to be a hyphomycete (Embree, 1963). From the illustrations of *G. hyalina* Matr. published by Matruchot (1899 : Pl. 14), Arnaud (1952 : 197) and Barron (1968 : 176) it seems clear that this species can be placed with it. The new combination **Gliocephalis pulchella** (Penz. & Sacc.) D. Hawksw. **comb. nov.** is consequently made here. *G. hyalina* differs from *G. pulchella* in being hyaline throughout and having completely smooth-walled prophialides, phialides and conidia; the dimensions of the various structures are remarkably alike in the two species except that the length on the conidiophore stalk is much longer in *G. pulchella* (to only 500 µm tall in *G. hyalina* according to Matruchot, *loc. cit.*). *G. hyalina* is most probably a saprophyte and is known from soil and decaying plant material.

Hymenella veronensis C. Massal., *Atti Mem. Accad. Agr., Soc. Lett. Art., Verona* IV, **3** : 149 (1902).
Type: Italy, Verona, on bark of *Platanus*, January 1902, *C. Massalongo* (VER—holotype!).

This name was accepted by Keissler (1930 : 641) as a facultatively lichenicolous fungus, apparently on the basis of a reference to its occurrence on the apothecia of *Lecanora dispersa* (Pers.) Sommerf. (syn. *L. umbrina* auct.) growing on linoleum in France and collected by Bouly de Lesdain. Massalongo's taxon proves to be a later synonym of the sporodochial hyphomycete *Bloxamia leucophthalma* (Lév.) Höhn. (syn. *B. truncata* Berk. & Br.) previously known from bark of *Malus* and *Ulmus*; this fungus was illustrated by Pirozynski & Morgan-Jones (1968 : 185–187) and is not lichenicolous. As Keissler cited the page number of Massalongo's work incorrectly and, to illustrate the genus, provided a figure of a *Chalara* species, it is doubtful if Keissler saw the original publication let alone Massalongo's collection. Keissler did not provide any details of Bouly de Lesdain's fungus, the published description probably being drawn from Saccardo's *Sylloge* treatment of Massalongo's name, and so the identity of his specimen remains uncertain.

Hymenobolus parasiticus Zukal, *Öst. bot. Z.* **43** : 73 (1893).
Hymenobolina parasitica (Zukal) Zukal, *Öst. bot. Z.* **43** : 133 (1893).
Licea parasitica (Zukal) G. Martin, *Mycologia* **34** : 702 (1942).

For typification and further synonyms see Martin & Alexopoulos (1969 : 46–47).

While following Lister (1925 : 184) and accepting Zukal's taxon as a myxomycete, Keissler (1930 : 631) also listed the name 'pro parte' as a synonym of *Illosporium roseum*. This arises because Zukal considered the hyphomycete present in his material to be the plasmodial phase of the myxomycete. Santesson (1948) argued that Zukal's name should consequently be rejected as based on discordant elements but his view was not accepted by Martin & Alexopoulos (1969 : 47) who considered that the myxomycete element should be selected as a 'satisfactory type' in the sense of Art. 70. Since Zukal's name has not been taken up in the Hyphomycetes, and as the species is well known as a myxomycete, I concur with their view.

Hyphelia rosea Pers. ex Fr., *Syst. mycol.* 3(1) : 211 (1829).
Trichoderma roseum Pers., *Römer's Neue Mag. Bot.* **1** : 92 (1794); nom. inval. (Art. 13).
Hyphoderma roseum (Pers. ex Fr.) Fr., *Summ. veg. Scand.* **2** : 447 (1849).
Trichothecium roseum (Pers. ex Fr.) Link, *Magazin Ges. naturf. Fr. Berl.* **3** : 18 (1809); nom. inval. (Art. 13).
Trichothecium roseum (Pers. ex Fr.) Link ex Fr., *Syst. mycol.* 3(2) : 426 (1832).

For typification and further synonyms see Hughes (1958).

The name '*Hyphelia rosea* Fr.' was listed by Keissler (1930 : 524) as sterile mycelium of the fungus now known as *Athelia arachnoidea* (Berk.) Jül. However, Fries based his name on Persoon's taxon and this has been typified by material in L (Hughes, 1958) and is the ubiquitous saprophyte well known as *Trichothecium roseum* today. This species is not uncommonly encountered on decaying lichens but it is by no means primarily a lichenicolous species. It was also treated by Keissler (*loc. cit.*) under the name *T. roseum*, but must be omitted from any account of the obligately lichenicolous fungi.

Fries (1825 : 149) introduced the generic name *Hyphelia* Fr. for Persoon's fungus instead of employing Link's generic name *Trichothecium* as he considered Link to have misapplied Persoon's name. As Link clearly based his name on Persoon's species it can nevertheless be typified by Persoon's material and not that of Link.

Hyphelia viridula Wallr., *Fl. crypt. Germ.* **2** : 244 (1833).
Type: Germany, circa Heringam Thuring, 'ad Lichenum gonidia asyntheta in *Salicum* cortice rarius'.

The original description of this taxon was 'sporodochis primum maculari pallide-viride depresso, ambitum hyphoideum pallidiorem emittente dein coacto umbonato, sporidia alba compacta obvallante'. No reply could be obtained from STR so it is not known whether the original material on which this name was based is present there today amongst Wallroth's herbarium; no fungi under this name exist in PRM (M. Svrček, *in litt.*) which has a few Wallroth collections according to Hughes (1958). Keissler (1930 : 622) noted 'Die Deutung dieser Art is ganz unmöglich'; it must so remain until Wallroth's material can be examined.

Hyphoderma effusum Fuckel, *Jb. nassau. Ver. Naturk.* **23/24** : 363 (1870); nom. inval. (Art. 32).
Type: Germany, Reichartshausen, on *Xanthoria parietina* (L.) Th. Fr., *K. W. G. L. Fuckel*, Fungi rhen. no. 241 (sub *Illosporium roseum*) (K—2 isotypes!).

The host of this fungus was originally given as '*Parmelia stellaris*' but only *Xanthoria parietina* was present on the isotypes studied and the thalli of this had been killed by an invading white mycelium. Although no sclerotia were found, the habit and symptoms recall those caused by *Athelia arachnoidea* (Berk.) Jül. on this host; Keissler's (1930 : 524) suggestion that it might be an immature state of that species is consequently accepted.

Hyphoderma sparsum Fuckel, *Jb. nassau. Ver. Naturk.* **23/24** : 363 (1870).
Type: Germany, Hessen-Nassau, 'ad Lichenes varios in corticibus, non frequens. Autumno', *K. W. G. L. Fuckel*, Fungi rhen. no. 239 (sub *Illosporium aurantiacum*) (K—2 isotypes!).

One of the isotypes studied mainly comprised *Physcia adscendens* (Th. Fr.) Oliv. attacked by a sparse sterile white mycelium, while the second had both this species and *P. aipolia* (Ehrh. ex Humb.) Hampe attacked by abundant *Illosporium corallinum*. Keissler (1930 : 524) placed Fuckel's name as a synonym of the species now called *Athelia arachnoidea* (Berk.) Jül. but also listed the exsiccatum under *Illosporium*. As Fuckel compared his taxon with *Hyphoderma effusum* (q.v.) however, it is evident that he intended the name to apply to the element other than the *Illosporium*. The name *H. sparsum* is consequently treated here as of uncertain application as it is not clear that the sterile mycelium belongs to *Athelia*.

Illosporium coccineum Fr., *Syst. mycol.* **3**(1) : 259 (1829).
Type: France, *Mougeot* '*666*' (UPS-Fries—lectotype!).
Illosporium roseum β. coccineum (Fr.) Ferr., *Fl. ital. Crypt.* **1** : 43 (1910).

Icones: Corda, *Icon. Fung.* **3** : Pl. 1 fig. 3 (1839).

Exsiccatae: Mougeot and Nestler, *Stirp. crypt. Voges.*, fasc. 10 no. 996 (1833).—Roumeguère, *Fungi sel. Gall.* no. 321 (1879).

The original habitat of this taxon was given by Fries (*loc. cit.*) as 'In Lichenibus leprosis crustaceis, v.c. in *Leparia argena* et *aglaea* [sic] Ach. in Gallia occidentali. Prevost.' There are three specimens under this name in Fries's herbarium: (1) 'Scania' [Skåne] collected by Fries but undated, (2) 'Moug. n. 666' with no further information and (3) a specimen collected by Flotow in Germany in 1848 occurring on *Parmelia saxatilis* (L.) Ach. and labelled with a query ('?'). The first two specimens agree in all respects but the third does not and belongs elsewhere (see p. 238); in view of its date this latter collection is not important for the purposes of typification of Fries's name. As Fries did not mention any occurrences in Scandinavia, it seems possible that the first was collected after 1829. The second collection mentioned is intriguing; Mougeot and Nestler's exsiccatum no. 666 is '*Sphaeria trichina* Pers.', has nothing to do with the present taxon, but was distributed in 1820; material agreeing with the Uppsala specimen was, however, sent out by them as no. 996 in 1833 or 1834 (Sayre, 1969 : 77) but labelled 'invenit primo in Gallia occidentali amicus *Le Prevost*, nos postea in Lotharingia'. It is tempting to speculate that Mougeot sent a Le Prevost specimen to Fries prior to 1820 when preparing the seventh fascicle of the exsiccata intending to distribute this as no. 666, but subsequently found he had insufficient material and held back sending it out until they had collected further specimens themselves. This second specimen is designated as lectotype for Fries's name here as it is presumably from France and may well have been seen before 1829; if the above speculations were correct, however, it would be the holotype for this name.

The 'host' in all cases proved to be *Phlyctis argena* (Spreng.) Flot. but the identity of the vivid pink granules described by Fries and later author's was at first puzzling as they appeared to be essentially structureless crystalline massess dissolving in potassium hydroxide. A survey of the literature on this host soon left me in no doubt that these were the same structures described as pink soralia which were considered to constitute f. *erythrosora* (Erichs.) Almb. (syn. *Phlyctis erythrosora* Erichs.), a taxon not accepted as meriting separate recognition by modern lichenologists (Laundon, 1970 : 307). In fact these structures seem to be almost devoid of algae and essentially represent excrescences of norstictic acid which is normally colourless but can assume a pink colouration on decomposition in basic situations, particularly by the seepage of alkaline moisture (see Lamb, 1964 : 11); it is noteworthy that the pink granules occur on parts of thalli which would have been in bark crevices and thus subject to such seepage. *Illosporium coccineum* Fr. is consequently to be regarded as a synonym of this morph of *Phlyctis argena.*

In addition to the exsiccatae cited above, two further exsiccatae were sent out under this name (Libert, *Pl. crypt. Ard.* no. 281; Fuckel, *Fungi rhen.* no. 240); these have been mentioned on p. 236.

Keissler (1930 : 633) noted that this taxon had been reported from a range of hosts; all apart from those not cited as 'on' *Phlyctis* species (a genus surprisingly not included in Keissler's list!) are misidentifications.

Illosporium flavellum Berk. & Br., *Trans. Linn. Soc. Lond.* II Bot., **2** : 68 (1883).
Type: Australia, Queensland, Brisbane, *F. M. Bailey 273* (K—holotype!).

Icones: Berkeley & Broome, *Trans. Linn. Soc. Lond.* II Bot., 2 : Pl. figs 12–14 (1883).

The lichen in the type collection was not determined by the authors of this taxon but proves to be *Heterodermia speciosa* (Wulf.) Trevis. (syn. *Anaptychia speciosa* var. *tremulans* (Müll. Arg.) Kurok.). The pale orange structures described and illustrated by Berkeley & Broome (*loc. cit.*) are not, however, confined to the soralia and lobe surfaces of the lichen but also occur directly on both leaves of mosses and other debris amongst the lichen lobes. A microscopic examination of the orange bodies showed them to comprise spherical cells mainly 7–10 µm diam which were sometimes linked in irregular chains or had the individual cells becoming more elongate and filament-like. The cells appear to contain a parietal cupuliform chloroplast and this name is consequently to be referred to the Chlorophyceae and not to the Fungi. The *Heterodermia* is not damaged by the presence of this superficial alga and no lobe discoloration had taken place.

Illosporium globulatum Nyl., *in* Nylander & Saelan, *Herb. mus. fenn.* : 112 (1859).
Type: Finland, Ob. Övertorneå (Ylitornio), Alkkula, 1850, [*A.*] *E. Nylander* (H—holotype!).

This name was treated as probably identical with *Illosporium roseum* (see p. 236) by Keissler (1930 : 631) who gave the 'host' as *Solorina saccata* (L.) Ach. The type collection has eroded orbicular patches on the thallus, erumpent from the algal layer, which comprise globose structures mainly 60–80 µm diam made up of cells mainly 7–8 µm diam, which were originally taken to be conidia. At first the structures are pale pink but later some become bluish-green due to the inclusion of algal cells. A comparsion of the material with *Peltigera spuria* (Ach.) DC. (as the sorediate morph *P. erumpens* (Tayl.) Vain.) leaves no doubt that Nylander's name was simply based on the soredia of this species and that it has nothing to do with *Solorina*. This confusion is perhaps not too surprising if it is remembered that the sorediate morph of *P. spuria* was first described in 1847 and Nylander was probably unfamiliar with it by 1850 when the diagnosis of this taxon may well have been written.

Illosporium puniceum Lib., *Pl. crypt. Arduenn.*, fasc. 3, no. 282 (1834).
Type: Belgium, Arduennes, 'in *Muscis*, Hieme', *M. A. Libert*, Pl. crypt. Arduenn., fasc. 3, no. 282 (K—3 isotypes!).
Myxosporium puniceum (Lib.) Corda, *Icon. fung.* **3** : 2 (1839).
Phylloedia punicea (Lib.) Sacc., *Syll. Fung.* **4** : 66 (1886).
Myrothecium puniceum (Lib.) Oud., *Enum. syst. Fung.* **1** : 184 (1919); ? nom. inval. (Art. 34).

One of the isotypes in K has *Cladonia portentosa* (Duf.) Zahlbr. which supports superficial deep red sessile or shortly stipitate translucent bodies 1–1·5 mm wide; similar structures occur on bryophytes in that isotype and on the bryophytes in the other two isotypes studied, which contain no lichens. Microscopic examination revealed that the bodies contained sporangia with rounded thick-walled microcysts characteristic of the Bacteria, order Myxobacteriales; the material could not be referred to any particular family or genus within this order on the basis of this state but it is of interest that the epithet appears to be the oldest ever proposed for a member of the Myxobacteriales (see Buchanan & Gibbons, 1974).

Tulloch (1972 : 40) regarded Oudeman's use of *Myrothecium* for this taxon as merely a misprint for *Myxosporium*; this interpretation is almost certainly correct.

Isaria virescens Elenk. & Danil., *Notul. syst. Inst. cryptog. Horti bot. petropol.* **1** : 5 (1922).
Type: U.S.S.R., 'e thallo *Peltigerae aphthosae* (L.) Hoffm. hic fungus ab A. B. Danilov sub vitro in cultura purissima receptus'.

This taxon probably represents the first lichenicolous hyphomycete to be grown in pure culture. No herbarium material or dried cultures could be located amongst either the fungal or lichen herbaria in LE (N. Golubkova, *in litt.*) but from the extensive description provided it seems most probable that this fungus was *Penicillium claviforme* Bain., a not uncommon saprophytic species common in forest soils and frequent on dung. For a detailed description of *P. claviforme* see Samson *et al.* (1976 : 13–14). This is consequently not a strictly lichenicolous fungus and is excluded from further consideration here, its isolation from *Peltigera aphthosa* being treated as accidental.

Lichen roseus Schreb., *Spicil. Fl. Lips.* : 140 (1771).
Type: Germany, Leipzig, 'cortici tiliarum annosarum adnascitur, in horto Apeliano frequens'.
Lepra rosea (Schreb.) Willd., *Fl. Berol. Prodr.* : 371 (1787).
Byssus roseus (Schreb.) Retz., *Fl. Scand. Prodr.*, Ed. 2 : 308 (1795).
Tubercularia rosea (Schreb.) Pers., *Obs. mycol.* **1** : 78 (1796).
Lepraria rosea (Schreb.) Ach., *Lich. Suec. Prodr.* : 9 (1798); nom. inval. (Art. 34).
Palmella rosea (Schreb.) Lyngb., *Tent. Hydroph. Dan.* : 207 (1819).
Coccochloris rosea (Schreb.) Spreng., *Linn. syst. Veg.*, Ed. 16, **4**(1) : 373 (1827).
Illosporium roseum (Schreb.) Fr., *Syst. mycol.* **3**(1) : 258 (1829).
Protococcus roseus (Schreb.) Corda, *in* Sturm, *Dtsch. Fl., Alg.* **6** : 37 (1833).
Microcystis rosea (Schreb.) Kütz., *Linnaea* **8** : 373 (1833).
Haematococcus roseus (Schreb.) Meneghini, *Consp. Alg. Eugan.* : 5 (1837).
Non *Illosporium roseum* Mart. ex Ficinus & Schub., *Fl. Dresd.* **2** : 259 (1823); nom. illegit. (Arts. 13, 64).

No authentic material of this taxon could be located in M (H. Hertel, *in litt.*). Drouet & Daily (1956 : 153), however, designated Schreber's original description as the 'temporary Type'. This was as follows (Schreber, *loc. cit.* : 140):

'1150. LICHEN (*roseus*) pulverulentus conglomeratus roseus.'

'Glebulae parvae, rotundae aut irregulares, pulcherrimae, figura et colore floris cobalti, (qualis quarzo inspersus in fodinis subinde occurrit) pulverulentae: moleculis ejusdem formae ac pulveris saepe e lichenibus efflorescentis.'

On the basis of this description it cannot be certainly stated that Schreber was dealing with a lichenicolous organism as the last phrase could mean simply arising from amongst lichen thalli. Persoon (1796 : 79) was in no doubt that the taxon could *sometimes* be lichenicolous and gave *Anaptychia ciliaris*, *Physcia stellaris*, *P. tenella* and *Xanthoria parietina* as hosts. Acharius (1798 : 9) at first considered it a true lichen but later (Acharius, 1803 : 3) followed Persoon and treated it as a fungus. Quite independently Schreber's name came to be used by algologists as will be evident from the synonymy above. If the species was lichenicolous as Persoon, and later Fries, thought, it is surprising that Schreber, who was a lichenologist of some note, did not clearly indicate that this was the case or name the host lichen. Schreber's original description does not agree with any lichenicolous fungus known to me; the cobalt crystal colour and shape reported is particularly difficult to explain. It does not seem possible to be certain what type of organism Schreber was dealing with.

While the identity of Schreber's taxon remains obscure, there can be little doubt that Persoon (1796 : 78–79) and many later authors have applied this name to the lichenicolous fungus now treated as *Illosporium corallinum*; this same usage was adopted by Fries (1829 : 258–259) but no material is present amongst his collections in UPS today. This usage of the name cannot, however, be reconciled with either Schreber's description or the use of the epithet by algologists. Further, Schumacher (in Oeder, 1799 : Pl. 1243 fig. 1) and Nees (1837 : Pl. 11(2) figs. 1–3) both provided coloured illustrations under the name *Lichen roseus* in which vivid pinkish masses arose on wood but not on foliose lichens close by in their illustrations; there are several possibilities as to the identities of the structures figured. The taxon might have been a member of the Dacrymycetales (e.g. *Dacrymyces stillatus* Nees ex Fr.), young *Ascocoryne sarcoides* (Jacq. ex Gray) Groves & Wilson, *Hormomyces aurantiacus* Bonord. (see Tubaki, 1976), the *Tubercularia* state of a *Nectria*, a member of the Myxobacteriales, plasmodia of some myxomycete (e.g. *Arcyria* spp., *Lycogala epidendrum* (L.) Fr.), etc.

In view of these uncertainties there is no alternative but to treat Schreber's name as of uncertain application. As it cannot be firmly established to which group of organisms this name belongs, its starting point date and hence its place of valid publication is also uncertain. Such difficulties in the application of multiple starting point dates have already been commented upon elsewhere (Hawksworth, 1978*a* : 232–234).

Lindauopsis caloplacae Zahlbr., *Ber. dt. bot. Ges.* **24** : 145 (1906).

Type: Crete, Pa Bhöhe Bebona bei Kavusi, in apothecia of *Caloplaca aurantia* (Pers.) Hellb. on limestone, 21 May 1904, *R. Sturany* (W 1906/755—lectotype!).

Icones: Keissler, *Rabenh. Krypt.-Fl.* **8** : 598 fig. 120, 599 fig. 121 (1930).—Zahlbruckner, *Ber. dt. bot. Ges.* **24** : Pl. 10 fig. 1–10 (1906).

Zahlbruckner introduced the new generic name *Lindauopsis* Zahlbr. for this taxon which he interpreted as a hyphomycete growing in the hymenium of *Caloplaca aurantia*. Riedl (1976*b*) investigated this case in some detail and concluded that the structures figured by Zahlbruckner merely represented degenerated hymenial tissues in which the paraphyses tips had become rather swollen and consequently were mistaken for conidia. My examination of the lectotype specimen confirms Riedl's interpretation of this name.

Macrosporium commune Rabenh. ex Sacc., *Fungi ital. delin.* : tab. 1207 (1882).

This species was mentioned by Vouaux (1913 : 78) as occurring on thalli of *Ochrolechia parella* (L.) Massal. infected by *Merismatium lecanorae* (Oliv.) Vouaux in France; it was accepted in Keissler (1930) as a lichenicolous species. The identity of *M. commune* has been thoroughly investigated by Wiltshire (1938) who found it to be a synonym of *Stemphylium botryosum* Wallr., the conidial state of *Pleospora herbarum* (Fr.) Rabenh., a widespread parasite and saprophyte of vascular plants forming leaf-spots and occuring on decaying herbaceous stems, etc. This is consequently excluded as not an obligately or primarily lichenicolous fungus but one fortuitously occurring on lichens.

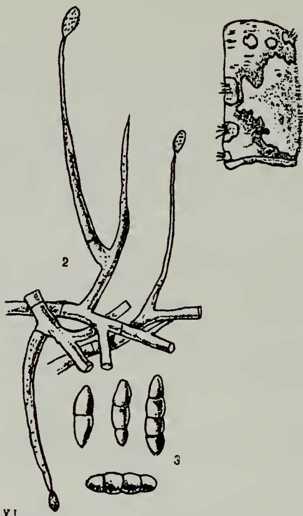

Fig. 46 *Monacrosporium carestianum.* Reproduced from Ferraris (1904).

Monacrosporium carestianum Ferraris, *Malpighia* **18** : 500 (1904).
(Fig. 46)
Type: Italy, Riva Valdobbia, on thallus of a *Physcia*, September 1901, *A. Carestia 2121.*

Icones: Ferraris, *Malpighia* **18** : Pl. 9 fig. 11 (1904).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 601 fig. 122 (1930).

No material of this taxon could be located in PAD (L. Curti, *in litt.*), RO (Q. Bartoli Rambelli, *in litt.*), VER (F. Bianchini, *in litt.*), or TOR (G. Forneris, *in litt.*). This fungus was described as producing long conidiophores to about 100 μm tall and 5 μm wide at the base, which were hyaline singly but pale rose in mass. The conidia were 1–3 septate, slightly constricted at the septa, broadly fusiform, rose in mass, and 21–26 × 7–8 μm. The striking resemblance between the description of this fungus and that of *Dactylium dendroides* subsp. *lichenicola* has already been mentioned under the latter above. *Monacrosporium* Oud. mainly comprises nematophagous fungi and it seems most unlikely that this species should be placed there. An assessment of the position of this fungus must await either the location of the type material or the re-discovery of a species agreeing closely with the original description so that the method of conidiogenesis can be established.

Oidiodendron rhodogenum Robak, *Nyt Mag. Naturvid.* **71** : 251 (1932).

Smith (1946 : 232) reported this species as new to the British Isles on the basis of a culture 'Ag 109' which was 'isolated by the late J. H. V. Charles from a lichen on a wooden post, in

December 1926'. No indication of the name of the lichen was provided but, as the culture came from the Ardeer collection of the Nobel Explosive Company, it almost certainly originated in Scotland. *Oidiodendron rhodogenum* was originally isolated from the sludge of wood pulp containers in Norway. To judge from material of this fungus now in IMI, it is predominantly a species of decaying wood but can occur in a variety of other habitats (air spora, cellophane, soil, straw and the stomach of an aborted bovine foetus). A subculture of 'Ag 109' is maintained at CMI as IMI 91983(!) and appears conspecific with the non-lichenicolous isolates. It seems most probable that this was only fortuitously obtained from a lichen as a result of conidia which had spread on to the thallus from the wooden post on which it was growing.

Sclerococcum lecanorae Vouaux, *Bull. trimest. Soc. mycol. Fr.* **30** : 325 (1914).
Diplodia lecanorae (Vouaux) Keissl., *Ark. Bot.* **18**(16) : 10 (1923).

This taxon was originally described from the apothecia and thalli of *Lecanora saligna* (Schrad.) Rabenh. collected by Bouly de Lesdain at Ghyvelde and Versailles, and also from apothecia of *L. piniperda* Körb. collected by Marc at Meyrueis in Lozère; as Bouly de Lesdain's herbarium was destroyed in 1940 and no material is present amongst Vouaux's remaining material (Rondon, 1970) some doubt must surround the application of this name. Vouaux (*loc. cit.*) compared the taxon to *Microdiplodia lecanorae* Vouaux but stated that it had no 'perithecia'; the brown 1-septate ellipsoid conidia described are strongly reminiscent of that species. Keissler (1923) referred some specimens on unnamed *Lecanora* and *Lecidea* species in UPS to this which definitely had pycnidia; later (Keissler, 1930 : 575) he indicated that this species differed from *Microdiplodia lecanorae* in the much darker brown conidia, which are also reported to be slightly longer than is usual for that species. The available evidence consequently suggests that Vouaux really had a coelomycete very similar to the common *M. lecanorae*.

Sclerotium granulatum Schumacher, *Enum. Pl. Sæll.* **2** : 186 (1803).
Type: Denmark, Zealand, *H. C. F. Schumacher*, MS 'Flora Hafniensis fungi delineati' (C—lectotype!).

No herbarium material of this taxon is now available but through the courtesy of Dr H. Knudsen I was able to examine colour transparencies of Schumacher's drawings of this in C. The organism looks superficially *Illosporium*-like and forms irregular pinkish masses on the thallus of a foliose lichen, most probably a *Parmelia* species. The pinkish granules are not, however, confined to the lichen thallus but figured as abundant on adjacent bryophytes; for this reason I am not convinced that this was a fungus and suggest that a member of the Myxobacteriales was involved. The original habitat was cited as '. . . in Lichenibus variis, stellato, saxatilique arborea praesertim . . .' so it would appear probable that some other specimens included under this name belonged in *Illosporium*. If the name was proved to be of a fungus it would not be validly published (Art. 13).

Sclerotium lichenicola Svendsen, *Bot. Notiser* **52** : 227 (1899).
Type: Sweden, 'ad Upsaliam, Holmiam, Dalarö et Örebro'.

This sclerotium-forming fungus was investigated in culture in considerable detail but failed to produce any perfect stage. As clamp-connections were produced (Svendsen, 1899 : Pl. 2 figs 2–3) there can be no doubt that this was a basidiomycete and, from the host lists and descriptions provided, this taxon was certainly the sclerotial state of *Athelia arachnoidea* (Berk.) Jül.

Selenosporium lichenicola Speg., *An. Mus. nac. B. Aires* **20** : 459 (1910).
Type: Argentina, La Plata, on *Candelaria fibrosa* (Fr.) Müll. Arg. (thallus), September 1906, *C. Spegazzini* (LPS 32.788—holotype!).
Fusarium lichenicola (Speg.) Sacc. & Trott., *Syll. Fung.* **22** : 1486 (1913); nom. illegit. (Art. 64), non *Fusarium lichenicola* C. Massal. ex anno 1903.

The type material supports some orange-red translucent sporodochia-like structures recalling *Illosporium corallinum* in their superficial appearance, but no conidia could be found. There is a pencil drawing on the packet in Spegazzini's hand which shows 3–5 septate slightly curved

Fusarium-like conidia borne on simple conidiophores; the conidia are given as 75–110 × 8–9 µm on the packet but in the published description the width appeared as 6–9 µm. There can be no doubt that this fungus was a *Fusarium* species but it cannot be placed in any of the species accepted by Booth (1971) without further information on the arrangement of the conidiogenous cells. The host lichen is little affected by the presence of this fungus and is in a reasonably healthy condition. It is thus possible that Spegazzini's fungus represents an obligately lichenicolous species but it would be premature to accept it (which would mean introducing a new name) in the absence of further material.

Following Wollenweber, Booth (1971 : 201) placed this name tentatively as a synonym of *Bactridium lichenicola* (C. Massal.) Wollenw. but it is clearly nothing to do with that taxon (see p. 272).

Spilomium species.

The identities of all taxa which have been referred to *Spilomium* Nyl. are discussed by Hawksworth (1975*a*) and are therefore not repeated here.

Sporoschisma mirabile var. **lichenicola** Gonz. Frag., *Bolm Soc. broteriana* II, **2** : 49 (1924).

Type: Portugal, 'cerca de Coimbra', on thalli of *Collema cristatum* var. *marginale* (Huds.) Degel. (syn. *C. multifidum* (Scop.) Rabenh.) on mossy ground, January 1922, *G. Sampaio* (MA 5918—holotype!).

The thallus of the *Collema* supports colonies of an epiphytic alga, different from the lichen phycobiont. The measurements of the alga leave no doubt that this is what González Fragoso (*loc. cit.*) described. My conclusions are thus in accordance with those of Hughes (1949 : 20) who further reported that Miss C. E. Dickinson had indicated that the alga belonged to the Scytonemataceae (Cyanophyceae).

Sporotrichum lettauianum Bachm., *Hedwigia* **66** : 336 (1926).

Type: Germany, Thüringen, Unterpörlitz, in thalli of *Cornicularia* cf. *aculeata* (Schreb.) Ach., *G. Lettau* (W 1940/503—holotype!).

Icones: Bachmann, *Hedwigia* **66** : 331 fig. 1, 332 fig. 2, 334 figs. 3–8 (1926).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 595 figs. 117–119 (1930).—Keissler, *Rabenh. Krypt.-Fl.* **9**, 5(4) : 186 fig. 29A (1959).

This taxon was described as probably the causal agent of the formation of abnormal witches' broom-like (Hexenbesen) tufts of branches in *Cornicularia*. These were studied in some detail by Bachmann (1926) but the material on which the investigation was based is now reduced to a few minute scarcely determinable fragments in which no structures recalling the conidia, 8·5–10 × 4–6 µm reported, could be found. Some brown torulose hyphae similar to those originally described were found within the thallus but it is possible that these belonged to a species of *Lichenoconium* (probably *L. usneae* (Anzi) D. Hawksw.) also found on this specimen by Bachmann. There is a second specimen which was tentatively referred to this species by Keissler (**Sweden:** Hälsingland, Enåger, Båckmolaasen, October 1935, *S. Ahlner*, W 1936/1629!) on *Cornicularia muricata* (Ach.) Ach.; in this, which was sufficiently large to permit examination in section, some torulose hyphae were again discovered and, with extensive searching, a few rare structures that *might* correspond to the structures considered as conidia by Bachmann; these are drawn in Fig. 47.

The identity of the type species of *Sporotrichum* Link ex Fr., *S. aureum* Link ex Gray, has been investigated by von Arx (1971) who found it to have clamp connections and thus to be the imperfect state of a basidiomycete; it is also hyaline and has conidia with broadly truncate bases. The structures illustrated by Bachmann cannot be referred to that genus. They perhaps show some superficial similarity to *Beniowskia sphaeroidea* (Kalchbr. & Cooke) Mason, a graminicolous species, but that is completely hyaline, has globose conidia, and distinct denticulate scars. A more definite opinion as to the identity of Bachmann's structures will have to await the discovery of further such deformed *Cornicularia* thalli; it is regrettable that the original slides used by Bachmann were not kept in W with the drawings.

Keissler (1959 : 185) interpreted *Cornicularia tenuissima* f. *pustulata* (Schaer.) Zahlbr. as material infected by *Sporotrichum lettauianum*; this view was reiterated by Grummann (1960 : 125–126) but there is no evidence either saw Schaerer's material.

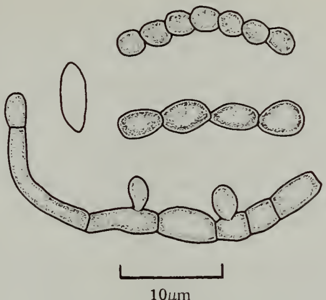

Fig. 47 ? *Sporotrichum lettauianum* (W 1936/1629).

Sporotrichum lichenicola Berk. & Br., *J. Linn. Soc., Bot.* **14** : 102 (1873).
Type: Sri Lanka, Peradeniya, 'our white mould', December 1867, [collector not indicated] (K—holotype!).

The type collection comprises a species of *Phaeographina* with pruinose margins to the lirellae on which there is a considerable amount of insect frass and eggs. Some superficial white mycelium is present and some ellipsoid hyaline conidia 3–5 × 1·5–2 µm were found but no conidiophores discerned. A sketch by Berkeley on the type sheet indicates that he found these to be branched in a manner reminiscent of *Verticillium* sect. *Prostrata* W. Gams, with the conidia borne singly and not in chains. I suspect this fungus to be very close to or conspecific with *V. lecanii* (Zimm.) Viégas, a primarily entomogenous fungus which is known to be very common in the Peradeniya Botanic Garden today (Gams, 1975). Its occurrence on the lichen thallus appears to be due merely to the insect debris present, and so this taxon is not accepted as a true lichenicolous species. The epithet *lichenicola* predates *lecanii* by 25 years but as some measure of doubt as to the identity of *Sporotrichum lichenicola* remains it should not be taken up for that well-known species.

Keissler (1930 : 524) listed *Sporotrichum lichenicola* as a synonym of the species now called *Athelia arachnoidea* (Berk.) Jül. but this cannot be supported. There is no evidence that Keissler ever saw the original collection of the *Sporotrichum* in K.

Stigmatella aurantiaca Berk. & Curt., *in* Berkeley, *Intr. Crypt. Bot.* : 313 (1857).
Type: U.S.A., South Carolina, *H. W. Ravenel 1328* (K—lectotype!).
Chondromyces aurantiacus (Berk. & Curt.) Thaxt., *Bot. Gaz.* **17** : 401 (1892).

For further synonyms and citations of illustrations see Keissler (1930 : 33) and McCurdy (1974).

The name *Stigmatella aurantiaca* was introduced in Berkeley (1857) as a new genus and species with only an illustration and citation in the figure legend of the name and a collection by Ravenel on '*Sphaeria hibisci*'; in my view this publication can be accepted as valid under Art. 44 although this was not, or was overlooked, by Anon. (1976 : 587) and McCurdy (1974). Only the pyrenomycete, which is effete, was found on this collection in K. In providing a description of the organism for the first time, Berkeley (1875 : 97), however, cited an additional collection, 'Ravenel No. 1328. On Lichens'; two specimens of this number are present in K (that ex-herb. Berkeley being designated as lectotype above) which, as Ravenel noted on the label of one packet, are on 'truncis putridis' and not lichenicolous but rather associated with various fragmented dematiaceous Hyphomycetes and effete Pyrenomycetes. Thaxter (1892) investigated this taxon thoroughly and established its position as a mycobacterium, the commonest of the group, occurring 'on decaying wood and fungi'; two strictly lichenicolous species were described by Thaxter in the same paper, *Chondromyces lichenicola* Thaxt. (correctly *Melittangium lichenicola* (Thaxt.) McCurdy) and *C. serpens* Thaxt. (correctly *Archangium gephyra* Jahn), but these are not discussed further here as they are not Hyphomycetes.

In treating *Stigmatella aurantiaca* as a hyphomycete Vouaux (1914 : 314) and Clauzade & Roux (1976 : 94) evidently overlooked the work of Thaxter (1892) and saw no material of this taxon.

This genus and species are currently accepted in the gliding bacteria (Myxobacteriales, Cystobacteriaceae McCurdy) and McCurdy (1974) provides a comprehensive description of the organism including its behaviour in pure culture. He also designated *Thaxter 4477* (FH *non vidi*) as a neotype for the name but this appears to be superfluous in view of the material suitable for lectotypification preserved in K.

Torula alpina Fourç., *in* Roumeguère, *Fungi sel. Exs.* no. 4188 (1887).

Type: Spain, Pyrenées, rochers du Col de Venasque, on *Alectoria ochroleuca* (Hoffm.) Massal., automne 1886, *C. Fourçade*, Roum. Fungi sel. Exs. no. 4188 (K—isotype!).

No fungus in a determinable condition was located on the isotype in K and Dr J. L. Crane (*in litt.*) also failed to find any fungus on further isotypes in ILL and NY. To judge from the original description only torulose dark brown hyphae were being described, and therefore this name is rejected as based merely on sterile mycelium. Rather few fungi seem able to occur on this host but it is perhaps of interest that one which does occur on it in the Pyrenees, *Tichothecium alectoriae* D. Hawksw. (Hawksworth, 1971), has dark brown hyphae.

Keissler (1910 : 22 fig. 1) illustrated some sterile brown torulose hyphae found on thalli of *Pertusaria lactea* (L.) Arnold from Thüringen which he tentatively referred to *Torula alpina.*

Torula cyanescens Kalchbr., *Mat. természettud. Közlem.* **3** : 296 (1865).

Type: Hungary, Szepes Hebrich adjoining Szepes Olaszi forest, on '*Usnea barbata* var. *dasypoga*,' *K. Kalchbrenner.*

Oospora cyanescens (Kalchbr.) Sacc. & Vogl., *in* Saccardo, *Syll. Fung.* **4** : 25 (1886).

Icones: Kalchbrenner, *Mat. természettud. Közlem.* **3** : Pl. 2 fig. 10 (1865).

Keissler (1930 : 557), in listing this name as a synonym of the species now known as *Lichenoconium usneae* (Anzi) D. Hawksw., attributed the epithet to Hazslinský and gave the date of publication as 1855. In the course of my studies on *Lichenoconium* I had been unable to obtain a copy of Kalchbrenner's original description of this taxon but through the courtesy of Dr J. L. Crane I have now been able to examine this work. There is no doubt that Kalchbrenner is the author of the epithet as while 'm.' appears on p. 296, 'Kalchbr.' is given in the legend to the plate on p. 319; the cover of the journal has the date 1845 in Roman numerals but the title page and its reverse side both have 1865 (in Roman on the cover and Arabic numerals on its reverse); the date 1855 does not appear on the publication.

The original description of this fungus was very brief:

> 'Ferme microscopica! Sporidiis 3–10 subhyalinis, sphaeroideis, in fila erecta, brevia, moniliformia plerumque simplicia compaginatis, hyphas non vidi.'

The published illustration shows three erect chains of subglobose cells, one of which has a single lateral branch towards its apex. Unfortunately no material of this taxon has been traced in either B (B. Hein, *in litt.*) or BP (J. Gönczöl, *in litt.*) and on the basis of the original description and illustrations it is not possible to assign this name with confidence to any known genus of Hyphomycetes; however, there is no doubt it is not *Lichenoconium usneae* and it must be excluded from that genus (Hawksworth, 1977*b* : 193).

There is also a report of *Oospora cyanescens* from Denmark (Lind, 1913 : 495) but as this was growing directly on wood it seems most unlikely that this was conspecific with Kalchbrenner's material.

Torula lichenicola Linds., *Trans. R. Soc. Edinb.* **25** : 515 (1869).

Type: Scotland, Perthshire, Loch Tay, on thallus and apothecia of *Lecanora chlarotera* Nyl. on *Fraxinus* by roadside, June 1856, *W. L. Lindsay* (E—lectotype!).

Sirothecium lichenicola (Linds.) Keissl., *Öst. bot. Z.* **60** : 61 (1910).

Vouauxiella lichenicola (Linds.) Petr. & Syd., *Reprium Spec. nov. Regni veg., Beih.* **42**(3) : 484 (1927).

This is the holotype species of the generic name *Vouauxiella* Petr. & Syd., an obligately lichenicolous genus of Coelomycetes in which three species are currently accepted (Hawksworth, 1976, 1978*b*). Lindsay (1869 : 515–518, 530–533, Pl. 23 figs 1–18) described this species in considerable detail and, unlike most of the subsequent workers on lichenicolous imperfect fungi, also provided fine coloured illustrations (macro- and microscopic). He cited 30 collections, most of which are now in E, but no lectotype appears to have been previously selected; the specimen chosen here is one of those figured in Lindsay's plate, has more pycnidia than many of the others studied and correspond's exactly to the concept of this species adopted by later workers (e.g. Vouaux, 1914; Keissler, 1930; Hawksworth, 1976). It should be noted that some of the specimens cited by Lindsay prove not to belong to *V. lichenicola* but to other lichenicolous Coelomycetes.

Torula lichenicola f. **cerinae** B. de Lesd., *Bull. Soc. bot. Fr.* **55** : 424 (1908).

Type: France, Cantal, bois de Nuits, on apothecia of *Caloplaca cerina* (Ehrh. ex Hedw.) Th. Fr., 1902, *l'Abbé Charbonnel*.

Sirothecium lichenicola f. *cerinae* (B. de Lesd.) Keissl., *Zentbl. Bakt. ParasitKde* II, **27** : 210 (1910).

Unfortunately the material on which this name was based was destroyed with Bouly de Lesdain's herbarium in 1940. Keissler (1930 : 567) placed this name as a synonym of the coelomycete *Vouauxiella lichenicola* (Linds.) Petr. & Syd. but to my knowledge that species does not occur in the apothecia of *Caloplaca* species. Bouly de Lesdain (*loc. cit.*) considered that his form was distinguished from f. *lichenicola* by '. . . des périthèces plus réguliers et des chapelets de spores beaucoup moins longs (2 à 3 spores seulement)'. The occurrence of only 2–3-celled chains of conidia would be most unexpected in *V. lichenicola*; it seems probable that what Bouly de Lesdain was describing were 1-septate conidia attached to the conidiogenous cells in *Microdiplodia lecanorae* Vouaux (syn. *M. ferrugineae* Vouaux), a fungus not uncommon in apothecia of *Caloplaca* species.

Torula lichenopsis Höhn., *Denkschr. Akad. Wiss. Wien* **83** : 36 (1907).

Type: Brazil, São Paolã, on indet. sterile crustose lichen on bark, July 1901, *G. Schiffner* (FH-Höhnel 1275—holotype!).

The original collection was examined by Dr J. L. Crane (*in litt.*) in 1973 and found to be conspecific with *Cladosporium sphaerospermum* Penz., an ubiquitous saprophytic species; I agree with this determination. The host of the *Cladosporium* is sterile and indeterminate, but it is of interest that the fungus is restricted to a single lichenized taxon in this collection and does not spread on to the thalli of a *Lecanora* intermixed with it.

Torula lichenum Keissl., *Zentbl. Bakt. ParasitKde* II, **37** : 388 (1913).

Type: Austria, Steiermark, 'in der Userzone des Leopoldsteiner See bei Eisenerz', alt. *c.* 600 m, in aged perithecia of *Staurothele rupifraga* (Massal.) Arnold, June 1910, *K. von Keissler* (W 1912/17—holotype!).

Icones: Keissler, *Zentbl. Bakt. ParasitKde* II, **37** : 389 fig. 1 (1913).—Keissler, *Rabenh. Krypt.-Fl.* **8** : 607 fig. 126 (1930).

Only sterile brown torulose hyphae were illustrated by Keissler (*loc. cit.*) and this was all that could be located in the type collection; this name is consequently to be rejected from the Hyphomycetes as representing only sterile mycelium. Keissler (1930 : 608) tentatively referred collections on *Lecanora subfusca* Ach. and *Pertusaria lactea* (L.) Arnold from Germany, and on *Lecanora dispersa* (Pers.) Sommerf. from Switzerland, to this species. Material on which these reports were based has not been seen but there are two further collections under this name in W (**Yugoslavia**: Dalmatia, West-Cursola, 'Honi' bei Velaluka (Vallé grande), alt. 200–250 m, on *L. dispersa*, 21 March 1910, *J. Baumgartner*, W 1918/29!; **Finland**: Karelia ladogensis, Kurkijoki, on *Pertusaria protuberans* (Sommerf.) Th. Fr. on *Alnus incana*, 1 June 1933, *C. F. E. Erichsen 287*, W 1935/340!); these, like the holotype, merely support sterile brown torulose hyphae. *Torula lichenum* was also mentioned by Magnusson (1946 : 144) on *L. polytropa* (Hoffm.) Rabenh. (apothecia), *P. protuberans* (apothecia) and *Xanthoria elegans* (Link) Th. Fr. (apothecia), all from Lycksele Lappmark, Sweden; the *Xanthoria* apothecia were said to be 'blackish brown from dense conidia' but no further details were supplied.

Torula opaca Cooke ex Sacc., *Syll. Fung.* **10** : 574 (1892).

Type: U.S.A., New Jersey, Newfield, 'on bark of various dead and living shrubs', November 1881, *J. B. Ellis*, N. Am. Fungi, cent. 8, no. 759 (K—isotype!).

Torula opaca Cooke, *in* Ellis, *N. Am. Fungi*, cent. 8, no. 759 (1882); nom. inval. (Art. 32).

This fungus occurs in scattered colonies on thalli of three lichens in the isotype in K (*Buellia erubescens* Arnold, *Lecanora pallida* (Schreb.) Rabenh. and *Pertusaria multipuncta* (Turn.) Nyl.) but does not appear to damage them at all. As reported by Hughes (1958 : 817), the fungus is conspecific with *Taeniolella breviuscula* (Berk. & Curt.) S. Hughes, a species illustrated by Ellis (1976 : 60 fig. 42A) and characteristic of live *Acer* bark in North America. This is not primarily a lichenicolous fungus, but is only fortuitously present on lichen thalli in Ellis' material and is consequently excluded from further consideration.

Torula ramalinae Nyl., *in* Roumeguère, *Fungi sel. Exs.* no. 4188 (1887); nom. inval. (Art. 34).

The name '*Torula ramalinae* Nyl. pr.p.' appears on the above exsiccatum label as a synonym of *T. alpina* Fourç. (q.v.). It has not been possible to locate any mention of this name in the publications of Nylander examined so far, and no specimens under this name could be located in Nylander's herbarium in H (T. Ahti, *in litt.*). This epithet is consequently of uncertain application.

Torula verrucosa Vouaux, *in* Bouly de Lesdain, *Bull. Soc. bot. Fr.* **54** : 697 (1907).

Type: France, Parc de Versailles, Trianon, in *Lecanora chlarotera* apothecia on *Juniperus*, 24 October 1907, *M. Bouly de Lesdain* (hb. Vouaux—holotype!).

Sirothecium verrucosum (Vouaux) Keissl., *Öst. bot. Z.* **60** : 61 (1910).

Vouauxiella verrucosa (Vouaux) Petr. & Syd., *Rep. Spec. nov. Regni veg., Beih.* **42** : 483 (1927).

This is a coelomycete correctly placed in *Vouauxiella* which, as it has been discussed and illustrated by Hawksworth (1976 : 58), is not treated further here.

Torulella asperellae Gyeln., *Lilloa* **4** : 64 (1939).

Type: Norway, Hedemarken, Röräs, Skaar Hammerdal, on *Placynthium aspratile*, July 1924, *E. P. Vrang* (S—? holotype!).

Icones: Gyelnik, *Lilloa* **4** : 65 fig. 1 (1939).

This species, the holotype of the generic name *Torulella* Gyeln. (Gyelnik, 1939 : 64), was described as occurring in the apothecia of *Placynthium aspratile* (Ach.) Henss. (syn. *P. asperellum* (Ach.) Trev.). The holotype was said to be in BP but no reply has been received to requests for the loan of this taxon. The collection located in S, however, is labelled '*Torulella asperellae* Gyelnik n. sp. *et* n. gen. 1938.iv. Gyelnik' in Gyelnik's own hand and is evidently that sent by Vrang to Gyelnik. Gyelnik is known to have returned original collections of some lichen names he described to the collectors without retaining a portion in BP (although the type was stated to be in BP; see, for example, Brodo & Hawksworth, 1977 : 68, 103, 136) and it is probable that this occurred in this instance; this view is supported by Gyelnik (1940 : 64) citing Vrang's collection of the host as 'Herb. Vrang' with no mention of BP. As it is not certain that no material is in BP, the specimen in S can at the moment only be regarded as probably the holotype; at the very least it is an isotype.

Gyelnik (1939) described the conidia as 1-septate, ellipsoid, 'fusca', about 8×4 µm, and considered them to be produced at the surface of the apothecia from conidiophores originating in the hypothecium. Rather few apothecia were present on the specimen examined and a proportion of these were studied; in no case could structures recalling Gyelnik's description be found and the apothecial tissues were normally developed. However, scattered amongst the *Placynthium* are some pale fawn convex bodies 1–1·5 mm wide. It could not be firmly established if these were gall-like structures belonging to the *Placynthium* or areolae or young fruits of some other lichen. These growths were found to support torulose brown mycelium, mainly 3–5 µm wide, at their surface from which some hyphae penetrated down into the lichenized tissues; some rounded cells, mainly in chains, were discovered and a few of these were 1-septate but only appeared to be chlamydospores. As the latter measured $7–9 \times 4–5$ µm there can be little doubt that these were the structures on which Gyelnik based his name; *Torulella asperellae* is consequently rejected as based on sterile torulose mycelium.

Torulella solorinella Gyeln., *Lilloa* **4** : 66 (1939).

Type: Austria, near Krems, alt. 200–350 m, on apothecia of *Solorinella astericus* on bare ground, *J. Baumgartner*, Krypt. Exs. Vindob. no. 43 (BM—2 arithmotypes!).

Icones: Gyelnik, *Lilloa* **4** : 66 fig. 2 (1939).

This taxon was described on the basis of a copy of the exsiccatum cited above in BP. Although this was requested from BP it was not received, but two copies of this number in BM were available for study; neither appeared to have the 3–4 µm wide brown mycelium Gyelnik (*loc. cit.*) described ramifying through the lichen, and no structures recalling the about $8 \times 4{\cdot}5$ µm 1-septate, ellipsoid, 'fusca' conidia he reported, were discovered. The application of this name consequently remains uncertain but in view of Gyelnik's description and the study of *Torulella asperellae* (above) it might be expected to be based merely on sterile torulose hyphae. A further possibility might be that what was really being observed was the apical parts of the paraphyses which form a dark brown epithecial layer (see illustrations in Poelt & Vězda, 1969).

Tubercularia lichenicola Sacc., *Fungi ital.* no. 962 (1881).

Type: Italy, sylva Montello, September 1876, *P. A. Saccardo* (PAD—holotype!).

Icones: Saccardo, *Fungi ital.* no. 962 (1881).

This species was described 'in thallo lichenum' but examination of the holotype revealed that the whitish 'thallus' on which Saccardo's fungus was growing was merely bird lime. The conidia are borne on creamy white stalked synnemata which are very sparse in the type collection; some larger synnematous heads occur and appear almost sessile, and Saccardo (1882 : 561) described these, apparently overlooking the more typical stalked type. The heads of the synnemata are pale yellowish in colour and the hyaline ellipsoid conidia, which adhere in a translucent gelatinous mass, measure $2{\cdot}5–4(–6) \times 2–3$ µm. This fungus is clearly a member of the genus *Stilbella* Lindau and appears to be indistinguishable from *S. erythrocephala* (Ditm. ex Fr.) Lindau, a common coprophilous fungus.

The place of publication of this name has generally been cited as Saccardo (1882 : 561) but in Saccardo's series of icones cited above this taxon was not only provided with an illustration, but also details of conidial measurements and citation of the holotype collection; this meets the requirements for valid publication (Art. 32) and so the name is considered to date from 1881.

Glossary

As many of the lichenologists wishing to use this work may be unfamiliar with some of the terms employed by mycologists in descriptions of Hyphomycetes, those most likely to be a cause of difficulty are briefly defined here. For fuller information on mycological terms see Ainsworth (1971), Ellis (1971) and Kendrick (1971).

acrogenous : conidia forming entirely immediately outside the apex of the conidiogenous cell (e.g. not enclosed in a collarette or bounded by the wall of the conidiogenous cell).
acropleurogenous: conidia forming at the ends and at the sides of the conidiogenous cells.
annellations: ring-like scars on conidiogenous cells which are annellides.
annellides: conidiogenous cells in which each conidium originates from the end of a proliferation extending above the scar left by the separation of the previous conidium.
basipetal: developing towards the base so that the apical cell or conidium is the oldest.
catenate: forming chains.
collarette: a cup-shaped extension of the apex of phialides.
conidiogenous cells: cells actually producing the conidia.
conidiophores: cells immediately supporting the conidiogenous cells; conidiophores may or may not resemble conidiogenous cells or mycelium.
determinate: of conidiophores and conidiogenous cells whose growth ceases with the production of conidia from the apex.
discrete: conidiogenous cells which have a distinctive shape so that they are easily distinguished from the conidiophores bearing them.
dry: of conidia not adhering in a slimy mass which are powdery.
hyphopodia: short specialized lateral branches arising from mycelium which lies on the host; sometimes with delicate, presumably absorptive or adhesive, processes arising from them when they are referred to as *mucronate*.
integrated: conidiogenous cells incorporated into the main axis or branches of the conidiophores.
macronematous: conidiophores which are morphologically very distinct from the vegetative mycelium.
micronematous: conidiophores which are not or scarcely morphologically distinct from vegetative mycelium.
monoblastic: a conidiogenous cell producing conidia by forming an apical blow-out which involves both the inner and outer walls of the conidiogenous cells.
mononematous: conidiophores arising singly or in loose tufts.
montretic: a conidiogenous cell producing conidia by forming a blow-out which involves only the inner wall of the conidiogenous cell, this wall often extending through a distinctive scar or pore in the outer wall of the conidiogenous cell.
penicillate: conidiogenous cells arranged in a brush-like manner comparable to that seen in the genus *Penicillium* Link ex Gray.
percurrent: conidiogenous cells which grow straight on through the open end left by the separation of the previous conidium.
phialide: conidiogenous cells in which neither the inner nor the outer wall of the conidiogenous cell gives rise to the conidium but in which the conidia are formed by extrusion through a pore or narrow canal (usually apically and with a collarette).
polyblastic: a conidiogenous cell producing conidia like a monoblastic cell but in which conidia are produced at several points on the conidiogenous cell and not only at the apex.
semi-macronematous: conidiophores which are morphologically very similar to the vegetative hyphae but differ in that they are ascending and not prostrate.
setae: bristle-like erect modified vegetative hyphae.
slimy: of conidia adhering in a globular mass due to production of some gelatinous substance; slimy conidial masses generally appear as drops of liquid at the apices of the conidiogenous cells in unsquashed preparations.
sporodochia: a dense tufted mass of short conidiophores supporting a common mass of conidia.
stroma: a dense mass of vegetative tissue, sometimes involving material of the host, and from which conidiophores may arise.
synnema (pl. *synnemata*): a compacted and often fused erect group of elongate conidiophores bearing conidia in a mass at the apex or, more rarely, also laterally.

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Host index

Names of lichen-forming fungi mentioned in the introductory sections are also included here.

Fungus index

In addition to synonyms cited in this paper, this index contains some synonyms of accepted species further information on which is provided in papers cited in the text. New taxa and the page numbers of the principal references to the accepted species are printed in **bold** type. An asterisk (*) indicates pages on which there is a figure.

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The species of *Chisocheton* (Meliaceae)

D. J. Mabberley

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The species of *Chisocheton* (Meliaceae)*

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Contents

Synopsis

The Indo-Malayan genus *Chisocheton* Blume (Meliaceae) is revised. There are 51 species, of which seven are newly described (*C. aenigmaticus*, *C. crustularii*, *C. granatum*, *C. lansiifolius*, *C. pellegrinianus*, *C. rex*, *C. vindictae*) and four (three undescribed) are still poorly known, arranged in four sections, one (*Rhetinosperma*) new. Two series (*Sandoricocarpi* and *Schumanniani*) and two new subspecies (*C. macrophyllus* subsp. *fulvescens* and *C. pentandrus* subsp. *medius*) are formally described. Four new combinations (*C. perakensis*, *C. tomentosus*, *C. cumingianus* subsp. *kinabaluensis*, and *C. pentandrus* subsp. *paucijugus*) and one *nomen novum* (*C. koordersii*) are proposed. The genus *Megaphyllaea* is reduced to a synonym of *Chisocheton* for there is a range of floral construction from two whorls, the allegedly distinguishing feature of *Megaphyllaea*, to one in ser. *Pauciflori* of *Chisocheton*. There are prefatory accounts of the history of the discovery and taxonomy of the species, and notes on growth form (transition from Corner's to Champagnat's Model), axis and wood, leaf (the nature of the shoot-like 'leaves', usually pseudogemmulate and sometimes bearing 'epiphyllous' inflorescences, is discussed at length), flower, fruit and seeds (arillate and sarcotestal present). Variation patterns, both ecogeographical and checkerboard, within species and their taxonomic treatment, particularly that of the latter in New Guinea, are discussed. The ten species names excluded from the genus are referred to *Aglaia* Lour., *Dysoxylum* Blume and *Walsura* Roxb.

Introduction

The moist forests of the Indo-Malayan region characteristically have small to medium-sized Meliaceous trees in their understorey, notably species in the genera *Aglaia*, *Aphanamixis*, *Dysoxylum*

*Materials for a Monograph of the Meliaceae IV. This series is being prepared at the Commonwealth Forestry Institute, Oxford.

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and *Chisocheton*. There exists no modern monograph of any of these genera, except the generic accounts in Harms's Meliaceae in Engler & Prantl's *Die Natürlichen Pflanzenfamilien* (1896, 1940), other than that of Casimir de Candolle of 1878, and the lack of information makes the naming of these species and an understanding of the interrelationship of insular floras of the region difficult. Synonymy abounds, particularly as some species are very widespread, as in *Aphanamixis* (Corner, 1946).

Aphanamixis is a small genus, whilst *Dysoxylum* and *Aglaia* are comparatively large and widespread in the Pacific area; *Chisocheton* comprises 51 species distributed from eastern India to southern China, throughout the islands of the China Sea to northern Australia, and eastwards to the New Hebrides. In New Guinea *Chisocheton* species are a common feature of the understorey of lowland rain forest, rarely growing (elsewhere) at high altitudes, although *C. ceramicus*, *C. pentandrus* and *C. cumingianus* subsp. *kinabaluensis* occur in the forests of the upper slopes of Mount Kinabalu in Borneo.

In general these small trees are of little commercial value, although in India *Chisocheton cumingianus* has been tested for the quality of its wood which is softer than *chir* (*Pinus roxburghii* Sarg.) (Pande *et al.*, 1957); in New Guinea this species is used as a fish poison; the oil expressed from its seeds has been used in soap-making and as a purgative in the Philippines (Burkill, 1935, 1 : 526–528). The oil of *C. pentandrus* has been used as hair oil and that of *C. macrophyllus* as an illuminant. Some forms of *C. lasiocarpus* from New Guinea* are highly ornamental and are successfully cultivated at Lae and Bogor Botanic Gardens; *C. polyandrus*, a striking pachycaul treelet from Borneo with long peduncles of creamy red flowers, would also be well worth establishing in cultivation (*cf.* Menninger, 1964 : 161, t. 228).

The distribution of the genus is that of the Indo-Malayan rain forest, and the discovery of its 51 species is therefore of some interest, being a reflexion of botanical endeavour in Malesia. Much of the detailed information below has been culled from van Steenis-Kruseman (1950, 1958, 1974).

Species of *Chisocheton* first appear in the literature in 1814, with William Carey's publication of William Roxburgh's *Hortus bengalensis*, in which *C. tomentosus* and *C. cumingianus* (subsp. *balansae*) appear as *Melia tomentosa* and *Guarea paniculata* respectively. *C. tomentosus* was collected in Penang, perhaps by Roxburgh's son in 1802 or by Christopher Smith in 1805–6; *C. cumingianus* was grown from material sent by Matthew Smith of the Silhet Botanic Garden although the earliest herbarium specimen is that collected by Francis Buchanan (later Hamilton) in Assam in 1808. Both species flowered at Calcutta and drawings of them were made there. Calcutta's collectors included George Porter, who accompanied Roxburgh's eventual successor, Nathaniel Wallich, to Singapore when the first Botanic Garden was set up there, and remained in Penang as a schoolmaster, collecting *C. penduliflorus* there in the same year. Another of Wallich's collectors, Gomez, found *C. grandiflorus* in Tavoy in 1827.

Meanwhile, Caspar Reinwardt, founder of Buitenzorg (now Bogor) Botanic Garden, had discovered three of the four native Javanese species before 1822: *Chisocheton pentandrus*, which he thought was Francisco Noroña's *Irina* (Sapindaceae) and labelled it thus, and *C. macrophyllus*, both sterile, as well as *C. patens*, which he called *Melia pendula* (it may have been discovered by Roxburgh's son in (?) 1803, for there is a specimen at CALC labelled 'Malacca R'). The assistant curator at Buitenzorg, Alexander Zipelius, found *C. lasiocarpus* in Irian Jaya on the voyage of the *Triton* and *Isis* in 1828.

Of the remaining 43 species recognized as distinct in this revision, the next to be discovered were chiefly the finds of Dutch botanists. The freshwater peat swamp forest tree, *Chisocheton amabilis*, was found by Pieter Korthals on the River Balito in southern Borneo in 1836, *C. diversifolius* by Johannes Teijsmann in Sumatra in the 1850s, and *C. ceramicus* by him with de Vriese in the Moluccas in 1860, whilst *C. lasiogynus* was probably discovered in Sumatra by Franz Iunghuhn. In the British possessions, Sir Dietrich Brandis found *C. dysoxylifolius* in Burma in 1859, Alexander Maingay first collected *C. erythrocarpus* in Malacca in 1865–6 and Odoardo Beccari discovered *C. sarawakanus* in Sarawak in 1865–8. With the exploration of Perak

*According to J. M. Powell & K. Paijmans, *New Guinea Vegetation* : 109 (1976), the 'nut' of '*Chisocheton* sp.' is eaten in the Jimi Valley of Papua New Guinea and, in New Britain (p. 162), the timber is used for housebuilding.

and the discovery of *C. pauciflorus* in 1882 and *C. perakensis* the following year by King's collector, Hermann Kunstler, all the known species from the peninsula and from Java had been found. A few years later, W. A. Sayer found *C. sayeri* on Cuthbertson's expedition to Papua in 1887 and O. Warburg collected *C. warburgii* (subsequently never refound) in Sulawesi on his world voyage of the following year.

The next decade saw George Haviland, medical officer to the Sarawak Government, sending out collectors, one of whom, Kunoeang, found the curious pachycaul treelet, *Chisocheton setosus*, in Limbang in 1890, whilst the year before, Haviland himself had discovered at Padawan *C. ruber*, a cauliflorous tree restricted to the Sarawak limestone. Hans Hallier, based at Buitenzorg, found the pachycaul *C. macranthus* on G. Kenepai in Borneo in 1893–4, and in Sulawesi, Sijfert Koorders, also of Buitenzorg, found *C. celebicus* and *C. koordersii* in 1895, whilst in Australia, the only species known from that continent, *C. longistipitatus*, was first collected by Ebenezer Cowley in the inhospitable Queensland forests before 1899.

More than half, then, of the known species had been discovered by 1900, but even now new species are being found in New Guinea and Borneo. In 1902, *Chisocheton sarasinorum* was found by the Swiss zoological cousins Sarasin in Sulawesi, and Raden Mas Pringgo Atmodjo found *C. vindictae* in northern Sumatra on van Daalen's expedition of 1904, whilst Forest Officer Hugh Curran found *C. curranii* on Luzon in 1906. The Dutch Lorentz expedition to Irian Jaya added *C. pilosus*, collected by Gerard Versteeg in 1907 and subsequently never refound. Five years later, the highlands of Papua New Guinea were visited by Carl Ledermann on the Kaiserin Augusta-Fluss (Sepik) Expedition, and a species with epiphyllous inflorescences, *C. pohlianus*, collected. *C. laosensis* of the Moluccas was probably collected before 1914, in which year the Philippine endemic, *C. cauliflorus*, was found by Maximos Ramos of the Bureau of Science, Manila, and he also added *C. mendozai* two years later, so that all the known Philippine species had been discovered. 1918 saw *C. polyandrus* discovered by Devillo Wood, Conservator of Forests at Sandakan, Sabah and *C. aenigmaticus* by Karel Heyne's collector, Achmad, on Simalur Island off Sumatra.

In 1922–3, Adolph Elmer, an American collector based in the Philippines collected the pachycaul *Chisocheton medusae* in fruit near Tawao, Sabah, whilst François Evrard found the last-discovered Asiatic species, *C. pellegrinianus*, in Vietnam. Three years later, Frederick Endert of Buitenzorg found *C. lansiifolius* in W. Kutai in Borneo, where Joseph and Mary Clemens discovered *C. granatum* in 1931 during their long stay on Mount Kinabalu; Mrs Clemens also found a second species with epiphyllous inflorescences, *C. tenuis*, at Sattelberg in Papua New Guinea in 1935. After this period there is a gap of about twenty years engendered by the war, in which many *Chisocheton* types were destroyed at Manila and Berlin, the only new species collected being *C. stellatus* found by Ryôzo Kanehira and Samihiko Hatusima in Irian Jaya in 1940.

In 1953, Michael Jackson and Gregory McDonald of the Forest Service found *Chisocheton schoddei* on the Brown River in Papua, and, following intensive collecting by botanists based at Lae under John Womersley, were discovered *C. sapindinus* by Andrée Millar in 1959, *C. novobritannicus* by Andrew Gillis in 1965, *C. glirioides* by Ted Henty, as well as *C. montanus* by Richard Hornabrook and there is still at least one species too inadequately known to be formally described. Nothing new has been found in Asia, Philippines, Malaysia or Indonesia since the Second World War, except for *C. crustularii* first collected by L. S. V. Murthy of the Forest Department in Sarawak in 1965 as well as two insufficiently known species from the east of Borneo.

Lastly in 1970, the known distribution of the genus was extended by the discovery of *Chisocheton rex* in the New Hebrides by the Cambridge botanist, Timothy Whitmore.

The species recognized in this account are as follows:

(i) sect. *Clemensia*
1. *C. macranthus*, 2. *C. medusae*, 3. *C. tomentosus*, 4. *C. polyandrus*, 5. *C. penduliflorus*, 6. *C. crustularii*, 7. *C. setosus*.

(ii) sect. *Chisocheton*
(a) ser. *Schumanniani*: 8. *C. schoddei*, 9. *C. tenuis*, 10. *C. cauliflorus*, 11. *C. novobritannicus*, 12. *C. montanus*, 13. *C. pohlianus*, 14. *C. lasiocarpus*, 15. *C. pilosus*, 16. *C. sayeri*,

17. *C. aenigmaticus*, 18. *C. celebicus*, 19. *C. glirioides*, 20. *C. sapindinus*.
(b) ser. *Paniculati:* 21. *C. laosensis*, 22. *C. ruber*, 23. *C. sarawakanus*, 24. *C. lasiogynus*, 25. *C. amabilis*, 26. *C. macrophyllus*, 27, *C. dysoxylifolius*, 28. *C. cumingianus*, 29. *C. patens*, 30. *C. lansiifolius*, 31. *C. granatum*.

(iii) sect. *Dasycoleum*
(a) ser. *Pauciflori:* 32. *C. perakensis*, 33. *C. sarasinorum*, 34. *C. pauciflorus*, 35. *C. diversifolius*, 36. *C. grandiflorus*, 37. *C. mendozai*.
(b) ser. *Sandoricocarpi:* 38. *C. vindictae*, 39. *C. ceramicus*, 40. *C. curranii*, 41. *C. pentandrus*, 42. *C. pellegrinianus*, 43. *C. erythrocarpus*.

iv) sect. *Rhetinosperma*
44. *C. koordersii*, 45. *C. rex*, 46. *C. stellatus*, 47. *C. longistipitatus*.

Non satis cognitae: three other (?) new species and *C. warburgii* (see Enumeration).

Taxonomic history

Chisocheton cumingianus was first referred to the allied genus *Guarea* of tropical Africa and America by Roxburgh in *Hortus bengalensis; Chisocheton tomentosus* was included in *Melia*, a 'dustbin' genus for many Meliaceae as *M. baccifera* Roth (to *Cipadessa*), *M. excelsa* Jack (to *Azadirachta*), *M. iloilo* Blanco (to *Aglaia*), *M. koetjape* Burm. f. (to *Sandoricum*), *M. parasitica* Osb. (to *Dysoxylum*), *M. integerrima* Buch.-Ham. (to *Heynea* – see Mabberley (1977)), *M. pumila* Moon (to *Munronia*), etc. were included, and, in Wallich's '*Catalogue*', *Chisocheton penduliflorus* was *Melia penduliflora*, whereas *Chisocheton grandiflorus* was placed with *Chukrasia* in *Plagiotaxis*.

Meanwhile, Blume had erected the genus *Chisocheton* in 1825, distinguishing it from *Melia*, *Aglaia* and *Dysoxylum*, Reinwardt's *Melia pendula* becoming *Chisocheton patens*. Blanco, writing in isolation in the Philippines, placed *C. pentandrus* in *Trichilia*, of which genus he had a broad view not seriously held since, though hinted at by Kostermans as recently as 1966. Miquel took up Blume's lead, describing *Chisocheton diversifolius* in 1859, but later had qualms about the crudely formed generic name, his classical sensitivity forcing him to follow Sprengel's amended '*Schizochiton*' when describing *C. amabilis* and *C. ceramicus* in 1868. At this time he described *C. lasiocarpus* as a *Dysoxylum*, as he had only fruiting material to guide him.

Working on Cuming's collection in Russia, Turczaninow described a new genus based on *Chisocheton pentandrus*, separating it as *Dasycoleum* on account of its apparently indehiscent fruit; 20 years later Casimir de Candolle described more species in this genus, which Harms delimited as a section of *Chisocheton* in 1896. By chance, however, Turczaninow had stumbled on the distinction between those species with a sarcotestal seed (*Dasycoleum*) and those with an arillate seed, a distinction of supreme ecological importance and of evolutionary and taxonomic significance in the genus.

Casimir de Candolle's enumeration (1878) is the most recent account extant and although *Chisocheton* is divided artificially on trivial characters: free or 'fused' staminal tube, disk annular or stipitate, panicles branched or not, the account deals with all the species known up to that time including those described by Hiern for Hooker's *Flora of British India* (1875). Nine years later, Hemsley described *C. perakensis* in making his new genus *Megaphyllaea*, said to differ from *Chisocheton* in its multilocular ovary and in the biseriate corolla; *Megaphyllaea* is here incorporated in *Chisocheton* for the first time (see below). In 1889, K. Schumann established *Melioschinzia* for a 'new' species, which Harms correctly included in *Chisocheton* for it is a form of *C. lasiocarpus*.

Other species were described spasmodically by Koorders and others when Harms's account of the genus appeared in *Die Natürlichen Planzenfamilien*, dividing the genus into two sections as described above, the type section being further divided into series, of which one has been further divided in this account, a second passed to sect. *Dasycoleum* with *Megaphyllaea*, and the third to yet another section. His second account in 1940 keeps *Megaphyllaea* apart, as well as *Clemensia*, a genus established by Merrill on its polymery but reduced to a section in *Chisocheton* by Airy Shaw (1937), and *Rhetinosperma*, a genus made and tentatively assigned to the Sapindaceae by Radlkofer and based on the fruiting material of *Chisocheton longistipitatus* first described as a

Castanospora (Sapindaceae) by F. M. Bailey. In the new account Harms merely gives a provisional arrangement into series. At the end, a species Harms had described, *Chisocheton pohlianus*, was placed *incertae sedis* as it seemed curious in its epiphyllous inflorescences. Harms also prepared an account of the genus for the *Flora von Papuasien*, but this was a compilation rather than a revision, there being no keys and many new species rather uncritically described. This account has been replaced by an important review of the genus in Papuasia by Stevens (1975). Stevens also described all the new finds in the area, leaving a further seven to be added from Vietnam, Sumatra, Borneo, and New Hebrides in this account.

Although a few species of *Dysoxylum* etc. have been described in *Chisocheton* (see species *excludendae*), few *Chisocheton* spp. have been described in other genera since the early 19th-century fumblings, although Philippine collections of *C. ceramicus* and other species were unaccountably and repeatedly described in *Amoora* by Merrill and Elmer. In short, the circumscription of the genus has been rather stable despite the great variation in all characters to be found within the genus. I agree with the circumscription summarized by Pennington & Styles (1975), except in their maintenance of *Megaphyllaea* as a separate genus.

The inclusion of Megaphyllaea, a misleading pachycaul

In describing his new Meliaceous genus, *Megaphyllaea*, from material collected by Wray in Perak in 1885, Hemsley wrote, 'The biseriate petals are very remarkable, and it was first suspected that this was an abnormal condition; but we are assured by Mr Wray that they were so in all the flowers he had observed on more than one occasion' (Hook., *Ic. Pl.* t. 1708 (1887)). To the only known species *M. perakensis* Hemsley was added *M. annulata* (King) Ridley in 1922 (*Fl. Malay Penin.* **1** : 386) a species originally placed, somewhat hesitatingly, in *Chisocheton* by King in 1895 (*J. As. Soc. Bengal* **64** (2) : 32)*. The curious biseriate corolla of these two species is not recorded elsewhere in the family by Pennington & Styles (1975).

During the preparation of this monograph, itself a prelude to more profound study of evolutionary trends within the *Melioideae*, I found it necessary to study the species of *Megaphyllaea*, for sterile material of *Chisocheton ceramicus* is easily confused with that of *Megaphyllaea* as was first pointed out by King ('*C. spectabile* Miq.'). I have examined isosyntype material of *Chisocheton annulatus* at SING and compared this with the holotype of *Megaphyllaea perakensis* at K and unnamed material at KEP collected by Mr Kochummen at Maxwell's Hill. It transpires that *Chisocheton annulatus* was described from immature flowering material of *Megaphyllaea perakensis*, which accounts for the anthers of *Chisocheton annulatus* being 'attached at the very base of the tube' as the intercalary expansion of the staminal tube has not occurred. Flowerbuds in all stages are to be found in Kochummen's material.

Megaphyllaea perakensis resembles *Chisocheton ceramicus* not only in its leaflets but also in the pseudogemmula (Briquet, 1935), i.e. a persistent meristem producing new leaflet primordia in successive seasons, at the leaf apex, the thickened calyx, locellate anthers and other details of the flower. According to Pennington & Styles (1975), *Megaphyllaea* can be separated from species of *Chisocheton* only on its biseriate corolla. As no other Malesian Meliaceae, nor indeed all the species of *Chisocheton* have locellate anthers or pseudogemmulate leaves, it is clear that *Megaphyllaea perakensis* is particularly closely related to *Chisocheton ceramicus* and its allies. The double corolla of *Megaphyllaea perakensis* comprises an outer whorl of three large petals, tomentellous outside, and an inner whorl of (3–)4–7 smaller glabrous petals. Of all the published descriptions of *Chisocheton*, that of *C. sarasinorum* Harms (Harms, 1937) includes a description of a corolla with three outer and two to three inner petals a little smaller than those of *Megaphyllaea perakensis*. *Chisocheton sarasinorum* was collected by the Swiss zoological cousins Sarasin on their successful north-south crossing of central Sulawesi in 1902. Their collection is the type and is destroyed and no other material from Sulawesi has been seen. However, Harms's excellent description allows no doubt that unnamed sheets collected by Kostermans (Berau, near Teluk Bajur, no. 21585 (SAR!) in neighbouring East Kalimantan and further material from the Sandakan area of

*'Megaphyllaea sp.' of Merrill in *Univ. Calif. Publ. Bot.* **15**: 123 (1929) is a fruiting specimen of *Chisocheton medusae*.

Sabah (*Castro* SAN A43 (K!,SING!); *Ah Wing* SAN 29528 (K!, SAN!)) is conspecific with that of the Sarasins. Harms particularly noted the tough thick staminal tube and the large flower size; further, the shallow calyx, the two rows of petals and the sparsely flowered inflorescences are characteristic of this tree. Recently, fruiting material has been collected by Dr Pennington near Sandakan (no. 7910 (FHO!, SAN!) and by W. Meijer (SAN 34298 (SAN!)). The fruits and seeds very closely resemble those of *Megaphyllaea perakensis*.

In many respects the facies of the inflorescence and flowers of *Chisocheton sarasinorum* resembles that of those of *C. pauciflorus*, an aptly named leptocaul tree of peninsular Malaysia. On examination the corolla of this species is found to comprise an outer whorl of three petals, tomentose outside, and (1–)2–3 marginally smaller inner petals, glabrous except where they protrude between the outer three in bud, where they are marked by a longitudinal band of tomentum. In short, the aestivation of this 'double corolla' is almost indistinguishable from the quincuncial and imbricate conditions of corollas in many other species of *Chisocheton*. Details of the pubescence and obscure lobing of the staminal tube and of the anthers are similar, as is the style, to those of *C. sarasinorum* and *Megaphyllaea perakensis*. The stylehead is subcylindrical to discoid in *Chisocheton pauciflorus* and *C. sarasinorum* and even more pronouncedly discoid in *Megaphyllaea perakensis*, a rather unusual feature in *Chisocheton* where the stylehead is most often cylindrical. In summary, the flowers of *Megaphyllaea perakensis*, *Chisocheton sarasinorum* and *C. pauciflorus* show the transition concomitant with an increase in leptocauly, from a double corolla to a single whorl as in say *C. cumingianus* where the aestivation may be quincuncial, alternative or imbricate.

There seems little reasonable alternative to the transfer of *Megaphyllaea perakensis* to *Chisocheton*; the other course would be to transfer *C. sarasinorum* and *C. pauciflorus* to *Megaphyllaea*. This would demand the wholesale splitting of *Chisocheton*, its sections, e.g. sect. *Clemensia* and sect. *Dasycoleum*, being resurrected to generic status as well as reintroducing the long-sunk genera *Rhetinosperma* Radlk. and *Melioschinzia* K. Schum. and perhaps creating even more new generic names. Besides the abominable nomenclatural upheaval this would initiate, the futility of such action is obvious when the variable nature of other genera in Meliaceae, e.g. *Aglaia* Lour. is considered (Pennington & Styles, 1975). *Megaphyllaea perakensis* is therefore transferred to *Chisocheton* below with a full description of this remarkable local and rarely collected pachycaul tree.

Morphological notes

Growth form

Chisocheton species are typically trees of the understorey of rain forest. Adult trees vary from small undergrowth treelets, some of which are sparsely branched pachycauls as *C. setosus* or weeping leptocauls as *C. sapindinus* to medium-sized leptocaul trees to 39 m and 75 cm d.b.h. in *C. longistipitatus* or 37 m and 150 cm d.b.h. in *C. cumingianus*, though many species, for example *C. patens*, flower when quite small. Larger species have fluted boles, sometimes heavily buttressed as in *C. macrophyllus* where the buttresses may be 3 m high and 2 m out, or have 'stilt roots'.

Such pachycaul species as *Chisocheton tomentosus*, *C. polyandrus*, *C. penduliflorus*, etc. produce flowers when the tree is unbranched (Hallé & Mabberley, 1977). Such 'architecture' corresponds to 'Corner's Model' in the scheme of tree branching drawn up by Hallé & Oldeman (1970). Branching following this flowering comprises 'reiteration' (Oldeman, 1974) and is found in these species. In less pachycaul species, however, flowering is postponed until after branching, whilst the general architecture of the tree is the same, as drawn in Fig. 1, e.g. *C. perakensis*, *C. macrophyllus* (Koorders & Valeton, 1913) and *C. schoddei*, i.e. Champagnat's Model. The more leptocaul species have retarded flowering, e.g. *C. pentandrus*. In the dense ombrogenous crowns of, for example, *C. ceramicus* and *C. lasiocarpus* the sympodial branching is much exaggerated.

Allied to these tall species are undergrowth ones. *Chisocheton setosus* and *C. crustularii* appear to be precocious pachycauls, their foliage resembling that of juvenile forms of their allies *C. tomentosus*, *C. polyandrus*, etc. *C. lasiogynus* seems to be a precocious ally with juvenile foliage of *C. patens* in a more leptocaul group. In the ser. *Schumanniani*, *C. sapindinus* and *C. tenuis* seem to be genuine 'miniatures' for the treelets are weeping leptocauls with small leaves on thin twiggy

Fig. 1 Architecture of *Chisocheton* species. Corner's Model: 1, *C. polyandrus;* 2, *C. tomentosus* with 'reiteration'. Champagnat's Model: 3, *C. macrophyllus;* 4, *C. lasiocarpus.*

branches. It is to be noted that the range of branching and retardation of flowering is to be found within different taxonomic groupings within the genus. For, although all the members of sect. *Clemensia* seem to correspond to Corner's Model, the sections *Dasycoleum*, and *Chisocheton* include a wide range of the degree of branching before flowering. The sect. *Rhetinosperma* comprises similar leptocaul species.

In south-east Asia the subfamily *Melioideae* appears to be rather restricted in its range of growth form. *Vavaea* exhibits *Terminalia*-branching (Pennington, 1969) and *Melia azedarach* L. is also monopodial (Corner, 1940 : 27). Otherwise all the genera of south east Asia appear to follow the same sympodial pattern as *Chisocheton*, which is briefly recorded for *Azadirachta* ('*Melia excelsa*') by Corner (*l.c.*), i.e. it is the model for *Aglaia*, *Aphanamixis*, *Dysoxylum*, *Sandoricum*, *Heynea trijuga* Roxb. ex Sims and *Turraea breviflora* Ridl. Only in *Aglaia* is there so wide a range of the degree of pachycauly and branching as there is in *Chisocheton.*

Corner's Model is to be found in *Guarea richardiana* A. Juss. as well as *Aglaia* (Hallé & Mabberley, 1977). In allied families the Model is found in *Chytranthus*, *Deinbollia*, *Jagera*, *Placodiscus* and *Radlkofera* (Sapindaceae), *Brucea* and *Eurycoma* (Simaroubaceae), but nothing like the unbranched hapaxanthic pachycauls, *Spathelia* (Krause, 1921 '*Sohnreyia*'), from the allied Rutaceae is known in Meliaceae. Champagnat's Model is known from *Guarea guidonia* (L.)

Sleum. ('*G. guara*') and *Turraea heterophylla* Sm. (Hallé & Oldeman, 1970) but is also absent from allied families.

In all the above-mentioned *Chisocheton* species, particuarly the pachycaul ones, the foliage is bunched at the branch-tips; the notable exception is *C. pohlianus* which is a sparsely-branched undergrowth tree. Here the old leaves are retained and resemble branches more than do any other leaves in the genus, for inflorescences are borne on the leaves as in *C. tenuis*. Except for the non-rosetted leaves, the tree otherwise resembles a young form of its allies in ser. *Schumanniani*.

Axis and wood

The leafy twigs vary in diameter from about 1.5 mm in *Chisocheton sapindinus* to about 40 mm in *C. macranthus*. This reflects the wide range of primary body size manifest in the pith diameter and the length of unfurling time of the leaf in the more pachycaul species. Most species have leafy twigs between these extremes and average about 5–6 mm. The bark of the twigs and branches is usually smooth or finely cracked and blackish in colour, the underbark pinkish brown to reddish. Cicatrices are usually conspicuous, particularly in the pachycaul species such as *C. macranthus*, where the scutellar cicatrices may be up to 3 cm long and 2·5 cm wide. Lenticels, conspicuous in *C. cumingianus*, are usually not so in other species.

Twigs, leaf bases and occasionally inflorescences of some trees in the *Chisocheton lasiocarpus* complex, some specimens of *C. ceramicus*, *C. cumingianus*, including subsp. *kinabaluensis*, *C. sarawakanus*, *C. koordersii* and *C. longistipitatus* are inhabited by ants although myrmecophily appears not to be a diagnostic feature of any species. It is noteworthy that the phenomenon is not recorded west of Borneo. Ant species from four genera have been noted by Stevens (1975) in three Papuasian species.

The axis is more or less covered with unicellular hairs in all species, except those of sect. *Rhetinosperma* where they are 4-stellate. Usually small multicellular glandular hairs occur mixed with these. The hairs of sect. *Clemensia* are setose and irritant, those of *Chisocheton setosus* and *C. crustularii* being the largest (2–3 mm long) and 'tinkling' when stroked as first noted by Airy Shaw (1937).

The anatomy of the stem is rather simple and is of a type common in Meliaceae; it does not depart from that recorded by Metcalfe & Chalk (1950 : 349). The pith always contains prosenchymatous sclerenchyma which comprises large groups of cells in *Chisocheton patens* (*Mabberley* 1560) and *C. sarawakanus* (*M.* 1716) and the secondary phloem contains tangential bands of more or less scattered fibres (there is variation in this within species), although apparently absent from *C. macranthus* (*M.* 1718) and *C. polyandrus* (*M.* 1688). The pericycle has a more or less well developed band of groups of fibres, sometimes more or less discrete, but again variable. The cortex has groups of prosenchymatous sclerenchyma with or without small groups of sclereids, which are particularly large in *C. medusae* (*M.* 1680). This species is also notable for the resin-filled parenchyma cells of the wood. Of the species examined, *C. cumingianus* (*M.* 1757), *C. sarawakanus*, *C. patens*, *C. sapindinus* (*M.* 1745), *C. macrophyllus* (*M.* 1546) and *C. macranthus* are devoid of the apparently suberized cells in the pith and cortex of all the other species – *C. ceramicus* (*M.* 1573), *C. lasiocarpus* (*M.* 1751), *C. longistipitatus* (*M.* 1793), *C. montanus* (*M.* 1766), *C. pentandrus* (*M.* 1669), *C. pohlianus* (*M.* 1772), *C. ruber* (*M.* 1635), *C. sayeri* (*M.* 1788), *C. schoddei* (*M.* 1773), *C. tenuis* (*M.* 1765) and *C. tomentosus* (*M.* 1557)); they are particularly noticeable in *C. ruber* where they comprise a conspicuous network.

The wood of the four Javanese species has been examined in detail by Moll & Janssonius (1908) in their account of Meliaceous woods. Metcalfe & Chalk (*l.c.*) and Pennington & Styles (1975) have examined more species and commented on the earlier work, the latter authors stressing the intraspecific variation to be found in this family. My own findings on the species above do not depart from those of these authors. A *précis* is included in the generic description below.

Leaf

The largest leaves in the genus exceed 240 cm in length when shed, as, for example, in *Chisocheton macrophyllus*, and leaves at least 2 m long are known in *C. medusae*, *C. macranthus*, *C. tomentosus*, *C. sarawakanus*, *C. pohlianus*, ? *C. lasiocarpus*, *C. perakensis*; there are another 12 species with leaves at least 1 m long. The leaves are up to 28-jugate in *C. macrophyllus* and *C. pohlianus*, but in general, *c.* 12–15-jugate is the range of most species. By contrast, the leaves of leptocaul species such as *C. sapindinus* have at most nine pairs of leaflets and in others, e.g. *C. pauciflorus*, as few as five or *C. curranii* with three (? poor material). The leaflets may all emerge at once as in the imparipinnate species and seedlings, or as in paripinnate forms of *C. patens* or develop in flushes of several pairs at a time (*cf.* Volkens, 1912 : 61), rarely a pair at a time concomitant with the emergence of a new leaf at the stem apex as illustrated for *C. pentandrus* subsp. *paucijugus* ('*C. spicatus*') by Corner (1964 : t. 42). The young leaflets are bright pink in all the species I saw flushing in the field *viz. C. erythrocarpus*, *C. pentandrus*, *C. ceramicus*, *C. patens*, *C. sarawakanus*, *C. macrophyllus*, *C. ruber*, and *C. tomentosus*, though in *C. macranthus* they are certainly plain green. According to Corner (*l.c.*), the leaves of *C. pentandrus* subsp. *paucijugus* develop eight pairs of leaflets over eight seasons before being shed, the older leaflets falling when four or five seasons old.

All *Chisocheton* seedlings seen have unifoliolate leaves in the young stages, e.g. *C. cumingianus* cultivated at Lae (P. F. Stevens, *in litt.*) and *C. medusae* (*Mabberley* 1682). The sequence of build-up of leaves of the seedling of *C. medusae* was as follows: unifoliolate, trifoliolate, imparipinnate with five, seven and nine leaflets, imparipinnate with pseudogemmula and *three* or four pairs of leaflets.

The anatomy of a young leaf rachis has a 5-arch stele but this is consolidated into a cylindrical one in leaves flushing for the first time. The rachis has seasonal increments of growth, seen in the increasing amounts of secondary xylem. In *Chisocheton* species it is not possible to discern the number of seasons' growth from this. Cork is formed, too, as in *Guarea rhopalocarpa* Radlk. (Skutch, 1946). Such accumulation of secondary xylem is not peculiar to this family and is found in other pinnate leaves as in those of *Kigelia* (Bignoniaceae) (Beck, 1970).

The 'ever-growing' leaves are even more unusual in the New Guinea species *Chisocheton pohlianus* and *C. tenuis*, which have epiphyllous inflorescences. The inflorescences are borne on the segment of rachis produced as part of the current flush of leaflets. The inflorescence of *C. pohlianus*, which I have examined in detail, may be unbranched and bearing one or two flowers or with one order of branching and bearing several. The anatomy of the rachis is undisturbed, resembling that of other species, which, as Melville (1962) has pointed out, is like that of a stem. Distal to the inflorescences, the rachis is unthickened and resembles more nearly a 'typical' leaf. In other words, contrary to the views of some workers, e.g. van Steenis (1969), we are not dealing with an adnate inflorescence as in *Gloriosa* (van der Pijl, 1951), where the axis is united to a stem. Indeed, if it were adnate we would have an 'evergrowing' inflorescence as is seen, for example, in *Hoya* (Asclepiadaceae), *Dietes* (Iridaceae), *Couroupita* (Lecythidaceae) and *Phalaenopsis* (Orchidaceae). Vascular strands merely pass from the central stele to an approximately inter-leaflet position. As the 'leaves' of *Chisocheton* defy the rigid 'rules' of morphology derived from temperate plants, so does the course of these vascular strands and the initiation of the meristems they grow to serve.

The leaves of other Meliaceae may be simple, e.g. *Turraea*, unifoliolate as in some *Aglaia* spp., trifoliolate as in *Sandoricum*, pinnate as in most species, or pseudogemmulate as in most species of *Chisocheton*. The pseudogemmula of *Chisocheton* is known in angiosperms only from the closely allied genus *Guarea*. Such apparently indeterminate growth has excited much morphological interest, and it has been suggested that such an arrangement supports the theory of the origin of pinnate leaves from branches (Lam, 1932). Corner (1954) has argued that the indeterminate growth is more archaic than the determinate.

Indeterminate growth of 'leaves' is also to be found in Filices in vascular plants, notably in *Lygodium* and the Gleicheniaceae. Pinnate fronds of some species of *Asplenium* without terminal pinnae, for example *A. sandersonii* Hook., have a subterminal gemma, the apex aborting (Faden, 1973), gemmae appearing elsewhere on the frond or stipe in other species. However, the species *A. mannii* Hook. does have truly indeterminate growing fronds with croziers, but such fronds are distinct from the soriferous ones, giving rise to lateral gemmae in place of pinnae (Faden, 1973). In *Lygodium*, the frond dichotomizes repeatedly. the products growing unevenly and one overtopping the other, dichotomizing, etc. (Holttum, 1957). In the Gleicheniaceae, the unbranched fronds of *Stromatopteris* are considered advanced when compared with the branched ones of other genera. The periodic dormancy of the 'leaves' of *Dicranopteris* is also to be found in the rhizomes of *Stromatopteris* (Holttum, 1957). Young plants of *Gleichenia glauca* (Thunb.) Hook. have determinate growth and the fronds resemble those of *Cyathea*. Holttum considers the periodic dormancy to be a specialization associated with thicket formation and climbing, the finest example being the 30 m fronds of some forms of *Dicranopteris linearis* (Burm. f.) Underw.

In Meliaceae, the determinate juvenile 'leaves' of *Chisocheton* which are the adult form in the apparently neotenic *C. lasiogynus*, *C. setosus*, etc. seem to be homologous with those of *Dysoxylum* spp., and have the characteristics of the 'universal category leaf'. Those of the adult forms have certain characters of the 'universal category shoot', and those with epiphyllous inflorescences more so, behaving like the branches of those Rubiaceae, e.g. *Lasianthus* spp., which are shed like pinnate leaves. If the only species of *Chisocheton* known were *C. pohlianus*, then perhaps the genus would be considered a 'simple-leaved' Meliacea with branches behaving like those of *Lasianthus*.

Thus, in the ontogeny of *Chisocheton* species, one passes from 'leaf' to quasi-branch, showing that the *Chisocheton* 'leaf' is one of those intermediate organs which defy placing in a pigeon-hole (Sattler, 1967). That this should not be unexpected is shown by the work of Sussex (1955) where, dependent on isolation from the apex, even *Solanum* primordia may develop into centric ('shoot') or dorsiventral ('leaf') organs.

Inflorescence

As with the leaves, the conventional tenets of morphology are again broken, for not only are epiphyllous inflorescences developed, but supra-axillary inflorescences are found in *Chisocheton cumingianus*, *C. schoddei*, etc. In *C. cumingianus*, there is variation in inflorescence position, from axillary to a branch of supra-axillary inflorescences to such a branch in the axils of fallen leaves, in a roughly north-west to south-east direction from China to New Guinea. The Bornean montane populations, subsp. *kinabaluensis*, have cauliflorous branches of inflorescences, a condition always found in *C. ruber*. Ramiflory, of branches or simple inflorescences, is found in some forms of *C. laosensis*, *C. amabilis* and *C. lasiocarpus*, and regularly in *C. lasiogynus* and *C. cauliflorus*.

Variation in inflorescence size within species has been stressed by Stevens (1975). Most species are dioecious, and female trees usually have more sparsely branched inflorescences. The branched inflorescences might be termed thyrses, with subpaniculate branches. Flagelliflory is characteristic of many species in sect. *Clemensia*.

Flower

Although appearing hermaphrodite at a first glance, all individuals, except trees of *Chisocheton cumingianus* and *C. koordersii*, seem to be unisexual, the males with small ovaries and aborted ovules, the females with pollen-less antherodes or, at least, abnormal pollen (Styles, 1972; Stevens, 1975). However, some specimens of *C. cumingianus* seem to be polygamo-dioecious, as was noted by Valeton (in Hochreutiner 1904, as *C. amboinensis*).

The aestivation of the petals may be valvate, alternative, imbricate or quincuncial. This may be manifest only at the tips of the fleshy petals of many species. In *Chisocheton perakensis* and its allies there is a range of conditions from a biseriate to uniseriate corolla – see above. The aestivation is variable in species like *C. cumingianus*, but constant and correlated with characters of the fruit in other parts of the genus, for example ser. *Sandoricocarpi* of sect. *Dasycoleum* and sect. *Rhetinosperma* have valvate aestivation and sarcotestal seeds. However, the other sections, as well as the *C. perakensis* group of sect. *Dasycoleum*, have alternative to imbricate or quincuncial aestivation.

Characters of the staminal tube are useful in ordering the species. Several species have tubes with lobed margins. At anthesis, these lobes are recurved. This feature is characteristic of all species of sect. *Clemensia*, except *Chisocheton medusae*, which has, at most, an undulate margin. Such an unlobed margin characterizes *C. perakensis* and its allies and ser. *Schumanniani* of sect. *Chisocheton*. The lobed tube is found in ser. *Paniculati* of sect. *Chisocheton* (there are rather crenate margins in *C. laosensis*, *C. sarawakanus* and *C. lasiogynus*), and in the remainder of sect. *Dasycoleum* and in sect. *Rhetinosperma*.

The tube is usually more or less pubescent, but there is considerable intraspecific variation in this. Hairs are found both within and without the tube in sect. *Dasycoleum* ser. *Sandoricocarpi*, and in sect. *Rhetinosperma*, but sparsely, if at all, and then only within, in the *Chisocheton perakensis* group. Elsewhere a glabrous tube is found in *C. medusae* of sect. *Clemensia* and in ser. *Schumanniani*, in some forms of the variable *C. lasiocarpus* complex, *C. novobritannicus* and *C. sapindinus*. Tubes of the rest of the species of ser. *Schumanniani* and of sect. *Chisocheton* and sect. *Clemensia* are pubescent on at least one surface.

The anthers of many species are locellate, unlike any other Meliacea, but resemble those in *Iguanura* (Palmae), *Macaranga* (Euphorbiaceae) as well as *Mkilua* and *Xylopia* (Annonaceae). In *Chisocheton* such locellae are not found in sect. *Rhetinosperma* nor in *C. macranthus*, *C. medusae* and *C. setosus* of sect. *Clemensia*, and are not clear in some forms of *C. sayeri* and other species in sect. *Chisocheton*, though are diagnostic for sect. *Dasycoleum*. Pollen grain diameter varies from 30–105 μm, though there is great intraspecific variation in this, that of *C. macranthus* varying from 70 to 105 μm.

A shallow cupular disk is found in many species in sect. *Clemensia*, in *Chisocheton amabilis* and *C. laosensis* and in some forms of the variable *C. patens* in sect. *Chisocheton; C. pellegrinianus* and *C. vindictae* in sect. *Dasycoleum* and is characteristic of sect. *Rhetinosperma*, but not in any species without a lobed, or at least crenate, margin on the staminal tube.

The stylehead is usually capitate, that of the *Chisocheton perakensis* group is discoid, as is that of *C. medusae*, a character diagnostic of the allied genus, *Guarea*, and found in most species of *Dysoxylum*. It is noteworthy that in these *Chisocheton* species, the staminal tube margin is unlobed. Griffith (1847 : 76) noted that in such cases in *Dysoxylum*, the stigmatic surface is confined to the lower half of the margin of the discoid head, pollen tubes penetrating from the side.

Observations on pollination are sadly lacking. The flagelliflory of sect. *Clemensia* suggests chiropterophily (or perhaps chiropterochory), while the sweet-scented branched inflorescences of sect. *Chisocheton* may indicate entomophily. However, Mr A. Lamb of Sabah (*in litt.* 20.i.76) informs me that the flowers of *C. polyandrus* (sect. *Clemensia*) are visited by the sunbirds known as spiderhunters. It seems not unreasonable to suppose that the fimbriations of the staminal tube, its hairs, position of the anthers, the presence of a disk and the shape of the stylehead, some states of which seem to be correlated as mentioned above, may constitute very exacting 'syndromes' adapted to particular groups of animals, as hinted at by White (1975) in discussing the Hymenoptera which visit *Trichilia havanensis* Jacq. in Mexico.

Fruit and seed

The fruits may be dehiscent or not, those of some species, notably in sect. *Clemensia*, bearing irritant, deciduous, golden-brown hairs on the pericarp. Other species have a glabrous pericarp at maturity, though the young fruit is always hairy. Sometimes the pericarp hairs are of conspicuously different lengths, as in *Chisocheton sayeri* (Stevens, 1975). White latex exudes from the cut fruits and seeds of some species, notably those in sect. *Dasycoleum*, *C. macrophyllus*, *C. sarawakanus* and *C. cumingianus*, though in the last two it is not always present. The fruits are 2–9-locular, and there is some infraspecific variation, sometimes visible on the same tree, in this, though species in sect. *Dasycoleum* ser. *Sandoricocarpi* and sect. *Rhetinosperma* almost always have 2-locular fruits. Occasionally some ovules may abort to give a monospermous fruit. The fruits of certain leptocaul species are prominently beaked at maturity, as, for example, *C. sapindinus* (sect. *Chisocheton*) and *C. pentandrus* subsp. *paucijugus* (sect. *Dasycoleum*), though *C. macranthus* and *C. penduliflorus* (sect. *Clemensia*) and *C. ruber* (sect. *Chisocheton*) pass through such a stage.

The seeds of Meliaceae are extremely diverse in construction (Netolitzky, 1926; Corner, 1976) with intrageneric variation. *Chisocheton*, distinct from the rest of the family in its orthotropous seeds, is no exception. The two most common types, figured in the immature state by Corner (1976, **2** : 324), are the arillate (*C. patens*, '*C. divergens*') and the exarillate (*C. ceramicus*, '*C.

sandoricocarpus'). The seeds vary in size from the small arillate seeds of *C. sapindinus* to the large orange-segment-shaped sarcotestal seeds of *C. medusae*. In sect. *Rhetinosperma*, they (two per fruit) are scutellar and sarcotestal. In the allied sect. *Dasycoleum*, there are similar seeds to these in those species with two seeds per fruit, but in those with larger numbers, e.g. *C. perakensis*, *C. sarasinorum*, they resemble seeds of *C. medusae*. An extended essay on the seeds of Meliaceae is to appear elsewhere, but for the purposes of this account, a few details of the structure are worth noting:

(i) Arillate seeds – All seeds of sect. *Chisocheton* so far known are arillate: *C. lasiocarpus*, *C. macrophyllus*, *C. cumingianus*, *C. patens*, *C. pohlianus*, *C. sapindinus*, *C. sarawakanus*, *C. schoddei*. Those of ser. *Schumanniani* have an (orange-)red aril which edges the brown to black testa. Sometimes, as in *C. schoddei* (*Mabberley* 1773) and *C. cumingianus*, there is a narrow extension to the micropyle. The other species in ser. *Paniculati* have a variable amount of arillate tissue, sometimes almost enveloping the testa, as in *C. cumingianus* (*Pennington* 8052), leaving a small bare area around the micropyle; there is often less aril tissue in this species. The aril is rich in oil and is attached to a swollen funicle–hilum region. As the funicle and hilum are not distinct from one another in these orthotropous seeds, nothing can be gained by speculating on the precise origin of the aril (Corner, 1976, **1** : 187; *cf.* Endress, 1973). Except that these seeds are orthotropous, they resemble those of *Dysoxylum cauliflorum* Hiern (Corner, 1976, **2** : 325) in that the seed is enclosed, except at the chalaza in a tough lignified exotegmen. Lying within this are vascular bundles sometimes associated with laticifers (in *C. cumingianus* and *C. macrophyllus*, but not constantly so), and occasionally with large knots of sclereids (e.g. *C. macrophyllus*). *C. granatum* fits this group on floral characters and has a similar structure in its testa and tegmen, but has no aril.

(ii) Exarillate seeds – These differ entirely in their construction, a young specimen of *Chisocheton ceramicus* being figured by Corner (1976) and a maturer seed of this type is figured by Pennington & Styles (1975 : t. 16) for *Guarea excelsa* Kunth. The lignified exotegmen of the arillate seeds is not to be found, and the construction of the seed-coat is entirely pachychalazal, like the bulk of that in *Aphanamixis grandifolia* Blume figured by Corner (1976, **2** : 322).

In sect. *Clemensia*, besides the sarcotestal seeds of *Chisocheton medusae*, which are heavily vascularized, there are arillate seeds. A species which is often confused with *C. medusae* in flower, *C. macranthus*, is arillate, but has a tough but unlignified tegumen unlike other arillate seeds in *Chisocheton*. Similarly, *C. tomentosus*, with sarcotestal seeds, is readily confused in flower with *C. polyandrus* which has arillate seeds of the standard type.

There are indications that the sarcotestal seeds are associated with tardy dehiscence of the fruit, the seeds being exposed on impact of the fruit falling on the ground, or even later, as seems to be the case in *Chisocheton medusae* and *C. tomentosus*. By contrast, the arillate seeds are exposed by the splitting of the pericarp on the tree, e.g. *C. macranthus*, *C. polyandrus*. It is to be noted that in these species pairs, the latter have extremely long peduncles (sometimes a few metres long), whilst the former are very much shorter. The long peduncle is also to be found in *C. penduliflorus*, which has arillate seeds. Again, those arillate species in sect. *Clemensia* have 'reversed' fruits, such that when their fruits split on the tree, they present their seeds at right angles to the peduncle, i.e. not hanging down for ready deciduousness, but ready for animals mobile at around that height. The fruits contain no alkaloids as far as is known (see Stevens, 1975), though their bright colours may be mimicking 'warning colours', warding off overindulgent 'wrong' dispersal agents. Collectors have noted that the sarcotestal seeds of *C. tomentosus* and *C. medusae* are eaten by 'squirrels', but whether this was on or off the tree has not been recorded.

Chromosomes

There are few counts, and my efforts to obtain more were frustrated by the death of seeds and seedlings in the fuel crisis of 1974–75. *Chisocheton cumingianus* subsp. *balansae* has n = 23 (Mehra *et al.*, 1972, '*C. paniculatus*') and *C. lasiocarpus* ('C. sp. LAE 46746') has 2n = 46, while the type subspecies of *C. cumingianus* has 2n = 94 (Khosla & Styles, 1975). Polyploid series within genera of Meliaceae are now well known, and intraspecific cytodeme series of the *C. cumingianus* type are also known in *Aphanamixis* (Styles & Vosa, 1971; Styles & Khosla, 1976).

Relationships and infrageneric classification

The genus falls into four sections on characters of the fruit and indumentum when considered in concert with those of the flower, *viz.* sect. *Chisocheton* with arillate seeds, simple hairs and alternative to imbricate aestivation of the petals; sect. *Dasycoleum* with sarcotestal seeds, simple hairs and alternative to valvate aestivation of the petals; and sect. *Rhetinosperma* with sarcotestal seeds, stellate hairs and valvate aestivation, probably a derivative of sect. *Dasycoleum*. The fourth, sect. *Clemensia*, with the large multipetalled, apparently most primitive flowers has a range of fruit-form from arillate to sarcotestal (see above). This variation which separates sections in other parts of the genus is associated with floral homogeneity, suggesting that sect. *Clemensia* may represent the relics of the proto-*Chisocheton* stock which gave rise to the two major lines in the genus.

Sect. *Chisocheton* is divisible into two series, species with an entire staminal tube margin and a peripheral aril comprising ser. *Schumanniani*, those with a fimbriate tube and variable aril comprising ser. *Paniculati*. The species *Chisocheton laosensis*, *C. ruber*, *C. sarawakanus* and *C. lasiogynus* link the two groups but are placed in ser. *Paniculati* for convenience. Sect. *Dasycoleum* is also divisible into two series; species with valvate aestivation and two-seeded fruits comprising ser. *Sandoricocarpi*, the remainder with opposite or alternative or imbricate aestivation and two-to-several-seeded fruits making up ser. *Pauciflori*. Again the two series are linked, by *C. grandiflorus* and *C. mendozai*, which are here placed in ser. *Pauciflori*.

Natural key to infrageneric groupings

Pachycaul treelets or trees, indumentum of long simple trichomes, inflorescences usually unbranched, fruit armed with irritant hairs	sect. *Clemensia*
Not this combination of characters	
Seeds arillate	sect. *Chisocheton*
Staminal tube entire	ser. *Schumanniani*
Staminal tube lobed	ser. *Paniculati*
Seeds sarcotestal	
Trichomes simple	sect. *Dasycoleum*
Aestivation opposite to imbricate	ser. *Pauciflori*
Aestivation valvate	ser. *Sandoricocarpi*
Trichomes 4-stellate	sect. *Rhetinosperma*

It is to be noted that the presence of a disk, a character which is said to separate *Dysoxylum* from *Chisocheton*, is found in *C. patens*, *C. setosus*, sect. *Rhetinosperma*, etc. Further, the paripinnate leaves of *C. patens* approach the condition of many *Dysoxylum* species, as do the imparipinnate ones of *C. setosus*, *C. crustularii* and *C. lasiogynus*. That some *Chisocheton* species have discoid styleheads and/or alocellate anthers emphasizes that the genera can only be separated when a complex of characters associated with floral and vegetative features is considered. At present, however, the orthotropous ovules and seeds of *Chisocheton* seem absolutely diagnostic. Nevertheless, '*Dysoxylum*-ness' is approached in various parts of the genus, particularly strongly in sect. *Rhetinosperma* which has leaves resembling *Dysoxylum* in the weakly developed pseudogemmula, where most of the leaflets are formed at once, disks, and stellate hairs known in some *Dysoxylum* species. *Dysoxylum* is held together as a genus on its disk, but is so variable in fruit, that it may possibly be polyphyletic, its sections deriving, with sect. *Rhetinosperma*, from a variable proto-*Chisocheton* ancestry.

Types of species and their variation patterns

Distribution maps of the 47 named species have been prepared, plotting records by degree-squares, and the ratio of endemic to recorded species for each island, island group or continent is shown in Fig. 2. No fewer than 34 species are restricted to one such unit and of these, 14 are very restricted indeed, some being known only from the type gathering. Borneo and New Guinea have the greatest concentrations of both endemic species and species recorded, with the Malay Peninsula, Sumatra and the Philippines with smaller but considerable concentrations. Borneo, with the Malay Peninsula, is the centre of diversity of sect. *Clemensia* and ser. *Paniculati*, New Guinea being that of sect. *Rhetinosperma* and ser. *Schumanniani*. Of the ten species recorded from,

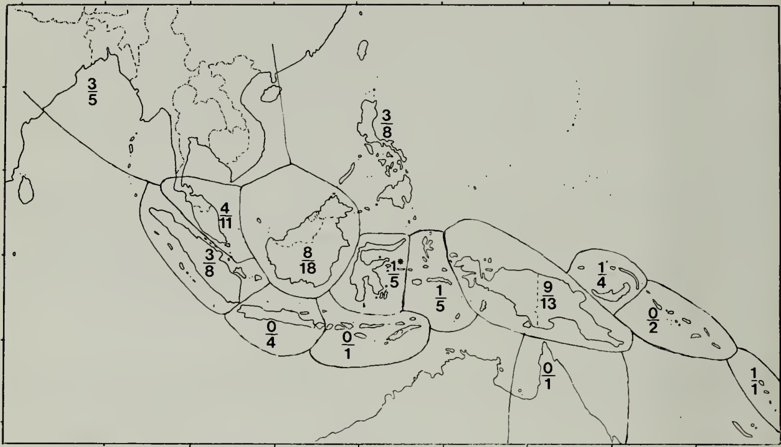

Fig. 2 $\frac{\text{Endemic species}}{\text{Species recorded}}$ of *Chisocheton*.
$^{*}\frac{2}{6}$ if *C. warburgii* included.

but not restricted to, Borneo, one of three species is common to Borneo and each of the Malay Peninsula, the Philippines and Sulawesi, the remaining species having wider distributions, two with the Malay Peninsula and Sumatra and one with the Malay Peninsula and Java, while the last four are very widespread in Malesia, two of them extending beyond Sulawesi to New Guinea. Of the other two non-endemic species recorded from New Guinea, one occurs in the Moluccas, the other extends to Australia.

Of the very restricted species, only *Chisocheton ruber* has any claim to an obvious ecological 'preference', being endemic to the Sarawak limestones near Kuching. Of the more widespread species, *C. amabilis* is restricted to freshwater peatswamp forests of Borneo, Sumatra and the Malay Peninsula, while *C. erythrocarpus* is almost restricted to the coastal forests of the Malay Peninsula and northern Borneo. Of the widespread species with no obvious edaphic and climatic restrictions within Malesia, *C. ceramicus* is more or less uniform from the Malay Peninsula to New Britain, whereas *C. macrophyllus*, *C. cumingianus* and *C. pentandrus* are best divided into geographical subspecies, which in the last is associated with distribution in two forest-types. The remaining three species of the genus, *C. sarawakanus*, *C. patens* and *C. lasiocarpus*, exhibit variation which is not readily correlated with geographical or ecological variables, and exhibit a perplexing checkerboard variation, which is most apparent in *C. lasiocarpus* of ser. *Schumanniani*. The situation in *C. patens*, and to a lesser extent in *C. sarawakanus*, is rather similar (see enumeration for details). Ser. *Schumanniani* is centred on New Guinea and its surrounding islands, but *C. cauliflorus* is restricted to the Philippines, *C. celebicus* to Sulawesi and *C. aenigmaticus* to

Sumatra. The fruit of these three species is unknown, however, and they may therefore be referable to another grouping. Most of the species in the series are clearcut and homogeneous. However, at the heart of this group is a cluster of closely related species, the variation patterns of which have been analysed by Stevens (1975). In Stevens's treatment there are 18 Papuasian species referable here. Of these, *C. schoddei*, *C. tenuis*, *C. montanus*, *C. pohlianus*, *C. novobritannicus*, *C. glirioides* and *C. sapindinus* are clearcut and distinct, and *C. sayeri* is readily separable from the rest. The remaining ten taxa comprise one of the most complex problems in the taxonomy of the genus.

Of these ten species, I have been able to study the material cited from LAE by Stevens, as well as the holdings at BP, E, FHO, G, K, L, LE, SING, U and extra material kindly sent from A by Dr Stevens; in addition I have had the opportunity to study populations of three of the species at several localities in Papua New Guinea.

At any one locality, there may be two or more apparently distinct taxa of trees: Stevens (1975 : 6) has afforded these entities specific rank stating 'on the mainland there are groups of specimens which can be recognized and characterized'. For example, in the Gogol Valley near Madang, Papua New Guinea, trees corresponding typologically to *Chisocheton schumannii* (*Mabberley* 1747, 1754) may be found growing within a few metres of trees corresponding to *C. trichocladus* as defined in Stevens's treatment (*Mabberley* 1751, 1753). Now, if the distribution of '*C. trichocladus*' is considered, it is found that it is very wide and apparently disjunct, occurring on the islands off Irian Jaya and the adjacent mainland, and scattered north-eastwards to Madang; moving eastward it is next to be found in New Britain and Bougainville and Choiseul in the Solomon Islands. In these eastern localities '*C. trichocladus*' seems to intergrade with the local forms of *C. schumannii* or *C. weinlandii* (Stevens, 1975 : 42, 49). The typological species is thus difficult to marry with a biologically meaningful one. The distinctions between the east Papuasian taxa also break down in Irian Jaya and the Moluccas. On the Vogelkop, specimens intermediate between *C. lasiocarpus* and *C. pachyrhachis* (Stevens, 1975 : 16) are found and other specimens cited by van Steenis (1961) as well as Seram material approach *C. weinlandii* or *C. schumannii*. In West Sepik, a specimen intermediate between *C. formicarum* and *C. schumannii* is known (Stevens, 1975 : 12). *C. caroli* is known from three collections in the Sepik area, but if the distinctions between *C. trichocladus*, *C. schumannii*, *C. weinlandii* and *C. pachyrhachis* are not maintained, it too falls into this complex, as do (*e descr.*) *C. lamekotensis* and perhaps *C. oreophilus*, as well as *C. versteegii*, *C. biroi*, *C. ledermannii* and *C. schlechteri* which are linked to *C. trichocladus* by material from Western District, Papua.

Stevens (1975 : 5) suggests that 'although a number of taxa recognized [in his review] are clearcut, the status of others must be considered as uncertain and these might well, in a monograph of the genus, be considered synonyms of a widespread variable species', and compares that move with the treatment of *Vavaea amicorum* Benth. (Meliaceae) by Pennington (1969), where 21 species were reduced to one variable one.

In *Vavaea amicorum*, variation patterns were found to be repeated in the Philippines, New Guinea, the Solomons and Fiji. Pennington continues, 'A botanist who was acquainted with *Vavaea* only in part of its range, e.g. in New Guinea, in the Solomon Islands, or Fiji Islands, would be justified in assuming that distinct subspecies or even species could be recognized'. He cites apparently distinct taxa in the Solomons but continues, 'But elsewhere, especially in the Philippines, these distinctions break down, since the characters vary independently there giving rise to many intermediates'. He chooses not to recognize subspecies or varieties within the group which he treats as one species, because (1) none of the variants is sufficiently well correlated with geography and there is no true geographical replacement; such phenetic 'splitting' would result in an infraspecific hierarchy like that made by Brenan & Brummitt (1965) for *Dichrostachys cinerea* (L.) Wight & Arnott, criticized by White (1971); (2) different variants frequently occupy not only the same locality but also the same habitats; (3) most variants are based on slight, often single, vegetative differences. He also notes that some of the most striking variants appear to have evolved polytopically. A similar situation is known in *Stachys aculeata* Hook. f. (Labiatae) (Björnstad *et al.*, 1971).

In the *Chisocheton lasiocarpus* complex, Pennington's conditions are satisfied. Following

Stevens's suggestion, I therefore amalgamate the nine species mentioned above, and using Pennington's criteria, I choose not to recognize formal infraspecific taxa. This leaves *C. novoguineensis*, which is known from comparatively few specimens and lies close to the '*C. weinlandii*' area of *C. lasiocarpus*, 'narrow-flowered specimens of the former [*C. weinlandii*] being especially difficult to distinguish from the latter [*C. novoguineensis*]' (Stevens, 1975 : 51). *C. novoguineensis* is a plant of hill or lower montane rain forest of the south of Morobe District and the Central District of Papua New Guinea. Further collecting in these areas may show that it is ecologically isolated from the rest of the complex, in which case subspecific rank might be appropriate for this tree. For the present, I leave it as part of the variable *C. lasiocarpus* complex.

To amalgamate the ten 'species' may seem an abrupt move, and without qualification as in some recent revisions, e.g. *Lobelia nicotianifolia* Roth ex Roemer & Schultes (Moeliono, 1960; *cf.* Mabberley, 1974), would lose, in my opinion, much valuable information in this interesting evolutionary situation. Other workers have used the concept of 'entities' for locally more or less well defined and recognizable forms, e.g. *Lepisanthes tetraphylla* (Vahl) Radlk. (Sapindaceae) – 47 entities (Leenhouts, 1969). An alternative approach is to afford such variants varietal status as successfully executed by Corner (1969) for the variable *Ficus deltoidea* Jack (Moraceae), and not using the subspecies, for 'geographical limits are not exactly known and to stretch the meaning of subspecies to include ecological separation *would also imply more knowledge than there is*' [my italics]. An intermediate solution has been sought by Jacobs (1962) for the widespread Malesian *Pometia pinnata* J. R. & G. Forster (Sapindaceae) which he presented as a number of forms, paramorphs, etc. The informal method has the advantage of no nomenclatural validity (Burtt, 1970): I have found it useful to employ it in the description of the local variants of *Senecio johnstonii* Oliv. (Compositae) in the Rwenzori range of east Africa (Mabberley, 1973).

Evolutionarily speaking, we may have in the *Chisocheton lasiocarpus* complex a series of semi-species, but as variation cannot yet be correlated with environmental parameters, geographical or ecological, as has been done for *Syzygium* (Myrtaceae) and *Parinari* spp. (Chrysobalanaceae) in Africa (White, 1978), this situation cannot be accommodated in the static, almost anti-evolutionary, straitjacket of a formal hierarchy. In many respects, we seem to have an 'ochlospecies' (White, 1962) first described in African *Diospyros* spp., and, although one might hesitate to use this term as it may be so easily misused to cloak ignorant 'lumping', I do so with some conviction, having the critical analysis of Stevens (1975) as evidence for this view.

I propose, therefore, to give the oldest name, *Chisocheton lasiocarpus*, to the complex and to suggest that workers dealing with apparently discrete morphological entities at the local level may use those names as described by Stevens in his review. These variants may be keyed out as below, although intermediate forms are plentiful.

Chisocheton lasiocarpus is close to the variable *C. sayeri* and the link seems to be *C. pilosus*. Stevens has reduced this to varietal status in *C. sayeri*, but as it is still known from the type gathering only, and as it appears to be a link, I propose leaving it at specific rank for the time being.

Enumeration

Generic description

CHISOCHETON Blume

Blume, *Bijdr.* **1** : 168 (1825); Schult. & Schult., *Syst.* **7** : 83 (1829); A. Juss., *Mém. Mus. Hist. Nat.* **19** : 73 (1830 ?); G. Don f., *Gen. Syst.* **1** : 685 (1831); Meisner, *Gen* : 48, 35 (1837); Steud., *Nomencl.* ed. 2 : 352 (1840; 'Chisogeton'); A. Juss. in d'Orbigny, *Dict. Hist. nat.* **8** : 80 (1849, 'Chizocheton'); Miq., *Fl. Ind. Bat.* **1** (2) : 527 (1859) & supp. **1** : 504 (1861); Benth. & Hook f., *Gen. Plant.* **1** : 333 (1862); Baillon, *Hist. Pl.* **5** : 504 (1874); Hiern in Hook. f., *Fl. Br. India* **1** : 550 (1875); C. DC. in DC., *Monog. Phan.* **1** : 528 (1878); Boerl., *Handl. Fl. Ned. Ind.* **1** : 190 (1890); King in *J. As. Soc. Bengal* **64** (2) : 24 (1895); Koord. & Val., *Bijdr. Boom.*: 96 (1896); Harms in Engl. & Prantl, *Nat. Pflanzenfam.* III, **4** : 294 (1896); Pierre, *Fl. for. Cochinch.* **5** : t. 346–347 (1897); Pellegr. in *Lecomte, Fl. Indoch.* **1** : 735 (1911); Ridley, *Fl. Malay Penin.* **1** : 386 (1922); Elmer, *Leafl. Philip. Bot.* **9** : 3341 (1937); Harms in Engl. & Prantl, *op. cit.*, ed. 2, **19b1** : 150 (1940); Pellegr. in Humbert, *Suppl. Fl. Gén. Indoch.* : 691 (1946); Bakker & Bakh., *Fl. Java* **2** : 124 (1965); Stevens in *Contrib. Herb. Austr.* **11** : 2 (1975) [See also *Handb. Flora of Papua N.G.* **1** : 135–174 (1978).]; Pennington & Styles in *Blumea* **22** : 497 (1975).

Type species: *C. patens* Blume, selected by Airy Shaw (1937). Airy Shaw's selection of the type (of the type section, 'Euchisocheton'), antedates Harms's selection (1940) of *C. divergens* Blume.

Schizochiton Sprengel, *Syst.* **4** (2) : 251 (1827); Walp., *Rep.* **1** : 429 (1842); M. J. Roemer, *Synops.* **1** : 102 (1846); Endl., *Gen.* : 1049 (1840); Miq., *Ann. Mus. Bot. Lugd.* **4** : 26 (1868). Type: *S. patens* (Blume) Sprengel.

Dasycoleum Turcz. in *Bull. Soc. Nat. Mosc.* **31** : 414 (1855); Benth. & Hook. f., *tom. cit.* : 335 (1862); Baillon, *tom. cit.* : 499 (1874); C. DC., *tom. cit.* : 539 (1878).
Type (obligate lectotype): *D. philippinum* Turcz. = *C. pentandrus* (Blanco) Merr.

[*Diplotaxis* Wall. ex Kurz, *Rep. Veg. Andam.* ed. 2 : 33 *nom. in synon.* (1870), *non* DC. (1821, Cruciferae), *sphalm. pro Plagiotaxis* Wall. ex Kuntze (1891) = *Chukrasia* A. Juss.]

Megaphyllaea Hemsley in Hook., *Ic. Pl.* [18] t. 1708 (1887); King in *J. As. Soc. Bengal* **64** (2) : 24 (1895); Harms in Engl. & Prantl, *Nat. Pflanzenfam.* III, **4** : 290 (1896); Ridley, *l.c.* (1922); Harms in *op. cit.*, ed. 2, **19b1** : 155 (1940); Pennington & Styles, *op. cit.*: 498 (1975).
Type (obligate lectotype): *M. perakensis* Hemsley = *C. perakensis* (Hemsley) Mabberley.

Melio-Schinzia K. Schum. in K. Schum. & Hollr., *Fl. Kaiser Wilh. Land* : 62 (1889); Boerl., *Handl. Fl. Ned. Ind.* **1** (2) : 676 (1890).
Type (obligate lectotype): *M. macrophylla* K. Schum. = *C. lasiocarpus* (Miq.) Valeton ('*C. schumannii* C. DC.').

Rhetinosperma Radlk. in Engl. & Prantl, *Nat. Pflanzenfam.* Nachtr. 3, Ergänzungsheft **2** (3) : 204 (1907) [Sapindaceae]; Harms, *tom. cit.* : 166 (1940).
Type (obligate lectotype): *R. longistipitata* (F. M. Bailey) Radlk. = *C. longistipitatus* (F. M. Bailey) L. S. Smith.

Clemensia Merr. in *Phil. J. Sci.* **3** : 143 (1908) and *Enum. Phil. Flow. Pl.* 2 : 371 (1923); Harms, *tom. cit.* : 155 (1940), *non Clemensia* Schlechter (1915) = *Clemensiella* Schlechter (Asclepiadaceae).
Type (obligate lectotype): *Clemensia macrantha* Merr. = *Chisocheton macranthus* (Merr.) Airy Shaw.

Trees, unbranched, branched low down or, usually, with trunk and sympodial crown, pachycaul to leptocaul, buttressed or not, sometimes laticiferous or myrmecophilous, very rarely foetid, dioecious (apparently sometimes polygamous). *Indumentum* usually of simple, rarely 4-stellate, hairs, sometimes irritant, mixed with small glandular hairs. *Wood* soft with septate fibres and frequently silica deposits; *vessel-elements* solitary or in radial rows, 60–180 μm diam. *Leaves* pinnate, pseudogemmulate, or sometimes imparipinnate, very rarely paripinnate, to 2·4 m long; leaflets in 2–28 pairs, usually opposite, rarely subalternate near leaf base, usually pink when young. *Inflorescence* paniculate, sometimes with long peduncle and then thyrsoid or subracemose, axillary to supra-axillary, ramiflorous or rarely borne on congested cauliflorous branches, or epiphyllous. *Flowers* unisexual, very rarely apparently hermaphrodite, usually bracteolate, articulated with pedicel or inflorescence branches, sometimes with elongated receptacle ('pseudopedicel'); *calyx* ± cupuliform, obscurely, rarely markedly, 3–6-lobed, sometimes closed in bud and splitting irregularly at anthesis when circumscissile at the base; *petals* (3–)4–6(–14), in 1(–2) whorls, free, imbricate, quincuncial or alternative, often merely at apices, or valvate, occasionally separating from one another on drying, rarely weakly united below or united at the base to staminal tube, white or pink (to claret); *tube* cylindrical, sometimes weakly expanded or contracted at the mouth, with an entire to crenate margin, or topped by 4–10(–30) emarginate, truncate or narrowly lanceolate 2(–3)-fid appendages, usually reflexed at anthesis; *anthers* (3–)4–10(–30), usually attached within the tube when completely included or partly exserted, hairy or glabrous, usually locellate, alternating with the lobes or appendages; *antherodes* very slender, indehiscent, without pollen; *pollen grains* 3–5-colporate, oblate-spheroidal or spheroidal with smooth or scabrous exine thickened at the apertures; *disk* usually absent, if present narrowly or broadly stipitate, annular or patelliform, occasionally lobed; *ovary* 2–8-locular, loculi with 1(–2) collateral or superposed orthotropous ovules; *stylehead* capitate, clavate or discoid; *pistillode* slender, base unexpanded, ovules minute or wanting. *Fruit* a 2–5(–8)-valved loculicidal capsule, often stipitate, sometimes rostrate, the valves 1(–2)-seeded; *pericarp* usually leathery or almost completely lignified, sometimes with soft spongy mesocarp or laticiferous. *Seeds* obovoid-spheroid to scutelliform or orange-segment-shaped, variously arillate or sarcotestal, orthotropous; *hilum* often large, heavily vascularized, whitish; *aril* reddish-orange with ± free flap over black testa; *sarcotesta* red, tough; *cotyledons* collateral, oblique or superposed. *Germination* semihypogeal (Ng, 1978).

Artificial key to the species

1. Leaves paripinnate, without pseudogemmula — 29. **patens** (p. 350)
1. Leaves imparipinnate or pseudogemmulate — 2
 2. Inflorescences epiphyllous (New Guinea) — 3
  3. Leaves ± densely pubescent, petiolules 3–6 mm long — 13. **pohlianus** (p. 331)
  3. Leaves sparsely hairy to subglabrous, petiolules (5–)10–23 mm long — 9. **tenuis** (p. 330)
 2. Inflorescences axillary, ramiflorous or from bosses — 4
  4. Inflorescences borne on long-lived bosses on bole (Borneo) — 5
   5. Leaflets strongly asymmetric, petals 5–6, red, anthers 8–10 (limestone) — 22. **ruber** (p. 342)
   5. Leaflets not so, petals (3–)4(–5), white, anthers 6–9 (mountains) — 28. **cumingianus** (subsp. **kinabaluensis**) (p. 349)
  4. Inflorescences ramiflorous, axillary, supra-axillary or in axils of unexpanded leaves — 6
   6. Pseudopedicel *c.* 10 mm long, calyx with conspicuous annular thickening, petals 6–10 in two whorls (Maxwell's Hill, W. Malaysia) — 32. **perakensis** (p. 356)
   6. Pseudopedicel, if present, much smaller — 7
    7. Calyx (10–)13–20(–23) mm tall (Borneo & Philippines) — 8
     8. Leaflets ± densely fulvescent abaxially, inflorescence to 30 cm, petals 9–14, anthers 15–20, stylehead discoid, seeds sarcotestal — 2. **medusae** (p. 322)
     8. Leaflets not so, inflorescence to 220 cm, petals 6–10, anthers 16–30, stylehead capitate, seeds arillate — 1. **macranthus** (p. 320)
    7. Calyx smaller — 9
     9. Leaves imparipinnate — 10
      10. Leaflets subglabrous abaxially (Sumatra, ? Java) — 24. **lasiogynus** (p. 343)
      10. Leaflets golden-to brown-pubescent, pilose or strigose adaxially — 11
       11. Anthers 3–5, corolla clavate in bud (Malay Peninsula) — 5. **penduliflorus** (p. 326)
       11. Anthers 6 or more — 12
        12. Petals 16 mm long (Borneo) — 6. **crustularii** (p. 327)
        12. Petals 20 mm or longer — 13
         13. Leaflets rugose, surface strongly reticulate-areolate abaxially, shiny and glabrous adaxially save brown-tomentose midrib; seed sarcotestal (Malay Peninsula) — 3. **tomentosus** (p. 323)
         13. Leaflets smooth, abaxial surface not strongly reticulate-areolate; seeds arillate or unknown (Borneo) — 14
          14. Leaves strigose with 'tinkling' (when stroked) hairs, petals glabrous — 7. **setosus** (p. 327)
          14. Leaves appressed hirsute abaxially, glabrous or sparsely pubescent on veins adaxially, petals densely pubescent outside — 4. **polyandrus** (p. 324)
     9. Leaves pseudogemmulate
       15. Petals 26–37 mm long, pachycaul treelets with irritant fruit hairs — 16
        16. Anther connective glabrous, seeds sarcotestal (Malay Peninsula) — 3. **tomentosus** (p. 323)
        16. Anther connective hairy, seeds arillate (Borneo) — 4. **polyandrus** (p. 324)
       15. Petals smaller, fruit unarmed — 17
        17. One or more petals narrower than and enclosed by the others — 18
         18. Leaves tawny pubescent abaxially, tube pilose outside (Burma & Thailand) — 36. **grandiflorus** (p. 358)
         18. Leaves glabrescent abaxially — 19
          19. Petals *c.* 8 mm long (Sumatra) — 35. **diversifolius** (p. 358)
          19. Petals 14 mm long or longer — 20
           20. Costae *c.* 5–8 on each side of leaflet midrib, leaves to 38 cm (Malay Peninsula) — 34. **pauciflorus** (p. 357)
           20. Costae *c.* 15 on each side of leaflet midrib, leaves to 150 cm (Borneo & Sulawesi) — 33. **sarasinorum** (p. 356)
        17. Petals ± same width — 21
           21. Tube not conspicuously lobed or strongly crenulate (if unclear, follow alternative) — 22
            22. Calyx 5·0–6·5 mm tall (New Guinea) — 8. **schoddei** (p. 329)
            22. Calyx up to 4 mm tall — 23
             23. Tube villous or sericeous outside — 24
              24. Anthers 8 (Philippines) — 10. **cauliflorus** (p. 330)

24. Anthers (3–)4–6 25
25. Petals 5 (Sumatra) 17. **aenigmaticus** (p. 338)
25. Petals (3–)4 26
26. Petals glabrous, leaflets tomentose abaxially (Sulawesi) 18. **celebicus** (p. 338)
26. Petals ± hirsute outside 27
27. Petals (3–)4, 7 mm long, ovary 4-locular (New Guinea) 12. **montanus** (p. 331)
27. Petals 4, much longer 28
28. Ovary bilocular, seeds 2, arillate 23. **sarawakanus** (p. 342)
28. Ovary 5-locular, seeds exarillate 31. **granatum** (p. 354)
23. Tube ± glabrous or sparsely hairy in middle or distal half outside 29
29. Inflorescence villous, to 80 cm, calyx 1·5–2·0 mm tall, anthers 8–9, petiolules *c.* 12 mm (New Britain) 11. **novobritannicus** (p. 331)
29. Not this combination of characters 30
30. Flower buds less than 1·5 mm diam. (New Guinea) 31
31. Leaves with conspicuous venation on both sides (dry) coriaceous, glabrescent; petals *c.* 13·5 mm long, fruit rostrate 20. **sapindinus** (p. 340)
31. Leaves different, fruit not rostrate 32
32. Petals *c.* 12 mm long, flowers crowded towards distal end of inflorescence, fruit spherical 19. **gliriodes** (p. 340)
32. Petals up to 10 mm long, or if slightly longer, then tube villous within and leaves pilose abaxially 33
33. Flower buds 9–10 mm long, anthers 4–6(–7), style to 0·15 mm diam. 16. **sayeri** (p. 337)
33. Flower buds *c.* 11·5 mm long, anthers 6–8, styles 0·25 mm diam. 15. **pilosus** (p. 337)
30. Flowers larger 34
34. Inflorescences borne on supra-axillary branch resembling supra-axillary inflorescence, petiolules fulvous tomentose, disk 1 mm tall (Moluccas & ? Laos) 21. **laosensis** (p. 341)
34. Inflorescences different; disk 0 14. **lasiocarpus** (p. 333)
21. Tube conspicuously lobed 35
35. Inflorescences borne on supra-axillary branch resembling supra-axillary inflorescence, petiolules fulvous tomentose (Moluccas & ? Laos) 21. **laosensis** (p. 341)
35. Inflorescences different 36
36. Hairs simple 37
37. Corolla aestivation imbricate 38
38. Costae 15–22 on each side of leaflet midrib, flower buds clavate, anthers 3–5, pachycaul treelet (Malay Peninsula) 5. **penduliflorus** (p. 326)
38. Not this combination of characters 39
39. Ovary 4-locular, seeds (3–)4 40
40. Disk prominent, subtubular to 1 mm 41
41. Calyx 4–5-lobed, petals 5–6, anthers scarcely locellate 25. **amabilis** (p. 344)
41. Calyx margin entire, petals (3–)4(–5), anthers locellate 28. **cumingianus** (p. 347)
40. Disk obscure 42
42. Anthers 2·5 mm long, glabrous 26. **macrophyllus** (p. 345)
42. Anthers 1·5 mm long, hairy 27. **dysoxylifolius** (p. 346)
39. Ovary 2-locular, seeds 2 43
43. Disk present 44
44. Venation very prominent on both sides (dried), seeds 3 cm diam. (Borneo) 30. **lansiifolius** (p. 352)
44. Venation and seeds different 29. **patens** (p. 350)
43. Disk 0 45
45. Petals 18 mm long (Philippines) 37. **mendozai** (p. 359)
45. Petals shorter 46
46. Tube crenate, anthers hairy 23. **sarawakanus** (p. 342)
46. Tube lobes long-triangular, anthers glabrous 29. **patens** (p. 350)
37. Corolla aestivation valvate, seeds sarcotestal 47
47. Disk present 48
48. Tube pubescent on both sides, calyx *c.* 6·5 mm diam. (Sumatra) 38. **vindictae** (p. 359)
48. Tube glabrous within, calyx *c.* 3·0 mm (Vietnam) 42. **pellegrinianus** (p. 366)
47. Disk 0 49

49. Twigs subglabrous 50
50. Petals 13–19 mm long, 2 mm wide in panicles, tube-lobes ± truncate, fruit 4·5 cm diam. or more 39. **ceramicus** (p. 361)
50. Petals 8–12(–19) mm long, only in panicles if flowers small, tube lobes ± laciniate; fruit to 2·1 cm diam. 41. **pentandrus** (p. 363)
49. Twigs fawn-pubescent 51
51. Petals 16 mm long (Philippines) 40. **curranii** (p. 363)
51. Petals 9–13 mm long (Malay Peninsula & Borneo) 43. **erythrocarpus** (p. 368)
36. Hairs stellate, disk present, seeds sarcotestal (Borneo eastwards) 52
52. Inflorescence axes slender (*c.* 1 mm), calyx *c.* 4 mm diam., petals 10 mm long (New Hebrides) 45. **rex** (p. 369)
52. Inflorescence axes stouter, calyx smaller 53
53. Flowers 11–12 mm long (Borneo, Sulawesi) 44. **koordersii** (p. 368)
53. Flowers less than 8 mm long 54
54. Inflorescence velutinous, style glabrous (New Guinea) 46. **stellatus** (p. 371)
54. Inflorescence subglabrous, style densely hairy 47. **longistipitatus** (p. 371)

N.B. The insufficiently known species numbered 48–51 are not included in the above key.

Natural arrangement and description of species

(i) sect. **Clemensia** (Merr.) Airy Shaw

In Hook., *Ic. Pl.*, *sub* t. 3333 (1937); Jacobs in *Reinwardtia* **3** : 263 (1955). Type: *C. macranthus* (Merr.) Airy Shaw.

Clemensia Merr. (genus) in *Philip. J. Sci.* **3** : 143 (1908); Pilger & Krause in Engl., *Nat. Pflanzenfam. Erg.* **3** : 162 (1914); Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2, **19**b1 : 155 (1940). Type (obligate lectotype): *Clemensia macrantha* Merr., i.e. *Chisocheton macranthus* (Merr.) Airy Shaw.

§*Graciles* Harms (sect. 'Euchisocheton') in Engl. & Prantl, *Pflanzenfam.* III, **4** : 295 (1896) & ed. 2, **19**b1 : 153, inc. 'Penduliflori' & 'Principes' (1940).

Pachycaul trees and treelets to 28 m high, unbranched or sparsely branched. *Leaves* to 220 cm long, imparipinnate or pseudogemmulate. *Inflorescences* unbranched or sparsely branched, to 7 m long, ± flagelliform with arillate seeds or shorter with sarcotestal seeds; *calyx* ± pubescent, entire or obscurely 3–4-lobed or splitting irregularly at anthesis; *petals* (4–)5–14, (16–)26–45 mm long, imbricate at apex; *staminal tube* glabrous or pubescent sparsely outside with band of hairs below lobes and/or within, up to the apical quarter, margin entire to lobed; *anthers* 3–30, hirsute or not, locellate or not; *disk* flattened or annular, sometimes lobed; *ovary* 4–6-locular; *stylehead* subdiscoid to capitate. *Fruit* tomentose with stinging hairs, to 13 cm diam., recurved; *seeds* arillate or sarcotestal, never scutellar.

1. Chisocheton macranthus (Merr.) Airy Shaw

In Hook., *Ic. Pl.* **34** : sub t. 3333 (1937); Jacobs in *Reinwardtia* **3** : 266 (1955); Meijer in *Bot. News Bull. Sabah* **8** : 78 (1967). Plate 1.

Clemensia macrantha Merr. in *Philip. J. Sci.* **3** : 144 (1908) & *Bibl. Enum. Born. Pl.* : 321 (1921) & *Enum. Philip. Fl. Pl.* **2** : 371 (1923) & in *Univ. Calif. Publ. Bot.* **15** : 122 (1929); Elmer, *Leafl. Philip. Bot.* **9** : 3349 (1937); Harms in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2, **19**b1 : 155 & t. 34 (1940); Heine in *Fedde, Repert.* **54** : 230 (1951). Types: Philippines, Mindanao, Lake Lanao, Camp Keithley, Sept.-Oct. 1906*, *Clemens 725* (?PNH†), also Jan., Feb., March, April, June & Sept. 1907, *Clemens s. n.* (?PNH†); Clemens specimens at Geneva, coll. March & Sept. 1907 and without date (G!), are probably isosyntypes.

[*Dysoxylum dehiscens* Elmer, *l.c.* (1937), *nom. in synon.*]

Chisocheton medusae sensu Heine in *Mitt. Bot. Staats. München.* **6** : 233 (1953), *non* Airy Shaw.

*Dates are recorded only for types, first records and material of new species or without collector's number.

Plate 1 *Chisocheton macranthus*. One infructescence and one leaf held by author. Malaysia, Sabah, Sandakan, Sekong Kechil, 24 May 1974, *Mabberley* 1718.

Pachycaul tree to 13 m with fastigiate branching and often several trunks from base, buttressed; d.b.h. to 22 cm. *Twigs* very stout, with large scutellar cicatrices, blackish. *Leaves* crowded in dense terminal spirals, to 220 cm long, pseudogemmulate; *petiole* and *rachis* stout, woody, dark-coloured, glabrescent to sparsely hairy; *leaflets* in up to 16 pairs, sometimes ± alternate at base of rachis, petiolules to 8 mm long, lamina oblong lanceolate, or ovate if small, 20–45(–55) cm long, (5–)8–12(–15) cm broad, weakly bullate, glabrous above, ± puberulous below, apex acute to acuminate, base obtuse to subacute, costae *c.* 15–24 on each side, tertiary venation scalariform. *Inflorescence* pendent, to 220 cm long; *axis* terete to weakly angular, weakly branched; *branches* crowded towards apex, with up to 12 flowers, bristly; *pedicels* in axils of fugacious pubescent bracts *c.* 6 mm long, *c.* 10 mm long, articulated with elongated base of calyx (pseudopedicel); *calyx* cupulate to cylindrical, 14–20 mm long and wide, pubescent, red-brown, apex ± truncate to irregularly 3–4-lobed; petals 6–10, 30–45 mm long, 4–7(–12) mm wide, creamy-pink; *staminal tube* 25–40 mm tall, 6–7 mm wide with entire to lobed lobes 4–6 mm long, creamy-white, glabrous outside except on the lobes, pilose within at base; *anthers* 16–30, *c.* 5 mm long, rather recurved, with pubescent connective; *disk* flattened, to weakly annular, glabrous; *ovary* in female flowers *c.* 5 mm diam., 5–6-locular, bristly; *style* bristly in lower half or glabrous, stylehead capitate, *c.* 2 mm diam. *Infructescence* from axils of last flush of leaves; *axis* to 3 m long with terminal bunches of up to 60 fruits, recurved, rostrate when immature, bright vermilion tomentose with irritant deciduous hairs, to 12 cm diam., dehiscent; *seeds* 2·5–3·3 cm long, triangular in cross-section arillate, aril reddish, covering inner edges of black testa.

Restricted to lowland rain forest of northern Borneo and the southern Philippines.

PHILIPPINES. Mindanao, Lake Lanao, Camp Keithley, March 1907, *Clemens s.n.* (G!)*; Surigao, *Ramos et al.* B. Sci. 34954 (K!) MALAYSIA. Sabah, Mt Kinabalu, Minitindok Gorge, *Clemens* 10431 (BM!, K!) & Beaufort, *Mikil* SAN 28119 (SAN!) & Sandakan, Lamag, SAN 66051 (SAN!) & Sandakan, Sekong Kechil, *Mabberley* 1718 (FHO!, SAN!) & Tawau, 30 miles NNW, Tawau, *Wood* SAN A3694 (A!); Sarawak, Bintulu, *Ashton* S17706 (A!, FHO!, K!, L!, SAR!) & Baram, *Anderson* S31804 (K!, SAN!, SAR!). INDONESIA. West Borneo, G. Kenepai, 20 Dec. 1893–4 Jan. 1894, *Hallier* 1938 (K!, L!, first record) & East Borneo, W. Kutai, 150–200 m, *Endert* 2591 (L!).

2. Chisocheton medusae Airy Shaw

In Hook., *Ic. Pl.* **34** : t. 3333 (1937); Harms in Engl. & Prantl, *Nat. Pflanzenfam.* ed. 2, **19**b1 : 155 (1940); Jacobs in *Reinwardtia* **3** : 264 (1955); Meijer, *Bot. News Bull. Sabah* **8** : 78 (1967). Type: Malaysia, Sarawak, 4th Divn, Mt Dulit (Ulu Tinjar), nr Long Kapa, < 300 m, 19 Feb. 1932, *Richards* 2631 (K, holo!; SING!).

Megaphyllaea sp., Merr. in *Univ. Calif. Publ. Bot.* **15** : 123 (1929).

Chisocheton medusae f. *hiascens* Jacobs, *op. cit.* : 265 (1955). Type: Indonesia, E. Borneo, W. Kutai, Long Hut, 150 m, 10 Nov. 1925, *Endert* 4766 (BO, ?holo; K!, L!, SING!).

Pachycaul tree to 28 m, d.b.h. to 30 cm, sparsely branched, buttressed; *bark* black with fine striations; *inner bark* dark brown, heartwood yellowish. *Young twigs* stout, fulvous tomentose. *Leaves* to 2 m long, bunched in terminal spirals, pseudogemmulate (imparipinnate with up to 4 pairs leaflets when young); *petiole* terete or flattened adaxially, decurrent with twig and forming axillary cavity with it; *rachis* somewhat angular, fulvous tomentose as the petiole or somewhat glabrescent; *leaflets* in up to 14 pairs, green when young, opposite except for those near base of rachis, petiolules terete, 2–3 mm long, densely pubescent, lamina to 40 cm long and 11 cm wide, lanceolate to elliptic-lanceolate, adaxial side sparsely pubescent when young, later glabrous, abaxial surface ± densely fulvous pubescent, apex acute to acuminate with 2 cm long tip, base narrowed into petiole and blunt, midrib stout, densely fulvous tomentose beneath, costae 20–24 on each side, weakly arcuate near margin, subpubescent above, prominent and hairy below. *Inflorescence* to 30 cm long, axils of upper or undeveloped leaves, weakly branched to narrowly paniculiform at base; *axis* compressed to angular, shortly fulvous-tomentose when young,

*Only one specimen per degree square is cited in order to save space; other specimens examined are given in the list on p. 372. An exclamation mark (!) indicates that I have studied the specimen cited, whilst a dagger (†) indicates material destroyed. For herbarium abbreviations see Holmgren & Keuken (1974).

glabrescent later; *branches* rather more densely pubescent, few-flowered, with caducous bracts; *pedicels* 3–20 mm long, somewhat angular, light-brown hirtellous, articulated with pseudopedicel, swollen at junction; *calyx* shallowly cupular to subcylindrical (10–)13–20(–23) mm long, 15–20 mm wide, ± densely ferruginous-velutinous, apex truncate or irregularly split halfway into 2–3 ± triangular lobes; *petals* 9–14, white, 35–40 mm long, 2–6 mm wide; *staminal tube* 27–32 mm long, glabrous, truncate, thin below; *anthers* 15–20, just exceeding tube or not, 3–4 mm long, glabrous; *disk* glabrous; *ovary* in female flowers 3–5 mm wide, 7–8-locular, glabrous to densely yellowish hirsute; *style* ± as long as tube, ± pubescent, especially below, stylehead discoid to shallowly cylindrical, 2 mm diam., glabrous. *Infructescence* to *c.* 30 cm of several ± spherical, golden-brown densely hispid fruits, to 13 × 10 cm, ? dehiscent; *seeds* to 5 cm long, orange-segment shaped with dense vascularized sarcotesta.

Northern Borneo, 0–300 m in lowland rain forest and hill dipterocarp forests, including those on limestone (Kalimantan).

Malaysia. Sabah, Sandakan, Sepilok, *Mabberley* 1680 & 1682 (FHO!) & Beluran, 20 m, Sg. Sapi Camp, *Tinggan* SAN 37378 (SAN!) & Tawau, mile 28, Kawa road, *Sinanggul* SAN 40604 (SAN!) & *Elmer* 21541 (A!, G!, K!, L!, SING!, first record) & Lamag, SE. Lotung Lake, *Lantoh* SAN 83177 (FHO!); Sarawak, 3rd Divn, Anap. Bt. Mersing, *Chai* S 19233 (FHO!, SAR!) & 4th Divn, *Richards* 2631 (type). Indonesia. E. Borneo, E. Kutai, G. Sekrat, S. of Sangkulirang, 200 m, *Kostermans* 5897 (A!, G!, K!, KEP!, L!, LAE!).

Jacobs's f. *hiascens* is linked to the typical plant by intermediates, such as S 21788 from Sarawak, which merely represent different conformations of the calyx after splitting at anthesis.

3. Chisocheton tomentosus (Roxb.) Mabberley, **comb. nov.**

Fig. 1 (2). *Melia tomentosa* Roxb., [*Hort. Beng.* : 90 (1814), *nom. nud*,; Roxb. ex A. Juss., *Mém. Mus. Hist. Nat.* **19** : 220 (1830 ?), *nom. nud.*; Roxb. ex G. Don f., *Gen. Syst.* **1** : 681 (1831), *nom. nud.*] *Flora Ind.*, ed. 2, **1** : 394 (1832); *Walp. Rep.* **1** : 427 (1842); Roem., *Hesper.* : 96 (1846); Hiern in Hook. f., *Fl. Br. Ind.* **1** : 543 (1875); C. DC. in DC., *Monog. Phan.* **1** : 458 (1878); Curtis in *J. Str. Br. Roy. As. Soc.* **25** : 21 (1894). Type: Drawing in Ic. Roxb. (K! (photo at FHO!)); BM!, lecto (selected here); CALC (reproduced in *Ic. Roxb. Drawings Ind. Pl.* 3 : 16 (1969)). *Non* Miq., *Fl. Ind. Bat.* **1** (2) : 532 (1859) = *?Melia azedarach* L., *nec* Kurz, *Rep. Fl. Andamans*, ed. **1** : iv (1870) = *Chukrasia tabularis* A. Juss.

[*Meliacea rugosa* Wall., Cat. 4891 (1831–2), 'Penang 1822' (K-W!); Hiern, *op*, *cit.* : 369 (1875).]

C. princeps Hemsley in Hook., *Ic. Pl.* **19** (2) : t. 1844 (1889); Curtis, *op. cit.* : 22 (1894); King in *J. As. Soc. Bengal* **64** (2) : 29 (1895); Ridley, *Fl. Malay Penins.* **1** : 388 (1922); Whitmore, *Trop. Rain For. Far East* : t. 2·7 (1975). Type: Malaysia, Penang Island, Waterfall Garden, *Curtis* 1519 (K, holo!; CALC!, SING!).

Azedarach tomentosa (Roxb.) Kuntze, *Rev. Gen* : 110 (1891).

C. rubiginosus King (1895); Ridley, *op. cit.* : 389 (1922); Burkill & Henderson in *Gdns' Bull. Str. Sett.* 3 : 357 (1925). Types: 'Perak: Scortechini, Wray, King's Collector' – at CALC is Perak, Dec. 1883, *King's Coll.* 5343 (CALC!, L!, SING!, syn); other *King's Coll.* specimens labelled in King's hand may be isosyntypes as March 1883, 3946 (G!, K!, LE!, SING!) and Nov. 1883, 5095 (BM!, E!, G!, K!, L!, LE!, SING!).

C. rugosus Pierre, *Fl. For. Cochinch.*, sub. t. 347 (1896). Type: Duplicate of *Wall.*, *Cat.* 4891 (P, holo; BM!, K-W!, iso).

Pachycaul tree to 21 m, unbranched or sparsely and fastigiately branched, often from near the base, taprooted at least when young; trunk to 20 cm diam., sometimes slightly fluted below, knobbled, or with small stilt roots; *bark* blackish brown, smooth to weakly fissured, greyer and with conspicuous scutellar cicatrices to 5 cm long and wide above; *inner bark* deep orange-yellow to brownish; *sapwood* ivory to fawn; *pith* soft, wide and white. *Terminal shoot axes* to 2 cm diam., below terminal rosettes of leaves; all young parts brown tomentose with irritant hairs. *Leaves* to 2 m, maturing in flushes, pinkish-red when young, imparipinnate (especially in saplings) or pseudogemmulate, pseudogemmula sometimes falling without further development; *petiole* base woody, massive, swollen, terete; *rachis* often angled, brown tomentose; *leaflets* sessile to subsessile, patent, basal ones smallest, 3–37 cm long, 2–10 cm wide, narrowly elliptic to oblong, rugose, shiny and glabrous adaxially except for brown-tomentose midrib, tomentose or tawny pubescent abaxially, surface strongly reticulate-areolate, costae 12–30 on each side, arcuate. *Inflorescence* borne in upper axils, appearing when fruit maturing in old infructescences (female trees); *axis* massive, tough, to 90 cm long with flowers forming a terminal head to 45 cm long and 10 cm diam., sometimes with short branches to 7 cm, composed of fascicles of sweetly-scented pedicellate flowers, brownish-pink in bud; *calyx* (3–)4–8 mm tall and wide, cupular, reddish-brown, minutely puberulous, often warty, margin entire or obscurely 3–4-lobed, ± setose; *petals* 5–6(–10), 26–37 mm long, creamy red-striped outside, white flushed pink within, waxy, concave distally, linear-spathulate, densely pilose outside; *staminal tube* cylindrical, slightly wider at lobed mouth, villous with downward-pointing hairs within lower three-quarters, sometimes sparsely hairy outside, especially just below lobes, lobes *c.* 10–15, often irregularly bifid, shorter than the anthers; *anthers* 7–13(–15), 4·5–5 mm long, basifixed, boat-shaped, locellate, glabrous; *disk* annular, to 1 mm high, apically pilose; *ovary* (4–)5(–6)-locular; *style* cylindrical, sparsely pubescent, stylehead spherical. *Infructescence* of subglobular fruits, (4–)5(–6)-locular to 7 cm diam., golden-brown velvety with irritant detachable hairs; *seeds* 3–5, to 4 cm long, with white sarcotesta.

Lowland and hill dipterocarp forest of the Malay Peninsula.

MALAYSIA. Penang, *Curtis* 1519 (type of *C. princeps*); Kelantan, SE., Ulu S. Aring nr K. Tanang, *Whitmore* FRI 4475 (K!, KEP!, SAR!, SING!) & N., Jeli F.R., *Chelliah* FRI 6526 (K!, KEP!) & S. Labir, *Whitmore* FRI 4352 (KEP!); Perak, Larut, 90–150 m, *King's Coll.* 5095 (BM!, E!, G!, K!, L!, LE!, SING!); Pahang, K. Lompat, Kerau Game Res., *Whitmore* FRI 3463 (A!, K!, KEP!, L!, SAN!, SING!); Selangor, Kepong, Bt Lagong F. R., 300 m, *Mabberley* (*& Loh*) 1542, 1556, 1557, 1561 (FHO!); Johore, Labis F. R., S. boundary, *Ng & Whitmore* FRI 1010 (K!, KEP!, L!, SING!) & 28 miles S. of Mersing, 4 miles from road, 30 m, *Pennington* 8027 (FHO!, KEP!, L!, SING!) & S. Kayu, Mawai–Jemaluang road, *Corner* SFN 29285 (K!, SING!).

Hiern thought that '*Meliacea rugosa*' was probably not even meliaceous, but Pierre rightly placed it in *Chisocheton.* The specimen is a typical fruiting example from Penang, probably collected by George Porter in 1822. King thought *Melia tomentosa* possibly identical to his *C. rubiginosus*, though he pointed out the differences as he saw them, as chiefly in the number of petals; how he did not see that the CALC drawing of *M. tomentosa* was identical to the type of *C. princeps* is difficult to explain. His own *C. rubiginosus* has a rather high number of petals, but is linked by intermediates to typical *C. princeps* in this respect, and differs in no other characteristic.

4. Chisocheton polyandrus Merr.

In *Philip. J. Sci.* **21** : 520 (1922). Types: Malaysia, Sabah, Sandakan, Labuk, 30 Sept. 1918, *Wood* 657 (PNH?†, syn; A!, K!) and Sandakan, Batu Lima, Sept.-Dec. 1920, *Ramos* 1217 (PNH?†, syn; A!). Plate 2 & Fig. 1 (1).

Pachycaul tree to 6 m, unbranched or very sparsely branched, occasionally with stilt roots. *Leaves* to 150 cm long, imparipinnate with up to 14 pairs leaflets or pseudogemmulate when pseudogemmula densely long-pubescent; *petiole* terete, woody; *rachis* terete; *leaflets* opposite, or subalternate at base, where they are often small, and even irregularly lobed, 11–43 cm long, 5–13 cm wide, oblong-lanceolate, rather acuminate, base asymmetrical, cuneate to subcordate, bullate at altitude, adaxial surface glabrous or the veins ± pubescent, shiny, abaxial surface appressed hirsute, more markedly at altitude, costae *c.* 15 on each side, often sunken above, petiolules to 2 mm. *Inflorescence* borne in upper axils, up to four at any time, to 2 m long, unbranched, or with a few squarrose branches to 13 cm long at apex, where flowers are crowded together, young parts ferruginous-pubescent; *calyx* cupular to subcylindrical, 5–8 mm long, 5–6 mm wide, densely ferruginous-pubescent, green to deep red, margin truncate; *petals* 5–6, 28–32 mm long, creamy white with conspicuous pink or red tinge, subspathulate, fleshy, externally densely pubescent; *staminal tube* cylindrical, white, subglabrous outside and within, apically and basally with conspicuous band of hairs within, margin with *c.* 12–14 linear lobes, *c.* 3 mm long; *anthers* 12–14, *c.* 4 mm long, locellate, scattered ferruginous-pubescent on connective; *disk* shallow (*c.* 1 mm high), thick, truncate, glabrous; *style* cylindrical, glabrous, stylehead subcapitate, *c.* 1 mm diam; *ovary* ?3–5-celled. *Infructescence* pendent, to 2 m long with fruit aggregated at apex (Plate 2),

Plate 2 *Chisocheton polyandrus* fruits dehiscing; Malaysia, Sabah, Sandakan, Ulu Dusun, 16 May 1974, *Mabberley* 1688.

each ± spherical, covered with reddish irritant hairs, splitting into 3–4 valves; *seeds* 3, arillate, testa black, covered on inner surface with orange-red aril.

Lowland and hill dipterocarp forest of Brunei, northern Sarawak and Sabah, 150–300 m.

MALAYSIA. Sabah, *Wood* 657 (type, first record) & Sandakan, miles 81 W. of Sandakan, *Mabberley* 1708, 1709 (FHO!) & Ranau, Bt Kulong, 450 m, *Sadau* SAN 49763 (K!, SAN!) & Keringau, Kg Biah, *Mikil* SAN 42075 (K!, SAN!) & Kudat, Bengkoka F. R., 90 m, *Shea & Minjulu* SAN 76067 (FHO!, K!, SAN!) & Ulu Anak, Sg Kaindangan, *Aban & Saikeh* SAN 82406 (FHO!); Sarawak, 5th Divn, Ulu Lawas, 160 m, *Chai & Pa'ie* S 31533 (FHO!, K!, SAR!, SING!). BRUNEI. K. Sebatu, Batu Apoi, 15 m, *Ashton* BRUN 349 (L!, SAR!).

There is considerable variation in stature, pubescence, flower-colour and the degree of bullation of the leaflets with altitude, such that the pachycaul treelet a few metres high in cocoa-shade (*Mabberley* 1688) at low altitude may seem very different from the tall pubescent tree of higher altitudes (*Mabberley* 1708, 1709) though linked by a complete series of intermediates.

5. Chisocheton penduliflorus Planchon ex Hiern

In Hook. f., *Fl. Br. India* **1** : 550 (1875); C. DC. in DC., *Monog. Phan.* **1** : 536 & t. 7 Fig. 4 (1878); Curtis in *J. As. Soc. Str. Br.* **25** : 22 (1894); King in *J. As. Soc. Bengal* **64** (2) : 38 (1895); Harms in Engl. & Prantl, *Pflanzenfam.* III, **4** : 292, t. 162 Fig. E-G (1896) and in ed. 2, **19b1** : 139, t. 30 Fig. E-G (1940); Ridley, *Fl. Malay Penins.* **1** : 388 (1922); Burkill & Henderson in *Gdns' Bull. Str. Sett.* **3** : 356 (1925); Briquet in *Mém. Inst. Nat. Genev.* **24** : 66 (1935). Types: Malaysia, Malacca, 10 Nov. 1867, *Maingay* (BM!, K!, '325', L!, syn) & Penang, 1822, *Porter* in E.I.C. (i.e. K-W) 1255 (BM!, CGE!, K!, K-W!, LE!, syn).

[*Melia penduliflora* Wall., *Cat. 1255* (1828), *nom. nud.*; Roem., *Hesperid.* : 96 (1846), *nom. nud.*]

C. kunstleri King, *op. cit.* : 27 (1895). Types: Malaysia, Perak, '*King's Collector* 4502 [CALC?, BM!, syn], 7783 [CALC?, syn], *Scortechini* [CALC?, syn].'

C. penduliflorus var. *kunstleri* (King) Ridley, *l.c.* (1922).

Pachycaul treelet or *tree* to 10 m and 10 cm diam.; *bark* blackish; *inner bark* pale fawn. *Leafy twigs* 6–7 m diam. ± densely to rusty tomentose, to 15 mm when in fruit. *Leaves* imparipinnate to pseudogemmulate, with up to 8 pairs leaflets; *petiole* to 22 cm long, ± channelled adaxially; *leaflets* (8–)17–27·5 cm long and (3–)8–11·5 cm wide, elliptic-ovate to elliptic-oblong, subcoriaceous, adaxial surface subglabrous except ± fulvescent-tomentose on veins, abaxial surface ± pubescent, particularly on veins, base rounded to subcordate, sometimes asymmetrical, apex ± gradually long-acuminate, costae 15–22 on each side, with prominent intercostals, prominent abaxially; *petiolules* to 1 mm. *Inflorescence* to 7 m long, supra-axillary, pendulous, unbranched, or with branches to 7 cm long, usually with flowers congested in subsessile cymes at distal end like a bell-rope; *axis* 3–5 mm diam., densely rusty tomentose, with linear, hirsute bracteoles; *calyx* 3–4 mm tall, cupular to shortly cylindrical, pubescent, margin obscurely lobed to entire; *petals* 4–5, 18–22 mm long, linear-spathulate, concave, thick, dull red, clavate in bud and narrower in male flowers, pubescent on outside, adnate to staminal tube below; *staminal tube* with 3–5 irregularly bifid lobes, pilose outside below lobes, long-pilose with downwardly directed hairs in lower half within; *anthers* 3–5, *c.* 3 mm long, locellate, glabrous, included or slightly exserted; *disk* obscure to cupular, fleshy, glabrous; *style* and *ovary* densely long-pilose in lower three-quarters, stylehead subdiscoid to capitate with ± pubescent annulus. *Infructescence* of *c.* 10–15 recurved dehiscent fruits, silky pubescent with (? irritant) hairs, rostrate when young, recurved, to 5 cm long, splitting into 3 valves; *seeds* 3, arillate, testa black, covered on inner surface by red-orange aril.

Lowland rain forest of Lower Thailand and Peninsular Malaysia, to 900 m.

THAILAND. Chawang, *Mrs Collins s. n.* (K!) & Phatalung, Kao Soi Dao, *Kerr* 19217 (K!, L!, P!) & Bukit, Pattani, *Put* 3629 (K!, L!) & Trang, Khao Chong, *Phusomsaeng* 59 (L!). MALAYSIA. Penang, *Porter* (type, first record); Kelantan, NW. Gunong Rabong, 45 m, *Stone* 7488 (KLU!, L!); Trengganu, Ulu Trengganu, near K. Petang, 160 m, *Cockburn* FRI 8434 (K!, KEP!, L!); Perak, Ipoh, Kledang Saiong F.R., 90 m, *Pennington* 7827 (FHO!) & Taiping, Waterfall Gdn, *Ridley* '1910' (BM!); Pahang, Chini, *Bray* FRI 11654 (K!, KEP!); Malacca, *Maingay* '325' (type); Johore, S. Kayu, *Kiah* SFN 32400 (KEP!, SING!).

Although the flowers are remarkably constant throughout the range of this tree, few other features are as stable. In Thailand, specimens tend to have smaller pseudogemmulate leaves, but in Malaysia there is great variation in leaf-shape, forms with wide leaflets being similar to those of the type of *C. kunstleri*, narrow ones to those of the type of *C. penduliflorus*. On the other hand, specimens such as that of *Phusomsaeng & Pinnin* 324 (L!) from peninsular Thailand are like those of *C. kunstleri*; the inflorescence of that specimen is some 7 m long compared with the shorter ones found in the Malaysian specimens, in some of which they are very short indeed. I am not altogether satisfied that the forms with slender branches and small leaves found in Thailand are inseparable from the others, but there is not sufficient material available to decide this at present.

6. Chisocheton crustularii Mabberley, **sp. nov.**
(Fig. 3) A *C. setoso* Ridley corolla parva, lobis tubi staminalis et antheris pluribus, lobis disco recurvis differt.

Arbor ad 8 m altus. *Truncus* ad 8 cm diam., interdum anteribus humilibus rotundatis praeditus; *cortex* cinerascens, auguste fissurata. *Ramuli* foliati circa 1·5 cm diam. *Folia* ad 135 cm longa, imparipinnata, foliolis usque ad 10-jugis; *rhachis* teres, subglabra; *foliola* opposita, subsessilia vel breviter petiolulata ubi petiolulo usque ad 16 mm longo, tumido, lamina 1·8 cm × 1·0 cm ubi proxima et pseudostipulanea, usque ad 38·0 cm × 10·1 cm ubi distali, vel 45·5 cm × 13·5 cm ubi terminali, auguste elliptica vel oblonga, supra perviridi, glabra, infra strigis sparsis apprime in nervature praedita, apice acuminato, base breviter attenuata vel subtruncata, nervis secundariis usque ad 24 utrinque, suboppositis alternatives, infra prominentibus, nervatura tertiaria conspicua, aliquantum scalariformi. *Inflorescentia* (mascula solum cognita) 38(–150) cm longa, pendens, gracilis; *axis* 2·0–3·0 mm latus, sericeus, dimidio distali florigero. *Flores* fasciculati, pedicellati, pedicellis 2·0–4·5 mm longis, recurvatis, hispidis; *calyx* 3·0 mm longus, circa 5·5 mm latus, vadose cupulatus, margine integro, extus pubescens apprime distali; *corolla* alba, petalis 5, 16 mm × 4·5 mm, auguste oblongis, extus pilis adpressis praeditis, intus glabris; *tubus staminalis* 14·5 mm longus, apice cum 11 lobulis, circa 3·5 mm longis, irregulariter bifidis, praeditus, subglaber praeter annulum latum pilorum adpressorum apice extus; *antherae* 11, circa 2·0 mm longae, infra apicem tubi insertae, vix locellatae; *discus* circa 0·5 mm altus, apice lobato penitus, lobis recurvatis; *stylus* filiformis, pilis dimidio proximo, pulvinifacientibus basi, praeditus, stigma circa 1 mm lata, sphaerica. *Fructus* ignotus.

TYPUS: Malaysia, Sarawak, 4th Divn, Marudi Tinjar, Ulu Sg. Dapoi, 'Lowland', 2 April 1965, *Ilias Pa'ie* S 22921 (K!, holo; FHO!, SAR!).

Known only from two collections from Tinjar, and closely resembling *C. setosus* which grows in the same area. The species differs in several floral features including the disk, which so resembles a pastrycook's creation as to suggest the specific epithet.

MALAYSIA. Sarawak, 4th Divn, S 22921 (type) & Tinjar, Ulu Buroi, Sg. Telangau, 28 March 1965, *Murthy* S 23329 (FHO!, K!, L!, SAR!).

7. Chisocheton setosus Ridley
In *Bull. Misc. Inf. Kew* **1930** : 366 (1930); Airy Shaw in Hook., *Ic. Pl.* **34** : t. 3334 (1937); Meijer in *Bot. News Bull. Sabah* **8** : 78 (1967). Type: Brunei, Limbang, 'c.o.d.z.' [4 Aug. 1890 (Stapf, 1907)], *Kunoeang in Haviland* 598 (K, holo! (photo at FHO); BM! (?, no data); SAR!).

Pachycaul treelet to 5 m, d.b.h. *c.* 8 cm, ? unbranched; *bark* smooth; *inner bark* pale yellow; *Leafy twigs c.* 1 cm diam., densely ferruginous-setose. *Leaves* to 1 m long, imparipinnate with at least 6 pairs leaflets; *petiole* to 35 cm long, subterete, sometimes grooved adaxially, to 6 mm diam., ferruginous-setose, hairs 2–3 mm long, swollen at base with conspicuous hollow at angle with stem; *rachis* 1–2-sulcate, setose as petiole; *leaflets*: proximal ones elliptic-oblong, to 20 cm long and 8·5 cm wide, distal ones oblanceolate to oblong, to 36 cm long and 10 cm wide, base rounded to attenuate apex acuminate, point 10–20 mm long, ± densely ferruginous setose on both sides, setae tinkling when stroked (dry plant), pale when dry, costae 17–20 on each side, prominent abaxially, intercostals ± prominently scalariform, petiolule 5–6 mm long, densely tomentose, that

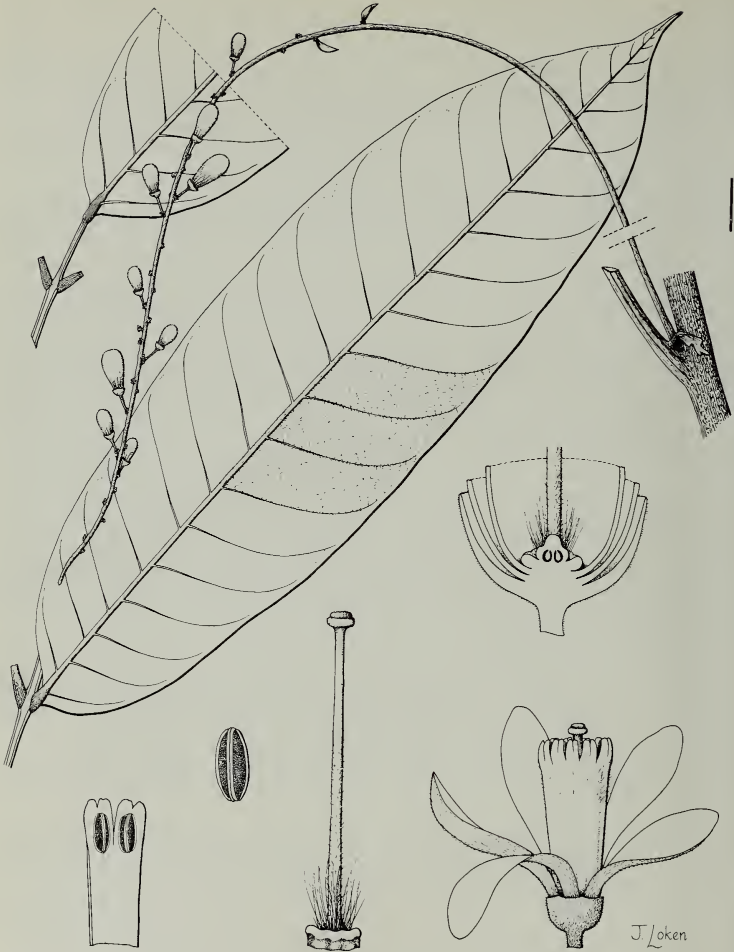

Fig. 3 *Chisocheton crustularii* Mabberley. Terminal leaflet, lateral leaflet and inflorescence from S22921, scale = 2 cm. Male flower (scale = 5 mm), half flower-base, pistil, part of tube (scale = 2·5 mm) and anther (scale = 1·25 mm) from S23329.

of terminal leaflet to 10 mm. *Inflorescence* to 2 m long, pendulous, ± densely setose, drying irregularly angled, with flowers, crowded in compressed cymes at distal end like a bell-rope, and linear setose bracts to 7 mm long; *flowers* recurved, shortly pedicellate; *calyx c.* 3 mm tall and 4 mm diam., cupular, margin entire to obscurely 3–4-lobed, setose to pubescent, reddish, somewhat elongated into a pseudopedicel below; *corolla* 3–3·5 cm long, *c.* 3 mm diam., weakly clavate, glabrous, white or with greenish tinge, petals 4–6, subspatulate, to 4 mm diam., imbricate at apices; *staminal tube* to 3·2 cm long, white, with 6–8 irregularly lobed or truncate lobes, glabrous except for band of hairs below lobes outside; *anthers* 6–8, *c.* 2 mm long, glabrous, scarcely locellate; *disk c.* 1 mm high, cupular, glabrous, obscurely lobed to entire; *ovary* in female flowers unknown; *style* sparsely pilose below, glabrous above, stylehead capitate distinctly narrow-annular above. *Unripe fruit* densely setose, pale yellow.

Rain forest of northern Borneo – Brunei, Sabah and Sarawak. Very rare and collected on only five occasions.

MALAYSIA. Sabah, Beaufort, Beaufort Hill P. F.R., 30 m, *Mikil* SAN 30162 (SAN!) & Sandakan, miles 16·5, Labuk road, 45 m, *Binson Sindin* SAN 62869 (K! (photo at FHO!)); Sarawak, 4th Divn, Mt Dulit, nr Long Kapa, *Local Coll. in Richards* 2539 (K!). BRUNEI. *Haviland* 598 (type, first record).

(ii) sect. **Chisocheton**

sect. *Euchisocheton* Harms in Engl. & Prantl, *Pflanzenfam.* III, **4** : 295 (1896), excl. *Pauciflori* et *Graciles*.

Trees and undergrowth treelets. *Indumentum* of simple hairs. *Leaves* pseudogemmulate, rarely imparipinnate (*C. lasiogynus*) or paripinnate (*C. patens, p.p.*). *Inflorescences* axillary, ramiflorous, cauliflorous or epiphyllous, or borne on supra-axillary branches. *Corolla* aestivation alternative, quincuncial or imbricate, white or cream to pink or red, petals 4–6. *Staminal tube* lobed or not. *Anthers* (3–)5–10(–18), locellate. *Disk* sometimes present. *Ovary* 2–8-merous. Stylehead capitate. *Fruit* unarmed. *Seeds* 3–6, arillate.

Allied to sect. *Clemensia* through the arillate species of the latter. Range of the genus except Australia and New Hebrides.

(*a*) ser. **Schumanniani** Harms ex Mabberley, **ser. nov.**

Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2, **19**b1 : 151 (1940), *sine descr. latin.*

A ser. *Paniculatis* Harms tubi staminalis margine integro.

Type: *C. schumannii* C. DC. = *C. lasiocarpus* (Miq.) Valeton, *s. lat.*

Ovary 3–8-locular. *Aril* covering only half of testa. *Inflorescences* axillary, supra-axillary or epiphyllous. *Leaves* pseudogemmulate.

Sumatra (?) and Sulawesi eastwards to Solomon Is.

8. Chisocheton schoddei P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 38 t. 5 (1975). Type: Papua New Guinea, Gulf District, junction Kapau & Tauri Rivers, *c.* 180 m, 2 March 1966, *Schodde & Craven* 4605 (LAE, holo!; A, K!).

Pachycaul tree to 12 m; d.b.h. 15 cm. *Bark* brown to greenish grey, rather smooth; *inner bark* creamy white to fawn. *Twigs* 7–8 mm diam., ± terete, pubescent when young, with leaves bunched in apical spirals. *Leaves* to 1·3 m long; *axis c.* 3·5 mm in diam., ± terete; *leaflets* 12–38(–50) cm long, 6·5–14·5(–20) cm wide, though most proximal ones may be much smaller, in up to 10 pairs, about 10 cm apart, with petiolules 5–8 mm long, ovate to oblong, sparsely pubescent adaxially, slightly more so below abaxially, venation prominent abaxially, acuminate, base ± subcordate, costae 8–14 on each side. *Inflorescence* from foliate axils, narrowly paniculate, to 1·2 m long; *axis* ± pubescent, unbranched or with distal branches to 5 cm long; *bracts* about 2 mm long, broadly ovate; *calyx* 5–6·5 mm tall, shallowly cupulate, pubescent outside, margin entire; *petals* (4–)5–6, to 17 mm long, 7 mm wide, alternative, quincuncial or imbricate, ligulate to elliptic, red outside, white to greenish within, ± pubescent except for top and bottom outside and just below anthers within; *anthers* 10–12, *c.* 3 mm long, locellate with ± pubescent connective; *ovary c.* 4 mm wide in female flowers, densely pubescent (4–)5–8-locular; style pubescent for most of its length, occasionally glabrous at apex, stylehead *c.* 1·5 mm diam., capitate. *Infructescence* to 65 cm long; *rachis c.* 4 mm diam., with fruits crowded at apex, red, flattened globose, densely tomentose (4–)6(–8)-merous, with thick creamy pericarp; *seeds* up to 6, with black testa and peripheral orange-red aril covering adaxial half.

Rain forests of southern Papua, to 180 m.

PAPUA NEW GUINEA. Gulf District, *Schodde & Craven* 4605 (type) & Vailala River, *c.* 3 km S. of junction with Lohiki River (LAE!); Central District, 5 km W. of Brown River Bridge, *Mabberley* 1773 (FHO!, K!, LAE!, UPNG!) & Brown River, *Millar & Gebo* 1154 (LAE!, UPNG!) & 1 mile N. of Brown River Bridge, 10 Nov. 1953, *Jackson & McDonald* NGF 4577 (K!, L!, LAE!, first record).

9. Chisocheton tenuis P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 46 t. 7 (1975). Type: Papua New Guinea, Eastern Highlands, Kassam Pass, 1280 m, 15 Jan. 1968, *Coode* NGF 32674 (LAE, holo!; A, BO, BRI, CANB, K, L!, SING).

[*C. pohlianus sensu* Harms in Engl., *Bot. Jahrb.* **72** : 187 (1942), *quoad spec. cit.*, *non* Harms (1917).]

Understorey tree to 8 m, 7·5 cm d.b.h., branches ascending. *Bark* pale fawn; *inner bark* straw. *Twigs* to 4 mm diam. *Leaves* to 30 cm long with up to 7 pairs leaflets; *rachis* 2–3 mm diam., terete, with minute pseudogemmula and inflorescence scars; *leaflets* 7·5–25 cm long, 3·3–9·5 cm wide, obovate to elliptic, weakly acuminate, ± glabrescent except for hairier midrib, costae 6–12 on each side, petiolule (5–)10–23 mm long. *Inflorescence* epiphyllous, to 9 cm long, not or sparsely branched, usually arising near leaflet petiolules; bracteoles to 1·5 mm long; *pedicel* 2–12 mm long; *calyx* 3–4 mm long, cupulate to cylindrical with pseudopedicel *c.* 1 mm long, margin truncate, sometimes ± split at one point, pubescent; *petals* 4, 7·5 mm long, alternative, pinkish, externally ± densely adpressed pubescent; *staminal tube c.* 6·5 mm tall, pubescent within and outside except at top and bottom, margin ± entire; *anthers* 7–8, *c.* 2 mm long, locellate, inserted *c.* 3 mm within tube, connective pubescent; *disk* small; *ovary* pubescent (female flowers unknown); *style* with long ascending hairs except near apex, stylehead *c.* 0·5 mm diam. *Infructescence* of red fusiform fruits to 6 cm long and 2·3 cm diam., 3–4 locular, ± pubescent; *seeds* 3–4, *c.* 18 mm long, ± ellipsoid, with black testa and orange-red aril on inner surface.

Understorey tree in lower montane forest or (W. Sepik) in lowland rain forest to 1700 m in New Guinea.

PAPUA NEW GUINEA. West Sepik, Ossima, 30 m, *Streimann & Kairo* NGF 39260 (L!, LAE!); Morobe, Sattelberg, 1360 m, *Clemens* 3825 (A!, first record) & Yunzaing, *Clemens* 3986 (A!) & Kulungtufu, 1675 m, *Clemens* 6588 (A!); Eastern Highlands, Kassam Pass, 1450 m, *Mabberley* 1765 (FHO!, LAE!).

10. Chisocheton cauliflorus Merr.

In *Philip. J. Sci.* **11** : 188 (1916, 'Chisochiton') & *Enum. Philip. Fl. Pl.* : 366 (1923). Type: Philippines, Samar, Catubig River, 1916, *Ramos* BS 24457 (PNH, holo ?†; A!, BM!, L!).

Treelet to 3 m high, trunk to 4 cm diam., young parts ± fulvous-villous or hirsute. *Leafy* branches glabrous, though fulvescent when young, *c.* 5 mm diam. *Leaves* to 50 cm long with up to 6 pairs leaflets; *petiole* and *rachis* ± conspicuously fulvescent; *leaflets* 10–22 cm long, 4–7 cm wide, oblong or (proximal ones) elliptic and weakly lobed, acuminate, base ± rounded, costae 8–15 on each side, venation ± conspicuously fulvescent abaxially, prominent, petiolules 5–10 mm long. *Inflorescence* narrowly paniculate to 50 cm long, from tubercles on trunk or branches, or axillary; *rachis* 1·5 mm diam., ± prominently fulvous-villose with few few-flowered branchlets to 4 cm; *calyx* 4–5 mm long, cupular to cylindrical, ± densely adpressed fulvescent, margin truncate; *petals* 4, to 18 mm long, pinkish red, spatulate, alternative, ± subvillose outside; *staminal tube c.* 16 mm long, cylindrical, villous outside, glabrous within, margin truncate; *anthers* 8, *c.* 2 mm long, inserted *c.* 1·5 mm within tube, locellate, glabrous; *ovary* densely villous; *style* appressed pubescent except in upper third, stylehead subcapitate. Female flowers and fruits unknown.

Lowland rain forest of S.E. Philippines.

PHILIPPINES. Samar, March-April 1914, *Ramos* BS 17625 (K!, first record) & Catubig River, *Ramos* BS 24519 (K! – photo at FHO!); Mindanao, Surigao, Mt Kabatuan, 470 m, *Mendoza & Convocar* PNH 10495 (L! – photo at FHO!) & Agusan, Asiga River, *Ramos & Convocar* BS 83702 (A!).

The specimens from Mindanao are somewhat less pubescent than those from Samar. *C. warburgii* Harms (see below), described from one specimen (now ? destroyed) collected in Sulawesi, seems to resemble *C. cauliflorus* in several respects, *viz*. pubescence, leaflets, calyx and other details of the flowers, but differs in the extreme length of the axillary inflorescences 'longissimo fere metrali vel ultra (vel breviore?)', shorter petals (10 mm) and tube (6 mm).

11. Chisocheton novobritannicus P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 22, t. 3 (1975). Type: Papua New Guinea, New Britain, Kandrian subdist, nr Akinum, 150 m, 6 Oct. 1965, *Gillison* NGF 22445 (LAE!, holo; L! – photo at FHO!).

Tree to 13 m high, 20 cm d.b.h. *Leafy twigs c.* 6 mm diam., terete, long-villous when young. *Leaves* to 1·25 cm long with up to 11 pairs leaflets; *rachis* 5 mm in diam.; *leaflets* 13–37 cm long, 6·5–15 cm wide, ovate to oblong, adaxial surface subglabrous, or venation ± pubescent, abaxial surface glabrous except on fine venation, acute to acuminate, base rounded, sometimes asymmetrical, costae 10–17 on each side, petiolules to 12 mm. *Inflorescence* axillary, to 80 cm long, narrowly paniculate, twice branched with branches to 2 cm long, patent or reflexed with ± sessile flowers; *calyx* shallowly cupular, 1·5–2 mm deep, pubescent outside, with pseudopedicel 1 mm to margin entire; *petals* 4, *c.* 16 mm long, alternative, white, glabrous outside except sometimes pubescent at apex; *staminal tube c.* 14 mm long, glabrous or with spreading hairs near base within, margin ± entire to very shallowly lobed; *anthers* 8–9, 1·5–2·5 mm long locellate, glabrous; *disk c.* 0·5 mm high, glabrous; *ovary* small (female flowers unknown); *style* densely pubescent in lower half, stylehead *c.* 1 mm diam. *Infructescence* of ± globose fruits, *c.* 3·2 cm diam., 4-locular, sparsely pubescent; *seeds* ellipsoid, *c.* 20 mm long, with aril on inner surface.

Lowland rain forest of New Britain, to 150 m.

PAPUA NEW GUINEA. New Britain, Cape Gloucester, north Aesiga village, *Frodin* NGF 26683 (LAE!) and Richthofen Bay, *Buderus* NGF 24041 (LAE!).

12. Chisocheton montanus P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 18 & t. 2 (1975). Type: Papua New Guinea, Eastern Highlands, Kassam Pass, 1450 m, 22 Jan. 1973, *Foreman & Stevens* LAE 58075 (LAE!, holo; A, BO, BRI, CANB, E!, K!, L!, NSW, SING!).

Understorey tree to 8 m; d.b.h. 24 cm. *Bark* dark brown, darker within, underbark reddish. *Twigs* to 3 mm diam. *Leaves* to 75 cm long; *petiole* and *rachis* to 2·5 cm diam., terete; *leaflets* in up to 13 pairs, petiolule to 6·5 mm long, pubescent, lamina 4·5–30 cm long, 2·7–9·0 cm wide, obovate or elliptic to oblong, the proximal ones often conspicuously smaller than the distal, fulvous-pubescent abaxially and on major venation adaxially, apex ± acuminate, base acute to cuneate, costae *c.* 7–15 on each side, venation weakly prominent abaxially. *Inflorescence* to 18 cm long, weakly scented, paniculate, arising from leafy axils though subtending leaf sometimes undeveloped, velutinous; *axis* unbranched (? female) or with branches to 2·5 cm long (male); *bracts* subulate to 3 mm long; *calyx* cupulate, 3–4 mm long, pubescent without, margin entire; *petals* (3–)4, *c.* 7 mm long, 2 mm wide, creamy yellow, pubescent without; *staminal tube* weakly adnate to corolla, *c.* 6 mm tall, margin ± entire, sericeous without though sometimes glabrous at base, glabrous within though sometimes with a few hairs at base; *anthers* (5–)6, *c.* 1·5 mm long, locellate, inserted *c.* 3 mm in tube, connective glabrous to sparsely hairy; *ovary* 4-locular; *style* to 6 mm long, glabrous or with hairs in lower half. Mature female flowers, fruits and seeds unknown.

Restricted to disturbed lower montane forest (1450–1850 m) in the highlands of eastern New Guinea.

PAPUA NEW GUINEA. Eastern Highlands: Kassam Pass, 1450 m, *Mabberley* 1763 (FHO!) and 1766 (FHO!, K!) and ridge above Aiyura Agricultural Station, 1770 m, *Wheeler* ANU 5562 (L!, LAE!).

13. Chisocheton pohlianus Harms

In *Ber. Deut. Bot. Ges.* **35** : 341, abb. 1 (1917) & in Engl., *Bot. Jahrb.* **72** : 187 (1942, *excl. specim. cit.*) Hutchinson, *Phylogeny of Fl. Pl.* : t. 342 (1969); Stevens in *Contrib. Herb. Aust.* **11** : 28 (1975). Plate 3.

Plate 3 *Chisocheton pohlianus*. Epiphyllous inflorescence near apex of leaf; note pseudogemmula between most distal pair of leaflets (at bottom of plate). Papua New Guinea, Eastern Highlands,

Type: Papua New Guinea (East Sepik), Etappenberg, 850 m, Oct. 1912, *Ledermann* 9337 (B?†, holo). Plate 3.

Understorey tree to 8 m, sparsely branched; d.b.h. 7 cm. *Bark* greyish brown, scarcely cracking, cicatrose; *inner bark* claret. *Twigs* to 4 mm diam. *Leaves* to 2 m long; *petiole* and *rachis* to 3·5(–6·5) mm diam., terete with cicatrices of old inflorescences; *leaflets* in up to 28 pairs, petiolule to 6 mm long, lamina 5–14·5(–22) cm long, 3·2–5·5(–7) cm wide, ovate to lanceolate or elliptic, pubescent on veins adaxially and abaxially where sometimes over whole surface, apex acuminate, base cuneate, costae *c.* 14 on each side, venation weakly sunken adaxially, prominent abaxially. *Inflorescence* to 5 cm long, borne on currently flushing rachis, *Cymbopogon*-scented; *calyx* cupulate, to 3·5 mm long, margin ± entire, sericeous; *petals* (3–)4, to 10 mm long, 2 mm wide, creamy green, sparsely hairy outside; *staminal tube c.* 9 mm tall, margin obscurely lobed, subglabrous or with retrorse hairs within except at top and bottom; *anthers* (4–)6–7, locellate, inserted up to 3 mm within tube; *ovary* 3–4-locular; *style* to 8 mm long, glabrous or with ascending hairs throughout most of its length. *Fruits* subovoid to ellipsoid, to 4 cm long, 2·5 c m wide; *seeds* unknown.

Restricted to lower montane forest (600–1770 m) in the highlands of eastern New Guinea.

PAPUA NEW GUINEA. East Sepik, Wewak-Angoram, *Pullen* 1531 (CANB, L!, LAE!); Western Highlands, Jimi Valley, NGF 38920 (K!, L!, LAE!); Eastern Highlands, 4 miles E. of Korn, NGF 10451 (K!, LAE!) & *Mabberley* 1772 (FHO!, LAE!).

14. Chisocheton lasiocarpus (Miq.) Valeton

In *Bull. Dept. Agr. Ind. Neerl.* **10** : 25 (1907); Steenis in *Blumea* **11** : 132 (1961); Stevens in *Contrib. Herb. Aust.* **11** : 15 (1975). Fig. 1 (4).

Dysoxylum lasiocarpum Miq. in *Ann. Mus. Bot. Lugd.-Bat.* **4** : 13 (1868); C. DC. in DC., *Monog. Phan.* **1** : 527 (1878) & in *Bull. Herb. Boiss.* II, **3** : 168 (1903). Type: Indonesia, Irian Jaya (Digul/Mimika/Fakfak), 1828, *Zippelius s. n.* (L!, holo).

Alliaria lasiocarpa (Miq.) Kuntze, *Rev. Gen.* **1** : 109 (1891).

Chisocheton sp. (Indonesia), Menninger, *Flow. Trees* : t. 228 (1962).

Tree to 33 m, d.b.h. to 60 cm; *trunk* fluted, with small buttresses to 1 m when mature. *Bark* blackish-brown to red, sometimes cracking vertically and flaking; *inner bark* ± red; *wood* pinkish straw to white. *Twigs* (2–)4–9 mm diam. cicatrose, sometimes myrmecophilous.* *Leaves* to 150 cm long; *rachis* 2–4·5 mm diam., terete to ± winged or rarely ± flattened; *leaflets* in up to 11 pairs, petiolules 3–8(–12) mm long, lamina (7–)14–45 cm long, (2·5–)7–23 cm wide, ovate to elliptic or suboblong, base occasionally subcordate, indumentum of adpressed hairs usually rather inconspicuous or puberulous on veins adaxially and/or velutinous abaxially, fine venation slightly raised, especially abaxially. *Inflorescences* axillary or on short shoots in defoliated axials of twigs to 2·5 cm diam., to 60 cm long but usually less, 0–2-branched, sweetly scented; *branches* to 20 cm long; pedicels 0–5 mm long; *pseudopedicel* to 1·5 mm long; *calyx* 2–4 mm tall, margin entire; petals (3–)4–5(–6), *c.* 7–16(–22) mm long, 0·7–4·5 mm wide, white or sometimes flushed pink, or claret, aestivation quincuncial, alternative or rarely imbricate; *staminal tube* a little shorter than petals, to 3 mm wide, pinkish, apex ± entire to shallowly lobed, outside glabrous to sparsely hairy in distal half, with retrorse hairs within from (usually) just below the anthers to the base, very rarely glabrous; *anthers* (3–)5–10(–18), *c.* 1·0–3·0 mm long, locellate, inserted about 2–4 mm within the tube; *ovary* (3–)4–5(–6)-locular; *style* 6–15 mm long, with hairs at least at base. Fruit to 4 cm diam., obovoid to ± spherical, brownish red, hairs dense, sometimes of conspicuously different lengths, pericarp fibrous; *seeds* up to 5, with black testa and red aril surrounding hilum, cotyledons superposed. 2n = 92.

Moluccas (Seram), New Guinea to Solomon Islands. 5–1525 m in primary or secondary forest, riparian or submontane, persisting in logged and grazed-through forest.

This species is broadly conceived (see p. 315). It may be useful for ecological and forestry purposes to recognize the major morphological entities, though there are many intermediates.

**Crematogaster*, *Iridomyrex*, *Campanotus* and *Tapinoma* spp. (Stevens, 1975 : 7).

The following key may be useful, though the very nature of this species denies the possibility of placing every specimen:

Key (after Stevens, 1975)

Leaf rachis prominently ridged or winged, adaxial surface flattened.
- Inflorescence 3·5–12 cm long, flattened, petals 14–22 mm long — (e) **pachyrhachis**
- Inflorescence 8·0-*c*. 45 cm long, ± terete, petals 7·5–12 mm long — (a) **novoguineensis**

Leaf rachis channelled to terete
- Inflorescence to 8(–12) cm long, flowers dense; buds *c*. 4 mm across; indumentum never of long, erect hairs
  - Leaflets with dense ± crisped short hairs on midrib adaxially; anthers *c*. 3 mm long, style with hairs for most of its length — (c) **lasiocarpus**
  - Leaflets with, at most, adpressed hairs adaxially; anthers less than 2 mm long; style ± glabrous — (d) **formicarum**
- Inflorescence usually more than 8 cm long; if less, flowers not dense, or buds *c*. 2 mm across or both
  - Leaflets with erect or crisped hairs at least adaxially on midrib
    - Leaflets without hairs abaxially; flowers always (?) 5-merous — (g) **versteegii**
    - Leaflets with erect hairs abaxially
      - Leaflet base shallowly cordate — (j) **schlechteri**
      - Leaflet base rounded to acute — (i) **trichocladus**
  - Leaflets adaxially with adpressed hairs, often appearing glabrous
    - Leaflets subcoriaceous; inflorescences less than 12 cm long, branches narrowly ascending, few-flowered — (f) **caroli**
    - Not this combination of characters
      - No glabrous zone immediately below the anthers on inside of tube; flowers often 5-merous; calyx erect — (h) **schumannii**
      - Short glabrous zone immediately below anthers inside tube; flowers usually 4-merous; calyx usually ± spreading to suberect
        - Style usually hairy for its entire length; fruit ovoid — (a) **novoguineensis**
        - Style glabrous at apex; fruits spherical — (b) **weinlandii**

(*a*) **novoguineensis**

C. novoguineensis C. DC. in *Bull. Herb. Boiss.* II, **3** : 169 (1903, '*novoguineense*'); Baker f. in *J. Bot., Lond.* **61**, suppl. : 8 (1923); Stevens, *op. cit.* : 25 (1975). Type: Papua New Guinea, Central District, Sogere, *Forbes* (G!, holo '62').

C. forbesii C. DC., *op. cit.* : 168 (1903) & in *Nova Guinea* (Bot.) **8** : 424 (1910); Baker f., *l.c.* (1923). Type: Papua New Guinea, Central District, Sogere, *Forbes* 714 (G!, holo).

[*C. biroi sensu* C. T. White in *Proc. R. Soc. Qd* **34** : 38 (1922), *non* Harms (1905).]

Dasycoleum forbesii Baker f. & Norman in *J. Bot., Lond.* **61**, suppl. : 8 (1923). Types: Papua New Guinea, Central Dist., Mt Wori-Wori, 1500 m, *Forbes* 714 (BM!, G!, syn) & Sogere, 600 m, 21 March 1886, *Forbes* 834 (BM!, K!, syn).

C. myrmecophilus Merr. & Perry in *J. Arnold Arbor.* **21** : 313 (1940). Type: Papua New Guinea Central Dist., Mafulu, 1100 m, Sept.-Nov. 1933, *Brass* 5367 (A, holo; BM! BRI, K!, L!, US).

Central east New Guinea, hill or submontane rain forest (100–)600–1525 m.

PAPUA NEW GUINEA. Morobe Dist., LAE 53857 (L!, LAE!); Central Dist., *Carr* 12156 (A, SING!).

(*b*) **weinlandii**

C. weinlandii Harms in K. Schum. & Lauterb., *Nachtr.* **3** : 283 (1905); Merr. & Perry in *J. Arnold Arbor.* **29** : 157 (1948); Hartley *et al.* in *Lloydia* **36** : 261 (1973); Stevens, *op. cit.* 50 (1975); Johns, *Comm. For. Trees Papua N. Guinea* **5** : 213, (1976). Type; Papua New Guinea, Morobe Dist., Finschhafen, Mar. 1890, *Weinland* 150 (B?†, holo; BRI, L!, SING!).

C. multijugis C. DC. in *Nova Guinea* (Bot.) **8** : 424 (1910). Types: Indonesia, Irian Jaya, (Digul/Mimika) Noord ('Lorentz') Rivier, 8 May 1907, *Versteeg* 1030 (L!, syn) & Sabangkamp, 3 May 1908, *Branderhorst* 315 (K!, L!, U!, syn).

C. multijugis var. *glabrior* C. DC., *l.c.* (1910). Type: Indonesia, Irian Jaya, (Digul/Mimika) Noord ('Lorentz') Rivier, 8 Oct. 1907, *Versteeg* 1903 (K!, L!, U!).

[*C. schumannii sensu* C. DC., *op. cit.* : 424 (1910, *quoad specim. cit.*), *non* C. DC. (1910).]

C. frutescens C. DC., *op. cit.* : 1013 (1914). Type: Indonesia, Irian Jaya, (Digul/Mimika) Noord ('Lorentz') Rivier, 13 Sept. 1909, *Römer* 6 (L!, iso).

C. sp. *aff. schumannii* C. DC.; White in *J. Arnold Arbor.* **10** : 228 (1929).

C. boridianus Harms in Engl., *Bot. Jahrb.* **72** : 180 (1942). Types: Papua New Guinea, Central Dist., Boridi, *c.* 1065 m, 21 Oct. 1935, *Carr* 14658 (B?†, syn; A, CANB, K!, L!) & 1280 m, 18 Nov. 1935, *Carr* 14997 (B?†, syn; BM!, CANB, K!, L!).

C. eurycalyx Harms, *op. cit.* : 182 (1942). Type: Indonesia, Irian Jaya, (Djajapura) Gebiet des Flusses Tor, 10 Oct. 1911, *Gjellerup* 732 (B?†, L!).

Eastern Moluccas, New Guinea and New Britain, in primary and secondary rain forest to 1280 m.

INDONESIA. Seram, Central, Manoesela, *Kornassi* 578 (L!); Irian Jaya, Vogelkop, *Pleyte* 1113 (A, K!, L!, SING!) & Geelvink Bay, BW 1040 (A, LAE!) & Djajapura, BW 2747 (A, LAE!) & Mimika, BW 5155 (A, LAE!) & Digul/Mimika, *Branderhorst* 351 (K!, L!, U!). Cult. ex Irian Jaya, *Rastini* (K!, L!, SING!). PAPUA NEW GUINEA. West Sepik, Varimo, *Streimann* LAE 52942 (A, K!, L!, LAE!); East Sepik, Ambunti, *Hoogland & Craven* 10118 (A, K!, L!, LAE!); Madang, Ramu valley, *Saunders* 401 (A, BM!, K!, LAE!); Morobe, Bulolo, *Mabberley* 1721, 1726, 1733 (all FHO!, LAE!) & Oomsis, *Henty* NGF 14358 (A, K!, L!, LAE!) & Huon Peninsula, *Hoogland* 8905 (A, K!, LAE!) & Markham River, *Hartley* 10954 (A, K!, LAE!); Western, Kiunga, Ok Tedi, *Henty et al.* NGF 42784 (A, K!, LAE!) & D'Albertis Junction, *Millar* NGF 35387 (K!, LAE!, SING!); Gulf, Purari Delta, *Schodde & Craven* 4448 (K!, LAE!); Central, Kairuku, *Darbyshire* 718 (A, K!, LAE!) & Karema, *Schodde* 2528 (A, K!, LAE!) & Cape Rodney, Pullen 8195 (A, K!, LAE), Milne Bay, Gumini River, *Brass* 23849 (A, K!, LAE!, US); New Britain, Rabaul, Powell Harbour, *Foreman* LAE 52156 (K!, LAE!) & Mussau Is., *Køie & Olsen* 1184 (FHO!).

This is a very widespread form, but tends to be difficult to separate from *novoguineensis*, on the one hand, and, on the other, *lasiocarpus*, e.g. *Kornassi* 578 above and *Teijsmann* 6058 (L!) and 6060 (K!, L!) and *formicarum*, e.g. *Pleyte* 1113 above in its western range, as well as *schumannii*, e.g. NGF 6427, 6566 & 7075 (all K!, New Britain) in the east and *trichocladus*, e.g. NGF 35387 above. Such a latter specimen has been named:

C. biroi Harms in K. Schum. & Lauterb., *Nachtr.* **3** : 283 (1905); Stevens, *op. cit.* : 53 (1975). Type: Papua New Guinea, Morobe, Sattelberg, 24 Nov. 1898, 'Oserdöben 20–25 m', *Birö* 18 (B?†, holo; BP!, iso).

(*c*) lasiocarpus

Western New Guinea rain-forest at low altitudes.

INDONESIA. Irian Jaya, Vogelkop, *van Royen* 3439 (A, K!, LAE!) & Digul/Mimika/Fakfak, *Zippelius s. n.* (L!).

(*d*) formicarum

[*C. lamii* Diels ex Lam in *Nat. Tid. Ned. Ind.* **88** : 216 (1928); Perry in *Sargentia* **5** : 59 (1945), *nom. nud., fide* Stevens, *op. cit.* : 52 (1975).]

C. formicarum Harms in Engl., *Bot. Jahrb.* **72** : 182 (1942); Stevens, *op. cit.* : 12 (1975). Types: Indonesia, Irian Jaya, (Djajapura) Mamberano River, Pionersbivak, 10–60 m, 2 July 1920, *Lam* 502 (B?†, syn; L!) & 6 July 1920, *Lam* 573 (B?†, syn; L!).

Lowland rain forest of north-west & central New Guinea.

INDONESIA. Irian Jaya, Vogelkop, *van Royen & Sleumer* 7602 (K!) & Djajapura, *Lam* 502 (L!). PAPUA NEW GUINEA. West Sepik, NGF 13269 (L!).

This entity is very similar indeed to some forms of *pachyrhachis* and is connected to *schumannii* by *Pullen* 1789 (LAE!) from West Sepik.

(*e*) pachyrhachis

C. pachyrhachis Harms in K. Schum. & Lauterb., *Fl. Schutzgeb.* : 382 (1901); C. DC. in *Bull. Herb. Boiss.* II, **3** : 169 (1903); Merr. & Perry in *J. Arnold Arbor.* **21** : 314 (1940); Harms in Engl., *Bot. Jahrb.* **72** : 187 (1942); Stevens. *op. cit.* : 27 (1975). Types: Papua New Guinea, *c.* 700 m (Madang), 22 June 1896, *Kersting* 2408, 2409 and Bismarcke-Gebirge (Madang), 7 June 1899, *Rodatz & Klink* 230 & Sattelberg (Morobe), 27 June 1890, *Lauterbach* 566 (all B?†, syn).

C. gjellerupii Harms, *op. cit.* : 183 (1942). Type: Indonesia, Irian Jaya, (Djajapura) Sawia, 100 m, 20 Aug. 1911, *Gjellerup* 596 (B ?†, holo; L!).

New Guinea, primary rain forest to 1000 m.

INDONESIA. Irian Jaya, Vogelkop, *Kostermans* 2650 (A, L!, SING!) & Djajapura, *Lam* 1201 (L!). PAPUA NEW GUINEA. West Sepik, NGF 3697 (A, FHO!, K!, LAE!, SING!); East Sepik, *Hoogland & Craven* 19627 (K!, LAE!); Madang, NGF 28011 (LAE!); Morobe, *Clemens* 535 (L!).

(*f*) **caroli**

C. caroli Harms, *op. cit.* : 181 (1942); Stevens, *op. cit.* : 9 (1975). Type: Papua New Guinea, (East Sepik) Felsspitze, *c.* 1500 m, 24 Aug. 1913, *Ledermann* 13096 (B ?†, holo; B!).

North-eastern New Guinea, primary rain forest to 1500 m.

PAPUA NEW GUINEA. West Sepik, NGF 3928 (A, FHO!, K!, LAE!).

(*g*) **versteegii**

C. versteegii C. DC. in *Nova Guinea* (Bot.) **8** : 424 (1910); Stevens, *op. cit.* : 49 (1975). Type: Indonesia, Irian Jaya (Digul/Mimika), Noord ('Lorentz') Rivier, nr Geitenkamp, 12 Apr. 1907, *Versteeg* 1423 *p.p.* (K!, L!, iso).

Known only from the type.

(*h*) **schumannii**

Melioschinzia macrophylla K. Schum. in K. Schum. & Hollr., *Fl. Kais. Wilh. Land* : 62 1889); Warb. in Engl., *Bot. Jahrb.* **13** : 343 (1891). Type: Papua New Guinea, 'Augusta Station' (East Sepik), Sept. 1887, *Hollrung* 698 (K!, L!, LE!, iso).

C. macrophyllus (K. Schum.) Harms in Engl. & Prantl, *Nat. Pflanzenfam.* III, **4** : 295 (1896) & in K. Schum. & Lauterb., *Fl. Schutzgeb.* : 381 (1901), *non* King (1895).

C. schumannii C. DC., *op cit.* : 425 (1910), *excl. specim. cit.*; Harms in Engl., *Bot Jahrb.* **72** : 188 (1942); Stevens, *op. cit.* : 40 (1975); Johns, *Comm. For. Trees Papua New Guinea* **5** : 216 (1976). Type as above.

? *C. lauterbachii* Harms in K. Schum. & Lauterb., *Fl. Schutzgeb.* : 382 (1901); C. DC. in *Bull. Herb. Boiss.* II, **3** : 168 (1903). Type: Papua New Guinea, Upper Ramu Valley (Madang), 21 Oct. 1899, *Lauterbach* 3123 (B ?†, holo).

? *C. lamekotensis* Harms in Diels, *Notizbl. Bot. Gard. Mus. Berl.* **10** : 276 (1928); Stevens, *op. cit.* : 53 (1975). Type: Papua New Guinea, New Ireland, Lamekot, Jan. 1926, *Peekel* 1022 (B ?†, holo). *Fide* Stevens, *op. cit.* : 42 (1975).

Northern New Guinea and (?) New Ireland in lowland rain forest. It intergrades with *trichocladus* in the Solomons (see below) and is difficult to distinguish from *weinlandii* when in fruit.

INDONESIA. Irian Jaya, Vogelkop, BW 7086 (SING!) & Djajapura, BW 2747 (K!, LAE!) & Fakfak, BW 12186 (A). PAPUA NEW GUINEA. West Sepik, NGF 46710 (K!, LAE!); East Sepik, NGF 3848 (FHO!, K!, LAE!, SING!); Madang, *Mabberley* 1747 (FHO!, LAE!) & 1754 (FHO!, LAE!); Bougainville, *Kajewski* 1997 (BM!, G!). SOLOMON ISLANDS. Choiseul, BSIP 17461 (K!, LAE!); New Georgia Group, BSIP 6016 (K!, LAE!, SING!) & 5878 (K!, LAE!, SING!, tending to *trichocladus*); Santa Isabel, BSIP 3650 (K!, SING!); Guadalcanal, BSIP 11289 (LAE!, SING!); Malaita, BSIP 3859 (K! LAE!, SING!); San Cristobal, RSS 6107 (K!, L!, LAE!, SING!).

(*i*) **trichocladus**

C. trichocladus Harms in Engl., *Bot. Jahrb.* **72** : 189 (1942); Stevens, *op. cit.* : 48 (1975). Type: Indonesia, Irian Jaya (Djajapura), Middle Tor River, 20 m, 10 Oct. 1911, *Gjellerup* 726 (B ?†, holo; L!).

C. ledermannii Harms, *op. cit.* : 184 (1942); Stevens, *op. cit.* : 53 (1975). Type: Papua New Guinea, (East Sepik) Aprilflusse, 2–400 m, Nov. 1912, *Ledermann* 9661 (B ?†, holo; B!).

Northern New Guinea to the Solomons in primary or secondary rain forest to 150 m.

INDONESIA. Irian Jaya, Vogelkop, BW 6703 (L!, LAE!) & Djajapura, *Gjellerup* 726 (L!). PAPUA NEW GUINEA. West Sepik, NGF 19515 (K!, LAE!, SING!, tending to *weinlandii*); Madang, *Mabberley* 1751 (FHO!, LAE!) & 1753 (FHO!, LAE!); New Britain, NGF 22409 (K!, LAE!, SING!); Bougainville, *Schodde & Craven* 4112 (K!, L!, LAE!). SOLOMON ISLANDS. Choiseul, BSIP 18902 (K!, LAE!).

N.B. This is linked to *schlechteri* by the type of *C. ledermannii* and NGF 45834 of Western District (L!; LAE!), as well as to *schumannii* and *weinlandii* by intermediate forms.

(*j*) **schlechteri**

C. schlechteri Harms, *op. cit.* : 188 (1942); Stevens, *op. cit.* : 37 (1975); Johns, *op. cit.* : 215 (1976). Type: Papua New Guinea (Morobe Dist.), Jaduna, April 1909, *Schlechter* 19238 (B?†, holo).

North-east New Guinea, primary rain forest.

PAPUA NEW GUINEA. Morobe, LAE 52343 (LAE!).

Sayers NGF 21573 (BM!, L!) from Morobe District is a leptocaul treelet less than 3 m high. The flowers are close to those of the more glabrous forms of *Chisocheton weinlandii*, but the inflorescence is 3-branched, the major branches being up to 16 cm long. In some respects it approaches *C. oreophilus* Harms, *op. cit.* : 185 (1942) – types: Papua New Guinea, (East Sepik), Etappenberg, 850 m, 28 Oct. 1912, *Ledermann* 9536, 18 Oct. 1912, *Ledermann* 9370 and 14 Oct. 1912, *Ledermann* 9265 (all B?†) – which probably belongs in the *lasiocarpus* complex – in its small size, but that plant had a smaller calyx and may well have been a form of *C. sayeri*.

15. Chisocheton pilosus C. DC.

In *Nova Guinea* (Bot.) **8** : 423 (1910). Type: Indonesia, Irian Jaya (Digul/Mimika), Noord Rivier near Geitenkamp, 12 July 1907, *Versteeg* 1423 *pro parte* (L!, iso).

C. sayeri var. *pilosus* (C. DC.) P. F. Stevens in *Contrib. Herb. Aust.* **11** : 36 (1975).

Understorey tree to 2·5 m. *Leaves* at least 25 cm long; *rachis* terete; *leaflets* in up to at least 3 pairs, to 26 cm long and 8 cm broad, shortly petiolulate, petiolule to *c.* 5 mm long, lamina oblong-ovate, glabrous adaxially and pilose abaxially, apex (?) acuminate, base cuneate, costae *c.* 13 on each side of midrib. *Inflorescence* axillary to 12 cm long, weakly paniculate; *branches* to 3 cm long, pilose; *bracts* linear, pubescent; *pedicels* very short; *calyx* campanulate, pubescent, margin entire; *petals* 4, *c.* 11·5 mm long, *c.* 1·5 mm wide, puberulous without; *staminal tube* villous within, margin entire; *anthers* 6–8, *c.* 1·5 mm long, alocellate; *ovary* and female flowers unknown; *style c.* 0·25 mm across, pubescent below, stylehead shortly cylindrical. *Infructescence* unknown.

Known only from the type collection.

16. Chisocheton sayeri (C. DC.) P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 32 (1975), *excl.* var. *pilosus.*

Dasycoleum sayeri C. DC. in *Bull. Herb. Boiss.* II, **3** : 170 (1903). Type: Papua New Guinea (Central Dist., Papua), 'Mt Olom', i.e. Mt Obree, 1887, *Sayer* 44 (G!, holo).

[*C. erythrocarpus sensu* Lane-Poole, *Rep. For. Res. Papua New Guinea* : 100 (1925), *non* Hiern (1875).]

C. archboldianus Merr. & Perry in *J. Arn. Arb.* **21** : 312 (1940). Type: Papua New Guinea, Central Dist., Bella Vista, 1450 m, Nov. 1933, *Brass* 5477 (A, holo; BRI (phot. at SING!)).

C. erythranthus Merr. & Perry, *l.c.* (1940). Type: Papua New Guinea, Central Dist., Papua, Kubuna, 100 m, Nov. 1933, *Brass* 5561 (NY, holo; A, BRI, (phot. at SING!)).

[*C. pohlianus sensu* Merr. & Perry, *op. cit.* : 311 (1940), *non* Harms (1917).]

C. acariianthus Harms in Engl. *Bot. Jahrb.* **72** : 180 (1942, '*acariaeanthus*'). Types: Papua New Guinea, Central Dist., Papua, Boridi, *c.* 1350 m, 11 Oct. 1935, *Carr* 14517 (B?†; CANB, K!, L!, SING!, syn) & *c.* 1435 m, 28 Oct. 1935, *Carr* 14757 (B?†; A, CANB, L!, SING!, syn).

C. graciliflorus Harms, *op. cit.* : 183 (1942). Type: Papua New Guinea (Madang Dist.), Bismarck-Gebirges, 1300 m, Nov. 1908, *Schlechter* 18582 (B?†, holo; B!).

? *C. leptopetalus* Harms, *op. cit.* : 184 (1942). Type: Papua New Guinea (Morobe Dist.), 'von Quembung zu Sattelberg', 700–1000 m, 28 March 1936, *Clemens* 2195 (B?†, holo).

[*C. schumannii sensu* Hartley *et al.* in *Lloydia* **36** : 261 (1973), *non* C. DC. (1910).]

Tree or *treelet* to 15 m tall, d.b.h. to 30 cm. *Bark* smooth or shallowly fissured, grey-green; *inner bark* pale brown. *Twigs* to 3·5 mm across. Leaves to 25(–75) cm long; *petiole* and *rachis* to 3·5 mm across, terete; *leaflets* in up to 9(–12) pairs with petiolules to 8 mm long, lamina (5–)7·5–20(43) cm long, (2·5–) 3·5–6·5(–9) cm wide, ovate to narrowly elliptic or lanceolate, subglabrous to velutinous on main veins adaxially and over whole abaxial surface, *c.* 9 costae on each side. *Inflorescences* axillary, to 70 cm long, but usually much shorter, not or 1-branched (female) or 1–2-branched (male), sweetly scented; *branches* to 15 cm, patent or ascending, sometimes with congested flowers; *pedicels* to 2·5 mm long; *calyx* 1–1·5 mm tall, reddish brown, obscurely lobed;

petals (3–)4(–5), 8–10 mm long, 1–1·5 mm wide, alternative to imbricate, pale cream; *staminal tube* to 10 mm tall, margin entire, pubescent without, glabrous to densely hairy within from just below anthers almost to base, white; *anthers* 4–6(–7), 0·7–1·2(–1·5) mm long, locellate or not, glabrous; *ovary* 3–5-locular; *style* to 9·5 mm long, densely hairy in lower two-thirds. *Infructescence* of obovoid to ellipsoid fruits to 2·8 cm long, 2 cm wide, obscurely stipitate, golden brown when young, with fibrous pericarp bearing hairs of conspicuously different lengths: *seeds* 3 with circum-hilar aril, cotyledons collateral or superposed.

Lowland or submontane forest of New Guinea to 1500(–1830) m.

INDONESIA. Irian Jaya, Geelvink Bay, Boemi near Nabire, *Kanehira & Hatusima* 12179 (A!). PAPUA NEW GUINEA. Madang, *Schlechter* 18582 (B!, iso of *C. graciliflorus*); Morobe, Lae, Bumbu, *Womersley* NGF 17609 (K!, LAE!, SING!) & Busu, *Hartley* 11081 (K!, LAE!); Central, Kairuku nr Maipu Airstrip, *Darbyshire* 968 (K!, LAE!, SING!) & Abau, Cape Rodney, *Mabberley* 1788 (FHO!); Milne Bay, *Henty* NGF 16936 (K!, LAE!) & *Streiman & Katik* NGF 34112 (K!, L!, LAE!); Palmer River ?), 100 m, *Brass* 7174 (A!); Normanby Is., Lebudwa River, *Brass* 25607 (A!, K!, LAE!).

17. Chisocheton aenigmaticus Mabberley, **sp. nov.**

(Fig. 4) A *C. celebico* Koorders calyce breviore, minus pubescente, corolla 5-mera, tubo densissime sericeo, antheris longioribus, brevibus piliis foliorum differt.

Arbor ad . . . *Ramulus* floriferus circa 8–14 mm crassus, teres, lenticellatus. *Folium* pseudo-gemmulatum; *rhachis* usque ad 78 cm longa; *foliolis* usque ad 13-jugis, *petiolulus* 3·5 mm longus, *lamina* usque ad 24 × 5·5 cm, elliptico-oblonga, apice aliquantum acuminata, basi obtusa vel subcordata, supra pilis sparsis adpressis in nervatione, infra aliquantum numerosioribus praedita, nervis secundariis usque ad 14-jugis. *Inflorescentiae* ex axillis vel paulum supra axillas foliorum ortae, thyrsoideae, pyramidales, 3-ramosae; *axibus* usque ad 70 cm longis et 6 mm crassis; *ramulus* proximis usque ad 25 cm longis, ascendentibus. *Flores* unisexuales subsessiles; *calyx* 2–2·5 mm longus, circa 3 mm latus, cupulatus, margine integro vel vadose 4–5-lobato, extus pilis brevibus, intus glaber; *corolla* aestivatione quincunciale vel alternativa, *petalis* 5–10 mm × 1·5 mm, angustate spathulatis, plus minusve extus pilis adpressis praeditis, intus glabris; *tubus staminalis*, apice cum vadosis 5-lobulis vel integra, extus pilis longis adpressis praeditus, intus plus minusve villosus, *antheris* 5, circa 2·2 mm longis, infra apicem tubi insertis, locellatis, fere basifixis; *discus* nullus; *ovarium* ?; *stylus* pilis ascendentibus praeditus, *stigma* cylindrico-capitato. *Infructescentia* ignota.

TYPUS: Indonesia, Sumatra, Simalur Is., 1 Oct. 1918, *Achmad* 642 (L!, holo (photo at FHO!); K!).

Known only from Achmad's collections from Simalur Is. Ecology unknown. The specific epithet draws attention to the fact that this isolated tree seems to be allied to the predominantly Papuasian section in which I have placed it. A knowledge of the fruit may suggest that it is better incorporated elsewhere.

INDONESIA. Sumatra, Simalur Is., 7 Dec. 1917, '1918', *Achmad* 117 (L!) & 1 Oct. 1918, *Achmad* 642 (type) & 21 Oct. 1918, *Achmad* 681 (A!, K!, L!).

18. Chisocheton celebicus Koord.

In *Meded. Lands Plant.* **19** : [385 (1895/6) &] 636 (1898, '*celebica*') & *Suppl. Fl. N.O. Celebes* **2** : t. 42 & **3** : 22 (1922). Type: 'Minahassa, 600 m' (Koorders, 1898); Indonesia, Sulawesi, Minahassa, 15 Jan. 1895, *Koorders* 17950β (BO?, lecto? (*cf.* Koorders, 1922); L! (photo at FHO!)).

[*C. glomeratus sensu* Koord. in *Meded, 's Lands Plant.* **19** : 385 (1895/6) & Koord. Schum., *Syst-Verz.* III, Abt. **1** : 63 (1914), *non* Hiern (1875).]

C. sp. A, Koord. Schum., *l.c.* (1914).

Tree form unknown. *Leafy twigs c.* 8 mm diam. *Leaves* to at least 30 cm long, pseudogemmulate; *leaflets* in up to at least 5 pairs, to 32 cm long and 14 cm wide, ovate to elliptic-oblong, fulvous-tomentose on venation adaxially and over whole abaxial surface, apex shortly and gradually acuminate, base rounded, costae in about 19 sub-opposite pairs, midrib sunken adaxially,

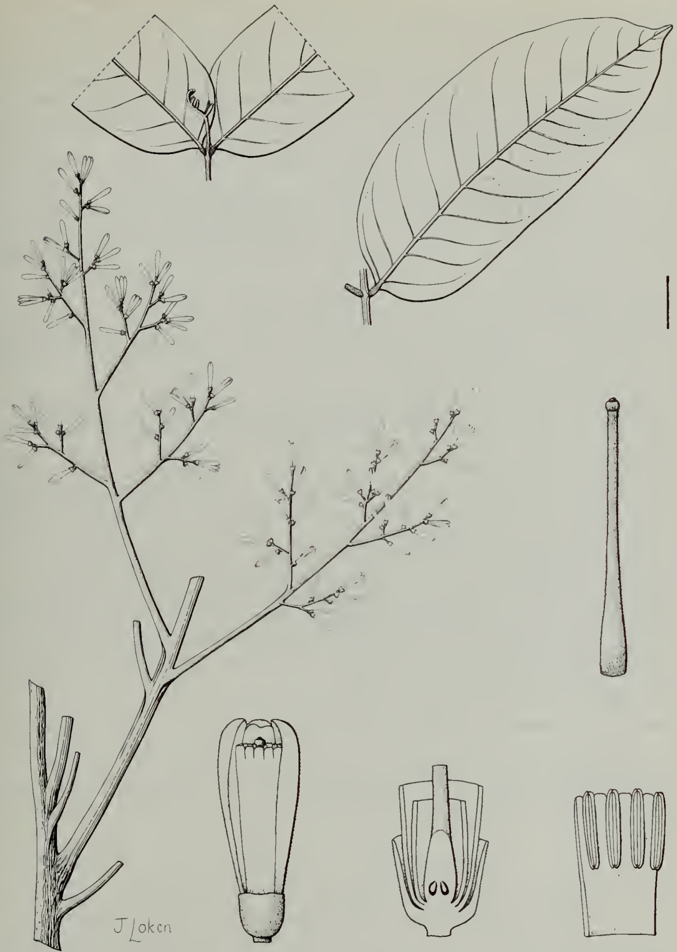

Fig. 4 *Chisocheton aenigmaticus* Mabberley. Leaf apex and lateral leaflet from *Achmad* 642 and inflorescence from Coll. 149 H. Bog. (scale = 2 cm). Flower (scale = 2·5 mm), half flower base, pistil and part tube (scale = 1·25 mm) from latter.

intercostal venation distinct; *petiolules to* 8 mm long; *pseudogemmula* densely long fulvous tomentose. *Inflorescence* supra-axillary, to 85 cm long; *axis c.* 3 mm diam., 2-branched; *branches* to 9 cm long, ± fulvous tomentose; *calyx* tubular, 2·5–3·5 mm long, 2–3 mm wide, long pubescent, margin truncate; *petals* 5, 12–14 mm long, 1·8 mm wide, alternative, narrowly spathulate, glabrous; *staminal tube* densely sericeous without, especially in more distal half up to the anthers, glabrous within or very sparsely villose, margin truncate: *anthers* 6, 1·2–1·5 mm long, narrowly oblong, locellate, glabrous, basifixed, inserted: *disk* conspicuous; *style* terete, long sericeous, style-head cylindrical-capitate. *Infructescence* unknown.

Known only from Koorders's collections from north-east Sulawesi, where it was found from 100 to 700 m.

INDONESIA. Sulawesi, Minahassa, Menado, 500 m, *Koorders* 17948β (K!, L!) & Menado, 200 m, *Koorders* 17958β (K!) & 50 m, *Koorders* 17977β (L!) & 100 m, *Koorders* 17988β* (L!) & 200 m, *Koorders* 17957β (K!) & 500 m, *Koorders* 17975β (L!) & 600 m, *Koorders* 17950β* (L!) & 700 m, *Koorders* 19701β (L!) & 17965β (L!).

19. Chisocheton glirioides P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 13 & t. 1 (1975). Type: Papua New Guinea, Central Dist., Cape Rodney, near P.I.T. (Pacific Islands Trading, currently Australia New Guinea) Sawmill, 60 m, 18 June 1968, *Henty* NGF 38514 (LAE!, holo; A, BISH, BO, BRI, CANB, E!, K!, L!, NSW, PNH, SING! (photo at FHO!), US).

Tree to 21 m; d.b.h. to 25 cm; *outer bark* dark grey to grey-brown; *inner bark* dark straw. *Twigs* to 4·5 mm across. *Leaves* to 35 cm long, pseudogemmulate; *petiole* and *rachis* to 3·5 mm thick, terete; *petiolules* to 6·5(–12·5 mm long); *leaflets* 10–18(–24) cm long, 3·7–7 cm wide, ovate-elliptic, subglabrous with adpressed hairs on the venation, particularly adaxially, apex acute to weakly acuminate, base acute, costae up to 13 on each side of midrib. *Inflorescence* axillary, to 40 cm long, subglabrous, paniculate 1(–? 2) branched; branches to 4 cm long borne on proximal half of axis, patent; *bracts* narrowly triangular, to 1 mm long; *calyx* sessile, *c.* 2 mm long, cupulate, pubescent without, glabrous within, margin entire; *petals* 4, 12 mm long, 1·7 mm wide alternate to imbricate, pubescent without, glabrous within, red; *staminal* tube white, *c.* 11 mm tall, sparsely hairy in the middle on both sides, apex shallowly lobed to entire: *anthers* 6–7, *c.* 1·3 mm long, locellate, inserted about 2·5 mm within tube; *ovary* 3–4-locular, *c.* 2 mm long (male flowers only known); *style c.* 9 mm long, pubescent, stylehead about 0·6 mm in diam. *Infructescence* of dehiscent spherical fruits *c.* 1·5 cm diam., shortly pubescent, with fibrous pericarp; *seeds* unknown.

Lowland rain forest to 240 m in southern Papua.

PAPUA NEW GUINEA. Central Dist., Abau subdist., Mori River, *Henty & Lelean* NGF 41853 (A, LAE!).

20. Chisocheton sapindinus P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 29 & t. 4 (1975). Type: Papua New Guinea, Morobe Dist., Oomsis, 270 m, 23 Oct. 1967, *Kairo & Streimann* NGF 30901 (LAE!, holo; A, BISH, BO, BRI, CANB, K, L!, NSW, PNH, SING, US).

Leptocaul, somewhat weeping, ± riparian *tree* to 10 m, d.b.h. to 10 cm; *outer bark* greyish, smooth or finely fissured, reddish within; *inner bark* straw sometimes unpleasantly scented. *Twigs* to 2 mm diam., weakly hairy when young, glabrous later, cicatrose. *Leaves* to 45 cm long with very small pseudogemmula; *petiole* and *rachis* 1–2 mm diam.; *petiolules* to 10 mm long; *leaflets* in up to 9 pairs, (4–)7·5–15·5 cm long, (2–)3·3–6·3 cm wide, lamina ovate to elliptic, glabrescent, apex acuminate, base cuneate to acute, ± asymmetrical, coriaceous, venation impressed adaxially when fresh, prominent on both sides when dry, costae 5–10 on each side. *Inflorescence* axillary, to 60 cm long but usually much less, 0–2-branched in males, unbranched in females; *branches* to 3 cm long, patent, with scattered flowers, especially distally; *bracts c.* 1 mm long, subulate; *pedicels* to 2 mm long; *calyx* 1·7–2·5 mm tall, often with a slit to 1 mm in margin; *petals* 4, *c.*

*Included in *Cedrela celebica* Koord. by Koord-Schum. (*loc. cit.*)

13·5 mm long, 1 mm wide, though smaller in males, alternative, ligulate, white or pinkish-green, glabrous or with a few hairs apically; *staminal tube* *c.* 13 mm tall, but smaller in males, glabrous, margin weakly lobed; *anthers* 4–6, *c.* 0·7 mm long, locellate, inserted *c.* 1·5 mm within tube, connective glabrous or weakly pubescent; *disk* *c.* 0·3 mm tall; *ovary* *c.* 0·7 mm tall (female), 3–4-locular, densely pubescent; *style* *c.* 8·5 mm tall, pubescent in lower half, stylehead *c.* 0·4 mm in diam. *Infructescence* of red, dehiscent, glabrous fruits to 6·5 mm long, 2·25 cm diam., with 3–4 valves, *seeds* 2–4, ellipsoid to boat-shaped, to 3 cm long, 1·8 cm wide and 1·1 cm thick, with orange-red circumhilar aril and superposed cotyledons.

Very local in primary rain forest to 760 m in eastern New Guinea.

PAPUA NEW GUINEA. Morobe Dist., Oomsis, 150 m, *Mabberley* 1745 (FHO!, K!) & 1746 (FHO!); Central Dist., Ower's Corner, *c.* 675 m, *Hartley* 10760 (A!, LAE!).

(*b*) ser. **Paniculati** Harms

In Engl. & Prantl, *Pflanzenfam.* III, **4** : 295 (1896) & *ibid.*, ed. 2, **19**bI : 151 (1940, 'emend.'). Type: '*C. paniculatus* Hiern', i.e. *C. cumingianus* subsp. *balansae* (Pierre) Mabberley, selected here.
§ *Tetrapetalum* Miq., *Ann. Mus. Bot. Lugd. Bat.* **4** : 26 (1868).
§ *Hexapetalum* Miq., *l.c.* (1868).
§ *Tetrapetali* Harms, *l.c.* (1940).

Leaves pseudogemmulate, or rarely imparipinnate or paripinnate. *Inflorescences* axillary, supra-axillary, cauliflorous, ramiflorous or borne on supra-axillary branches. *Seeds* arillate. *White latex* sometimes present in pith, pericarp, etc. of some species.

21. Chisocheton laosensis Pellegrin

In *Bull. Soc. Bot. Fr.* **91** : 178 (1945) & in Humbert, *Suppl. Fl. Gén. Indo-Chine* : 694 (1946). Type: 'Laos', '*Dusseaud*' (*Dussault*) 85 (P!, holo (photo at FHO!)).

Tree to 20 m, all young parts densely fulvous tomentose. *Leafy twigs* 6–9 mm diam. *Leaves* to 50 cm long, pseudogemmulate; *leaflets* in up to 8 pairs, to 22 cm long and 10 cm wide, elliptic, coriaceous, glabrous adaxially except (usually) on venation, ± tawny pubescent abaxially, apex obtuse and abruptly shortly acuminate, acumen 6–8 mm long, costae *c.* 13 on each side, arcuate, prominent adaxially, intercostal venation conspicuous; *petiolules* *c.* 1 cm long velutinous-fulvous. *Inflorescence* on supra-axillary branches to 90 cm long with reduced caducous leaves, the whole resembling a supra-axillary inflorescence, to 25 cm long, sparsely or unbranched with congested cymules of flowers; *bracts* lanceolate; *calyx* to 3 mm tall, cupular, pubescent without, glabrous within, ± 4-lobed; *petals* 4, 11–14 mm long, 2·5 mm wide, linear-oblong, alternative to imbricate, adpressed pubescent without, drying blackish, glabrous within; *staminal tube* *c.* 11–13 mm high, 7–8 crenulate or lobed, glabrous except for a few hairs in notches of lobes without and towards the base within; *anthers* 6–8, oblong-elliptic, locellate, glabrous, included; *disk* cylindrical, 1 mm tall, glabrous; *ovary* apparently 2-locular; *style* filiform, papillose, pubescent in lower half, stylehead subglobular, glabrous with an equatorial papillose band. *Infructescence* of obovoid dehiscent fruits with 3–4 valves to 3 cm long, 2·5 cm diam., rusty tomentose; *seeds* 1–2, apparently arillate, *c.* 15 mm long.

Rain forest to 600 m in Halmahera (& Seram ?), Moluccas.

INDONESIA. Moluccas, Halmahera, Goal Tugu aër, 125 m, *Pleyte* 230 (A!, K!, L!, SING!) & Gn Sembilan, 600 m, *Pleyte 360* (K!, L!, SING!) & W. Tobelo, *Beguin* 2302 (K!, L!) & Seram, East, Kiandarat ± 60 m, NIFS bb 25930 (L!, immature and possibly *C. lasiocarpus* '*trichocladus*'). 'Pl. du Laos. M. Dussaud [*sic*]. reçu 4 Octobre 1913, No 98' '85' (P!, type).

The type collection is clearly conspecific with the Moluccan gatherings. No other material from Indochina, nor indeed west of Halmahera, has been seen. I conclude that the tag '85', which, according to Dr H. Heine is the only label in Dussault's own hand, is extraneous. How such a transposition of a Moluccan plant to Dussault's collection of 106 specimens which were received from Hanoi (entry in acquisition list of the Laboratorie de Phanérogamie, P, according to Dr Heine) arose is difficult to understand, but may be attributable to a mix-up during the mounting of the material. A similar explanation may account for *Solanum clerodendroides* Hutch. & Dalziel, a species described from 'west Africa' but which in reality came from Madagascar and is, in fact, a synonym of *S. madagascariensis* Dunal (see Heine, 1969). The choice of specific epithet for the *Chisocheton* was unfortunate!

22. Chisocheton ruber Ridley

In *Bull. Misc. Inf. Kew* **1930** : 365 (1930). Type: Malaysia, Sarawak, Padawan, 'Mt Braang', 240 m, 'b.u.d.l.' (4 Nov. 1889), *Haviland* 594 (K!, holo; SAR!, '$\frac{290}{594}$').

Tree to 15 m with fluted bole; d.b.h. to 20 cm. *Bark* smooth to weakly and irregularly flaky, greenish to creamy grey or reddish, with conspicuous inflorescence bosses, sometimes bearing short leafy shoots, arranged ± spirally from ground level to 5 m; *wood* ivory. *Leafy twigs c.* 12–15 mm diam. *Leaves* in terminal spirals, to 1·5 m long, pseudogemmulate, subglabrous; *rachis* ± 3-ribbed; *leaflets* up to 15 pairs, petiolules *c.* 6 mm long, lamina to 42 cm and 10 cm wide, oblong, coriaceous, brilliant carmine when young and appearing in flushes of up to 11 pairs at one time, very sparsely puberulous adaxially, apex acuminate, base asymmetric, subacute, costae about 12–14 on each side, tertiary venation conspicuous below. *Inflorescence* not or once-branched, sweetly scented, arising from bosses which produce inflorescences over several seasons, to 10 cm long; *rachis* pubescent; *pedicels* 1–3 mm long, pubescent, minutely bracteolate; *calyx* ± 4–5-lobed, *c.* 4 mm tall, cupular, rugose, pubescent, red; *petals* 5–6, 20–22 mm long, 4 mm wide at widest, 2·5 mm at narrowest, linear-oblong to spathulate, fleshy distally, pale red, pubescent without, imbricate to quincuncial; *staminal tube* ± adnate to corolla at base, pubescent distally without, villous within, white, 6–8 shallowly lobed, each lobe praemorse or irregularly 2–3-fid; *anthers* 8–10, 2 mm long, oblong, alocellate, yellow, basifixed, sparsely hairy near connective; *disk* obscure; *ovary* conical, appressed pubescent, 5-locular; *style* white, hairy in lower three-quarters or throughout, stylehead to 1·8 mm diam., very shortly cylindrical to subdiscoid. *Infructescence* to 12 cm long, weakly or not branched; *fruits* to 5 cm long, 3 cm diam., top-shaped, reddish, 5-merous with white latex in pericarp: *seeds* unknown.

Restricted to the limestone formations in Sarawak, 1st Divn, 80–250 m.

MALAYSIA. Sarawak, 1st Divn, Bau, *Anderson* in SAR 27889 (FHO!, K!, L!, SAN!, SAR!, SING!) & Padawan, Tiang Bekap, *Mabberley* 1635 (FHO!) & 1637 (FHO!).

23. Chisocheton sarawakanus (C. DC.) Harms

In Engl. & Prantl, *Pflanzenfam.* III, **4** : 296 (1896). Type: Malaysia, Sarawak, 1865–8, *Beccari* 3186 (K!, holo).

Dasycoleum sarawakanum C. DC. in DC., *Monog. Phan.* **1** : 541 (1878).

C. laxiflorus King in *J. As. Soc. Bengal* **64** (2) : 33 (1895) *p. maj. p.*; Ridley, *Fl. Malay Penin.* **1** : 390 (1922); Craib, *Fl. Siam. Enum.* **1** (2) : 253 (1926). Types: Malaysia, Perak, *Scortechini* '219' (CALC!, E!, K!, LE!) & 388 (CALC!), *King's Coll.* 1876 (CALC!), 4348 (CALC!, G!, L!), 5735 (CALC!, CGE!, E!, K!, SING!) & 7783 (BM!, CALC!, K!), [*King's Coll.* 5765 (CALC!, G!, K!, L!, LE!) cited by King is referrable to *C. patens* Bl.].

C. brachyanthus ['*brachyanthum*'] Merr. in *J. As. Soc. Str. Br.* **86** : 315 (1922) & in *Univ. Calif. Publ. Bot.* **15** : 122 (1929); Meijer, *Bot. News Bull. Sabah* **8** : 79 (1967). Type: Malaysia, Sabah, nr Sandakan, Sept.- Dec. 1920, *Ramos* 1252 (PNH?†, holo; A!, K!).

C. spec. A, Meijer, *l.c.* (1967).

[*C. glomeratus sensu* Meijer, *l.c.* (1967), *non* Hiern (1875), i.e. *C. patens*.]

Tree 5–20 m high, fluted below with small buttresses to 2 m tall; d.b.h. to 30 cm. *Bark* fawn to chocolate, smooth to weakly flaking; *inner bark* brownish yellow; *wood* white to pale fawn. *Innovations* ± pale ferruginous pubescent. *Twigs* terete, dark brown, glabrous when leafless, elenticellate, leafy twigs *c.* 5 mm in diam., rarely myrmecophilous. *Leaves* to 2 m long, pseudogemmulate; *rachis* pubescent to ultimately glabrous, brown; *leaflets* in up to 26 pairs, flushing in up to 3 pairs at once, 8–29 cm long, 4–8 cm wide, elliptic to elliptic-oblong, subcoriaceous, shiny and glabrous on both surfaces to ferruginous pubescent abaxially, particularly on veins, and on veins adaxially, apex rather abruptly caudate-acuminate with acumen to 2 cm, base slightly narrowed or rounded, sometimes asymmetrical, costae 10–14 on each side, spreading, depressed adaxially and prominent abaxially when dried; *petiolule c.* 6 mm long, hairy. *Inflorescences* narrowly paniculate to subspiciform, to 50 cm long, supra-axillary, with few primary branches borne perpendicular to axis, with short few-flowered secondary branches, the sweetly scented flowers usually borne in pairs, sessile; *calyx* 2–3 mm tall, *c.* 1·8 mm diam., cupular, truncate to obscurely crenate, glabrous to puberulous outside, glabrous within; *petals* 4, *c.* 12 mm long, 1·8 mm wide, linear, obtuse, slightly concave at apex, white, drying black, puberulous outside, glabrous within; *staminal tube* slightly shorter than petals, cylindric, about 12 mm tall, 1·8–2·00 mm wide, somewhat appressed hirsute in distal part, crenate at apex; *anthers* (3–)4–5–6, 1–2 mm long inserted just below the rim and bearing posteriorly a few ciliate hairs; *disk* 0; *ovary* ovoid, appressed pubescent; *style* pubescent proximally, stylehead subcapitate, *c.* 0·5 mm diam. *Infructescence* with branches to 6 cm with up to 8 fruits on each; *young fruit* densely ferruginous pubescent, obovoid; *mature fruit c.* 4 cm diam., depressed globose, tapering into a short pseudostalk, crimson, pericarp sometimes with white sap; *seeds* 2 with shiny dark brown testa, partly covered in aril.

Malay Peninsula, Bangka and Borneo: 0–250 m.

INDONESIA. Bangka, Sg Lau, *Teijsmann* 386 (K!); Kalimantan, NE. of Bulungan, along Sebaku River, *Kostermans* 9318 (A!, K!, L!, SING!) & Nunukan, *Meijer* 2297 (A!, K!, L!, LAE!, SING!). MALAYSIA, Kedah, nr Kulim, Gg Bongsu F.R., *Pennington* 7835 (FHO!, KEP!, SING!); Kelantan, Ulu Lebir Res., *Suppiah* FRI 17742 (K!, KEP!); Perak, Larut, *King's Coll.* 6864 (K!); Selangor, Kuala Lumpur, Weld Hill, *Hanid* FD 1837 (KEP!, SING!); Johore, K. Tinggi to Mawai, *Corner* SFN 29311 (B!, K!, L!, LAE!, SING!); Sarawak, 1st Divn – Paku, *Haviland* 1601 (K!, SING!) & Matang, 'c.p.g.c.', *Haviland* (K!) & Lundu, Gg Gading, *Chai* S 18476 (A!, FHO!, K!, L!, SAN!, SAR!, SING!) & 3rd Divn – 2½ hr from Kapit, *Pennington* 8013 (FHO!, SAR!) & Baram, Gg Mulu, *Chew* 344 (SING!) & 5th Divn – Ulu Lawas, Kenayu F.R., *Chai & Ilias* S 31542 (FHO!, K!, SAR!, SING!); Sabah, Kota Kinabalu, Gaya Is., *Saikeh* SAN 67192 (K!, SAN!) & Sandakan - Sepilok, *Mabberley* 1646 (FHO!) & Sekong Kechil, *Mabberley* 1716 (FHO!) & Beaufort, Kg Banbangan, *Abau* SAN 66873 (FHO!, K!, L!, SAN!) & Semporna, Mt Pock F.R., *Nordin* SAN 54462 (SAN!) & Lamag, lake below Gg Lotung, *Cockburn* SAN 83010 (FHO!). SINGAPORE. Bt Timah, *Pennington* 8017 (FHO!, KEP!).

Chisocheton brachyanthus was described from a sparsely flowered specimen, which falls within the variable *C. sarawakanus*, the type of which lies within the range of form displayed by the syntypes of *C. laxiflorus*. There is a complete gradation between ± glabrous and hairy forms, such as *C. glomeratus sensu* Meijer in Sabah, as, for example, in Sepilok F.R. These hirsute forms may readily be distinguished from the pubescent forms of *C. patens* in the same area by their prominent leaf venation. However, elsewhere sterile material of these two species is often very difficult to separate.

24. Chisocheton lasiogynus Boerl. & Koord.
In Koord.-Schum. *Syst. Verz.* **2** : 26 (1910). Type: Indonesia, Sumatra, R. Kuantan, nr Mokko-Mokko [Mukomuko], 100 m, 19 Feb. 1891, *Koorders* 10380*β* (?BO).

Treelet to 2 m. *Leafy twigs* 4–5 mm diam. *Leaves* 50–68 cm, imparipinnate, 3-5-jugate, drying pale brown, subglabrous; *leaflets* opposite to subopposite, to 12 cm long and 5 cm wide, oblong to elliptic-ovate, sometimes subcrenulate, apex acuminate with acumen to 17 mm long, base cuneate, costae *c.* 9–10 on each side, venation impressed above, prominent below. *Inflorescence* to 24 cm long, unbranched, bracteate, flowers aggregated near apex; *calyx* 4·5–5·0 mm tall, 4·0–4·5 mm diam., cupular cylindrical, truncate to obscurely lobed, pubescent; *petals* 4–5, 17 mm long, *c.* 3 mm wide, glabrous to sparsely pubescent proximally outside, crimson; *staminal tube* 16 mm tall, slightly expanded at mouth, truncate to weakly crenulate, densely pubescent in distal half, white; *anthers* 5–8, 1·5–2·0 mm long, narrowly oblong to boat-shaped, basifixed, included (base *c.* 3 mm below rim of tube), scarcely locellate, glabrous; *ovary* conical, densely hairy, 3-loculate; *style* terete, sparsely pubescent in proximal half, stylehead subcylindrical, strongly exserted. *Infructescences* ramiflorous, sometimes apparently borne on reduced shoots, with fruits strongly rostrate when immature, crowded at apex; *seeds* unknown.

An apparently rare undergrowth treelet collected less than a dozen times in Sumatra and (?) western Java, but not in the latter since the 1880s.

INDONESIA. Sumatra, Asahan, Aer Moette, 500 m, *Rahmat si Boeea* 9133 (A!, L!) & Lampung, NW. of Kotaagung, 350–450 m, *Jacobs* 8485 (K!, L!). Java, *Junghuhn* '216' (L!) & W. Java ('South-east'), *Forbes* 1383 (A!, BM!).

The specimens collected by Forbes and labelled Sumatra, *viz.* 1319 (CALC!), 1325, 1363 & 1399C (all BM!) do not correspond to the numbers listed in *Flora malesiana* 1, **8** : 34 (1974), where these numbers would appear to refer to Javanese collections. Clearly there is some confusion here, and it is possible that the Forbes's Java specimen and the Junghuhn collection were gathered in Sumatra. *Alston* 14553 (BM!) from Atjeh has rather larger flowers than usual and is more pubescent in all its parts.

25. Chisocheton amabilis (Miq.) C. DC.

In DC., *Monog. Phan.* **1** : 537 (1878); Merr. in *J. Str. Br. Asiat. Soc.* **spec. no.** : 319 (1921). Corner in *Gdns' Bull., Sing.*, suppl. 1 : 198 (1978).

Schizochiton amabile Miq., *Ann. Mus. Bot. Lugd. Bat.* **4** : 26, 27 (1868). Type: Indonesia, Kalimantan, R. Balito, 1836 ('Borneo'), *Korthals s. n.* (L!, U!) – 'along R. Doesoen' (*fide* Miq., *l.c.*).

S. amabile β sumatranum Miq., *op. cit.* : 28 (1868). Type: 'Sumatra', *Korthals s. n.* (L!).

C. illustris Ridley in *Bull. Misc. Inf. Kew* **1930** : 366 (1930). Type: Malaysia, Sarawak, 'nr Kuching', 27 Apr. 1893, *Haviland* 2854 (K!, holo; SAR!).

C. hackenbergii Harms in *Notizbl. Bot. Gart. Berlin* **15** : 476 (1941). Type: Indonesia, Kalimantan, 'Sampit, Urwald', 26 May and 7 July 1923, *Hackenberg* 1 & 1a (B?†).

[*C. brachyanthus sensu* Anderson in *Gard. Bull. Sing.* **20** : 115 (1963), *non* Merr.]

Tree 6–10 m high; *trunk* to 10 cm d.b.h. *Bark* smooth to finely cracked or pustulate, grey-green; *underbark* orange-red to pinkish; *inner bark* cream; *wood* white. *Leafy twigs* 3–7 mm diam.; elenticellate, reddish when dried. *Leaves* 20–95 cm long, pseudogemmulate; *rachis* terete or channelled laterally when dry; *pseudogemmula* fulvous-tomentose; *leaflets* in (4–)7–20 pairs, most proximal 2·2–11·5 cm long, 1·9–4·8 cm wide, regularly elliptic, most distal 7·5–25·5 cm long, 2·4–8·5 cm wide, more or less asymmetrical, elliptic oblong, coriaceous, shiny above, dull below, glabrous on both sides, or midrib brown-tomentose adaxially and/or venation pubescent abaxially, apex long cuspidate, base subequally acute or obtuse, costae 5–14 on each side, ascending, prominulous to prominent abaxially, petiolule 2–5 mm long. *Inflorescences* in axils of youngest leaves, thus occasionally appearing terminal, often supra-axillary, 8–45 cm long, pendent, fragrant; *rachis* glabrous to weakly pubescent, 3–5 mm diam., paniculate and 1–2-branched with pubescent pedicels articulated on slender branchlets *c.* 3–4 mm long arising from first-order branches to 9 cm long in male, unbranched, spiciform and minutely pedunculate with subsessile flowers condensed into short dense cymules mostly at distal end of rachis in females; *calyx* 3–4 mm long, cupular, 4–5-lobed, subglabrous to weakly pubescent, green; *petals* 5–6, 15–25 mm long, 2–3 mm wide, narrowly obovate, white or sometimes also tipped pink, sparsely hairy without or glabrous, drying reddish, alternate or quincuncial; *staminal tube* a little shorter than petals, subcylindrical, 5–7-lobed, subglabrous to villous without especially at base of lobes, villous within especially near base, lobes irregularly 2–3-fid or subentire; *anthers* 8–10, *c.* 1·5 mm long, scarcely locellate, long-pubescent dorsally, included within lobes; *disk c.* 0·5–1 mm high, subtubular, thick; *ovary* in female flowers conical, 4-loculate; *style* pubescent particularly in lower half, stylehead subcylindrical to spherical. *Infructescences* borne on foliate twigs to 8 mm diam.; *fruits c.* 4·0 cm diam., when dried, spherical, long stipitate with stipe 1·7–2·2 cm long, glabrous, pink ripening to bright rose-red, splitting into 3–4 locules, each with one seed, clustered at distal end of rachis in groups of 3–10; *seeds c.* 9 mm long, with chestnut brown testa and half covered in a basal yellow-orange aril.

Peat swamp forest and riparian forest (as at Sg. Sedili, Johore, where it is a common tree) from Sumatra and Malay Peninsula to Borneo, 0–20 m.

INDONESIA. Sumatra, Palembang, ± 20 m, *Grashoff* 808 (L!); Kalimantan, *Korthals s. n.* (L!, U!, type). MALAYSIA. Selangor, Telok F.R., Klang, *Sinclair* SFN 40112 (SING!, ?label & locality confused, '4′ shrub') & Pahang, Kuantan mile 14, Pekan road, *Wyatt Smith* KEP 76583 (KEP!, SING!) & Johore, Sg. Sedili area, *Corner* SFN 21199 (KEP!, SING!); Sarawak, Kuching, *Haviland* 2854 (K!, SAR!, type of

C. illustris) & Rejang, 3rd Divn, *Anderson* 8087 (K!, KEP!, SAR!, SING!) & Baram, 4th Divn, *Anderson* S 2064 (SAR!, SING!). BRUNEI. Belait, Rasau, 5 m, *van Niel* 4335 (L!).

Chisocheton illustris was described from robust, somewhat pubescent, male material whereas *C. amabilis* was designated from a terminal bunch of undeveloped leaves and small inflorescences. All intermediate states are known from Johore material collected by Corner (SFN 21199 (KEP!, SING!), 21199A (SING!), 28568 (L!, LAE!, SING!), 28595 (K!, L!, LAE!, SING!), 28674 (K!, SING!), 28675 (A!, K!, L!, LAE!, SING!) & 32434 (K!, L!, SING!)). Although the type material of *C. hackenbergii* is apparently destroyed, there can be no doubt of its identity with *C. amabilis*. Harms's excellent description of the Sampit specimens exactly fits that of *C. amabilis* from the rest of Borneo, and is well matched by material collected from Sampit district by Kostermans (8026 (L!)), which, incidentally, bears inflorescences on reduced axillary branches as is found in *C. cumingianus*.

26. Chisocheton macrophyllus King

In *J. As. Soc. Bengal* **64** (2): 32 (1895): Koord. & Valeton, *Bijdr. Java* : 106 (1896); Ridley in *J. R. As. Soc. Str. Br.* **33** : 59 (1900); Backer, *Schoolfl. Java* : 208 (1911); Koord., *Excl. Java* **2** : 443 (1912); Koord.-Schum., *Syst. Verz.* I Abt. **1** (140): 27 (1912); Koord. & Val., *Atlas Baum. Java*, t. 166 (1913); Ridley, *Fl. Malay Penin.* **1** : 389 (1922); Backer & Bakh., *Fl. Java* **2** : 12 (1965). Types: Malaysia, Penang, 'Polo Boeting', 150 m, July 1890, *Curtis* 2469 (BM!, CALC!, K!, K [ex SING]!) & Perak, 'Selangor, near the Caves', Feb. 1890 *Curtis* 2327 (SING!) & Singapore, Pulau Ubin, 1893, *Ridley* 4767 (K!, SING!). *Non* (Koord.-Schum.) Harms (1896), i.e. *C. lasiocarpus* (Miq.) Valeton *schumannii*. Fig. 1 (3).
C. sp., Curtis in *J. R. As. Soc. Str. Br.* **25** : 22 (1894, '*Curtis* 2469').
C. kingii Harms in Engl. & Prantl, *Nat. Pflanzenfam.* III, **4** : 295 (1896), *nom. superfl.*

Tree to 35 m with irregular sparsely branched crown and buttresses to 3 m high and 2 m out, tap-rooted, at least when young; d.b.h. to 70 cm; *saplings* unbranched until *c.* 10 m high. *Bark* smooth to weakly cracking when exposing paler inner bark, with lenticels to 1 cm long, greenish brown; *inner bark* midbrown; *sapwood* pale fawn. *Twigs* stout with conspicuous cicatrices and white latex in pith and phloem. *Leaves* crowded in terminal spirals, to 240 cm, pseudogemmulate; *petiole* and *rachis* ± angled or grooved, subglabrous; *leaflets* in up to 28 pairs, to 39 cm long and 11 cm wide, oblong, pinkish when young, shortly acuminate, glossy dark green adaxially, paler abaxially, minutely pubescent on midrib, and also abaxially on veins (densely so in subsp. *fulvescens*), base rounded and asymmetrical, or, particularly in young plants, cuneate, costae 18–25 on each side, spreading, rather prominent adaxially in dried leaf, petiolules to 13 mm long. *Inflorescence* paniculate to 80 cm long, puberulous; branches rather distant, to 12 cm long, ultimate branchlets cymulose, many-flowered, smelling of prunes (Jacobs); *pedicels* pubescent; *calyx c.* 3–4 mm tall, cupular, pubescent, obscurely 4-lobed to entire; *petals* 4–5, to 15 mm long, linear, imbricate, spathulate and concave at apices (corolla clavate in male flowers), puberulous (to pubescent), glabrous within; *staminal tube* weakly adherent to corolla, hirsute along interlobe sutures near apex outside, villous within, mouth wider than tube with 6–8 linear 2–3-toothed lobes to 2·5 mm long; *anthers* 5–8(–9), *c.* 2·5 mm long, oblong, basifixed, locellate, sometimes slightly exserted; *disk* obscure; *ovary* 4-locular, sericeous; *style* sericeous in proximal $\frac{7}{8}$, stylehead cylindrical with apical lobing. *Infructescence* of globular, dehiscent pink-purple capsules to 8 cm diam., pericarp rather hard, laticiferous; *seeds* 4, with dark brown testa partly enclosed in an orange aril.

To 1100 m in lowland rain forest of western Malesia, the northern populations of the Malay Peninsula constituting the pubescent subsp. *fulvescens*.

(*a*) subsp. **macrophyllus**

INDONESIA. Sumatra, '1881–2', ? Upper Musi Region, *Forbes* 2928 (A!); Anamba Is., Siantan, nr Terempak, *Henderson* SFN 20261 (K!, SING!); Java, Banten, Mt Hondje, 75 m, *Kostermans* 19369 (A!, K!) & Garut, 1360 m, FRI Ja. 4647 (L!) & Kediri, Wlingi, ± 200 m, *Koorders* 23020β (FHO!, L!) & Besuki, SE slope of Raung, 550 m, *Jacobs* 4860 (L!) & nr Puger, *Koorders* 5078β (L!); Kalimantan, W. of Samarinda, 60 m, *Kostermans* 6834 (A!). MALAYSIA. Kelantan, S. Betis nr S. Nenggiri, *Henderson* SFN 29718 (K!, L!, SING!); Perak, K. Kangsar, *Rahim* KEP 99818 (SING!); Pahang, 'Raub', FD 20410

(SING!); Selangor, Kepong, *Mabberley* 1546, 1547 & 1553 (all FHO!); Sabah, Ranau, *Pennington* 7934 (FHO!)? & Kinabatangan, Tedong, *Singh* SAN 31087 (K!)? SINGAPORE. Pulau Ubin, *Ridley* 4767 (SING!).

(*b*) subsp. **fulvescens** Mabberley, **subsp. nov.**
A subsp. typico corollis et fructis et foliis fulvo-pubescentibus differt.

TYPUS: Malaysia, Kedah, Bt Perak F.R., south-facing slope, 450 m, disturbed forest, 27 Nov. 1969, *Everett* FRI 13699 (K!, holo; A!, KEP!, L!, SING!).

The geographically separated north-eastern populations in the Malay Peninsula are distinct in their heavy pubescence, but as there are a few intermediate specimens, subspecific rank for this taxon seems appropriate.

THAILAND. Peninsular, Narathiwat, Bacho, *Phusomsaeng* 35 (K!, L!, P!) & Yala, Baw Hin, *Suvarnakoses* 1745 (L!). MALAYSIA. Kedah, Bt Perak F.R., 300 m, *Chan* FRI 13130 (K!, KEP!, L!, SING!) & 450 m, *Chan* FRI 13204 (K!, KEP!, L!) & Baling, Kroh–Baling road, *Yong* KEP 94679 (K!, KEP!) & Bt Enggang F.R., 120 m, *Chan* FRI 13242 (K!, KEP!, SING!); Kelantan, Ulu Sat F.R., *Kochummen* FRI 2946 (K!, KEP!) & Sg. Lebir, 2 miles S K. Sepia, *Cockburn* FRI 7053 (KEP!, L!, SAR!) & Ulu S. Aring nr K. Tapah, *Whitmore* FRI 4495 (K!, KEP!, L!, SING!); Perak, Grik State Land, *Rahim* KEP 95007 (A!, K!, KEP!, L!, SAN!, SING!) & Ulu Perak, K. Tianag, Jeram Benuas, 200 m, *Whitmore* FRI 15813 (KEP!) & Bintang Hijau F.R. 450 m, *Everett* FRI 14522 (A!, K!, KEP!); Pahang, Taman Negara, 150 m, *Whitmore* FRI 15319 (K!, KEP!) & 150 m, *Loh* FRI 17256 (K!, KEP!, SING!) & 200 m, *Kochummen* KEP 77763 (L!, SING!) & 300 m, *Shah & Shukor* MS 2635 (KEP!, SING!); Trengganu, Ulu Brang, 150 m, *Moysey & Kiah* SFN 33752 (SING!).

Intermediate specimens include: MALAYSIA. Selangor, Gombak, *Kochummen* FRI 2048 (A!, K!, KEP!, L!, SAN!, SING!); Pahang, 89 miles Benting River, 480 m, *Quaife* SFN 37393 (SING!) & Ulu S. Trengganu, between K. Biwa and K. Taat, *Cockburn* FRI 10644 (K!, KEP!).

27. Chisocheton dysoxylifolius (Kurz) Hiern
In *Hook*. f., *Fl. Br. India* **1** : 551 (1875); C. DC. in DC., *Monog. Phan.* **1** : 537 (1878); Prain, *Bengal Pl.* **1** : 315 (1903); Brandis, *Ind. Trees*: 139, 703 (1906). Type: Burma, Martaban, Thaungyin ['Thounggyeen'], March 1859, *Brandis* 720 (CALC; K!, photo at FHO!).
Schizochiton dysoxylifolium Kurz in *J. As. Soc. Bengal* **40** : 49 (1871) & **44** : 145 (1875) & *For. Fl. Br. Burma* **1** : 215 (1877). Type as above.

Tree to 28 m high; d.b.h. to 60 cm. *Leafy twigs* 5–8 mm diam., drying blackish. *Leaves* to 1 m long, pseudogemmulate, pseudogemmula pubescent; *leaflets* in up to 10 pairs, to 35 cm long and 11 cm wide, oblong to oblong-lanceolate, very sparsely hairy abaxially to entirely glabrous, apex acuminate, base somewhat asymmetric, cuneate, costae about 12–14 on each side, somewhat ascendant, tertiary venation prominent, petiolule to 8 mm long. *Inflorescence* supra-axillary, paniculate with ± squarrose branching to 2 orders, to 70 cm long; *branches* to 16 cm long (male) or with small subsessile glomerules of flowers, pubescent, bracteate; *bracts* fulvous pubescent, triangular, to 1 mm long; *calyx* 4 mm high, 3·5 mm diam., campanulate, pubescent; 4-toothed, teeth to *c*. 1 mm long; *petals* 4, *c*. 16 mm long, obovate linear, puberulous without; *staminal tube* adnate to corolla at base, appressed yellowish pubescent without, villous within, 6–7-lobed, lobes blunt or weakly toothed, glabrous; *anthers* 6–7, alternating with the lobes, *c*. 1·5 mm long, included, locellate, hairy on connective; *disk* obscure; *ovary* 4-merous, ± appressed pubescent; *style* ± pubescent in lower half. *Infructescence* of spherical to pyriform fruit to *c*. 7 cm diam., densely fulvous tomentose, shortly stipitate and weakly rostate; *rachis* to 5 m; *seeds* unknown.

Lower Burma and Thailand. Rarely collected. *Chisocheton dysoxylifolius* is closely allied to *C. macrophyllus*, but is readily distinguished from that species by its conspicuous bracts, and from the nearest populations of *C. macrophyllus*, i.e. subsp. *fulvescens*, by the subglabrous leaves.

BURMA. *Brandis* 720 (type). THAILAND. Southwestern, Kanchanaburi Dist., Lieuw Long Hill nr Khao Ngi Yai, E. of Sangkhla, *van Beusekom & Phengkhlai* 277 (E!, K! [photo at FHO!], L! [photo at FHO!], P!) & Peninsular, Trang, Khao Chong, 800–900 m, *Phusomsaeng* 170 (L! [photo at FHO!]).

28. Chisocheton cumingianus (C. DC.) Harms
In Engl. & Prantl, *Pflanzenfam.* III, **4** : 296 (1896).
Dasycoleum cumingianum C. DC. in DC., *Monog. Phan.* 1 : 541 (1878). Type: Philippines, Luzon, Albay Prov., 1841, *Cuming* 842 (A!, BM!, G!, K!, L!, LE).

Tree to 37 m tall; *bole* to 14 m d.b.h. to 150 cm; *buttresses* to 3 m tall and 2 m long, or bole fluted to 10 m. *Bark* scaly pale grey-brown; *inner bark* chestnut brown; *blaze* straw. *Cicatrices* conspicuous. *Leafy twigs* 5–7 mm diam., dark brownish black, smooth but conspicuously lenticellate, sometimes with white latex, rarely myrmecophilous. *Innovations* more or less rusty pubescent. Leaves crowded in dense terminal spirals, to 120 cm long, pseudogemmulate; *rachis* and *petiole* 2·5–5·0 mm thick, terete or weakly flattened adaxially; *leaflets* in up to 15 pairs, opposite or subopposite proximally, petiolules (4)–6–12 mm long, glabrescent to tawny tomentose, lamina (6–)10–42 cm long, (2·0–)5·0–14 cm wide, ovate to elliptic, apex shortly cuspidate, base unequally acute, pale abaxially, drying red-brown, papery to coriaceous, glabrescent or hispid pubescent on the costae adaxially or exceptionally softly velutinous (*Lister* 40 (L!)), costae 10–15 on each side, ascending, arcuate, more or less prominent below, fine venation prominulous. *Inflorescence* axillary, supra-axillary, or borne on short shoots (3–8 inflorescences per shoot) on defoliated twigs, branches or bole (Borneo), to 50 cm long, 2–3-branched; branches to 10 cm long, more or less pubescent; *pedicel* to 3·0(–4·0) mm long, with bracteoles 2 mm long, linear; *pseudopedicel* to 1 mm long; *calyx* 1·0–3·0 mm tall, campanulate, puberulous without, margin more or less entire; *petals* (3–)4(–5), 12–20(–25) mm long, 2·5 mm wide, spathulate, acute, pale yellow to white, reddish when dried; *staminal tube* to 18 mm tall, 1 mm wide, lobes, 6–9, entire or 2–3-fid, to 2·5 mm tall, ± glabrous without, ± pubescent within from just below anthers to base; *anthers* 6–9, 1·5–2·2 mm long, locellate, elliptic-oblong, glabrous to villose; *disk* annular, to 0·5 mm tall, glabrous; *ovary* in female (? and hermaphrodite) flowers 3–4-locular, each cell with 1–(2) ovules; *style* to 14 mm pubescent in proximal three-quarters, stylehead disciform to capitate. *Infructescence* a pendulous raceme to 30 cm long of globose to pyriform, glabrous to velutinous, occasionally weakly rostrate fruit to 6·0 × 7·0 cm, orange-red, stipe to 1·5 cm long, pericarp usually with white latex, dehiscent; *seeds* 3–4, reddish brown, arillate, aril orange-red, covering inner edges of blackish brown testa, crenate and sometimes with extension to hilum (see Roxb., *Ic.* 2229 (K!)), cotyledons superposed.

2n = 46, 92.

Used as a fish poison in New Guinea. The wood of Indian specimens has been tested against *chir*. Rain forest from Assam to New Ireland, to 1300 m. Three subspecies are recognized:

Inflorescences axillary to supra-axillary, paniculate ... (*a*) subsp. **balansae** (mainland Asia)
Inflorescences borne on supra-axillary or ramiflorous short shoots, rarely supra-axillary and simple ... (*b*) subsp. **cumingianus** (Philippines eastwards)
Inflorescences cauliflorous ... (*c*) subsp. **kinabaluensis** (Borneo)

(*a*) subsp. **balansae** (C. DC.) Mabberley
In *Taxon* **26** : 528 (1977).
C. balansae C. DC. in *Bull. Herb. Boiss.* **2** : 578 (1894); Pellegrin in Lecomte, *Fl. Gén. Indo-Chine* **1** : 737 + t. 81, fig. 12–15 (1911); Lecomte, *Bois de l'Indoch.* : 134 (1925). Type: Vietnam, Tonkin, Mt Bari, Laubrok Forest, July 1887, *Balansa* 3693 (G!, holo; K!, P!).
[? *Guarea gobara* Buch.-Ham. in *Mem. Wern. Soc.* **6** : 306 (1832), *pro min. p.*; Wall Cat. 4885 *p.p.* (1831–2) *non Dysoxylum gobara* (Buch.-Ham.) Merr.]
G. paniculata Roxb., [*Hort. Beng.* [28] (1814); Juss., *Mém. Mus. Hist. Nat. Paris* **19** : 241 (? 1830), *nom. nud.*] *Fl. Ind.*, ed. 2, **1** : 242 (14 Jan. 1832), Wight, *Ic.* n. 146 (1839, 'Guaria'); Walp., *Rep.* **1** : 435 (1842); *non* Buch.-Ham., *l.c.* (1 Jan. 1832) *nec* Wall., *Cat.* 4882 (1831–2) = *Dysoxylum alliaria* (Buch.-Ham.) Balakr. Type: 'India Orientalis', 1811, *Roxburgh s.n.* (BM!, lecto, selected here).
Dysoxylum multijugum Arnott in Wight & Arnott, *Prodr.* : 121 (1834); Steud., *Nomencl.* ed. 2: 534 (1840); Voigt. *Hort. Sub. Calc.* : 135 (1845); Roemer, *Hesperid.* : 101 (1846); Drury, *Handb. Ind. Fl.* **1** : 168 (1864); *non C. multijugis* C. DC. (1910), i.e. *C. lasiocarpus s.l.* Type as for *G. paniculata* Roxb.
[*D. paniculatum* Arnott ex Wight, *Ic. sub* n. 146 (1839), *nom. in synon.*]
[*Cupania* sp. Wall., Cat. 4884B, i.e. 'Gentea [Jaintia] Hills', Assam, July 1830 (K-W!), (1847).]

Chisocheton paniculatus Hiern in Hook. f., *Fl. Br. Ind.* **1** : 552 (1875), *excl. syn. Sapindus multijugus* Wall. [= ? *Chukrasia*] *et Trichilia longissima* Wall. [= *C. patens* Blume]; C. DC. in DC., *Monog. Phan.* **1** : 531 (1878); Gamble, *Trees, Shrubs Bengal*, ed. 2 : 16 (1896); Prain, *Bengal Pl.* **1** : 315 (1903); Brandis, *Ind. Trees* : 139, 703 (1906); Pellegrin, *op. cit.* : 736 (1911) & supp. : 692 (1946); Cowan & Cowan, *Trees N. Bengal* : 32 (1929); Kanjilal *et al., Fl. Assam.* **1** (2) : 234 (1936); Chun in *Sunyatsenia* **4** : 237 (1940); How & Chen in *Acta Phytotax. Sin.* **4** : 18 (1955). *Nom. superfl.*

Schizochiton paniculatum (Hiern) Kurz in *J. Asiat. Soc. Bengal* **44** : 145 (1875) & *For. Fl. Br. Burma* : 216 (1877).

C. coriaceus Pierre, *Fl. Cochinch.* t. 346A (1896); Pellegr., *op. cit.* : 737 (1911). Type: Vietnam, Saigon & Be Rivers, April 1866, *Pierre* 4302 (P!, holo; BM!, K!, L!, LE!).

C. thorelii Pierre, *op. cit.* : *sub* t. 346 (1896); Pellegrin, *op. cit.* : 740 (1911) & suppl. : 696 (1946). Type: Vietnam, Saigon River, *Pierre* 6318 (P ?).

C. cochinchinensis Pierre, *op. cit.* : t. 356B (1896); Pellegrin, *op. cit.* : 739 (1911). Type: Khmer Republic, Quan Phu Quoc Is., 18 Jan. 1874, *Pierre* 1397a ('1397') (P!, holo).

C. harmandianus Pierre, *op. cit.* : t. 347 (1896); Pellegrin, *op. cit.* : 740 (1911). Type: Laos, 'Bassin d'Attopeu', March 1877, *Harmand* 1228 (P!, holo).

C. chinensis Merr. in *Philipp. J. Sci.* **21** : 497 (1922). Type: China, Kwangtung, Tung Hsing, 24 June 1918, *Ts'oong* 1889 (PNH ?† (photo at A!)).

C. siamensis Craib in *Bull. Misc. Inf. Kew* **1926** : 342 (1926) & *Fl. Siam. Enum.* **1** : 253 (1926); Pellegrin, *op. cit.*, suppl. : 692 (1946). Type: Thailand, Mae Hong Son, 500 m, 28 June 1922, *Kerr* 6171 (K! holo; SING!).

The mainland subspecies with axillary or supra-axillary inflorescences, and usually with rather pubescent leaves. 2n = 46. Assam to southern China and south-eastwards to Vietnam.

CHINA. Kwangsi, Mekon, Seh-Feng Dar Shan S. Nanning, *Ching* 8484 (A!); Kwangtung, E. of Tung Hsing, *Liang* 69470 (A!); Valley of the Mali Kha, Hkamti Plain, 360–420 m, *Kingdon Ward* 12837 (BM!). INDIA. Assam, Garo Hills, Tura, *Chand* 3061 (L!); Rajabhatkhawa, 60 m, *Bistras* (?) 1577 (A!); Khasia Hills, *Griffith* '1063' (A!, K!); Darjeeling, *Cowan s.n.* (E!, K!). BANGLADESH (?). Bengal, Cox's Bazar, *Sinclair* 5741 (E!). BURMA. S. Shan States, 600 m, Keng Tung, *Macgregor* 546 (E!); Hanthawaddi Dist., *Lace* 3059 (E!); Myitkyina, Nammu to Namna, *Lace s.n.* (E!); Myawadi to Kawhereik Hills, *Rock* 928 (US!). LAOS. 'Bassin d'Attopeu', *Harmand* 1228 (P!). KHMER. Quan Phu Quoc Is., *Pierre* 1397a (P!). VIETNAM. Annam, N. of Ninhhoa, *Poilane* 6374 (P!) & Quang Tri, *Poilane* 10829 (P!) & Da Nang ['Tourane'], 300 m, *Poilane* 7843 (P!); Tonkin, Phu-Tho, Cnan Mong, *Fleury* 30107 (P!) & Laocai to Cha Pa, *Petelot* 8663 (A!) & Si Hansi to Hoa Binh, *Petelot* 5833 (A!) & Tay-Ninh, *Thorel s.n.* (K!); Saigon & Be Rivers, *Pierre* 4302 (BM!, K!, L!, LE!, P!). THAILAND. Mae Hong Son, 500 m, *Kerr* 6171 (K!, SING!); N., Chieng Mai, Doi Chiengdao, 100 m, *Bunchuai* 458 (FHO!) & 10 km W. of Fang, *Larsen et al.* 2623 (E!, K!, L!).

Chisocheton balansae was described from Vietnam and seems to differ from Roxburgh's '*C. paniculatus*' in its leathery leaflets, short unbranched inflorescence and pubescent anthers, but there are many intermediate specimens. The types of *C. cochinchinensis*, *C. coriaceus*, *C. harmandianus*, *C. siamensis* and *C. thorelii* (*e descr.*) fall within the range of variation of subsp. *balansae*. Specimens which have been referred to *C. siamensis* are said to differ in their larger leaflets and shorter pedicels, but plenty of intermediate specimens are known.

N.B. The type of *Epicharis juglans* Hance (BM!) includes a leaf of this plant.

(*b*) subsp. **cumingianus**

Dasycoleum cumingianum C. DC., *sensu str.*; Vidal, *Phan. Cuming. Philipp.* : 102 (1885) & *Rev. Pl. Vasc. Philipp.* : 84 (1886); F.-Vill., *Novis. App.* : 42 (1880).

C. cumingianus sensu str.; Merr. in *Philip. J. Sci.* **1**, suppl. : 72 (1906); West & Brown in *Bull. Philip. Dept Agr. For.* **20** : 117 & t. (1920) & **22** : 119 (1921); Merr., *Enum. Phil. Pl.* : 367 (1923); Briquet in *Mém. Inst. Nat. Genev.* **24** : 67 (1935); Elmer, *Leafl. Philip. Bot.* : 3346 (1937).

C. amboinensis Valeton in Hochr., *Pl. Bogor. Exsicc.* : 67 (1904); Briquet, *op. cit.* : 66 (1935). Type: Indonesia, Ambon, *Teijsmann s.n.* (K!).

[*C. benguetensis* Elmer, *Leafl. Philip. Bot.* **9** : 3343 (1937), *nom. non rite publ.* (*anglice*).]

[*Dysoxylum sorsogonense* Elmer, *op. cit.* : 3378 (1937), *nom. non rite publ.* (*anglice*).]

C. morobeanus Harms in Engl., *Bot. Jahrb.* **72** : 185 (1942); Stevens in *Contrib. Herb. Aust.* **11** : 21 (1975); Johns, *Comm. For. Trees Papua New Guinea* **5** : 214 (1976). Type: Papua New Guinea, Morobe Dist., Sattelberg, 1000 m, 23 Jan. 1936, *Clemens* 1687 (B ?†, holo).

?*C. toricelliensis* Harms in *op. cit.* : 188 (1942); Stevens in *op. cit.* : 53 (1975). Type: Papua New Guinea, West Sepik, Torricelli Mts, April 1902, *Schlechter* 14402 (B†, holo).
[*C. cf. pachyrhachis sensu* Hartley *et al.* in *Lloydia* **36** : 261 (1973), *non* Harms (1901).]
C. sp., Lane-Poole, *Rep. For. Res. Terr. Papua New Guinea* : 100 (1925).

Throughout the range of this subspecies there is a distinct trend from axillary inflorescences in the north-west (Philippines) to reduced branches bearing inflorescences on defoliated twigs in the south-east. There are specimens which represent the exception throughout the range, however (see Stevens, 1975), and a similar variation is also to be noted in *C. cauliflorus* Merr. The leaves lack the conspicuous rusty pubescence characteristic of many of the mainland forms. $2n = 92$.
Malesian Islands from Philippines and Sulawesi to New Ireland.

PHILIPPINES. Luzon, Tayabas, Lucbau, *Elmer* 9304 (A!, BM!, E!, G!, LE!); Albay, *Cuming* 842 (A!, BM!, G!, K!, LE!); Sorsogon, Mt Bulusan, *Elmer* 15451 (A!, BM!, G!, K!, U!); Laguna, Mt Maquiling, *Elmer* 18055 (A!, BM!, K!, U!); Catanduanes, *Ramos* BS 30340 (BM!, K!). Leyte, *Wenzel* 1289 (A!, BM!, G!). Mindanao, Benguet, Baguio, *Elmer* 8964 (A!, BM!, K!); San Ramon, Zamboanga, *Williams* 2442 (A!, K!). Basilan, *Vidal* 2329a (K!). Canarines, Saguay, *Ramos* BS22157 (BM!). INDONESIA. Moluccas, Ambon (cult. Java), *Sutrisno* 13 (K!, L!); Ternate, Foramadiahi, 400 m, *Beguin* 1240 (L!); Buru, *de Vriese* 293 (L!). Sulawesi, Malili, 250 m, bb Cel/V-173 (L!). Irian Jaya, Serui, Eil. Japen Manialtu, ± 370 m bb 30364 (L!); Vogelkop, *Kostermans* 2827 (A, *fide* Stevens); Djajapura, Camp Albatross, *Docters van Leeuwen* 11268 (K!, L!, SING!). PAPUA NEW GUINEA. East Sepik, NGF 3812 (LAE! SING!). Madang, Gogol Logging Area, *Mabberley* 1757 (FHO!, LAE!). Morobe, Bulolo, *Pennington* 8084 (FHO!) & Busu nr Lae, *Pennington* 8052 (FHO!) & Gurakor, *Mabberley* 1742 (FHO!, LAE!) & Sankwep, *Stevens & Katik* NGF 58003 (K!, L!, LAE!). Western Highlands, Hagen, *Millar* NGF 37713 (K!, L!, LAE!). Central, Abau, Mori River, *Henty & Lelean* NGF 41896 (K!, L!, LAE!). Northern, Popondetta Dist., *Cavenagh & Pryor* NGF 2056 (K!, L!, LAE!) & Kokoda, *Millar* NGF 23601 (K!, L!, LAE!, SING!). New Britain, Rabaul, Matanakunei, *Ridsdale & Katik* NGF 38001 (K!, LAE!); Kariura R., *Henty* NGF 29406 (K!, L!, LAE!, SING!); Keravat, *Pennington* 8109 (FHO!). New Ireland, NGF 46065 (A, K!, L!, LAE!).

The flowers of the type of *Chisocheton cumingianus* are somewhat larger and borne on somewhat stouter pedicels than, in general, those of the mainland subspecies although specimens approaching the type of subsp. *balansae* may have such flowers; alternatively there are specimens of subsp. *cumingianus* from the Philippines with slender flowers more typical of subsp. *balansae*, e.g. *Vidal* 2330 from Sorsogon. Stevens (1975) drew attention to the close similarity between *C. cumingianus*, *C. amboinensis*, *C. morobeanus* and *C. torricelliensis*. *C. morobeanus* and *C. amboinensis* typically have inflorescences borne on short shoots (see above), whereas this condition is found in trees with axillary inflorescences as well as in 'typical' *C. cumingianus*. Stevens thought that *C. torricelliensis* might be *C. morobeanus* but noted that it has an axillary inflorescence. A recent collection of the latter from Madang (*Mabberley & Katik* 1757) has axillary and ramiflorous inflorescences as do some Philippine specimens such as *Fénix* BS28223 (A!) from Luzon. In the light of this variation, it seems pointless keeping these taxa apart.

(*c*) subsp. **kinabaluensis** (Merr.) Mabberley, **comb. & stat. nov.**
C. kinabaluensis ['*kinabaluense*'] Merr. in *J. Str. Br. Roy. Asiat. Soc.* **86** : 316 (1922). Type: Malaysia, Sabah, Mt Kinabalu, Minitindok Gorge, Nov. 1915, *Clemens* 10116 (PNH!†; A!, iso) & 10490 (PNH ?†; A!, K!, isopara).

Cauliflorous. High-altitude subspecies restricted to the mountains of Sabah.

MALAYSIA. Sabah, Kinabalu, Ulu Liwagu & Ulu Mesilan, 1500 m, *Chew, Corner & Stainton* 2827 (K!, L!, SAN!) & Keningau, Trusmadi, *Saikeh et al.* SAN 74460 (SAN!).

The populations of this tree on Mts Kinabalu and Trusmadi are both vegetatively and florally very similar to *Chisocheton cumingianus*. However, the inflorescences are always borne cauliflorously, often very close to the ground indeed, and I therefore propose that the taxon be maintained at the subspecific level. It is noteworthy that, contrary to general expectation, it is the high-altitude tree which is the truly cauliflorous taxon in this species.

29. Chisocheton patens Blume

Bijdr. : 169 (1825); Schult. & Schult., *Syst.* **7** : 83 (1829) & 1626 (1830); G. Don f., *Gen. Syst.* **1** : 685 (1831); Miq., *Fl. Ind. Bat.* **1** (2) : 537 (1859); C. DC. in DC., *Monog. Phan.* **1** : 529 & t. 7, fig. 5 (1878); Koord., in *Meded. Lands Plant.* **19** : 385 (1898); King in *J. Asiat. Soc. Bengal* **64** (2) : 34 (1895); Ridley in *J. Roy. Asiat. Soc. Str. Br.* **33** : 591 (1900); Koord.-Schum., *Syst. Verz.* III Abt. **1** : 63 (1914). Type: Indonesia, Java, *Blume s.n.* (L!, holo (photo at FHO!); G!, U!).

C. divergens Blume, *l.c.* (1825); Schult. & Schult., *op. cit.*: 83 (1829) & 1627 (1830); G. Don f., *l.c.* (1831); Miq., *l.c.* (1859); C. DC., *op. cit.* : 528 (1878); Curtis in *J. Asiat. Soc. Str. Br.* **25** : 22 (1894); King, *op. cit.* : 35 (1895); Harms in Engl. & Prantl, *Pflanzenfam.* III, **4** : 292 & t. 162, fig. H (1896) & ed. 2, **19**b1 : 139, t. 30, fig. h (1940); Koord. & Val., *Boomfl. Java* **3** : 99 (1896); Brandis, *Ind. Trees* : 139 (1906); Koord.-Schum., *Syst. Verz.* I Abt. **1** (140) : 25 (1912); Backer, *Schoolfl. Java* : 208 (1911); Koord. & Val., *Atlas Baum. Java* : t. 165 (1913); Ridley, *Fl. Malay Penins.* **1** : 390 (1922); Briquet in *Mém. Inst. Nat. Genev.* **24** : 64 (1935); Backer & Bakhuizen, *Fl. Java* **2** : 124 (1965); Pennington & Styles in *Blumea* **22** : 496, t. 12, figs c & d (1975); Corner, *Seeds Dicots* **2** : t. 383 (left) (1976). Type: Indonesia, Java, *Blume s.n.* (L!, ? holo (photo at FHO!); K!, U!).

Schizochiton patens (Blume) Sprengel, *Syst.* **4** : 251 (1827); Walp., *Rep.* **1** : 429 (1842), '*Schizogiton*' in index); Miq., *Ann. Mus. Bot. Lugd.* **4** : 27, 29 (1868); Roemer, *Hesperid.* : 102 (1846).

S. divergens (Blume) Sprengel, *l.c.* (1827); Walp., *l.c.* (1842); Roemer, *l.c.* (1846); Miq., *op. cit.* : 26, 28 (1868).

[*Trichilia longissima* Wall., Cat. 8069, *nom. nud.* (1847).]

[*Cupania* sp., Wall. Cat. *l.c.* (1847).]

[*Schizochiton* ?, Wall. Cat. 9040 (1847).]

S. tetrapetalum Turcz. in *Bull. Soc. Nat. Mosc.* **1** : 411 (1858). Type: Philippines, Luzon, Tayabas Prov., 1841, *Cuming* 822 (CW, ? holo; A!, BM!, CGE!, G!, K!, L!, OXF!).

[*Melia pendula* Reinw. ex Miq., *op. cit.* : 29 (1868), *nom. in synon.*]

[*T. hexandra* Blume ex Miq., *l.c.* (1868), *nom. in synon.*]

Chisocheton fragrans Hiern in Hook. f., *Fl. Br. India* **1** : 551 (1875); C. DC., *op. cit.* : 529 (1878). Type: Malaysia, Malacca, 26 July 1867, *Maingay* '324' (K!, '324', '2459', '1382', holo; A!, BM!, CGE!, L!).

C. glomeratus Hiern, *l.c.* (1875); C. DC., *op. cit.* : 532 (1878); Curtis, *l.c.* (1894); King, *op. cit.* : 30 (1895); Ridley, *op. cit.* : 389 (1922); Briquet, *op. cit.* : 66 (1935). Type: Malaysia, Penang, *Porter* (Wall. Cat. 9040) *s.n.* (K!, holo; A!, BM!, CGE!, G!, K-W!, LE!).

C. holocalyx Hiern, *l.c.* (1875); C. DC., *op. cit.* : 530 (1878). Types: Malaysia, Malacca, 25 Aug. 1865–6, *Maingay* 1124 (K!, '326', syn) & Singapore, October, *Anderson* 30 (K!, syn; E!).

C. vrieseanus C. DC., *op. cit.* : 533 (1878); Koord. & Val., *Bidjr. Boomfl. Java* **3** : 105 (1896). Type: Indonesia, Java, *de Vriese s.n.* (K!, holo).

C. barbatus C. DC., *op. cit.* : 536 (1878). Type: Indonesia, Java, *Blume* (G!, holo; L!).

C. tetrapetalus (Turcz.) C. DC., *op. cit.* : 530 (1878); Merr., *Enum. Phil. Pl.* **2** : 368 (1923); Briquet, *op. cit.* : 65 (1935); Elmer, *Leafl. Phil. Bot.* **9** : 3347 (1937).

C. laxiflorus King, *op. cit.* : 33 (1895), *p. min. p.*, i.e. Syntype: *King's Coll.* 5765 (CALC!, G!, K!, L!, LE!).

C. divergens var. *genuinus* Valeton in Hochr., *Pl. Bogor.* : 68 (1904). Type: Indonesia, Java (BO ?, holo; CALC!, G!, K!, L!, iso.)

C. divergens var. *minor* Valeton, *l.c.* (1904). Type: Indonesia, Java (BO ?, holo; G!, K!, L!, iso).

C. divergens var. *robustus* Valeton, *l.c.* (1904); Craib in *Aberd. Univ. Studies* **57** : 36 (1912); Schmidt in *Bot. Tidskr.* **32** : 328 (1916): Craib, *Fl. Siam. Enum.* **1** : 253 (1926); Pellegr. in Humbert, *Fl. Gén. Indo-ch.*, suppl. (5) : 693 (1946). Type: Thailand, 'Siam' (BO ?, holo; G!, K!, iso).

C. fulvus Merr. in *Philip. J. Sci.* **3** : 146 (1908) & *Enum. Phil. Pl.* **2** : 367 (1923). Types: Philippines, Mindanao, Lake Lanao, Camp Keithley, May 1907, *Clemens* 1046 (PNH ?†), also 554, 583, 1062 and three *s.n.* [? inc. June 1907, G!] (PNH ?†).

C. divergens var. *patens* Ridley, *op. cit.* : 390 (1922).

[*C. urdanetensis* Elmer ex Merrill, *op. cit.* : 368 (1923), *nom. in synon.*]

[*C. apoensis* Elmer ex Merrill, *l.c.* (1923), *nom. in synon.*; Elmer, *op. cit.* : 3341 (1937), *descr. angl.*]

Tree to 35 m, but often flowering when a sapling of 2–3 m; *trunk* to 20 m and 70 cm diam., sometimes fluted and buttressed, with buttresses to 2 m high, 1 m long and 8 cm thick, concave; *bark* pale greenish to black, smooth to faintly cracked, lenticellate the lenticels in horizontal rows (Pennington), inner bark pale to dark brown, wood pale to dirty cream, often smelling of methyl captan. *Young leafy shoots c.* 6 mm diam., deciduously ± tomentose to glabrous, bark dark, cicatrices conspicuous. *Leaves* in terminal bunches, paripinnate or psuedogemmulate to 70 cm long; *rachis* pubescent to glabrous; *leaflets* in up to 14 pairs, 6–28 cm long, 2·5–10·5 cm wide, opposite to subopposite, often maturing all together, thinly coriaceous, often paler below, narrowly oblong to oblong-lanceolate or elliptic-lanceolate, shortly acuminate; base ± unequal, ± rounded and rarely subcordate, largest leaflet with 9–14 veins on each side of midrib, ± prominent abaxially, and sunken adaxially, adaxial surface glabrous or with tomentose midrib and pubescent veins, abaxial surface glabrous to softly tawny-pubescent, midrib and veins tomentose, tertiary venation often conspicuous adaxially; *petiolule* 3–6 mm long. *Inflorescence* paniculate to 89 cm long, pendent, from upper axils or supra-axillary, pyramidal, lowermost branches to 17 cm long, 10 cm in females, tomentose to glabrous, ultimate branchlets dense, cymelike, of white to greenish cream, fragrant flowers, 6–9(–11) mm long, subsessile to shortly pedicellate, minutely bracteolate to bracteolate; *calyx* 2·5–3·0 mm long, cupular to shortly tubular, puberulous, subentire to minutely and irregularly toothed; *petals* 4, 5–10 mm long, subspathulate elliptic, glabrous to glabrescent, *staminal tube* 5–7(–8) mm long, glabrescent or minutely pubescent near mouth without and pubescent tomentellous or very rarely villous within, with (5–)6–8 long linear triangular lobes, sometimes reflexed, a little shorter than anthers; *anthers* (5–)6–7(–8), elongate, basifixed, glabrous, locellate; *ovary* obovoid, pubescent, surrounded by narrow ± lobed fleshy glabrous disk or 0; *style* cylindrical densely short, pubescent to subglabrous, stylehead cylindric to clavate, glabrous. *Fruit* to 5 cm long and 4·5 cm wide, stipitate, glabrous to tomentose (especially when immature), 2-celled, stipe to 2 cm; *seeds* 2, 5–11 mm long, 8 mm wide, scutiform, half covered by an aril.

A common tree of lowland rain forest from southern Thailand, through the wetter parts of Malesia to Sulawesi.

THAILAND. Peninsular, Phuket nr Thalang, *van Beusekom & Phengkhli* 662 (E!, K!, L!, P!). BURMA. Tavoy, *Wallich*, 1836 (Cat. 8069) *s.n.* (K-W!, LE!) & *B* . . . (?) 8213 (CALC!). INDONESIA. Sumatra, Simalur, *Achmad* 947 (U!); Musi Ili. ± 20 m, Bp 1042 (L!); Upper Riauw, Pakanbaru, Tenajan River, 30 m, *Soepadmo* 231 (A!, E!, K!, SING); nr Kajanpu, *Lütjeharms* 5246 (K!); Asahan, Mashi F.R., *Krukoff* 4355 (G!, SING!). Java, SW, Udjong Kulon, 200 m, UNESCO (*Kostermans*) 143 (A!, BM!, K!, KEP!, LAE!, SAN!, SING!). Bangka, Labokbesar, G. Pading, 20 m, *Kostermans & Anta* 1038 (A!, L!). Kalimantan, S. Borneo, Sampit River area, 100 m, *Kostermans* 8127 (K!, L!, SING!); E. Kutei, along Balikpanan, *Kostermans* 10195 (K!, SING!); W. of Samarinda, Loa Djanan River, *Kostermans* 9963 (K!, SING!) Sulawesi, Minahasa, *Koorders* 17949β (L!). MALAYSIA. Kedah, Lankawi, *Chelliah* FRI 6934 (K!, KEP!, SAR!); Perak, Gg Bubu *Selvaraj* FRI 11153 (K!, KEP!) & Jengka F.R., *Whitmore* FRI 6 (K!, KEP!, L!) & Tapah, *Wray* 1279 (BM!, G!); Pahang, Kemasul F.R., *Kochummen* FRI 2579A (L!) & Kuala Lipis, *Somerville* FD 10457 (K!, KEP!) & G. Benom Game Res., *Rahim* KEP 97486 (KEP!, SING!). Penang, 1888, *Curtis s.n.* (K!) & 892 (SING!); Selangor, Kuala Lumpur, Weld Hill, *Hamid* FD 10463 (K!, KEP!); Negri Sembilan, Port Dickson, Sg. Mangole F.R., *Wyatt-Smith* KEP 64782 (KEP!); Malacca, S. Udang F.R., *Sinclair* SFN 40589 (K!, SING!); Johore, Banang F.R., *Kochummen* FRI 2130 (KEP!, L!, SAN!, SING!) & Labis F.R., *Kochummen* FRI 2287 (KEP!, L!) & Endau, *Singh & Samsuri* HS 1039 (SING!, LAE!); Sarawak, Kuching, Semengoh, *Ghezalli* S 13666 (SAR!) & Ulu Kapit, 7th Divn, *Chai* S 33183 (FHO!, K!); Sabah, Kudat, *Shea & Minjulu* SAN 75986 (FHO!) & Sandakan, *Ramos* 1732 (A!) & Mostyn, Madai F.R., *Nordin* SAN 46148 (K!, SAN!) & Lahad Datu, *Cockburn* SAN 71008 (FHO!, SAN!) & Kinabalu East, *Chew, Corner & Stainton* 522 (K!, SAN!, SING!) & Ranau, *Singh & Brand* SAN 24761 (SAN!). SINGAPORE. Mandai Road, *Corner* SFN 36292 (K!, KEP!, SING!). BRUNEI. Seria, Teraja F.R., 350 m, *Hotta* 12947 (SAR!). PHILIPPINES. Luzon, Camarines, *Ramos & Edaño* BS 33871 (BM!) & Laguna, San Antonio, *Ramos* BS 23848 (FHO!) & Bataan, Lamao River, *Barnes* BS 211 (SING!) & Isabela, *Velasco* FB 29043 (K!) & Sorsogon, Mt Juban, *Edaño* PNH 37151 (K!) & Ilocos Norte, Burgos, *Ramos* BS 27340 (A!); Catanduanes, *Ramos & Edaño* BS 75391 (SING!); Babuyames, Camiguin Is., Camiguin Volczno, *Edaño* BS 79163 (SING!); Mindoro, Bongabong River, *Whitford* 1474 (SING!); Bohol, *Ramos* BS 42812 (A!); Surigao, *Wenzel* 3492 (A!, K!); Samar, Catarman, *Sulit* PNH 14344 (A!) & Mt Calbiga, *Sulit* PNH 6403 (A!); Mindanao, Zamboanga Malangos, *Ramos & Edaño* BS 37000 (A!, K!) & Agusan, Mt Urdaneta, *Elmer* 13592 (A!, BM!, G!, K!, U!) & Davao, Mt Apo, *Elmer* 10884 (A!, BM!, G!, K!, L!, U!).

Chisocheton divergens, *C. patens* (Java), *C. fragrans* and *C. holocalyx* (Malay Peninsula) were described from trees with subglabrous narrow leaflets. Material corresponding to these 'species' intergrades, some specimens having paripinnate leaves, others pseudogemmulate, some from trees with strong stercoraceous odour, some apparently without. '*Trichilia longissima*' corresponds to *C. divergens* var. *robustus* (Thailand), which is a large form of *C. vrieseanus*, *C. divergens* var. *minor*, *C. divergens* var. *genuinuus* and *C. barbatus*, which also intergrade. These, especially on herbarium sheets like *King's Coll.* 10750 from Malaysia, cannot be separated from the type of *Schizochiton tetrapetalum* from the Philippines, a plant with more or less glabrous, shiny leaflets. In the Malay Peninsula and Sumatra, intermediates between the 'patens' group and the 'tetrapetalus' group occur (one of which was included in King's circumscription of *C. laxiflorus* = *C. sarawakanus*), and these are often pubescent, e.g. *King's Coll.* 10266, some so much so that they match the material, until now, included in the pubescent *C. glomeratus* described from the Malay Peninsula. Similarly, in the Philippines, *C. tetrapetalus* intergrades into '*C. fulvus*' in the southern part of the country.

I therefore include all the above taxa in *Chisocheton patens*, although on some islands, it may be possible, and useful, to retain distinct micro-taxa. For example, in the Malay Peninsula, most herbarium specimens can be allotted to *C. patens s. str.* or *C. glomeratus* and, in the Philippines, *C. patens s. str.* or *C. fulvus*, but, even so, there are always a number of intermediates. The variation pattern somewhat resembles that recorded for *C. lasiocarpus* (*q.v.*) but is not as intractable as in that perplexing group.

N.B. Chisocheton patens was selected as lectotype species for the genus *Chisocheton* by Airy Shaw (1937) as type of the type section 'Euchisocheton' which thus antedates Harms's selection of *C. divergens* (1940). Koorders (*Bidjr. Baum.*, 1896) wrote that *C. patens* was merely a female form of *C. divergens*, but in *Meded. Lands Plant.* (1898) reduced the latter to a synonym of the former species thus making Ridley's decision to relegate *C. patens* to varietal status of *C. divergens* an error.

Some specimens from Sarawak, particularly from the Semengoh Forest Reserve near Kuching, are curious for their large coriaceous leaflets resembling those of material collected from very large trees in northern and eastern Borneo, except that the venation on the adaxial surface is not pubescent. These specimens come from treelets to 3 m high and deserve further study: *Banyeng & Sibat* S 27053 (FHO!), *Mabberley* 1590 and 1595 (both FHO!). The other trees are different from the main corpus of *Chisocheton patens*, however, and I distinguish them as a new species (*vide infra*).

30. Chisocheton lansiifolius Mabberley, **sp. nov.**

(Fig. 5). A *C. patento* Blume foliolis valde majoribus acuminatis, nervatura foliolorum prominente utrinque, calyce minore, seminibus majoribus differt.

Arbor ad 18 m altus. *Truncus* ad 25 cm diam., interdum striatus et anteribus concavis ad 2 m altis, circa 5 cm latis praeditus; *cortex* fusca, rasilis desquamatave. *Ramuli* umbrini, lenticellati, cicatricosi, foliati circa 0·8 cm diam. *Folia* ad 54 cm longa, paripinnata, ? pseudogemmulata,* foliolis usque ad 5-jugis; *foliola* coriacea, una crescentia, avellanea ubi exsiccata, nervatura prominente utrinque, lamina subglabra usque ad 42·0 × 10·5 cm, oblonga-elliptica vel -ovata, valde acuminata, acumine ad 18 mm longo, nervis secundariis usque ad 10(–14) utrinque, arcuatis. *Inflorescentia* ad 65 cm longa, paniculata; *ramuli* ubi proximi ad 18 cm longi, squarrosi, ramulis sensim fasciculos 1–6 floribus praeditos transientibus, ubi distali minores et ipsi fasciculatos similes transientes; *calyx* circa 1·5 mm longus, cupulatus, rugosus, margine obscure quadrilobata; *corolla* erminea interdum subrosea, petalis, 4, 8–9 mm × 1·5 mm basi connatis, extus leviter pubescentibus, intus glabris; *tubus staminalis* 5·0–5·5 mm longus, apice cum 6 lobulis, circa 2 mm longis, integris, praeditus, intus gossypine pubescens, extus vix; *antherae* 6, circa 2·5 mm longae, inter lobulos insertae, glabrae, vix locellatae; *discus* annularis tumidus; *stylus* 7·5–8·0 mm longus, teres, pilis in tribus quadrantibus proximis praeditus, stigma subcylindrica. *Infructescentia* ad 85 cm longa; *axis* circa 8 mm diam., pendens; *rami* 1–2 fructus ferentes; *capsula* ad 5 cm diam., stipitata, ruber, quadrivalvis, seminibus duobus, scutatis circa 3 cm diam., praedita.

TYPE: Malaysia, Sarawak, 3rd Divn, Balleh, Ulu Mujong, N. Temiai, 'occasionally flooded clay

*Cicatricem pseudogemmulae tantummodo vidi.

Fig. 5 *Chisocheton lansiifolius* Mabberley. Flower to $\frac{1}{12}$ scale; half base flower, tube and pistil to $\frac{1}{64}$ scale.

alluvium, very old secondary forest, *c*. 250 m alt.', 10 March 1964, *P. S. Ashton* S 12141 (K!, holo; A!, FHO!, L!, SAN!, SAR!, SING!; duplicates also deposited BO, KEP, MEL).

Primary and old secondary forest including peat swamp forest to 100 m. Northern and eastern Borneo. First collected by F. H. Endert in 1925.

The specific name refers to the similarity between the leaflets of this species and the leaves of *Lansium* spp. and other *Aglaiaeae*, e.g. *Aglaia oligophylla* Miq. (*Aphanamixis reticulosa* Kost.), noted by collectors.

INDONESIA. Kalimantan, Sangkulirang Dist., G. Medadam, N. of Sangkulirang, 100 m, *Kostermans* 13249 (L!, SING!) & W. Kutai, Kombeng, *c*. 30 m, *Endert* 5127 (L!) & E. Kutei, Sg Susuk region, 10 m, *Kostermans* 5490 (SING!). MALAYSIA. Sarawak, Beram Dist., Tinjar, *Tong* S 34950 (FHO!, SAR!); Sabah, Lamag, River Kinabatangan, *Jaswir* SAN 30737 (K!, L!, SAN!) & Kalumpang, mile 15, Tawau Rd, *Muin Chai* SAN 26978 (K!, SAN!) & Sandakan, Sg Tabing, *Ah Wing* SAN 34971 (SAN!) & Mt Kinabalu, Kinataki stream, *c*. 1000 m, *Carr* SFN 26817 (SING!).

31. Chisocheton granatum Mabberley, **sp. nov.**
(Fig. 6). A *C. sarawakano* Harms nervis secundariis pluribus, ovario 5-mero, capsula majore seminibus exarillatis pluribus, differt.

Arbor ad 12 m altus. *Truncus* ad 8 m altus, 17 cm diam.; *cortex* cinerascens, rasilis desquamatave. *Ramuli* fusci, lenticellati, ubi foliferentes circa 6 mm diam. *Folia* spiris laxis terminalibus portata, ad 120 cm longa, pseudogemmulata, plus minusve pubescentia, foliolis usque ad 12-jugis, pseudogemmula singulariter circinale; *foliola* ad 24 cm × 7·5 cm, oblonga vel oblonga-ovata, abaxiale exsiccata pallentia, apice obtuse acuminato, base cuneata, aliquantum asymmetrica, nervis secundariis usque ad 22 utrinque, vadose arcuatis, marginem fere attingentibus, abaxiale prominentibus. *Inflorescentia* ad 25 cm longa, supra-axillaris, prope axillas foliorum immaturorum orta; *ramuli* proximi ad 6 cm longi (♂) vel glomeruli breves (♀); *calyx* 2·5–3·0 mm longus, campanulatus, pubescens, margine truncato; *corolla* 12–16 mm longa, clavata (♂), erminea, petalis 4, circa 3·5 mm latis, imbricatis, spathulatis-linearibus, extus pubescentibus; *tubus staminalis* 9·0–12·5 mm longus, prope antheras inflatus, extus dimidio distale pubescens, intus glaber, margine obscure lobato truncatove; *antherae* 6, 1·5 mm longae, oblongae, locellatae, glabrae; *discus* obscurus; *ovarium* 5-merum, stylum pilis in tribus quandrantibus proximis praeditum, transiens; *stigma* breviter cylindrica, glabra, apice lobata. *Fructus* ad 9 cm diam., complanato-globosus, suturis quinque praeditus; *pericarpium* glabrum tenax, extus ictericum, intus album, sine latice albo; *semina* 4–5, circa 3 cm longa, scutata (ubi 4) vel formam segmentae hesperidii simulans (ubi 5), cotyledonibus laticiferibus.

TYPUS: Malaysia, Sabah, Mt Kinabalu, 'Dallas, 3000″, 28 Nov. 1931, *Clemens* 27299 (K!, holo (photo at FHO!); A!, B!, BM!, G!).

Hill forest of the Mt Kinabalu area, Borneo.

MALAYSIA. Sabah, Mt Kinabalu, 'Dallas 3000″, *Clemens* 26080 (BM!, K!), 26428 (BM!) & 26814 (K!) & 27015 (A!, BM!, K!) & 'Tenompok 5000″, *Clemens* 30218 (A!) & Ranau, road below hot springs, *Pennington* 7941 (FHO!).

N.B. The specific epithet is a substantive, referring to the superficial resemblance of the fruit to that of *Xylocarpus granatum* Koen. (*Granatum* of Rumpf).

(iii) sect. **Dasycoleum** (Turcz.) Harms
In Engl. & Prantl, *Pflanzenfam.* III, **4** : 296 (1896).
Dasycoleum Turcz. (genus) in *Bull. Soc. Nat. Mosc.* **31** : 414 (1858). Type (obligate lectotype): *D. philippinum* Turcz., i.e. *C. pentandrus* (Blanco) Merr.
§*Holopentas* Miq., *Ann. Mus. Bot. Lugd.* **4** : 27 (1868).

Trees or treelets, pachycaul to slender leptocaul, usually with white latex. *Indumentum* of simple hairs. *Leaves* psuedogemmulate. *Inflorescences* axillary or supra-axillary; *petals* in 1–2 whorls, imbricate to valvate; *tube* lobed or not; anthers glabrous, locellate; *disk* obscure to shallowly cupulate; *ovary* 2–9(–11)-locular. *Fruit* laticiferous; *seeds* sarcotestal.

Twelve species; Indochina throughout Malesia to Papua New Guinea.

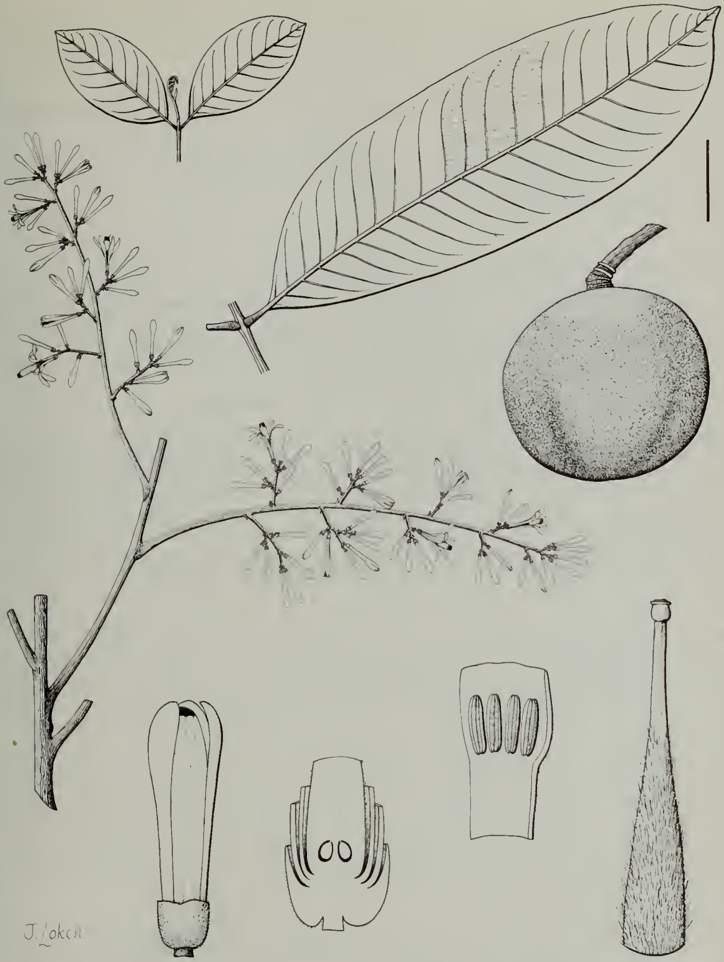

Fig. 6 *Chisocheton granatum* Mabberley. Leaf apex, lateral leaflet and fruit from *Pennington* 7941, inflorescence from *Clemens* 27299–30212 (scale = 3 cm); flower (scale = 5·0 mm), half flower base, part tube and pistil (scale = 2·5 mm) from latter.

Key to series

Corolla enclosing at least one petal, imbricate; tube weakly lobed or unlobed, stylehead discoid or subcapitate (*a*) **Pauciflori**

Petals valvate; tube conspicuously lobed; stylehead capitate (*b*) **Sandoricocarpi**

(*a*) ser. **Pauciflori** Harms

Op. cit.: 295 (1896, in sect. '*Euchisocheton*'), *p.p.*, *non sensu* Harms (1940), i.e. *ser. seq.* Type (selected here): *C. pauciflorus* King.

[§*Grandiflori* Harms, *op. cit.*, ed. 2, **19** (1): 151 (1940, *nom. non rite publ.* (*descr. germ.*))]

Corolla of 1–2 whorls, including at least one petal, imbricate; *tube* weakly lobed; *stylehead* discoid to subcapitate.

Five species from S. Burma to Sulawesi.

32. Chisocheton perakensis (Hemsley) Mabberley, **comb. nov.**

Megaphyllaea perakensis Hemsley in Hook., *Ic. Pl.* 18, t. 1708 (1887); King in *J. As. Soc. Bengal* **64** (2) : 24 (1895); Ridley, *Fl. Malay Penin.* **1** : 386 (1922); Burkill & Henderson in *Gdns' Bull. Str. Sett.* **3** : 356 (1925); Pennington & Styles in *Blumea* **22** : 496, fig. 12e (1975). Type: Malaysia, Perak, Larut, 'Hill Garden', 900 m, 1885, *L. Wray f.* 504 (K!, holo photo at FHO)).

C. annulatus King, *op. cit.* : 31 (1895); Types: Malaysia, Perak, Maxwell's Hill, 900 m, May 1889, *Curtis* 2693 (CALC!, syn; SING!) and *s. loc.*, *Scortechini s.n.* (CALC!, syn).

M. annulata (King) Ridley, *l.c.* (1922); Burkhill & Henderson, *l.c.* (1925).

Pachycaul tree to 15 m high with sparse and somewhat fastigiate branching. *Leafy twigs c.* 1 cm diam., with white exudate. *Leaves* to 2 m long, at least 7-jugate, pseudogemmulate, with compressed petiole and rachis, glabrous to pubescent; *leaflets* to 38 cm long, 10 cm wide, oblong to elliptic-oblong, subcoriaceous, weakly asymmetric, subacute, shortly acuminate, base cuneate, shortly petiolulate, petiolule to 15 mm, *costae* 10–14 on each side, rather oblique, prominent below. *Inflorescences* to 75 cm, supra-axillary, pendent, puberulous, sparsely 1–2-branched (♂) or unbranched (♀); *main rachis* 4-angled, compressed; *lowermost branches* to 12 cm long, few-flowered; *pedicel* 7–10 mm; *flowers* laticiferous, sweetly scented somewhat larger in ♀ infls.; *calyx* clavate, extended into a stout pseudopedicel *c.* 10 mm long below, campanulate to shortly cylindrical above where *c.* 6 mm high, 9 mm diam., puberulous to rusty-tomentose outside, with thickened wavy median band, apex completely enclosing corolla in bud and splitting into *c.* 4 irregularly triangular teeth *c.* 5 mm high; *petals* white adhering to base of staminal tube, in two ranks, 3 outer 14–24 mm × 7–8 mm, oblong-spathulate, rounded, tomentellous without, glabrous within, fleshy, inner (3–)4–7 10–18 mm × 3–5 mm, narrowly oblong-spathulate, glabrous; *staminal tube* 8–16 mm high, 5–7 mm diam., obscurely crenulate or with lobes to 1 mm high, glabrous without, sparsely pilose within below anthers; *anthers* 10–13, *c.* 2·5 mm long, linear-oblong, locellate, glabrous, included *c.* 1 mm inside tube, basifixed, pollenless in ♀; *disk* shallow to obscure, pubescent; *ovary c.* 9 mm tall, 3 mm diam. (♀), or rudimentary (♂), 7–9-locular; *style* terete, pubescent below; *stylehead c.* 1·5 mm across, discoid, glabrous. *Fruit c.* 8 cm diam., flattened-globose, borne singly or in pairs, densely but minutely tomentose; *pericarp* thick, leathery, exuding white latex on cutting; *seeds c.* 2·5 cm long, shaped like the segment of an orange, one per loculus, with vascular sarcotesta and large hilum; *cotyledons* free, superposed.

Restricted to hill-forest, 900–1150m in Maxwell's Hill area, Malaysia.

MALAYSIA. Perak, 'Thaiping Hills', *King's Coll.* 5305 (G!, L!, LE!, SING!), 6317 (G!, K!, L!, SING!) 8320 (L!); *Ridley* 11962 (K!); Larut, 'Hill Garden', *Wray* 504 (K!, holotype) & 504A (K!); Pahang, Maxwell's Hill, 900 m, *Curtis* 2693 (SING!) & mile $5\frac{1}{4}$, *Kochummen* FRI 2876 (K!, KEP!) & *Wray s.n.* (SING!); Ridley 5358 (SING!) above Maxwell's Hill, *Ridley* 11963 (SING!) & Birch's Hill, 1140 m, *Burkill & Haniff* 12985 (K!, KEP!, SING!) & s. loc., *Scortechini s.n.* (SING!).

33. Chisocheton sarasinorum Harms

In *Fedde, Repert.* **42** : 8 (1937). Type: Indonesia, Sulawesi, 'Nördlicher Gebirgsabfall gegen Bada', Sept. 1902, *K. F. & B. P. Sarasin* 2137 (B?†, holo).

Pachycaul treelet to *small tree* 15 m high with open crown. *Bark* smooth, greyish green; *inner bark* pale brown; *wood* pale fawn. *Twigs* rather rough, brown, with vertical lenticels, leafy ones *c.* 8 mm diam. *Leaves* in terminal spirals to 150 cm long, at least 7-jugate, pseudogemmulate, dull above, pale below; *rachis* green, subglabrous to weakly pilose; *petiole* to 20 cm long or more, subglabrous to weakly pilose; *leaflets* petiolulate, petiolule to 15 mm, sometimes pubescent, lamina 10–28 cm long, 3·5–10 cm wide, oblong or oblong-lanceolate, glabrous or subglabrous when sparsely pubescent on the veins, base acute or weakly obtuse, apex acuminate, costae *c.* 15 on each side of main vein, prominent and drying pale below. *Inflorescences* axillary to supra-axillary, narrow to 35 cm long, sparsely branched, lower branches to 14 cm, ascendant, weakly pilose to subglabrous, few-flowered, each with 1–4 white flowers, *c.* 18–22 mm long; *pedicels* short, stout *c.* 2–3 mm long; *calyx* 5–6 mm long, 7–8 mm wide, shallowly cupular, densely tomentose outside, margin truncate to obscurely undulate; *petals* (5–)6 adhering to tube at base, in two ranks, *outer* 3 – 16–20 mm long, 6 mm wide, narrowly oblong, obtuse, *inner* (2–)3 – 14–18 mm long, almost linear, obtuse, apex hooded; *staminal tube* 12–15 mm high, thick, tough, margin truncate to obscurely dentate, glabrous to subglabrous outside, laxly pilose within below; *anthers* 8–10(–11), 2–2·5 mm long, linear, included, basifixed; *ovary* and style-base densely villose; *stylehead* discoid to stoutly cylindrical. *Fruit* to 8 cm diam., 7 cm long, flattened-globose, 6–8-locular, borne singly or in pairs on rachis to 20 cm long, and 8 mm diam.; *pericarp c.* 4 mm thick, tough, greenish-brown velutinous, exuding white latex on cutting; *seed* to 5 cm long, like a segment of an orange, with vascular sarcotesta.

Swampy and hill forest, sometimes disturbed, to 1150 m, north-eastern Borneo and Sulawesi.

INDONESIA. Kalimantan East, nr Teluk Bajur, Berau, *Kostermans* 21585 (SAR!). MALAYSIA. Sabah, Sandakan, Kabili, *Castro* SAN A43 (K!, SING!) & Sepilok, *Meijer* SAN 34298 (SAN!) & *Pennington*, 7910 (FHO!, SAN!) & Lungmanis, 1150 m, *Ah Wing* SAN 29528 (K!, SAN!); Sarawak, 5th Divn Lawas, Bangkor, Kong Khaw area *Chai & Ilias* S31577 (FHO! SAR!).

The Indonesian material is nearer the type in being marginally more pubescent than the material from Sabah.

The leaves closely resemble those of *Chisocheton ceramicus* and sterile material can be easily confused.

34. Chisocheton pauciflorus King

In *J. As. Soc. Beng.* **64** (2) : 27 (1895); Ridley in *J. As. Soc. Str. Br.* **33** : 59 (1900) & *Fl. Malay Penin.* **1** : 387 (1922). Types: Malaysia, Perak, *Scortechini s.n.* (CALC, CGE!, E!, K [ex SING]!), 90–150 m, July 1882, *King's Coll.* 3128 (BM! CALC, K! (photo at FHO!), U!), 30–90 m, Sept. 1882, 3313 (CALC, K! (photo at FHO!)), 3396 (CALC), 150–240 m, Oct. 11882, 3467 (CALC, K! (photo at FHO!)), 150–240 m, June 1883, 4455 (CALC, L!, SING!).

Leptocaul shrub to *small tree* 17 m tall, d.b.h. to 20 cm. *Bark* dark brown to reddish, smooth; *inner bark* red; *wood* white. *Leaf-bearing twigs* about 3 mm diam., puberulous, blackish: when dry. *Leaves* to 38 cm long and 5-jugate, pseudogemmulate; *leaflets* to 25 cm long and 10 cm wide, but usually much smaller, oblanceolate or oblong-lanceolate to elliptic-ovate, adaxial surface glabrous, shining, the abaxial paler, glabrescent, reticulate, puberulous on veins, apex shortly acuminate base cuneate, costae 5–8 on each side of midrib, arcuate and slightly prominent below. *Inflorescences* 2–13 cm long, supra-axillary, puberulous, 1–6-flowered. *Flowers* about 2 cm long, waxy and heavily scented; *pedicel* 6–12 mm, puberulous; *calyx c.* 6 mm long and wide, tubular, fleshy, tomentose on the outside, margin truncate to obscurely 5-lobed, enveloping petals in bud, accrescent in fruit; *petals* (4–)5–6 white, waxy, in two ranks of 3 outer and (1–)2–3 inner, outer *c.* 18 mm long and 6 mm wide, spathulate-elliptic to elliptic, minutely tomentose outside, glabrous within, inner *c.* 17 mm long and 3–5 mm wide, narrowly spathulate-elliptic, glabrous except for longitudinal median band of minute tomentum in those flowers where inner rank is partly exposed through gaps between the outer petals, all blunt and weakly overlapping at apex; *staminal tube* a little shorter than petals, obscurely lobed at apex, glabrous except for sparse pubescence within below anthers; *anthers* (4–)8–10, *c.* 1·5 mm long, narrowly elliptic to linear, weakly locellate, basifixed, included below lobes, glabrous; *disk* small, flat, tomentose; *ovary* and *style* pubescent except for glabrous band below the discoid to shortly cylindrical stylehead. *Fruit* elliptic rostrate, tomentose with persistent and sometimes accrescent calyx when young, spherical and at least 1 cm diam., when mature; *seeds* unknown.

Primary forest to 550 m, west and south of Malay Peninsula, formerly (?) occurring in Singapore.

MALAYSIA. Kedah, Gn. Busong, *Loh* FRI 6886 (K!, KEP!, L!, SING!) & 6974 (K!, KEP!, SING!); Perak, Larut, *King's Coll.* 2876 (BM!, G!, K!), 3128 (K!, U!), 3313 (K!), 3467 (K!), 4455 (SING!), 11067 (K!); Pahang, Jerantut, *Holttum* SFN 24755 (SING!); Selangor, Ulu Gombak, *Ahmad* KEP 99006 (K!, KEP!, SING!), Kajang, *Symington* KEP 24124 (SING!); Malacca, Bt. Seggeh F.R., *Kiah* SFN 37220 (A!, K!, KEP!, LAE!, SING!); Johore, Kulai, *Corner* SFN 29959 (K!, LAE!, SING!) Labis F.R., Ulu Endau, *Ogata* KEP 110338 (KEP!, L!).

35. Chisocheton diversifolius Miq.
Fl. Ind. Bat., supp. **1** : 196, 504 (1861, 'diversifolium'); C. DC. in DC., *Monog. Phan.* **1** : 538 (1878). Type: Indonesia, Sumatra, nr Lubualang, *Teijsmann s.n.* (U!, holo (photo at FHO!)).
Schizochiton diversifolium (Miq.) Miq., *Ann. Mus. Bot.* **4** : 27, 31 (1868).

Leptocaul (?) *shrubby tree. Twigs c.* 4 mm diam. *Leaves* to 47 cm long; *petiole* weakly pubescent; *leaflets* in up to 9 pairs, alternate to subopposite proximally, opposite distally, petiolulate, to 15 cm long and 4 cm wide, oblong-lanceolate, apex acuminate, base acute, costae about 12 on each side. *Inflorescence* a panicle of cymes with very short distal branches and sessile distal cymules, *pedicel* densely pubescent; 3–5 mm high, densely pubescent, obconical to campanulate, margin entire; *petals* 4–5, 8 mm long, 3 mm wide, spathulate-linear, two often narrower than the others, imbricate, white; *staminal tube* 5–6-dentate, teeth retuse, glabrous to very sparsely pubescent without; *anthers* 5–6, 2 mm long, linear, locellate, glabrous, included; *ovary* pubescent; *style* hirtellous, stylehead capitate to subdiscoid. *Fruit* unknown.

INDONESIA. Sumatra, *sine loc.*, *Korthals s.n.* (A!, L! (Herb. Lugd. Bat. 908132–749, 908132–778 & 908132–788), LE!, U!).

It is remarkable that this tree has not been collected again. The leaves may be confused with those of *Chisocheton pentandrus* subsp. *paucijugus*, but those have larger and fewer leaflets.

36. Chisocheton grandiflorus (Kurz) Hiern
In Hook. f., *Fl. Br. India* **1** : 552 (1875); C. DC. in DC., *Monog. Phan.* **1** : 534 (1878); *Andamans & Nicobar Gaz.* April 1900 (1900); Kloss, *Andamans & Nicobars* : 336 (1903); Brandis, *Ind. Trees* : 139 (1906); Parkinson, *For. Fl. Andamans* : 119 (1923). Lectotype (selected here): Burma, Tenasserim, Tavoy, 22 Oct. 1827, *Gomez* '355' [Wall. Cat. 1271] (K-W!; BM! ['Tavoy' (photo at FHO!)], LE! ['Tavoy']).
[*Plagiotaxis grandiflora* Wall., *Cat.* 1271 (1829), *nom. nud.*; [Wall. ex] W. & A., *Prodr.* **1** : 123 (1834), *in obs.*, *nom. in synon.*]
[*Dysoxylum grandiflorum* Arnott ex Steud., *Nomencl.*, ed. 2 : 534 (1840), *nom. nud.*: M. J. Roem., *Hesperid.* : 101, 135 (1846), *nom. nud.*]
[*Epicharis* sp., Kurz, *Rep. Veg. Andam.*, ed. 1 : iv (1867).]
[*Chisogeton grandiflorum* Wall. ex Kurz, *op. cit.*, ed. 2 : 33 (1870), *nom. nud.*]
[*Diplotaxis grandiflora* Wall. ex Kurz, *l.c.*, *sphalm.*, *nom. in synon.*]
Schizochiton grandiflorum Kurz in *J. As. Soc. Bengal* **41** : 296 (1872) & in *op. cit.* **44** : 145 (1875) & *For. Fl. Burma* **1** : 216 (1877).
[*Chisocheton grandifolius* Lace, *List Trees Burma* : 26 (1914), *sphalm.*]

Tree to 13 m high. *Twigs c.* 6 mm diam., tawny-velutinous. *Leaves* to at least 55 cm long, pseudogemmulate; *rachis* terete, tawny pubescent; *leaflets* in up to at least 6 pairs, shortly petiolulate to 5 mm, to 24 cm long, 8 cm wide, narrowly oblong-elliptical, apex acute to subacuminate, base weakly asymmetrical, tawny pubescent abaxially, costae to 18 on each side, arcuate, ascending, weakly sunken adaxially, prominent abaxially. *Inflorescence* to at least 32 cm long, sparsely branched, pendent ± supra-axillary; *rachis* 2·5 mm diam., densely tawny velutinous, with flowers rather crowded at apex; proximal *bracts* to 3 mm long; *pedicel* and *pseudopedicel* ± absent; *calyx* 5–6·5 mm tall, cupuliform, ± 4–5-toothed or entire, densely fulvescent-tomentose without, margin ciliate; *petals* 5–6, 12–14 mm long, *c.* 4 mm wide, linear spathulate, alternative, inner 1–2 *c.* 12·5 mm long, 2·5 mm wide, all densely pubescent without; *staminal tube* crenulate or weakly 6–7-lobed, thick and fleshy lobes truncate, pilose without except most proximally, glabrous within; *anthers* 6–8, 3–4 mm long, glabrous, locellate; *disk* cupuliform, adnate to ovary, glabrous; *style* adpressed pubescent, stylehead 1 mm diam., subcapitate. *Fruit* 'large apple-like' (Rock), '3-lobed pyriform, 3-valved' (Hiern) [*non vidi*].

Known only from the following collections.

BURMA. Tavoy, *Gomez* '355' (type). THAILAND. 'Between Ban Doi, Chang Doi & Ban Mai Kit (Chang Sen Luang)', 18 Jan. 1922, *Rock* 1867 (A!).

Despite Kurz's and Parkinson's reports, I have not seen any specimens from the Andamans.

Though providing a description and suggesting that Wallich's unpublished *Plagiotaxis grandiflora* probably belongs to *Dysoxylum*, Wight & Arnott, *Prodr.* (1834), did not take up *Dysoxylum grandiflorum*, the name which was used by Steudel and Roemer but without reference to Wight & Arnott.

37. Chisocheton mendozai Hildebr.

In van Steenis in *Philip. J. Sci.* **91** : 509 (1963). Type as below.

Amoora fulva Merr. in *Philip. J. Sci., Bot.* **11** : 187 (1916), *Enum. Phil. Fl. Pl.* **2** : 370 (1923), *non C. fulvus* Merr., i.e. *C. patens* Blume Type: Philippines, Samar, Catubig River, Pinipisakan, 21 March 1916, *Ramos* Bur. Sci. 24497 (PNH ?†; BM!, K!, L!, SING!).

Tree c. 9 m high; d.b.h. 25 cm. *Twigs c.* 9 mm diam. *Leaves* to at least 20 cm long with large densely tomentose pseudogemmula; *leaflets* in up to at least 3 pairs to 20 cm long and 9 cm wide, elliptic, apex acuminate, petiolulate, bright rusty-tomentose when expanding, costae up to 12 on each side, tertiary venation very conspicuous. *Inflorescence* to 40 cm long, strongly supra-axillary, twice branched; *branches* to 6 cm long, fulvous; *calyx c.* 3·5 mm tall, obscurely lobed to praemorse, cupulate; *petals* 5, *c.* 18 mm long, oblong-spathulate, 3 valvate, 1 ± enclosed, 1 enclosed, sericeous without, glabrous within, fleshy; *staminal tube* with five lobes 3 mm long, entire, pilose without to half-way up teeth, pubescent within to just below anthers; *anthers* 5, locellate, *c.* 3 mm long, narrowly oblong, sub-basally attached to tube; *ovary* and *style* hairy to just below sub-cylindrical stylehead, 1 mm diam. *Fruit* unknown.

Known only from Samar.

PHILIPPINES. Samar, Catubig River, *Ramos* 24497 (type) & Oquendo, Mt Mahagna, 27 April 1951, *Sulit* (4293) PNH 14459 (A!, BM!, K!, L!).

(*b*) ser. **Sandoricocarpi** Harms ex Mabberley, **ser. nov.**

Harms in Engl. & Prantl, *Nat. Pflanzenfam.*, ed. 2, **19**b1 : 153 (1940), *sine descr. latin.*

§*Pauciflori sensu* Harms, *op. cit.* : 151 (1940), *non* Harms (1896).

§*Dasycolei* Harms, *op. cit.* : 153 (1940).

A ser. *Paucifloris* corolla valvata, tubo staminalis lobato differt. Type: *C. sandoricocarpus* Koord. & Valeton, i.e. *C. ceramicus* (Miq.) C. DC.

Seven species from Indochina through Malesia to New Britain.

38. Chisocheton vindictae Mabberley, **sp. nov.**

(Fig. 7.) A ceteribus speciebus ser. *Sandoricocarporum*, inflorescentia longa, calyce magno, differt.

Arbor . . . Ramuli foliati circa 12 mm diam. *Folia* ad 51 cm longa, ? pseudogemmulata; *foliola* ad 21 cm × 7·5 cm, elliptico-ovata, subglabra pilis sparsissimis praedita, apice breviter abrupteque acuminata, base cuneata, petiolulo 5–7 mm longo, costa adaxiale depressa, nervis secundariis circa 11 utrinque, ascendentibus, abaxiale prominentibus. *Inflorescentia* circa 105 cm longa, thyrsiformis, pendens, pauciramosa; *rami* ad 11 cm longi (proxissimi), subsquarrosi, pauciflori vel uniflori (distissimi); *rhachis* circa 4·5 mm diam., teres, subglaber; (? *pseudo-pedicellus* circa 4 mm × 4 mm; *flores* (feminei solum cogniti) 2 cm longi; *calyx* 4·5 mm longus, 6·5 mm diam.,

Fig. 7 *Chisocheton vindictae* Mabberley. From *Pringgo Atmodjo* 428: leaf apex, lateral leaflet and inflorescence (scale = 2 cm), flower (scale = 5·0 mm), half flower base, pistil and part tube (scale = 2·5 mm).

vadosissime cupulatus, extus plus minusve pubescens, margine integro vel obscure lobato; *petala* 6, 18 mm longa, naviculiformia, carnosa, valvata, extus pubescentia; *tubus staminalis* circa 12 mm longus, 7 lobis, circa 1·5 mm longis, truncatis vel parum bilobatis praeditus, intus extusve dense pubescens, sed lobis sparsissime pubescentibus; *antherae* 7, 3 mm longae, apice basive parum bilobatae, prope basifixae, glabrae, locellatae; *discus* 2 mm altus, stipitatus; *pistillum* 8 mm longum, ovario 11-porcato, dense pubescente, stylo subglabro, terete, stigma 1·5 mm diam., breviter cylindrico-subdiscoidea, glabra, mammilla apicale praedita. *Fructus* ignotus.

TYPE: Indonesia, Sumatra, Atjeh, 'Alaslanden (Lawé, Kingo)', i.e. Bambel area (*fide Fl. malesiana* I, **1** : 417), 17 June 1904, *Pringgo Atmodjo* 428 'coll. 83' (L!, holo (photo at FHO!)).

Only known from the type material* collected on Lt. Col. G. C. E. van Daalen's punitive expedition to northern Sumatra, commemorated in the specific epithet.

39. Chisocheton ceramicus (Miq.) C. DC.

In DC., *Monog. Phan.* **1** : 533 (1878); Stevens in *Contrib. Herb. Aust.* **11** : 9 (1975); Johns, *Comm. For. Trees Papua New Guinea* 5 : 210, 217 (1976). Type as below.

Schizochiton ceramicum Miq., *Ann. Mus. Bot. Lugd. Bat.* **4** : 27, 29 (1868). Type: Indonesia, Seram, 'Teysmann et de Vriese'. Sheet labelled Teysmann at U!, ?holo; CALC! & L!.

S. spectabile Miq., *ll. cc.* (1868). Type: Indonesia, Kalimantan, River Doessen area, *Korthals* (U!, ? holo; L! '121').

C. spectabilis (Miq.) C. DC., *op. cit.* : 539 (1878); Merr. in *J. Str. Br. R. Asiat. Soc.* **spec. no** : 320 (1921); Meijer in *Bot. News Bull. Sabah* **8** : 78 (1967).

S. junghuhnii Miq., *op. cit.* : 27, 30 (1868). Type: Indonesia, Sumatra, Upper Angkola, *Junghuhn* (U!, ? holo; L!).

C. junghuhnii (Miq.) C. DC., *op. cit.* : 533 (1878).

C. macrothyrsus King in *J. Asiat. Soc. Bengal* **64** (2) : 33 (1895); Koord. & Val., *Atlas Baumg. Java*, t. 166 (1913); Ridley, *Fl. Malay Penin.* **1** : 389 (1922); Burkill & Henderson in *Gdns' Bull. Str. Sett.* **3** : 356 (1925). Types: '*Scortechini* [Maxwell's Hill, 900 m, *s.n.* (CALC!, ? syn; BM!, K!), '314' (G!), '433' (G!)], *Wray* [3289 & *s.n.* (both CALC!), ? syn], *King's Coll.* [2634 (CALC!, ? syn; G!) & 3187 (G!, K!)]'.

C. sandoricocarpus Koord. & Valeton in *Meded. Lands Plant.* **16** : 111 (1896); Backer, *Schoolfl. Java* : 209 (1911); Koord., *Exc. Fl. Java* **2** : 443 (1912); Koord.-Schum., *Syst. Verz.* I Abt. **1** (140) : 29 (1912); Backer & Bakh., *Fl. Java* **2** : 124 (1965); Corner, *Seeds Dicots.* **2** : t. 383 (right) (1976). Types: according to specimens preserved at L(!), description based on the following *Koorders* Java collections (BO, ? syn): 4887*β* (also K!), 4998*β*, 6020*β* (also K!), 28674*β* & 28985*β*.

? *C. globosus* Pierre, *Fl. Cochinch.* t. 347A (1896); Pellegrin in Lecomte, *Fl. Gén. Indo-Chine* **1** : 740 (1911) Briquet, *Mém. Inst. Nat. Genev.* **24** : 66 (1935). Type: Viet Nam, Annam, Bien Hoa, towards Chias Xan & Binh Thuan, Feb. 1877, *Pierre* 1619 (P!, holo!; BM!, E, G!, K!, L!, LE!).

C. clementis Merr. in *Philip. J. Sci.* **3** : 145 (1908) & *Enum. Phil. Fl. Pl.* **2** : 367 (1923); Briquet, *op. cit.* : 67 (1935); Elmer, *Leafl. Philip. Bot.* **9** : 3345 (1937); Heine in *Fedde. Rep.* **54** : 230 (1951). Type: Philippines, Mindanao, Lake Lanao, Camp Keithley, July - 7 Sept. 1907, *Clemens s.n.* (PNH†, G!, ? isosyn).

Amoora cupulifera Merr. in *Philip. J. Sci. Bot.* 9 : 365 (1914) & *Enum. Phil. Fl. Pl.* **2** : 370 (1923); Briquet, *op. cit.* : 76 (1935). Type: Philippines, Leyte, Dagami, 3 Aug. 1913, *Wenzel* 311 (PNH†; A!, BM!, G!).

[*C. vulcanicus* Elmer ex Merr., *Enum. Phil. Fl. Pl.* **2** : 367 (1923), *nom. in synon.*]

A. mindorensis Merr. in *Philip. J. Sci.* **27** : 459 (1925). Type: Philippines, Mindoro, Pinamalayan, 21 May 1922, *Ramos* BS40860 (PNH†, A!, K!).

C. aff. biroi, Lane-Poole, *Rep. For. Res. Terr. Papua New Guinea* : 100 (1925).

C. peekelianus Harms in *Notizbl. bot. Gard. Mus. Berl.* **10** : 276 (1928). Type: Papua New Guinea, New Ireland, Lamekot, June 1927, *Peekel* 1090 (B?†, holo).

[*A. caesifolia* Elmer, *Leafl. Philip. Bot.* 9 : 3321 (1937), *nom. non rite publ.* (*descr. angl.*).]

C. rhytidocalyx Airy Shaw in *Bull. Misc. Inf. Kew* **1940** : 256 (1940). Type: Malaysia, Sarawak, 4th Divn, Mt Dulit, Dulit Trail, *c.* 400 m, 26 Aug. 1932, *Richards* 1460 (K!, holo; SING!).

C. doctersii Harms in *Engl., Bot. Jahrb.* **72** : 181 (1942). Type: Indonesia, Irian Jaya, Djajapura, Rouffaer River, 175 m, Aug. 1926, *Docters van Leeuwen* 9927 (B?†, holo; A, K!, L!).

C. pachycalyx Harms, *op. cit.* : 186 (1942). Type: Papua New Guinea, East Sepik, 'hauptlager Malu', 1912, *Ledermann* 6707 (B?†, holo; B!).

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*Since going to press, *de Wilde et al.* 16513 (L!) from Atjeh, *c.* 35 km N.W. of Kutatjane has been seen, "Tree 15 m, d.b.h. *c.* 25 cm, wood creamy, milky sap from cambium region. Fls . . . greyish green to dirty yellowish-brown, anthers creamy. Fls *c.* 2·5 cm long, ± fragrant".

Tree to 30 m; d.b.h. to 40 cm. *Trunk* with buttresses to 3 m high and 2 m out; *bark* dippled, lenticellate, dark brown, tardily white-laticiferous; *inner bark* dark red-brown; *sapwood* yellow. *Twigs* 4–12(–20) mm diam., cicatrices conspicuous. *Leaves* in terminal spirals on drooping branches, casting dense shade, to 1·5 m long, pseudogemmulate; *rachis* 2·5–6·0(–11) mm thick, terete to angled; *leaflets* in up to 17 pairs, petiolule (3–)6–13 mm long, lamina (4–)10–38 cm long and (2·7–)5·5–14·5 cm wide, ovate to oblong, dull midgreen adaxially, paler abaxially, reddish when expanding, inconspicuously adpressed hairy notably on abaxial surface of veins, midrib strongly sunken adaxially, costae 10–15 on each side. *Inflorescence* to 65 cm long, 2–3-branched fragrant; *branches* to 45 cm long, ± ascendant; *pedicels* short, pseudopedicels 2·5–3·5 mm long; *calyx* 2·0–5·5 mm tall, shallowly cupular to cylindrical, sometimes thickened annularly, obscurely 5-lobed to truncate; *petals* (4–)5(–6), 13–19 mm long, 2–3 mm wide, pinkish, valvate; *staminal tube* *c.* 11 mm tall, (4–)5(–8)-lobed, sericeous except basally and apically, occasionally subglabrous without, lobes to 4 mm long, ± truncate; *anthers* (4–)5–6(–9), 2·8–3·8 mm long, locellate; *ovary* 2–3-locular; *style* 8–10 mm long, densely pubescent except near cylindrical stigma. *Infructescence* to 45 cm long, pendent, of subglobose fruits to 4·5 cm wide, 3·2 cm long, velutinous, fleshy orange to bright red, stipe to 1·5 cm long, pericarp thick, spongy with 2 strong and 2 weak sutures, latex white to colourless; *seeds* 1–2, shining pale orange, sarcotesta perforated with 1·5 mm hole near micropyle, cotyledons collateral.

Vietnam, Thailand and Malesia east to the Bismarck Archipelago, 0–700 m, in primary and secondary forest and as a relic in hedgerows, etc.

Thailand. Peninsular, Yala, Banaang Sata, *Sangkhachand* 1390 (K!, P!). Indonesia. Sumatra, Asahan, Mosihi For. Res., *Krukoff* 4214 (A!, L!, LE!, SING!); West, Mt Sago, 800 m, *Meijer* 5793A (L!); Simalur Is., *Achmad* 265 (L!); Java, Pasuruan, *Koorders* 38283β (K!) & Pangrango, *Junghuhn* '127' (L!); Kalimantan, SE, Berouw, bb 19220 (A!); G. Sekrat, S. of Sangkulirang, *Kostermans* 6225 (A!) & C. Kutei, nr Tabang K., *Kostermans* 10588A (K!); Moluccas, Morotai, Tobelo, N. Totodoku, *Tangkilisah* 43 (K!, L!); Buru, Bal Balo bb 25173 (A!), & Seram, Kairata, *Kuswata & Soepadmo* 41 (A!, K!, L!, SING!); Irian Jaya, Geelvink Bay, Nabire, *Kanehira & Hatusima* 11499 (A!) & Vogelkop, BW 314 (L!, LAE!) & Djajapura, BW 786 (K!, L!, LAE!) & Fakfak, BW 10000 (L!). Malaysia. Kedah, Gg. Jerai, 100 m, *Pennington* 7853 (FHO!); Kelantan, 1 mile E from K. Yai, 1200 m, FRI 4174 (A!); Perak, Larut, *King's Coll.* 3235 (A!); Pahang, Krau Game Res., 300 m, FRI 3587 (A!, K!); Selangor, mile 17, Ulu Gombak, *Nur* SFN 34231 (SING!); Sarawak, Beram 200 m, *Anderson* 4084 (A!, K!, SAN!, SAR!); 1st Divn, Santubong, 300 m, *Mabberley* 1624 (FHO!, SAR!); Kapit, *Anderson & Pa'ie* S 28269 (SAR!); Sabah, Lahad Datu, Kretam, *Wood* SAN A 4824 (A!, K!, SING!); Sandakan, Sepilok *Pennington* 7917 (FHO!, SAN!) & Beaufort, *Mikil* SAN 32026 (SAN!). Brunei. Above K. Empau, BRUN 5221 (KEP!, SAR!). Philippines. Luzon, Cagaya Prov., nr Penablanca, *Adduru* 77 (K!) & Isabela, San Mariano, Sierra Madré Mts, *Gutierrez* PNH 78075 (A!); Sorsogon, Mt Juban, *Edaño* PNH 37096 (K!) & Mt Bulusan, *Elmer* 16698 (A!, BM!, BP!, G!, K!, U!). Leyte, *Wenzel* 311 (A!). Samar, *Ramos* BS 1708 (A!, BM! SING!). Mindoro, Pinamalayan, *Ramos* BS 40860 (A!, K!) & Bongabong River, *Merritt* FB 3664 (K!). Mindanao, Davao, Mt Apo, *Elmer* 11618 (A!, BM!, BP!, G!, K!, L!, U!) & Zamboanga, Sax R., *Williams* 232G (K!). Papua New Guinea. West Sepik, NGF 13259 (K!, LAE!); East Sepik, *Hoogland & Craven* 10161 (LAE!); Madang, Gogol, *Mabberley* 1748 (FHO!, LAE!); Morobe, Tamiloa, 6 miles W of Lae, *Mabberley* 1720 (FHO!, LAE!); Southern Highlands, *Schiefflin* 9 (LAE!); Gulf, NGF 8045 (K!, LAE!); Central, *Pullen* 8119 (LAE!); Northern, *Saunders* 59 (LAE!); Milne Bay, *Brass* 24035 (K!, LAE!); New Britain, *Pennington* 8104 (FHO!, LAE!).

Stevens (1975 : 10) noted that *Chisocheton ceramicus* occurs in Borneo and the Philippines as well as in Java, the Moluccas and New Guinea. The description and type material of *C. clementis* from the Philippines fall within the range of *C. ceramicus* from those areas. I have also reduced to synonymy *C. junghuhnii*, *C. macrothyrsus* and *C. rhytidocalyx* from Sumatra, Malay Peninsula and Sarawak respectively. Type material of *C. junghuhnii*, included by Stevens in *C. ceramicus* (*op. cit.* : 11), has flowers borne on inflorescences in the axils of unexpanded leaves. Otherwise it compares well with *C. ceramicus* from Java; *C. macrothyrsus*, according to the material available to Stevens (*op. cit.* : 10), differs in its larger flowers and accrescent calyx in fruit. Not all specimens from the Malay Peninsula have such a calyx and large flowers are to be found in material from the Philippines. Type material of *C. macrothyrsus* does not have the large calyx whereas *Pennington* 8104 (FHO!) in L! and LAE! from New Guinea does have. The number of stamens in some specimens from the Malay Peninsula and from Sumatra is often higher than the norm for the species, e.g. *Lörzing* 12785 (A!, K!, L!) from northern Sumatra. This character also distinguishes the type of *C. rhytidocalyx*. In view of the range of intermediates to be found in the Malay Peninsula, I cannot see the value of upholding the latter species either. None of the features of extreme forms of the species is connected clearly with any geographical or ecological replacement and therefore I have refrained from creating or considering any infraspecific taxa.

The repeated new descriptions of Philippine material, clearly identical with *Chisocheton clementis*, in *Amoora* (i.e. *Aglaia*) by Merrill is not easily explained.

Chisocheton globosus is known to me only from the type collection which is extremely meagre. It is possible that it refers to *C. dysoxylifolius* and is thus included here with caution.

40. Chisocheton curranii Merr.

In *Philip. J. Sci.* **3** : 234 (1908) & *Enum. Philip. Fl. Pl.* **2** : 367 (1923). Types: Philippines, Luzon, Benguet, Baguio, Aug. 1906, *Curran* FB 4865 (PNH ?†; K!, isosyn (photo at FHO!)) & 4923 (PNH ?†).

Tree about 5 m high. *Twigs* fawn pubescent. *Leaves c.* 20 cm long; *rachis*, petiolules midribs and costae densely fawn pubescent; *leaflets* 8–11 cm long, 3·0–4·5 cm wide, elliptic, subcoriaceous, in up to 3 pairs, apex shortly acuminate, base acute, costae about 7 on each side, venation prominent; *petiolules* 5·0–7·0 mm long. *Inflorescence* (*fide* Merrill) to 15 cm long, paniculate; *branches* to 2 cm long, spreading or ascending pubescent; *calyx* 4–5 mm tall, cupulate, pubescent, margin subentire to obscurely lobed; *petals* 5, to 16 mm long, 2 mm wide, pubescent without, yellowish white; *staminal tube* to 14 mm long, appressed hairy on both sides, 5-lobed, lobes 2·5 mm long, obtuse; *anthers* 5, 2·5 mm long; *ovary* 2-celled, hirsute; *style c.* 10 mm long, hirsute. *Fruit* (*fide* Merrill) globose to 6 cm diam., brown; *seeds* to 3 cm long.

Known only from the types.

PHILIPPINES. Luzon, *Curran* FB 4865 (K!, type).

This species is known to me only from Merrill's description and the meagre isosyntype, which I hesitated to dissect. In many respects the plant has similarities to both *Chisocheton ceramicus* and *C. pentandrus*, for example the fruit of the former and the inflorescence of the latter. Although *C. curranii* may be based on a mixed gathering, it seems unlikely to be an hybrid between the two above-mentioned species, as it differs from both in the nature of its indumentum.

41. Chisocheton pentandrus (Blanco) Merr.

In *Philipp. Gov. Lab. Bur. Bull.* **27** : 31 (1905) & *Spec. Blanc.* : 210 (1918); West & Brown in *Bull. Phil. Is. Dep. Agr. Bur. For.* **20** : 119 (1920) and *op. cit.*, **22** : 121 (1921); Merr., *Enum. Phil. Fl. Pl.* **2** : 367 (1923) & in *Philip. J. Sci.* **29** : 378 (1926); Elmer, *Leafl. Phil. Bot.* **9** : 3347 (1937); Harms in *Fedde, Rep.* **42** : 7 (1937) & in Engl. & Prantl, *Pflanzenfam.* **19b1** : t. 33 (1940); Meijer in *Bot. News Bull. Sabah* **8** : 78 (1967). Fig. 8.

Trichilia pentandra Blanco, *Fl. Filip.* : 355 (1837) & ed. **2** : 249 (1845); Roem., *Hesperid.* : 115 (1846); C. DC. in DC., *Monog. Phan.* **1** : 749 (1878). Type: I designate Merrill's 'illustrative specimens' mounted on the same sheet (*Sp. blancoanae* no. 6) as neosyntypes: Philippines, Luzon, Mt Maquiling, Nov. 1912 (flowers) and March 1913 (fruit) (BM!), neosyn.

Dasycoleum philippinum Turcz. in *Bull. Soc. Nat. Mosc.* **31** : 415 (1858); C. DC., *op. cit.* : 540 & t. VII, 8 (1878); Vidal, *Sin. Fam. & Gen. Pl. Filip. Atlas* : t. 29C (1883) & *Pl. Vasc. Filip.* : 84 (1886). Type: Philippines, Luzon, Tayabas, 1841, *Cuming* 683 (CW, holo; BM!, G!, K!, L!, LE!, OXF!).

[*C. ceramicus* sensu F. Vill., *Novis. App.* : 42 (1880), *non* C. DC.]

C. sp., Vidal, *op. cit.*: 82 (1886).

C. microcarpus Koord. & Valeton in *Meded. Lands Plant.* **16** : 115 (1896); Backer, *Schoolfl. Java*: 209 (1911); Koord., *Exc. Fl. Java* **2**: 443 (1912); Koord.-Schum., *Syst. Verz.* I Abt. **1** (140): 28 (1912); Backer & Bakh., *Fl. Java* **2** : 125 (1965). Type: sheets in Koorders's herb. (BO); duplicates at L with inscription, 'De hoc specimine agitur in libro . . .', *viz.*: Java, 'Besoeki, Tjoermanis', *Koorders* 21872*β* (K!, L!) & 'Batavia, Tjiampea', *Koorders* 31350*β* (K!, L!) may be good candidates as isotopes.

C. philippinus (Turcz.) Harms in Engl. & Prantl, *Pflanzenfam.* III, **4** : 296 (1896); Perkins, *Fragm. Fl. Philip.* : 32 (1904); Briquet in *Mém. Inst. Nat. Genev.* **24** : 67 (1935).

C. microcarpus var. *moluccanus* Valeton in Hochr., *Pl. Bogor* **69** n. 146 (1904); Briquet, *op. cit.* : 65 (1935, '*macrocarpus*'). Type: Indonesia, Sulawesi, Menado, *Pelenkahn s.n.* (BO ?, holo; CALC!, G!, K!, L!).

Chisochiton sp., Merr. in *Philip. J. Sci. Bot.* **11** : 280 (1916).
Chisocheton parvifoliolus Merr. in *op. cit.*, **13** : 297 (1918) & *Enum. Phil. Fl. Pl.* **2** : 367 (1923). Type: Philippines, Luzon, Ilocos, Tineg, 300 m, 20 March 1913, *Paraiso* FB 25467 (PNH ?†; K!).
[*C. sorsogonensis* Elmer ex Merr., *l.c.* (1923), *nom. in synon.*]
[*C. curranii sensu* Elmer, *op. cit.* : 3346 (1937), *non* Merr.]

Tree or *treelet* 3–18 m high; *bole* to 10 m sometimes slightly buttressed to 60 cm. *Bark* greenish grey; *inner bark* pale fawn or pinkish; *sapwood* pale cream. *Twigs* 2·5–6·0 mm diam., deciduously tawny pubescent to subglabrous. *Leaves* to 45 cm long; *rachis* terete, minutely pubescent; *petiolules* to 8 mm long; *leaflets* in up to 9 pairs, to 16·5(–26·5) cm long, to 6·0(–9·0) cm wide, elliptic- to ovate-oblong, dark green adaxially, paler abaxially, glabrous or sparsely pubescent on veins, apex acuminate to acutely cuspidate, base ± unequally acute or obtuse, costae 8–16 on each side. *Inflorescence* spiciform to paniculate, to 63 cm long, axillary to supra-axillary or borne in axils of unexpanded leaves; *rachis* finely velvety puberulous; *flowers* pedicellate, fragrant (Pennington) or odourless (Elmer, 1937); *calyx* cupular, margin entire to obscurely or irregularly lobed, *c.* 4 mm tall, ± sparsely puberulous without; *petals* (4–)5, 8–12(16) mm long, 2 mm wide, cream, densely fulvescent-hirsute without, valvate, apex acute; *staminal tube* white, 5-lobed, lobes laciniate, ± densely pilose within, rarely subglabrous, pubescent without; *anthers* 5(–6), 3 mm long, glabrous; *ovary* shortly stipitate, hirsute, 2-locular; *style* glabrous to pubescent. *Infructescence* to 30 cm long with fruit to 21 mm diam., globose or beaked, dull red with minutely rusty tomentose indumentum, pericarp with white latex; *seeds* 2, flattened, to 1·5 cm diam., sarcotestal.

Rain forest from Malay Peninsula and Sumatra to Philippines and Seram, to 1400 m.

Readily divisible into two subspecies, with overlapping populations in northern Borneo, here treated as a third subspecies.

Key to subspecies

Fruit spherical; inflorescence ± branched
- Inflorescence to 4-branched; flowers to 8 mm long, leaflet costae *c.* 16 on each side — (a) subsp. **pentandrus**
- Inflorescence sparsely branched; flowers 8–16 mm long; leaflet costae *c.* 13 on each side — (b) subsp. **medius**

Fruit conspicuously beaked; inflorescence ± unbranched; flowers to 18 mm long; leaflet costae 8–12 on each side — (c) subsp. **paucijugus**

(*a*) subsp. **pentandrus**
(Fig. 8.3) *C. pentandrus s. str.*, see synonymy above.

Tree to 16 m high. *Twigs* 4·0–6·0 mm diam. *Leaflets* elliptic-oblong, base unequally obtuse or acute, costae *c.* 16 on each side. *Inflorescence* paniculate, 3–4-branches; *branches* to 12 cm long; *petals* to 8 mm long. *Fruit* to 21 mm diam., spherical with abrupt stipe to 8 mm long, 3 mm diam., and minute beak.

Drier forests of Malesia: Philippines, north-eastern Borneo, Sulawesi, Moluccas, Lesser Sunda Is., Java & Johore.

INDONESIA. Java, Kediri, Gadrengau, *Koorders* 22680β (FHO!) & Pekalongan Subah, *Koorders* 13564β (K!); Bali, N. of Tabanau, Mt Bakukaru, 1000 m, *Wirawan* 448 (A!, K!, L!, LAE!); Sumbawa, Mt Balmante, 1000 m, *Kostermans* 18318 (A!, K!, L!); W. Flores, 300 m, *Kostermans & Wirawan* 202 (K!, L!); Kalimantan, E. Kutei, Sangkulirang Is., 30 m, *Kostermans* 4892 (BM!, K!); Sulawesi, Pangkadjene, *Teijsmann* 11734 (K!, L!) & Menado, Klabat, 340 m, bb 13502 (L!); Halmahera, Galela, *Beguin* 1900 (L!) Ambon, *Robinson* 1995 (K!). MALAYSIA. Johore, Jason Bay, Sg Rhu Rebu, *Corner* SFN 28496 (BM!,; K!, SING!); Sabah, Kinabalu, Ranau Rd, mile 43, *Pennington* 7930 (FHO!) & Tawau, Tinagat F.R., 45 m, *Talip & Nordin* SAN 48968 (K!, SAN!) & Semporna, Pababag F.R., 30 m, *Binson & Arto* SAN 63819 (K!, SAN!) & Kudat, *Ampuria* SAN 40389 (K!) & Lahad Datu, Palabag Is., *Harvey* SAN A 128 (K!) & Banggi Is., *Castro & Melegrito* 1612 (BM!). PHILIPPINES. Luzon, Montalban, *Vidal* 704h (A!) & Cagayan, nr Penablanca, *Adduru* 17 (K!) & Laguna, Mt Maquiling, *Elmer* 17552 (A!, BM!, K!, U!) & Marinduque, *Vidal* 1340 (K!) & Sorsogon, Mt Bulusan, *Elmer* 15857 (A!, BM!, K!, U!) & Baler, *Merrill Bur. Agric.* 1032 (K!) & Ticao Is., *Vidal* 2311 (K!) & Ilocos Norte, Mt Quebranda, *Edaño* PNH 17843 (A!, SING); Benguet, Baguio, *Elmer* 8828 (E!, G!); Mindoro, Paluan, *Ramos* BS 39742 A, *pp* [part fr. =

Fig. 8 *Chisocheton pentandrus* (Blanco) Merr. 1, subsp. *paucijugus* (Miq.) Mabberley from *Pennington* 7987; 2, subsp. *medius* Mabberley from SAN 76651; 3, subsp. *pentandrus* from *Pennington* 7930.

Dysoxylum sp.]!, BM!) & Bongabong, *Whitford* 1415 (BM!); Camiguin Is., *Fénix* BS 4046 (SING!); Leyte, *Wenzel* 65 (A!, E!); Basilan, *Miranda* FB 18965 (BM!); Negros, Oriental, Cuerno Mts, *Elmer* 10379 (A!, E!, K!, LE!); Mindanao, Davao, Quinoroan River, *Edaño* PNH 11425 (A!, SING!) & Lanao, *Cruz* FB 23880 (A!) & Surigao, Lake Mainit, *Ramos & Gonvocar* BS 83392 (A!, SING!).

I have added *Chisocheton parvifoliolus* to Harms's (1937) synonymy: it is merely a specimen with small leaflets from Luzon, where plenty of intermediates have been collected.

(*b*) subsp. **medius** Mabberley, **subsp. nov.**
(Fig. 8.2) [*C. beccarianus sensu* Merr., *Pl. Elm. Born.* (*Univ. Calif. Publ. Bot.* **15**) : 122 (1929); Heine in *Mitt. Bot. Staats. Münch.* **6** : 218 (1953); Meijer in *Bot. News Bull. Sabah* **8** : 78 (1967), *non* Harms (1896).]

A. subsp. *pentandro* fructu majore, floribus majoribus et a subsp. *paucijugo* fructu globoso differt.

TYPE: Malaysia, Sabah, Sandakan, Sepilok Forest Reserve, Jalan Kantor Pos, behind 'Post Office', 9 May 1974, *Mabberley* 1676 (FHO!, holo; K!, iso).

Small tree to *c.* 8 m. *Twigs c.* 4·0 mm diam. *Leaves* to 32·5 cm long; *leaflets* in *c.* 4 pairs, base cuneate, apex long-acuminate (acumen *c.* 15 mm), costae *c.* 13 on each side, petiolule to 5 mm long. *Inflorescences* to 30 cm long, weakly branched, proximal branches to 6 cm long. *Fruit* globose.

Palawan (Philippines) and northern Borneo.

PHILIPPINES. Palawan, Puerto Princera, Babayan, *Edaño* PNH 94 (A!). INDONESIA. Kalimantan, S. of Sangkulirang, G. Sekrat, *Kostermans* 6224 (K!). MALAYSIA. Sabah, Sandakan, *Mabberley* 1676 (FHO!, K!, type) & Lahad Datu, ± 800 m, 3¾ miles, Silau road, *Sinanggul* SAN 57318 (SAN!) & Tawau, 15 miles, Apas road, *Gibot* SAN 30006 (K!, SAN!) & Ranau, 900 m. Bt Tampurango, *Singh* SAN 24160 (SAN!) & Mt Kinabalu, *Clemens* 10164 (A!).

In the absence of fruits, it is difficult to assign some specimens. Such gatherings could represent either of the other two subspecies.

(*c*) subsp. **paucijugus** (Miq.) Mabberley, **comb. & stat. nov.**

(Fig. 8.1) *Schizochiton paucijugum* Miq., *Ann. Mus. Bot. Lugd. Bat.* **4** : 27, 30 (1868). Types: Indonesia, Sumatra, W., Mt Singalaang, *Korthals s.n.* (L!; U!, syn) & Kalimantan, S. Mt Sakoembang & nr River Poenay, *Korthals s.n.* (L!; U!, syn).

Dasycoleum beccarianum Baillon in *Adansonia* **11** : 263 (1874); C. DC. in DC., *Monog. Phan.* **1** : 540 (1878). Type: Malaysia, 'Sarawak 1865–8', *Beccari* 1845 (FL, G!, K!, LE!, *P*).

C. spicatus Hiern in Hook. f., *Fl. Br. India* **1** : 550 (1875); C. DC., *op. cit.* : 535 (1878); Curtis in *J. As. Soc. Str. Br.* **25** : 22 (1894); King in *J. As. Soc. Bengal* **64** (2) : 26 (1895); Merr. in *J. As. Soc. Str. Br.*, spec. no. : 319 (1921); Ridley, *Fl. Malay Penin.* **1** : 387 (1922); Corner, *Life of Plants*, t. 42 (1964) & *Seeds Dicots.* **2** : t. 375c (1976). Type: Malaysia, Malacca, *Maingay* '363' (K!, holo; A!, CGE!).

C. paucijugus (Miq.) B. D. Jackson, *Ind. Kew.* **1** : 517 (1895); Merr., *l.c.* (1921).

C. beccarianus (Baillon) Harms in Engl. & Prantl. *Pflanzenfam.* III, **4** : 296 (1896).

C. sp., Merr. in *Univ. Calif. Publ. Bot.* **15** : 122 (1929).

Small *tree* to 8 m high. *Twigs* 2·5–3·0 mm diam. *Leaves* to 45 cm; *leaflets* in 3–5(–6) pairs, ovate-oblong, base cuneate, apex acutely cuspidate, costae *c.* 8–12 on each side, petiolules 6–8 mm long. *Inflorescence* to 24 cm, usually unbranched, bearing cymules of 1–few flowers; *petals* to 18 mm long. *Infructescence* with fruits borne at tip, tapering at each end, the distal acute, proximal terete.

Wetter forests of western Malesia from Sumatra and Malay Peninsula to Borneo and southern Philippines.

INDONESIA. Sumatra, N., Padang Sidempnan, *Kostermans* 22001 (L!) & Asahan, Kuala Masihi, *Yates* 2396 (B!); Kalimantan, 1°50′ S, 115°40′ E, 240 m, *Vogel* 802 (L!) & Sangkulirang Distr., Mt Dedadam, *Kostermans* 13460 (L!). MALAYSIA. Penang, *Kiah* SFN 35345 (KEP!, SING!); Perak, *Burn Murdoch* 201 (SING!); Pahang, Taman Negara, *Whitmore* FRI 15310 (K!, KEP!); Malacca, *Alvins* 1989 (SING!); Johore, Labis, *Whitmore* FRI 15620 (KEP!); Sarawak, Kuching, *Ghazalli* S13402 (SAR!) & Baram, *Chew* CWL 480 (SAR!) & Miri, *Othman* S21346 (A!, FHO!, L!, SAN!, SAR!) & Marudi, *Sibat* S22806 (L!, SAN!, SAR!) & 5th Divn, *Chai & Ilias* S31541 (FHO!, SAR!); Sabah, Tawau, *Brand* SAN 21484 (SAR!) & Sandakan – Sepilok, *Singh* SAN 22542 (SAR!) & Lungmanis *Putan* SAN 46682 (SAN!) & Beaufort, BNB 3215 (K!). SINGAPORE. *Ridley s.n.* (SING!). PHILIPPINES. Palawan, Iwahig, Lapulapu River, *Edaño* PNH 143 (A!, L!).

The type of *Dasycoleum beccarianum* is a good match for other Bornean material identical with the types of *Schizochiton paucijugum*.

42. Chisocheton pellegrinianus Mabberley, **sp. nov.**

(Fig. 9) A *C. erythrocarpo* Hiern ramuli ubi siccati nigelli, nervis secundariis pluribus, floribus parvis, disco annulare differt.

[*C. glomeratus sensu* Pellegrin in Humbert, *Suppl. Fl. Gén. Indochine* (5) : 692 (1946), *non* Hiern (1875), i.e. *C. patens* Bl.]

[*C. erythrocarpus sensu* Pellegrin, *op. cit.* : 695 (1946), *non* Hiern (1875)].

Arbor ad 10–12 m altus. *Ramuli* foliati circa 5·0–6·0 mm diam., velutino-fulvi ubi juventes, nigelli ubi siccati. *Folia* 30–45 cm longa, pseudogemmulata, foliolis usque ad 8-jugis; *petiolus* circa 7 cm longus, pubescens; *foliola* usque ad 15 cm × 6 cm, elliptico-oblonga, praeter costam adaxiale glabra, abaxiale pubescentia, apice cuspidato, base parum asymmetrica, cuneata subcordatave, petiolulo 3–4 mm longo, pubescente, nervis secundariis circa 11 utrinque, abaxiale prominentibus, nervatura tertiaria conspicua. Inflorescentia circa 27 cm longa, supra-axillaris, pendens, dense pubescens; *rami* ad 3·5 cm longi, plus minusve squarrosi floribus glomeratis; *bracteae* lanceolatae,

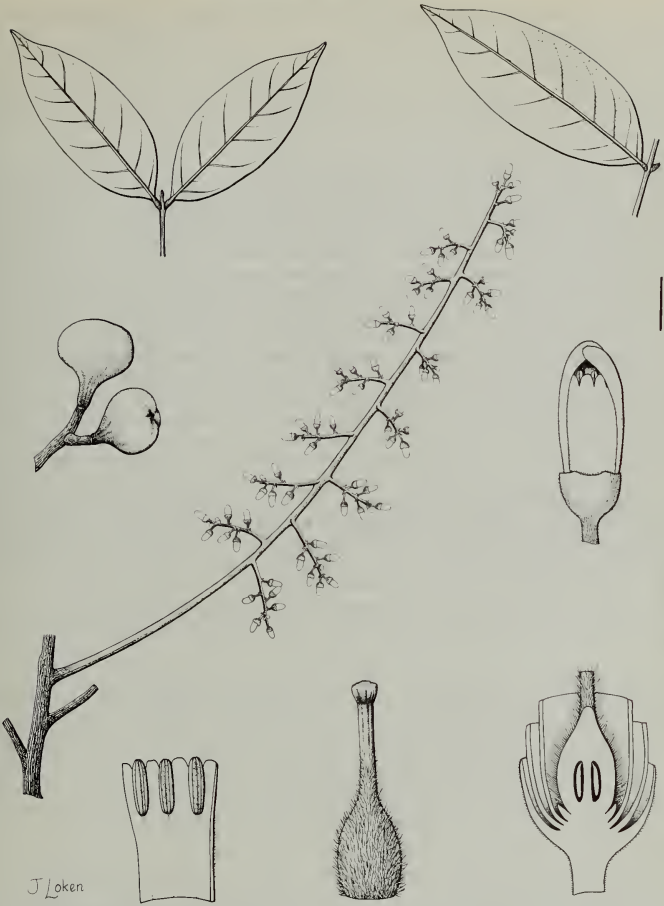

Fig. 9 *Chisocheton pellegrinianus* Mabberley. Leaf apex and fruit from *Poilane* 8429 (scale = 2 cm), inflorescence (scale = 2 cm), flower (scale = 2·5 mm), half flower base, pistil and part tube (scale = 1·25 mm) from *Evrard* 766.

pusillissimae; *calyx* 2·5–3·0 mm longus, cylindricus, pubescens, margine integra vel parum 3–4-dentata; *petala* 5, 8 mm longa, elliptico-oblonga, concava, extus velutina; *tubus staminalis* 6–8-lobatus, intus glaber, extus velutinus, lobatis obtusis, glabris; *antherae* 2·5 mm longae, oblongae, locellatae, parum exsertae; *discus* annularis; *ovarium* pubescens, bilocularis; *stylus* dimidio distale glaber, stigma cylindrica mammilla centrale praedita. *Fructus* 2·5–4·0 cm longus, 2·0–2·5 cm diam., pyriformis, fulvo-pubescens; *semina* 2.

TYPE: Vietnam, Xa-cam nr Honquam, 60 km from Thu-Dan-Mot (11°0′ N, 106°37′ E), 15 April 1922, *Evrard* 766 (P!, holo (photo at FHO!)).

Other material: km25 Nha Trang to Ninh Hoa, 100 m, 26 Oct. 1923, *Poilane* 8429 (P! (photo at FHO!)).

The specific name commemorates François Pellegrin (1881–1965), student of Indochinese Meliaceae (*Taxon* **14** : 249–250).

43. Chisocheton erythrocarpus Hiern

In Hook. f., *Fl. Br. Ind.* **1** : 550 (1875); C. DC., *Monog. Phan.* **1** : 534 (1878); King in *J. As. Soc. Bengal* **64** : 31 (1895); Ridley in *J. As. Soc. Str. Br.* **33** : 59 (1900) & *Fl. Malay Penin.* **1** : 388 (1922). Type: Malaysia, Malacca, *Maingay* '322' (21 Aug. 1865/6, 1379 (K!) & 1867–8, 2525 (K!, L!)).

Small-crowned tree to 25 m; *bole* diam. to 25 cm. *Buttresses* to 1 m long and tall and 10 cm thick. *Bark* smooth to cracking, dark grey to chocolate brown; *inner bark* reddish brown; *wood* cream. *Twigs* rough, dark brown. *Leafy twigs* 4–5 mm diam., densely and minutely rusty tomentose. *Leaves* pseudogemmulate to 36 cm long; *leaflets* in up to 6 pairs, to 10 cm long, 8 cm wide, elliptic oblong to broadly ovate, shortly abruptly and bluntly acuminate, cuneate or rounded at the slightly asymmetric base, chartaceous, adaxial surface glabrous except the puberulous midrib, abaxial softly and shortly rusty-pubescent, costae 6–8 on each side of midrib, somewhat arcuate; *petiolule* to 1 cm. *Inflorescence* to 14 cm long, paniculate, in upper axils of shoots, supra-axillary, minutely rusty-tomentose; *lateral branches* short, horizontal, cymose; *pedicels* short; *calyx c.* 4 mm long, cylindric, margin truncate to praemorse, densely tomentose without, glabrous within; *petals* 5–6, 9–13 mm long, 3–3·5 mm wide, narrowly boat-shaped, creamy-white, valvate, separating on drying, fleshy, adpressed sericeous without, glabrous within; *staminal tube* a little shorter than petals with 5–6 blunt, weakly lobed teeth *c.* 2·5 mm long, sericeous without except for narrow band at base and lobes, pubescent similarly within; *anthers* subsessile, basifixed at notch of lobes, *c.* 3 mm long, locellate; *pistil* minutely pubescent except for narrow band below cylindrical stylehead with glabrous apical mammilla. *Fruit* globose, peach-like to 6 cm diam., with minute beak, 2-locular, dehiscent, minutely tomentose, yellow when immature, blood-red when ripe, with white latex; *seeds* 2, *c.* 2·5 cm long, somewhat flattened, with thick orange-red sarcotesta.

Primary and secondary forests of the coastal regions of the Malay Peninsula and northern Borneo.

INDONESIA. Kalimantan, Sebatik Is., 10 m, *Kostermans* 9141 (A!, K!, L!, SING!). MALAYSIA. Kedah, Kuala Muda, Sungkap F.R., 60 m, *Wyatt-Smith* KEP 71153 (KEP!); Pahang, Temerloh, Jenka F.R., *Kochummen* KEP 98578 (K!, KEP!, SAN!, SING!); Selangor, Sg. Buloh, *Hardial & Sidek* 452 (K!); Trengannu, K. Dungun, *Soepadmo & Mahmud* 9125 (A!); Negri Sembilan, Sg Menyala, ± sea-level, *Pennington* 7861 (FHO!, KEP!, SING!); Sabah, Jesselton, Sipanggar Is., 30 m, *Ampuria* SAN 41320 (K!, L!, SAN!, SAR!) & Sandakan, Kabun China F.R., 90 m, *Sinanggul* SAN 38379 (K!, SAN!) & Kudat, Temalang F.R., *Meijer* SAN 19923 (K!, SAN!) & Lahad Datu, base of Mt Silam, 100 m, *Tarmiji* SAN 73426 (SAN!). SINGAPORE. Tampinis River, *Ridley* 5965 (K!, SING!); Pulau Ibai (?), *Ridley s.n.* (SING!). BRUNEI. Telamba, *Ashton* BRUN 5033 (K!, KEP!, SAR!, SING!).

(iv) sect. **Rhetinosperma** (Radlk.) Mabberley, **comb. & stat. nov.**

Rhetinosperma Radlk. (genus) in Engl. & Prantl. *Pflanzenfam. Ergänz.* II (3), **5** : 204 (1908). Type: *R. longistipitata* (F. M. Bailey) Radlk. = *Chisocheton longistipitatus* (F. M. Bailey) L. S. Smith.

Trees. Indumentum of stellate hairs. *Leaves* pseudogemmulate with pseudogemmula approaching condition of some *Dysoxylum* species. *Inflorescences* axillary to supra-axillary. *Flowers* with valvate(-imbricate) petals, separating on drying; *anthers* scarcely locellate; *disk* cupular. *Seeds* sarcotestal.

Four species. North-eastern Borneo eastwards to New Hebrides.

44. Chisocheton koordersii Mabberley, **nom. nov.**

C. kingii Koord. in *Meded. Lands Plant.* **19** : 385 & 636 (1898); Koord.-Schum., *Syst. Verz.* III Abt. **1** : 63 (1914); Koord., *Fl. N.U. Celebes*, suppl. 2 : t. 43 (1922). Types: Sulawesi, Minahasa, *Koorders* 17978β (Menado, 26 Jan. 1895; BO, L!), 17960β (50 m, 4 Feb. 1895; BO, K!, L!), 17973β (50 m, 6 Feb. 1895;

BO, L!), 17989β (700 m, 15 April 1895; BO, L!), 17964β (22 April 1895, BO, L!). *Non C. kingii* Harms (1896), i.e. *C. macrophyllus* King.

Tree to 30 m; *bole* to 14 m, diam. to 60 cm; *buttresses* to 1·5 m. *Bark* rather rough, finely fissured, brown, ½ mm thick; *living bark* 5 mm thick, yellow to white; *wood* white. *Twigs* (6–)8–12 mm thick, pith wide and hollow in herb. specimens, sometimes housing ants. *Young twigs*, petiole, rachis, pseudogemmula and leaflets, especially veins below minutely stellate (4-armed) pubescent, pseudogemmula rusty thus. *Leaves* to at least 35 cm long, pseudogemmulate; *petiole* to 18 cm, terete; *leaflets* to 25(–35) cm long, 10 cm wide, elliptic to suboblong, acuminate, base rounded, symmetrical, costae up to 17 on each side of midrib sunken in dried specimens. *Inflorescence* to 45 cm long, axillary, of ascendant branches to 18 cm long, forming 3-branched pyramidal panicle of creamy-white, scented, apparently bisexual, apparently ebracteate, sessile flowers with short 'pseudopedicel'; *calyx* tubular-urceolate, obscurely lobed, almost praemorse, 3·5–4·0 mm long, *c.* 2·5–3·0 mm across at apex, minutely stellate-pubescent without, glabrous within; *petals* 5–6, narrowly spathulate, valvate and connate below for lowermost ½–⅓, densely, minutely stellate-pubescent without, glabrous within, 11–12 mm long; *staminal tube c.* 10 mm long, long-villous without in band below lobes, lobes *c.* 2·5 mm long, ± bilobed, glabrous, reflexed at anthesis, tube glabrous within except for band of small ascendant hairs just below anthers; *anthers* 5–6, *c.* 2–2·5 mm long, glabrous, alocellate, sessile, basifixed in angle of lobes, minutely pointed at apex; *disk* cupular, adnate to the ovary and half its height, glabrous; *ovary c.* 2·5 mm high, minutely pubescent; *style* glabrous except minutely pubescent in lower ½–⅓, capitate. *Fruit c.* 5 cm diam. (after Koorders).

Eastern Borneo and Sulawesi, 10–600 m.

INDONESIA. Kalimantan, E. Kutei, Sg Susuk Region, 20 m, 1 July 1951, *Kostermans* 5592 (A!, K!, L! LAE!, SING!); Sulawesi, Minahasa (Menado), 50 m, 4 Feb. 1895 *Koorders* 17960β (type); Menado Bolaang Mongodow Solog, 200 m, 12 April 1935, *Neth. Ind. For. Ser.* bb 19597 (A!). CULT. Bogor, 111 F8a, *Sutrisno* 45 (K!, LAE!, SING!). MALAYSIA. Sabah, Keningau, nr Laing Cave, Apin Apin, ± 600 m, 4 Aug. 1965, *Lajangah* SAN 44563 (K!, SAN!).

45. Chisocheton rex Mabberley, **sp. nov.**
(Fig. 10) A *C. koordersii* Mabberley foliis non acuminatis, nervis secundariis pluribus, ramis inflorescentiae tenuibus, floribus parvis sed calyco majore, differt.

Arbor ad 25 m altus, ambito 1·75 m. *Ramuli* foliati *c.* 11 mm diam., lenticellati, indumento stellato. *Folia* ad 52 cm longa, pseudogemmulata, foliolis usque ad 7-jugis; *rhachis* ubi siccata adaxiale canaliculata; *foliola* ad 21 cm × 6·5 cm, oblongo-ovata, praeter nervaturam abaxiale subglabra, apice non acuminata, base plus minusve rotundata, pseudogemmula dense pubescente, nervis secundariis circa 21 utrinque, fere marginem attingentibus. *Inflorescentia* (mascula solum cognita) ad 53 cm longa, axillis foliorum immaturorum orta, 2-ramosa, tenuis; *rami* ad 15 cm longi, circa 1 mm diam., gracillimi, dense pubescentes; *pedicelli* circa 5–8 mm longi, graciles, pubescentes; pseudopedicelli circa 1 mm × 1 mm, crassi; *calyx* circa 4 mm × 4 mm, cupulatus, pubescens, margine integro vel 6-lobato, prope pseudopedicellum rugoso; *petala* 5, 10 mm longa, anguste oblongo-elliptica, alba, valvata vel leviter imbricata, ubi siccata disjuncta, extus dense pubescentia, apice cucullata; *tubus staminalis* ad 8 mm longus, extus dimidio distale dense adpresse pubescens, intus praeter caespites sparsos infra antheras glaber, lobis 5, 1·5 mm longis, aliquantum praemorsis parum pubescentibus, praeditus; *antherae* 5, 1·5–2·0 mm longae, vix locellatae, glabrae, basifixatae; *discus* cupuliformis; *ovarium* ? bilocularis, pubescens; *stylus* distale glaber, stigma subcapitata mammilla apicale praedita. *Flores feminei* et *fructus* ignoti.

TYPE. New Hebrides, Espiritu Santo Is., N. coast of alluvial plain, E. of River Jordan, 5 March 1970, *Whitmore* 3032 (K!, holo (photo at FHO)).

LOCAL NAME. *Takavui* (Whitmore).

Known only from the type though this majestic tree is, according to Dr Whitmore, common on Espiritu Santo.

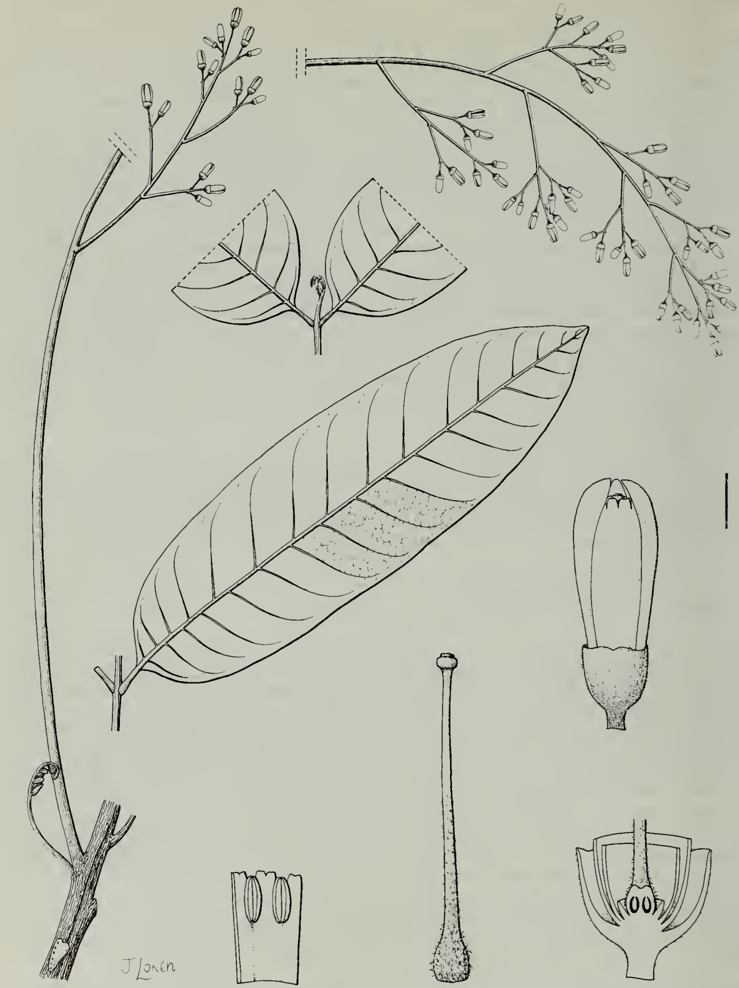

Fig. 10 *Chisocheton rex* Mabberley. From *Whitmore* 3032: leaf apex, lateral leaflet and inflorescence (scale = 2 cm), flower (scale = 2·5 mm) half flower base, pistil and part tube (scale = 1·25 mm).

46. Chisocheton stellatus P. F. Stevens

In *Contrib. Herb. Aust.* **11** : 43 & t. 6 (1975). Type: Papua New Guinea, Madang, Gogol logging area, 150 m, no. 1 ramp, 9 April 1970, *Wagapani* LAE 50004 (LAE!, holo; A, BRI, CANB, BO, K!, SING, NSW).

Tree to 30 m tall, to 60 cm d.b.h., buttressed to 1 m. *Bark* brown, flaky or not; *inner bark* brown to yellowish; *sapwood* white to straw. *Twigs c.* 6 mm across, stellate-velutinous. *Leaves* to 30 cm long, pseudogemmulate; *rachis* 3·0–4·5 mm across, petiolules 4–8 mm long; *leaflets* in up to 9 pairs, to 17 cm long and 8·5 cm wide, ovate to oblong, apex ± rounded, base rounded, stellate hairy on both surfaces, sometimes velutinous adaxially, midvein impressed adaxially, costae up to 18 on each side, venation prominulous abaxially. *Inflorescence* to 45 cm long, 1–2-branched; *branches* to 22·5 cm long, with congested cymules of flowers; *bracts* triangular, *c.* 1 mm long; *calyx* 1·3–1·7 mm long, densely pilose without, margin ± entire; *petals* 5(–6), 4·0–5·5 mm long, 0·7–1·0 mm wide, oblong-ligulate, white to yellow-green, densely pubescent without, valvate, separating from one another on drying; *staminal tube* (5–6)-lobed, lobes 1·0–1·2 mm long, retuse, pubescent without except at base and apex, within a little below anthers; *anthers* 5(–6), 0·8–1·0 mm long, scarcely locellate, connective pilose; *disk* crenulate, 0·4–0·8 mm tall, glabrous; *ovary* 2-locular, densely hairy; *style* ± glabrous, stylehead 0·4 mm diam. *Female flowers* and *fruits* unknown.

Northern New Guinea to 150 m.

INDONESIA. Irian Jaya, Geelvink Bay, Nabire, 3 m, *Kanehira & Hatusima* 11478 (A!) & Djajapura, Res. Hollandia, Tami, *Brouwer* BW 804 (LAE!). PAPUA NEW GUINEA. Madang, Gogol, LAE 50004 (type).

47. Chisocheton longistipitatus (F. M. Bailey) L. S. Smith

In *Proc. R. Soc. Queensl.* **70** : 29 (1959); Stevens in *Contrib. Herb. Aust.* **11** : 16 (1975); Johns, *Comm. For. Trees Papua New Guinea*, **5** : 217 (1976).

Castanospora longistipitata F. M. Bailey, *Queensl. Fl.* **1** : 288 (1899). Type: Australia, Queensland, Barron River (nr Cairns), 1895–99, *Cowley* 8D (BRI, holo).

Chisocheton polyanthus Harms in K. Schum. & Lauterb., *Fl. Schutzgeb.* : 383 (1901) & in *Engl., Bot. Jahrb.* **72** : 187 (1942). Type: Papua New Guinea, Morobe, Sattelberg, 12 Jan. 1899, *Bamler* 32 (B?†, holo).

Rhetinosperma longistipitata (F. M. Bailey) Radlk. in Engl. & Prantl, *Pflanzenfam.* II (3), **5** : 204 (1908).

Tree to 39 m tall; d.b.h. 75 cm; *buttresses* to 1·5 m. *Bark* dark brown, lenticellate; *inner bark* pale pink to yellowish; *sapwood* white. *Twigs* 4·0–8·0 mm diam., sometimes myrmecophilous, occasionally with milky latex. *Leaves* to 1 m long; *rachis* 2·0–4·5 mm diam. terete or channelled with short claw-like pseudogemmula; *leaflets* in up to 18 pairs, 9·0–32·0 cm long, 4·2–13·0 cm wide, elliptic-oblong, sparsely stellate-pubescent, midrib sunken, costae *c.* 18 on each side petiolules 4·0–8·0 mm. *Inflorescence* to 45cm long, 3–4-branched; *branches* to 10 cm long; *calyx* ± sessile, 1·5–3·0 mm tall, irregularly lobed to 1 mm; *petals* 4–5, 6–7 mm long, 0·4–0·7(–(1·0) mm wide; *staminal tube* 5-lobed, pubescent except at base and apex, lobes retuse, 1·4–1·8 mm long; *anthers* (4–)5, 0·8–1·3 mm long, scarcely locellate; *disk* cupular; *ovary* 2(–3, Stevens)-locular; *style* 3·5–4·0 mm long, stellate-pubescent except near apex, stylehead cylindrical with small mammilla. *Infructescence* to 30 cm, of reddish ± spherical fruit, 3·0–3·5 cm long, stipe 1·0–2·0 cm long, pericarp spongy; *seeds* 3, sarcotestal, with hole at micropyle, cotyledons collateral.

Papuasia and Queensland to 1065 m.

INDONESIA. Irian Jaya, Djajapura, Bodem River, BW 8106 (LAE!) & Arfai, Manokwari, *Mangold* 147 (L! LAE! (BW 2218)). PAPUA NEW GUINEA. West Sepik, Aitape, NGF 528 (LAE!); Madang, 5 miles SE Faita, *Saunders* 459 (LAE!); Morobe, Bulolo, NGF 7428 (A!, K!, LAE!); Northern, Isuarava, *c.* 1000 m, *Carr* 15887 (B!, BM!, SING!); Milne Bay, Raba Raba, NGF 34049 (L!, LAE!); Central, Abau, Cape Rodney, *Mabberley* 1793 (FHO!, K!, LAE!); New Britain, Hoskins, NGF 41464 (K!, LAE!); Bougainville, Mt Kamo, NGF 801 (L!, LAE!). SOLOMON IS. Choiseul, Wagina Is., BSIP 5447 (LAE!, SING!); Santa Isabel, Jejevo River, BSIP 7397 (K!, LAE!). AUSTRALIA. Queensland Whitfield Range, *Volck & Hyland* 2122 (BRI, L!) & 17°05′ S, 145°40′ E, *Hyland* 7955 (K!) & N. Kennedy Dist., Mission beach, *Smith & Webb* 4920 (BRI, K!).

Species *non satis cognitae*

48. Species A (sect. *Chisocheton* ser. *Schumanniani*)

Tree to 4 m. *Leaves* small, with small leaflets. *Fruit* 3-locular, pink.

PAPUA NEW GUINEA. Western Dist., Kiunga, *Ridsdale & Galore* NGF 33428 (LAE!) & 33466 (LAE!) & Ingembit, *Ridsdale & Galore* NGF 33348 (LAE!).

Known only in fruit, but apparently distinct from the rest of the species in the series.

49. Species B (sect. *Dasycoleum* ser. *Sandoricocarpi*)

Tree 20 m tall; d.b.h. 35 cm. *Bark* smooth, greyish, hoop-marked; *buttresses* to 1·3 m, 7·5 cm thick. *Leaves* to 70 cm; *leaflets* to 27 cm long, 8 cm wide, bluntly long-acuminate, velutinous abaxially, weakly pubescent on veins adaxially, costae *c.* 15 on each side. *Inflorescence* paniculate, supra-axillary, 70 cm long; *branches* to 22 cm, all brown long-tomentose; (*flowers* immature:) *calyx* irregularly lobed; *petals* 5; *anthers* 5, locellate; *disk* 0; *style* glabrous. *Fruit* 5 cm diam., red, velutinous; *seeds* 2.

INDONESIA. Kalimantan, C. Kutei, *Kostermans* 10558A (L!, SING!) & Balikpapan, *Kostermans* 10024 (L!), 4175 (A!, SING!), 7383 (A!, K!, SING!). MALAYSIA. Sarawak, Kapit, S 25844 (K!, SAR!) & S 28793 (FHO!, K!, L!) & Miri, S 21307 (FHO!, K!, SING!).

N.B. The flowering specimen 10558A from Kalimantan seems referable here. The inflorescences are very short and some of the flowers are apparently galled or otherwise deformed. I refrain from giving this species a name until better flowering material is seen.

50. Species C (sect. *Dasycoleum* ser. *Sandoricocarpi*)

Two gatherings from Lahad Datu, Sabah, Malaysia, resemble *C. erythrocarpus* but the flowers are 4-merous, with a frilled calyx.

MALAYSIA. SAN 36018 (SAN!) & SAN 42241 (K!, SAN!).

51. Chisocheton warburgii Harms in *Fedde, Repert.* **42** : 9 (1937). Type: Indonesia, Sulawesi, N. Bojong, *Warburg* 15428 (B?†).

The description of this tree resembles that of *Chisocheton* species B, but differs in having 8–9(–10?) anthers. It has some similarities with *C. cauliflorus* Merr. (*q.v.*) but I have seen no material that exactly matches Harms's long and excellent description.

N.B. Stevens (1975 : 18) notes that *Schodde* 2404 from the Southern Highlands of Papua New Guinea may well represent a new species allied to *C. longistipitatus* (F. M. Bailey) L. S. Smith (sect. *Rhetinosperma*), but differing from that species in its larger fruit with lignified pericarp.

List of specimens studied

As the specimens in the above enumeration represent records by degree square in the main, it seems worthwhile to list all specimens seen for this monograph, not only as identification aid, but as an indication of the material on which the species descriptions are based. The figures in parentheses indicate the species numbering in the above account. 2280 gatherings (3970 sheets) were examined.

Key: A = species A (48), aen = *C. aenigmaticus* (17), amab = *C. amabilis* (25), B = species B (49), C = species C (50), caul = *C. cauliflorus* (10), cel = *C. celebicus* (18), cer = *C. ceramicus* (39), cru = *C. crustularii* (6), cum = *C. cumingianus* (28), -bal = subsp. *balansae*, -kin = subsp. *kinabaluensis*), cur = *C. curranii* (40), div = *C. diversifolius* (35), dys = *C. dysoxylifolius* (27), ery = *C. erythrocarpus* (43), gli = *C. glirioides* (19), gra = *C. granatum* (31), grand = *C. grandiflorus* (36), ko = *C. koordersii* (44), lan = *C. lansiifolius* (30), lao = *C. laosensis* (21), lasioc = *C. lasiocarpus* (14, -car = *caroli*, -form = *formicarum*, -novog = *novoguineensis*, -pach = *pachyrhachis*, -schlec = *schlechteri*, -schum = *schumannii*, -tric = *trichocladus*, -vers = *versteegii*, -wein = *weinlandii*), lasiog = *C. lasiogy-*

nus (24), lon = *C. longistipitatus* (47), macra = *C. macranthus* (1), macro = *C. macrophyllus* (26, -fulv = subsp. *fulvescens*), med = *C. medusae* (2), men = *C. mendozai* (37), mont = *C. montanus* (12), novob = *C. novobritannicus* (11), pat = *C. patens* (29), pauc = *C. pauciflorus* (34), pell = *C. pellegrinianus* (42), pend = *C. penduliflorus* (5), pent = *C. pentandrus* (41, -med = subsp. *medius*, -pauc = subsp. *paucijugus*), per = *C. perakensis* (32), pil = *C. pilosus* (15), pohl = *C. pohlianus* (13), poly = *C. polyandrus* (4), rex = *C. rex* (45), rub = *C. ruber* (22), sap = *C. sapindinus* (20), sar = *C. sarawakanus* (23), saras = *C. sarasinorum* (33), say = *C. sayeri* (16), scho = *C. schoddei* (8), set = *C. setosus* (7), ste = *C. stellatus* (46), ten = *C. tenuis* (9), tom = *C. tomentosus* (3), vin = *C. vindictae* (38).

Achmad 117 (L) – aen, 265 (L) – cer, 642 (K, L) – aen, 673 (U) – pat, 681 (A, K, L) – aen, 947 (U) – pat, 1337 (K, U) – pat; *Adduru* 17 (K) – pent, 77 (K) – cer, 168 (K) – cer; *Alphonso et al.* S 195 (KEP, L) – pauc; *Alston* 14553 (BM) – lasiog, 15430 (BM) – lasioc-wein, 15575 (BM) – cum; *Alvins* 871 (SING) – pauc, 1163 (SING) – pend, 2004 (SING) – pat, 2011 (SING) – pend, *s.n.* (SING) – ery, *s.n.* (SING) – pat; *Anderson* 30 (E, K) – pat, 499 (K, SAR) – cer, 4084 (A, K, SAN, SAR) – cer, 4281 (K, SAN, SAR) – pent-pauc; *Ando et al.* 32 (KEP) – sar, 51 (KEP) – sar; *Anon. s.n.* (CALC, G, K, L) – pat; ANU 5562 (L, LAE) – mont, 9591 (LAE) – cum; *Atmodjo* 428 (L, FHO (photo)) – vin;

B . . . (CALC. herb. 79862–3) 8213 (CALC) – pat; *Balansa* 1489 (K) – cum-bal, 3697 (P) – cum-bal, 3701 (G, K, L, LE, P) – cum-bal; *Barnes* (Dec. Phil. : 239) (A, G) – pent; *Bates* 12159 (K) – cum-bal; *bb* 6644 (L) – pent, 12663 (L) – pent, 13502 (L) – pent, 14333 (K, L) – pent, 16168 (A) – macro, 17894 (A) – macro, 18526 (A) – ? cer, 18813 (A) – ? cer, 19208 (L) – ko, 19220 (A) – cer, 19221 (A) – cer, 19230 (L) – macra, 19239 (L) – macro, 19597 (A) – ko, 21323 (A) – ko, 22392 (A) – cer, ± 25173 (A) – cer, 25930 (L) – ? lao, 26246 (?) – pat, 30364 (L) – cum, 33431 (*Kostermans* 226) (K, SING) – cer; *bb Cel/V*-173 (L) – cum; *Beccari* 1845 (G, K, LE) – pent-pauc, 3186 (K) – sar; *Beguin* 551 (L) – cer, 1240 (L) – cum, 1900 (L) – pent, 2302 (K, L) – lao; *van Beusekom & Phengkhlai* 277 (E, K, L, P) – dys, 662 (E, K, L, P) – pat; *Birő* 18 (BP) – lasioc-wein/trich, 202 (BP) – lon; *Bistras* (?) 1577 (A) – cum-bal; *Blume s.n.* (G, L.) – pat, *s.n.* (G, L. (FHO photo), U) – pat, *s.n.* (CALC, K, L) – pat, *s.n.* (K, L (FHO photo), U) – pat; *BNB* 3116 (FHO, K) – Ian, 3215 (K) – pent-pauc, 7705 (K, L, SING) – sar, 9950 (K, L, SING) – sar; *BNB FD* 3213 (FHO, K) – macra, 4561 (K, L) – med; *Boden Kloss* 19079 (SING) – poly; *Borden* 1656 (K) – pent, 1689 (BM, SING) – pent, *s.n.* (K) – pent; *Bp F* 341 (U) – pat, 1042 (L) – pat; *Branderhorst* 351 (K, L, U) – lasioc-wein; *Brandis* 720 (K) – dys; *Brass* 716 (A, SING (photo)) – say, 1080 (K, LAE) – lasioc-wein, 5367 (BM, K, L) – lasioc-novog, 5477 (SING (photo)) – say, 5561 (SING (photo)) – say, 7174 (A) – ? say, 8020 (BM) – lasioc-wein, 8127 (LAE) – lasioc-wein, 23624 (LAE) – say, 23849 (K, LAE) – lasioc-wein, 23998 (LAE) – lasioc-wein, 24035 (K, L, LAE) – cer, 25607 (A, K, LAE) – say; *Brooke* 10138 (G, L) – poly, 10157 (L) – poly; *Brown* 109 (A) – lasioc-wein; *BRUN* 349 (L, SAR) – poly, 5033 (K, KEP, L, SAR, SING) – ery, 5221 (KEP, SAR) – cer; *BS* 211 (SING) – pat, 950 (A) – pent-pauc, 1031 (U) – pent, 1077 (U) – pat, 1324 (A, BM, SING) – pent, 1708 (A, BM, SING) – cer, 1812 (BM, SING) – pent, 1898 (SING) – pent, 2649 (A) – pent-pauc, 4046 (SING) – pent, 12646 (BM, G, K,) – cum, 15427 (BM, SING) – pent, 15771 (G) – cum, 16429 (BM, K) – pent, 17537 (K) – pat, 17625 (K) – caul, 20426 (BM) – pat, 22157 (BM) – cum, 23848 (FHO) – pat, 24457 (A, BM, L) – caul, 24497 (BM, K, L, SING) – men, 24519 (K, FHO, photo) – caul, 27340 (A) – pat, 28188 (A) – pat, 28243 (BM) – cer, 29056 (A) – cum, 30001 (A, BM) pat, 30340 (BM, K) – cum, 30898 (SING) – pent, 33871 (BM) – pat, 33912 (A) – pent, 34367 (BM, SING) – cer, 34502 (BM) – pat, 34954 (K) – macra, 37000 (A, K) – pat, 39742 (A, *pp*; BM) – pent, 40860 (A, K) – cer, 41088 (A, G) – cer, 41669 (A, K) – pat, 42768 (A) – pent, 42812 (A) – pat, 45516 (A) – pat, 46982 (A) – pat, 47092 (BM, SING) – pent, 48838 (E, SING) – pent, 49820 (B) – cum, 75391 (SING) – pat, 77074 (K, SING) – cer, 79163 (SING) – pat, 83392 (A, SING) – pent, 83618 (A, SING) – pent, 83702 (A) – caul, *BSIP* 2717 (LAE) – lasioc-schum, 3164 (K, LAE) – lasioc-schum, 3181 (K, LAE) – lasioc-schum, 3209 (K, LAE) – lasioc-schum, 3650 (K, SING) – lasioc-schum, 3772 (K, LAE, SING) – lasioc-schum, 3859 (K, LAE, SING) – lasioc-schum, 4379 (K, LAE) – lasioc-schum, 4783 (K, LAE) – lasioc-schum, 5075 (K, LAE) – lasioc-schum, 5134 (K, LAE) – lasioc-schum, 5195 (K, LAE) – lasioc-schum, 5364 (LAE) – lasioc-schum, 5447 (K, LAE, SING) – lon, 5878 (K, LAE, tending to trichocladus) – lasioc-schum, 6016 (K, LAE, SING) – lasioc-schum, 6755 (K, LAE) – lasioc-schum, 6929 (K, LAE) – lasioc-schum, 7178 (K, LAE) – lasioc-schum, 7233 (K, LAE) – lasioc-schum, 7397 (K, LAE) – lon, 7573 (K, LAE, SING) – lasioc-schum, 7698 (K, LAE) – lasioc-schum, 7731 (LAE) – lasioc-schum, 8320 (K, LAE, SING) – lasioc-schum, 8670 (K, LAE, SING) – lasioc-schum, 9589 (K, LAE) – lasioc-schum, 10428 (K, LAE, SING) – lasioc-schum, 10789 (K, LAE, SING) – lasioc-schum, 10941 (K, LAE, SING) – lasioc-schum, 11013 (K, LAE) – lasioc-schum, 11289 (LAE, SING) – lasioc-schum, 11410 (K, LAE) – lasioc-schum, 12081 (LAE) – lasioc-schum, 12314 (LAE) – lasioc-schum, 12669 (K, LAE) – lasioc-schum, 12846 (LAE, SING) – lasioc-schum, 13452 (LAE) – lasioc-schum, 13586 (LAE) – lasioc-schum, 14667 *p.p.* (LAE) – lon, 14889 (LAE) – lon, 15620 (K, LAE) – lasioc-schum, 15746 (LAE) – lasioc-schum, 16239 (K, LAE, SING) – lasioc-schum, 16442 (LAE) – lasioc-schum, 16607 (K, LAE) – lasioc-schum, 17303 (K, LAE) – lasioc-schum, 17461 (K, LAE) – lasioc-schum, 18831 (K, LAE) – lasioc-schum, 18902 (K, LAE) – lasioc-tric, 18990 (LAE) – lasioc-schum; *Bunchuai* 458 (FHO) – cum-bal; *Bur. Agr.* 1932 (K) – pent, 1939 (A, K) – pent, 2046 (SING) – pent, 2605 (K) – pent; *Burkill* 1312 (SING) – pat, *& Haniff* 12985 (K, KEP, SING) – per, 36622 (CALC) – cum-bal, *s.n.* (A, K, SING) – pat; *Burn Murdoch* 199 (SING) – tom, 201 (SING) – pent-pauc; *BW* 314 (L, LAE) - cer, 359 (L, LAE) – cer, 488 (L, LAE) – cer, 645 (LAE) – cum, 657 (L) – cer, 786 (K, L, SING) – cer, 804 (LAE) – ste, 817 (L) – cer, 1040 (LAE) – lasioc-wein, 1259 (K, LAE) – lasioc-wein/schum, 1454 (L) – lasioc-tric, 1625 (K, L, LAE, SING) – cer, 2218 (L, LAE) – lon, 2219 (LAE) – lon, 2220 (K) – lon, 2536 (L) – cer, 2695 (K, L, LAE) – cer, 2747 (K, LAE) – lasioc-schum, 2906 (L, LAE) – cer, 3410 (L) – cer, 3762 (LAE) –

lasioc-schum, 3940 (LAE) – lon, 3941 (LAE) – lon, 3963 (L, LAE) – cer, 4444 (L) – cer, 4668 (L) – lasioc-pach, 5155 (LAE) – lasioc-wein, 5627 (KEP, L, LAE) – cer, 5765 (L, LAE) – cer, 6293 (LAE) – lasioc-wein, 6703 (L, LAE) – lasioc-tric, 6815 (K, L, LAE) – lasioc-tric, 6998 (L) – cer, 7086 (SING) – lasioc-schum, 7701 (LAE) – cum, 7832 (L) – cer, 8106 (LAE) – lon, 8151 (LAE) – ste, 9152 (LAE) – cum, 9220 (LAE) – ste, 9202 (LAE) – cum, 9381 (LAE) – cum, 9771 (LAE) – lasioc-wein, 9833 (L, LAE) – cer, 9859 (LAE) – lasioc-wein, 10000 (L) – cer, 10085 (K, L, LAE) – cer, 10818 (LAE) – cum, 10842 (L, LAE) – lasioc-tric, 10859 (L, LAE) lasioc-tric/wein, 10950 (LAE) – lasioc-wein, 10959 (LAE) – lasioc-wein, 11021 (L, LAE) – cer, 11322 (L) – lasioc-pach, 11323 (L) – lasioc-pach, 11365 (K, L, LAE) – cer, 11683 (L) – cer, 11928 (L) – cer, 12144 (K, LAE) – cer.

Cantley's Coll. 2110 (?) (SING) – pend, *s.n.* (SING) – pend; *Carman* 50 (LAE) – cum; *Carr* 11589 (BM) – lasioc-wein, 12156 (BM, SING) – lasioc-novog/wein, 13243 (BM) – say, 13244 (BM, SING) – say, 13334 (BM, K, SING) – say, 13691 (BM, K) – say, 14259 (BM, K, L, SING) – say, 14484 (BM, K) – say, 14517 (BM, K, L, SING) – say, 14526 (BM, K, SING) – say, 14658 (BM, K, SING), lasioc-wein, 14757 (L, SING) – say, 14811 (BM, K, SING) – say, 14997 (K, SING) – lasioc-wein, 15396 (BM, K, L. SING) – say, 15797 (BM, L) – lon, 15887 (B, BM, SING) – lon, 15888 (B) – lon, 15920 (B) – say, 15921 (B) – say, 15951 (B, BM) – lasioc-wein, 16116 (SING) – say, 16232 (B, BM) – cum, 16268 (B, L, SING) – say, 16405 (B, BM, L) – cum, 16465 (SING) – cer; *Castro & Melegrito* 1441 (BM, K) – pent, 1612 (BM) – pent; CF 528 (SING) – pent-pauc, 968 (KEP, SING) – cer, 1134 (SING) – tom, 1588 (SING) – tom, 2439 (K) – cer, 3228 (K, SING) – pent-pauc; *Chand* 3061 (L) – cum-bal; *Chew* 244 (SING) – sar, 480 (K, SAR) – pent-pauc, 510 (A, K, L, SAR, SING) – rub, 955 (K) – pent-pauc, 1042 (L) – macra, 1175 (SING) – sar; *Chew, Corner & Stainton* 84 (K) – pent-med, 522 (K, SAN, SING) – pat, 1167 (K, SING) pat, 2693A (K, L, SAN) – cum-kin, 2827 (K, L, SAN) – cum-kin; *Ching* 8484 (A) – cum-bal; *Clemens* 103B (L) – lasioc-wein, 307 (L) – say, 311A (L) – say, 459 (A) – say, 535 (L) – lasioc-pach, 562 (L) – lasioc-pach, 854 (L) – say, 856B (L) – lasioc-wein, 1284 (L) – lasioc-pach, 1687 (G) – cum, 3825 (A) – ten, 3986 (A) – ten, 6588 (A, B) – ten, 7053 (K) – med, 8222 (L) – cum, 8391 (A) – cum, 10164 (A) – pent-med, 10389 (A) – cum-kin, 10414 (A, K) – cum-kin, 10431 (BM, K) – macra, 10903 (E) – lasioc wein, 11371 (E) – cum, 18061 (BM) – pent, 20023 (BM) – med, 20647/?26467 (A, BM, L, SING) – lan, 26080 (BM, K) – gra, 26100 (A, B, BM, G, K, L, SING) – cer, 26114 (L, SING) – macra, 26206 (A, BM, K) – pent-med, 26280 (BM, K) – macra, 26373 (A, BM, G, K, L) – poly, 26428 (BM) – gra, 26504 (BM) – gra, 26513 (BM) – macra, 26535 (A, B, BM, G, K, L) – lan, 26537 (BM) – gra, 26610 (BM) – macra, 26636 (BM) – poly, 26814 (BM, K) – gra, 26824 (BM) – cum-kin, 27015 (A, BM, K) – gra, 27217 (BM, G, K, L) – macra, 27299 (A, B, BM, G, K) – gra, 27892 (A, B, BM, G, K, L) – cum-kin, 28148 (A, G) – cum-kin, 28504 (A, B, BM, G, K) – cum-kin, '28862–30215' (A, B, BM, G, K, L) – cum-kin, '28872–30213' (A, BM, L) – cum-kin, 29310 (BM) – cum-kin, 29451 (A, B, BM, G, K) – cum-kin, 30214 (A, G, K) – pent-med, 30218 (A) – gra, 30220 (G, K, L) – macra, 32158 (BM, G, K) – cer, 40615 (A, BM, G, K) – cer, 41342 (E) – lasioc-wein, 50043 (A, BM, G, K) – lan, 50391 (BM, K) – cer, 50411 (BM, G, K, L) – macra, 51302 (K) – macra, *s.n.* (G) – cer, *s.n.* (March, 1907) (G) – macra, *s.n.* (June 1907) (G) – pat, *s.n.* (Sept. 1907) – macra, *s.n.* (Sept. 1931) – cer; *Mrs Collins s.n.* (K) – pend; *Corner s.n.* (LAE, SING) – pat, *s.n.* (SING) – pat, *s.n.* (SING) – pend, *s.n.* (SING) – pent-pauc, *s.n.* (SING) – sar; *Cowan s.n.* (E) – cum-bal, *s.n.* (E, K) – cum-bal; *Craven & Schodde* 157 (K, LAE) – lasioc-schum, 863 (K, LAE) – lasioc-wein; *Cuming* 683 (BM, G, K, L, LE, OXF) – pent, 822 (A, BM, CGE, G, K, L, OXF) – pat, 842 (A, BM, G, K, L, LE) – cum; *Curtis* 460 (BM, SING) – pend, 655 (K, SING) – pent-pauc, 892 (SING) – pat, 1493 (SING) – pent-pauc, 1519 (CALC, K, SING) – tom, 1685 (CALC, K, SING) – pat, 2002 (SING) – cer, 2327 (SING) – macro, 2469 (BM, CALC, K, K[ex SING]) – macro, 2693 (CALC, SING) – per, *s.n.* (K) – pat, *s.n.* (MPU) – pat, *s.n.* (SING) pend, *s.n.* (SING) – pauc, *s.n.* (April 1890) – (SING) – pent-pauc.

Darbyshire 283 (K, LAE) – lasioc-pach, 718 (K, LAE) – lasioc-wein, 852 (LAE) – cer, 968 (K, LAE, SING) – say; *Docters van Leeuwen* 9697 (L) – lasioc-schum, 9711 (L) – lasioc-schum, 9927 (K, L) – cer, 11268 (K, L, SING) – cum; *Doppler* (?) *s.n.* (BM) – cum-bal; *Dumas* 1571 (L) – pat; *Dussault* '85' (P) – lao.

Elmer 7507 (A, BM, BP, E, LE) – pent, 7837 (BP) – pat, 8155 (G) – cum, 8169 (BP, K, LE) – cum, 8828 (E, G) – pent, 8964 (A, BM, K) – cum, 9304 (A, BM, BP, E, G, LE) – cum, 10379 (A, BP, E, K, LE) – pent, 10697 (BM, K, L) – macra, 10884 (A, BM, BP, G, K,L, U) – pat, 11082 (BM, K, L) – macra, 11618 (A, BM, BP, G, K, L, U)– cer, 13487 (A, BM, G, K, U) – cer, 13592 (A, BM, BP, G, K, U) – pat, 13924 (A, BM, BP, K, U) – pent, 14395 (A, BM, BP, G, U) – pent, 15209 (A, BM, BP, K, U) – pent, 15451 (A, BM, G, K, U) – cum, 15496 (A, BM, BP, K, U) – pent, 15776 (A, BM, K, U excl. fls) – pent, 15857 (A, BM, BP, K, U) – pent, 16698 (A, BM, BP, G, K, U) – cer, 17552 (A, BM, BP, K, U) – pent, 18055 (A, BM, BP, K, U) – cum, 18285 (A, BM, BP, K, U) – pent, 20687 (A, BM, BP, G, K, U) – pent-med, 21541 (A, G, K, L, SING) – med, 21552 (BM, K, L, SING, U) – pent- pauc, 21706 (A, BM, BP, G, K, U) – pent-med, 21826 (A, BM, BP, G, K, U) – pent-med, 21834 (A, BM, G, K, SING, U) – sar, 21861 (K, L, SING) – macra; *Endert* 2591 (L) – macra, 4766 (K, L, SING) – med, 5127 (L, SING) – lan; *Evrard* 766 (P, photo FHO) – pell; *Expo. Paris* 64 (L) – ama.

FB 78 (BM) – pent, 417 (K, SING) – pent, 651 (K, SING) – pent, 718 (K, SING) – pent, 993 (K) – pent, 1470 (K) – pent, 1482 (BM) – pat, 1653 (K) – pat, 1743 (K) – pat, 1800 (K) – pent, 2250 (SING) – pent, 2441 (SING) – pat, 3187 (K, SING) – pent, 3664 (K) – cer, 3679 (K) – pent, 4097 (K) – pat, 5765 (LE) – pent, 10273 (G) – cum, 18965 (BM) – pent, 22702 (K) – pent, 22805 (A, SING) – pent, 22852 (A) – pat, 23880 (A) – pent, 24645 (BM) – pent, 24707 (A) – pent, 25467 (K) – pent, 28650 (BM) – pent, 29043 (K) – pat, 29045 (SING) – pent, 29048 (BM) – pent, 29545 (A, SING) – pent; *FD* 720 (SING) – pat, 1355 (K) – pent-pauc, 1837 (KEP, SING) – sar, 2275 (K) – tom, 2844 (KEP) – cer, 3228 (SING) – pent-pauc, 4620 (K) – pent-med, 4771 (K) – pent-med, 5120 (KEP) – sar, 8038 (FHO, KEP) – pat, 10457 (K, KEP) – pat, 10463 (K, KEP) – pat, 11156 (KEP, SING) – sar, 13077 (KEP) – pat, 13385 (KEP) – macro, 13609 (KEP) – sar, 14355 (KEP, SING) – pat, 20410 (SING) – macro, 23346 (SING) – pend, 25576 (KEP) – pent-pauc, 28228 (KEP) – pat, 38021 (KEP) – cer, 48623 (KEP) – pent-pauc; *Fénix* 28223

(A) – cum, 28230 (A, BM, K) – cum, 28243 (K) – cer; *Fleury* 30107 (P) – cum-bal, 32160 (P) – cum-bal; *FMS* 10468 (SING) – pend; *Forbes* '62' (G) – lasioc-novog, 69 (BM) – say, 88 (BM, L) – cer, 179[a] (BM) – say, 270 (BM) – say, 714 (BM, G) – lasioc-novog, 834 (G) – lasioc-novog, 1319 (CALC) – lasiog, 1325 (BM) – lasiog, 1363 (BM) – lasiog, 1383 (A, BM) – lasiog, 2723 (BM, L, LE, SING) – pat, 2755 (BM, L) – cer, 2928 (A) – macro, 1399 C (BM) – lasiog; *For. Guard* 592 (SING) – pat, *s.n.* (BM) – pend; *Foxworthy* 23 (A) – cum; *Frake* 950 (A) – cum; *FRI* 6 (K, KEP, L, SING) – pat, 96 (K, KEP, SING) – pat, 681c (A, K) – cer, 741 (A, K, L, SAN, SING) – pat, 900 (KEP, SAN, SING) – macro, 1010 (KEP, L, SING) – tom, 1534 (K, L, SAR, SING) – pat, 2048 (A, K, KEP, L, SAN, SING) – macro-mac/fulv, 2130 (K, KEP, L, SAN, SING) – pat, 2225 (K, L, SING) – pat, 2287 (KEP, L) – pat, 2298 (KEP, SING) – pent-pauc, 2300 (KEP) – pent-pauc, 2320 (K, KEP, L, SING) – ery, 2400 (K, L) – sar, 2505 (KEP) – pend, 2554 (KEP) – pent-pauc, 2579 (K, KEP, SAR) – pat, 2579A (L) – pat, 2876 (K, KEP) – per, 2946 (K, KEP) – macro-fulv, 2966 (KEP) – tom, 3037 (KEP, L, SING) – pat, 3152 (A, K, KEP, SAN SING) – cer, 3463 (A, K, KEP, L, SAN, SING) – tom, 3517 (A, KEP, L, SING) – pauc, 3587 (A, K, KEP, L, SAR, SING) – cer, 4174 (A, K, KEP, SING) – cer, 4352 (KEP) – tom, 4475 (K, KEP, SAR, SING) – tom, 4495 (K, KEP, L, SING) – macro-fulv, 4615 (KEP) – pat, Ja 4647 (L) – macro, 4964 (KEP) – pat, 6371 (KEP) – cer, 6526 (K, KEP) – tom, 6774 (K, KEP, SAR) – cer, 6886 (K, KEP, L, SING) – pauc, 6934 (K, KEP, SAR) – pat, 6974 (K, KEP, SING) – pauc, 7053 (K, KEP, L, SAR) – macro-fulv, 7227 (A, K, KEP) – sar, 7240 (A, K, KEP, SING) – sar, 7436 (KEP, L, SAR) – cer, 7444 (KEP) – cer, 7596 (K, KEP, L, SAR) – pent, 7855 (KEP, L) – pauc, 8252 (KEP) – pend, 8353 (K, KEP) – sar, 8434 (K, KEP, L) – pend, 8763 (K, KEP) – pent-pauc, 10644 (K, KEP) – macro-mac/fulv, 11153 (KEP) – pat, 11266 (K, KEP, SING) – macro, 11369 (K, KEP, SING) – sar, 11595 (K) – tom, 11654 (K, KEP) – pend, 11721 (K) – pent-pauc, 11857 (K, KEP, L, SING) – cer, 12050 (K, L, lvs of *Aglaia:* KEP) – cer, 13130 (K, KEP, SING) – macro-fulv, 13204 (K, KEP, L) – macro-fulv, 13242 (K, KEP, SING) – macro-fulv, 13433 (A, K, KEP, L, SING) – sar, 13627 (A, K, KEP) – sar, 13677 (K, KEP, SING) – cer, 13699 (A, K, KEP, L, SING) – macro-fulv, 13762 (A, K, KEP L.) – pat, 14120 (A, K, KEP, SING) – pauc, 14411 (A, K, KEP, L, SING) – macro-fulv, 14522 (A, K, KEP) – macro-fulv, 14680 (K, KEP) – tom, 14700 (K, KEP) – tom, 14802 (K) – cer, 14827 (K) – pat, 14896 (K) – cer, 15310 (K, KEP) – pent-pauc, 15319 (K, KEP) – macro-fulv, 15620 (K, KEP) – pent-pauc, 15729 (KEP) – cer, 15737 (K, KEP) – sar, 15802 (K) – tom, 15813 (KEP) – macro-fulv, 15832 (KEP) – cer, 16396 (K, KEP) – tom, 16397 (K) – pauc, 16943 (KEP) – pat, 17151 (K, KEP, SAR, SING) – ery, 17256 (K, KEP, SING) – macro-fulv, 17323 (K, KEP, SING) – ery, 17742 (K, KEP) – sar, 19017 (KEP) – macro-fulv, 19278 (KEP) – pend, 19811 (K, KEP) – pent-pauc, 20130 (K) – macro-fulv, 21571 (K) – cer, 23361 (K) – cer.

Gamble 7697 (K) – cum-bal; *Garrett* 1224 (E, K, L) – cum-bal; *Geesink et al.* 5283 (K) – pat, 5724 (K) – cum-bal; *Gjellerup* 596 (L) – lasioc-pach, 726 (?L) – lasioc-tric, 732 (L) – lasioc-wein; *Gomez* '355' (BM, K-W, LE) – grand; *Grashoff* 741 (L) – pat, 808 (L) – ama; *Griffith* 660 (BM) – cum-bal, 1062/1 (A, K, L) – pat, '1063' (A, K) – cum-bal, '1065' (K) – pend, '1084' (K) – cum-bal, 1845 (CGE, K) – pat, *s.n.* (BM, CGE, MPU) – pat, *s.n.* (K, MPU) – cum-bal.

Haines 342 (K) – cum-bal; *Hallier* 466 (G, K) – sar, 1938 (K, L) – macra; *Haniff* 15517 (K, SING) – pat, 21031 (SING) – pend; *Hardiel & Sidek* 452 (K, L, LAE, SING) – sar, 457 (K, LAE, SAN, SAR, SING) – pat, 644 (LAE) – pat; *Hartley* 9901 (G, LAE) – lasioc-wein, 9902 (G, K, L, LAE) – cer, 10081 (K, LAE) – cum, 10238 (A, G, LAE) – say, 10603 (G, K, LAE) – lasioc-wein, 10760 (A, LAE) – sap, 10954 (K, LAE) – lasioc-wein, 10995 (LAE) – sap, 10996 (K, LAE) – cum, 11081 (K, LAE) – say, 11867 (K, LAE) – say, 11919 (LAE) – say, 12193 (K, LAE) – say, 12397 (G, LAE) – cum, 12648 (G, K, L, LAE) – sap; *Haviland* 594 (K, SAR) – rub, 597 (K) – ama, 992 (SAR) – ama, 1601 (K, SAR, SING) – sar, 1777 (SAR) – cum-kin, 1883 (K) – ama, 2379 (SAR) – ama, 2853 (K, SAR) – ama, 2854 (K, SAR) – ama, b z f d (K) – pent-pauc, c p g c (K) – sar; *H. Bot. Bogor* 126 (U) – pent; *Henderson s.n.* (SING) – pend; *Hollrung* 698 (K, L. LE) – lasioc-schum; *Holttum* 9628 (K, SING) – pauc; *Hoogland* 3447 (G, L, LAE) – cer, 3728 (BM, K, LAE) – say, 4898 (L, LAE) – lasioc-schum, 4931 (LAE) – lasioc-tric, 4932 (LAE) – lasioc-tric, *Hoogland* [*& Pullen*] 6178 (BM, G, K, L, LAE) – pohl, 8905 (K, L, LAE) – lasioc-wein, [*& Craven*] 10118 (K, L, LAE) – lasioc-wein, 10161 (K, L, LAE) – cer, 10504 (L, LAE) – cer, 19627 (K, LAE) – lasioc-pach; *Hornabrook* 45 (LAE) – mont; *Hotta* 12947 (SAR) – pat; *Hull* 133 (SING) – pat; *Hullett* 800 (K) – pat; *HUM* 9027 (KLU) – pent-pauc; *Hyland* 2163 (LAE) – lon, 7955 (K) – lon.

Jacobs 4829 (K, L) – macro, 4860 (L) – macro, 5141 (B, K, L, SAR) – rub, 7872 (A, K, L) – pent, 8485 (K, L) – lasiog; *Jaheri* 529 (K) – sar, *s.n.* (K) – sar; *Jelinck s.n.* (LE) – pat; *Jenkins* '408' (A) – cum-bal, 413 (A) – cum-bal, *s.n.* (CALC, CGE, K) – cum-bal; *Junghuhn* 6 (L) – pat, '25' (L) – pent-pauc, '127' (L) – cer, '216' (K) – lasiog, *s.n.* (L) – cer.

Kadim & Noor 414 (K, L, SING) – pat; *Kajewski* 1997 (BM, G) – lasioc-schum, 2545 (BM, SING) – lasioc-schum; *Kanehira & Hatusima* 11478 (A) – ste, 11499 (A) – cer, 12719 (A) – say; *KEP* 7195 (KEP) – tom, 7296 (KEP) – cer, 12890 (SING) – macro, 17101 (KEP, SING) – ama, 20410 (SING) – macro-fulv, 24124 (SING) – pauc, 25159 (SING) – macro, 27919 (SING) – macro, 32552 (KEP) – ama, 44919 (K, KEP) – pat, 51961 (K, KEP) – sar, 52293 (KEP) – tom, 63123 (KEP) – pat, 63144 (KEP) – tom, 64090 (KEP) – ery, 64313 (KEP) – sar, 64337 (KEP) – sar, 64338 (KEP) – sar, 64530 (KEP) – ery, 64571 (KEP) – ery, 64596 (KEP) – ery, 64772 (KEP) – ery, 64782 (KEP) – pat, 65140 (KEP) – sar, 66640 (K, KEP) – macro, 68812 (KEP) – cer, 71153 (KEP) – ery, 71238 (KEP) – pat, 72431 (FHO, K, KEP, L, SING) – pat, 73502 (KEP) – pent-pauc, 76583 (KEP, SING) – ama, 77691 (K) – pent-pauc, 77783 (L, SING) – macro-fulv, 85233 (K, KEP, SING) – pat, 85240 (K, KEP, SAN, SAR, SING) – macro, 94082 (K, KEP) – pent-pauc, 94088 (A, K, KEP, L) – pat, 94679 (K, KEP) – macro-fulv, 94698 (L) – cer, 94747 (K, KEP, L, SING) – pat, 95007 (A, K, KEP, L, SAN, SING) – macro-fulv, 95010 (A, KEP, L, SAN, SING) – pat, 95012 (K, KEP, L, SAN, SING) – cer, 97728 (A, KEP, SING) – pat, 97758 (KEP) – sar, 97761 (K, KEP, SAN, SAR, SING) – pat, 97846 (KEP, SING) – pat, 97966 (KEP) – tom, 98236 (KEP, L, SING) – pat, 98513 (K, KEP, L, SAN, SING) – cer, 98548 (KEP, L) – pat, 98578 (K, KEP, SAN, SING) – ery, 98829 (K, KEP) – pauc, 98937 (A, K, KEP, L, SAN, SING) – cer, 99006 (K. KEP, SING) – pauc, 99018 (K, KEP, L) – macro, 99096 (KEP) – tom, 99160 (KEP) – tom, 99224 (KEP) – pent-pauc, 99379 (K, KEP) – cer, 99391 (K, L) – pauc, 99461 (KEP, SING) – macro, 99462 (K, KEP) – macro, 99588 (L, SING) – cer, 99818 (SING) – macro, 110338 (KEP, L) – pauc, 115694 (KEP) – tom, 115695 (K, KEP, L, SAR, SING) – pat; *Kerr* 2922 (K) – cum-bal, 5135 (K) – cum-bal, 6171 (K, SING) – cum-bal, 19217 (K, L, P) – pend; *Kiah s.n.* (KEP, SING) – pend; *King* '262' (CALC) – tom; *King's Coll.* 1746 (BM, CALC, K) – pent-pauc, 1876 (CALC) – sar, 2634 (CALC, G) – cer, 2876 (BM, G, K) – pauc, 3128 (BM, CALC (photo FHO), K, U) – pauc, 3187 (G, K) – cer, 3235 (A) – cer, 3312 (BM, K) – pat, 3313 (CALC (photo FHO), K) – pauc, 3396 (CALC, K) – pent-pauc, 3467 (CALC (photo FHO), K) – pauc, 3542 (K) – sar, 3848 (LE) – tom, 3946 (G, K, L, SING) – tom, 4348 (CALG, G, L) – sar, 4455 (CALC, L, SING) – pauc, 4502 (BM, SING) – pend, 4631 (G, K) – pat, 4795 (BM, G, LE, SING) – pat, 4860 (K) – pat, 5095 (BM, E, G, K, L, LE, SING) – tom, 5305 (G, L, LE, SING) – per, 5318 (BM, SING) – pend, 5343 (CALC) – tom, 5735 (CALC, CGE, E, K, SING) – sar, 5765 (CALC, G, K, L, LE) – pat, 5894 (CALC, K) – pend, 6137 (G, K, SING) – per, 6272 (CALC) – pend, 6864 (K) – sar, 7783 (BM, CALC, K) – sar, 8320 (L) – per, 8462 (BM, G, K) – pat, 10181 (BM, K) – cer, 10227 (G, K) – pat, 10266 (CGE, LE, SING) – pat, 10624 (CALC, LE, SING) – pat, 10750 (CALC, CGE, E, LE, SING) – pat, 11067 (CALC, K) – pauc, 11502 (CALC, SING) – pend, *s.n.* (Nov. 1881) (CALC) – sar; *Kingdom Ward* 12837 (BM) – cum-bal; *Kloss s.n.* (K) – pat; *Koerniasih* 31 (K, SING) – lasioc-wein; *Køie & Olsen* 1184 (FHO) – lasioc-wein; *Koorders* 4778β (A, L) – macro, 4878β (L) – macro, 4879β (L) – macro, 4880β (G, LE) – pat, 4883β (G, L) – macro, 4886β (G) – cer, 4887β (K, L) – cer, 4890β (K, LE) – pat, 4891β (G) – pat, 4892β (K, L) – macro, 4963β (K) – pat, 4991β (G, K, L) – macro, 4998β (L) – cer, 5020β (FHO) – pat, 5044β (L) – macro, 5065β (L) – macro, 5075β (G) – pent, 5076β (L) – macro, 5077β (K) – pent, 5078β (L) – macro, 5092β (K) – pent, 5329β (L) – macro, 5977β (K, L) – macro, 5999β (L) – macro, 6011β (L) – macro, 6020β (K, L) – cer, 12445β (SING) – pat, 12716β (G) – pent, 13564β (K) – pent, 14593β (FHO) – cer, 17948β (K, L) – cel, 17949β (L) – pat, 17950β (L) – cel, 17957β (K) – cel, 17958β (L) – cel, 17960β (K, L) – ko, 17964β (L) – ko, 17965β (L) – cel, 17973β (K, L) – ko, 17975β (L) – cel, 17977β (L) – cel, 17978β (L) – ko, 17988β (L) – cel, 17989β (L) – ko, 19701β (L) – cel, 19961β (LE) – pent, 19963β (L) – macro, 20852β (L, LE) – macro, 21872β (K, L) – pent, 21874β (K) – pent, 22673β (K) – pent, 22680β (FHO) – pent, 23020β (FHO, L) – macro, 23722β (L–) – macro, 28764β (L) – cer, 28985β (L) – cer, 29311β (SING) – cer, 29315β (L) – macro, 31350β (K) – pent, 31350β (K, L) – pent, 33016β (L) – macro, 33874β (L) – macro, 38283β (K) – cer, 38370β (L) – macro, 38760β (LE) – cer, 38771β (K) – pat, 38814β (L) – macro, *s.n.* (LE) – pat; *Kornassi* 578 (K, L) – lasioc-wein/lasioc; *Korthals* '121' (L) – cer, ?871 (L) – pat, *s.n.* (A, L, LE, U) – div, *s.n.* (L) – ama, *s.n.* (L) – pat, *s.n.* (L, U) – ama, *s.n.* (L, U) – pent-pauc, *s.n.* (U) – cer, *s.n.* (U) – pat; *Kostermans* 1A (G, K, LAE, SING) – pent, 44A (K) – pent, – *& Kuswata* 64 (K) – pent, 75A (K) – pent, (*UNESCO*) 143 (A, BM, K, KEP, LAE, SAN, SING) – pat, – *& Soegeng* 199 (L) – lasioc-pach, – *& Wirawan* 202 (K, L) – pent, 207 (K, L) – cer, 260 (= *bb* 33459) (SING) – cer, 275 (= *bb* 33475) (L, SING) – cer, 374 (K) – pat, KK & SS 383 (K, KEP, SING) – pent, – *& Wirawan* 413 (SING) – pent, 489 (L) – lasioc-pach, – *& Anta* 1038 (A, L) – pat, 1134 (SING) – cer, 2650 (L, SING) – lasioc-pach, 2650A (L) – cer, 4175 (A, SING) – B, 4361 (BM, G, K, LAE, SING) – pat, 4892 (BM, K) – pent, 5490 (SING) – lan, 5592 (A, K, L, LAE, SING) – ko, 5750 (K, LAE) – pent, 5897 (A, G, K, KEP, L, LAE) – med, 6224 (K) – pent-med, 6225 (A) – cer, 6834 (A) – macro, 7383 (A, K, SING) – B, 7694 (BM, K, LAE, SING) – pat, 8026 (L) – ama, 8127 (K, L, SING) – pat, 8681 (L) – pent-pauc, 8900 (L, LAE, SING) – sar, 9021 (SING) – lan, 9140A (L) – lan, 9141 (A, K, L, SING) – ery, 9318 (A, K, L, SING) – sar, 9571 (K, L, SING) – macro, 9963 (K, SING) – pat, 10024 (L) – B, 10172 (BM, K) – pat, 10195 (K, SING) – pat, 10523 (L) – lan, 10558A (K, L, SING) – B, 10716 (K) – sar, 11027 (K, SING) – lasioc-wein, 11208 (A, K) – cum-bal, 13249 (L, SING) – lan, 13460 (L) – pent-pauc, 13967 (K, L) – med, 18093 (A, K, L) – pent, 18254 (A, K, L) – pent, 18318 (A, K, L) – pent, 19083 (A, K, L, LAE) – pent, 19369 (A, K) – macro, 21585 (SAR) – saras, 22001 (L) – pent-pauc, 22014 (L) – pent-pauc, 23821 (G, K) – pat, 23890 (K) – pat; *Krukoff* 4041 (G, L) – lasiog, 4214 (A, L, LE, SING) – cer, 4234 (G, L, LE) – pat, 4255 (G, SING) – pat; *Kunoeang in Haviland* c o d z (BM (?), K, SAR) – set; *Kunstler* 3187 (L) – macro; *Kurz s.n.* (U) – pat; *Kuswata & Soepadmo* 41 (A, K, L, SING) – cer, 135 (A, L) – cer, 166 (A, K) – cer, 297 (K, L) – pent, 873 (K) – pent-pauc.

Lace 3059 (E) – cum-bal, *s.n.* (E) – cum-bal; *LAE* 50004 (K, LAE) – ste; 50356 (LAE) – say, 51216 (K, LAE) – lasioc-tric, 52075 (K, L, LAE) – cer, 52087 (K, L, LAE) – cer, 52097 (K, L, LAE) – lasioc-wein, 52100 (K, L, LAE) – cer, 52110 (L, LAE) – lasioc-tric, 52126 (LAE) – lasioc-tric, 52134 (K, L, LAE) – lasioc-wein, 52156 (K, L, LAE) – lasioc-wein, 52168 (K, L, LAE) – lasioc-wein, 52343 (LAE) – lasioc-schlec, 52830 (K, L LAE) – lasioc-car, 52941 (K, L, LAE) – cer, 52942 (K, L, LAE) – lasioc-wein, 53441 (KLU, LAE) – lasioc-wein, 53855 (L, LAE) – lasioc-novog, 53857 (L, LAE) – lasioc-novog, 55778 (K, L, LAE) – lasioc-wein, 56353 (K, LAE) – sap, 56356 (LAE) – say, 56360 (K, LAE) – say, 58001 (L, LAE) – cer, 58003 (K, L, LAE) – cum, 58007 (E, K, L, LAE) – cum, 58011 (LAE) – lasioc-wein, 58013 (K, LAE) – lasioc-wein, 58064 (LAE) – cum, 58065 (L, LAE) – mont, 58067 (LAE) – ten, 58075 (E, K, L. LAE, SING) – mont, 58082 (LAE) – sap, 58083 (K, LAE) – sap, 58171 (L, LAE) – say, 58173 (LAE) – say, 58175 (LAE) – say, 58185 (LAE) – lasioc-wein, 58697 (LAE) – lasioc-wein, 58703 (LAE) – lasioc-tric, 60170 (K, LAE) – say, 60347 (K) – cer, 66519 (K) – lasioc-wein; *Lake & Kelsall s.n.* (SING) – pend; *Lakshnakara* 643 (L) – cer; *Lam* 502 (L) – lasioc-form, 573 (L) – lasioc-form, 1201 (L) – lasioc-pach; *Larsen et al.* 2623 (E, K, L) – cum-bal; *Ledermann* 6707 (B) – cer, 6717 (B) – lasioc-?schum, 9661 (B) – lasioc-tric, 10401 (B) – cer, 13096 (B) – lasioc; *Liang* 69470 (A) – cum-bal; *Loher* '260' (K) – cum, 265 (K) – pent, 266 (K) – cum, 5655 (K) – pent, 5662 (K) – cum, 5665 (K) – pent, 5666 (B, K) – pent, 5681 (K) – pent, 5687 (K) – pat, 5693 (K) – cum, 5700 (K) – pent, 6749 (K) – pat, 5865 (K) – pat, 13969 (A) – pat, 14501 (BM) – pat; *Lörzing* 5505 (K, U) – cer, 5518 (U) – cer, 12785 (A, K, L) – cer; *Lütjeharms* 5246 (K) – pat.

Mabberley 1542 (FHO) – tom, 1546 (FHO) – macro, 1547 (FHO) – macro, 1551 (FHO) – pat, 1553 (FHO) –

macro, 1556, 1557, 1561 (FHO) – tom, 1560 (FHO) – pat, 1573 (FHO) – cer, 1624 (FHO, SAR) – cer, 1635 (FHO) – rub, 1637 (FHO) – rub, 1645 (FHO) – sar, 1645 (FHO) – sar, 1653 (FHO) – pent-med, 1651 (FHO) – pent-med, 1655 (FHO) – sar, 1663 (FHO) – sar, 1669 (FHO) – pent-med, 1676 (FHO, K) – pent-med, 1680 & 1682 (FHO) – med, 1688 (FHO) – poly, 1690 (FHO) – sar, 1708, 1709 (FHO) – poly, 1716 (FHO) – sar, 1718 (FHO, SAN) – macra; *Mabberley & Henty* 1720 (FHO, LAE) – cer, *Mabberley* 1721, 1726 (FHO, LAE) – lasioc-wein, 1742 (FHO, LAE) – cum, 1745 (FHO, K) – sap, 1746 (FHO) – sap, 1747 (FHO, LAE) – lasioc-schum, 1748 (FHO, LAE) – cer, 1751 (FHO, LAE) – lasioc-tric, 1753 (FHO, LAE) – lasioc-tric, 1754 (FHO, LAE) – lasioc-schum, 1757 (FHO, LAE) – cum, 1763 (FHO) – mont, 1765 (FHO, LAE) – ten, 1766 (FHO, K) – mont, 1772 (FHO, LAE) – pohl, 1773 (FHO, K, LAE, UPNG) – scho, 1788 (FHO, K, LAE) – say, 1789 (FHO, LAE) – say, 1793 (FHO, K, LAE) – lon, 1797 (FHO) – pat; *MacAdam* 264 (LAE) – cum; *Macgregor* 546 (CALC, E) – cum-bal; *McIntosh* W79 (LAE) – lon; *McKee* 6240 (K) – cum-bal, 6302 (K) – cum-bal, 6303 (K) – cum-bal; *Mahmout* (??) 1887 (SING) – cer; *Maingay* '324' (A, BM, CGE, K, L) – pat, '325' (BM, K) – pend, '363' (A, G, E, K) – pent-pauc, '1379' (K) – ery, '1382' (K) – pat, '2459' (K) – pat, 2525 (K, L) – ery; *Mann s.n.* (CALC) – cum-bal; *Meijer* 2075 (A, L, LAE, SING) – sar, 2297 (A, K, L, LAE, SING) – sar, 5793A (L) – cer; *Merrill* 1890 (K) – pat, 2933 (BM) – pent; *Millar & Gebo* 1154 (LAE, UPNG) – scho; *Müller* 921 (L. P) – cum-bal; *Murton* 95 (BM, K) – pent-pauc; *Mzadiman s.n.* (SING) – pat.

NBFD 1523 (K) – sar; *van Niel* 3847 (L) – ama, 4335 (L) – ama; *NGF* 148 (L, LAE) – lasioc-wein, 228 (LAE) – cer, 238 (K, L, LAE) – lasioc-wein, 528 (LAE) – lon, 596 (K, L, LAE) – lasioc-tric, 695 (LAE) – lasioc-wein, 699 (LAE) – cum, 801 (L, LAE) – lon, 868 (K, L, LAE) – cum, 869 (K, L, LAE) – cer, 905 (LAE) – lasioc-wein, 908 (LAE) – lasioc-wein, 911 (LAE) – lasioc-wein, 913 (LAE) – cer, 1185 (K, L, LAE) – lasioc-wein, 1650 (LAE) – cer, 1704 (K, L, LAE) – lasioc-wein, 1725 (K, L, LAE) – cer, 1740 (K, L, LAE) – cum, 2055 (K, L, LAE) – cer, 2056 (K, L, LAE) – cum, 3208 (K, LAE) – lasioc-wein, 3244 (K, LAE) – lasioc-wein, 3430 (BM, K, LAE, SING) – cum, 3586 (FHO, K, LAE, SING) – lasioc-wein, 3684 (K, LAE) – lasioc-schum, 3697 (FHO, K, LAE, SING) – lasioc-pach, 3812 (LAE) – cum, 3848 (FHO, K, LAE, SING) – lasioc-schum, 3921 (FHO, K, LAE, SING) – lasioc-schum, 3928 (FHO, K, LAE) – lasioc-car, 4010 (FHO, K, LAE, SING) – lon, 4015 (FHO, K, LAE, SING) – lasioc-wein, 4081 (K, LAE) – lasioc-wein, 4577 (K, L, LAE) – scho, 5264 (K, LAE, SING) – cum, 5288 (K, LAE, SING) – lasioc-wein/schum, 5618 (K, LAE) – say, 6215 (K, L, LAE) – lasioc-wein, 6219 (K, L, LAE) – lasioc-wein, 6427 (K, LAE) – lasioc-wein/schum, 6566 (K, LAE) – lasioc-wein/schum, 6671 (K, L, LAE, SING) – cer, 7035 (K, LAE)– cer, 7067 (K, L, LAE) – cer, 7075 (BM, K, LAE, SING) – lasioc-wein/schum, 7162 (K, L, LAE, SING) – cer, 7248 (K, LAE, SING) – lasioc-wein, 7327 (K, LAE) – lasioc-wein, 7334 (K, LAE) – cum, 7428 (K, LAE) – lon, 7517 (K, LAE) – cum, 7533 (K, LAE, SING) – lasioc-wein, 7943 *p.p.* (BM, K, LAE, SING) – lasioc-wein/schum, 7943 *p.p.* (LAE) – cer, 7989 '9789' (K, L, LAE) – sap, 8045 (K, L, LAE) – cer, 8162 (K, L, LAE, SING) – cer, 8170 (K, LAE) – lasioc-wein, 8207 (LAE) – lasioc-wein, 8256 (LAE) – scho, 8812 (K, LAE) – lasioc-wein, 9164 (K, L, LAE) – lon, 9667 (K, LAE, SING) – lasioc-wein, 10015 (LAE) – novob, 10106 (K, LAE, SING) – lasioc-wein, 10128 (K, LAE, SING) – lasioc-wein, 10132 (K, LAE, SING) – lon, 10206 (LAE) – lon, 10253 (LAE) – cer, 10451 (K, LAE) – pohl, 10536 (L, LAE) – cer, 10537 (L, LAE) – lasioc-wein, 10542 (K, L, LAE, SING) – cer, 10830 (K, LAE, SING) – lasioc-wein/schum, 10884 (LAE) – cum, 11608 (K, LAE, SING) – cum, 11665 (K, LAE, SING) – say, 11750 (LAE) – lasioc-wein, 11926 (LAE) – sap, 13038 (LAE) – cer, 13259 (K, L, LAE, SING) – cer, 13269 (L, LAE) – lasioc-form, 13277 (K, L, LAE) – cer, 14348 (L, LAE) – cer, 14358 (K, L, LAE) – lasioc-wein, 14358 (LAE) – lasioc-wein, 14417 (K, L, LAE) – cer, 14862 (K, LAE) – cum, 15439 (LAE) – lasioc-wein, 16086 (E, LAE, SING) – cer, 16936 (LAE, SING) – say, 17014 (K, LAE) – lasioc-wein, 17186 (K, LAE) – lasioc-wein, 17299 (E, K, L, LAE, SING) – lasioc-wein, 17609 (K, LAE, SING) – say, 17800 (E, K, L, LAE, SING) – lasioc-wein, 18400 (L, LAE) – lasioc-wein, 18413 (LAE) – lasioc-wein, 19154 (LAE) – sap, 19176 (K, L, LAE, SING) – lon, 19205 (K, L, LAE) – sap, 19271 (LAE) – say, 19416B (LAE) – lasioc-wein, 19515 (K, LAE, SING, tending to weinlandii) – lasioc-tric, 19624 (LAE) – cer, 19633 (K, LAE) – cer, 21573 (BM, FHO, L) – lasioc-wein, 21740 (K, SING) – lasioc-wein/schum, 21758 (K, LAE, SING) – lasioc-wein/schum, 22127 (LAE) – scho, 22409 (K, LAE, SING) – lasioc-tric, 22410 (LAE) – novob, 22445 (L (photo FHO), LAE) – novob, 23049 (LAE) – lasioc-wein, 23481 (K, L, LAE) – cer, 23576 (LAE) – say, 23601 (K, L, LAE, SING) – cum, 24024 (K, LAE) – lasioc-wein, 24029 (K, LAE, SING) – cum, 24041 (LAE) – novob, 24324 (L, LAE) – lasioc-wein, 24328 (L, LAE) – lasioc-wein, 24335 (L, LAE) – lasioc-wein, 24848 (K, L, LAE, SING) – cum, 26489 (K, L, LAE) – cer, 26582 (K, LAE, SING) – cer, 26683 (LAE) – novob, 26727 (BM, LAE, SING) – lasioc-wein/schum, 27530 (E, K, L, LAE) – lon, 28011 (LAE) – lasioc-pach, 28014 (K, LAE) – lasioc-tric, 28610 (L, LAE) – say, 28748 (L, LAE) – say, 28808 (LAE) – say, 29141 (K, L, LAE, SING) – cer, 29406 (K, L, LAE, SING) – cum, 30900 (K, L, LAE, SING) – cum, 30901 (L, LAE) – sap, 31344 (K, LAE) – schum, 32641 (E, K, L, SING) – cum, 32674 (L, LAE) – ten, 32725 (E, K, LAE) – lasioc-wein, 32790 (LAE) – lasioc-schum, 33348 (LAE) – A, 33428 (LAE) – A, 33466 (LAE) – A, 33911 (K) – lasioc-wein, 33911 (K, LAE) – lasioc-wein, 33917 (K, LAE, SING) – lasioc-wein/schum, 33920 (K, LAE) – lasioc-wein, 34049 (L, LAE) – lon, 34112 (L, LAE) – say, 34236 (LAE) – cer, 35387 (K, LAE, SING) – lasioc-wein/tric, 36302 (K, L, LAE) – cer, 37266 (L, LAE) – pohl, 37534 (K, LAE) – lasioc-schum, 37702 (LAE) – cum, 37713 (K, L) – cum, 38001 (K, LAE) – cum, 38514 (E, K, L, LAE, SING) – gli, 38920 (K, L, LAE) – pohl, 39031 (LAE) – lasioc-novog, 39260 (L, LAE) – ten, 40566 (K, LAE) – lasioc-wein/schum, 41464 (K, LAE) – lon, 41496 (LAE) – lasioc-tric, 41853 (LAE) – gli, 41896 (K, L, LAE) – cum, 42048 (L, LAE) – pohl, 42296 (K, LAE) – lasioc-wein, 42298 (K, LAE) – say, 42679 (LAE) – lasioc-pach, 42784 (K, LAE) – lasioc-wein, 43588 (K, LAE, SING) – say, 43964 (K, LAE) – cer, 44399 (K, L, LAE, SING) – lasioc-wein, 44400 (K, LAE) – lasioc-wein, 45140 (LAE) – sap, 45834 (L, LAE) – lasico-tric/schlec, 46028 (E, K, L, LAE) – cum, 46065 (K, L, LAE) – cum, 46532 (K, LAE) – lasico-schum, 46710 (K, LAE) – lasioc-schum, 46746 (K, LAE) – cer, 46749 (K, LAE) – cum, 46941 (LAE) – say, 47427B (K, LAE) – cer, 48865 (LAE) – sap, 49501 (LAE) – lasioc-wein.

Paijmans 157 (LAE) – cum; *Panoff* 434 (LAE) – lasioc-wein; *Parry* 1277 (K) – cum-bal; *Paymans* 12 (L) – ery, 110 (L) – sar; *Pelenkahn s.n.* (CALC, G, K, L) – pent; *Pennington* 7804 (FHO) – macro, 7827 (FHO) – pend, 7828 (FHO, KEP, SING) – sar, 7830 (FHO, KEP, SING) – pat, 7835 (FHO, KEP, SING) – sar, 7853 (FHO) – cer, 7858 (FHO, KEP) – macro, 7858A (FHO) – macro, 7861 (FHO, KEP, SING) – ery, 7865 (FHO, KEP, SING) – pent-pauc, 7873 (FHO, SAN) – pent-med, 7879 (FHO, SAN) – sar, 7882 (FHO, SAN) – sar, 7883 (FHO, SAN) – pent-med, 7896 (FHO, SAN) – sar, 7910 (FHO, SAN) – saras, 7911 (FHO, L, SAN) – med, 7912 (FHO) – med, 7913 (FHO) – med, 7915 (FHO, SAN) – ? macro, 7917 (SAN) – cer, 7924 (FHO, L, SAN) – sar, 7930 (FHO) – pent, 7934 (FHO, SAN) – ? macro, 7941 (FHO) – gra, 7945 (FHO) – cum-kin, 7946 (FHO, L, SAN) – cum-kin, 7987 (FHO, L, SAR) – pent-pauc, 7995 (FHO, SAR) – pat, 8002 (FHO) – med, 8013 (FHO, SAR) – sar, 8017 (FHO, KEP) – sar, 8027 (FHO, KEP, L, SING) – tom, 8029 (FHO) – sar, 8033 (FHO, L, LAE) – lon, 8051 (FHO, L, LAE) – cer, 8052 (FHO, LAE) – cum, 8053 (FHO, LAE) – say, 8058 (FHO, L, LAE) – cer, 8062 (FHO, LAE) – lasioc-wein, 8077 (FHO, L, LAE) – lon, 8084 (FHO, LAE) – cum, 8089 (FHO, L, LAE) – lon, 8090 (FHO, LAE) – lasioc-wein, 8104 (FHO, L, LAE) – cer, 8109 (FHO) – cum; *Petelot* 5833 (A) – cum-bal, 8663 (A) – cum-bal; *Phusomsaeng* 35 (K, L, P) – macro-fulv, 59 (L) – pend, 170 (L) – dys, [*& Pinning*] 324 (L) – pend, 348 (K) – pend, 420 (K) – cer; *Phyt. Survey* 417 (KEP) – pat, 1195 (KEP) – pat, 1904 (KEP) – pat, 1956 (K, KEP, SING) – pat, 2182 (KEP) – pat, 2280 (KEP) – pat, 2288 (KEP) – pat; *Pierre* 1619 (BM, E, G, K, L, LE, P) – ? cer; *Pleyte* 173 (A, K, L, SING) – lao, 230 (A, K, L, SING) – lao, 360 (K, L, SING) – lao, 1113 (K, L, SING) – lasioc-wein/form; *PNH* 94 (A) – pent-med, 143 (A, L) – pent-pauc, 2783 (SING) – pent, 4766 (A) – pat, 6403 (A) – pat, 8538 (A) – pat, 10495 (L, photo at FHO) – caul, 11425 (A, SING) – pent, 14344 (A) – pat, 14424 (A) – pent, 14459 (A, BM, K, L) – men, 17843 (A, K, SING) – pent, 18615 (A) – pat, 34502 (K, LAE) – pat, 37096 (BM, K) – cer, 37151 (K) – pat, 78075 (A, K) – cer, 78127 (A, K) – pat; *Poilane* 6374 (P) – cum-bal, 7327 (E, P) – cum-bal, 7843 (L, P) – cum-bal, 8429 (P, photo FHO) – pell, 10510 (P) – cum-bal, 10829 (P) – cum-bal, 19855 (P, SING) – cum-bal, 21779 (K, P) – cum-bal, 22268 (K, L) – cum-bal; *Porter in E.I.C.* 1255 (BM, CGE, K, K-W, LE) – pend, *s.n.* (A, BM, CGE, G, K-W, LE) – pat; *Pullen* 968 (L, LAE) – cer, 1379 (L, LAE) – lasioc-pach, 1401 (L, LAE) – lasioc-pach, 1531 (L, LAE) – pohl, 1789 (LAE) – lasioc-form/schum, 6341 (LAE) – cer, 7326 (K, LAE) – lasioc-wein, 7352 (K, LAE) – lasioc-wein, 7537 (LAE) – say, 7563 (LAE) – say, 8108 (L, LAE) – say, 8119 (LAE) – cer, 8185 (LAE) – lasioc-wein, 8195 (K, LAE) – lasioc-wein; *Put* 3629 (K, L) – pend.

'*R*' (Roxb. f. ?) (CALC) – pat; *Rahmat si Boeea* 302 (A) – lasiog (*si Toroes*), 5420 (A, G, K, L) – pat, 7844 (A) – lasiog, 9133 (A, L) – lasiog; *Ramos* 1217 (A) – poly, 1252 (A, K) – sar, 1660 (A) – pent-pauc, 1708 (G) – cer, 1732 (A, K) – pat, 18212 (LE) – cum, 46966 (L) – cum; *Rastini* 177 (K, L, SING) – lasioc-wein, *s.n.* (K, SING) – lasioc-wein; *Reinwardt* '47' (FHO, photo) – pent, '878' (L) – pat; *Richards* 1460 (K, SING) – cer, 2539 (K) – set, 2631 (K, SING) – med; *Ridley* 373 (SING) – pend, 1094 (BM, SING) – pat, 1296 (SING) – pauc, 1631 (SING) – pauc, '1910' (BM) – pend, 4762 (K) – pat, 4763 (BM, G, K) – pat, 4764 (BM, SING) – pat, 4765 (G, SING) – pat, 4767 (K, SING) – macro, 5819 (BM. K. SING) – pat, 5965 (K, SING) – ery, 7030 (BM, SING) – cer, 7909 (SING) – pent-pauc, 8387 (SING) – pent-pauc, 8448 (K, SING) – pent-pauc, 8609 (SING) – pat, 9108 (E, K, SING) – pat, 9187 (SING) – pat, 10843 (SING) – pat, 11080 (SING) – pent-pauc, 11962 (K) – per, 11963 (SING) – per, 12566 (BM, SING) – pent-panc, *s.n.* (BM, 8/14) – pat (BM, SING) – pent-pauc, *s.n.* (K, 3/15) – cer, *s.n.* (K) – pend, *s.n.* (BM) – pauc, *s.n.* (SING) – ery, *s.n.* (SING) – pat, *s.n.* (SING) – pend, *s.n.* (SING) – pent-pauc; *Robbins* 1878 (LAE) – lasioc-pach, 1995 (K) – pent; *Rock* 928 (US) – cum-bal, 1867 (A) – grand; *Römer* 6 (L) – lasioc-wein; *Roxburgh s.n.* (BM) – cum-bal; *van Royen* 3439 (K, LAE) – lasioc-lasioc [*& Sleumer*] 6815 (K) – lasioc-wein, 7602 (K) – lasioc-form; *RSS* 2665 (K, LAE, SING) – lasioc-schum, 6107 (K, LAE, SING) – lasioc-schum, 6286 (K, LAE) – lasioc-schum.

S 670 (SAR) – ama, 1461 (SAR) – ama, 2064 (SAR, SING) – ama, 4060 (A, K, SING) – macra, 4281 (A) – pent-pauc, 7769 (L) – rub, 8087 (BM, K, KEP, KLU, SAR, SING) – ama, 9003 (K, SAR, SING) – ama, 9260 (K, L, SAR, SING) – ama, 9269 (K, L, SING) – ama, 12128 (FHO, K, L, SAR) – macra, 12141 (A, FHO, K, L, SAN, SAR, SING) – lan, 12146 (K, SAR) – sar, 12258 (K, L, SAR, SING) – ama, 12947 (SAR) – ama, 13382 (SAN, SAR) – sar, 13402 (SAR) – pent-pauc, 13658 (K, SAR) – pent-pauc, 13666 (SAR) – pat, 13765 (FHO, K, L, SAR ?) – macra, 14577 (L, SAR, SING) – rub, 15287 (K, L, SAR) – rub, 16181 (A, K, L, SAN, SAR, SING) – rub, 17706 (A, K, L, SAR) – macra, 18476 (A, FHO, K, L, SAN, SAR, SING) – sar, 19049 (A, FHO, K,L, SAN, SAR, SING) – macra, 19233 (FHO, K, L, SAR) – med, 21307 (FHO, K, SING) – B, 21346 (A, FHO, K, L, SAN, SAR) – pent-pauc, 21353 (A, FHO, L, SAN, SAR) – pent-pauc, 21788 (A, FHO, K, L, SAN, SAR, SING) – med, 22806 (A, FHO, K, SAN, SAR) – pent-pauc, 22921 (FHO, K, SAR) – cru, 23036 (A, FHO, K, L, SAN, SAR) – pent-pauc, 23304 (A, FHO, K, L, SAN, SAR, SING) – med, 23329 (FHO, K, L, SAR) – cru, 24146 (FHO, K, SAR) – pent-pauc, 24440 (FHO, K, SAN, SAR) – pent-pauc, 24871 (SAR) – macra, 25565 (SAR) – ama, 25844 (K, SAR) – B, 26965 (FHO) – pat, 27423 (FHO, K, L, SAR) – rub, 27778 (FHO, L, SAR) – ery, 27889 (FHO, K, L, SAN, SAR, SING) – rub, 28269 (SAR) – cer, 28793 (FHO, K, L) – B, 29982 (K, L, SAR) – macra, 30697 (FHO, K, SAR) – sar, 31130 (FHO, SAR) – poly, 31533 (FHO, K, SAR, SING) – poly, 31541 (FHO, K, SAR) – pent-pauc, 31542 (FHO, K, SAR, SING) – sar, 31577 (FHO, SAR) – saras, 31804 (K, SAN, SAR) – macra, 32151 (FHO, K, SAR) – rub, 33183 (FHO, K) – pat, 33753 (FHO) – cer, 34440 (FHO, SAR) – sar, 34950 (FHO, SAR) – lan, 34984 (FHO, SAR) – lan; *Sablaya* 34 (A, K) – cum, 77 (A, K) – pat; *Samsuri et al.* SH 437 (SING) – pat, SA 451 (KEP, SING) – tom, SA492 (KEP, L) – pat, 538 (SING) – pat, SA 770 (SING) – pend, 912 (SING) – pat; *SAN* A 34 (K) – pent-pauc, 43 (K, SING) – saras, 128 (K) – pent, 636 (A, K, SING) – sar, 962 (K, L, SING) – sar, 1700 (K, SING) – sar, 1871 (K) – pent-med, 2170 (K, SING) – pat, 3401 (K, SING) – sar, 3444 (A, SING) – cer, 3450 (L, SING) – sar, 3694 (A, SING) – macra, 3868 (L, SAN) – sar, 4824 (A, K, SING) – cer, 7046 (SING) – sar, 10179 (K, SING) – sar, 10289 (K) – pent-pauc, 10374 (K) – pent-pauc, 10384 (K, L) – sar, 13402 (K) – pent-pauc, 16008 (K) – pent-med, 16204 (A) – pent-med, 16501 (A, K) – med, 17222 (K, L, SING) – sar, 17454 (A, KEP, K, L, SING) – ama, 18305 (SAN) – sar, 19009 (K, L, SAN) – sar, 19132 (SAR) – sar, 19249 (K, L, SAR, SING) – sar, 19923 (K, SAN)

– ery, 20611 (SAN) – sar, 20811 (?7) (SAN) – sar, 21130 (K, SING) – sar, 21180 (SING) – sar, 21201 (K, L) – pent-med, 21296 (K, L) – pent-med, 21352 (K, L) – pent-med, 21355 (SAN) – poly, 21476 (K, SAN, SAR, SING) – sar, 21484 (K, L, SAR) – pent-med, 22142 (K) – pent-med, 22542 (K, SAR) – pent-med, 22555 (A, K, SAN) – pent-med, 22798 (A, K, L, SAR) – sar, 23198 (SAN) – cer, 24160 (SAN, SAR) – pent-med, 24357 (SAR) – pent-pauc, 24448 (SAN) – sar, 24462 (K, L) – pent-med, 24671 (SAN) – pat, 24732 (SAN) – cer, 24761 (K, SING) – pat, 24790 (K, SAN, SAR, SING) – sar, 25322 (K, SAR) – pent, 25386 (K, SAR) – pent-pauc, 26003 (K) – cer, 26260 (K, L, SAR) – pent-pauc, 26327 (K) – pent, 26539 (K, L, SAN, SAR, SING) – sar, 26852 (K, SAN, SING) – sar, 26960 (K) – pent-med, 26978 (K, SAN) – lan, 27357 (K) – pent-med, 28629 (K, SAN, SING) – sar, 28928 (K, LE, SAN) – pent, 29410 (SAN) – pent, 29473 (K, SAN, SAR) – pent-med, 29528 (K, SAN) – saras, 29690 (K, L, SAN) – sar, 29724 (K, SAN) – pent, 29821 (K) – lan, 30006 (K, SAN) – pent-med, 30157 (K, L, SAN) – poly, 30162 (SAN) – set, 30376 (K) – pent-med, 30487 (K) – pent-med, 30574 (K, L, SAN) – sar, 30677 (K, SAN, SING) – cer, 30689 (K, SAN) – sar, 30737 (K, L, SAN) – lan, 31004 (K) – pent-med, 31009 (K, L, SAN) – sar, 31087 (K, SAN) – macro, 31185 (K, L, SAN) – sar, 31330 (K, SAR) – pent-med, 31343 (K, SAN) – pent, 31517 (SAN) – lan, 32026 (SAN) – cer, 32490 (SAR) – pent-pauc, 32550 (K) – pent-med, 32563 (K, L, SAN) – sar, 32576 (K, SAN, SAR) – macra, 32584 (SAN, SING) – sar, 32637 (K, SAN) – cer, 33041 (K, L, SAN) – sar, 33107 (SAR) – pent-pauc, 33172 (K, L, SAN, SING) – sar, 33381 (K) – pent-pauc, 33633 (K, L, SAN) – ery, 34259 (SAN) – macra, 34260 (K) – pent-med, 34270 (SAN) – sar, 34282 (SAN) – set, 34298 (SAN) – saras, 34300 (K, L, SAN) – sar, 34930 (K, SAN, SING) – sar, 34927 (SAN) – macra, 34971 (SAN) – lan, 35154 (LE, SAR) – pent-pauc, 35258 (SAN) – pent, 35319 (K) – pent-med, 35433 (SAN) – pent-pauc, 35772 (K, L, SAN, SING) – sar, 36018 (SAN, SAR) – C, 36347 (K) – pent-med, 36717 (LE, SAR) – pent-pauc, 36935 (K) – med, 37378 (SAN) – med, 37546 (LE SAR) – pent-pauc, 37559 (K, SAR) – pent-pauc, 38209 (K, SAN) – pent-med, 38379 (K, SAN) – ery, 38736 (K) – pent-med, 38775 (K) – pent-med, 38875 (K, L) – sar, 39141 (SAN) – cer, 39142 (SAN) – med, 39149 (SAN) – med, 39292 (LE) – pent-pauc, 39345 (K, SAR) – pent-med, 39453 (LE, SAR) – pent-pauc, 39463 (K) – pent-med, 39484 (K, SAN) – sar, 39711 (K, LE) – pent-med, 39719 (K, L, SAN) – sar, 39737 (K) – pent-med, 39743 (K, L, SAN, SING) – sar, 39913 (SAN) – pent-med, 40389 (K) – pent, 40533 (K, SAR) – pent-med, 40572 (LE, SAR) – pent-pauc, 40604 (SAN) – med, 40682 (K, SAN, SAR) – pent-pauc, 40758 (K) – pent, 41010 (K, L) – sar, 41320 (K, L, SAN, SAR) – ery, 41442 (K) – pent-med, 41570 (K, SAN) – sar, 41907 (K, SAN) – pat, 42075 (K, SAN) – poly, 42112 (K) – pent, 42241 (K, SAN) – C, 43362 (SAN) – sar, 43854 (SAN) – pent, 44563 (K, SAN) – ko, 45856 (SAN) – sar, 46170 (SAN) – sar, 46200 (K, L, SAN) – sar, 46325 (SAN) – sar, 47160 (SAN) – sar, 47163 (K) – pent-med, 47163 (SAR) – pent-pauc, 47192 (K, L, SAN) – sar, 47255 (K, SAN) – pent, 47632 (K) – pent-med, 47751 (K) – pent-med, 47781 (SAR) – pent-pauc, 48053 (K) – pent-pauc, 48968 (K, SAN) – pent, 48988 (K) – pent, 49166 (SAN) – ery, 49763 (K, SAN) – poly, 49801 (SAN) – pent-pauc, 50363 (K, L, SAN) – ery, 50478 (K) – pent-pauc, 51229 (SAN) – sar, 51303 (SAN) – cer, 51751 (SAN) – cer, 52600 (SAN) – cer, 52695 (SAN) – pat, 52794 (K, SAN) – pent, 53409 (K, L, SAN) – pat, 53457 (K, L, SAN, SAR, SING) – sar, 53941 (SAN) – sar, 54462 (SAN) – sar, 54524 (K, L, SAN) – sar, 54628 (K) – pent-med, 55163 (K) – pent-pauc, 56156 (SAN) – sar, 56955 (SAN) – sar, 57164 (SAN) – sar, 57196 (K, L, SAN) – sar, 57253 (K) – pent-pauc, 57318 (SAN) – pent-med, 57319 (K) – pent, 58038 (SAN) – pent-med, 58432 (FHO, K, L, SAN) – sar, 58513 (SAN) – sar, 61234 (K) – pent-pauc, 61727 (SAN) – sar, 62068 (FHO, K, L, SAN) – sar, 62147 (SAR) – pent-pauc, 62166 (SAN) – cer, 62425 (FHO, SAN) – poly, 62869 (K) – set, 62884 (FHO, SAN) – sar, 63552 (K, L, SAN) – sar, 63695 (SAN) – cer, 63819 (K, SAN) – pent, 64603 (SAN, SAR) – sar, 65894 (SAN) – sar, 66051 (SAN) – macra, 66873 (FHO, K, L, SAN) – sar, 67192 (K, SAN) – sar, 67234 (FHO, K, SAN) – ery, 68506 (FHO, SAN) – pat, 71008 (FHO, SAN) – pat, 71167 (SAN) – pat, 71544 (FHO, K, SAN) – sar, 71775 (SAN) – cer, 72697 (SAN) – cer, 72844 (SAN) – sar, 70365 (SAN) – sar, 73426 (SAN) – ery, 73541 (SAN) – sar, 73699 (FHO, K, SAR) – pent-med, 73709 (FHO, K) – pent-med, 74352 (K) – sar, 74360 (K, SAN) – sar, 74460 (SAN) – cum-kin, 74532 (FHO) – pat, 74958 (K, SING) – sar, 75490 (FHO, K) – poly, 75492 (FHO) – sar, 75986 (FHO, K) – pat, 76067 (FHO, K, SAN) – poly, 76651 (FHO) – pent-med, 76676 (FHO, SAN) – poly, 78021 (FHO, K) – ery, 78122 (FHO) – pat, 78469 (FHO) – sar, 78613 (FHO, K) – pent-med, 78637 (FHO) – pent-med, 78643 (FHO, K) – pent-med, 79690 (FHO) – pent-med, 79763 (FHO) – lan, 79773 (FHO, K) – lan, 80374 (FHO) – ery, 81026 (FHO) – pent-med, 81222 (FHO) – pat, 81223 (FHO) – sar, 81309 (FHO) – cer, 81312 (FHO) – cer, 81375 (FHO) – poly, 81436 (FHO) – cer, 81447 (FHO) – sar, 81773 (FHO) – sar, 81903 (FHO) – cer, 82077 (FHO) – sar, 82145 (FHO) – sar, 82344 (FHO) – sar, 82345 (FHO) – pent, 82406 (FHO) – poly, 82437 (FHO) – med, 82565 (FHO) – sar, 82804 (FHO) – pent-pauc, 82871 (FHO) – sar, 82954 (FHO) – pent-med, 83010 (FHO) – sar, 83054 (FHO) – poly, 83097 (FHO) – pent-pauc, 83162 (FHO) – med, 83177 (FHO) – med, 83552 (FHO) – pent-pauc, 83711 (FHO) – pent-med, 83978 (FHO) – pent-pauc, 84019 (FHO) – pent-pauc, 84993 (FHO) – pent, 85198 (FHO) – pat.

Sangkhachand 1390 (K, P) – cer; *Sargent s.n.* (A) – cum-bal; *Sar. Mus.* 414 (SAR) – ama; *Saunders* 59 (L, LAE) – cer, 186 (LAE) – cum, 238 (L, LAE) – cer, 390 (LAE) – cer, 401 (BM, K, LAE) – lasioc-wein, 459 (LAE) – lon, 545 (K, LAE) – cer, 923 (LAE) – cer, 941 (LAE) – cum, 1082 (LAE) – cum; *Sayer* 44 (G) – say; *Scheffer s.n.* (BP, MPU) – pat; *Schiefflin* 9 (LAE) – cer; *Schlechter* 17534 (L) – lasioc-pach, 18582 (B) – say; *Schmutz* 722A (L) – pent, 744 (L) – pent, 1275 (L) – pent; *Schodde* 2404 (LAE) – ? lon, 2510 (A, K, L, LAE) – scho, 2528 (K, LAE) – lasioc-wein, [*& Craven*] 3781 (K, LAE) – lasioc-schum, 3951 (K, LAE) – lasioc-tric, 4112 (K, L, LAE) – lasioc-tric, 4341 (LAE) – scho, 4448 (K, LAE) – lasioc-wein, 4457 (K, LAE) – lasioc-wein, 4605 (K, L, LAE) – scho, 5642 (LAE) – say; *Scortechini* '1' (BM, CALC, K) – cer, 48 (?) – pend, '82' (SING) – cer, '94' (E) – pauc, '199' (G, K, [ex SING]) – pauc, '219' (CALC, E, K, L) – sar, '314' (G) – cer, '324' (K, SING) – pat, 388 (CALC) – sar, '433' (G, LE) – cer, '716' (CALC, LE) – pent-pauc, '1343' (BM) – tom, *s.n.* (BM, G) – pent-pauc, *s.n.* (CALC, CGE, K [ex SING], LE) – pauc, *s.n.* (CALC) – per, *s.n.* (E, K) – tom; *SFN* 10205 (A, E, K, L, SAR, SING) – ery, 10542 (SING) – pauc, 10714 (SING) – pend, 11772 (K, SING) – pend, 11740 (SING) – pend, 11986 (SING) – pend, 18888 (SING) – pent-pauc, 19038 (K, SING) – sar, 19080 (BM, K, SING) – sar, 20261 (K, SING) – macro, 21002 (SING) – pent-pauc, 21199 (KEP, SING) – ama, 21199A (SING) – ama, 21350 (K, L, LAE, SING) – sar, 21500 (K, SING) – cer, 23632 (SING) – pat, 23664 (KEP) – macro, 24755 (SING) – pauc, 25272 (E, K, SING) – macra, 26817 (SING) – lan, 27394 (SING) – lan, 28496 (BM, K, SING) – pent, 28568 (L, LAE, SING) – ama, 28595 (K, L, LAE, SING) – ama, 28674 (K, SING) – ama, 28675 (A, B, K, L, LAE, SING) – ama, 28714 (A, K, LAE, SING) – pauc, 29285 (K, SING) – tom, 29311 (B, K, L, LAE, SING) – sar, 29445 (K) – pent-pauc, 29445 (SING) – pent-pauc, 29465 (B, K, L, LAE, SING) – sar, 29718 (K, L, SING) – macro, 29959 (K, LAE, SING) – pauc, 30528 (KEP, SING) – pat, 32071 (KEP, SING) – pent-pauc, 32400 (KEP, SING) – pend, 32402 (A, K, KEP, SING) – ery, 32434 (K, L, SING) – ama, 32684 (L, LAE, SING) – macro, 33748 (K, SING) – sar, 33752 (BM, LAE) – pend, 34231 (A, E, K, SING) – cer, 34260 (B, K, LAE, SING) – cer, 35083 (K, SING) – cer, 35345 (BM, K, KEP, SING) – pent-pauc, 36292 (K, KEP, SING) – pat, 36418 (K, KEP, SING) – pat, 36986 (BM, K, KEP, LAE, SING) – pat, 37220 (A, K, KEP, LAE, SING) – pauc, 37268 (K, SING) – pat, 37393 (SING) – macro-mac/fulv, 37747 (K, KEP, SING) – pat, 39334 (SING) – pend, 39453 (BM, K, SING) – pat, 40112 (SING) – ama, 40589 (K. SING) – pat; *Shah* 167 (SING) – pent-pauc; *Shah & Shukor* MS 2450 (SING) – pent, 2635 (KEP, SING) – macro-fulv; *Sidek* S 334 (SING) – pend; *Simons s.n.* (BM) – cum-bal; *Sinclair* 5741 (E) – cum-bal, 6334 (E) – pat; *Singh & Samsuri* HS 1039 (LAE, SING) – pat; *Smith & Webb* 4920 (K) – lon; *Soa* (?) *s.n.* (Goat Hill) (BM) – tom; *Soekaria* 87 (L, SING) – pat; *Soepadmo* 231 (A, E, K, SING) – pat, 608 (KLU) – cer, 765 (KLU, L) – pauc, [*& Mahmud*] 9125 (A, KLU) – ery; *Stevens s.n.* (LAE) – lasioc-schum; *Stone* 5529 (KLU, L) – pauc, 7445 (KLU) – cer, 7488 (KLU, L) – pend, 12444 (KLU) – cer; *Strugnell* 10536 (E, K) – pat; *Sutrisno* 13 (K, L) – cum, 44 (K) – ko, 45 (K, LAE, SING) – ko, 58 (K, L, SING) – lasioc-wein/pach, 88 (K) – lasioc-wein; *Suvarnakoses* 1745 (L) – macro-fulv.

Tangkilisah 43 (K, L) – cer; *Teijsmann* 20 (L) – cum, 386 (K, L) – sar, 6058 (L) – lasioc-wein/lasioc, 6060 (K, L) – lasioc-wein/lasioc, 11734 (K, L) – pent, *s.n.* (CALC, L, U) – cer, *s.n.* (L) – pat, *s.n.* (L) – pat, *s.n.* (L) – pent-pauc, *s.n.* (U) – div; *Thorel s.n.* (K) – cum-bal; *Tsang* 26905 (A, E, K, P) – cum-bal, 27191 (A, E, K, P) – cum-bal, 30245 (A, E, K, L, P, SING) – cum-bal; *Ts'oong* 1889 (A, photo) – cum–bal.

Valeton 142A & B (G, K, L) – cum; *Versteeg* 1030 (L) – lasioc-wein, 1423 *p.p.* (K, L) – lasioc-vers, 1771 (K, U) – lasioc-wein, 1803 (U) – lasioc-wein, 1903 (K, L, U) – lasioc-wein; *Vidal* 164 (K) – pent, 702 (K) – pat, 704^{f} (A) – pent, 704^{g} (A) – pent, 704^{h} (A) – pent, 704 *bis* (A) – pent, 1336 (K) – pat, 1340 (A, K) – pent, 2311 (A, K) – pent, 2317 (K) – pat, 2329a (K) – cum, 2330 (A) – cum, 2378 (K) – pat, *s.n.* (K) – pent, *s.n.* (K) – pent; *Vogel* 802 (K, L) – pent-pauc, 972 (K, L) – pent-pauc; *Voigt* 515 (A) – cum-bal; *Volck* 1476 (LAE) – lon, [*& Hyland*] 2122 (L) – lon; *de Vriese* 293 (L) – cum, *s.n.* (K) – pat.

Wall. Cat. 4891 (BM, K-W) – tom; *Wallich* 1829 (G) – pend, '1836' (Cat. 8069) (K, K-W, LE) – pat; *Wang* 77053 (A) – cum-bal, 80163 (A) – cum-bal; *Waterhouse* 136B (K, LAE) – lasioc-tric, 564B (K, LAE) – lasioc-schum, 631B (K) – lon, 822 (K) – lon, Y.80 (K) – lon; *Weber* 1570 (A, BM, K) – pent; *Weinland* 150 (L, SING) – lasioc-wein; *Wenzel* 65 (A, E) – pent, 206 (A, E) – pent, 311 (A, BM, G) – cer, 810 (A, BM, G) – cum, 988 (A, BM) – pat, 1289 (A, BM, G) – cum, 1600 (A, BM) – pent, 1740 (A, BM) – cum, 3280 (A, K) – caul, 3492 (A, K) – pat, 3520 (SING) – pent; *Whitford* 193 (K) – cum, 1039 (G) – pat, 1237 (G, K) – cum, 1314 (K) – cum, 1415 (BM) – pent, 1474 (SING) – pat, *s.n.* (K) – cum, *s.n.* (K) – pat; *Whitmore* 3032 (K, photo FHO) – rex; *Williams* 160 (SING) – pent, 232G (K) – cer, 522 (A, K) – pat, 567 (A, K) – pent, 589 (A, K) – cum, 2442 (A, K) – cum; *Winckel* 245 (K, L, U) – macro; *Wirat* 1136 (K) – cum-bal; *Wiriwan* 354 (K, LAE) – pent, 448 (A, K, L, LAE) – pent; *Wood* 657 (A, K) – poly, 950 (K) – pent-pauc; *Wray* 155 (G) – pend, 504 (K, photo FHO) – per, 504A (K) – per, 507 (K, SING) – cer, 1279 (BM, G) – pat, 1797 (SING) – cer, 1889 (SING) – cer, 2110 (SING) – tom, 2352 (SING) – tom, 2681 (CALC, K [ex SING]) – pauc, 3244 (CALC, G, SING) – pent, 3289 (CALC, SING) – cer, *s.n.* (CALC) – cer, *s.n.* (SING) – per.

Yates 2396 (B) – pent-pauc.

Zippelius s.n. (L) – lasioc, *s.n.* (BP, L) – pat.

Species *excludendae*

(i) **Chisocheton canalensis** Baillon, *Adansonia* **11** : 260 (1874, 'canalense') = *Dysoxylum canalense* (Baillon) C. DC.

(ii) **Chisocehton costatus** Hiern in Hook. f., *Fl. Br. India* **1** : 552 (1875); C. DC. in DC., *Monog. Phan.* **1** : 538 (1878); Brandis, *Ind. Trees* : 139 (1906). Type: India, Cachar, Shapore, 18 May 1873, *Ramdane in Keenan s.n.* (K!, holo) = *Dysoxylum* sp. Hiern hesitatingly placed this in *Chisocheton*, having only the one fruiting specimen. It closely resembles material at Kew labelled *D. lukii* Merr., e.g. Burma, Mergui, *Parker* 2562.

(iii) **Chisocheton dempoensis** Baker f. in *J. Bot., Lond.* **62**, supp. : 18 (1924) = *Dysoxylum dempoense* (Baker f.) Harms. Type: Indonesia, Sumatra, Mt. Dempo, 4000′, *Forbes* 2229 (BM!, holo; L!). This is *Walsura chrysogyne* (Miq.) Bakh. f.

(iv) **Chisocheton erythrocarpus** Hayata & Kanehira in Hayata, *Ic. Fl. Formosa* **10** : 2 ('*erythrocarpa*', 1921), *non* Hiern (1875) = *D. kusukusense* (Hayata) Kanehira & Hatusima.

(v) **Chisocheton hongkongensis** Tutcher in *J. Linn. Soc.* **37** : 64 (1905); Crook, *Fl. Pl. Hong Kong, Ran.-Mel.* : 99 (1930) = *Dysoxylum hongkongense* (Tutcher) Merr.

(vi) **Chisocheton kanehirae** Sasaki in *Trans. Nat. Hist. Soc. Formosa* **18** : 173, C (1928) = *Dysoxylum kusukusense* (Hayata) Kanehira & Hatusima.

(vii) **Chisocheton kusukusensis** Hayata, *Ic. Pl. Formosa* **3** : 52 (1913, 'kusukusense'); Kanehira, *Form. Trees* : 116 (1917) = *Dysoxylum kusukusense* (Hayata) Kanehira & Hatusima.

(viii) **Chisocheton rigidus** Ridley in *Bull. Misc. Inf. Kew* **1929** : 122 (1929) Types: Malaysia, Pahang, Temerloh, Kemasul Res., 19 Oct. 1925, *Hamid* FD 10880 (K!, syn) & Selangor, Kuala Lumpur, Weld Hill, *Rahman* 2829 & Johore, Castlewood, 1906, *Ridley* 12492 (K!, syn). The flowers and leaves of the Pahang and Johore specimens are those of *Dysoxylum* sp. (= *Forbes* 3088 (BM!) from Sumatra).

(ix) **Chisocheton sogerensis** Baker f. in *J. Bot., Lond.* **61,** suppl. : 8 (1923) = *Dysoxylum variabile* Harms (see Stevens, 1975 : 53).

(x) **Chisocheton sumatranus** Baker f. in *op. cit.* **62,** suppl. : 18 (1924). Type: Indonesia, Sumatra 1880, *Forbes* 2278 (BM!, holo; A!, L!, LE!). The flowers and leaves of the type are those of an *Aglaia.*

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Taxonomic index

Extant names are given in roman and synonyms in italic; new names are in bold, as are principal references

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