PERSOONIA

A MYCOLOGICAL JOURNAL

VOLUME 7

1972—1974

Published by the

RIJKSHERBARIUM

LEIDEN, THE NETHERLANDS

Dates of publication:

Part 1, pp. 1—118, pls. 1—15, 21 Dec. 1972
Part 2, pp. 119—350, pls. 16—27, 20 July 1973
Part 3, pp. 351—441, pls. 28—39, 21 Dec. 1973
Part 4, pp. 443—591, pl. 40 , 8 Mrt. 1974

Corrigenda

The reader should continue the bottom line of p. 32 on the top line of p. 35 only three lines, following which he is referred back to the top line on p. 33.

The reader should continue the bottom line of p. 33 on the fourth line from top of p. 35.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 7, Part 1, pp. 1–16 (1972)

THE RELATIONSHIPS BETWEEN THE TREMELLALES AND THE APHYLLOPHORALES

F. OBERWINKLER

Institut für Systematische Botanik der Universität München

(With 10 Text-figures)

The relationships between the Tremellales and Aphyllophorales are discussed by comparison of the micromorphology of some species belonging to the following pairs of genera: *Exidiopsis—Athelopsis*, *Basidiodendron—Dendrothele—Heterochaete*, *Myxarium—Oliveonia—Repetobasidium*, *Tremellodendropsis—Aphelaria*, *Uthatobasidium—Botryobasidium*. A new combination is proposed in the genus *Athelopsis*.

The discovery that phragmo- and holobasidia are distinct structures has greatly advanced the classification in the lower Basidiomycetes. Some additional characters have led to the concept of two divisions, Phragmo- and Holobasidiomycetes, which for the occasion may be opposed to each other as follows:

PHRAGMOBASIDIOMYCETES (Fig. 1a)	HOLOBASIDIOMYCETES (Fig. 1b)
1. Mature basidia septate.	1. Basidia undivided.
2. Sterigmata stout, mostly long and irregularly flexuous.	2. Sterigmata slender, relatively short and horn-like.
3. Spores forming secondary spores.	3. Spores producing hyphal mycelium.
4. Walls of hyphae gelatinous; fruitbody greatly changing its shape on drying.	4. Without gelatinous hyphal walls; living and dried specimens with more or less the same shape.

Are these characters of value in separating subclasses? The following remarks on some species of either group touch upon this question.

There is no doubt that the genus *Sebacina* in the current broadly conceived sense is highly artificial. There are some well-founded arguments for splitting this taxon into a series of more natural genera. One of these would appear to be *Exidiopsis* (Bref.) A. Möll., based on *Exidia effusa* Bref. This species is characterized by all the features mentioned above as being typical of Phragmobasidiomycetes, i.e. septate basidia, flexuous sterigmata, spores forming secondary spores, gelatinized hyphae, and gelified fruitbodies when fresh. The basidia, which are globose or only slightly elongated and possess basal clamps seem to constitute an important character for

generic delimitation. Moreover, as distinct from *Exidia*, the fruitbody is strictly resupinate and usually the hymenium is smooth. With the circumscription of *Exidiopsis*, as emended by Wells (1961), the following unnamed species (see Fig. 2a) can be conveniently placed in this genus. This species differs however from typical

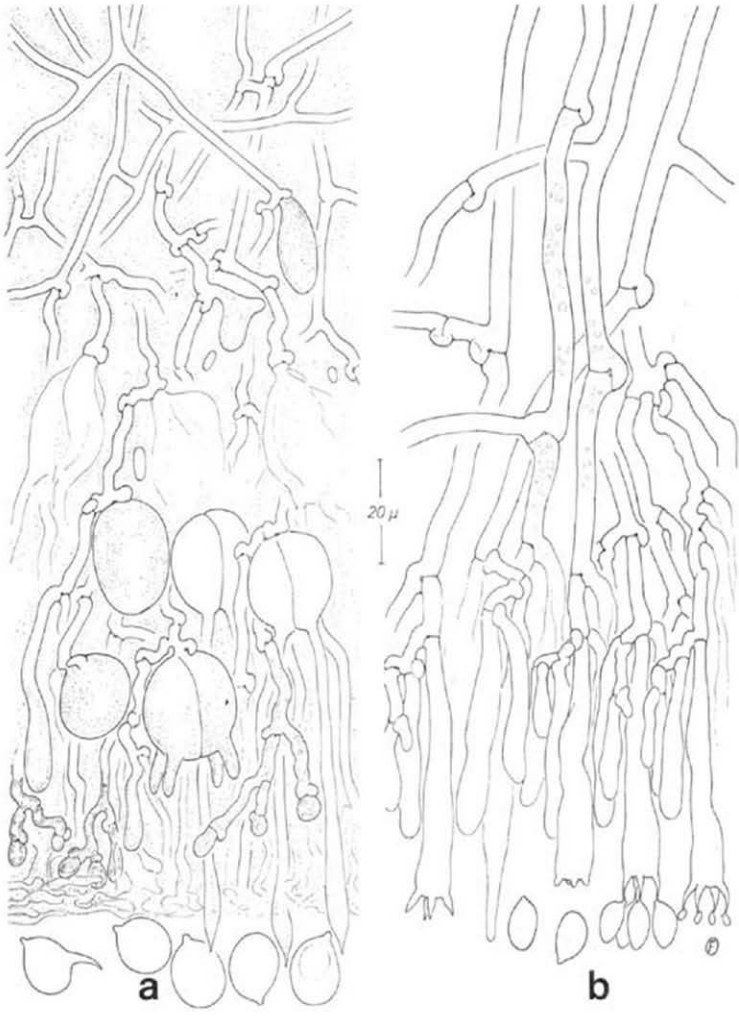


Fig. 1. Sections of hymenium and subhymenium, showing hyphal context, basidia, and spores. — a. *Tremella mesenterica* Retz. per Hook. — b. *Corticium evolvens* (Fr. per Fr.) Fr.

members of the genus in lacking a well-developed context, while the fruitbody is not gelatinous; the basidia arise on the surface, consequently the sterigmata sporulate directly in the air without first having had to grow through gelatinized tissue, a condition that explains their short horn-like shape rather well.

A homobasidial counterpart may be found within the genus *Corticium* in its traditional sense. Some of the members of Bourdot & Galzin's section *Athele* (1928: 206–211), transferred to the new genus *Athelopsis* (Oberwinkler, 1965: 48; accepted by Parmasto, 1968: 41), may well be compared with the species of *Exidiopsis* referred to above. The fungi (Fig. 2c) are adnate to the substratum, the non-effigurated hymenium lacks cystidia, the holobasidia commonly bear four sterigmata, and produce colourless, smooth, thin-walled spores. This general diagnosis of the 'Corticia' can be restricted even further. The basal hyphae are few and strongly interwoven, but they are not obviously gelatinous; the basidia are extremely short-cylindrical to subglobose with sterigmata of the common horn-like type.

Two points remain which should be mentioned. The first one is apparently easy

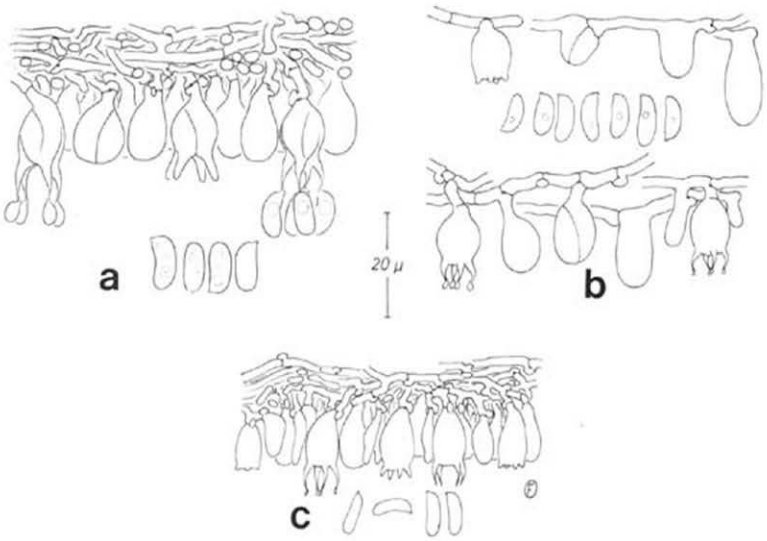


Fig. 2. Fruitbodies shown in section with spores. — a. *Exidiopsis* sp. — b. Coll. BFO 13845. — c. *Athelopsis lembospora* (Bourd.) Oberw.[1]

[1] **Athelopsis lembospora** (Bourdot) Oberwinkler, *comb. nov.* (basionym: *Corticium lembosporum* Bourdot *in* Rev. Sci. Bourb. **32**: 10. 1910).

to decide. The main and probably only difference of taxonomic importance at the moment between both species under discussion is the presence of phragmobasidia in the former and holobasidia in the latter. Another distinction may well be found in spore germination in that the spores of the *Exidiopsis* species may be expected to form secondary spores, whereas those of the *Athelopsis* species ought to germinate by producing hyphae.

The similarity indicated above, which might be explained by convergence, acquires a different slant by the find of a species which we collected in the Andes of Venezuela (Fig. 2b). The drawing shows a section of the whole fructification of the fungus, consisting of substrate-hyphae and some few, scattered basidia, which seem to belong to both the septate and the holobasidial type. Regrettably in this case, too, I have been unable to find germinating spores.

This species is likely to arouse theoretical speculations, but for the time being it seems more appropriate to look for other comparable taxa. For that purpose an additional structure of the fungus in question should not be overlooked. There are some elongate terminal bodies, whose nature is not clear, but which may be regarded as small cystidia. Within the genus *Bourdotia* s.l. (Fig. 3a) similar structures are to be found. Typically these are gloeocystidia which contain a yellow oleaginous substance.

A really interesting and highly characteristic group has been removed from *Bourdotia* in the original sense by Luck-Allen (1963) and transferred to an emended *Basidiodendron*. Well developed material (Fig. 3b) shows generative hyphae of ver-

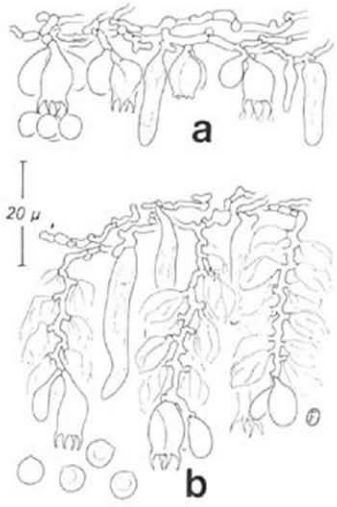


Fig. 3. *Basidiodendron eyrei* (Wakef.) Luck-Allen. — a. Section through a peripheral part of the fruitbody. — b. Section through the central part; with details of the young and old hymenium and spores.

tical growth which continue to produce apically mature basidia, surrounded by younger ones, while the exhausted basidia remain as calyx-like enveloping sheaths of the supporting hyphae.

I would like to draw attention to the basidial morphology in this genus, too. Some well-known species, for example *Basidiodendron eyrei* (Wakef.) Luck-Allen or *B. caesio-cinereum* (Höhn. & Litsch.) Luck-Allen show septate and undivided basidia in a single fructification. Thus, it is not surprising that von Höhnel & Litschauer (1908: 1116) had originally described *B. caesio-cinereum* as belonging to the genus *Corticium*, while Bourdot & Galzin (1912: 369), giving prevalence to the presence of gloeocystidia, transferred it to *Gloeocystidium* sensu von Höhnel & Litschauer, a

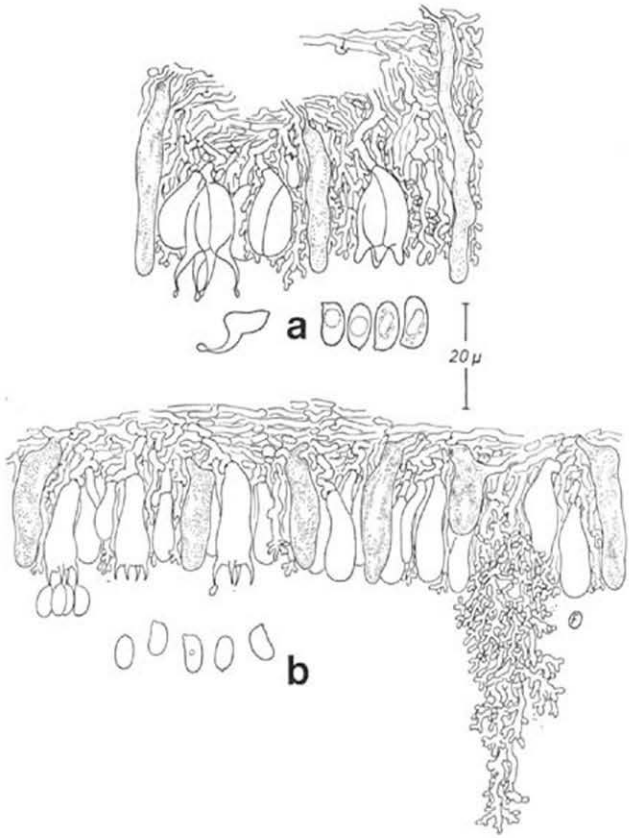


Fig. 4. Fruitbodies shown in section, showing substrate-hyphae, gloeocystidia, dendrophysoid hyphae and a hyphal peg (4b), basidia, and spores. — a. *Basidiodendron cinereum* (Bres.) Luck-Allen. — b. *Dendrothele* sp.

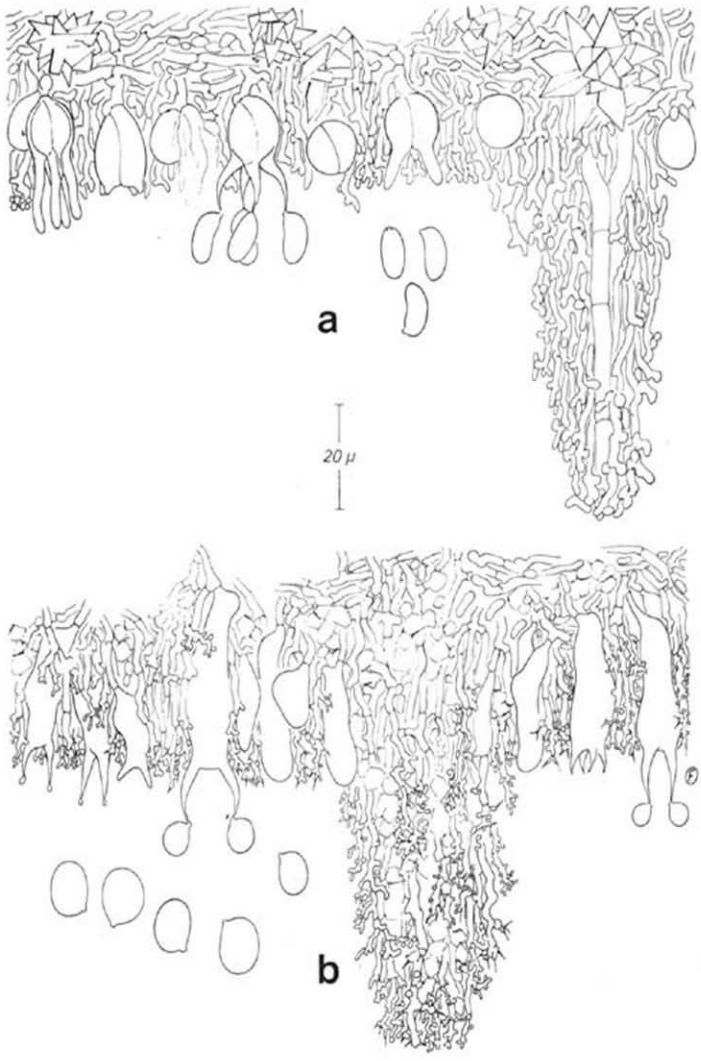


Fig. 5. Fruitbodies shown in section, with details of the hymenium, sterile teeth, and spores. — a. '*Heterochaete*' sp. — b. *Dendrothele griseo-cana* (Bres.) Bourd. & Galz.

typically holobasidial genus. Similar arguments surely apply to Rick's *Basidiodendron luteo-griseum* (1938: 74; probably synonymous to *B. eyrei*, as already stated by Luck-Allen, l.c.), the type species of the genus *Basidiodendron*.

Apart from this, I would like to add some further details in comparing *Basidiodendron cinereum* (Bres.) Luck-Allen (Fig. 4a) with a species that might possibly be placed in the genus *Dendrothele* Höhn. & Litsch. (Fig. 4b). The latter genus is well defined by dendrophysoid hyphae which may form a primary layer, a sterile tissue, through which the basidia have to grow in order to reach the surface (catahymenium). Teeth made up of the same ramified hyphae are more or less characteristic. Size and shape of both basidia and spores seem to vary considerably according to the species. In some taxa gloeocystidia also occur. Leaving the sterile teeth aside, there are only two major morphological differences: phragmobasidia with the spores germinating by repetition, and holobasidia with the spores producing hyphae on germinating.

In addition to the preceding example there exist species without conspicuous gloeocystidia (Fig. 5b). The type species of the genus *Dendrothele*, *D. griseo-cana* (Bres.) Bourd. & Galz. (= *D. papillosa* Höhn. & Litsch.) shows the above mentioned characteristics; gloeocystidia seem to be rare or inconspicuous.

An equivalent micromorphology can be seen in some species currently referred to the heterobasidiomycetous genus *Heterochaete* (Fig. 5a). Some remarks may be made concerning the type species, *Heterochaete andina* Pat. The basal hyphae are loosely interwoven, non-gelatinized, partly thick-walled, with brown cell-walls. In contrast, the hyphae of the subhymenium, hymenium, and sterile teeth are more or less densely interwoven, while some are extremely thick-walled and have brown, plasmatic contents. At the apex, most of the sterile hyphae are dendritically ramified. The basidia have a basal stalk and develop diverging longitudinal septa.

It is obvious that *Heterochaete andina* and the fungus used for comparison with *Dendrothele griseo-cana* have little in common, except the cystidia-like, sterile hyphal pegs and cruciate-septate basidia. On the other hand this '*Heterochaete*' sp. and *Dendrothele* agree in hyphal construction and context, but their basidia belong to different types.

Whereas the species discussed above have effused fructifications, a second group includes clavarioid species (see Crawford, 1954; Reid, 1956; Corner, 1966). Corner (1970: 283) states that *Tremellodendropsis* "structurally knits *Aphelaria* with *Tremellodendron* and *Paraphelaria*."

The genus *Tremellodendron*, as typically represented by *T. candidum* (Schw.) Atk., differs from *Tremellodendropsis* by more or less globose basidia, lack of clamps throughout, and slightly thick-walled tramal hyphae. On account of basidial morphology it seems doubtful whether both genera are closely related. On the other hand there still remain points in need of investigation. In the first place *Tremellodendropsis tuberosum* (Grev.) Crawf. (Fig. 6a) is now a fairly well-known species with a curious method of basidial septation. The bases of the sterigmata are sunken into the apical

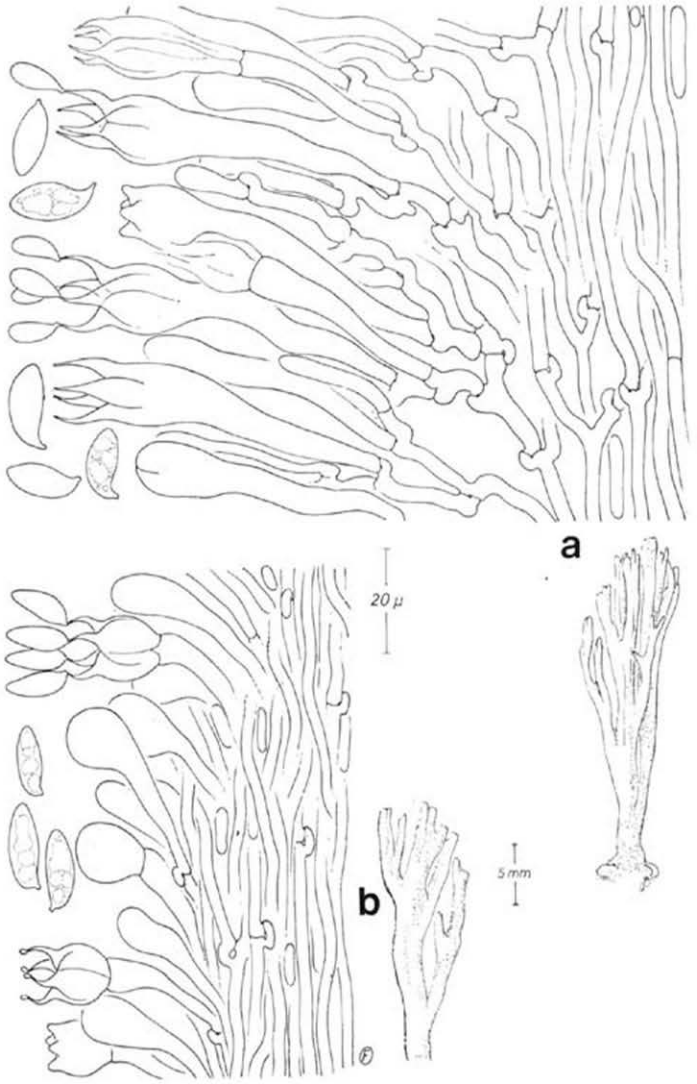


Fig. 6. Habit sketch of fruitbody and partial sections of hymenium and subhymenium. — a. *Tremellodendropsis tuberosum* (Grev.) Crawf. — b. *Tremellodendropsis transpusio* Crawf.

part of the basidial body. This means that the apex of the basidium is in part longitudinally septate. After spore discharge these septa diverge and may form what looks like a secondary transverse septum. Thus, the original basidium is divided into a basal stalk and in an effete apical part. In addition to this, Crawford (l.c.) was able to show that there also exist species like *T. transpusio* Crawf. (Fig. 6b), in which the terminal part of the basidium is septate in the normal tremellaceous manner, i.e. before producing the spores. There is a perfect correlation between *Tremellodendropsis tuberosum* and *T. transpusio* with respect to most of the other characteristics such as shape, consistency, and colour of fruitbodies; moreover in hyphal peculiarities (hyphae thin-walled, non-gelatinized, with clamp connections), shape of basidia (long-stalked, with an apical swollen part), and spores (navicular, smooth, and thin-walled) they are indistinguishable.

Secondly, there is a '*Pterula pusio*' collected by Ramos (1204) in the Philippines, with tremellaceous basidia (Fig. 7b). It differs from the description given above in the following details: fruitbodies much more ramified, central hyphae somewhat thick-walled, all septa without clamps, spores subglobose. Aside from this, the basidial development seems to agree with that described for *Tremellodendropsis transpusio*. Besides *Tremellodendropsis* one should consider also *Tremellodendron* itself; but the type of this genus has non-stalked, globose basidia which are strongly different.

There also exists a third group, which may be of interest in this problem, the genus *Aphelaria* Corner, a derivative of the holobasidial *Clavaria* s.l. I have chosen *Aphelaria guadelupensis* (Lév.) Corner, of which a habit sketch and the hymenial micromorphology may serve for comparison with the collection Ramos 1204 (Fig. 7a). Except for the structure of the mature basidia there is a conspicuous agreement; but for the holobasidia, *Aphelaria* would be indistinguishable from the tremellaceous '*Pterula*.'

In the Heterobasidiomycetes also holobasidial species are included, whose affinities and taxonomic positions have been hotly debated recently by some authors (Lowy, 1968 and 1969; Talbot, 1968 and 1970). I would like to delimit the discussion to the so-called Ceratobasidiaceae and to comparable species of the artificial Corticiaceae. I am fully aware of the fact that further taxa could be brought into discussion too. With regard to *Pseudotulasnella* (Lowy, 1964), I am convinced that this taxon is well placed within the Tulasnellaceae. Likewise I believe that much favours the treatment of *Cerinomyces* as a member of Dacrymycetaceae.

Ceratobasidiaceae, whose members so far known are corticioid species, show some characteristic features, such as often short-cylindric holobasidia with differently shaped sterigmata and spores forming secondary spores. The genus *Oliveonia* Donk (Figs. 8b, 9a) may be further characterized by the presence of cystidia. Moreover I would not be surprised if future investigations would re-establish Parker-Rhode's (1954: 325) invalidly published genus *Hydrabasidium*; it seems to me that *Cejpomyces* Svr. & Pouz. (Svrček & Pouzar, 1970: 5) could be the corresponding homobasidial taxon.

If we consider the basidia of *Oliveonia* s. str. to be slightly sphaero-pedunculate, then a counterpart in tremellaceous fungi can be found within the genus *Myxarium*.

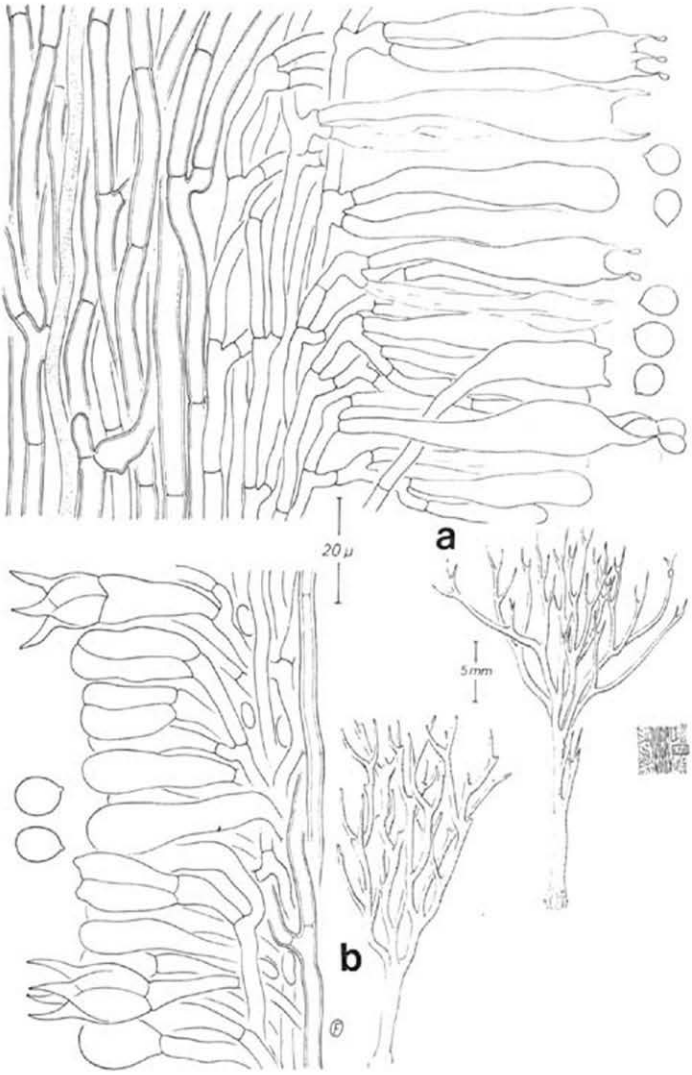


Fig. 7. Habit sketch of fruitbody and hymenial detail. — a. *Aphelaria guadelupensis* (Lév.) Corner. — b. '*Pterula pusio*', Ramos 1204.

Such species (compare Fig. 8a) would fit in well with this description. It is obvious that the main difference between both species lies in the phragmo- against the holobasidium.

A second interpretation would describe the basidia as only short cylindric with an attenuate base. This would render it necessary to look for equivalent taxa in a different area of tremellaceous genera. There exist a few species in the genus *Bourdotia* in its old and artificial circumscription, which show close resemblance in morphological aspects. And finally the genus *Metabourdotia* Olive should be taken into consideration. In comparison with *Oliveonia*, some differences can be pointed out: the presence of few hyphidia, apparently true gloeocystidia, and the apically partially cruciate-septate basidia. *Metabourdotia* is in fact of great theoretical interest (Olive, 1957: 429; Talbot, 1965: 378–379; Lowy, 1968: 124–125; Rogers, 1971: 251–252). I do not intend to discuss once more either the problems or the different systematic conclusions. It seems more appropriate to consider the development of *Oliveonia* itself. The drawing discussed above (Fig. 8b) shows a section through a young fruitbody. In central portions of the same sample (Fig. 9a) which normally contain more developed stages, a thickening of the hymenium is the result of a basidial repetition. Such a behaviour was first shown to exist by J. Eriksson (1958: 67–70) in *Corticium vile* Bourd. & Galz. (Fig. 9b), for which a new genus *Repetobasidium* was subsequently proposed. This is apparently a homobasidiomycetous genus with holobasidia whose spores on germinating produce normal hyphae. Although spore germination has not been directly observed in this genus, the absence of secondary spores on the hymenial surface makes direct hyphal germination likely. Furthermore, repetobasidia have as yet not been reported from the genus *Oliveonia*. The only comment found in literature is a note by Talbot (1965: 381): "In a material of the

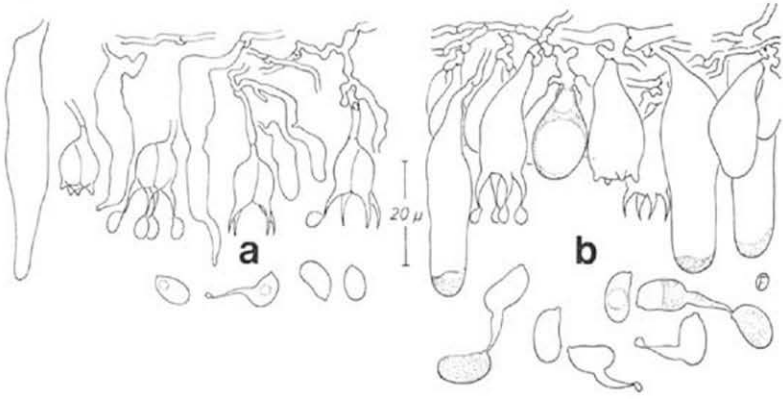


Fig. 8. Sections of fruitbodies in a young developmental stage. — a. *Myxarium* sp. — b. *Oliveonia fibrillosa* (Burt) Donk.

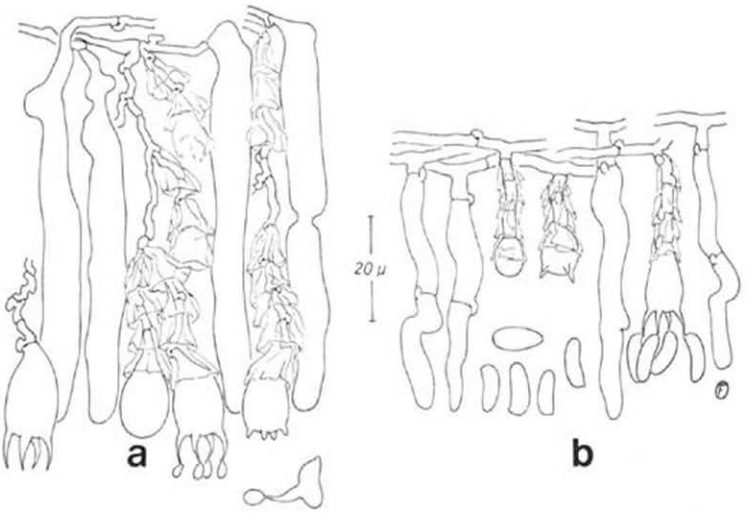


Fig. 9. Sections of fruitbodies. — a. *Oliveonia fibrillosa* (Burt) Donk. — b. *Repetobasidium vile* (Bourd. & Galz.) J. Erikss. var. *macrosporum* Oberw.

type species some of the probasidia had what appeared to be a partial or complete annulus of variable position. . . ." I have little doubt that these are the envelopes of old basidia surrounding the younger ones, as I could easily prove in living material collected in Merida (Venezuela).

Additional reports on hetero- versus homobasidiomycetous taxa of recognized affinities should be mentioned. Two well-known genera need to be discussed briefly, *Uthatobasidium* Donk and *Botryobasidium* Donk (Figs. 10a, b), detailed information on which is to be found in Rogers, 1934: 174–175; 1971: 248–249; Linder, 1940: 442–444; Donk, 1956: 373–375; 1964: 225, 227–229, 258, 261–262; 1966: 255; Martin, 1957: 25; J. Eriksson, 1958: 47; Oberwinkler, 1965: 5–7; Talbot, 1965: 375–379; 1971: 224. These genera are similar in most details: effused, pruinose-arachnoid to hypochnoid fructifications composed of rather broad hyphae which branch at right or at least extremely wide angles. Basidia are short cylindrical and not or inconspicuously constricted. The generic separation is supported by basidia having normally four sterigmata and spores producing secondary spores in *Uthatobasidium*, and basidia having supernumerary sterigmata and spores forming hyphal mycelium from the beginning of their germination in *Botryobasidium*.

There is no doubt that the points mentioned in the beginning separating the Phragmo- and Holobasidiomycetes are not well-founded. The characters of fructifications and hyphae are extremely variable and occur in different groups of both taxa. But also basidia and spores of some genera and species of Tremellales and Aphyllophorales show great similarity in morphological respect.

There remain only two characters which may be combined to circumscribe the Heterobasidiomycetes: mature basidia septate or, if undivided, basidiospores forming secondary spores. The Homobasidiomycetes, on the other hand, include fungi with holobasidia whose spores never produce secondary spores.

The details shown above may indicate that this classification is still in need of improvement.

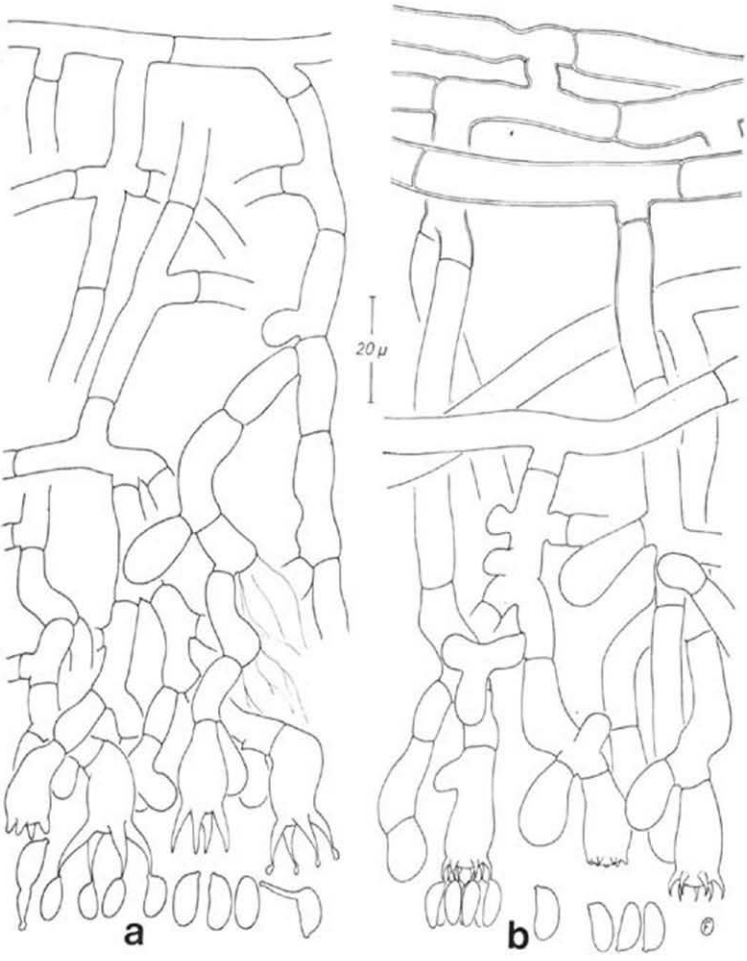


Fig. 10. Sections of fruitbodies. — a. *Uthatobasidium* sp. — b. *Botryobasidium obtusisporum* J. Erikss.

ACKNOWLEDGEMENTS

I am grateful to Dr. L. S. Olive, University of North Carolina, Chapel Hill, for the gift of some very important collections. For the loan of specimens I wish to express my sincere thanks to Dr. M. I. Lamb of the Farlow Herbarium, Cambridge, Massachusetts (FH); Dr. B. Lowy of the Mycological Herbarium, Louisiana State University, Baton Rouge (LSUM); the Director, Royal Botanic Gardens and Dr. D. A. Reid, Kew (K). I am highly indebted to the late Dr. M. A. Donk, to Dr. H. Merxmüller, Munich, and to my wife, Dr. Barbara Oberwinkler, for their helpful and detailed criticism.

Collecting data of the species represented by drawings

Fig. 1a. *Tremella mesenterica* Retz. per Hook. Deutschland, Bayern; Grundübelau am Hintersee, bei Berchtesgaden, 820 m., 12.11.1961, *F. Oberwinkler.*

Fig. 1b. *Corticium evolvens* (Fr. per Fr.) Fr. Deutschland, Bayern; Halblech nordöstlich Füssen, 830–850 m., 23.3.1968, *B. Mayr & F. Oberwinkler.*

Fig. 2a. *Exidiopsis* sp. Venezuela, Dto. Federal; Baruta bei Caracas, ± 1300 m., 5.2.1969, *B. & F. Oberwinkler 14558.*

Fig. 2b. Coll. BFO 13845. Venezuela, Anden, Edo. Merida; El Valle nordöstlich Merida, ± 2300 m., 8.12.1968, *B. & F. Oberwinkler 13845.*

Fig. 2c. *Athelopsis lembospora* (Bourd.) Oberw. Venezuela, Dto. Federal; alte Strasze von Caracas nach La Guaira, 700 m., auf morschem Holz von *Bathysa pittieri* (Standl.) Steyerm. (Rubiaceae), 2.2.1969, *B. & F. Oberwinkler 14537.*

Fig. 3. *Basidiodendron eyrei* (Wakef.) Luck-Allen. Venezuela, Anden, Edo. Merida; Umgebung des Instituto Forestal Latino-Americano in Merida, 1800 m., 27.11.1968, *B. & F. Oberwinkler 13733.*

Fig. 4a. *Basidiodendron cinereum* (Bres.) Luck-Allen. Venezuela, Cordillera de la Costa, Edo. Aragua; Parque National Henri Pittier ("Rancho Grande") nördlich Maracay, 1100 m., 9.2.1969, *B. & F. Oberwinkler 14633.*

Fig. 4b. *Dendrothele* sp. Venezuela, Anden, Edo. Merida; La Mucuy oberhalb Tabay, östlich Merida, ± 2000 m., 3.9.1968, *B. & F. Oberwinkler 12611.*

Fig. 5a. *Heterochaete* sp. Venezuela, Anden, Edo Merida; Umgebung des Instituto Forestal Latino-Americano in Merida, 1800 m., 7.6.1969, *B. & F. Oberwinkler 16019.*

Fig. 5b. *Dendrothele griseo-cana* (Bres.) Bourd. & Galz. Venezuela, Anden, Edo. Merida; Umgebung des Instituto Forestal Latino-Americano in Merida, 1800 m., 12.11.1966, *B. & F. Oberwinkler 13390.*

Fig. 6a. *Aphelaria tuberosa* (Grev.) Corner Pellston Hills, Michigan, USA 19.8.1961, *D. A. Reid* (Royal Botanic Gardens Kew, K).

Fig. 6b. *Tremellodendropsis transpusio* Crawf. Venezuela. Anden, Edo. Merida; La Mucuy oberhalb Tabay, östlich Merida, ± 2200 m., 6.7.1969, *B. & F. Oberwinkler 16167.*

Fig. 7a. *Aphelaria guedelupensis* (Lév.) Corner (als *Pterula aurantiaca* P. Henn.), E. Ule, Appendix Mycothecae brasiliensis 10. Amazonas, Manáos. Ad solum humidum, 1902, *E. Ule* (Botanische Staatssammlung München, M).

Fig. 7b. '*Pterula pusio* (Berk.) Bres.' Luzon. Rizal, Bosoboso, *Max. Ramos 1204* (Botanische Staatssammlung München, M).

Fig. 8a. *Myxarium* sp. Deutschland, Bayern; Predigtstuhl bei Bad Reichenhall, 1400 m., 10.9.1962, *F. Oberwinkler 2887a.*

Fig. 8b. *Oliveonia fibrillosa* (Burt) Donk Venezuela, Anden, Edo. Merida; Umgebung des Instituto Forestal Latino-Americano in Merida, 1800 m., 27.12.1968, *B. & F. Oberwinkler 14101.*

Fig. 9a. *Oliveonia fibrillosa* (Burt) Donk BFO 14101, compare Fig. 8b!

Fig. 9b. *Repetobasidium vile* (Bourd. & Galz.) J. Erikss. var. *macrosporum* Oberw. Deutschland, Bayern; Funtensee im Steinernen Meer bei Berchtesgaden, 1600 m., 6.8.1963, *F. Oberwinkler 5570, 5571a.*

Fig. 10a. *Uthatobasidium* sp. Venezuela, Anden, Edo. Merida; Umgebung des Instituto Forestal Latino-Americano, 1800 m., 1.10.1968, *B. & F. Oberwinkler 12904.*

Fig. 10b. *Botryobasidium obtusisporum* J. Erikss. Venezuela, Anden, Edo. Merida; Umgebung des Instituto Forestal Latino-Americano in Merida, 1800 m., 9.1968, *B. & F. Oberwinkler.*

REFERENCES

BOURDOT, H. & A. GALZIN (1912). Hyménomycètes de France IV. Corticiés: *Vuilleminia*, —— *Aleurodiscus*, *Dendrothele*, *Gloeocystidium*, *Peniophora*. *In* Bull. trimest. Soc. mycol. Fr. **28**: 349–409.

—— & —— (1928). Hyménomycètes de France. Hétérobasidiés—Homobasidiés gymnocarpes. Sceaux ("1927").

CORNER, E. J. H. (1966). The clavarioid complex of *Aphelaria* and *Tremellodendropsis*. *In* Trans. Br. mycol. Soc. **49**: 205–211.

—— (1970). Supplement to "A Monograph of *Clavaria* and Allied Genera". *In* Nova Hedwigia **33**: 1–299.

CRAWFORD, D. A. (1954). Studies on New Zealand Clavariaceae I. *In* Trans. R. Soc. N.Z. **82**: 617–631.

DONK, M. A. (1956). Notes on resupinate Hymenomycetes—II. The tulasnelloid fungi. *In* Reinwardtia **3**: 363–379.

—— (1964). A conspectus of the families of Aphyllophorales. *In* Persoonia **3**: 199–324.

—— (1966). Check list of the European hymenomycetous Heterobasidiae. *In* Persoonia **4**: 145–335.

ERIKSSON, J. (1958). Studies in the Heterobasidiomycetes and Homobasidiomycetes – Aphyllophorales of Muddus National Park in North Sweden. *In* Symb. bot. upsal. **16**: 1–172.

HÖHNEL, F. VON & V. LITSCHAUER (1908). Beiträge zur Kenntnis der Corticieen III. *In* Sber. Akad. Wiss. Wien (Math.-naturw. Kl.) **117**: 1081–1124.

LINDER, D. H. (1940). Evolution of the Basidiomycetes and its relation to the terminology of the basidium. *In* Mycologia **32**: 419–447.

LOWY, B. (1964). A new genus of the Tulasnellaceae. *In* Mycologia **56**: 696–700.

—— (1968). Taxonomic problems in the Heterobasidiomycetes. *In* Taxon **17**: 118–127.

—— (1969). Septate holobasidia. *In* Taxon **18**: 632–634.

LUCK-ALLEN, E. R. (1963). The genus *Basidiodendron*. *In* Can. J. Bot. **41**: 1025–1052.

MARTIN, G. W. (1957). The tulasnelloid fungi and their bearing on basidial terminology. *In* Brittonia **9**: 25–30.

OBERWINKLER, F. (1965). Primitive Basidiomyceten. Revision einiger Formenkreise mit plastischer Basidie. *In* Sydowia **19**: 1–72.

OLIVE, L. S. (1957). Two new genera of the Ceratobasidiaceae and their phylogenetic significance. *In* Am. J. Bot. **44**: 429–435.

PARKER-RHODES, A. F. (1954). The Basidiomycetes of Skokholm Island. I. Annotated species list. *In* Trans. Br. mycol. Soc. **37**: 324–342.

PARMASTO, E. (1968). Conspectus systematis Corticiacearum. Tartu.

REID, D. A. (1956). New or interesting records of Australian basididomycetes II. *In* Kew Bull. **3**: 535–540.

RICK, J. (1938). Resupinati riograndenses. *In* Brotéria (Ciênc. nat.) **7**: 71–77.
ROGERS, D. P. (1934). The basidium. *In* Stud. nat. Hist. Iowa Univ. **16**: 160–183.
—— (1971). Patterns of evolution to the homobasidium. *In* R. H. Petersen (ed.), Evol. high. Basidiomyc. 241–257.
SVRČEK, M. & Z. POUZAR (1970). *Cejpomyces* gen. nov., a new genus of resupinate Hymenomycetes (Corticiaceae). *In* Česká Mykol. **24**: 5–11.
TALBOT, P. H. B. (1965). Studies of "*Pellicularia*" and associated genera of Hymenomycetes. *In* Persoonia **3**: 371–406.
—— (1968). Fossilized pre-Patouillardian taxonomy. *In* Taxon **17**: 620–628.
—— (1970). The controversy over septate holobasidia. *In* Taxon **19**: 570–572.
—— (1971). Principles of fungal taxonomy. London and Basingstoke.
WELLS, K. (1961). Studies of some Tremellaceae. IV. *Exidiopsis*. *In* Mycologia **53**: 317–370.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 7, Part 1, pp. 17–21 (1972)

A NOTE ON THE GENUS JUNGHUHNIA

L. RYVARDEN

Botanical Laboratory, University of Oslo, Oslo

The type of *Laschia crustacea* Jungh. has been examined. *Junghuhnia* Corda was based on this species and is in the present paper demonstrated to be an earlier name for *Chaetoporus* Karst. Eight species answering to the generic concept are transferred to *Junghuhnia*. Eighteen species previously transferred to, or described, in *Chaetoporus* are discussed; of these three are transferred to *Oxyporus*, one to *Cristella* and one to *Incrustoporia*, while the remainder is placed in synonymy with other species.

The name *Junghuhnia* was proposed by Corda (*1842*: 195) to replace *Laschia* Jungh. non Fr. A few months earlier *Aschersonia* Endl. had been proposed for the same reason but this is a nomen rejiciendum against *Aschersonia* Mont. 1848 which is conserved for a large group of imperfect fungi.

The type of *Junghuhnia* is *Laschia crustacea* Jungh., a species for a long time known only from the type locality in Java. Bresadola (*1910*: 587) reported it from the Philippines and transferred it to *Poria*. Boedijn (*1940*: 383) later collected specimens on Krakatau and Lang Eiland in the Sunda Strait.

During a stay in Leiden the type of *Laschia crustacea* was examined as well as Bresadola's material from the Philippines. The description runs as follows: —

Fruitbody resupinate, up to 1 mm thick, small to more widely effused, hugging the substrate, fragile when dry, pale ochraceous to buff (café au lait); margin absent; pores up to 0.5 mm deep, thin-walled, angular, 5–7 per mm, the pore-mouths finely dentate owing to excreted small crystals (lens); subiculum up to 0.5 mm thick. Hyphal system (as observed in 5 per cent KOH) dimitic; generative hyphae hyaline, delicately thin-walled, mostly collapsed, with clamps at septa, 1–3 μ in diameter; skeletal hyphae hyaline, thick-walled to almost solid, 2.5–5 μ in diameter, coarsely incrusted cystidia abundant both in hymenium and trama, arising from the skeletal hyphae, 20–45 μ long (measured from the point where the diameter starts to increase), 5–9 μ in diameter (measured without crystals and at the widest section; the crystals dissolving after 20–30 minutes in 5 per cent KOH). The type is sterile, but spores were observed in Bresadola's material, both floating and in the collapsed hymenium, globose to semiglobose, smooth, thin-walled, hyaline, IKI–, 3–4 μ in diameter (also observed by Bresadola). Hymenium collapsed so that no good measurements of basidia could be obtained.

It is apparent from the description above that *Junghuhnia* is an earlier generic name for a group of fungi now often placed in *Chaetoporus* Karst., a name typified by *C. tenuis* Karst. = *Poria euporia* (Karst.) Cooke = *C. nitidus* (Pers. ex Fr.) Donk. For a detailed description of this species, see Lowe (*1966*: 122).

Hymenogramme Mont. & Berk. (*1844*: 329), typified by *H. javensis*, has been considered to be a synonym of *Junghuhnia* Corda and *Laschia crustacea* respectively (Mont. & Berk., *1844*: 330). However, after having checked the type of *H. javensis*, I am convinced that this is not so. *Hymenogramme javensis* is a resupinate fungus with a slightly folded, light yellowish hymenium and resinous consistency. The outline of the hymenium is difficult to ascertain as it seems to have contracted and flattened during drying. The hyphae are difficult to separate even in 10 per cent KOH and I did not manage to find any septa. Crystalline matter and oily drops are abundant in preparations and many types of spores are present. No hymenium could be found. The species is unknown to me, I doubt very much if it belongs in the Polyporaceae at all, the general impression being that of a *Merulius*-like species.

JUNGHUHNIA Corda emend. Ryvarden

Laschia Jungh. *in* Verh. Bataviaasch Genootsch. **17** [2]: 74. "1839" (reprint presumably, 1838), non *Laschia* Fr. 1830 (Auriculariaceae). — ≡ *Aschersonia* Endl., Gen. Pl. Suppl. **2**: 103. 1842, non *Aschersonia* Mont. 1848 (Deuteromycetes; nomen conservandum) — ≡ *Junghuhnia* Corda, Anl. Stud. Mycol. 195. 1842.

Chaetoporus Karst. *in* Hedwigia **29**: 148. 1890.

Fructification resupinate; hymenial surface poroid, pale ochraceous, yellowish to light pinkish brown. Hyphal system dimitic; generative hyphae with clamps at septa; skeletal hyphae hyaline, encrusted cystidia present, arising from skeletal hyphae. Spores small, globose to almost cylindrical, hyaline, smooth and IKI negative.

TYPE SPECIES. — *Laschia crustacea* Jungh.

The following species belong here: —

Junghuhnia collabens (Fr.) Ryv., *comb. nov.*; basionym, *Polyporus collabens* Fr., Hym. europ. 572. 1874.

Junghuhnia crustacea (Jungh.) Ryv., *comb. nov.*; basionym, *Laschia crustacea* Jungh. *in* Verh. Bataviaasch Genootsch. **17** [2]: 75. "1839" (reprint presumably, 1838).

Junghuhnia fimbriatella (Peck) Ryv., *comb. nov.*; basionym, *Polyporus fimbriatellus* Peck *in* Rep. N.Y. St. Mus. nat. Hist. **38**: 91. 1885.

Junghuhnia luteo-alba (Karst.) Ryv., *comb. nov.*; basionym, *Physisporus luteoalbus* Karst. *in* Rev. mycol. **9**: 10. 1887.

Junghuhnia nitida (Pers. ex Fr.) Ryv., *comb. nov.*; basionym, *Polyporus nitidus* Pers. *ex* Fr., Syst. mycol. **1**: 379. 1821.

Junghuhnia pseudozilingiana (Parm.) Ryv., *comb. nov.*; basionym, *Chaetoporus pseudozilingianus* Parm. *in* Eesti NSV Tead. Akad. Toim. (Biol. Ser. 2) **8**: 113. 1959.

Junghuhnia separabilima (Pouz.) Ryv., *comb. nov.*; basionym, *Chaetoporus separabilimus* Pouz. *in* Česká Mykol. **21**: 210. 1967.

In the "Index of Fungi" (**3**: 457, 1968) the specific name was spelt "separabillimus." Here an error seems to have crept in. There are six adjectives in Latin ending

with 'ilis' which double the 'l' in the superlative form 'illimus'. However, separabilis is not one of these (cf. Kennedy, *1962*: 42).

Junghuhnia zonata (Bres.) Ryv., *comb. nov.*; basionym, *Poria zonata* Bres. *in* Mycologia **17**: 77. 1925.

The following species (listed in alphabetical order according to the specific epithet) have been transferred to, or described in, *Chaetoporus* but do not belong in *Junghuhnia* as defined here.

Chaetoporus ambiguus (Bres.) Bond. & Sing. (*1941*: 51). The species is a synonym of *Oxyporus latemarginatus* (Dur. & Mont.) Donk.

Chaetoporus corticola (Fr.) Bond. & Sing. (*1941*: 51). Authentic material examined. The species clearly belongs in *Oxyporus* and was, not validly, transferred to this genus by E. Komarova (*1964*: 175). She referred to *Oxyporus corticola* (Fr.) Parm. (*1969*: 161). However, on the page cited there is no combination *Oxyporus corticola*, hence the binomial used by Komarova is not validly published as no basionym is cited either in her or Parmasto's publication. The recombination is here formally proposed as **Oxyporus corticola** (Fr.) Ryv., *comb. nov.*; basionym, *Polyporus corticola* Fr., Syst. mycol. **1**: 385. 1821. I am grateful to the late Dr. M. A. Donk for information on the points indicated above.

Chaetoporus iodinus (Mont.) Rom. (*1901*: 15). Type examined. The species is better known as *Cyclomyces iodinus* (Mont.) Pat.

Chaetoporus gilvus (Schw.) Rom. (*1901*: 14). Authentic material examined. The species is very common in the tropics and should be named *Phellinus gilvus* (Schw.) Pat.

Chaetoporus latitans (Bourd. & Galz.) Parm. (*1963*: 113). Lowe (*1959*: 101) first identified the species with *Poria versipora* (Rom.) Lloyd. However, later (*1966*: 72) he described it as a species in its own right with monomitic hyphal system, with clamps at the septa, smooth cystidia, and allantoid spores. The species is the type of *Chaetoporellus* Bond. & Sing. ex Sing.

Chaetoporus licnoides (Mont.) Rom. (*1901*: 15). Type examined. The species is, in my opinion, a synonym of *Phellinus senex* (Nees & Mont.) Imaz. (type examined).

Chaetoporus melleofulvus Rom. (*1901*: 16). No material seen. According to the description it seems likely that the species belongs in the Hymenochaetaceae. Species described by Romell will be dealt with in a later paper.

Chaetoporus novae-zelandiae (G. Cunn.) G. Cunn. (*1965*: 71). Authentic material examined. The species has a dimitic hyphal system with clamped generative hyphae. Cystidia proper, as I define them, are not present. The skeletal hyphae are, especially in the dissepiments, finely incrusted, and this apparently misled Cunningham into calling them cystidia. His drawing (*1947*: 27) supports this theory. The spores are more oblong ellipsoid to short cylindrical than shown in this drawing. The species clearly belongs in *Incrustoporia* Dom., hence the recombination **Incrustoporia novae-zelandiae** (G. Cunn.) Ryv., *comb. nov.*; basionym, *Poria novae-zelandiae* G. Cunn. *in* Bull. Pl. Dis. Div. N.Z. Dep. scient. ind. Res. **72**: 29. 1947.

Chaetoporus pearsonii (Pilát) Bond. (*1953*: 180). Type examined. The species is a synonym of *Oxyporus corticola* (Fr.) Ryv., as already pointed out by Lowe (*1966*: 19).

Chaetoporus philadelphi Parm. (*1959*: 237). Authentic material examined. The species is monomitic without clamps, while the cystidia are short and mostly apically incrusted. The species is here referred to *Oxyporus* as **Oxyporus philadelphi** (Parm.) Ryv., *comb. nov.*; basionym, *Chaetoporus philadelphi* Parm. *in* Bot. Mater. Inst. spor. Rast. **12**: 237. 1959.

Chaetoporus radula (Pers. ex Fr.) Bond. & Sing. (*1941*: 51). The species is a synonym of *Schizopora paradoxa* (Schrad. ex Fr.) Donk.

Chaetoporus regularis (Murr.) Wright (*1964*: 786). Type examined. This is a monomitic species with abundantly clamped hyphae. The spores are echinulate and cystidia are present. Except for the latter character the species is very close to *Cristella candidissima* (Schw.) Donk and should be placed in the same genus. Hence: **Cristella regularis** (Murr.) Ryv., *comb. nov.*; basionym, *Poria regularis* Murr. *in* Mycologia **12**: 87. 1920.

Chaetoporus rixosus (Karst.) Bond. & Sing. (*1941*: 51). A synonym of *Junghuhnia collabens* (Fr.) Ryv.

Chaetoporus scruposus (Fr.) Rom. (*1901*: 16). Type examined. The species is a synonym of *Phellinus gilvus* (Schw.) Pat.

Chaetoporus similis (Bres.) Wright (*1964*: 786). Authentic material examined. The species is monomitic with the hyphae devoid of clamps and with incrusted cystidia. It clearly belongs in *Oxyporus*, to which genus it is here transferred as **Oxyporus similis** (Bres.) Ryv., *comb. nov.*; basionym, *Poria similis* Bres. *in* Mycologia **17**: 76. 1925.

Chaetoporus subacidus (Peck) Bond. & Sing. (*1941*: 51). The species belongs in *Perenniporia* as *P. subacida* (Peck) Donk.

Chaetoporus variecolor (Karst.) Parm. (*1961*: 120). This combination was also made by Domański (*1963*: 303), M. Bondarceva (*1964*: 189), and Pouzar (*1967*: 211). Type material examined. As pointed out by Lowe (*1956*: 115) the type material is of mixed identity. The predominant material is *Poria luteo-alba* and Lowe was therefore inclined to apply 'variecolor' as the correct specific epithet to this taxon. Resulting from this are all the combinations mentioned above. However, Lowe himself (*1966*: 106) was still reluctant to accept *P. variecolor*. Donk (*1967*: 119) challenged his view of 1956 by pointing out that the spores cited by Karsten do not fit those of *P. luteo-alba*. Another point which also clearly excludes *P. luteo-alba* as a synonym of *P. variecolor*, is the substrate. Karsten gives the substrate as *Alnus glutinosa*. However, *P. luteo-alba*, at least in Fennoscandia, is strictly confined to coniferous wood, usually of *Pinus sylvestris*. I have no idea about the identity of the specimen Karsten had in hand when he made the description of *Physisporus variecolor*. The name should be dropped as a nomen confusum.

Chaetoporus vinctus (Berk.) Wright (*1964*: 786). Type examined. The species is monomitic and the hyphae are devoid of clamps, with the cell-walls of very variable

thickness. The spores are globose and large, while coarsely incrusted cystidia are present. The species has been transferred to *Rigidoporus* as *R. vinctus* (Berk.) Ryv. (*1972*: 143).

REFERENCES

BOEDIJN, K. B. (1940) *in* Bull. Jard. bot. Buitenz. III **16**.
BONDARCEV, A. S. (1953), Trut. Griby,
BONDARCEV, A. S. & SINGER, R. (1941) *in* Annls mycol. **39**.
BONDARCEVA, M. (1964) *in* Nova Sist. niz. Rast. **1**.
BRESADOLA, G. (1910) *in* Annls mycol. **8**.
CORDA, A. C. J. (1842), Anl. Stud. Mycol.
CUNNINGHAM, G. H. (1947) *in* Bull. Pl. Dis. Div. N.Z. Dep. scient. ind. Res. No. 72 — (1965) Polyp. New Zeal. (= *in* Bull. Pl. Dis. Div. N.Z. Dep. scient. ind. Res. No. 164).
DOMAŃSKI, S. (1963) *in* Monogr. Bot. Soc. Pol. No. 15.
DONK, M. A. (1960) *in* Persoonia **1**. — (1967) *in* Persoonia **5**.
KENNEDY, B. H. (1962), Revised Latin Primer.
KOMAROVA, E. (1964), Key det. porefungi Belorussia (translated title).
LOWE, J. L. (1956) *in* Mycologia **48**. — (1959) *in* Lloydia **21**. — (1966), Polyp. N. Am., *Poria* (= *in* Techn. Publ. St. Univ. Coll. For. Syracuse No. 90).
MONTAGNE, C. & BERKELEY, M. J. (1844) *in* Lond. J. Bot. **3**.
PARMASTO, E. (1959) *in* Eesti NSV Tead. Akad. Toim. (Biol.) **2**. — (1963) *in* Tartu Riik Ülik. Toim. No. 136 (6).
POUZAR, Z. (1967) *in* Česká Mykol. **21**.
ROMELL, L. (1901) *in* Bih. K. svenska VetenskAkad. Handl. III **26** (16).
RYVARDEN, L. (1972) *in* Norw. J. Bot. **19**.
WRIGHT, J. E. (1964) *in* Mycologia **56**.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 7, Part 1, pp. 23–54 (1972)

NOTES ON THE GENUS PSATHYRELLA—III

Unorthodox approach and key to section Atomatae

E. KITS VAN WAVEREN, M.D.

Amsterdam

(With 40 Text-figures)

The species of the genus *Psathyrella* listed by Romagnesi (1953: 355) in the groups of *Atomatae* and *Pronae* are brought into one section, section *Atomatae*. This section is divided into a coprophilous and a non-coprophilous group. Fifty-four collections of species, belonging to this section were examined, including type material of *Drosophila picta* Romagn., *D. orbitarum* Romagn., and *D. albidula* Romagn.; herbarium material of *Psathyrella atomata* (Fr.) Quél. and *Drosophila infida* Quél., received from Prof. H. Romagnesi; type material of *Psathyrella coprophila* Watling, *P. fimetaria* Watling, and *P. vinosofulva* Orton. A new species, *P. Romagnesii* Kits van Wav. and a new variety, *P. prona* var. *utriformis* Kits van Wav. are described and it is argued that the latter name is to replace the name *P. vinosofulva*. It is argued that *Agaricus atomatus* Fr. is a nomen dubium, while *D. albidula*, and *D. picta* are to be regarded as mere forms of *P. prona*, that *D. orbitarum* is a mere colour variant of *P. prona*, and that *D. infida* is identical with *P. prona*. *Psathyrella prona* f. *cana* Kits van Wav. is proposed for what hitherto has always been known as *P. atomata* (sensu Bresadola and Lange). It is also argued that *P. coprophila* and *P. fimetaria* are conspecific. A key to the species of this section is given.

Of the species belonging to Romagnesi's *Atomatae* and *Pronae* (Romagnesi, 1953: 355, 356[1]), *P. coprobia* (J. E. Lange) A. H. Smith and *P. stercoraria* (Kühn. & Joss.) Moser are exclusively coprophilous and moreover well defined, so that—like Moser (1967: 215) does in his key—we propose to separate these species together with the also coprophilous species *P. coprophila*, recently described by Watling (1971: 146) as the coprophilous group. All other species, listed by Romagnesi in his two groups are basically non-coprophilous and are very closely related. Both these coprophilous and non-coprophilous groups are here united to form a single section, the *Atomatae* (Romagn.) Sing.

Before giving descriptions of the coprophilous species, we will first give a full description of *P. prona* (based on 21 collections), to be followed by a critical discussion of a number of its characters. We will then argue the position of the other species of the non-coprophilous group.

[1] Romagnesi did not indicate what rank should be assigned to his "groupes." In the following these groups will be referred to only by their name.

For our methods of examining the pleuro- and cheilocystidia, the shape, size and colour of the spores, the basidia and the pigmentation of the hymenophoral trama, the reader is referred to our previous papers (Kits van Waveren, 1968: 132; 1971: 249). Owing to lack of space it was impossible to depict full cystidiograms in the present paper. Spore-measurements are given both as a range and as a mean value added between brackets like we did previously (Kits van Waveren, 1971: 249). Pleurocystidia, hitherto believed to be rather scarce and scattered in the species of this section (Singer, 1962: 511), turned out to occur in fairly large numbers when isolated gills (deprived of their edges and preferably coloured by Congo Red 1 %) were disrupted into a large number of very small pieces with the aid of a broken razor blade and a dissecting needle under the binocular lens, the fragments finally being brought under a coverslip and further disrupted by tapping the slip. For the description of the colours of the macroscopic structures and the spores (mounted in water and studied with oil immersion with a rather strongly lit field of view) we used 'Munsell Soil Color Charts' (abbreviated in the text to M.) and the code designating its colours. In the lists of collections examined, the author's name is abbreviated to E. K. v. W. It is assumed that Romagnesi wrote the chapter on the genus *Drosophila* in the 'Flore analytique' (Kühn. & Romagn., 1953), reason why only his name is quoted when our text refers to this chapter.

We are greatly indebted to Prof. H. Romagnesi for very kindly sending us fragments of a number of type and other specimens from his own herbarium, to the Director of The Herbarium, Royal Botanic Gardens, Kew, for lending the type specimen of *P. vinosofulva*, to Dr. R. Watling for sending us type material of his two recently described coprophilous species, to Dr. H. S. C. Huijsman and Mr. P. B. Jansen for making available to us collections from their herbarium, and to Mr. J. Daams for supplying us on several occasions with fresh material from hothouses.

PSATHYRELLA (Fr.) Quél. Section ATOMATAE (Romagn.) Sing.

Carpophores small, cap up to 18–20(–25) mm in diam., stem up to 55–65(–80) mm long; caps some shade of brown to grey and striate when moist, hygrophanous, paler and often more or less pink on drying; veil present but very fugacious; stem often flexuous, bulbous, not rooting; hymenophoral trama very slightly to distinctly coloured by membranal pigment; spores dark reddish brown in water, with large, conspicuous germ pore; basidia 4–, but often 2– and rarely 1–spored; pleurocystidia fairly numerous; gill edge sterile with very numerous spheropedunculate cells and much less numerous cheilocystidia.

TYPE: *Psathyrella prona* (Fr.) Gillet.

It should be noted that it is Romagnesi (1944: 53) who selected *Drosophila prona* (Fr.) Quél. sensu Ricken as type for his section *Atomatae*. *Psathyrella atomata* would have been a more logical choice.

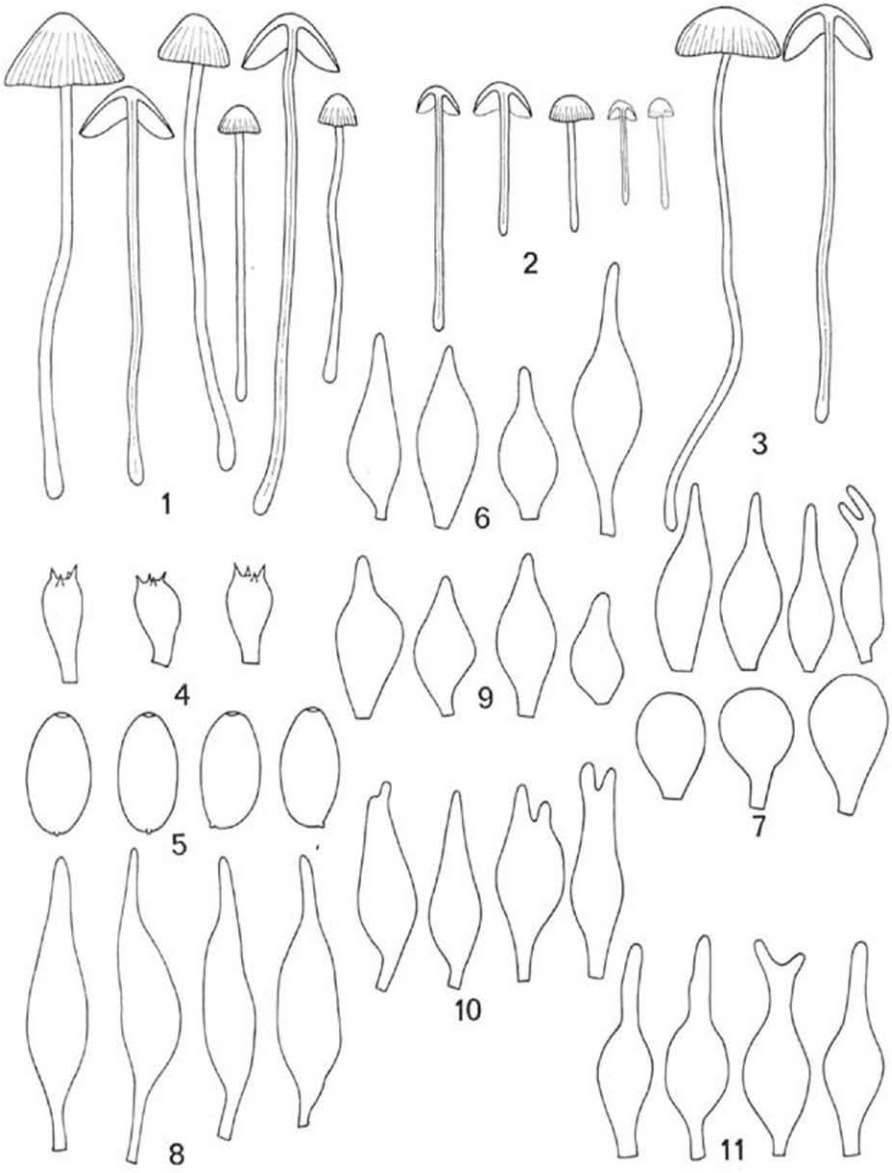
PSATHYRELLA PRONA (Fr.) Gillet var. PRONA—Figs. 1—11

Agaricus pronus Fr., Epicr. 239. 1838; Monogr. Hym. Succ. **1**: 450. 1857; Hym. europ. 315. 1874; Icon. sel. **2**: 39, pl. 139 fig. 3. 1879. — *Psathyrella prona* (Fr.) Gillet, Champ. France Hym. 618. 1878; Tabl. anal. Hym. pl. 589. 1890–1898. — *Coprinarius pronus* (Fr.) Quél.,

Enchir. 120. 1886. — *Drosophila prona* (Fr.) Quél., Fl. mycol. 57. 1888. — *Psathyra prona* (Fr.) J. E. Lange *in* Dansk bot. Ark. **4** (9): 16. 1936.
Agaricus expolitus Fr., Epicr. 239. 1838; Hym. europ. 315. 1874.
Psathyrella subprona Cleland. *in* Trans. Proc. R. Soc. S. Austr. **51**: 306. 1927.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS. — Gillet, Champ. France Hym. 618. 1878; Tabl. anal. Hym. pl. 589. 1890. — Cooke, Ill. Brit. Fungi **5**: pl. 656 (640). 1886–1888. — Bresadola, Icon. mycol. **18**: pl. 890. 1931. — Ricken, Blätterp. 265: pl. 68 fig. 6. 1915. — J. E. Lange, Fl. agar. dan. **4**: 101, pl. 155 C and C'. 1939. — Kühn. & Romagn., Fl. anal. 356. 1953.

MACROSCOPIC CHARACTERS.— *Cap* both in the early and later stages paraboloid or conico-paraboloid, conical, sometimes hemispherical, sometimes with slight umbo in final stages usually spreading to convex-paraboloid or convex-hemispherical, 6–20(–25) mm in diam. and 5–10 mm high; in early stages (cap 3–6 mm) already somewhat striate and strikingly chocolate brown to dark brown (M. 7,5 YR 3/2, 4/2), sometimes even reddish brown (M. 5 YR 3/3, 4/3, 4/2), especially at central 2/3 of cap; later strongly sulcate-striate up to 1/2–2/3(–3/4) from margin inwards, centre and striae rather dark brown to greyish brown (M. 10 YR 3/4, 3/3, 3/2, 4/3, 4/2, 5/3, 5/2 and paler towards margin), striae light brownish grey (M. 10 YR 6/2), overall colour in final stages very often predominantly grey (M. 10 YR 4/1, 5/1, 6/1) with only apex showing a trace of brown (M. 10 YR 5/2); hygrophanous, drying out to pale grey (M. 10 YR 6/1, 7/1) or almost white or very pale brownish grey, alutaceous (M. 10 YR 6/2) or very pale brown (M. 10 YR 8/2, 8/3, 8/4, 7/2, 7/3), very often via reddish brown or dark reddish brown (M. 5 YR 5/3, 5/2) turning to some shade of very distinct pink (M. 5 YR 6/2, 6/3, 7/2; 7,5 YR 8/2, 8/4) or even pale red (M. 10 R 5/3, 5/2, 6/3), usually moderately to strongly micaceous and slightly to moderately rugulose.
Veil very poorly developed; in mature specimens remnants normally very scanty if not altogether absent, consisting of only a few scattered minute fibres or very small bundles of fibres on surface of cap near margin, never appendiculate and rarely reaching further inwards from margin; in very early stages often more distinct, and then fibres or sometimes networks of fibres reaching up to 2/3 from margin inwards and/or connecting cap and stem.
Gills 2–3 mm broad, large gills numbering (13–)15–20, moderately crowded, in some specimens subdistant because of their small number (13–15), very broadly adnate either without, but usually with a distinct small decurrent tooth, rounded near and sometimes protruding below margin of cap, further up with straight edge and distinctly ascending, in early stages at basal 1/3 of gill usually pale brown (M. 10 YR 6/4, 6/3 or even 5/3), sometimes even yellowish brown (M. 10 YR 5/6, 5/4) at base itself, the remainder very pale brown (M. 10 YR 7/3, 7/2) to whitish but soon greying (M. 10 YR 6/2) towards edge, later grey (M. 10 YR 5/1) with a trace of purple (M. 5 YR 5/1) and near base with brown tinge (M. 10 YR 6/2, 5/2, 4/2), finally dark grey (M. 10 YR 4/1), purplish grey (M. 5 YR 4/1) or purplish black (M. 10 YR 2/2, 3/1, 5 YR 3/1) all over, but often still near base with trace of brown (M. 10 YR 6/2 in somewhat younger stages and 10 YR 5/2, 4/2 later on), these brown shades easily overlooked but also not infrequently indeed practically absent and gills then merely grey or very dark grey; edge in early stages white, later conspicuously red; sometimes, however, predominantly white with red tinges restricted to either edges of only some gills or short stretches of (some) edges near margin of cap or near stem, rarely entirely white (in which case microscopical examination sometimes still reveals short stretches of red edge near margin of cap).
Stem (13–)18–65(–80) × (0.5–)1–1.5(–2) mm, equally thick, hollow, straight but



Figs. 1—11

very often slightly to conspicuously flexuous, with base not rooting but distinctly bulbous ("bulbilleux") and usually covered with a thin whitish tomentose layer, rarely with short white hairs, white usually only in upper part (1/2–1/5 of total length, but sometimes all over), lower part slightly coloured, isabelline or very pale brown (M. 10 YR 8/2, 8/3, 7/3, 6/3), rarely distinctly brown (M. 7.5 YR 4/4), slightly darkening towards base; surface shining and at lower part sparsely covered with scattered longitudinally arranged white velar fibres; apex pruinose.

Flesh in centre of cap 0.5–1.5 mm thick, dark greyish brown (M. 10 YR 3/3, 4/2, 4/3, 4/4, 5/2), in upper part of stem white (often in apex with narrow reddish zone along attachment of gills) but pale brown lower down, browner or greyer brown in base of stem. Smell and taste indistinctive.

Spore print purplish black to black.

Pigmentation of gills under binocular lens: Trama of washed gills distinctly coloured but to a variable extent; in basal 1/4–1/3 of width of gills pale brown (M. 10 YR 6/3, 6/4, 7/4), in a very narrow zone along base of gills sometimes even browner (M. 10 YR 5/3 or slightly paler than M. 7.5 YR 5/6), in remaining part (and sometimes in entire gill) very pale brown and increasingly paler towards edge (M. 10 YR 7/4, 7/3), near the edge and sometimes even entire gill practically colourless (M. 10 YR 7/2 or 2.5 Y 7/2).

MICROSCOPIC CHARACTERS.— *Spores* ellipsoid-amygdaliform, in specimens with exclusively 4-spored basidia (11.7–)12.6–15.3(–15.8–17.1) × 6.3–8.1 μ (13.7 × 7.1 μ), in specimens with both 4- and 2-spored basidia 12.6–15.8 × 6.3–8.1 μ (14.1 × 7.3 μ), in specimens with exclusively 2-spored or 2- and 1-spored basidia (12.6–)14.4–17.1(–18) × (6.3–)6.8–8.1 μ (15.7 × 7.4 μ), in water dark to very dark reddish brown (M. 2.5 YR 2/4, 3/4, 3/6; 5 YR 3/3, 3/4) and opaque to subopaque, with large apical germ pore (1.8–2 μ, sometimes 2.5 μ wide), with comparatively small hilar appendix.

Basidia 4–, 2– or 1-spored, (17.5–)20–30(–35) × (10–)11–13(–15) μ.

Pleurocystidia moderately to fairly numerous, rarely scarce, size and shape variable, lageniform, with neck usually rather long and either subcylindrical (width 2–3 μ) or tapering towards acute apex, more or less sharply delimited from or broadening towards and gradually passing into ventricose cell-body, with apex rarely forked into two fingerlike protuberances, 35–65(–80) × 10–17.5(–20) μ; cell wall of normal thickness and colourless.

Marginal cells: Gill edge sterile and usually very densely packed with normally rather large, but sometimes small, spheropedunculate cells (12.5–)15–50 × 7.5–20 (–25) μ, mixed with lageniform cheilocystidia, (25–) 35–65(–70) × 7.5–17.5 μ, the latter usually being absent or very scarce near margin of cap, but conspicuously increasing in number towards stem and from about midway gill edge usually rather densely packed, the number of spheropedunculate cells simultaneously becoming smaller, to 50 % or less of total number of marginal cells, and their size also decreasing.

EXPLANATION OF FIGURES 1–11

Figs. 1–11. *Psathyrella prona* var. *prona*. — 1–3. Habit sketches (1: Haarzuilens, 31 Oct. 1969; 2: Rannoch, 31 Aug. 1965; 3: Boekelo, 29 July 1967). — 4–7. Elements from the Haarzuilens collection (4: basidia; 5: spores; 6: pleurocystidia; 7: marginal cells). — 8–11. Pleurocystidia (8: Nuenen, 6 Oct. 1962; 9: 's-Graveland, 8 April 1970; 10: Bôle, 12 July 1966; 11: Denekamp, 5 July 1963). (Habit sketches, x 1; spores, x 1212; all other elements, x 575.)

Pigmentation of hymenophoral trama under microscope in washed gills distinctly pale brown by membranal pigment but sometimes practically colourless near gill edge, increasingly brown towards base, where pigmentation normally moderately and rarely even fairly strong; yellow hyphal septa more or less abundant and small encrustations present (sometimes very scarce, on other specimens rather abundant).

Cuticle of cap cellular; cells 25–50 μ.

HABITAT.—In grass by roadsides, in parks, meadows, muddy cart-tracks in woods, sometimes on compost, also around and on dung in strongly manured meadows and rarely just on dung. Sometimes subcespitose. (April–)June–November. Fairly common.

COLLECTIONS EXAMINED.—4-spored form:—

NETHERLANDS: Denekamp, Estate "Singraven", 4 August 1962, E. K. v. W. (L); Boekelo, 29 July 1967, E. K. v. W. (L); Wageningen, Plant physiological Research Centre, 20 Nov. 1963, S. de Boer (L); Haarzuilens, Estate "De Haar", 31 Oct. 1969, E. K. v. W. (L); Vleuten (hothouses), 31 March 1972, J. Daams (L); Amsterdam, Amsterdamse Bos, 21 June 1961 and 12 August 1967, E. K. v. W. (L); Dorst, 25 April 1965, P. B. Jansen (Herb. Jansen); Nuenen, 5 Oct. 1962, E. K. v. W. (L).

SCOTLAND: Perthshire, grounds of Rannoch School, 31 August 1965, E. K. v. W. (L).

SWITZERLAND: Bôle, 28 June 1961 and 2 June 1965, H. S. C. Huijsman (L).

2-spored form:—

NETHERLANDS: Doetinchem, Estate "Bijvanck", 20 June 1953, H. S. C. Huijsman (L); Amsterdam, Amsterdamse Bos, 27 July 1960, E. K. v. W. (L).

SWITZERLAND: Bôle, 12 July 1966, H. S. C. Huijsman (L).

4- and 2-spored form:—

NETHERLANDS: Denekamp, Estate "Singraven", 5 July 1963, E. K. v. W. (L); 's-Graveland, Estate "Boekesteyn", 8 April 1970, J. Daams (L); Amsterdam, Amsterdamse Bos, 19 July 1962, E. K. v. W. (L).

2- and 1-spored form:—

NETHERLANDS: Leiden, 23 Sept. 1969, C. Bas 5140 (L).

SWITZERLAND: St. Cèrgue, 23 Sept. 1966, E. K. v. W. (L).

1. Observations on various characters of Psathyrella prona

A.—The colour of the gill edge.

Romagnesi made the colour of the gill edge the chief key character for separating the species of his *Atomatae*, having a white gill edge, from those of his *Pronae* in which the edge is red. In the species of *Psathyrella* which are supposed to possess a red gill edge, the red zone under the marginal cells, however, is quite often partly and sometimes even altogether missing. In our experience, this is particularly so in the *Atomatae* and *Pronae*, in which the colour of the gill edge is a very unreliable character.

In a previous paper (Kits van Waveren, 1971) we pointed out that in *P. gracilis* and *P. microrrhiza*, both species normally having a red gill edge, it is not at all un-

common that the gill edge is seemingly white and that only on close examination (washed gill under binocular lens or microscope) small stretches of a red zone are revealed, usually only in older specimens and only near the margin of the cap or near the stem. In both species it moreover does occur, be it rarely and more often in younger specimens, that even on such a close scrutiny the entire gill edge is white in all gills.

Apparently the same goes for *P. stellata* Romagnesi, as in the description of that species (Romagnesi, 1953: 359) the reader is warned that while in search for a red gill edge, he should "examiner au microscope un fragment d'arête de spécimens bien développés" as in this species the red gill edge "peut être tout à fait insensible macroscopiquement."

In the *Pronae* this situation turned out to be even more misleading. Out of our 20 collections of *P. prona*, five were described as having macroscopically a white gill edge (in another two the colour was not mentioned). As a result these collections had been taken for either *P. atomata* or *P. albidula*. Examination of a washed gill both under the binocular lens and microscope clearly revealed in four out of these five collections distinct stretches of a red zone under the marginal cells, be it that sometimes two to four fruitbodies had to be examined.

One out of these four collections (Nuenen, 5 Oct. 1962) consisted of three fruitbodies, which were macroscopically described very carefully immediately after they had been collected and taken for *P. atomata*, because of their beautifully white gill edge, their conspicuously grey caps, habitat in grass and flexuous stems. Later, examination of the washed gills of the dry herbarium material revealed a fairly faint but quite distinct red zone under the marginal cells along the entire length of the edge. Much to our disappointment, as it was the only collection of which we ever believed that it was the true *P. atomata*.

In December 1969 we were enabled to examine ten collections labelled *P. atomata* in the Kew Herbarium. Unfortunately except for one collection (one specimen collected in 1948), none of these collections was accompanied by descriptive notes. On close examination (binocular lens, microscope) the specimens of five of these ten collections showed stretches of a red zone under the marginal cells (four could be identified as *P. prona*, one as *P. gracilis*), two others were taken to be *P. prona* because of distinctly but not strongly pigmented hymenophoral trama, one collection (leg. Broome, 1869) had very pale and small spores and therefore could not possibly belong to the *Pronae*, and only two might have been identified as *P. atomata* if a macroscopic description had been available;

The uselessness of the red gill edge as distinctive character is finally clearly demonstrated by the cases of *P. picta* and *P. infida*. Romagnesi's original description of *P. picta* (1952: 151) and the one in the 'Flore analytique' (1953: 356) mention the presence of a red gill edge in that species. But Favre (1960: 550) in giving the only other description of *P. picta* (or rather, what he believed to be *P. picta*) available in the literature, calls the edge white, saying that he does not believe this to be sufficient reason not to identify his specimens as *P. picta!*

Romagnesi (1953: 356) ranks *P. infida* Quél. with the species of the *Pronae* (edge of gills red), but Quélet himself in all his publications (1877: 329; 1886: 120; 1888: 61) calls the edge white and so do Bigeard & Guillemin (1913: 281). As for *P. prona*, Quélet (1880: 52; 1888: 57) calls the gill edge "parfois rosée" or "souvent rose", therefore by no means always red.

Like in other species of *Psathyrella*, which normally have a red gill edge, in the *Pronae* the red zone under the marginal cells therefore can either be absent altogether or only be present along small stretches of the edge or be concealed by a thick spore deposit, which only leaves the marginal cells exposed and therefore the edge seemingly white.

In conclusion, we have very little faith in the taxonomic value of this character, which is unreliable and should therefore be used with great caution and preferably not at all in distinguishing species of the non-coprophilous group of section *Atomatae*.

B. The colour of the moist cap.

In the genus *Psathyrella* it is generally overlooked (especially in *P. gracilis*, which is always described as having a predominantly mud-grey cap) that the moist caps of primordia and early stages of many species are dark reddish brown (M. 5 YR 3/3, 3/4, 4/4). Very soon this colour changes into some shade of (dark) brown or greyish brown. For *P. prona* Fries (1836: 239; 1853: 450; 1874: 315) called it "fuligineus." In our experience (and the same goes for the trama of the gills) the amount of pigment causing these colours varies from one collection to another, and in one collection from one specimen to another, and with both age and weather conditions. In wet weather and on ageing the caps of *P. prona* loose some of their pigment, becoming paler brown, more greyish brown and finally grey. The drying caps become very pale brown, dirty greyish brown, alutaceous or dirty pale grey and sometimes even whitish.

On several occasions and particularly in the collections (30–40 specimens) from Haarzuilens, 31 October 1969, and Denekamp, 4 August 1962, we were able to observe both the dark reddish brown colours in young specimens and the very grey colours in old specimens, with the brown and greyish brown shades in intermediate stages. Dr. Bas in his collection 5140 described the colour of moist young specimens as "rather dark brown with chocolate tinge, older more sepia, M. 7.5 YR 3/2."

It is perhaps often overlooked that in *Psathyrella* the process of drying of the cap begins very soon (favoured by wind and drought). Often, when one collects mature specimens of *P. prona*, the caps seemingly are still moist, whereas in fact they have already begun to dry.

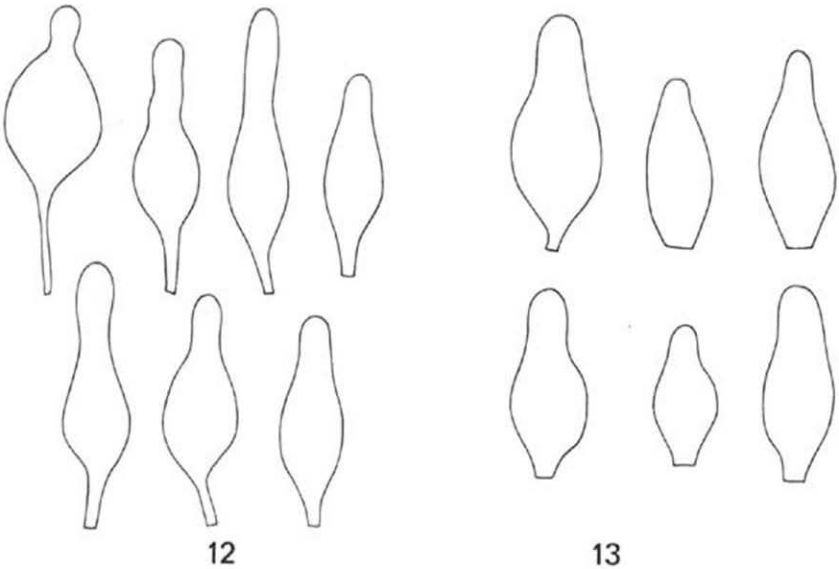
C. The appearance of pink in the colour of the drying cap.

What exactly causes the caps of *P. prona* and many other species of *Psathyrella* to acquire a—often very striking—pink colour in the process of drying, is unknown. It

must be some quality of the pigment (chiefly located in the hypodermis). The amount of pigment (largest in very young caps) present at any time must be an important factor. As a result of the following observations, we believe that the amount of moisture in the trama of the cap and above all the speed by which the caps dry, also are important factors.

Specimens from a large collection (Haarzuilens, 31 October 1969) which were made to dry quickly in the heater or on the radiator of the central heating system never showed the slightest trace of pink during their process of drying. Other specimens of the same collection, which were left lying on the table for some hours to dry very slowly, produced the most wonderful pink colours (up to M. 10 R 6/3). Again other specimens of the same collection and age were first put with the lower part of their stems in water for 24 hours, their caps resting on white paper in order to obtain a spore print. At the end the caps were very wet and the carpophores were then left to dry slowly on the table. These caps hardly showed a trace of pink during their process of drying.

On June 3rd 1972, Mr. Daams brought us a fresh collection of some 30 specimens collected only a few hours previously in a hothouse and kept by him in the moist atmosphere of a closed box. In spite of this careful precaution, the caps of most specimens already showed a beautiful pink discoloration. Only a few were still quite moist and as a result very brown (M. 7.5 YR 4/2, 3/2) without any trace of pink.



Figs. 12, 13. *Psathyrella prona* var. *utriformis*, pleurocystidia (12: Salernes, 28 Sept. 1960; 13: Amerongen, 19 Sept. 1965). (× 575.)

Others, seemingly moist also but apparently having already begun to dry, were of a peculiar dark reddish brown, vinaceous colour (M. 5 YR 4/3, 4/2). Still others, obviously involved in the process of drying, showed a variety of mainly pink colours (M. 5 YR 6/3, 6/2; 10 R 5/3, 5/2, even 6/3), usually being more brown on top and greyer near the margin. The specimens were all left to dry slowly on a table and then put in a heater. In this case the pink shade remained to a slight extent.

Ageing, drying out and remoistening of caps of carpophores of species of *Psathyrella* are bound to occur in the field also.

D. The ultimate colours of the cap in P. prona.

At any moment the ultimate colour of the caps of *P. prona*, as we have seen under B and C, therefore depends on the amount of pigment still present at that moment, the speed by which the process of drying took place up till that moment and the degree of dryness reached at that moment. Romagnesi made similar observations and conclusions. He states (1953: 356) that the cap in *P. prona* takes a "couleur crème-grisâtre blafarde (parfois mêlée de rose pâle au bord), ou blanchâtre-alutacé sale mais seulement si c'est un adulte qui sèche." He does not state what colour the younger stages take when they dry out. In our experience they remain browner and may develop dark vinaceous colours, which eventually may turn distinctly red.

From all this it should be clear that the caps of *P. prona* are bound to show such a multitude of colours that it seems very hazardous and therefore undesirable to attach any taxonomic importance to these colour variants, let alone to base new species on them. We thus do not believe in the taxonomic value of the differences in colour used by Romagnesi (1953: 356) in distinguishing the six non-coprophilous species of his *Atomatae* and *Pronae*. Of these six species, *P. atomata* stands more or less apart as the one and only species which has very little pigment, so that we will deal with the relation of this species to *P. prona* separately.

E. The colour of the gills.

Two factors are responsible for the colour of the gills, viz. the amount of pigment in the hymenophoral trama and the number and ripeness of the spores. The true colour of the trama, we feel, should therefore be examined and assessed in the absence of the spores and thus after their removal from the gill. This is done by the process of washing the gills, as fully described in a previous paper (Kits van Waveren, 1971: 249). Dry herbarium material and NH_4OH 10 % being used as medium, the pigmentation presents itself as brown under the binocular lens when viewed against a white background. Curiously enough the red zone under the marginal cells turns a distinctly olive, olive-brown to greenish colour. We always avoided as much as possible examination of either very young or very old specimens.

In very early stages of *P. prona* the fresh gills usually are distinctly brown in the

almost exclusively responsible for the colour of the gills, which is then dark grey to purplish black or black, with, however, usually still a trace of brown near the base. Not infrequently, however, mature gills are just grey or dark grey all over, having very little or hardly any pigment in the trama.

As was expected from our general experience in *Psathyrella*, the degree of pigmentation of the trama of washed gills turned out to vary rather considerably; the gills in some collections or some specimens of the same collection being distinctly but never strongly coloured (strongest at the base), in others practically colourless (M. 10 YR 7/3, 7/2; 2.5 Y 7/2). On microscopical examination the trama often appeared to be more pigmented than was expected from the preceding examination under the binocular lens. In *P. prona* all intermediate stages between distinctly pigmented and almost colourless trama were encountered.

F. The flexuous stem.

In 12 out of our 20 collections of *P. prona* the stem was called either slightly or usually very distinctly flexuous. In five the stem had been described as straight, suggesting that they must have been stiffer than in the specimens with flexuous stems. In four the shape was not mentioned. Fries in all his publications called the stem of *P. prona* "laxus"; in 'Monographia' (1857: 450) and 'Hymen. europ'. (1874: 315) he called it "flexuosus," but in the 'Icones' (1879: 39, pl. 139 Fig. 3) he depicted straight stems and in the accompanying description he said that the stems could either be flexuous or straight ("normaliter flexuosus sed variat strictus").

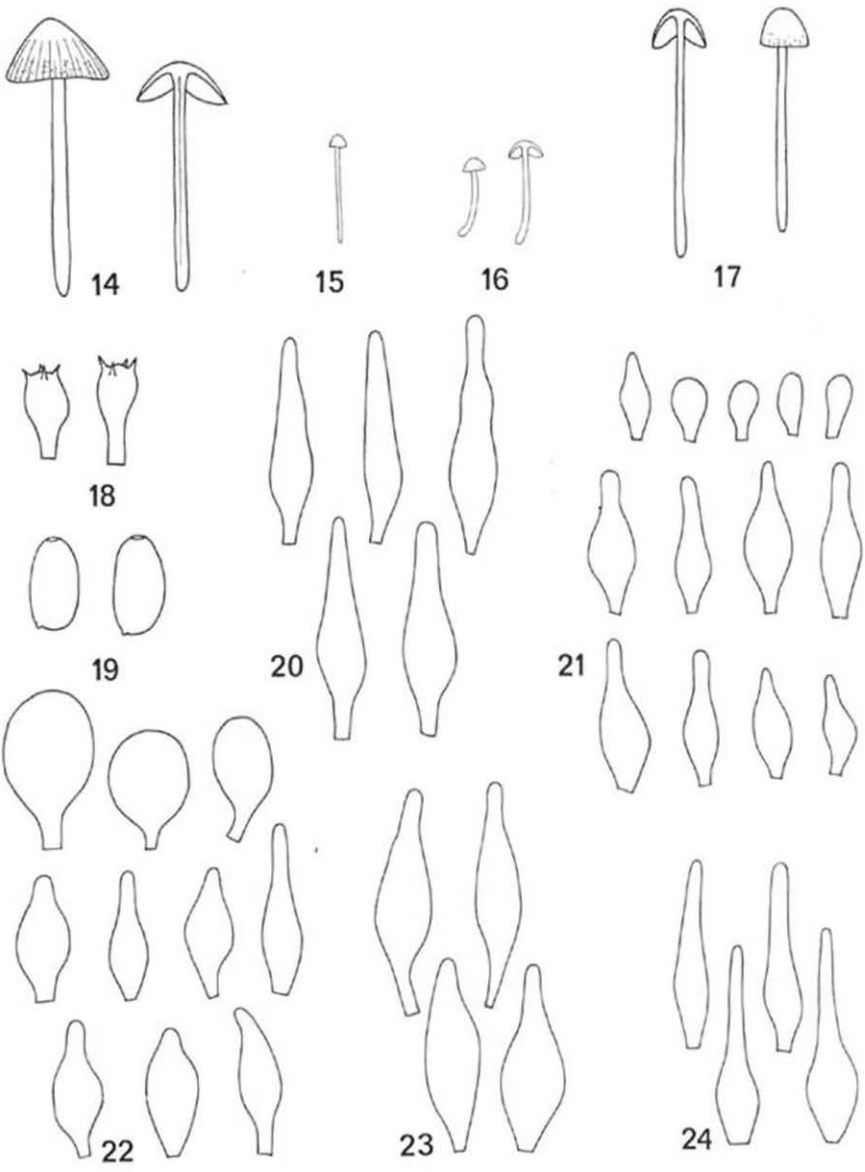
Romagnesi (1953: 356) does not mention a flexuous stem in any of the species of the *Pronae*, but the stem of *P. orbitarum* is called "recto" (1952: 152), also "raide" (1953: 356). Of *P. albidula* Romagnesi (1953: 356) states that the stem is "plus flexueux" than that of *P. atomata*.

From these data we think it sufficiently clear that the stem, being either more or less flexuous or straight, cannot play a part in the separation of species in section *Atomatae*, the variability obviously being too great.

G. Habitat.

It would seem from the 'Flore analytique' that the habitat of the non-coprophilous species of the *Pronae* and *Atomatae* is of some importance with regard to distinguishing the various species.

Psathyrella atomata is said to grow in "pelouses ou ornières herbeuses des chemins éclairés, en général isolé ou par deux"; *P. albidula* "sur les graminées fanées" and its var. *palustris* "dans les endroits boueux" (of both *P. atomata* and *P. albidula* it is also stated that they may occur "au plus sur paille pourrie"). *Psathyrella prona* is supposed to grow "surtout dans l'herbe des endroits ± ensoleillés"; *P. picta* in "humus des endroits ombragés," whereas *P. orbitarum* and *P. infida* are supposed to be "espèces caractéristiques des ornières boueuses des chemins ombragés." In a recent letter to



Figs. 14—24

basal part, but the intensity of this colour gradually but rapidly decreases towards the area of the edge, in which the colour is whitish to hardly brown or already slightly grey because of the presence of some spores. In later and final stages the spores are the Dutch mycologist Mr. Daams, Prof. Romagnesi stated having found *P. albidula* also in meadows.

We feel that there is no essential difference between the various habitats listed above. The list does not mention manured meadows or dung. As for *P. prona* Fries (1838: 239; 1874: 315), however, already stated that this species grows "in graminosis fimetosis" (exactly like the habitat of the gregariously growing fruit-bodies of our Scottish find of 31 August 1965). Later (1857: 450) Fries mentioned "locis graminosis pinguibus, juxta vias passim" and still later (1879: 39, description accompanying his plate 139 fig. 3) he mentioned "locis graminosis pinguibus ad viarum margines" (exactly like our gregariously growing find in Denekamp, 4 August 1962). Mr. Daams found the species on compost in hothouses, Dr. Huijsman in a recently manured garden, and Dr. Bas found some 40 specimens on wood chips in sandy clay in a park (some subcespitose). Finally we found two beautiful specimens on a large dungheap (29 July 1967) and two specimens attached to small pieces of burnt wood at a burnt place in a meadow in Switzerland (23 September 1966).

Therefore, although *P. prona* preferably grows in grass or muddy cart-tracks, it may sometimes be found growing in heavily manured fields or gardens and sometimes actually even on dung.

2. Psathyrella atomata versus P. prona

Fries described *P. atomata* in 'Syst. mycol.' (1821: 298) and *P. prona* together with *P. atomata* in 'Epicrisis' (1838: 239). In 'Monographia' (1857: 450) and 'Hymen. europ.' (1874: 315) he gave a description of both species and in the 'Icones' (1879: 39 pl. 139 fig. 3) he described and depicted *P. prona*. From these descriptions it is clear that the differences between the two species are mainly differences of degree. In *P. atomata*: cap "striatulo," stem "leviter flexuoso"; in *P. prona*: cap "striato," stem "flexuoso." Gills are called "subdistantes" in both species, but "subtriquetrae" or "subtriangulares" in *P. prona*, whereas for *P. atomata* no particular shape is mentioned.

The only real difference seems to be a difference in colour of cap, gills and gill edge. In 1821 the cap of *P. atomata* is called "albido roseo," in 1838 and 1874 "A gracilis instar e livido in albidum et roseum mutator" and in 1857 "livescens siccus

---

EXPLANATION OF FIGURES 14–24

Figs. 14–24. *Psathyrella coprobia*. — 14–17. Habit sketches (14: Braemar, 25 Aug. 1961; 15: Denekamp, 15 Oct. 1962; 16: Rannoch, 24 Aug. 1965; 17: Glenisla, 28 Aug. 1966). — 18–21. Elements from the Glenisla collection (18: basidia; 19: spores; 20: pleurocystidia; 21: marginal cells). — 22, 23. Elements from the Rannoch collection (22: marginal cells; 23: pleurocystidia). — 24. Pleurocystidia from the collection Hilversum, 27 Oct. 1970. (Habit sketches, × 1; spores, × 1212; all other elements, × 575).

alutaceo aut incarnato-pallescente," the comparison with *P. gracilis* and the word "livescens" indicating the presence of another—no doubt somewhat browner—colour at some earlier stage of development. In all descriptions the gills are called "cinereo-nigricantibus" and in 1838 and 1874 the gill edge is called "concolore l. albicante."

In *P. prona* the cap is called "livido-fuligineus" (1838) or "fuligineus" (1857, 1874, 1879), a pink colour never being mentioned! The gills of *P. prona* are always called "livido-fuligineus" and the gill-edge "obsolete roseolae" (1838, 1874). We therefore share Romagnesi's view (1953: 371) about Fries in this matter: "sans doute Fries n'a-t-il pas exactement limité les deux espèces," and think that the differences in colour of cap and gills mentioned by Fries are merely differences of degree. As we pointed out under 1A, we consider the colour of the gill edge totally unreliable.

Having reached this conclusion it would be only natural to combine the two species under the older name, *P. atomata*. However, whereas we are sufficiently informed about *P. prona*, particularly through the illustration in the 'Icones', we have very little definite knowledge of *P. atomata*. Indeed, the latter is mainly known in the sense as interpreted by Bresadola and Lange. This consideration has eventually led us to reject *Agaricus atomatus* of Fries as a nomen dubium and to choose *P. prona* instead as the name covering the assemblage of forms to be described presently. Romagnesi (1953: 371) had to make some decision with regard to the interpretation of *P. atomata* and adopted Bresadola's and Lange's interpretation of *P. atomata* and Ricken's interpretation of *P. prona*, quoting Lange's plate (1939: pl. 156 C) for *P. atomata* with an exclamation mark. Romagnesi (l.c.) gave the following characteristics of *P. atomata*: —

1. Cap "cendré sur le frais, puis blanc-gris-cendré ou blanc par le sec." Above, under 1B, we stressed the point that usually mature caps of *P. prona* are predominantly grey and that the cap can also dry to practically white, like Romagnesi himself said for *P. prona* ("blanchâtre-alutacé sale"). On the other hand the caps of *P. atomata* must have a touch of brown in their earlier stages, because they dry to "d'ocre-clair ou de fauvâtre," at the centre according to Romagnesi.

2. Dry cap "dépourvu de teintes rosées ou rougeâtres." But Fries and practically all other authors mention the appearance of pink in the drying cap. Even Bresadola (1931: pl. 889 fig. 1) and Lange (1939: 102) mention and clearly depict a pink colour in the drying cap.

3. Cap "jamais strié même lorsqu'il est humide." But Fries and practically all other authors consider the caps of *P. atomata* to be striate to some extent (in a membranaceous, hygrophanous species like this *Psathyrella* this is to be expected). Again, both Bresadola and Lange depict distinctly striate caps, although Lange in his description curiously enough calls the caps "never pellucido-striate."

4. Gills "gris-perle, gris-cendré, puis gris-noirâtre sans nuances brunes." But Lange's plate clearly depicts a brown shade in the gills, although in the text he calls them "pale to dark grey." If there is a difference in the colour of the gills between *P. atomata* and *P. prona* it must be caused by a difference in the amount of

pigment in the hymenophoral trama. Like we pointed out under 1E the pigmentation of this trama in *P. prona* may, in our experience, vary from fairly strong to almost nil. If indeed it is almost nil or nil, the gills are bound to be grey in the earlier, and purplish black or black in the later stages, "cinereo-nigricantibus" (Fries).

5. Gills subhorizontal (1953: 356 fig. 468 and in comparison with the gills of *P. albidula*; in *P. prona* "ventrues-ascendantes"). But it was *P. prona*, of which Fries calls the gills "subtriangulares" and one of the sketches we have of cross-sections of carpophores of *P. prona* and also one of a cross-section of a specimen of *P. prona* f. *picta* shows a practically horizontal gill edge. Moreover, both Lange and Bresadola depict distinctly ascending gills for *P. atomata*.

6. "Voile nul." But the veil in *P. prona* is very poorly developed, very evanescent and usually missing in mature specimens. It is never even mentioned in any of the descriptions of *P. prona* in literature!

7. Gill edge white. Under 1A we have demonstrated the unreliability of this character.

8. *P. atomata* is supposed to grow "en général isolé ou par deux," but out of our 20 collections of *P. prona* eight consisted of either one or two specimens.

In conclusion, we feel that there is sufficient reason to assume that what hitherto has been called *P. atomata* in the sense of Bresadola and Lange merely is a pigment-poor form of *P. prona*, which happens to have a white gill edge macroscopically and rarely also microscopically. We propose to describe this form as: —

PSATHYRELLA PRONA f. **cana** Kits van Wav., *f. nov.*

A *Psathyrella prona* var. *prona* differt pileo griseo lamellisque acie haud rubris.
TYPUS: Bresadola, Icon. mycol. **18**: pl. 889 fig. 1. 1931 ("*Psathyrella atomata* Fr.")

SELECTED DESCRIPTIONS AND ILLUSTRATIONS. — Bresadola (l.c.). — J. E. Lange, Fl. ag. dan. **4**: 102, pl. 156 C. 1939.

Differing from *P. prona* var. *prona* in the grey colour of the cap and in the gill edge which is not red.

COLLECTION EXAMINED. — FRANCE: Oct. 1939 (Herb. H. Romagnesi).

3. Drosophila picta, D. infida, Psathyrella orbitarum, and P. albidula versus P. prona

Romagnesi (1953: 356) made the colour of the cap one of the chief characters in distinguishing these five non-coprophilous species from one another. In the light of the very great variability of the colours of the cap of *P. prona* as outlined above under 1D these differences cannot be of any taxonomic importance. This may be best shown by quoting these colours of the five species one by one as given by Romagnesi.

P. prona: "brun-bistre-ocracé, prenant—mais seulement si c'est un adulte qui

sèche—une couleur crème-grisâtre blafarde (parfois mêlée de rose pâle au bord) ou blanchâtre-alutacé sale."

D. picta: "couleur particulièrement vive, d'abord d'un brun-fauvâtre obscur, mais chaud, puis brun-chocolat et conservant une nuance ocre, par le sec alutacé-ocracé terne, mais chaud, avec un léger reflet incarnat."

P. orbitarum: "brun-chocolat ou brun-bistre foncé par l'humidité, mais laissant deviner déjà dans cet état la teinte pourpre-vineux ou incarnat-vineux qu'il prend ± dès qu'il se met à sécher."

D. infida: "brun-bistre-ocracé intense, sombre mais beau, un peu teinté de fauvâtre en haut (rappelant un peu *picta*, mais cependant bien moins fauve), pâlissant remarquablement quand il sèche, en passant au crème-alutacé pâle et sale sur le bord, un peu jaunâtre sur le mamelon."

P. albidula: "d'abord brun-ocre terne ou brun-fauvâtre ± sale, mais se déshydratant vite et pâlissant en crème-blanchâtre ou alutacé clair avec le sommet crème ou brun-jaunâtre pâle."

What it comes to is that the caps of *Drosophila picta* and *D. infida* have more pigment than the cap of *P. prona* and so are very dark brown, and that in *Psathyrella orbitarum* the pink and reddish colours on drying come early and are rather intense. These differences with *P. prona* are obviously merely differences of degree. On more than one occasion we have been in great doubts whether we had found *D. picta* or *P. orbitarum*, or merely a colour variation of *P. prona*. We will now deal with each of these species separately.

A. Drosophila picta Romagn.

Apart from Romagnesi (1952: 151 and 1953: 356) only Favre (1960: 550) has ever given a description of this species (which he describes as having a white gill edge, a paler colour of the cap than mentioned by Romagnesi and no pink in the dry cap). It is mentioned neither by Moser, nor in the New British Check List. According to Romagnesi the stems of this species are darker than in any of the other species, but becoming paler in their upper part. In the Latin description the colour of the gills is called "brunneis" and in the 'Flore analytique' the hymenophoral trama is described as being "remarquablement colorée en brun-jaune vif." (We saw this for ourselves while studying the type specimen.) Obviously, therefore, cap, stem and trama of the gills are more strongly coloured than in *P. prona*, but in all other respects (shape and size of carpophores, spore size, size and shape of cystidia, occurrence of 4- and 2-spored basidia etc.) this species is identical with *P. prona*, reason why we propose to regard *D. picta* as a strongly pigmented form of *P. prona*.

We believe having found this form on 23 April 1961 near Amsterdam (some 50 specimens in grass) and at some distance from the same locality on 16 July 1966 (two specimens). In every respect they were identical with *P. prona*, but the young caps

were very dark reddish brown (M. 5 YR 2/2, 3/2, 3/4), and the older ones still very dark brown (M. 7.5 YR 3/2, 4/2, 4/4, also M. 10 YR 3/4, 4/3). Some of these colours, however, are already lying within the range of *P. prona*. On drying, the caps became pale greyish yellow to alutaceous with a very distinct touch of pink. The stems were either whitish or very pale brown at the apex and gradually darker towards the base (up to M. 10 YR 7/3, 6/3, sometimes even 5/3), a flesh colour occasionally mixing with the brown ("fauvâtre"). The gills in the mature specimens were distinctly browner than they usually are in *P. prona* (at the base M. 10 YR 4/4, in the basal part M. 10 YR 4/3, 4/2, and greyer towards the edge, M. 10 YR 5/2; 5 YR 5/2, 5/1).

At first we found in the collection of 23 April 1961 the trama of a washed gill only pale brown (M. 10 YR 7/3) under the binocular lens, but unexpectedly it turned out to be more strongly coloured under the microscope. Examination of another gill showed it to be browner (M. 10 YR 6/3) and again another gill showed a brown narrow zone at the base, the remainder being pale brown. Finally we examined a younger specimen and here the gill showed in its basal 1/3 the very same brown colour as the gills of the type specimen (slightly paler and more ocre than M. 7.5 YR 5/4). The colour was paler towards the edge and pale brown (M. 10 YR 7/3, 7/2) close to the edge. The very same pigmentation was next encountered in the specimens of 16 July 1966.

As a result of these observations we propose the name *P. prona* f. **picta** (Romagn.) Kits van Wav., *comb. nov.*, for this colour variant (basionym: *Drosophila picta* Romagn. *in* Bull. mens. Soc. linn. Lyon **21**: 151. 1952).

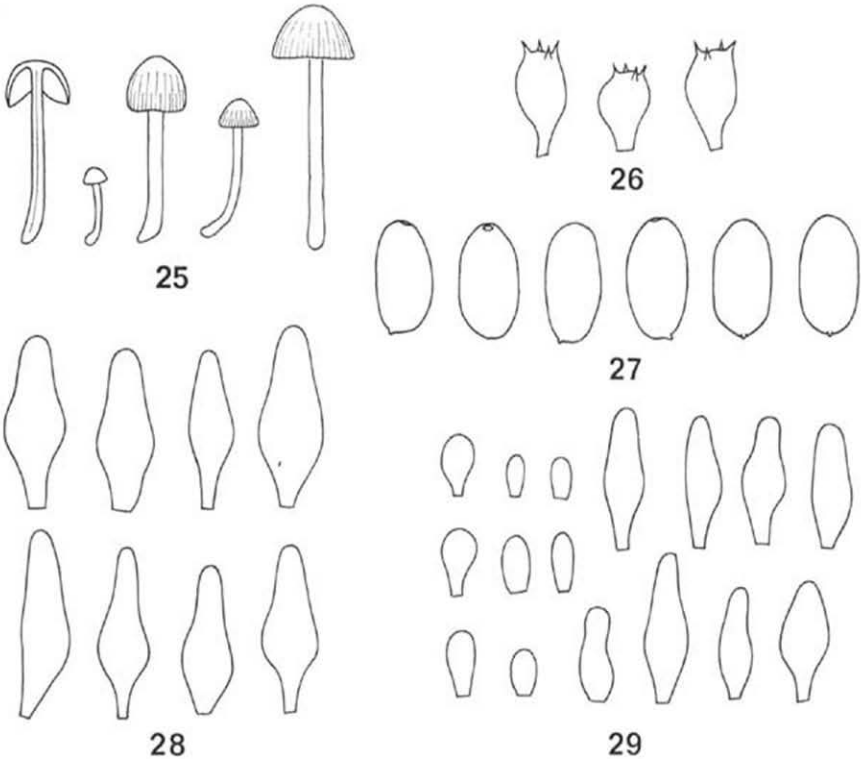
B. Drosophila infida Quél.

Apart from Konrad & Maublanc (1928: 77), who call this taxon a "forme voisine de *P. prona*" and list it with a number of "espèces peu connues, douteuses ou à exclure" and Bigeard & Guillemin (1913: 281), who call it *Hypholoma infidum* (Quél.), this species, described by Quélet (1877: 329) is only mentioned by Romagnesi (1937: 246 and 1953: 356) and Moser (1967: 215), the latter author obviously copying Romagnesi's description. The species seems most likely to represent young stages of *P. prona* as Quélet (1877: 329; 1888: 61) called the cap "villeux, floconneux" and also (1886: 120) merely "flocculoso" and as Romagnesi (1937: 246) described the cap as being "revêtu de petites soies blanches qui ne paraissent pas provenir du tout de la cortine." But later (1953: 367) Romagnesi neither mentioned these "soies," nor the presence of a veil. This species is also supposed to be very small (cap 6–10 mm, but in 1953: 5, 12–18 mm) and the cap is conical (like often in younger stages of *P. prona*). The gill edge, according to Quélet in all his descriptions, is white, which also supports the view that the species represents young stages of *P. prona*. Romagnesi, however, ranks the species in the *Pronae* (red gill edge).

Both Quélet and Romagnesi call the gills "espacées" and "triangulaires," the number of large gills according to Romagnesi being "parfois frappant, 16–19

grandes lames." But Dr. Huijsman (notes in herbarium) counted in one fresh collection of *P. prona* ± 20 large gills, in another ± 18 and in a third 13–17. Dr. Bas (notes in herbarium) called the gills in one fresh collection of *P. prona* "moderately distant" and in another "rather crowded." We counted the gills in three dry collections from our herbarium and found 14–15 in one collection, 14–14–18–13 in another and 15–16–16–14 in a third. Moreover Quélet (1880: 52) also called the gills of *P. prona* "espacées." In several other species of *Psathyrella* and particularly in *P. fulvescens* we have occasionally come across specimens which had strikingly distant gills, so that this character can hardly be of any importance in distinguishing the species of this group.

As for the gills being triangular (Quélet, Romagnesi), it was Fries (1838: 239; 1857: 450; 1874: 315) who called the gills of *P. prona* "subtriquetrae" or "sub-



Figs. 25–29. *Psathyrella coprophila*, Rannoch, 25 Aug. 1965. — 25. Habit sketches. — 26. Basidia. — 27. Spores. — 28. Pleurocystidia. — 29. Marginal cells. (Habit sketches, × 1; spores, × 1212; all other elements, × 575).

triangulares"; on rare occasions we found the gills of *P. prona* and *P. prona* f. *picta* to be subhorizontal.

All that remains as a possible difference between *Drosophila infida* and *P. prona* is the fact that according to Romagnesi the gills are "d'un brun tabac, à la fin très foncé" (according to Quélet they are "incarnat bistré, puis brun noir" or "carneo-fuscis" or "incarnat, puis baies"). The trama of a washed gill taken from a fragment of a cap of a specimen which Prof. Romagnesi sent us and which he had identified as *D. infida*, indeed was very brown (M. 7.5 YR 4/4), and towards the gill edge slightly paler. This being the one and only difference with *P. prona* to go by and for that matter only a difference of degree, we recommend to consider the name *D. infida* Quél. a synonym of *P. prona*. Quélet himself (1886: 120) once listed *D. infida* as a variety of *P. prona*.

C. Psathyrella orbitarum (Romagn.) Moser

From the original description (1952: 153) and from the description in the 'Flore analytique' (1953: 356) it is quite obvious to us that this species represents those forms of *P. prona* in which the pink discoloration of the drying cap is very strong and sets in very early, so that in combination with the brown pigment of the cap a dark wine-reddish colour originates. In the original description the gills are called "e brunneis cinereis" (the hymenophoral trama is called "subhyalina vel hyalina"), but in the 'Flore analytique' the gills of *P. prona* are said to be of practically the same colour, viz. "gris-lilacin, puis gris-brunâtre." In all other macroscopic and microscopic respects *P. orbitarum* and *P. prona* are also identical. The stem of *P. orbitarum* is called "raide" (1953: 356) and also "recto" (1952: 152), but the fact that, like we have seen, the stems in *P. prona* also often are straight, indicates that they can be "raide" too.

Romagnesi (1953: 356) refers for *P. orbitarum* only to plate 155 C of Lange (1939) and not to plate 155 C′ to which Romagnesi does not refer any of the species of the *Pronae*. Lange himself considers both plates to represent *P. prona* and it is interesting to notice that the specimen depicted by him on the right of plate 155 C is absolutely identical with the specimen depicted in the middle of plate 155 C′ (both specimens are conspicuously dark brown!). Also the cap of the specimen depicted on the left on plate 155 C is hardly more pink than the cap of the specimen depicted on the right of plate 155 C′. Dennis & *al.* (1960: 147) consider both plate 155 C and C′ to represent *P. orbitarum*.

Mr. J. Daams, while collecting four specimens of a *Psathyrella* on rich soil in a hothouse at Vleuten on 31 March 1972, noted the colour of the moist caps as being a beautiful wine-red, hence the identification as *P. orbitarum*. But on 22 April 1972 he collected on the very same spot young specimens of which he described the caps as "entirely brown, rather dark coffee-brown without any trace of red." Of the latter collection older specimens were brown-grey, only some of them showing a trace of pink. (Mr. Daams also noticed that the young specimens had a conspicuous red

gill edge, while in older specimens the red gill edge was present only in a few places.) Our explanation would be that the fruit-bodies of the two collections had been drying at a different speed owing to external conditions (see above under 1C). Valuable observations like these just show how erratic the matter of the pigmentation of the cap (and gill edge) and its pink discoloration on drying can be.

The hymenophoral trama (studied on a washed gill under a binocular lens) of a gill of a type specimen, received from Prof. Romagnesi, was practically colourless and hyaline, like the trama of several of our collections of *P. prona* in which the trama was almost colourless or very pale brown (M. 10 YR 7/3, 7/2).

In conclusion we think that *P. orbitarum* has to be looked upon as being conspecific with *P. prona* and not even worth separating as a taxonomic form.

D. Psathyrella albidula (Romagn.) Moser

Psathyra subatomata J. E. Lange (1936: 16; 1939: 102, pl. 153 C; 1940: VII) is not the same species (based on a different type) as *Psathyrella subatomata* Karsten (1885: 72), the latter species having a red gill edge and a stem with "basi curvatus, in radicem deorsum attenuatum" and therefore most likely to represent *P. gracilis*. Romagnesi (1952: 151) changed Lange's name into *Drosophila albidula* and later (1953: 356) gave his own description of this species, referring to Lange's plate 153 C. Moser (1967: 215) transferred the species to the genus *Psathyrella*. The species is supposed to have a white gill edge and a non-rooting stem.

Although Lange (1939: pl. 153 C) depicts this species with very slightly rooting stems, in the text (1939: 91) he puts this species in a group of "small not rooting species." Lange calls the colours of the cap "at first ochre clay" and—in small print—"like those of *P. prona* when dry." From his plate it is obvious that he must have dealt with specimens already in the process of drying. With Romagnesi the colour is "brun ocre terne ou brun-fauvâtre." Both descriptions therefore indicate that the drying cap must have turned pinkish.

Lange depicts straight stems whereas with Romagnesi the stems are "plus flexueux" (than those of *P. atomata*). With Lange the colour of the gills is "fuscous with a slight tinge of purplish" (for *P. prona* it even is "brownish fuscous"), with Romagnesi "± brunâtre, brun-tabac, brun noirâtre." In the light of the variability of the colour of the cap (see under 1D) and of the gills (see under 1E) and the stems being either straight or flexuous in *P. prona*, it is clear that with regard to these characters there are no real differences between on the one hand *P. prona* and on the other hand *P. subatomata* and *P. albidula*.

All other characters of *P. subatomata* and *P. albidula* also are identical with, or lie within the range of the normal variability of the characters of *P. prona*, except perhaps the somewhat browner gills and the white gill edge. But with Lange the gills in *P. prona* are even browner and—as we have seen—the edge of the gills in *P. prona* occasionally is white. We indeed found the hymenophoral trama of a type specimen of *P. albidula* distinctly coloured under the binocular lens (M. 10 YR 5/4, even

slightly darker at the base). Also microscopically the trama was distinctly pigmented. This puts the species in the same boat as *Drosophila picta* and *P. infida*, both species also having rather brown gills but then combined with a red gill edge. *Drosophila picta* we regard as a rather strongly pigmented form of *P. prona* (see above). In the same way we propose to regard *P. albidula* as yet another form of *P. prona*, in which both the cap and the hymenophoral trama are less coloured than in *P. prona* f. *picta*, and in which the colour of the gill edge moreover happens to be white; *Psathyrella prona* f. **albidula** (Romagn.) Kits van Wav., *comb. nov.* (basionym: *Drosophila albidula* Romagn. *in* Bull. mens. Soc. linn. Lyon **21**: 151. 1952).

We already argued that *P. atomata* should be regarded as a pigment-poor form of *P. prona* and it is interesting to notice that Lange considers his *P. subatomata* to stand even between *P. atomata* and *P. prona*. It just shows how very close these various forms are to one another and how justifiable it therefore is to unite them into one species, *P. prona*.

The futility of all these colour differences in species of the non-coprophilous group of the *Pronae* is once again demonstrated by our find of some 30 specimens in a heavily manured grass field in Scotland (Kinloch Rannoch, 31 August 1965), which at first we mistook for *P. albidula*. The caps were rather dark brown (M. 10 YR 5/3, 5/2), young gills were distinctly brown (M. 10 YR 5/6 near the base and M. 10 YR 6/4, 6/3 towards the edge), gills of older specimens were purplish grey with only a trace of brown near the base, and the edges of the gills looked white. Only on careful examination of a few gills of the herbarium material, distinct stretches of red gill edge were found.

Romagnesi (1952: 151) also described a *Drosophila albidula* var. *palustris*, which he called "très voisine" to *D. albidula* (1953: 356). This variety is characterized by "cystidiis primum obtuse fusiformibus, deinde saepe lageniformibus" (in the 'Flore analytique': "cystides avec le col souvent plus large et plus court" than in *P. albidula*), while it is supposed to grow in muddy places, to be darker and to have smaller spores (12–15.5 × 6.5–7.2 μ) than *P. albidula*, the latter species being supposed to grow on rotting grass and to have spores measuring 13–16 × 7–8 μ. In the discussion of the habitat (see under 1G) we already pointed out the variability of habitats of the species of the *Pronae* and we discussed also (see under 1D) the negligeable value of the differences in colour of the cap in these species. The difference in spore size between *P. albidula* and its var. *palustris* moreover showing considerable overlapping, we decided to consider this varietal name, which so far has only been mentioned by Romagnesi, a mere synonym of *P. prona* f. *albidula*.

4. PSATHYRELLA PRONA var. **utriformis** Kits van Wav., *var. nov.*—Figs. 12, 13

Psathyrella vinosofulva P. D. Orton *in* Trans. Br. mycol. Soc. **43**: 378. 1960.

A varietate typica differt pleurocystidiis utriformibus.

TYPUS: H. S. C. Huijsman, 28 Sept. 1960, France, Var, Salernes (L).

This variety differs from *P. prona* var. *prona* by the rather numerous and large

utriform pleurocystidia, 35–77.5 × 12.5–25 μ, of which the apex is very obtuse and broad (5–11 μ).

COLLECTIONS EXAMINED.—NETHERLANDS: Amerongen, near castle, 19 Sept. 1955, C. Bas 886 (L); Leiden, Estate "Nieuweroord", 19 Sept. 1960, R. A. Maas Geesteranus 13405 (L); Echt, 6 Oct. 1962, E. K. v. W. (L).

FRANCE: Dép. Ain, Simandre, 21 August 1957, H. S. C. Huijsman (L); Dép. Var, Salernes, 28 Sept. 1960, H. S. C. Huijsman (type, L).

OBSERVATIONS.—In four out of these five collections the hymenophoral trama was very pale brown, practically colourless, in the fifth it was slightly but distinctly brown. The specimens from the Echt collection had a white gill edge.

This variety, no doubt, is the same as *P. vinosofulva* P. D. Orton (1960: 378). For Orton the very conspicuous wine-reddish colour of the drying cap was a striking character; hence the name. This peculiar colour is the very same colour which made Romagnesi separate his *P. orbitarum* from *P. prona* and for all macroscopic characters *P. vinosofulva* seems identical with Romagnesi's *P. orbitarum*. As pointed out above, we regard *P. orbitarum* as being merely a colour variant of *P. prona*. The presence of a white gill edge and the utriform cystidia remain as the only difference between *P. vinosofulva* and this colour variant of *P. prona*. The gill edge in *P. prona*, however, is not infrequently white, as we pointed out above, and in one out of our five collections of *P. prona* var. *utriformis* it indeed was white also. The only remaining, but very striking difference therefore is the utriform shape of the cystidia. This is why we propose the name *P. prona* var. *utriformis* for this taxon.

5. **Psathyrella Romagnesii** Kits van Wav., *sp. nov.*—Figs. 34—40

Pileus 3–5 mm latus, semiglobatus vel semiglobato-paraboloideus, striatus, spadiceus dein cinereo-spadiceus, hygrophanus, siccus alutaceus haud rubescens, haud rugulosus, micaceus. Velum exiguum sed manifestum, e fibrillis parcis minutis ad pilei marginem vel paulo sursum constans. Lamellae 1 mm latae, 12–14 primariae, subdistantes, ventricosae ad pilei marginem, ascendentes, latissime adnatae in dentem brevem decurrentes, cinereo-spadiceae dein purpureo-ravidae, acie albae. Stipes 10–15 × 0.25–1 mm, aequalis, rectus, fistulosus, haud radicans, albus, basi bulbosus atque pilis minimis albis contectus, apice pruinosus. Caro in pileo tenuissima.

Sporae (10.4–)10.8–12.6 × 5.9–7.2 μ (11.2 × 6.3 μ), ellipsoideo-amygdaliformes, in aqua observatae obscure rubiginosae, poro germinativo magno (1.8 μ). Basidia 4-sporigera, 16–24 × 9.5–12 μ. Pleurocystidia dispersa ad modice numerosa, fusiformia, apices subcapitatae vel capitatae, 32.5–55 × 10–17.5 μ, hyalina, tenui-tunicata. Cellulae marginales: cheilocystidia 25–40 × 7.5–12 μ, pleurocystidia similia, hyalina, tenui-tunicata. Cellulae spheropedunculatae numerosae, 12.5–25 × 7.5–15 μ. Cuticula pilei cellularis e cellulis 10–30 μ formata. Trama lamellarum in partem basalem pallide brunnea, alibi hyalina. In quisquilias gramineas putridas.

TYPUS: The Netherlands, prov. Limburg, Bommerig, 3 Oct. 1964, E. Kits van Waveren (L).

MACROSCOPIC CHARACTERS.— *Cap* hemispherical to hemispherical-paraboloid, 3–5 mm in diam., striate, brown to greyish brown (M. 10 YR 4/3, 6/3, 6/2, not seen in probably darker and reddish brown earlier stages), hygrophanous, drying out to very pale alutaceous without pink, smooth, strongly micaceous.

Veil poorly developed but leaving distinct, scanty, very small fibres near margin of cap or even further up.

Gills 1 mm broad, subdistant, large ones numbering 12–14, rounded near margin of cap, ascending, very broadly adnate with small decurrent tooth, greyish brown to purple (M. 10 YR 5/2; 7.5 YR 5/2) with white edge.

Stem 10–15 × 0.25–1 mm, equal, straight, not rooting, at distinctly bulbous base covered with very small white hairs, pruinose at apex, hollow.

Flesh of cap very thin, colour not noted.

Spore print not obtained.

Pigmentation under binocular lens: Hymenophoral trama in basal 1/4–1/3 of gill distinctly brown (slightly paler than M. 10 YR 6/3), remainder of gill very pale brown (M. 10 YR 7/3, 7/2) and almost colourless near the edge.

MICROSCOPIC CHARACTERS.—*Spores* ellipsoid-amygdaliform, (10.4–)10.8–12.6 × 5.9–7.2 μ (11.2 × 6.3 μ), in water dark reddish brown (M. 2.5 YR 3/4, 3/6; 5 YR 3/4), opaque to subopaque with 1.8 μ wide pore and small hilar appendix.

Basidia 4-spored, 16–24 × 9.6–12 μ.

Pleurocystidia scattered to fairly numerous, fusiform, at apex subcapitate to capitate, 32.5–55 × 10–17.5 μ, with wall of normal thickness, colourless.

Marginal cells: Gill edge sterile with abundant spheropedunculate to clavate, fairly small cells, 12.5–25 × 7.5–15 μ, mixed with fairly densely packed, rather small, fusiform, subcapitate to capitate cheilocystidia, 25–40 × 7.5–12.5 μ, without crystals or mucoid deposits on marginal cells.

Pigmentation of hymenophoral trama under microscope in basal 1/3–2/3 part pale but distinctly brown with many yellow hyphal septa and few encrustations.

HABITAT.—On rotting grass or hay. Very rare.

COLLECTIONS EXAMINED.—NETHERLANDS: Heumen, farm "Boonenkamp", 12 Oct. 1964, E. K. v. W. (L); Bommerig, "Elzeter Bos", 3 Oct. 1964, E. K. v. W. (type: L).

OBSERVATIONS.—This species differs from *P. prona* and is characterized by its very small size, its small spores and its subcapitate to capitate cystidia. In the collections examined, the gill edge was white.

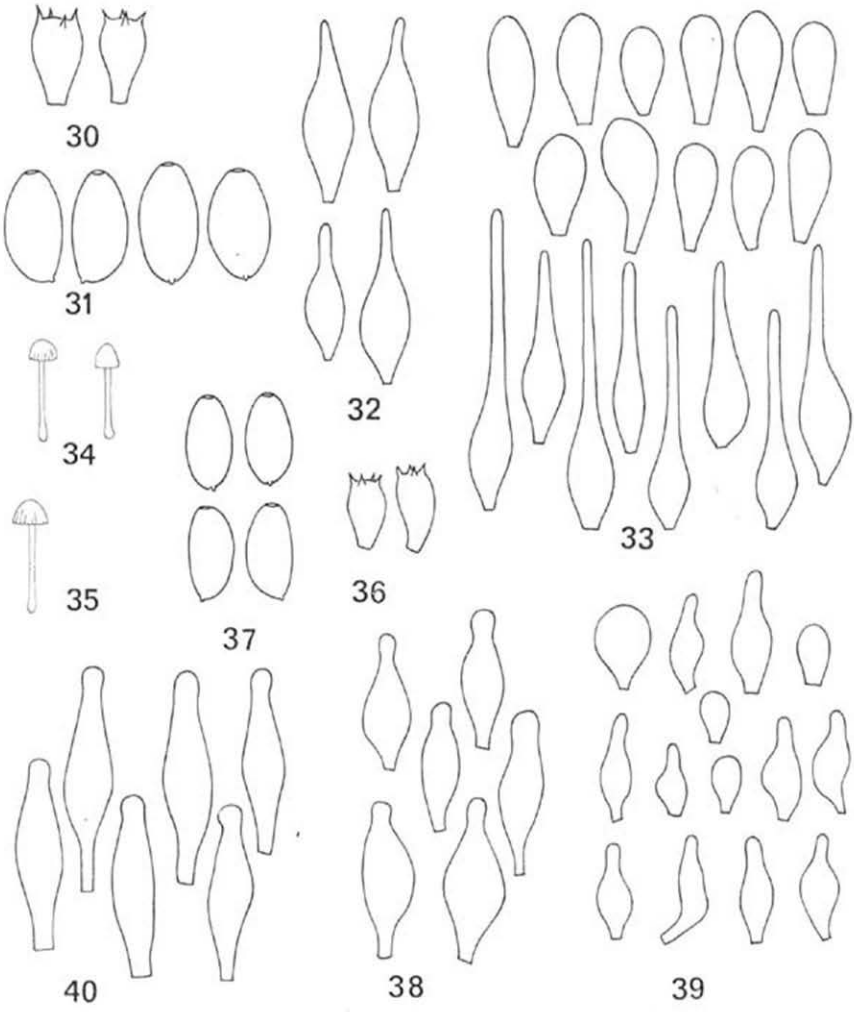
This is one of these remarkable instances in which a rare species is found twice within a very short time on two places lying many miles apart (in this particular case some 60 miles).

One might think that this is Romagnesi's *Drosophila albidula* var. *palustris* (see under 3D), but according to Romagnesi's Latin description that variety is a good deal larger (cap 5–10 mm, stem 18–35 mm long), it has larger spores (10–15 × 5.5–7.7 μ), and its cystidia are not capitate.

6. PSATHYRELLA COPROBIA (J. E. Lange) A. H. Smith—Figs. 14—24

Psathyra semivestita B. & Br. var. *coprobia* J. E. Lange *in* Dansk bot. Ark. **9** (1): 7. 1936. — *Psathyra coprobia* (J. E. Lange) J. E. Lange, Fl. ag. dan. **4**: 93. 1939. — *Psathyrella coprobia* (J. E. Lange) A. H. Smith *in* Contrib. Univ. Mich. Herb. **5**: 44. 1941. — *Drosophila coprobia* (J. E. Lange) Kühn. & Romagn., Fl. anal. 355. 1953.

MISAPPLIED: *Psathyra semivestita* (Berk. & Br.) Quél. sensu Kauffman, Agaric. Mich. 271. 1918.



Figs. 30–33. *Psathyrella stercoraria*, 's-Graveland, 8 April 1971. — 30. Basidia. — 31. Spores. — 32. Pleurocystidia. — 33. Marginal cells. (Spores, × 1212; all other elements, × 575).
Figs. 34–40. *Psathyrella Romagnesii*. — 34, 35. Habit sketches (34: Bommerig, 3 Oct. 1964; 35: Mook, 12 Oct. 1964). — 36–39. Elements from the Bommerig collection (36: basidia; 37: spores; 38: pleurocystidia; 39: marginal cells). — 40. Pleurocystidia om the Mook collection. (Habit sketches, × 1; spores, × 1212; all other elements, × 575.)

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—J. E. Lange, Fl. ag. dan. **4**: 93, pl. 152 F. 1939. — Kühn. & Romagn., Fl. anal. 355. 1953.

MACROSCOPIC CHARACTERS.—*Cap* hemispherical, paraboloid to slightly conico-paraboloid, 3–25 mm in diam., in early stages dark red-brown (M. 5 YR 3/4; 7.5 YR 3/2), very soon various shades of dark brown (M. 7.5 YR 4/2; 10 YR 3/3, 3/4) or just brown (M. 10 YR 5/3, 5/4), striate up to 1/2–3/4 from margin inwards; hygrophanous, drying out via yellowish brown (M. 10 YR 6/8, 6/6, 6/4) to pale brown, greyish brown or alutaceous (M. 10 YR 6/3, 6/2, 7/3), without pink, rarely slightly rugulose, sometimes micaceous.

Veil beginning as a thick woolly-fibrous coating, forming adpressed but sometimes also slightly reflexed bundles of fibres, sometimes even forming coarse fibrillose scales; its density increasing towards the margin of the cap; in older specimens still present as fibrous flocci and networks up to 1/3–2/3 from margin inwards.

Gills (1–)2–4 mm broad, ascending but sometimes subhorizontal, broadly adnate with or without a small decurrent tooth, distinctly brown (M. 10 YR 4/3, 5/4) at and near the base, greyish brown (M. 10 YR 4/2, 5/2) towards the edge and grey (M. 10 YR 6/1, 5/1, 4/1, 5 YR 4/1) at margin, with white edge.

Stem (15–)25–50 × (0.5–)1–2 mm, equal, straight, normally distinctly bulbous or with a gradually swelling extreme base, not rooting, whitish to very pale brown, hollow, pruinose at apex, covered with a fairly dense woolly-fibrous coating of veil.

Flesh of cap relatively thick, 0.75–1.5 mm, dark grey-brown (M. 10 YR 3/2, 3/3, 4/3), flesh of stem whitish but very pale brown alongside the cavity.

Spore print purplish black to black.

MICROSCOPIC CHARACTERS.—*Spores* ellipsoid-amygdaliform, 9.9–13.5 × (4.5–)5.9–7.2 μ (11.1 × 6 μ), in water very dark to dark reddish brown (M. 2.5 YR 3/4, 3/6, 2/4; 5 YR 3/3), subopaque, with 1.5–1.8 μ wide pore and small hilar appendix.

Basidia 4-spored, 16–27.5 × 9.6–12.5 μ.

Pleurocystidia fairly numerous, lageniform, with neck usually rather long and subcylindrical or tapering towards the subacute apex, sometimes either more or less sharply delimited from, but usually gradually broadening towards ventricose cell body, (20–)30–55(–60) × 10–17.5 μ.

Marginal cells: Gill edge sterile and normally densely packed with either fairly large or rather small spheropedunculate and clavate cells, 12.5–30(–40) × 7.5–25 μ, mixed with varying numbers (sometimes locally closely packed) of cheilocystidia of same shape as pleurocystidia, 25–45 × 7.5–15 μ.

Hymenophoral trama distinctly brown, increasingly so towards base of gill.

Cuticle of cap cellular; cells 25–50 μ.

HABITAT.—On (cow and) horse dung.

COLLECTIONS EXAMINED.—NETHERLANDS: Denekamp, Estate "Singraven", 15 Oct. 1962, E. K. v. W. (L); Hilversum, 27 Oct. 1970, J. Daams (L); Etten & Leur, "Haagsche Beemden", 6 June 1965, P. B. Jansen (Herb. Jansen); Nederweert-Asten, Groote Peel, 7 Nov. 1963 and 19 Oct. 1965, P. B. Jansen (Herb. Jansen).

SCOTLAND: Braemar, "Invercauld" Estate, 25 Aug. 1961, E. K. v. W. (L); Kinloch Rannoch, Perthshire, "Carmichael" Estate, 24 Aug. 1965 and "Dunalastair" Estate, 14 Sept. 1966, E. K. v. W. (L); Glenisla, "Brewlands" Estate, 28 Aug. 1966, B. Ivory (L); Edinburgh, 1967, culture received from M. Jurand; Glen Affric, Invernessshire, 17 Sept. 1968, E. K. v. W. (L); Tomich, Invernessshire, 17 Sept. 1968, E. K. v. W. (L).

7. PSATHYRELLA STERCORARIA (Kühn. & Joss.) Moser—Figs. 30—33

Drosophila stercoraria Kühn. & Joss. *apud* Kühn. & Romagn. *in* Bull. Soc. Nat. Oyonnax (Mém. hors sér. 2): 4, 57, 59. 1957. — *Psathyrella stercoraria* (Kühn. & Joss.) Moser *in* Gams, Kleine KryptogFl. 3. Aufl., 2 (b2): 215. 1967.

SELECTED DESCRIPTIONS AND ILLUSTRATIONS.—Kühn. & Joss. *in* Bull. Soc. Nat. Oyonnax (Mém. hors sér. 2): 4, 57, 59. 1957. — Kühn. & Romagn., Fl. anal. 356. 1953.

MACROSCOPIC CHARACTERS.—From field notes provided by Mr. Daams: Moist *cap* paraboloid, 8 mm in diam., dark brown, striate, hygrophanous, drying out to greyish pink (this colour is not mentioned by Kühn. & Joss.); *gills* grey with a red edge; *stem* 27 × 1 mm; whitish to yellowish white, hyaline, not rooting.

Abbreviated and compiled from descriptions published by Kühner and by Josserand: *Cap* campanulate, hemispherical or conical, 4–8 mm in diam., striate, dark reddish brown to dirty brown, hygrophanous, drying out to pale brown, alutaceous or coffee-colour, no pink appearing.

Veil arachnoid, evanescent, soon leaving only a few fibres and minute flocci near margin of cap and some fibres on stem.

Gills ascending, broadly adnate, dingy brown (Josserand: coffee-colour, then dirty grey), edge red.

Stem 15–25 × 1 mm (Josserand: 20–40 × 0.6 mm), equal, flexuous, pale brown, with base slightly bulbous, covered with small white hairs and not rooting.

Spore print blackish.

MICROSCOPIC CHARACTERS (examination of dried specimen, received from Mr. Daams).—*Spores* ellipsoid-amygdaliform, 11.7–12.6 × 6.3–7.2 μ (12.4 × 6.9 μ), in water dark reddish brown (M. 2.5 YR 3/4, 3/6), not opaque, with 1.8 μ wide pore and small hilar appendix.

Basidia 4-spored, 20–22.5 × 12–13 μ.

Pleurocystidia very scarce indeed, fusiform with neck thin, long, and either cylindrical, passing abruptly into ventricose cell body or gradually widening towards cell body, 32.5–45 × 10–14 μ, colourless.

Marginal cells: Gill edge sterile with a vast majority of spheropedunculate and clavate cells, 22.5–32.5 × 10–13 μ, mixed with a fair number, either scattered or in small or somewhat larger groups, of cheilocystidia, most of them with remarkably long, thin (2.5–4 μ), cylindrical necks, 45–75 × 10–12.5 μ, colourless.

Hymenophoral trama under binocular lens and microscope distinctly brown in basal 1/4, paler towards edge.

Cuticle of cap cellular; cells 15–45 μ.

HABITAT.—On dung.

COLLECTION EXAMINED.—NETHERLANDS: 's-Graveland (hothouse), 8 April 1971, J. Daams (L).

OBSERVATIONS.—According to Romagnesi (1953: 356) this is a rare fungus. We know of only two full descriptions of it, viz. those by Kühner and by Josserand (1957: 57, 59). Short descriptions were given by Moser (1967: 215), who transferred the species to *Psathyrella*, and by Romagnesi in the 'Flore analytique'. We have only seen dry specimens, found and dried by Mr. Daams.

This species is characterized by its exclusive occurrence on dung, by its small size, red gill edge, great scarcity of pleurocystidia, and the long thin necks of its cheilocystidia. The veil is far less developed than in *P. coprobia*, which species moreover has never been found with red gill edges.

Kühner in his description does not mention the pleurocystidia at all, while Josserand calls them "rares." Mr. Daams had been unable to find any and we only found four on an entire gill. Characteristic are also the very thin necks of the cheilocystidia (Kühner: "bec saillant plus grêle, 2.5–3.5 μ", and Josserand: "bec assez grêle, 2.5 μ"), which we found to be much longer than in any of the species of the *Atomatae*. Curiously enough here the cheilocystidia are much longer than the pleurocystidia, whereas normally it is the other way round.

8. PSATHYRELLA COPROPHILA Watling—Figs. 25—29

Psathyrella coprophila Watling *apud* Watling & Jurand *in* Notes R. bot. Gdn Edinb. **31**: 146. 1971.

Psathyrella fimetaria Watling *apud* Watling & Jurand *in* Notes R. bot. Gdn Edinb. **31**: 143. 1971.

MACROSCOPIC CHARACTERS (description based on our find of 25 August 1965).—*Cap* both in early and later stages predominantly hemispherical to paraboloid, sometimes slightly conical-paraboloid, 4–11 mm in diam., 2–8 mm high, in later stages striate up to 2/3 from margin inward, shining when moist, not viscid, in the early stages strikingly dark red-brown (M. 5 YR 3/4; 7.5 YR 3/2) and dark brown (M. 7.5 YR 4/2, 4/6) only near margin; later dark reddish brown only at centre (M. 7.5 YR 4/2), the remainder brown (M. 10 YR 3/3, 4/3); hygrophanous, drying out to pale brown (M. 10 YR 7/4, 6/4) without pink, smooth, not micaceous.

Veil on cap rather poorly developed but distinctly present, in very early stages reaching up to half-way from margin inward as isolated minute fibres or bundles of fibres and fairly copious at margin itself, soon disappearing and in mature specimens leaving only isolated fibres at margin.

Gills 2 mm broad, large ones numbering 16–20, rounded near margin of cap, further distinctly ascending, broadly adnate, in early stages distinctly brown (M. 10 YR 5/4) in very narrow zone at base, towards edge first greyish brown (M. 10 YR 5/2, 6/2) and near edge pale grey (M. 10 YR 6/1), later dark grey (M. 10 YR 5/1, 4/1) with narrow zone of brown (M. 10 YR 5/4, 5/3) at base; edge white, minutely flocculose.

Stem 15–25 × 1–2 mm, equal but at base gradually swelling up to 3–4 mm, not bulbous, not rooting, straight, white but extreme base isabelline or pale greyish brown, at surface covered with sparse and scattered small velar fibres, pruinose at apex, hollow.

Flesh of cap in centre 1 mm thick, dark red-brown (M. 5 YR 3/3; 7.5 YR 3/2 but in slightly less moist condition very soon dark brown, M. 10 YR 3/3, 4/3) also in apex of stem alongside its cavity; flesh of stem white but pale brown in very narrow zone alongside cavity. Smell and taste indistinctive.

Spore print purplish black.

Pigmentation of gills under binocular lens very pale brown (M. 10 YR 7/2, 7/3) but in very narrow zone along base more or less suddenly becoming distinctly ochre-brown (± M. 7.5 YR 5/4 but paler).

MICROSCOPIC CHARACTERS (description based on our find of 25 August 1965 and on three collections, one of them being the type material, received from Miss M. Jurand). — *Spores* ellipsoid-amygdaliform, in face-view often very slightly (hardly noticeable) elongate-hexagonal (best seen in the upper 1/3), 11.7–13.5 × (6.3–) 6.8–7.2(–8.1) μ (11.9 × 6.7 μ), in water very dark reddish brown (M. 2.5 YR 2/4, 3/4), opaque to subopaque, germ-pore distinctly eccentric on the abaxial face and rather small (1–1.5 μ).

Basidia 4-spored, 22.5–27.5 × 12–13 μ.

Pleurocystidia scattered to fairly numerous, sublageniform, subfusiform or subutriform, 30–47.5 × 10–17.5 μ, with wall of normal thickness, colourless.

Marginal cells: Gill edge sterile, usually densely packed (90–95 % of total number of cells, but locally sometimes very much less, and there crowded cheilocystidia dominating the picture) with small spheropedunculate cells, 12.5–22.5 × 6–10 μ, mixed with scattered, but sometimes locally rather densely packed, fairly small, sublageniform, subfusiform or subutriform cheilocystidia, 25–45 × 7.5–17.5 μ, without crystals or mucoid deposits.

Pigmentation of hymenophoral trama under microscope almost colourless to very pale brown in peripheral half, pale brown by membranal pigment in basal half, and distinctly brown with many yellow hyphal septa and small encrustations at base.

Cuticle of cap cellular; cells 25–50 μ.

HABITAT.—On horse dung.

COLLECTIONS EXAMINED.—SCOTLAND: Kinloch Rannoch, Estate "Carmichael", 25 August 1965, E. K. v. W. (L); specimens from cultures No. 1 (obtained from collection Blackford Glen near Edinburgh, 1966), and No. 51 (Perthshire, 1968) received from Miss Jurand.

SWEDEN: Specimens from culture No. 128 (collection of 1971) received from Miss M. Jurand.

9. Psathyrella coprophila versus P. fimetaria

Simultaneously with *P. coprophila* Watling (1971: 143) has described yet another coprophilous *Psathyrella*, also with subutriform cystidia, viz. *P. fimetaria*. Dr. Watling and we had a very lively correspondence about this species after we had carefully studied his descriptions of both species, our own find of *P. coprophila* of 25 August 1965, and the type material of both *P. coprophila* and *P. fimetaria*, which was kindly sent on loan. This because we came to the conclusion that, judging by purely morphological criteria, *P. coprophila* and *P. fimetaria* are to be considered conspecific.

According to Watling (1971: 149) *P. coprophila* "is separable morphologically from *P. fimetaria* in size, spore-shape and sparsity of pleurocystidia."

As for the size, Watling (1971: 149) states that "*P. fimetaria* is normally more of a robust species." In the actual descriptions of both species, however, it is just the other way round—*P. fimetaria*: cap 5–12 mm (up to 14 mm high), stem 40–50 × 2–3 mm versus *P. coprophila*: cap 5–18 mm (18 mm high) and stem 50–60 × 2–3.5 mm—and it is stated that in culture "the fruit-bodies of *P. coprophila* are more variable than those found in nature, the largest sized fruit-bodies resemble the size of *P. fimetaria*."

Like in all species of *Psathyrella* the size of the carpophores varies considerably, and Watling agreed that "fruitbody size probably is less significant" (in litt.).

As for the spore-shape, we very carefully compared the various characters of the spores of the type material of *P. coprophila* and *P. fimetaria* and we found them identical in every way. At our request Dr. Bas compared the spores of both type collections and observed that in both many spores are very slightly hexagonal in face view (hardly visible, best seen in the upper part of the spore). This must be what Watling means when he calls the spores of *P. coprophila* "slightly angled about apiculus and germ-pore." The very slight difference in colour of the spores between the two species was found to lie within the normal range of variability in spores of the species of section *Atomatae*.

The number of pleurocystidia is described as being smaller in *P. coprophila* (in the actual description they are even called "absent or very rare"; unfortunately there is an error in Watling's key, in which it is stated that in *P. fimetaria* pleurocystidia are scarce and in *P. coprophila* present). In our collection of 25 August 1965 we found these cells to be fairly numerous and it was quite easy to produce a full pleurocystidiogram. In the three collections received from Miss Jurand they were less numerous (we were able to draw 16, 13 and 7 pleurocystidia respectively). From the type specimen of *P. fimetaria* a full pleurocystidiogram was easily obtained and it did look as if here these cells were somewhat more numerous than in *P. coprophila*, but the number of these observations is far too small to be reliable, especially so as the difference is merely a matter of degree while there is also considerable overlapping. Consequently, we consider this character unsuitable for distinguishing the two species.

In Watling's key to the coprophilous species, *P. coprophila* and *P. fimetaria* are said to differ in spore size, the spores of the former measuring 12–13(–14) × 5.5–6.5 × 6–7 μ and of the latter 13.5–14.5(–15) × 6.5–7.5(–8) μ. The number of observations again is very small and besides we found for *P. coprophila* the mean value to be 11.9 × 6.7 μ and for *P. fimetaria* 12.5 × 7 μ. Again we consider this difference to be too slight for differentiating the two species.

Later Watling (in litt.) mentioned some other possible differences between the two species, two of which, we felt, perhaps being of greater importance than those mentioned in his key and text, because they were not differences of degree. In *P. fimetaria* the germ-pore was suggested not to be eccentric and the hymenophoral trama was suggested to be brownish as opposed to eccentric germ-pore and colourless hyaline trama in *P. coprophila*. However, we found the germ-pore in the type material of *P. fimetaria* also to be eccentric (confirmed by Dr. Bas). We also compared the pigmentation of the trama in both species by putting on one slide a gill from each species, by washing these gills, and subsequently comparing their colour under binocular lens and microscope. We found the pigmentation for both species to be exactly the same.

All other morphological differences mentioned by Watling turned out to be differences of degree.

In the key the colour of the cap is supposed to be chestnut honey or tawny in *P. coprophila*, bay brown or chestnut brown in *P. fimetaria*, but in the text the description of the colours in *P. coprophila* reads "commencing bay, chestnut honey or tawny flushed" and in *P. fimetaria* "very rich chestnut-brown or bay-brown at first, becoming flushed sepia."

The veil is supposed to be more developed in *P. fimetaria*. But the description for *P. coprophila* reads "margin with numerous small indistinct fibrils of veil extending as faint groups of hyphae to 1/2 way, but remnants soon disappearing" (this means the presence of a distinct veil) and for *P. fimetaria* "veil copious at margin of pileus when very young and on stipe, soon becoming lost or adpressed when on stipe." Again, this is a difference of degree if a difference at all.

The white edge of the gills is supposed to be more distinct in *P. coprophila* and Watling (in litt.) asked us whether this might be due to a different development of the vesiculose marginal cells (in the species of section *Atomatae* these cells far outnumber the cheilocystidia and can be either large or small). We found the spheropedunculate cells to be small in both species.

Clamp connections are called "present, numerous on cortical cells of stipe" in *P. coprophila*, and "infrequent, only seen in cells of stipe" in *P. fimetaria*; this again is a difference of degree, difficult to evaluate.

Pileocystidia are called "few" in *P. coprophila*, and "absent" in *P. fimetaria*, but this is hardly a character to go by, particularly since we know that both in *Conocybe* and *Galerina* some species occasionally have a few pileocystidia, although normally they do not possess them.

It is interesting to notice that for both species shape and size of the pleuro- and cheilocystidia were found to be the same.

As for the cultural differences noticed by Miss Jurand, we feel that these observations are still in an experimental stage (Miss Jurand was unable to obtain carpophores of *P. fimetaria* in culture) and that at the present moment we shall just have to go by morphological criteria only in distinguishing the species of section *Atomatae*.

In conclusion we believe *P. coprophila* and *P. fimetaria* to be conspecific, and have chosen the first name for this species, as *P. fimetaria* has been described with a central germ-pore.

KEY TO THE SPECIES OF PSATHYRELLA SECT. ATOMATAE

1. Non-coprophilous species.
   2. Cap 6–20 mm in diam., stem 18–65 mm long, spores 12.6–17.1 × 6.3–8.1 μ, pleurocystidia lageniform or utriform.
      3. Pleurocystidia lageniform . . . . . *P. prona* var. *prona*
      4. Gill edge white.
         5. Cap and gills grey . . . . . f. **cana**
         5. Cap and gills brownish . . . . . f. *albidula*
      4. Gill edge red.
         6. Mature cap brown to greyish brown, gills grey to purplish grey f. *prona*

6. Mature cap dark brown, gills brown . . . . . f. *picta*
3. Pleurocystidia utriform . . . . . var. *utriformis*
2. Cap 3–5 mm in diam., stem 10–15 mm long, spores 10.8–12.6 × 5.9–7.2 μ, pleurocystidia capitate . . . . . *P. Romagnesii*
1. Coprophilous species.
7. Germ-pore central, cystidia lageniform.
8. Veil strongly developed, gill edge white . . . . . *P. coprobia*
8. Veil poorly developed, gill edge red . . . . . *P. stercoraria*
7. Germ-pore eccentric, cystidia subutriform to utriform. . . . . *P. coprophila*

REFERENCES

BIGEARD, R. & H. GUILLEMIN (1913). Flore des champignons supérieurs de France. Complément ou tome II. Chalon-sur-Saône.

BRESADOLA, G. (1931). Iconographia mycologica **18**: pl. 889 fig. 1 and pl. 890. Mediolani.

DENNIS, R. W. G., P. D. ORTON & F. B. HORA (1960). New check list of British agarics and boleti. *In* Trans. Br. mycol. Soc., Suppl.

FAVRE, J. (1960). Catalogue descriptif des champignons supérieurs de la zone subalpine de Parc national suisse. *In* Ergebn. wiss. Unters. schweiz. NatParks **6** (Neue Folge): 42.

FRIES, E. (1821). Systema mycologicum **1**. Lundae.

—— (1838). Epicrisis Systematis mycologici. Upsaliae.

—— (1857). Monographia Hymenomycetum Sueciae **1**. Upsaliae.

—— (1874). Hymenomycetes europaei. Upsaliae.

—— (1879). Icones selectae Hymenomycetum nondum delineatorum **2** (3). Holmiae et Upsaliae.

KARSTEN, P. A. (1885). Fragmenta mycologica XX. *In* Hedwigia **24**: 72–74.

KITS VAN WAVEREN, E. (1968). The 'stercorarius group' of the genus *Coprinus*. *In* Persoonia **5**: 131–176.

—— (1971). Notes on the genus *Psathyrella*-I. *Psathyrella gracilis* and *P. microrrhiza*. *In* Persoonia **6**: 249–280.

KONRAD, P. & A. MAUBLANC (1928). Icones selectae Fungorum **6** (Fasc. 4): 73–112. Paris.

KÜHNER, R. & M. JOSSERAND (1957) apud R. Kühner & H. Romagnesi. Compléments à la Flore analytique 7. Espèces nouvelles, critiques ou rares de Naucoriacées, Coprinacées et Lépiotacées. *In* Bull. Soc. Nat. Oyonnax (Mém. hors sér. 2): 4, 57, 59.

KÜHNER, R. & H. Romagnesi (1953). Flore analytique des champignons supérieurs. Paris.

LANGE, J. E. (1936). Studies in the agarics of Denmark. Part XI. *Psathyra*, *Panaeolus*, *Psilocybe*, *Gomphidius*, *Phylloporus*, *Cantharellus*, *Schizophyllum*. *In* Dansk bot. Ark. **9** (1): 1–32.

—— (1939). Flora agaricina danica **4**. Copenhagen.

—— (1940). Idem **5**.

MOSER, M. (1967). Die Röhrlinge und Blätterpilze. 3. Aufl. *In* H. Gams, Kl. KryptogFl. **2** (b2). Stuttgart.

Munsell Color Company (1954). Munsell soil color charts. Baltimore.

ORTON, P. D. (1960). New check list of British agarics and boleti. Part III. Notes on genera and species in the list. *In* Trans. Br. mycol. Soc. **43**: 159–439.

QUÉLET, L. (1877). De quelques nouvelles espèces de champignons du Jura et des Vosges. *In* Bull. Soc. bot. France **23**: 324–332. "1876".

—— (1880). Diagnoses nouvelles de quelques espèces critiques de champignons. Première Partie. *In* Bull. Soc. bot. France **26**: 45–54. "1879".

—— (1886). Enchiridion Fungorum. Lutetiae.

—— (1888). Flore mycologique de la France. Paris.

ROMAGNESI, H. (1937). Florule mycologique des Bois de la Grange et de l'Etoile (Seine-et-Oise). Basidiomycètes (Suite). *In* Revue mycol. **2**: 243–256.
—— (1944). Classification du genre *Drosophila* Quélet. *In* Bull. mens. Soc. linn. Lyon **13**: 15–54.
—— (1952). Species et formae novae ex genere *Drosophila* Quélet. *In* Bull. mens. Soc. linn. Lyon **21**: 151–156.
—— (1953). See Kühner & Romagnesi (1953).
SINGER, R. (1962). The Agaricales in modern taxonomy, 2nd Ed. Weinheim.
WATLING, R. (1971). See Watling & Jurand (1971).
WATLING, R. & M. JURAND (1971). Two new coprophilous species of *Psathyrella*. *In* Notes R. bot. Gdn Edinb. **31** (1): 143–153.

PERSOONIA
Published by the Rijksherbarium, Leiden
Volume 7, Part 1, pp. 55–118 (1972)

SPECIES OF GANODERMA AND RELATED GENERA MAINLY OF THE BOGOR AND LEIDEN HERBARIA

R. L. STEYAERT

Jardin Botanique National de Belgique, Bruxelles

(With nine Text-figures and Plates 1–15)

This contribution to the knowledge of the Aphyllophorales is dedicated to Dr. M. A. Donk as a tribute to his life-long endeavour to put the systematics and the taxonomy of this challenging order on a sound basis.

A collection of South Asian specimens of *Ganoderma* and various other collections have been studied taxonomically as to spore, pore and anatomical cutis characters by using a technique devised by the author (Steyaert, *1946*: 137; *1947*: 47); it allows microtome sections of botanical material to be mounted immediately in Canada balsam.

Three genera and 15 of the 39 species studied are described as new. All species are from Indonesia except when indicated otherwise; they are *Humphreya*, *Haddowia*, *Magoderna*, and *Ganoderma kosteri* (The Netherlands), *G. vanheurnii*, *G. manoutchehrii* (Iran), *G. dejongii*, *G. donkii*, *G. puglisii* (Italy), *G. bruggemanii*, *G. trulla*, *G. trulliforme*, *G. lamaoense* (Philippines), *G. leytense* (Philippines), *G. ahmadii* (West Pakistan), *Humphreya endertii*, *Haddowia aëtii*, *Magoderna vansteenisii* (Indonesia and Australia). Eight new combinations are proposed, viz. *G. petchii* (Lloyd), *G. weberianum* (Bres. & Henn.), *Humphreya lloydii* (Pat. & Har.), *H. coffeatum* (Berk.), *Amauroderma preussii* (P. Henn.) (syn. *Ganoderma sikorae* Bres., *G. rubeolum* Bres.) (predominantly African), *Haddowia longipes* (Lév.), *Magoderna infundibuliforme* (Wakef.), *M. subresinosum* (Murrill).

The names of two important species, to wit *G. pseudoferreum* (Wakef.) Over. & Steinm. and *G. rivulosum* Pat. & Har. become synonyms of previously published names, whose correct combinations are *G. philippii* (Bres. & Henn.) Bres., and *G. weberianum* (Bres. & Henn.) *nov. comb.*, respectively.

Ganoderma lucidum (Curt. ex Fr.) Karst. and *G. resinaceum* Boud. are redefined especially on spore characters previously unreported and which prove infallible in distinguishing the two species. *Ganoderma chaffangeonii* Pat., *G. sessile* Murrill, *G. polychromum* (Copel.) Murrill, *G. praelongum* Murrill, *G. argillaceum* Murrill, and *G. subperforatum* Atk. are placed in the synonymy of *G. resinaceum* on the basis of their spore features.

The genus *Amauroderma* as currently understood is critically examined. Three new genera (*Humphreya*, *Haddowia*, *Magoderna*) are set up for a mixture of *Amauroderma* and *Ganoderma* species.

Additional details and distributional information are given for the previously published species that received new combinations (mentioned above) as well as for the following species: *Ganoderma applanatum* (Pers. ex S. F. Gray) Karst., *G. tornatum* (Pers.) Bres., *G. brownii* (Murrill) Gilbertson, *G. adspersum* (Schulzer) Donk, *G. mirabile* (Lloyd) Humphrey, G. *philippii*

(Bres. & Henn.) Bres., *G. williamsianum* Murrill, *G. tropicum* (Jungh.) Bres., *G. flexipes* Pat., *G. chalceum* (Cooke) Stey., *G. amboinense* (Lam. ex Fr.) Pat., *G. subtornatum* Murrill, *G. lucidum* (Curt. ex Fr.) Karst., *G. resinaceum* Boud, *G. colossus* (Fr.) C. F. Baker, and *Amauroderma rugosum* (Bl. & Nees) Torrend.

INTRODUCTION

The author's interest in the genus *Ganoderma* was awakened some forty years ago when as a recently appointed plant pathologist he came into contact with diseased oil palms in the Belgian Congo. It should be remembered that the oil palm, *Elaeis guineensis* Jacq., was then little more than a wild plant that had fairly recently been brought into cultivation, on a small scale in Africa but more extensively in South-east Asia. By then only elementary knowledge of its diseases had been gained. Amongst their causes species of *Ganoderma* appeared to occur not infrequently and some literature relating to them already existed. As to the identification of the species involved however the problem was practically at a deadlock not only in the herbaria but evidently much more so in the field. Besides an imposing array of more than 200 published binomials no published monograph of the genus existed and none exists to-day. Patouillard's brief paper of 1889 only reviewed the species known at that time, and it soon became obsolete under the avalanche of binomials published mostly at the beginning of this century. The papers by Humphrey & Leus (*1931*, *1932*) treated only the *Ganoderma applanatum* group as it occurred on the Philippine Islands. These publications mark however an important turning point in the study of the Polyporaceae as they put strong emphasis on anatomical features and employed the more elaborate laboratory technique devised at the end of the last century and the three first decades of the current. These publications are perhaps among the most important in connection with Polyporaceae; they were certainly momentous at the time of their publication. It is to be regretted that the example was not followed more extensively. We might probably have been spared the abundance of systems that have been suggested for the splitting of the very extensive family of Polyporaceae *sensu lato* into genera and all the controversies they engendered.

The author's concern for the systematics of the genus *Ganoderma* started in 1951 and has since remained the principal subject of his researches, except for a thirteen months period in 1952–3 when having a leave of absence as an FAO phytopathological expert in Iran.

During these well nigh twenty years a considerable amount of labour has been devoted to establishing iconographical documents of every specimen examined without which one cannot proceed to the distribution into species. During the first ten years research was restricted first to the Congo and then to Africa in general. This extension to the whole of Africa appeared to be insufficient because of the considerable number of species that could be distinguished. From 1961 onward research was extended to material of the whole world and an extensive study was carried out of type specimens that had been published from other regions than Africa. This policy proved to be rewarding as a much better knowledge has been

gained about the palmicolous species of *Ganoderma* (Steyaert, *1967b*), whose distribution patterns are either Americano-African, African, Asiatic, or pantropical.

The need of a monograph is evident, not only for *Ganoderma* but also for so many other extensive genera of fungi whose study has been left in abeyance. Yet taxonomists shy at undertaking such enterprises; they mean many years of perseverance and devotion. If however such undertakings are not fulfilled soon a time will come that the superabundance of published binomials will prevent them. It will by then have become impossible for a single person to attempt such a task. Although there may be still some corners of the world that are insufficiently explored there is already an abundance of specimens lying idle in the herbaria where they are unfortunately exposed to possible destruction. The destruction of the Berlin herbarium and a few others are telling examples of this danger. In this paper two suggestions are made of what could have happened had the Berlin collections been totally destroyed: the binomials *Ganoderma philippii* and *G. weberianum* would have been irretrievably 'lost'. Since the Berlin herbarium was particularly rich in type specimens it may be assumed that such losses must really have happened in regard with other binomials of fungi.

Time has come that in the very near future the accumulated wealth of specimens in the herbaria must be taken advantage of by elaborating monographs of the many giant genera that have been neglected in this regard. Nowadays much time and efforts are spent to write local floras although for many species taxonomic knowledge is inadequate or even faulty. The author does not wish to discredit these floras; they certainly fill an undisputed need but still there can be no doubt that in many a part they remind of buildings with many faulty-baked bricks.

Since this paper is the first of some size resulting from an accumulation of documents pertaining to the species of *Ganoderma* it appears desirable to go into the description, once and for all, of these documents and how they were or are obtained.

ELABORATION OF THE ICONOGRAPHIC DOCUMENTATION

The successive stages for each specimen are as follows:

(i) Specimens on loan are photographed when received; two or three photographs are taken: one of the upper surface, one of a section of a basidioma cut into halves, perhaps one of the pore side if it has any noteworthy peculiarities, and one of the basidioma taken sideways if it is stipitate. The photographic prints are to be enlarged in order to obtain an exactly life-size picture of the specimen.

(ii) (a) A small block ($\pm$ 3–4 $\times$ 8–9 mm) is cut out along a plane of section of the basidioma (Steyaert, *1967b*) so that the narrow edge of the block is parallel to the general direction of the hyphae (Steyaert, *1967a*: *fig. 1*).

(b) A block of the tube layer ($\pm$ 8 $\times$ 15–16 mm) is cut out.

(c) The two blocks are boiled in water.

(iii) In order to obtain the spore mounts the block of the tube layer is taken out of the water, drained of excess water and squeezed with the pores downward and

the tubes vertical over a slide. Two or three drops of water are evenly spread out and the slide left to dry on a heater at relatively low temperature. When dry one or two drops of Canada balsam are dripped on the slide. It may be useful to add a drop of chloralphenol and let it spread out together with the balsam. This will facilitate the elimination of air bubbles from the spores. The slide is left a few moments to let evaporate most of the xylene from the Canada balsam and a cover glass (20 × 40 mm) is then applied. On the heater the Canada balsam will spread out evenly under the cover glass. A slight pressure on the cover glass will squeeze out the excess balsam. The slide is then left to cool.

This procedure may seem rather unorthodox for fungi but somehow the *Ganoderma* spores withstand this treatment quite well.

(iv) Sections of the cutis and tube layer. —

Sections of the cutis (12–20 μ thick) and sections of the tube-layer (20–30 μ thick) are obtained with a freezing microtome. They are freed from the knife either with a drop of water or a very fine water-colour brush and dropped in a watch-glass or small petri dish filled with water. When enough sections have been cut the best are removed with a small narrow spatula aided by the brush and then placed in a second dish with water to let float away the free hyphal fragments that might have clung to them. The sections are then transferred to a slide either by dipping the spatula in a drop of water that had been put on the slide or by letting fall directly from the spatula a drop of water and in this manner carry the section onto the slide.

The sections (usually 9 to 12 of them for the cutis or 2 for the tube-layer) are arranged on the slides with the aid of two fine brushes and the water drained off with the help of a small square of tissue paper. After most of the water has been drained off a cover glass (18 × 18 mm) is laid over the sections.

One slide of the cutis sections is washed with a 7 % KOH solution in water. A drop of this liquid is placed at the edge at one side of the cover glass and a square of tissue paper at the other side to drain off the water. The KOH solution will thus remove the melanoid substances (Steyaert, *1967a*: 190) of the cutis. The potassium solution is washed out either by distilled water or a diluted solution of acetic acid.

The slides, either treated with the KOH solution or untreated, are then lixiviated with drops of chloralphenol (Steyaert, *1946*, *1947*; Langeron, *1925*: 747). (Chloralphenol = 2 parts by weight of chloral hydrate + 1 part of dry phenol, when heated melts into a sirupy liquid.)

Chloralphenol displaces the water and when this is achieved completely a drop of Canada balsam is put at the edge of the cover glass and drawn under it like the other liquids by a square of tissue paper. As many drops of Canada balsam are added as are needed to obtain both the full displacement of the chloralphenol and to fill the area underneath the cover glass. The slide is left on the heater to let evaporate as much xylene as possible. The cover glass becomes firmly fixed upon cooling.

The microphotographs appended to this article show that in this manner very good pictures of sections of the cutis can be obtained.

It can be stated that without this simple technique that ensures as permanent a

slide as can be obtained—Canada balsam alone has stood the test of time for at least one century—the study of the genus *Ganoderma* could not have been pursued to the extent to which it has now been carried. As more than 3000 specimens have been studied in the manner described, and at least 5 slides have been mounted for each specimen, a collection of at least 15.000 slides has been built up.

To be complete it should be noted that sections of the tube-layers are mounted in the same manner except that they are not washed with a KOH solution.

ICONOGRAPHY.—To ensure a uniform magnification of all drawings and photographs the same microscope and accessories (eye-pieces, objectives, and camera-lucida) have been used throughout this investigation; the correct position of the microscope on the table being secured by drawing the outline of the microscope base on the table; and at the perpendicular of the camera lucida's mirror a short line was scratched on the table to mark the spot on which the spores were to be drawn.

Failure to take the above precautions might result in serious variations in the magnification. These precautions were taken so that the drawings could be measured as a matter of routine; they eliminated the micrometer eye-piece as a tool of measuring. Measurements were obtained by projecting a stage micrometer scale onto a paper on the table and dividing this scale geometrically into microns. As the magnification of the spores on the table corresponds to a magnification of 3150 times the micron division lines are sufficiently spaced to be correct to half a micron. This scale was reproduced on a flat ruler with which the measurements are to be taken. It also carries the appropriate scales for the pore drawings and the microphotographs.

The basidiospore drawings—10 per specimen—are made on a piece of transfer paper and then lined up near the top of a sheet of drawing paper cut to the size of a herbarium sheet. The latter is called the voucher sheet. The rest of the voucher sheet receives the drawing of a cross section of the tube-layer, viz. a microscope field drawn at the magnification of 155 times. Such a field covers approximately 1700 μ in diameter.

The microphotographs of the cutis sections, whether washed with KOH or not, are magnified 720 times. The prints, about 29 × 19 cm, are hinged on the side of the voucher sheet and the life size photographs of the basidioma, on the lower edge.

These sheets are filed as herbarium sheets but the specimens are stored in boxes of various standard sizes so as to accommodate specimens of various sizes and bulk. The sizes of the boxes are indicated by letters A, B, C, and so on and for each size they are numbered from one on. The box numbers are mentioned on the voucher sheets and a label on the outside of the box mentions the temporary or definite determination.

All systems of filing bulky specimens have their advantages and inconveniences. In the standard systems of taxonomic filing, herbaria have been obliged to provide space in trays or drawers in separate cupboards and even a separate filing for very bulky specimens. This system of storage coupled with voucher sheets (as adopted

in the Brussels herbarium) permits—when a determination is altered—translocation of the voucher sheets only; the location of the boxes never varies. For medium sized and small herbaria the Brussels system offers the advantage of saving much filing space. A disadvantage is that when one wishes to assemble specimens for the study of a particular group this may be a tedious job. However with the iconography ready for every specimen the sorting out will have been made much easier.

Following a visit to Leiden in 1966 a loan was kindly granted of *Ganoderma* collections of the Rijksherbarium as well as those of the Bogor herbarium and of Dr. M. A. Donk, temporarily housed in the Rijksherbarium. The loan consisted of a selection made by the author.

For this and all the working facilities that were enjoyed in the Leiden herbarium deep appreciation and gratitude is expressed. That more than 30 species are involved speaks for the importance of these collections. The opportunity of publishing this paper is taken also to discuss a few specimens foreign to the main set, which is chiefly of Asian distribution.

As explained in a former publication by Steyaert (*1967b*) each basidioma studied, principally those received on loan, has been given a number. This is done because when a collection comprises several basidiomata it may represent more than one species. If the basidiomata are not numbered reference to a specimen will often be laborious and lacking in precision. It is also an indication that in the Brussels herbarium a voucher sheet of the specimen with complete iconography has been prepared and stored away.

As in previous publications Ridgway's "Color standards and nomenclature" has been used together with Dade's Latin translations. Most other charts are glossy, which impairs colour comparison of non-glossy objects and are therefore less suitable for this kind of work. Colours cited from Ridgway are capitalized, other non-capitalized colours are the author's own appreciations and are in the main restricted to spore colours as seen through the microscope.

The word basidioma—as a corollary to van Brummelen's (*1967*) re-introduction of the word ascoma—is resorted to as it appears to be the most appropriate term for what is currently referred to as fructification, carpophore, or sporophore and so on; all these denominations are open to some criticism, the first two being the least appropriate as there is certainly no analogy to a phanerogamic fructification. At the most a basidioma can be compared with a phanerogamic flowering stage, the spores being plus or minus polarized. The term sporophore applies to any spore-bearing hypha as these occur in the Fungi imperfecti. 'Basidioma' has a much more restricted application as it is to be used in connection with Basidiomycetes only.

The expression melanoid substances has been resorted to to designate the kind of wax that impregnates the cutis. It is a translation of the French expression 'substances mélanoïdes' of Maillard (Steyaert, *1967a*, foot-note on p. 190) for a complex of sugars and proteins.

The collectors' notes have been left in their original language. The word holotype

is capitalized for the type of the correct binomial; it is not capitalized for synonymous binomials. In mentioning dates, months have been indicated by roman figures to obviate any misrepresentation of arabic figures when they are used by themselves.

The author wishes to express his most sincere gratitude to Mr. R. Tournay for his unfailing help in elaborating the Latin diagnoses.

GANODERMA APPLANATUM (Pers. ex S. F. Gray) Pat.
Fig. 1a

Boletus applanatus Pers., Obs. mycol. **2**: 2. 1799. — *Boletus applanatus* Pers. *ex* S. F. Gray, Nat. Arr. Br. Pl. **1**: 642. 1821. — *Polyporus applanatus* (Pers. ex S. F. Gray) Wallr., Fl. crypt. Germ. **2**: 591. 1833; Fr., Epicr. 465. 1838. — *Ganoderma applanatum* (Pers. ex S. F. Gray) Pat. *in* Bull. Soc. mycol Fr. **5**: 67. 1889.

Polyporus megaloma Lév. *in* Annls Sci. nat. (Bot.) III **5**: 128. 1846.

Polyporus leucophaeus Mont., Syll. Crypt. 157. 1856.

Most of the specimens, but especially Donk 12,296, with 8 layers of tubes, and Ahmad 3085, with 4 layers, have extensive zones of white mycelium. These two specimens and some others (DD 14,247, 14,253, 14,266, 14,701; Everest Exp. 1953 remarkable by having nine layers of tubes) have several layers of tubes separated by thin layers of context tissue. They are all typical of the species; there can be no doubt as to their identity. The same applies to the Bombay specimen (DD 3065), which has a pale grey upper surface and pale brown context. The latter specimen probably marks the southern limit of distribution of the species. The other specimens have darker brown context—but not reddish brown—, some with pale brown zones near the cutis.

Beyond this southern limit *G. applanatum* seems to be replaced by *G. tornatum* and about this limit there appears to be an overlapping of the two species; the distinction between the two is then rather delicate. The upper surface of the basidiomata of *G. tornatum* may not be as dark as in the truly tropical specimens, but a distinctive feature seems to be the thin horn-like deposits in the context, which to the author's knowledge are not observed in *G. applanatum*.

SPECIMENS EXAMINED.—GERMANY: Falkenstein bei Zwiesel, s. hosp., Greiner (L), 10-IX-1966, 66.L.4.

AUSTRIA: Ober Oesterreich, Altergau, Buchberg, s. hosp., M. A. Donk 12,296 (L), 29-IX-1962, 66.L.5.

INDIA: Uttar Pradesh: Dehra Dun, alt. 650 m, on *Cedrela toona* at roadside, R. A. Maas Geesteranus 14,457 (L), 5-IX-1964, 66.L.6.; Chakrata, on *Picea morinda*, B. K. Bakshi (DD H.2434), 22-VI-1936, 58.DD.16; Haldwani, on butt of living *Mallotus philippensis*, B. K. Bakshi (DD H.3643), 27-III-1941, 58.DD.5; Nainital, on stumps of *Picris ovalifolia*, B. K. Bakshi (DD H.2380), 6-XI-1932, 58.DD.11; on roots of *Dalbergia sissoo*, B. K. Bakshi (DD H.5948), 58.DD.1; Dehra Dun, on stumps of *Tectona grandis*, B. K. Bakshi (DD H.3797), 4-X-1944, 58.DD.6; Dehra Dun, on stumps of *Bauhinia retusa*, B. K. Bakshi (DD H.4052 (a)), 9-XI-1945,

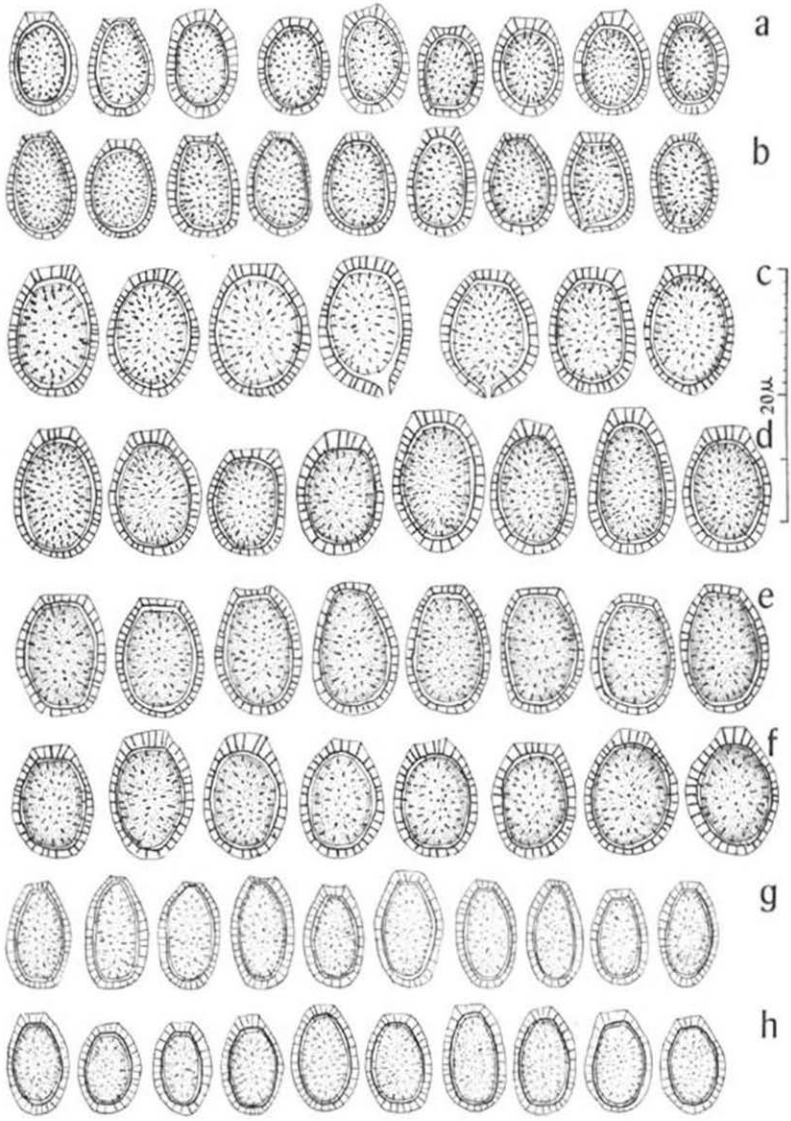


Fig. 1

58.DD.7; Dehra Dun, on stumps of *Pinus longifolia*, B. K. Bakshi (DD H.4199), 4-V-1939, 58.DD.9; Dehra Dun, on living *Morus alba* trunk, B. K. Bakshi (DD H.3025), I-1938, 58.DD.13. — Himachal Pradesh, Simla, alt. 2160 m, on logs of *Abies pindrow*, B. K. Bakshi (DD Khadrala 38/58), VI-1958, 58.DD.15. — Punjab: Kulu, on *Prunus pradus*, B. K. Bakshi (DD H.6096), 5-XI-1952, 58.DD. 12; Kulu, on log of *Pinus pindrow*, B. K. Bakshi (DD H.6080), 58.DD.14; Kulu valley, Manali, alt. 1850 m, on stumps of *Cedrus deodora*, R. A. Maas Geesteranus 14,315 (L), 20-VIII-1964, 66.L.13, 14. — Bombay, Maharashtra, on base of *Dipterocarpus* sp., B. K. Bakshi (DD H.3056), 4-V-1939, 58.DD.10.

NEPAL: s. loc., alt. 4500 m, Himalaya Everest Exp. 1953, s. coll. (K), 55.K.30.

PAKISTAN: Kagan Valley, Sharhan, s. hosp., S. Ahmad (Fungi of W. Pakistan 14,410), 21-VIII-1959, 59.LAH.2–4; Kagan Valley, Shogran, on a fallen log, S. Ahmad (Fungi of W. Pakistan 14,247), IX-1958, 58.LAH.18; Kagan Valley, Shogran, on a fallen log, S. Ahmad (Fungi of W. Pakistan 14,253), IX-1958, 58. LAH.19, 20; Kagan Valley, Sharhan, on logs, S. Ahmad (Fungi of W. Pakistan 14,701), 22-VIII-1959, 59.LAH.6; Nathia galli, s. hosp., S. Ahmad (Fungi of W. Pakistan s.n.), 9-VIII-1959, 59.LAH.7; Kagan Valley, Sharhan, on logs, S. Ahmad (Fungi of W. Pakistan s.n.), 20-VIII-1959, 59.LAH.13.

GANODERMA TORNATUM (Pers.) Bres.—Fig. 1b

Polyporus tornatus Pers. *apud* Gaud., Bot. *in* Freycinet, Voy. Uranie 173. 1827. — *Ganoderma tornatum* (Pers.) Bres. *in* Annls mycol. **10**: 502. Oct. 1912; *in* Hedwigia **53**: 55. Dec. 14. 1912. — *Ganoderma applanatum* var. *tornatum* (Pers.) Humphr. & Leus *in* Philipp. J. Sci. **45**: 543, 562, 565, 1931.

Ganoderma applanatum var. *laevisporum* Humphrey *apud* Humphr. & Leus *in* Philipp. J. Sci. **45**: 533, 565, 1931.

Ganoderma applanatum var. *philippinense* Humphrey *apud* Humphr. & Leus *in* Philipp. J. Sci. **45**: 535, 565, 1931.

Humphrey did not think it wise to maintain *G. tornatum* ("or *G. australe* of many writers", as he said, but to which the present author readily concurs) as a separate species from *G. applanatum*. Steyaert (*1967b*: 487–489) has indicated why they should be kept separate. In northern India and Pakistan, however, there are some specimens of *G. tornatum* that do not have the dark brown upper surface of the tropical specimens. The context is also of a lighter shade but in the author's opinion the presence of thin, shiny, horn-like layers (probably of melanoid substances) is

---

EXPLANATION OF FIGURE 1

Fig. 1. Basidiospores. — a. *Ganoderma applanatum*, Maas Geesteranus 14, 457, 66.L.6. — b. *G. tornatum*, C. & D. van Overeem & al. (BO 705), 66.L.92. — c. *G. brownii*, Lawrence 522, 66.L.24. — d, e. *G. adspersum*: d, Schulzer von Müggenburg, 68.BPU. 1; e. Swart, 66.L.3. — f. *G. kosteri*, Koster, 66.L.1 (Holotype). — g, h. *G. vanheurnii*: g, van Heurn, 66.L.119 (Holotype); h, ditto, 66.L.121.

decisive for classing them as *G. tornatum*. Besides, the fact that a typical specimen of *G. applanatum* has been collected in Bombay goes far towards confirming this point of view.

Discussions of taxonomic levels and the concept of what distinguishes varieties from species have not brought much enlightenment in this group. If the same problem would be considered in the *G. lucidum* group and the majority of species taken as varieties just because they have a hymenioderm as cutis the result would not only be a very cumbersome and unwieldy type of nomenclature but also a biologically incorrect concept.

Considering the wide distribution of both *G. applanatum* and *G. tornatum*, each covering several continents, the author arrived at a conclusion opposite to Humphrey's; he considers it wiser to decide that there are two species, each with some variation, that do not overlap except in the north of the Indian subcontinent as has been mentioned under *G. applanatum*.

As to his variety *philippinense*, Humphrey goes to several pages of considerations and descriptions to distinguish it from the type variety (*G. applanatum*). Yet when one has read this lengthy text the concept of the variety *philippinense* still remains vague. He seems to attribute some importance to the following feature (Humphrey & Leus, *1931*: 537): "One fairly constant feature of the context is the presence of distinct whitened flecks or areas from the size of a pin head to several millimeters . . .." This is simply a feature that cannot be brought forth to characterize a variety of *G. applanatum*; if that were the case the European *G. applanatum* would certainly have to be included in the variety. The bleaching of zones in the context and tube layers is evidently more frequent in the *G. applanatum* group but it is certainly not absent in the *G. lucidum* group. Steyaert (*1962*: 98–99) has suggested that in certain cases the bleaching of the hyphae could be due to parasitism.

It is remarkable indeed that Humphrey stressed the constancy of bleaching as a feature of the variety *philippinense* because on p. 517 he described the same anomaly for the main variety.

In regard to the spore sizes of variety *philippinense* and his variety *tornatum* Humphrey gave as averages 8.77 × 5.43 μ and 7.58 × 5.03 μ respectively. Examination of Gaudichaud's type material of *G. tornatum* from Lawak (Rawak) (Steyaert, *1967b*: 487) has shown that the spore measurements are 7.5–8.35–9.5 × 5–5.8–7 μ, which is very near to Humphrey's for variety *philippinense*.

In conclusion the author would consider *G. applanatum* var. *philippinense* redundant. So is *G. applanatum* var. *laevisporum*. Non-echinulate spores can be observed in many species. It has yet to be discovered what the cause is of this anomaly in the spores and whether these are fertile. Abundance of non-echinulate spores may vary very much from one specimen to another, viz. from a few per cent to a majority of the spores. In variety *laevisporum* the cause of these abnormal spores is certainly dominant, be it cytological or physiological. Nevertheless of the collection M. S. Clements (Bureau of Science 50,084) the Paris specimen shows only a few echinulate spores when sections of the tube layer are examined. Humphrey (*1931*: 535) cites

also Javanese specimens collected by van Overeem *et al.* (BO 705). What the author has seen of this collection consists of two basidiomata, one is poreless, the other has perfectly normal spores with no detectable non-echinulate spores. The conclusion drawn from the re-examination of the problem set by variety *laevisporum* is that this taxon has no real systematic basis and that its name is a nomen monstrositatis. On the other hand the non-echinulate spores could be the result of genetic recombination and due to a recessive character manifesting itself occasionally.

Students of *Ganoderma* specimens should be aware that apparently all species potentially may produce this kind of anomalous spores. Among the about 3000 specimens examined by the author the collection Bureau of Science 50,084 is certainly the one where this is most pronounced.

Ganoderma cochlear (Bl. & Nees) Bres. (Merrill, *1917*: 58) could be related to *G. tornatum*. Blume & Nees's (*1826*) plate VI shows a stipitate basidioma of a dull greyish dark-brown colour. This should exclude all species with basidiomata that are blackish-shiny; all of these possess a hymenioderm cutis type. The dull grayish brown colour is also known for *G. philippii* (Bres. & P. Henn.) Bres. [syn., *G. pseudoferreum* (Wakef.) Over. & Steinm.], but neither the latter species nor *G. tornatum* are known to form such a long and thin stipe as figured by Blume & Nees. Among the specimens that have been examined BO 705 comes closest in having such a stipe. In this case however it seems to be a matter of 'strangled' growth of basidiomata rather than the forming of a real stipe.

Merrill neotypified the name *G. cochlear* by Robinson 610, August 30, 1913, but the specimen cited by him seems to be lost. Inquiries at the Manila herbarium and several American herbaria have not been successful in locating this specimen.

SPECIMENS EXAMINED.—PAKISTAN: Sialkot, on dead wood, M. Nawaz (Fungi of W. Pakistan 14,181), IX-1954, 58.LAH.3; ditto (Fungi of W. Pakistan 14,180), IX-1954, 50.LAH. 4; Changa-Manga, on *Dalbergia sissoo*, S. Ahmad (Fungi of W. Pakistan 4345), 29-X-1950, 58.LAH.12; Kagan Valley, Sharhan, alt. 2400 m, on logs, S. Ahmad (Fungi of W. Pakistan s.n.), 20-VIII-1959, 59.LAH.14–15.

INDIA: West Bengal: Agarpara, 24 Parganas, s. hosp., D. N. Chakravorti 1249 (Herb. M. A. Donk 8740), XI-1931, 66.L.107.; Dehra Dun, Soharapur road, s. hosp., K. S. Thind, 28-VIII-1946, 63.K.35; Dehra Dun, on main stem of *Tectona grandis*, B. K. Bakshi (DD Lacch.30/58), 25-IX-1958, 58.DD.4.; Calcutta, on dead trunks of *Mangifera indica*, s. coll., 28-VIII-1946, 67.E. 12. — South India, s. loc., on stumps of *Shorea robusta*, B. K. Bakshi (DD. Lacch.87/58), 25-IX-1958, 58.DD. 3; s. loc., at base of living *Cedrela toona*, s. coll., (DD H.4242), 25–I–1946, 58.DD.2.

CEYLON: Naramwala, Berna Estate, on roots of *Cocos nucifera*, R. A. Bull, VII-1967, 69.K.26, 27, 28.

CHRISTMAS ISLAND: West coast, Dales, alt. 42 m, on fallen *Inocarpus*, D. A. Powell 121B, s. dat., 69.K.4.

INDONESIA: Java: Gunung Gedeh, Tjibodas, s. hosp., Bruggeman (BO 8760),

IX-1924, 66.L.89; G. Gedeh, Tjibodas, rott(ende) stammen en stompen, C. & D. van Overeem-de Haas & *al.* (BO 705), XI-1921, 66.L.91, 92; G. Gedeh, Tjibodas, s. hosp., Bruggeman (BO 8760), 23-IX-1924, 66.L.106; Oost-Java, Poedjon, s. hosp., W. C. van Heurn (Herb. M. A. Donk 8782), VII-1937, 66.L.141. — Kalimantan (Borneo), Bukit Raja, alt *circa* 1400 m, s. hosp., Hans Winkler 1047 (BO 3060), XII-1924, 66.L.55. — Amboina, s. loc., s. hosp., C. B. Robinson 2050, (Bur. Sci. Manila; Reliq. Robins., Pl. of Amb.), VII-XI-1913, 53.PC. 46.

MALAYSIA: Johore, Pontian Road, s. hosp., E. J. H. Corner (Singapore Field 23225), (Herb. M. A. Donk 8736), XII-1929, 66.L.134; s. loc., s. hosp., s. coll. (Dep. Agric. Fed. Malay St., Div. Pl. Path. 136), 1-XII-1954, 55.K.16.

PAPUA: Brown River, on *Tectona grandis*, K. J. White (Dep. Agric. & Livest. 6647), 20-VIII-1969, 69.TPNG.1.

CHINA: Hainan, Ling Shui Dist., Po Teng Shi (Bo Deng), on partly decayed living tree, H. Fung 20047 (Herb. Lingnan Univ., 6th Hainan Exp.), 26-29-IV-1932, 69.K.116.

PHILIPPINE ISLANDS: Palawan, Mt. Kabinbin, on dead wood, B. Reyes (Bur. Sci., Manila 50,021), 22-III-1929, 69.K.123. — Mindanao, dist. Davao, Todaya (Mt. Apo), s. hosp., A. D. E. Elmer (Philipp. Isl. Pl. 10,756), V-1909, 67.E.13. — Negros, Prov. Negros orient., Dumaguete, s. hosp., A. D. E. Elmer (Philipp. Isl. Pl. 10,017), IV-1908, 67.E.11. — Luzon, Prov. Laguna, Mt. Maquiling, profuse on large white Lauan, C. J. Humphrey 50,047 (part of Holotype of *G. applanatum* var. *philippense* Humphrey), 24-IX-1928, 53.PC.36; Prov. Bataan, s. loc., s. hosp., H. P. Curran (Forestry Bur. 19,234), XII-1909, 53.PC.22; Mountain Prov., Bontoc subprov., s. loc., s. hosp., in mossy forest, M. S. Clement (Bur. Sci., Manila 50,084) (part of Holotype of *G. applanatum* var. *laevisporum* Humphrey), II-1928, 53.PC.37.

GANODERMA BROWNII (Murrill) Gilbertson

Fig. 1c, Pl. 5 fig. 15

Elfvingia brownii Murrill, West. Polyp. 29. 1915. — *Ganoderma applanatum* var. *brownii* (Murrill) Humphr. & Leus *in* Philipp. J. Sci. **45**: 531, 565. 1931. — *Ganoderma brownii* (Murrill) R. L. Gilbertson *apud* Lowe & Gilbertson *in* Mycologia **53**: 505. 1962.

Basidioma dimidiate to subungulate, about 10 cm in radius and 7–8 cm thick. Upper surface irregular, sometimes with deep concentric grooves, dull Snuff Brown (Ridgway) with greyish blotches.

Section: cutis about 1000 μ thick, horny but fragmenting easily, sepia; context up to half the thickness of the basidioma, Auburn (Ridgway); tube-layer up to about equalling the thickness of the context but usually one third, concolorous with it.

Cutis a trichoderm (usually becoming deprived of the external hyphae in old specimens), about 1000 μ thick. Pores round, 120–165–270 μ in diam.; dissepiments 60–90–140 μ thick; distance between axes 225–255–265 μ. Basidiospores broad-ovoid, dark brown, 9.5–10.6–12 × 6.5–7.6–8 μ.

Where some abrasion by external factors has occurred, *Ganoderma brownii* has sometimes been misinterpreted since in old specimens the cutis is without hyphae protruding beyond the cutis. In younger specimens they are usually extant and Humphrey, faithful to his concept of varieties in the *G. applanatum* complex, considered this species a variety of *G. applanatum*. However there is significant difference in the spore morphology; since the size of the spores is considerably above that of the latter species or of *G. tornatum* it would seem preferable to consider such a difference sufficient for distinction at the species level; this has been done by Gilbertson.

SPECIMENS EXAMINED.—U.S.A.: California: Berkeley, Univ. Campus, Strawberry Canyon, on dead and decaying *Umbellularia*, V. S. Brown s.n., 27-IX-1913, 69.NY.17; Marin county, Alpine lake, on log of *Umbellularia californica* Nutt., J. F. Lawrence 522 (L 960.346-040), 30-I-1960, 66.L.24; Muir woods, San Francisco, on *Umbellularia californica*, Mrs. C. J. Humphrey (Herb. M. A. Donk 8738), XI-1915, 66.L.128.

GANODERMA ADSPERSUM (Schulzer) Donk—Figs. 1d, e

Polyporus adspersus Schulzer *in* Flora **61**: 11. 1878; *in* Linhart, Fungi hung. No. 55. 1882. — *Ganoderma adspersum* (Schulzer) Donk *in* Proc. Ned. Akad. Wet. (C) **72**: 273. 1969.

Polyporus linhartii Kalchbr. *in* Linhart, Fung. hung. No. 252. 1884. — *Ganoderma linhartii* (Kalchbr.) Igmándy *in* Acta phytopath. Acad. Sci. hung. **3**: 237. 1968.

Ganoderma europaeum Stey. *in* Bull. Jard. bot. Brux. **31**: 70. 1961.

Polyporus australis Fr. *sensu* Fr., Hym. europ. 556. 1874. — *Ganoderma australe* (Fr.) Pat. *sensu* Pat. *in* Bull. Soc. mycol. Fr. **5**: 71. 1889.

Through the courtesy of Dr. M. A. Donk and Dr. G. Bohus authentic specimens of *Polyporus adspersus* Schulzer and *Polyporus linhartii* Kalchbr. were located in, and loaned from, the Natural History Museum at Budapest. It is to be noted that the specimen Linhart 55 is not the type as it was collected in 1882 whereas Linhart 252 seems to be the type of *P. linhartii* as the specimen is accompanied by a diagnosis.

The cutis anatomy of both specimens is identical with that of *Ganoderma europaeum*; the spore sizes are 8.5–10.35–12 × 6.5–7.05–7.5 μ.

Schulzer did not publish a formal diagnosis in the current fashion. There are however enough characters, both morphological and anatomical, mentioned for *P. adspersus* by which his specimen can be related to *G. europaeum*. Schulzer describes the cutis as follows:—

„Bei der mikroskopischen Untersuchung fand ich den innern Bau völlig jenem verwandter Pilze [*Pol. applanatus* P. und *P. lucidus* P.] entsprechend .... Jene Fleischhyphen, welche sich der obern Pilzfläche zuwenden, treten mit sehr zarten, hyalinen Spitzen auf 0,025–0,05 Mm. über diese hervor, theilen sich in 2–3 Zweige und erzeugen an jeder Zweigspitze je eine Frucht, Sporen, die sich in gar keinem Stücke von den Sporen in den Röhrchen unterscheiden. Sie sind nämlich zuletzt purpurbraun, verkehrt-eiförmig, 0,009–0,011 Mm. lang und durchschnittlich 0,006 Mm. dick. Sie besitzen in der Mitte einen durchscheinenden, kugeligen Kern und aussen ein Exosporium, welches sich oben und seitlich an das Episporium dicht anschmiegt, unten aber weit davon getrennt ist, daher dort ein hyaliner Raum entsteht. Das

Episporium ist nämlich am untern Ende gleichsam abgestutzt, somit kürbiskernförmig. Nach dem Verschwinden des Exosporiums rundet sich das untere Ende des Episporiums ab und stellt wieder die verkehrte Eiform der Spore her."

Although Schulzer described the spores as attached by the apex he noticed that they collapsed and he also compared them to those of *P. lucidus* from which, he said, they cannot be distinguished.

It must also be noticed that Schulzer saw correctly the hyaline hyphae that branch off in the cutis. In the spore he also noticed that the spore-wall is made up of an exo- and an episporium but he does not mention the echinulae, probably because the optics he used were not powerful enough.

It is easy to recognize in his spore descriptions the spores of *Ganoderma* and as their sizes agree with those of *G. europaeum* it cannot be doubted that *Polyporus adspersus* is synonymous with the latter.

As regards *Polyporus linhartii* Kalchbr. the description that is appended to Linhart 252 could apply to many a species of *Ganoderma*; from the statement in the remarks that "Diese Art steht am nächsten zu *P. australis* Fr." it can be surmised that *G. adspersum* is involved. The specimen, however, removes all doubts; the spores measure 8.5–8.8–9.5 × 6–6.4–7 μ and the cutis anatomy is identical with that of *G. europaeum* or *G. adspersum*. The three binomials are therefore synonymous and 'adspersum' must prevail as the earliest epithet.

SPECIMENS EXAMINED.—YUGOSLAVIA: Slavonia, Vinkovce, on *Carpinus betulus*, Schulzer s.n. (Linhart, Fungi hungarici 55), XI-1882, 68.BP.1.

HUNGARY: Altenburg (apparently near Pressburg, which is now Bratislava), on *Populus nigra*, Linhart s.n. (Fungi hungarici 252), X-1883, 68.BP.2.

THE NETHERLANDS: Noord-Holland, Koog aan de Zaan, on pear tree, B. Swart (L 960.7–037), 27–IX–1932, 66.L.3.

Ganoderma kosteri Steyaert, *sp. nov.*
Fig. 1f, Pl. 1 fig. 1, Pl. 5 fig. 17

Basidioma sessile, flabelliforme, usque ad 180 mm diam. et usque ad 50 mm crassum. Pagina dorsalis concentrice corrugata, languida, brunneo-vinosa.

Sectio: cutis 1500 μ crassa, sepiacea, dura, fragilis; contextus tenuis, 3–5 mm crassus, umbrinus; tubuli usque ad 45 mm longi, umbrini, vulgo albo-striati.

Cutis anatomice anamixodermiformis, hyphis brunneis, apice subanticlinis, substantia ceracea. Pori circulares vel irregulares, 110–170–130 μ diam.; dissepimentis 30–60–120 μ crassis; axibus circa 230 μ distantibus. Basidiosporae ovoideae, vel subsphaericae, brunneae leviter fuscescentes, maturitate truncatae, 9–9.7–10.5 × 6.5–7.1–8 μ, echinulis valde conspicuis.

Basidioma sessile, flabelliform, up to 180 mm in diam. and 50 mm thick. Upper surface concentrically corrugated, dull, Blackish Brown (Ridgway).

Section: cutis 1500 μ thick, sepia, hard, fragmenting; context thin, 3–5 mm thick, Bay (Ridgway); tubes up to 50 mm long, Bay, generally striated by white lines.

Cutis of the anamixoderm type, with hyphal extremities generally anticlinal.

Pores round, often irregular, 110–170–300 μ in diam.; dissepiments 30–60–120 μ thick; distance between axes about 230 μ. Basidiospores ovoid or subspherical, brown, slightly fuliginous, 9–9.7–10.5 × 6.5–7.1–8 μ.

Although the cutis anatomy is of the anamixoderm type, it differs from that of *G. adspersum* in that the hyaline hyphae are more regularly anticlinal and do not intertwine as much as in the latter. The most marked difference lies in the reduction of the context. The maximum thickness reached at the base of Koster's specimen (66.L.1) is 13 mm but the context is nearly entirely 5 mm thick at the most. The other two specimens have almost exactly the same context and all are of a more dusky brown than is known for *G. adspersum*. In all three specimens of *G. kosteri*, although collected on two different host species and at different dates, the tubes have an almost identical layered disposition of the same thickness. They form whole solid blocks which is not observed in typical specimens of *G. adspersum*. It should be remarked that the tube layers are not interstratified by context tissue which characteristically distinguishes the three specimens from those of *G. applanatum*. All three specimens are intensively speckled or blotched by bleached mycelium or even have strands of this tissue running through context or tube layers.

By comparison the type specimens of *Polyporus adspersus* Schulz, *Polyporus linhartii* Kalchbr., and *G. europaeum* Stey. have contexts 50 mm, 36 mm, and 32 mm thick respectively.

SPECIMENS EXAMINED.—THE NETHERLANDS: Zuid-Holland, Gouda, in tuin, op *Pterocarya* sp., M. S. Koster (L 968.302–783), 13-III-1954, 66.L.1 (Holotype, fragment in BR), the other half of the basidioma (L 953.245–497); Gouda, op *Pterocarya*, M. S. Koster (L 953.245–466), 23-V-1954, 66.L.2. — Gelderland, Brummen, on *Fagus sylvatica*, F. Florschütz (Herb. M. A. Donk 3231), 23-IX-1919, 66.L.108.

Ganoderma vanheurnii Steyaert, *sp. nov.*

Figs. 1g, h, Pl. 1 fig. 2, Pl. 5 fig. 18

Basidioma sessile, ungulatum, triquetrum vel pulvinatum, languidum, olivaceum, sulcis concentricis paullum conspicuis, margine crassa sulcis profundis.

Sectio: cutis 1000 μ crassa; contextus tenuis, isabellinus, vulgo 2–5 mm crassus; tubuli usque ad 2.8 cm longi, isabellini ad sepiacei.

Cutis anatomice anamixodermiformis, ceracea, circa 130 μ crassa. Pori circulares, 100–140–170 μ diam., dissepimentis 30–70–110 μ crassis, axibus circa 210 μ distantibus. Basidiosporae ellipsoideae maturitate apice truncatae, melleae, 7–8.5–9 × 4.5–5.0–5.5 μ, echinulis paullum conspicuis.

Basidioma sessile, ungulate, triquetrous or pulvinate, up to 7.5 cm in diam. and 4.5 cm thick. Upper surface dull Saccardo Umber (Ridgway) with shallow concentric grooves; margin generally thick with deep grooves.

Section: cutis about 1000 μ thick, horny, Sepia (Ridgway); context thin, 2–5 mm thick up to 15 mm at the base; tubes up to 28 mm long, Tawny Olive (Ridgway) to Saccardo Umber (Ridgway).

Cutis of the anamixoderm type, horny, circa 130 μ thick. Pores round, 100–140–

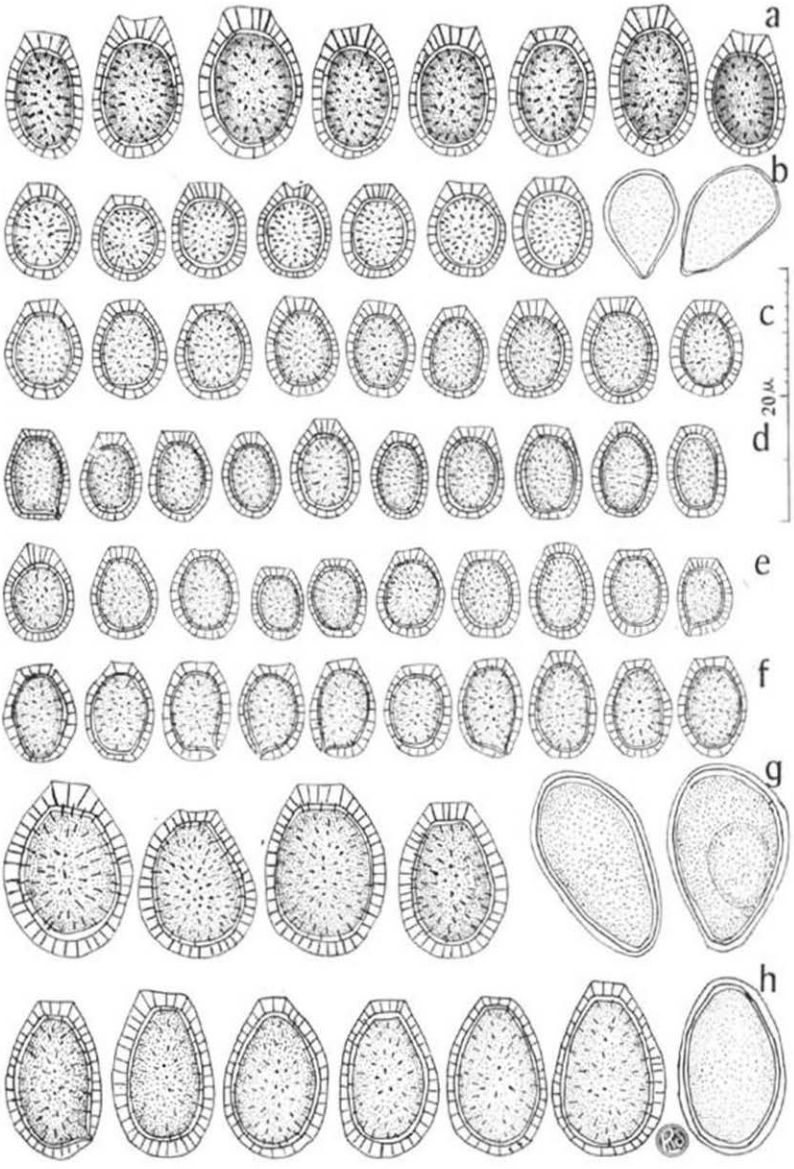


Fig. 2

170 μ in diam.; dissepiments 30–68–110 μ thick, distance between axes about 210 μ. Basidiospores ellipsoid, truncate at maturity, the echinulae little visible, chamois, 7–8.6–9 × 4.5–5.0–5.5 μ.

There is some variation in the tube length. Basidiomata 66.L.119 and 121 have the thinnest context and the longest tubes, whereas 66.L.122 and 123 have tubes only 3–4 mm long. Basidioma 66.L.120 has intermediate dimensions. Only basidiomata 66.L.119 and 121 sporulated. No differences in the cutis anatomy can be recorded for any of the five specimens.

SPECIMENS EXAMINED.—INDONESIA: J a v a, Probolinggo, Bremi, s. hosp., W. C. van Heurn (Holotype, Herb. M. A. Donk 13,596; fragment in BR), VII–1935, 66.L.119, other basidiomata: 66.L.120, 121, 122, 123.

Ganoderma manoutchehrii Steyaert, *sp. nov.*
Fig. 2a, Pl. 6 fig. 19

Basidioma applanatum, subungulatum, circiter 100 mm diam.; pagina dorsalis valde irregularis, verrucosa, brunneo-vinosa, nitens.

Sectio: cutis valde crassa, circa 2400 μ, olivacea sed centro fulva, ceracea; contextus 4–5 mm crassus, ferrugineus; tubuli stratosi, contextu nullo interposito, quidque stratum 6–13 mm crassum; in toto 16–20 mm, testacei.

Cutis subcharacodermiformis, hyphis hyalinis suberectis leviter intricatis et hyphis brunneis erectis subparallelibus. Pori circulares, 160–181–210 μ diam; dissepimentis 40–45–60 μ crassis; axibus circa 225 μ distantibus. Basidiosporae ovoideae, maturitate truncatae, obscure brunneae, 9.5–10.6–12 × 6.5–7.0–8.5 μ, echinulis conspicuis.

Basidioma flat, subungulate, circa 100 mm in diam.; upper surface very irregular, Warm Blackish Brown (Ridgway), laccate.

Section: cutis very thick, about 2400 μ thick, Mummy Brown (Ridgway) with a central zone Ochraceous Tawny (Ridgway), horny; context 4–5 mm thick, Kaiser Brown (Ridgway); tube layers stratified without intervening layers of context tissue, 16–20 mm thick, Cacao Brown (Ridgway).

Cutis of a type close to characodermiform, viz. with the hyaline hyphae suberect, slightly intertwining and the brown hyphae erect, subparallel. Pores round, 160–181–210 μ in diam.; dissepiments 40–45–60 μ thick; distance between axes 225 μ. Basidiospores ovoid, truncate at maturity, dark brown, 9.5–10.6–12 × 6.5–7.0–8.5 μ; echinulae conspicuous.

Dedicated to the memory of my esteemed colleague, Professor of Plant Pathology at the Karadj Faculty of Agronomy, Iran, Dr. Ali Manoutchehri.

A cursoryexaminati on might lead to referring this basidioma to *G. pfeifferi* since the

---

EXPLANATION OF FIGURE 2

Fig. 2. Basidiospores. — a. *Ganoderma manoutchehrii*, Manoutchehri, BR (Holotype). — b, c. *G. mirabile*: b, Merrill 3693, 69.S.1 (holotype of *Fomes fusco-pallens*); c, Corner, Sing. Field 24.199, 66.L.133. — d, e. *G. philippii*: d, Nongnong (BO 1028), 66.L.88; e, Nongnong 474a (BO 1028), 66.L.35. — f. *G. dejongii*, de Jong (BO 14,994), 55.K.8. — g, h. *G. williamsianum*: g, Williams, 69.NY. 12 (Holotype); h, 66.L.15.

spores have similar sizes, but the cutis anatomy is different, the skeletal hyphae reaching the upper level of the cutis and the hyaline hyphae being suberect and more or less intertwining.

SPECIMENS EXAMINED.—IRAN: Ramsar, Mazanderan, on *Acacia* sp., A. Manoutchehri s.n. (Holotype, fragment in BR), 15-IV-60.

GANODERMA MIRABILE (Lloyd) Humphrey
Figs. 2b, c, Pl. 1 fig. 3, Pl. 6 fig. 20

Fomes mirabilis Lloyd, Mycol. Writ. **3** (Letter 33): 3. 1911 ("Ussher"). — *Ganoderma mirabile* (Lloyd) Humphrey *in* Mycologia **30**: 332. 1938.
Fomes fusco-pallens Bres. *in* Hedwigia **56**: 294. 1915.

Basidioma sessile, dimidiate, 23 cm radius; upper surface covered by small warts, Sepia (Ridgway).
Section: cutis about 1200 μ thick, horny, fragmenting; context 7–8 mm thick, up to 40 mm at the base, Cinnamon Buff (Ridgway); tube layer up to 8 mm thick, Snuff Brown (Ridgway).
Cutis of the anamixoderm type with hyphae subparallel, densely impregnated by melanoid substances thus giving the illusion of brown hyphae. Context of light coloured hyphae 3 μ thick with no skeletal hyphae. Pores round, 100–125–150 μ in diam.; dissepiments 50–70–110 μ thick; distance between axes about 200 μ. Basidiospores ovoid to subspherical, chamois to brownish yellow, truncate at maturity, 7–7.7–8.5 × 5.5–6.0–6.5 μ.

Bresadola's original description of *Fomes fusco-pallens* states that the spores are globose and 3.5–4 μ in diameter; this would contradict the above-accepted synonymy. The loan of the type specimen from Stockholm showed however that it had spore and pore sizes and shapes identical with those of *Fomes mirabilis* specimens. The two taxa are also morphologically alike; all this confirms Humphrey's opinion that they are conspecific and that both have typical, although subglobose, *Ganoderma* spores. It may be reminded that Lloyd had already pointed out this synonymy in 1922.

SPECIMENS EXAMINED.—PHILIPPINE ISLANDS: Luzon, Bataan, s. hosp., E. D. Merrill 3693 (holotype of *Fomes fusco-pallens* Bres.), 69.S.1.
MALAYSIA: Pahang, Tembeling, parasitic on large Dipterocarp tree, E. J. H. Corner (Singapore Field 24,199), (Herb. M. A. Donk 8737), XI-1930, 66.L.133. — "Straits Settlements" s. loc., s. hosp., C. B. Ussher 12 (C. G. Lloyd Mycol. Coll. 38,731); IV-1910, 55.BPI.10 (Holotype) and 62.K.19.

GANODERMA PHILIPPII (Bres. & Henn.) Bres.
Figs. 2d, e, Pl. 1 fig. 4, Pl. 6 figs. 21, 22

Fomes philippii Bres. & Henn. *apud* Sacc., Syll. Fung. **9**: 180. 1881. — *Ganoderma philippii* (Bres. & Henn.) Bres., Iconogr. mycol. **21**: text to pl. 1014. 1932.
Fomes pseudoferreus Wakef. *in* Bull. misc. Inf. Kew **1918**: 208. — *Ganoderma pseudoferreum* (Wakef.) Over. & Steinm. *apud* Over. *in* Bull. Jard. bot. Buitenz. III **7**: 437. 1925.

There is considerable variation in the morphology of the basidiomata although the anatomical and spore characters are constant. The type specimen of *F. pseudoferreus*, kept in Kew, is unfortunately a small, non-fertile, misshapen specimen (6.5 cm in radius by 3.5 cm thick), almost useless for describing the gross morphology. On the other hand the type specimen of *G. philippii* is normal in shape but only a quarter or a third of it remains in Berlin. Both specimens have however a Bone Brown (Ridgway) upper surface.

In the twenty odd specimens available most basidiomata are very flat and thin with the upper surface Army Brown (Ridgway) to Bone Brown. Some have the upper surface finely concentrically grooved but with silvery patches and lines. Others have no apparent grooves while still others have a most irregular and knobbly upper surface. The basidiomata are mostly thin, not more than 10 mm towards the middle of the radius or sometimes in knobbly specimens up to 30 mm thick. In contrast the context colours are very constant, Tawny to Russet (Ridgway), interspersed with tiny, shiny, horny layers. The context seen in section is often marked by concentric lines of light and dark brown. Under the cutis there is a light brownish yellow zone. Tubes one-layered, 4–9 mm long, whitish ochraceous tawny, not matched in the Ridgway scale.

Cutis of the anamixoderm type (no external hyphae). Pores round, 80–125–240 μ in diam.; dissepiments 29–55–130 μ thick; distance between axes 160–180–205 μ. Spores obovoid, 6–7.5–8.5 × 4–5.2–8 μ, chamois. Only one specimen bears non-echinulate spores mixed with the normal 7–7.9–9.5 × 5.5–5.7–6 μ.

SPECIMENS EXAMINED.—INDIA: West Bengal, Sree mai Paliyn (low Chillagong hills), dead standing tree, R. S. Runge 470 (Herb. M. A. Donk 8727), 29-II-1921, 66.L.125.

BURMA: Mergui, s. hosp., T. Philippi s.n. (Holotype), 1846, 70.B.4.

MALAYSIA: s. loc., *Hevea brasiliensis*, K. P. Johr 858, (IMI 109,651), comm. 8-IX-1964, 68.K.48. — Selangor, Kuala Lumpur, s. hosp., W. N. C. Belgrave (holotype of *Fomes pseudoferreus* Wakef.), 1917. 55.K.6; Kuala Lumpur, *Hevea* stump no. 6, s. coll. (R.R.I.M.), 63.K.18–19; Sungei Lalang (20 miles south of Kuala Lumpur), s. hosp., J. Hadley, 1967, 69.K.19; Sungei Buloh Exp. Stn, *Hevea brasiliensis* (diseased rubber stump incubated under conditions ideal for continuous growth and spore production), B. Sripathi Rao (R.R.I.M. 871), IV-1970, 70.RRIM. 2; Sungei Buloh Expt Stn, *Hevea brasiliensis* dead as a result of red root disease, B. Sripathi Rao (R.R.I.M. 870), IV-1970, 70.RRIM.1; Kuala Lumpur, diseased *Hevea* stump, Lim Kow Ming (R.R.I.M. 877), 8-I-1971, 71.RRIM.1. — Pahang, Kuala Tekai, s. hosp., E. J. H. Corner (Singapore Field 24,890), 7-VI-1931, 55.K.9; Tembiling, s. hosp., E. J. H. Corner (Singapore Field 24,892), s. dat., 55.K.10. — Johore, Gunong Panti, parasitic at foot of large tree, E. J. H. Corner (Singapore Field 24,889), 16-IV-1931, 55.K.35.

SINGAPORE: Botanic Gardens, s. hosp., E. J. H. Corner (Singapore Field 24,887), 20-VIII-1931, 55.K.12; ditto (Singapore Field 24,888), 24-VIII-1931; ditto, E. J. H. Corner (Singapore Field 24,885), 28-VIII-1931, 55.L.11.

INDONESIA: Java, Buitenzorg, s. hosp., F. von Höhnel 1907–08, 69.K.136, 137; Hortus bogoriensis, afstervende *Albizia* boom, Nongnong (BO 1028), 66.L.35, 88; Buitenzorg, rottende stomp, C. van Overeem (BO 874), V-1922, 66.L.31; Depok (Natuurmonument) bij Buitenzorg, aan de voet van rottende stammen, J. G. B. Beumée (BO 2147), IV-1925, 66.L.52; West Java, s. loc., *Hevea*-boom, van der

Meulen (BO 8642), IX-1924, 66.L.87. — Sumatra, Bergen Est., *Hevea*, J. van Baalen (BO 14,992), VII-1934, 66.L.59, 60.

Ganoderma dejongii Steyaert, *sp. nov.* —Fig. 2f

Basidioma dimidiatum, semi-circulare, circiter 15 cm diam; pagina dorsalis applanata, olivaceo-nigra, languida; margo crassa alba.

Sectio: cutis leviter crassa, circiter 120 μ, nigra, subnitens; contextus usque ad 2/3 crassitudinis basidiomatis crassus, umbrinus, concentrice zonatus; tubuli unistratosi usque ad 1/3 crassitudinis basidiomatis longi, sepiacei.

Cutis anatomice anamixodermiformis, hyphis brunneis subparallelis leviter imbricatis. Pori circulares, 90–125–150 μ diam, dissepimentis 50–75–100 μ crassis, axibus circiter 200 μ distantibus. Basidiosporae ovoideae, maturitate truncatae, leviter brunneae, 7.5–7.9–8.5 × 5.5–5.6–6 μ.

Basidioma dimidiate, semi-circular, about 15 cm in diam.; upper surface applanate, Andover Green (Ridgway); about 30–40 mm thick at the base; margin thick (at least in growing specimens), white.

Section: cutis of medium thickness, 120 μ thick, black, somewhat shiny; context about 2/3 of the total thickness, Auburn (Ridgway), with concentric growth lines. Tubes about one third of the thickness of the basidiomata, Sepia (Ridgway).

Cutis of the anamixoderm type, made up mostly of subparallel anticlinal, brown hyphae, loosely intermixed. Pores round, 90–125–150 μ in diam.; dissepiments 50–75–100 μ thick; distance between axes about 200 μ. Basidiospores ovoid, truncate at maturity, light brown, 7.5–7.9–8.5 × 5.5–5.6–6 μ.

The specimen listed below was determined *in schedulis G. pseudoferreum* (Wakef.) Over. & Steinm. Although the basidiospores are undistinguishable from those of the latter species, the cutis anatomy, on the other hand, is very much at variance and so is the morphology of the basidiomata.

SPECIMEN EXAMINED.—INDONESIA: Java, Bogor (Buitenzorg), on *Albizia* sp., de Jong (Holotype, BO 14,994), VII-1934, 55.K.8.

GANODERMA WILLIAMSIANUM Murrill

Figs. 2g, h, 3a, b, Pl. 7 figs. 23, 24

Ganoderma williamsianum Murrill *in* Bull. Torrey bot. Club **34**: 478. 1907.

Basidioma generally dimidiate, semi-circular but becoming triquetrous with age, up to 15 cm in diam. and from 15 to 60 mm thick; upper surface dull brown or Hair Brown (Ridgway), with many narrow grooves; margin usually thin.

Section: cutis very thin, breaking easily, 20–30 μ thick; context usually half the thickness of the basidioma, sometimes only 3–4 mm thick, Russet (Ridgway); tubes usually up to 30 mm long but in ungulate specimens up to 50 mm, Cinnamon Brown (Ridgway).

Cutis of the anamixoderm type but composed of hyaline hyphae only, strongly impregnated with melanoid substances. Pores round, 100–160–250 μ in diam.; dissepiments 20–65–140 μ thick; distance between axes about 225 μ. Basidiospores ovoid, truncate at maturity, the echinulae thick and relatively few, slightly reddish brown, 9.5–12–14.5 × 6.5–8.5–10 μ; non-echinulate spores none too abundant, 11–13.1–14.5 × 7–8.7–10 μ. Hyphae grow in characteristic wavy or zig-zag manner.

The cutis anatomy of this species is unique. It can be placed more or less in the same group as *G. adspersum* but the long terminal, hyaline hyphae impregnated with melanoid substances sets it sharply apart. The most characteristic feature however is certainly the wavy course of the brown hyphae, unknown in any other species.

Holttum 11,355 is mentioned because of a correction that has to be made with regard to it. This specimen was determined by Stevenson & Cash (*1936*: 85) as *Fomes Petchii* Lloyd but it belongs unmistakably to *G. williamsianum*.

SPECIMENS EXAMINED.—PHILIPPINE ISLANDS: L u z o n, Prov. Bataan, Mt. Mariveles, Lamao River, s. hosp., R. S. Williams (Expl. of the Philippines 152; Holotype), I-1904, 66.NY. 12.

MALAYSIA: P a h a n g, Fraser Hill (alt. 4000 ft), s. hosp. R. E. Holttum 11,355, (Lloyd Mycol. Coll. 42,145), 4-IX-1923, 69.BPI.1, *vide infra*; Tembeling, s. hosp., E. J. H. Corner Singapore Field 23,693 (Herb. M. A. Donk 8734), 20-XI-1930, 66.L.124.

INDONESIA: S. loc., s. hosp., s. coll. (originally named *Boletus Apus odoratus*; *Ganoderma japonicum*, det. Bresadola), 66.L.15, 16. — J a v a, Hortus bogoriensis, stam van *Cinnamomum* sp. C. van Overeem (BO 161), VIII-1923, 66.L.76, 77, 78; Hortus bogoriensis, s. hosp., C. van Overeem (BO 619), I-1922, 66.L.93; Hortus bogoriensis, s. hosp., W. M. Docters van Leeuwen 3794 (BO 1638), 17-V-1919, 66.L.73, 74; Gunung Bundur, doode en afstervende stammen van *Albizia*, K. B. Boedijn 3635 (BO 14,494), 21-V-1933, 66.L.44; G. Salak, s. hosp., L. G. M. Baas Becking (BO 16,701), IV-1939, 66.L.36, 37. — S u m a t r a: Sebesie Isl., s. hosp., W. M. Docters van Leeuwen (BO 1584), IV-1921, 66.L., 94, 97, 98; Sumatra's Oostkust, Onderneming Haboko, s. hosp., W. M. Docters van Leeuwen 3349 (Bo. 1432), II-1919, 66.L.75, 95, 96.

Ganoderma donkii Steyaert, *sp. nov.*

Fig. 3c, Pl. 2 fig. 5, Pl. 5 fig. 16

Basidioma sessile, semi-circulare, triquetrum, 10–11 cm diam., ad basim 4–5 cm crassum; pagina dorsalis radialiter corrugata, concentrice cingulis griseis, cingulis latis olivaceis et cingulis angustis olivaceo-bubalinis zonata; margine similiter colorato.

Sectio: cutis 1000 μ crassa, sepiacea, dura; contextus 5–35 mm crassus, umbrinus, cum multis concretionibus directione hypharum parallelibus; tubuli 15 mm longi, umbrini.

Cutis anatomice anamixodermiformis, hyphis apice dense intricatis, ceracea. Pori circulares vel irregulares, 100–165–220 μ diam., dissepimentis 50–70–100 μ crassis, axibus circa 235 μ distantibus. Basidiosporae ovoideae, leviter brunneae, maturitate truncatae, 7.5–8.25–9 × 5.5–6.05–7 μ.

Basidioma sessile, semi-circular, triquetrous, 10–11 cm in diam. and 4–5 cm thick at the base; upper surface radially corrugated, concentrically zoned of Pearl Grey (Ridgway), wide bands dark Grayish Olive (Ridgway) and thin bands of Colonial Buff (Ridgway); wide margin of same colour.

Section: cutis 1000 μ thick, sepia, hard; context 5–35 mm thick, Brussels Brown (Ridgway), with many linear, horny deposits following the direction of the hyphae; tubes 15 mm long, concolorous with the context.

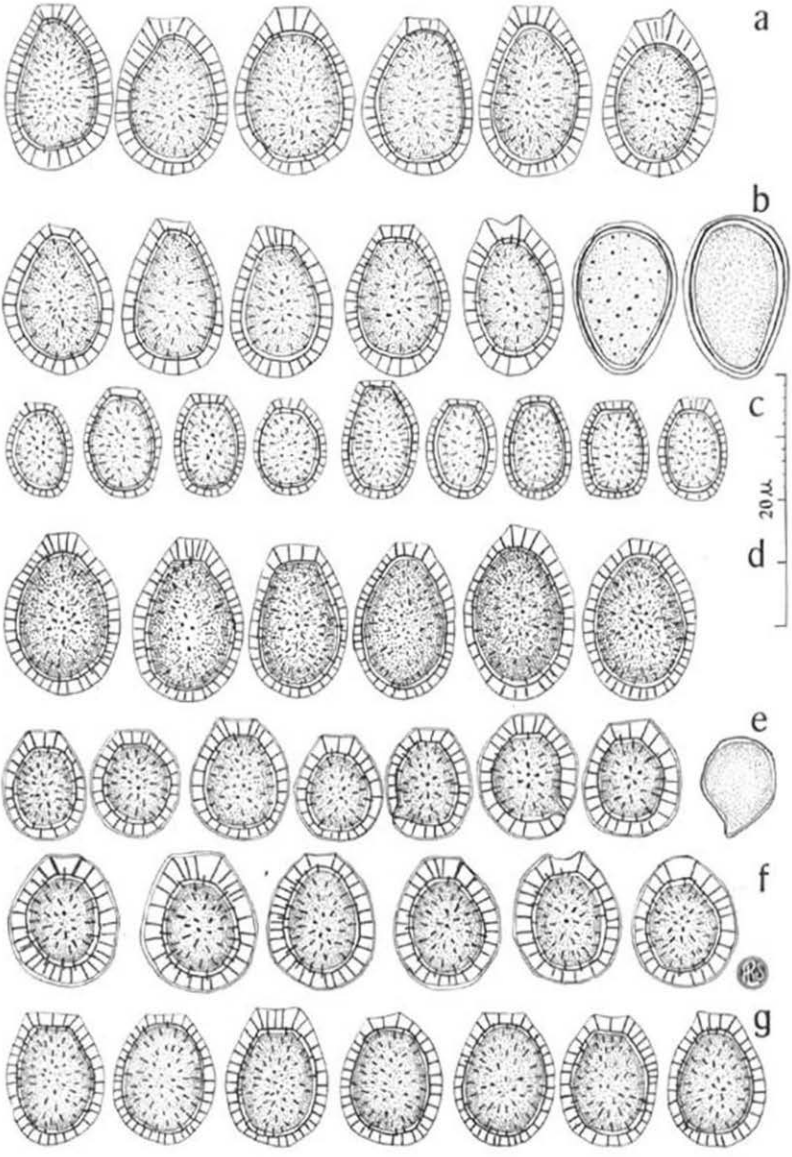


Fig. 3

Cutis of the anamixoderm type, with the hyphal extremities closely interwoven, hard. Pores round or irregular, 100–165–220 μ in diam.; dissepiments 50–70–100 thick; distance between axes about 235 μ. Basidiospores ovoid, slightly brownish, truncate at maturity, 7.5–8.25–9 × 5.5–6.05–7 μ.

SPECIMEN EXAMINED.—INDONESIA: West Java, s. loc., s. hosp., M. A. Donk 13,598, s. dat., 66.L.138 (Holotype), 66.L.139, 140 (Isotype).

Ganoderma puglisii Steyaert, *sp. nov.*
Fig. 3d, Pl. 2 fig. 6, Pl. 7 fig. 25

Basidioma sessile, dimidiato-ungulatum, saepe satis magnum, 36 cm diam. et 10–12 cm crassum, pagina dorsalis concentrice profunde corrugata, languida, griseo-olivacea.

Sectio: cutis 70–900 μ crassa, dura, ceracea, sepiacea; contextus tenuis, 5–13 mm crassus, umbrinus (cum maculis mycelii albi); tubuli usque ad 100 mm longi, stratosi, strata 5–20 mm crassa, vulgo albostriata, contextu nullo interposito, testacea.

Cutis anatomice characodermiformis, elementis apice leviter inflatis, ceracea. Pori circulares, 210–230–280 μ diam., dissepimentis 30–55–60 μ crassis, axibus circa 285 μ distantibus. Basidiosporae ovoideae, brunneo-fuscecentes, maturitate truncatae, 12–12.85–14 × 8–8.7–9 μ, echinulis crassis valde conspicuis.

Basidioma sessile, dimidiate, ungulate, becoming relatively large, 36 cm in diam. and 10–12 cm thick; upper surface deeply concentrically corrugated, dull, olivaceous-black.

Section: cutis 700–900 μ thick, horny, sepia. Context thin, 5–13 cm thick, Hazel (Ridgway), with flecks of white mycelium; tubes up to 100 mm long, finely striate with white, stratified; layers up to 5–20 mm thick, without intervening layers of context, Pecan Brown (Ridgway).

Cutis of the characoderm type, its elements slightly inflated at their extremity. Pores round, 210–230–280 μ in diam.; dissepiments 30–55–60 μ thick; distance between axes about 285 μ, Basidiospores ovoid, brown, more or less fuliginous, truncate at maturity, 12–12.85–14 × 8–8.7–9 μ.

This species, named after its Italian collector, is very close to *G. kosteri* Stey, but the cutis reminds one more of *G. pfeifferi* Bres. The spore size is however quite distinctive. In consulting Saccardo (*1916*) it was noticed that none of the eight Italian species and one variety he described has the large spores of *G. puglisii*. It would appear therefore that this species had remained undetected.

SPECIMEN EXAMINED.—ITALY: Potenza, Faggeto (30 km from Casso Castalda), Puglisi 1 (Holotype, BR), 19-VI-1965.

EXPLANATION OF FIGURE 3

Fig. 3. Basidiospores. — a, b. *Ganoderma williamsianum*: a, Holttum 11,355, 69.BPI.1; b, Boedijn 2625, 66.L.45. — c. *G. donkii*, Donk 13.598, 66.L.138. — d. *G. puglisii*, Puglisi 1, BR (Holotype). — e, f. *G. bruggemanii*: e, Bruggeman (BO 7304), 66.L.47 (Holotype); f, Donk 58, 66.L.50. — g. *G. tropicum*, Junghuhn, 66.L.9.

Ganoderma bruggemanii Steyaert, *sp. nov.*
Figs. 3c, f, Pl. 2 fig. 7, Pl. 7 fig. 26

Basidioma sessile vel pedicellatum, dimidiatum vel ungulatum; pagina dorsalis saepe laccata, gibbulosa, concentrice striata, margine albo et crasso.

Sectio: cutis tenuis, 110–130 μ crassa, atra; contextus 5–20 mm crassus, ochraceus, fulvo-zonatus, ad medium avellaneus; tubuli usque ad 35 mm longi, umbrini.

Cutis anatomice hymeniodermiformis, elementis claviformibus 30–40 μ longis, 8–12 μ diam. Contextus hyphis hyalinis et melleis in zonis hyphis densius coloratis et crassioribus intermixtis. Pori circulares, 180–260–370 μ diam.; dissepimentis 30–55–90 μ crassis, axibus circa 315 μ distantibus. Basidiosporae subsphaericae, 8.5–10–12 × 6.5–8.2–9.5 μ, luteo-brunneae.

Basidioma sessile or pedicellate, dimidiate or ungulate; upper surface normally laccate, black, sometimes dull reddish-black, coarsely striate and concentrically plicate; margin black, or thick and white.

Section: cutis thin, 110–130 μ thick, black; context 5–20 mm thick, Cinnamon Buff (Ridgway), with central zone Tawny Olive (Ridgway). Tubes up to 35 mm long, Saccardo Umber (Ridgway).

Cutis hymeniodermiform, its elements clavate, 35–40 μ long, 8–12 μ in diam. Context of thin hyphae, intermixed in the tawny olive zone with thicker, dark brown hyphae. Pores round, 180–260–370 μ in diam.; dissepiments 30–55–90 μ thick; distance between axes about 315 μ. Basidiospores subspherical, yellowish-brown, 8.5–10–12 × 6.5–8.2–9.5 μ.

G. bruggemanii is morphologically very close to *G. ostracodes* Pat. from La Pho, Tonkin (North Vietnam), Demange 328 (FH 3344) although according to the type specimen the latter is of a dull dark brown colour; the context and tube layers however are in both cases concolorous, Cinnamon Buff (Ridgway).

On the other hand the cutices are anatomically very different; the elements of *G. ostracodes* are very thin and more or less wavy, whereas in *G. bruggemanii* they are thick, straight, club-shaped, and well individualized. The spores in *G. ostracodes* are also smaller, being 7–7.35–7.5 × 5.5–5.7–6 μ.

SPECIMENS EXAMINED.—INDONESIA: J a v a, Tjibodas, Gunung Gedeh, s. hosp., M. L. A. Bruggeman (BO 7304), 14-I-1926, 66.L.47 (Holotype BO, fragment in BR); Tjibodas, G. Gedeh. s. hosp., K. B. Boedijn & M. A. Donk (Herb. M. A. Donk 8753), 8-VII-1934, 66.L.111; G. Patuha, above Tjimanggu, s. hosp., M. A. Donk 58 (BO 18,243), 24-IX-1941, 66.L.50, 51.

GANODERMA TROPICUM (Jungh.) Bres.
Figs. 3g, 4a, Pl. 2 fig. 8, Pl. 8 fig. 28

Polyporus tropicus Jungh. *in* Verh. Bataviaasch Genootsch. **17** (II): 63. 1838 ["1839"]. — *Ganoderma tropicum* (Jungh.) Bres. *in* Annls mycol. **8**: 586. 1910.
Ganoderma oroleucum Pat. & Har. *in* Bull. trimest. mycol. Soc. Fr. **22**: 118. 1906.

Basidioma dimidiate, flabelliform, up to 12 cm in diam.; upper surface usually black, laccate with fine, radial and concentric folds or grooves, with white margin

when in full growth; pore surface white when fresh, Cinnamon to Clay (Ridgway) when dry.

Section: cutis thin, about 65–70 μ thick; context up to 10 mm thick, divided about equally in a Cinnamon (Ridgway) upper part and a Walnut (Ridgway) lower part next to the tube layer; tube layer up to 10 mm thick, one-layered, Verona Brown (Ridgway).

Cutis hymeniodermiform, its elements subovoid to subcylindrical, 30–35 × 5–6 μ. Context in the upper part made up of light coloured hyphae 3 μ thick, those of the darker layer with brown hyphae up to 4.5 μ thick. Pores round, 80–145–240 μ in diam.; dissepiments 20–55–190 μ thick; distance between axes about 205 μ. Basidiospores ovoid, brown chamois, 8.5–9.9–12 × 6–7.3–8 μ.

SPECIMENS EXAMINED.—INDONESIA: Java: s. loc., s. hosp., F. W. Junghuhn (L 910.222–3540), s. dat., 66.L.9 (Holotype); Hortus bogoriensis, s. hosp., s. coll. (BO 7306), XII-1924, 66.L.69; Klangon bij Madiun, op *Cassia javanica*, L. G. E. Kalshoven (1665a) (BO 1920), II-1925, 66.L.105; between Tjibodas and Tjibeureum, s. hosp., J. Westenberg (BO 17,132) 13-VII-1929, 66.L.86; Surabaja, Simpang Park, op een dood boom-stompje, W. C. van Heurn (herb. M. A. Donk 8762), III-1934, 66.L.116; Surabaja, s. hosp., W. C. van Heurn (herb. M. A. Donk 8749), s. dat., 66.L.126, 127; Surabaja, s. hosp., W. C. van Heurn (herb. M. A. Donk 8750), XII-1933, 66.L.131. — Sumatra, Sumatra's Westkust, Batang Palupa(h) (1000 m), aan de voet van dode boomstam, E. Jacobson (BO 6813), 19-VII-1924, 66.L.82.

The Paris Museum specimens Zollinger, Plantae javanicae 2087, 53.PC.9 and Java, s. loc., Serre (Consul de France), 53.PC.15 belong to this species.

Ganoderma weberianum (Bres. & Henn.) Steyaert, *comb. nov.*
Figs. 4b, c, d, e, Pl. 3 fig. 9, Pl. 8 figs. 29, 30

Fomes weberianus Bres. & Henn. *in litt. apud* Sacc., Syll. Fung. **9**: 174. 1891.
Ganoderma rivulosum Pat. & Har. *in* Bull. trimest. Soc. mycol. Fr. **22**: 119. 1906.

Basidioma sessile to long, horizontally pedicellate. Pileus flabelliform to conchate, up to 13 cm in diam., Blackish Brown (Ridgway) to Mars Violet (Ridgway) gradually changing to Orange Rufous (Ridgway) towards the margin, which is pure white only at the very edge, rivulose with narrow grooves. Stipe, when present, usually short and stumpy but sometimes up to 11 cm long and only 7–8 mm in diam.

Section: cutis very thin, only 20–30 μ thick, context up to 15 mm thick, Light to Warm Buff (Ridgway), Buckthorn Brown (Ridgway) near the tube layer. Tube layer at most half the thickness of the basidioma, concolorous with the lower part of the context.

Cutis hymeniodermiform, the elements either 30 μ long by 7–8 μ thick at the tip or 20 μ long by 10–12 μ thick, in the latter case with thick deposits of melanoid substances within the cutis elements along the cell wall, leaving an empty central column (see comments below). Context made up of thin, yellowish hyphae, without brown hyphae, often with an abundance of gasterospores, in which case the cutis elements are of the second type, short and thick; frequently also with only a few gasterospores, the cutis is then of the first type; exceptionally only without or with few gasterospores. Pores round, 80–140–240 μ in diam.; dissepiments 20–60–180 μ

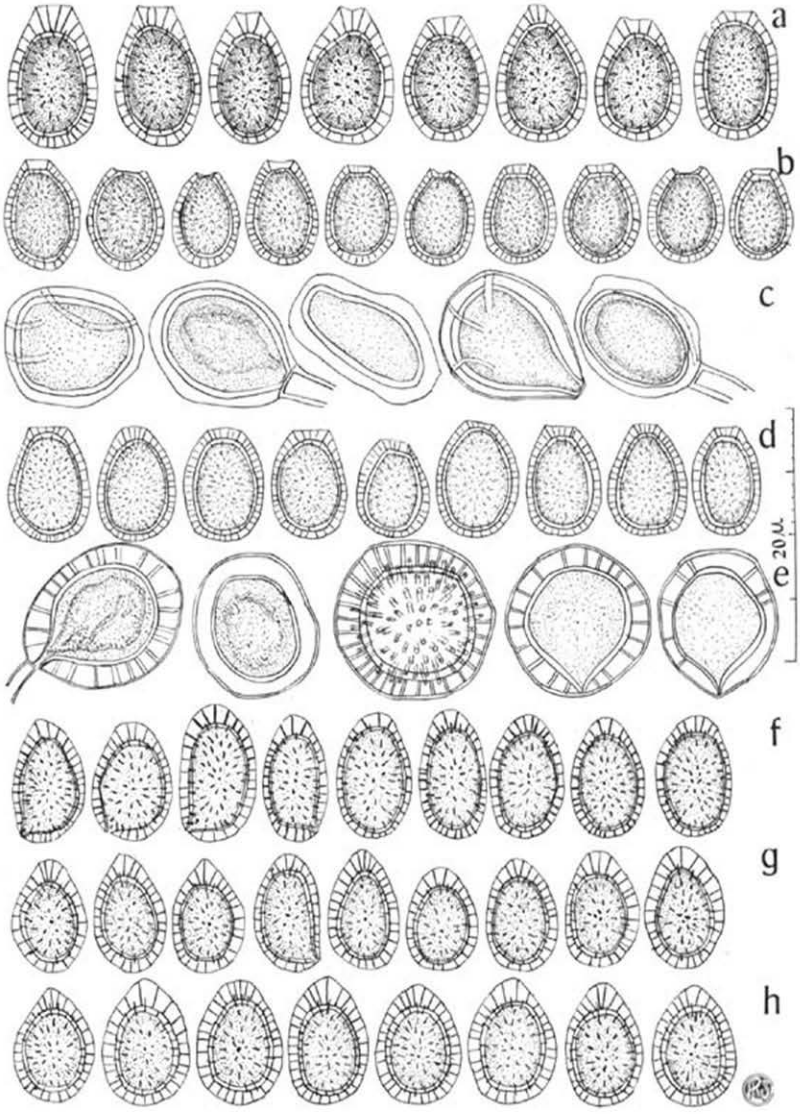


Fig. 4. Basidiospores (mainly). — a. *Ganoderma tropicum*, Kalshoven 1665a, 66.L.105. — b–e. *G. weberianum*: b, Boedijn 1035, 66.L.57, basidiospores: c, ditto, gasterospores; d, Donk (BO 18,030), 66.L.72, basidiospores; e. ditto, gasterospores. — f–h. *G. flexipes*: f, Eberhardt 103, 53.PC. 44; g, Joshi (holotype of *G. lucidum* f. *naiae*); h, Maas Geesteranus 14,510, 66.L.8.

thick; distance between axes about 195 μ. Basidiospores ovoid, thin-walled, the echinulae barely visible, very light yellowish, 6–8.0–10 × 4.5–5.9–7 μ. Gasterospores generally spherical but often spindle-shaped, normally with concentric double walls kept apart by columns or partitions 1–1.5 μ high, sometimes with single walls or with double walls without columns or partitions.

It seems that the basidiospores have lost much of their propagation potential; many basidiomata bear either few normal spores or the latter may be non-echinulate. In other instances gasterospores may be produced profusely; in some specimens the context may be choked up with them. It probably means that they play an important rôle in the propagation of the fungus.

It should be noted that the gasterospores may vary to a large extent in size and shape. If the majority of them are spherical, double-walled with cristae separating the walls, a high proportion of the gasterospores are either spherical but lacking the cristae or are variable in shape and cristate or not cristate.

Although the type localities for *G. weberianum* and *G. rivulosum* are Samoan and Javanese respectively, the species has probably a world wide tropical distribution. It is at least abundant in Africa and probably extant in tropical America although no specimen has been available from this region.

As to differences in the cutis anatomy, either the cutis elements are long, relatively narrow and with very little deposit of melanoid substances or they are short and thick with heavy deposit of melanoid substances within the elements. Taking into consideration the existence of these two types of cutis anatomy one could be tempted to believe in the existence of two distinct taxa. Yet, all the other characters, such as gross morphology, spores, gasterospores, sizes of the pores are absolutely identical. The difference in cutis anatomy must then have a reason.

If one sorts out the iconography of the examined specimens and arranges them according to the two types of cutis anatomy, one is struck by the difference in gasterospore development. Those of the first type of cutis anatomy, viz. those with long and narrow cutis elements, have very few gasterospores (Fig. 29) whereas those with an abundance of this kind of spores have a cutis anatomy of the second type (Fig. 30). On examining the two microphotographs it can be noticed that in the latter there is a relative paucity of hyphae producing cutis elements. This indicates that the gasterospores are produced at the expense of the hyphae. As lesser hyphae arrive at the cutis level their tips find more space to expand than in those basidiomata with relatively few gasterospores, where the hyphae reaching the cutis level are much more numerous. Their tips therefore have individually much less room to expand, and the cutis elements are for that reason thinner and more elongated.

The latter type should be considered normal. It has still to be explained what produces the abundance of gasterospores and consequently the other type of cutis anatomy. An explanation might perhaps be found by observing the stage of decay of the host. A possible hypothesis might be that the further the decay has advanced the more the fungus must raise its propagation potential and the more gasterospores are produced. This is perhaps an anthropocentric manner of reasoning but the

suggestion amounts to assuming either an abundance or a dearth of nutriment.

It happens that the holotype specimens of *Fomes weberianus* and *Ganoderma rivulosum* both have the cutis anatomy with the long and narrow elements, although in the type of *G. rivulosum* the elements are somewhat more swollen than in that of *G. weberianum*.

The variation in the cutis anatomy is also observable in the African specimens.

SPECIMENS EXAMINED.—SAMOA ISLANDS; s. loc., s. hosp., G. Weber (Holotype), s. dat., 70.B.5.

INDONESIA: J a v a: Gedangan, Onderzoek naar de flora der Djatibossen, Pilawa 2639 (BO 16,586), 17-VII-1936, 66.L.56; Island Nusa Kambangan, op hout, K. B. Boedijn 1035 (BO 12,054), s. dat., 66.L.57, 58; Rawah near Tangerang, on rotten stumps which are inundated several times a year, alt. 2500 m, M. A. Donk R7 (BO 18,030), s. dat., 66.L.70, 71, 72; Buitenzorg (Bogor), Hortus bogoriensis, s. hosp., J. Massart 827 (BO 3345), XI-1894, 66.L.79; Hortus bogoriensis, aan de voet van *Photinia serrulata*, C. en D. van Overeem-de Haas 25 (BO 523), 25-II-1921, 66.L.83; Surabaja, stadstuin, s. hosp., W. C. van Heurn (herb. M. A. Donk 8745), IV-1935, 66.L.129, 130; Surabaja, op een reeds sedert jaren dooden stronk, in een stadstuin, W. C. van Heurn (herb. M. A. Donk 8747), II-1936, 66.L.109, 110; Surabaja, s. hosp., W. C. van Heurn (herb. M. A. Donk 8748), 2-IV-1936, 66.L.117, 118; Surabaja, op een dooden boomstronk, W. C. van Heurn (herb. M. A. Donk 8744), 5-XI-1935, 66.L.132. — I r i a n B a r a t (W. New Guinea), Meervlakte, in een bosrand, H. J. Lam 1089 (BO 2255), 8-IX-1920, 66.L.53, 54.

GANODERMA FLEXIPES Pat.

Figs. 4f, g, h, Pl. 3 fig. 10, Pl. 9 fig. 31

Ganoderma flexipes Pat. *in* Bull. trimest. Soc. mycol. Fr. **23**: 75. 1907.
Ganoderma lucidum var. *naiae* Chona & Munjal *in* Indian Phytopath. **8**: 189. 1956 ("1955").

Basidioma pulvinate, up to 85 mm in diam.; stipitate; upper surface very irregular, warty, vaguely plicate, Roods Brown (Ridgway); stipe up to 170 mm long, 15 mm thick, but sometimes nearly sessile.

Section: cutis thin, about 150 μ thick, soft, Roods Brown (Ridgway); context mostly thin, up to 8 mm at the base, white or Light Buff (Ridgway); tubes up to 6 mm long, in a single layer, Clay (Ridgway).

Cutis hymeniodermiform, the elements about 30 μ long, 6—7 μ in diam. at the top. Context made up mostly of fine, hyaline hyphae. Pores round, 100—150—200 μ in diam.; dissepiments 10—40—90 μ thick; distance between axes 150—180—200 μ. Basidiospores ovoid, with non-collapsible permanent apex, brownish yellow, 8—9.9—13 × 5.5—6.5—8 μ.

It should be noticed that the two specimens of the Everest Expedition 1953 (RLS.61.K.26 and 106) bear in the context spherical gasterospores which are either crested or smooth, 5.4–5.8–7 μ in diameter.

The basidiospores have the peculiarity of usually keeping their apex unaltered at maturity; a few show however a slight flattening at the very tip.

The stipe may vary to a great extent in length and breadth. The holotype (Eberhard 103) has a stipe 170 mm long and 7 mm thick; on the other hand there are also some subsessile specimens, such as S. Ahmad (Fungi of W. Pakistan 14,183). The collection Maas Geesteranus 14,510 (RLS. 66.L.7, 8; now destroyed) had thick and short stipes, 100 × 15 mm. Joshi's specimen has a stipe 100 × 7 mm.

It seems possible that *Polyporus pisachapani* Bl. & Nees belongs to this species but this can not be proved otherwise than through its outer morphology known only from a plate showing a monstrosity.

SPECIMENS EXAMINED.—VIETNAM: Annam, s. loc., s. hosp., Eberhardt 103 (Holotype) 1912, 53.PC.44.

NEPAL: Himalaya, s. loc., alt. 4500 m, s. hosp., s. coll. (Everest Expedition), 1953, 61.K.26, 106.

INDIA: Uttar Pradesh, Mussoorie near Charleville, alt. about 2000 m, gregarious particularly under *Quercus incana*, R. A. Maas Geesteranus 14,510, 13-IX-1964, 66.L.7, 8 (later completely destroyed by insects). — Himachal Pradesh, Simla, Christian Lodge, alt. 2160 m, in dead humus [?] on ground, L. M. Joshi (holotype of *G. lucidum* f. *naiae* Chona & Munjal., VII-1949).

PAKISTAN: Murree, alt. 2100 m, on pieces of buried wood, S. Ahmad (Fungi of W. Pakistan 2470), VIII-1948, 58.LAH.2, 7, 8; Swar States, s. loc., alt. 1950 m, s. hosp., S. Ahmad (Fungi of W. Pakistan 14,183), 22-VIII-1952, 58.LAH.5, 9; Kagan Valley, Sharhan, alt. 2400 m, s. hosp., S. Ahmad (Fungi of W. Pakistan 14,387), s. dat., 59.LAH.5.

Ganoderma trulla Steyaert, *sp. nov.*
Fig. 5a, Pl. 3 fig. 11, Pl. 9 fig. 32

Basidioma lateraliter et horizontaliter stipitatum; pileus reniformis, diametro transversali 30–75 mm et radio longitudinali 25–40 mm; pagina dorsalis concentrice tenuiter undulata et radiatim gibboso-rugata; margine atro, strati tubulorum crassitudinem aequante; stipes 35–80 mm longus et 5–10 mm crassus, fusco-niger, nitens.

Sectio: cutis nigra, nitens, circa 50 μ crassa; contextus umbrinus, 2–7 mm crassus; tubulorum strata 1–2, usque ad 10 mm crassa, sepiacea.

Cutis hymeniodermiformis, elementis cylindraceis, rigidis, circa 20 μ longis et 3 μ diam. Contextus hyphae rectae, leniter coloratae, imbricatae. Pori circulares, 120–140–160 μ diam., dissepimentis 20–45–70 μ crassis, axibus 195 μ distantibus. Basidiosporae ovoideae, interdum apice truncatae, luteo-brunneae, 9.5–10–11 × 6.5–7.1–8 μ, echinulis pro rata paucis crassisque.

Basidioma horizontal and pleuropodial; pileus kidney-shaped, 30–75 mm in transversal diam. longitudinal radius 25–40 mm, Dusky Purplish Gray (Ridgway), shiny; upper surface with fine concentric undulations and lumpy radiating folds; margin black, shiny, as thick as the tube layer.

Section: cutis black, shiny, very thin, 50 μ thick; context Hazel (Ridgway),

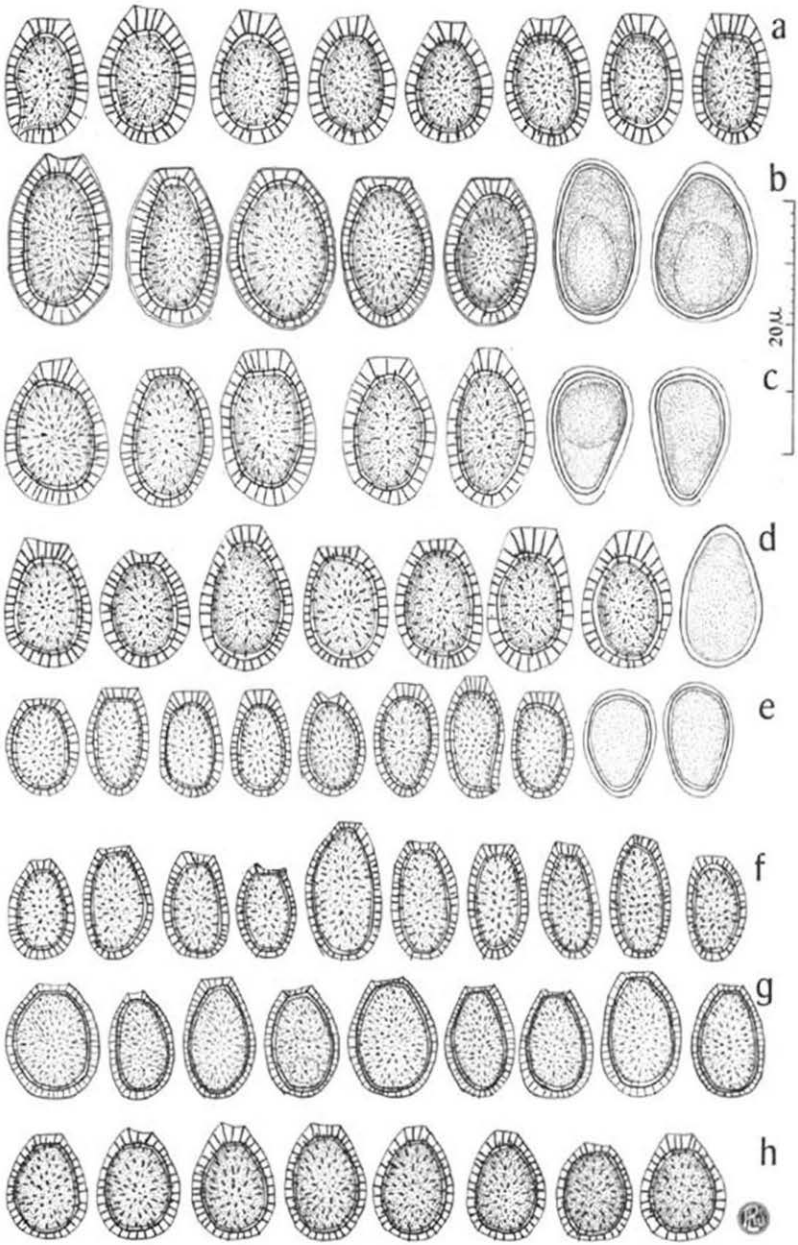


Fig. 5

2–7 mm thick; tubes in one or two layers without prominent separating layer, each layer up to 10 mm thick, Snuff Brown (Ridgway).

Cutis hymeniodermiform, with cylindrical rigid elements 20 × 3 μ. Context hyphae more or less rigid, anticlinal but very much intermixed, light coloured. Pores round, 120–140–160 μ in diam.; dissepiments 20–45–70 μ thick; distance between axes about 195 μ. Basidiospore ovoid, the apex flat at maturity, brownish yellow, with relatively few thick echinulae, 9.5–10–11 × 6.5–7.1–8 μ.

SPECIMENS EXAMINED.—INDONESIA: Java, Buitenzorg (Bogor), Hortus bogoriensis, s. hosp., s. coll. (BO 5511), 66.L.101 (Holotype), 102 (Isotype).

Ganoderma trulliforme Steyaert, *sp. nov.*

Figs. 5b, c, Pl. 3 fig. 12, Pl. 9 fig. 33

Basidioma ostreiforme, lateraliter et horizontaliter stipitatum, atronitens, usque ad 110 mm diam.; pagina dorsalis concentrice irregulariter late undulata et radialiter inconspicue paullum rugata, margine atro, strati tubulorum crassitudinem aequante. Stipes in paginam dorsalem insertus, 100 mm longus, 15 mm diam.

Sectio: cutis nigra, laccata, circa 180 μ crassa; contextus 2 mm usque ad stipitem 15 mm crassus, badius senato-zonatus; tubulorum stratum 1–18 mm crassum, umbrinum.

Cutis hymeniodermiformis, elementis plusminusve sphaero-pedunculatis cum hyphis contextus continuis sed paullum distinctis, 30–35 × 9–10 μ, hyphis hyalinis et brunneis contextus in substantia melanoides conglobatis. Pori circulares, 100–167–210 μ diam., dissepimentis 30–55–110 μ crassis, axibus circa 220 μ distantibus. Basidiosporae subellipsoideae, 10–11.7–13.5 × 6–7.2–9 μ, echinulis interdum numerosis sed pro rata longis et valde conspicuis.

Basidioma with ostreiform pileus, pleuropodial, up to 110 mm in diam.; upper surface with irregularly spaced undulations and some inconspicuous radial folds; margin black, as thick as the tube length; stipe inserted partly on upper surface, up to 100 mm in length and 15 mm thick, laccate, black.

Section: cutis black, laccate, some 180 μ thick; context from 2 mm near margin up to 15 mm near insertion of stipe, Chestnut (Ridgway) with zone Mars Yellow (Ridgway); tubes in one layer, up to 18 mm thick, Cinnamon Brown (Ridgway).

Cutis hymeniodermiform with spheropedunculate elements, which are continuous with, and not distinct from, the context hyphae and 30–35 μ long and 7–10 μ thick at the tip, with hyaline and brown hyphae embedded in melanoid substances. Pores round, 100–165–210 μ diam.; dissepiments 30–55–110 μ thick; distance between axes about 220 μ. Basidiospores subellipsoid, at maturity with truncate apex, yellow, 10–11.7–13.5 × 6–7.2–9 μ; echinulae well visible, rather numerous, but long and moderately thick.

SPECIMENS EXAMINED.—INDONESIA: Java, Priangan, Pengalengan, Gunung Kantjana, s. hosp., A. Maitland (BO 11,047), X-1929, 66.L.66 (Holotypus); Gunung

EXPLANATION OF FIGURE 5

Fig. 5. Basidiospores. — a. *Ganoderma trulla*, BO 5511, 66.L.101 (Holotype). — b, c. *G. trulliforme*: b, Maitland (BO 11,047), 66.L.66 (Holotype); Vischer (BO 1862), 66.L.32. — d. *G. petchii*, Petch 3238, 69.K.87 (Holotype). — e. *G. amboinense*, Schuitemaker (BO 13,446), 66.L.43 (Neotype). — f. *G. subtornatum*, Williams, 69.NY.10 (Holotype). — g. *G. lamaoense*, Williams 153?, 69.NY.26 (Holotype). — h. *G. leytense*, Elmer 7213 (Holotype).

Salak near Buitenzorg (Bogor), rottend hout, W. Vischer (BO 1862), X-1921, 66.L.32; Tjibodas, stam (?), K. B. Boedijn 3062, (BO 15,007), VII-1934, 66.L.33, 34, 103, 104; Tjibodas, Gunung Gedeh, s. hosp., K. B. Boedijn et M. A. Donk (herb. M. A. Donk 8456), VII-1934, 66.L.114, 115.

Ganoderma petchii (Lloyd) Steyaert, *comb. nov.*
Fig. 5a, Pl. 9 fig. 34

Fomes petchii Lloyd, Mycol. Writ. **4** (Syn. Fomes): 268. 1915; Petch *in* Ann. R. bot. Gdns Peradeniya **6**: 133. 1916; Trotter *in* Sacc., Syll. Fung. **23**: 392. 1925 (Latin diagnosis).

Some confusion has arisen concerning this species since a specimen belonging to *G. williamsianum* (Stevenson & Cash, *1936*: 85) was mistakenly determined as *G. petchii* and since Lloyd's type specimen had been reported as unretrievable. It should be noticed however that Stevenson & Cash cite a specimen '3235' whereas Petch mentions his as '3238'. Was '3235' a misprint or did the two authors look for the wrong specimen?

In the Kew herbarium two half basidiomata are found under the collection number Petch 3238. These show a remarkable likeness of Lloyd's (*1915*) published figure 605 of *Fomes petchii*.

Considering the similarity it may be presumed that Lloyd when he described *Fomes petchii* had in hand the two corresponding halves at Kew. It must be concluded then that the type is still extant if not in BPI then in any case as Petch's collection at Kew. As stated above Lloyd's figure 605 fits exactly one of the Kew specimens of Petch's collection No. 3238. It also shows that Lloyd's illustration is life-size.

Basidioma pulvinate, ungulate, laterally stipitate,[1] some 70 mm in radius, 30–40 mm thick, somewhat concentrically corrugated especially on the more vertical sides, Hessian Brown (Ridgway).

Section: cutis thin, at the most 100 μ thick; context thin, at the most 7–8 mm thick, two-coloured, upper half Cinnamon Buff (Ridgway), half nearest tube layer Pecan Brown (Ridgway) to Rood's Brown (Ridgway); tubes in one layer or in two (one rather thin), Mikado Brown (Ridgway).

Cutis hymeniodermiform, the elements claviform, about 6 μ thick at the top, about 25 μ long with skeletal hyphae in the sub-cutis. Context principally of sinuate, poorly coloured hyphae; generative hyphae in the upper part with denser skeletal hyphae in the lower part. Pores very regularly round, 140–170–210 μ in diam.; dissepiments 20–35–60 μ thick; distance between axes about 205 μ. Basidiospores ovoid, truncate at maturity, with long thick echinulae, 9.5–10.5–11.5 × 6.5–7.2–7.5 μ; non-echinulate spores obpyriform, 11 × 6.5–7 μ, yellowish, rare.

The last two specimens cited below have a short stipe.

It should be noticed that *G. petchii* (Lloyd) Stey. and *G. boninense* Pat. are very

[1] According to Petch's description. The two Kew specimens are without a stipe, but the stipe may have broken off when the specimens were cut into halves. The two Javanese specimens mentioned may therefore be a more complete representation of the species.

similar as to their outer morphology. The spores however are very different, those of *G. boninense* being rather narrowly ellipsoid with short echinulae, approximately 0.5 μ long, whereas the echinulae of *G. petchii* are at least 1 μ long and up to 2 μ at the apex of the spores.

Although the cutis elements are longer and thinner in *G. boninense* than in *G. petchii* it needs careful scrutiny to distinguish the two species by their cutis anatomy. Therefore in the absence of spores, which is the case in the Javanese specimens, care must be taken in directing the sectioning of the cutis so that the elements can be properly observed. This and the fact that the Javanese specimens have a second layer of tubes (a feature that has not yet been observed in *G. boninense* although an appreciable number of them have been examined) seems to justify their inclusion in *G. petchii*. The stipes are another feature in favour of this conclusion.

SPECIMENS EXAMINED.—CEYLON: Hakgala, s. hosp., (Petch's name not given but label is in his handwriting) 3238, V-1910, 69.K.87 (Holotype), 69.K.88 (Isotype).
INDONESIA: Java, Udjong Kulon, s. hosp., P. F. Franck (BO 13,988), s. dat., 66.L.67, 68.

GANODERMA CHALCEUM (Cooke) Steyaert

Polyporus cupreus Fr. *in* Nova Acta R. Soc. Sci. upsal. III **1**: 64. 1851, non *P. cupreus* Berk. 1839. — ≡ *Polyporus chalceus* Cooke *in* Trans. Proc. bot. Soc. Edinb. **13**: 135. 1878. — *Ganoderma chalceum* (Cooke) Stey. *in* Bull. Jard. bot. Brux. **37**: 481. 1967.

The various sizes recorded for the set of specimens cited below are within the limits observed previously (Steyaert, *1967b*). Basidiospores 8.5–10–11.5 × 4.5–5.9–7.5 μ. Pores 80–140–210 μ. Dissepiments 20–55–110 μ thick. Distance between axes of pores 155–195–245 μ. Non-echinulate spores 8.5–10–12 × 5–6.1–7 μ.
There is a slight discrepancy in that the non-echinulate basidiospores have a maximum breadth of 7 μ whereas the maximum recorded previously was 5.5 μ.

The determination of König's specimen as *Boletus polymorphus* Hoffm. appears to have no relationship with a type specimen. This ante-Friesian binomial is currently considered to be a synonym of *Trametes odorata* (Wulf. ex Fr.) Fr.

SPECIMENS EXAMINED.—CEYLON: s. loc., ad radices arborum in lucis et ad truncos putrides cocciferarum, [J. G.] Konig (L 910.219–543), 66.L.10, 11;
INDONESIA: Kalimantan (Borneo), Karimata, s. hosp., Mondih (BO 12,473), III-1931, 66.L.27, 41; Nunukan (northern part), s. hosp., W. Meijer (BO 18,157), 28-X-1953, 66.L.80, 81. — Java: unlocalized but perhaps Java, s. hosp., s. coll. (L 910.217–515), 66.L.12; Isl. Nusa Kambangan, s. hosp., A. J. G. H. Kostermans & C. L. L. H. van Woerden (BO 16,634), XI-1938, 66.L.39, 40, 65; ditto (BO 16,644), 66.L.33; Buitenzorg (Bogor), Hortus bogoriensis, on palm deeri (spiny palm), Nongnong (BO 5898), XI-1924, 66.L.90; Gunung Salak, s. hosp., W. Vischer (BO 1862), X-1921, 66.L.99; Grisée (sea level), on dead stem of *Arenga saccharifera*, W. C. van Heurn (Herb. M. A. Donk 8758, 8759), 13-IX-1926, 66.L.112, 113.

NEW GUINEA: s. loc., s. hosp., W. E. de M. Armit (L 910.252-1710), s. dat., 66.L.17, 18.

MALAGASY (Madagascar): Soaniëran'a-Antasibé, (alt. 250 m), dead wood, H. J. Lam et A. D. J. Meeuse 5829, (L 938.93-186), 9-XII-1938, 66.L.19, 20.

GANODERMA AMBOINENSE (Lam. ex Fr.) Pat.
Fig. 5c, Pl. 4 fig. 13, Pl. 10 fig. 35

Agaricus amboinensis Lam., Encycl. méth. Bot. **1**: 51. 1783. — *Polyporus amboinensis* (Lam.) *ex* Fr., Syst. mycol. **1**: 354. 1821. — *Ganoderma amboinense* (Lam. ex Fr.) Pat. *in* Bull. Soc. mycol. Fr. **3** (3): 171. 1888.

Lamarck, who introduced the name *Agaricus amboinensis*, referred to Rumphius' "Herbarium amboinense" (**6**: *pl. 57 fig. 1*). This figure shows a pulvinate fungus with a long and thin stipe. Merrill (*1917*), in the same publication in which he neotypified *G. cochlear*, designated the collection Robinson No. 572 as the neotype of *G. amboinense*. Attempts to locate this specimen or parts of it had no better results than in the case of *G. cochlear q.v.*; neither of the two neotypes has been found. It is therefore necessary to try a second neotypification, a procedure that must heed the original description or illustration or the opinion of former authors. Merrill wrote, "I have little hesitation in interpreting true *Ganoderma amboinense* (Lam.) Pat, as the form currently known as *Ganoderma rugosum* Bres." It is not possible to agree with this opinion. Rumphius' illustration of his *Agaricus amboinensis* is very much at variance with *G. rugosum*, which typically has a central stipe, whereas *G. amboinense* is definitely pleuropodial. Fortunately the Bogor herbarium possesses a specimen which corresponds fairly well with Rumphius' illustration; the pileus is decidedly smaller but it would be a miracle if a second specimen exactly the same were collected. Consequently the Bogor specimen is here chosen as neotype.

Basidioma stipitate; pileus 25 mm in radius, 35 mm broad and 20 mm thick, shiny laccate, Blackish Brown (Ridgway), the upper surface concentrically corrugated, attached laterally to a knobbly stipe 80 mm long and 4–8 mm thick and like the pileus black, shiny laccate.

Section: cutis 60 μ thick, shiny black; context 2 mm thick, Vinaceous Tawny (Ridgway) to Pecan Brown (Ridgway); tubes 15 mm long, Rood's Brown (Ridgway).

Cutis hymeniodermiform with club-shaped elements 28 μ long 4–5 μ thick at the top. Pores round, 70–80–90 μ in diam.; dissepiments 70–90–100 μ thick; distance between axes about 170 μ. Basidiospores ellipsoid, very light chamois, 7.5–8.4–9 × 5–5.35–6 μ. Non-echinulate spores same colour, 7.5–8.3–9 μ.

The second collection cited below, this time of a sessile basidioma, has all the anatomical and microscopic characters of the neotype: same type of hymenioderm, same type and dimensions of the spores. The size of the pilei and the colours of the context are also similar.

SPECIMENS EXAMINED.—INDONESIA: Kalimantan (Borneo), Pontianak, s. hosp., J. P. Schuitemaker (BO 13,446), s. dat., 66.L.43 (Neotype). — Riau Archipelago, Pulau Durian, s. hosp., Rachmat (BO 1822), s. dat., 66.L.84, 85.

GANODERMA SUBTORNATUM Murrill
Fig. 5f, Pl. 10 f. 36

Ganoderma subtornatum Murrill *in* Bull. Torrey bot. Club **34**: 477. 1907.

Ganoderma subtornatum Murrill has given rise to many misinterpretations. The name would suggest that it is closely related to *G. tornatum* (Pers.) Bres., yet when one reads Murrill's original description it will be noticed at once that there are significant differences; the upper surface is described as "shining-black" and the context as "punky, white above, chestnut-colored below." This shows it to be very unlike *G. tornatum*, which has a dull dark brown upper surface and a nearly uniformly Bay coloured context. Graff (*1921*) went so far as to reduce *G. subtornatum* to the rank of a variety of *G. tornatum*, notwithstanding Murrill's description opposes such an association in all details.

Anatomically the difference is clearly demonstrated by the fact that the type specimen has a cutis of the characoderm type (Steyaert, *1961a*: 70) and thereby belongs to another section of the genus than *G. tornatum*. The other basidiomata that Murrill cited do not agree with his description. There exists in the New York herbarium another collection numbered 153 marked "type". It is made up of two basidiomata (RLS.69.NY.26, 27), the context of which is bay brown but is largely replaced by discoloured white hyphae. Both these two specimens have a typical hymenioderm. The collections Elmer 7213 and 6943 are both different species. This is not all: where there are several basidiomata in one collection these may be a mixture of species, for instance, Elmer 7213 in Kew (RLS.62.K.48; see *G. leytense* Stey.) is a different species from Elmer 7213 in New York (RLS.69.NY.11), which belongs to *G. chalceum* (Cooke) Stey.

In view of this extreme confusion it is imperative to amplify and redress the description of the type specimen:—

Basidioma spathulate, about 45 mm in diam.; dorsal surface black, shiny laccate, concentrically grooved; margin recurved, shiny laccate.

Section: cutis about 250 μ thick, black, shiny; context 3–4 mm thick, chamois above, chestnut close to the tube-layer. Tubes one-layered, light brown, about 7 mm long.

Cutis of the characoderm type, the elements about 30 × 3 μ; melanoid substances barely soluble by KOH. Some skeletal hyphae reaching into the cutis. Pores round, small, 80–90–110 μ; dissepiments 40–55–70 μ thick; distance between axes about 150 μ. Basidiospores ellipsoid, light chamois, 7.5–9.1–11 × 5–5.3–6 μ.

SPECIMEN EXAMINED.—PHILIPPINE ISLANDS: L u z o n, Prov. Bataan, Mt. Mariveles, Lamao River, s. hosp., R. S. Williams (N.Y. Bot. Gdn Expl. Philipp. 153), XI-1903, 59.NY.10.

Ganoderma lamaoense Steyaert, *sp. nov.*
Fig. 5g, Pl. 10 fig. 37

Ganoderma subtornatum Murrill *in* Bull. Torrey bot. Club **34**: 477. 1907 in part.

Among the many specimens identified by Murrill as *G. subtornatum* Murrill but whose characters do not correspond with the original description there are two specimens that bear collectively the number 153; they have been given our numbers 69.NY.26 and 27. These specimens are marked "type" but they are not mentioned by Murrill in any special way. The author wonders whether there has not been a mistake in including these two specimens in the type because of the great differences with regard to the description. They are more suggestive of *G. tornatum*, if only the external morphology is taken into consideration by which they do not correspond at all with Murrill's description of *G. subtornatum*. All things considered there appears to be no justification to assign to those two specimens the status of either holotype (see under *G. subtornatum*) or isotype.

This conclusion was not rashly made: it rests on careful consideration of the available evidence necessitated by the fact that several species are involved. These two specimens do not correspond to any species known to the author; they are therefore described as representing a new species.

Basidioma flabelliforme, substipitatum, diametro transversali 60–120 mm, ad basin usque ad 20 mm crassum; stipes usque ad 10 mm longus; pagina dorsalis fere applanata, concentrice leviter undulata.

Sectio: cutis brunneo-atra, circa 25 μ crassa; contextus usque ad 10 mm crassus, lateritius pro majore parte plagis hypharum albarum successus); tubulorum stratum 1, usque ad 10 mm crassum, lateritium.

Cutis hymeniodermiformis, elementis subcylindricis, apice fere subsphaericis 35–40 × 7 μ, valde regulariter dispositis. Hyphae contextus rectae, circa 6 μ crassae, cum hyphis ligativis 2–3 μ crassis intermixtae. Pori circulares, parvi, 80–110–130 μ diam., dissepimentis 30–80–160 μ crassis, axibus 160–190–220 μ distantibus. Basidiosporae ovoideae, flavae, 8–9.3–10 × 5.5–6.3–7.5 μ, echinulis inconspicuis pro rata numerosis.

Basidioma flabelliform, substipitate, 60–120 mm in diam., up to 20 mm thick at the base, stipe up to 10 mm long; upper surface nearly plane, only slightly concentrically undulate, Blackish Brown (Ridgway).

Section: blackish brown, about 25 μ thick; context up to 10 mm thick, Van Dyck Brown (Ridgway) (but nearly completely replaced by large patches of white discoloured hyphae in both specimens); tubes in one layer, up to 10 mm long, Van Dyck Brown (Ridgway).

Cutis hymeniodermiform, with nearly cylindrical elements scarcely subspherical at the tip, 30–40 μ long, 6 μ in diam. and very regularly arranged. Context hyphae straight about 6 μ in diam., intertwined by binding hyphae about 2–3 μ thick. Pores round, small, 80–110–130 μ in diam.; dissepiments 30–80–160 μ thick; distance between axes of pores 160–190–280 μ. Basidiospores ovoid, light chamois, 8–9.3–10 × 5.5–6.3–7.5 μ, with short inconspicuous relatively numerous echinulae.

SPECIMENS EXAMINED.—PHILIPPINE ISLANDS: L a m a o, s. loc., alt. 150 m, s. hosp., R. S. Williams? 153, XI-1903, 69.NY.26 (Holotype). 69.NY.27 (Isotype).

Ganoderma leytense Steyaert, *sp. nov.*

Fig. 5h, Pl. 10 fig. 38, Pl. 11 fig. 39

Basidioma sessile, flabelliforme, usque ad 80 mm diam., pagina dorsalis concentrice corrugata, subnitens, atro-vinosa.

Sectio: cutis 120 μ crassa, atro-nitens, mollis; contextus ferrugineus, usque ad 8 mm crassus (interdum aliquot plagis decoloratis hypharum albarum successus); tubulorum stratum 1, usque ad 10 mm crassum, umbrinum, a contextu haud circumdatum.

Cutis hymeniodermiformis, elementis sphaeropedunculatis circa 16–17 μ longis, circa 4 μ diam. Hyphae contextus atro-brunneae anticlinae, subrectae, tenuiter ramosae; hyphae hyalinae in cutis elementa terminantes. Pori circulares, 100–118–140 μ diam.; dissepimentis 30–50–70 μ crassis; axibus circa 170 μ distantibus. Basidiosporae ovoideae, brunneae 8–8.8–9.5 x 6.5–6.8–7 μ.

Basidioma sessile, flabelliform, up to 80 mm in diam.; upper surface with concentrical irregularly spaced corrugations, somewhat shiny, black vinaceous (Ridgway: not matched.).

Section: cutis 120 μ thick, soft, shiny black; context Kaiser Brown (Ridgway), up to 8 mm thick (with a few blotches of discoloured white tissue); tubes up to 10 mm long, Cinnamon Brown (Ridgway), in one layer, not enveloped at margin by context and cutis.

Cutis hymeniodermiform; elements spheropedunculate, about 16–17 μ long and about 4 μ in diam. Context hyphae dark brown, sub-erect, little branched; hyaline hyphae ending up in the cutis elements. Pores round, 100-118-140 μ in diam.; dissepiments 30–50–70 μ thick; distance between axes about 170 μ. Basidiospores ovoid, brown, 8–8.8–9.5 × 6.5–6.8–7 μ.

The Elmer collection 6943 has been included in this species for its spore and cutis characters but its outer morphology shows some discrepancy.

As already stated under *G. subtornatum*, Elmer 7213 (69.NY.11; in NY) belongs to *G. chalceum* (Cooke) Stey. This is an example that shows the confusion and the misunderstanding that may arise when portions of a single collection are sent abroad as duplicates. It should be pointed out that the specimen Elmer 7213 (62.K.48) is one of the paratypes of the name *G. subtornatum*.

One cannot but stress the need for utmost caution in selecting subsidiary types and duplicates. The greatest care should be taken that all features, including microscopic ones, agree. Otherwise the distribution of subsidiary types or duplicates may become nothing but a damaging practice.

When possible the best way to proceed is to distribute portions of the holotype accompanied by natural-size photographs made of the entire specimen before it is cut up.

SPECIMENS EXAMINED.—PHILIPPINE ISLANDS: Leyte, Palo, s. hosp., A. D. E. Elmer 7213, I-1906, 62.K.48 (Holotype). — Luzon, Prov. Bataan, Mt. Mariveles, s. hosp., A. D. E. Elmer 6943, XI-1904, 60.NY.9.

INDONESIA: Verlaten Island, dead stems, K. B. Boedijn 2551 (BO 14,293), IV-1933, 66.L.30.

Ganoderma ahmadii Steyaert, *sp. nov.*

Fig. 6c, Pl. 4 fig. 14, Pl. 11 f. 40

Basidioma latum, leviter infundibuliforme, mesopodium. Pileus circularis; pagina dorsalis in centro sublucida et fusco-nigra, ad marginem fulva, parte intermedia annulis plusminusve

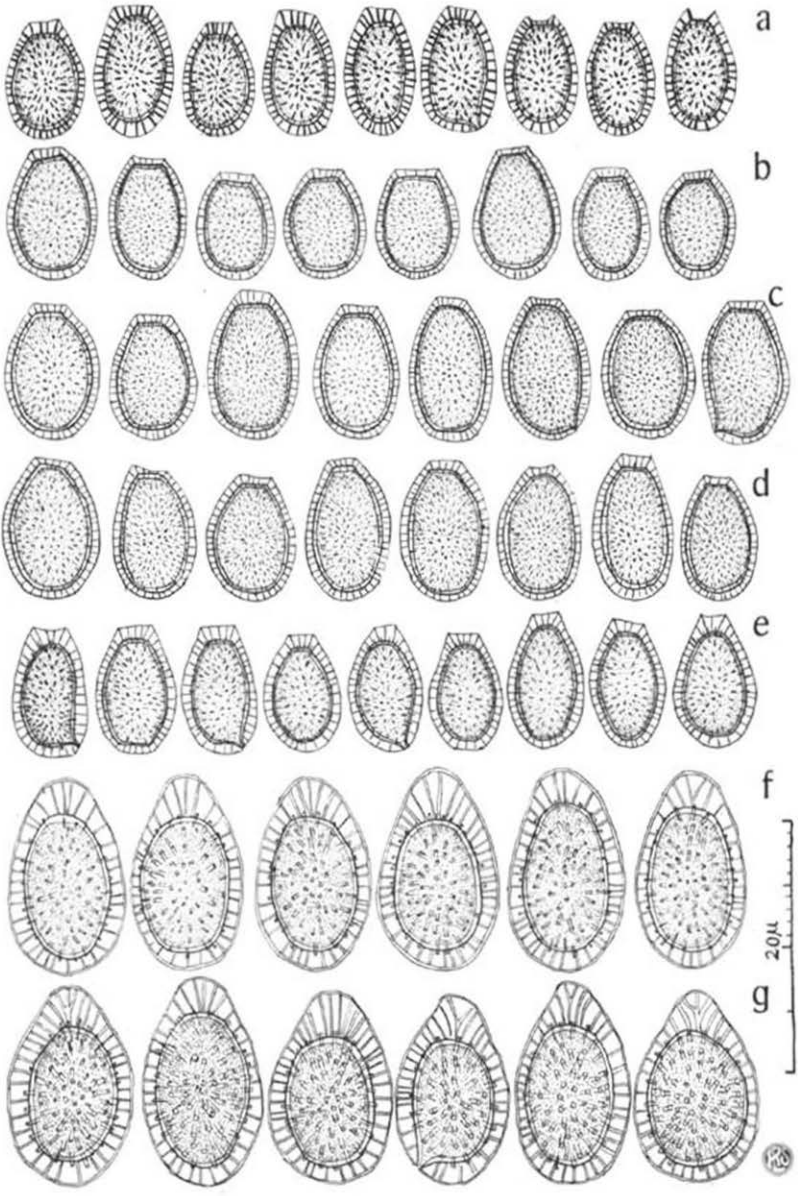


Fig. 6

distinctis alternis umbrinis et fulvis ornata; pagina ventralis in sicco albo-grisea vel avellanea, margine tenui, albo. Stipes fusco-niger, laccatus, usque ad 50 mm longus, circa 15 mm crassus.

Sectio: 1) Pileus: cutis tenuissima, vix 30 μ crassa; contextus prope cutem roseo-bubalinus, in medio usque ad tubulorum stratum brunneo-vinosus; tubuli isabellini, usque ad 5 mm longi. 2) Stipes: cutis nigra, nitida; contextus ut pilei contextus bicolor.

Cutis hymeniodermiformis, elementis claviformibus ad cylindricis, circa 25 μ longis, 4–5 μ latis. Contextus hyphae luteo-brunnescentes, 3–4 μ latae, sinuatae et ramosissimae, cum hyphis hyalinis elementis cutis producentibus intermixtae. Pori circulares, 110–159–220 μ diam.; dissepimentis 30–45–70 μ crassis; axibus circa 180–205–245 μ distantibus. Basidiosporae ovoideae, luteae 8–9.6–11 × 5.5–6.4–7 μ.

Basidioma wide and shallow, funnel-shaped, mesopodial. Pileus round, somewhat shiny, from Blackish-Brown (Ridgway) in the centre to Cinnamon-Rufous (Ridgway) at the margin with more or less distinct alternate rings Chestnut-Brown (Ridgway) and Cinnamon-Rufous (Ridgway) in between. Pore surface Greyish to Clay colour (Ridgway) when dry. Margin thin, white. Stipe Blackish Brown (Ridgway), laccate, up to 50 mm long and about 15 mm thick.

Section: (i) Pileus, cutis very thin, at most 30 μ thick; context near cutis Cinnamon Buff (Ridgway) in the middle down to the tube layer Verona Brown (Ridgway). Tubes Cinnamon Buff (Ridgway) up to 5 mm long. (ii) Stipe: cutis, black, laccate, context two-coloured like the pileus context.

Cutis hymeniodermiform, the elements claviform to cylindrical, about 25 μ long and 4–5 μ wide. Context hyphae yellow-brown, 3–4 μ thick, sinuate and much ramified, mixed with hyaline hyphae that produce the cutis elements. Pores round, 110–159–220 μ in diam.; dissepiments 30–45–70 μ thick; distance between pore axes 180–205–220 μ. Basidiospores ovoid, yellow, 8–9.6–11 × 5.5–6.4–7 μ.

SPECIMENS EXAMINED.—PAKISTAN: Sialkot, on *Dalbergia sissoo*, S. Ahmad (Fung of W. Pakistan 14,329), XI-1958, 58.LAH.15 (Holotype), 58.LAH.16, 17; Kagan Valley, s. hosp., S. Ahmad (Fungi of W. Pakistan 14,700), 20-VIII-1959, 59.LAH.1; Sialkot, s. hosp., M. Akram, VIII-1959, 59.LAH.8; Sialkot, on stumps of *Acacia arabica*, M. Akram (Fungi of W. Pakistan 14,702), VIII-1959, 59.LAH. 9, 10, 11.

INDIA: Uttar Pradesh, Dehra Dun, on stumps of *Areca catechu*, B. K. Bakshi (DD H. 5316), 26-VIII-1949, 58.DD.14.

GANODERMA LUCIDUM (Curtis ex Fr.) Karst.

Boletus lucidus Curt., Fl. londin. **2**: *pl. 224*. 1781. — *Polyporus lucidus* (Curt.) ex. Fr., Syst. mycol. **1**: 533. 1821. — *Ganoderma lucidum* (Curt. ex Fr.) Karst. *in* Revue mycol. **3** / No. 9: 17. 1881.

Boletus laccatus Timm, Fl. megalop. Prodr. 269. 1788. — *Polyporus laccatus* (Timm) *ex* Pers., Mycol. europ. **2**: 54. 1825.

EXPLANATION OF FIGURE 6

Fig. 6. Basidios pores. — a. *Ganoderma lucidum*, Harper, 66.L.21. — b–d. *G. resinaceum*: b Boudier?, 69. PC. 1 (Holotype); c, Welden 257, 66.L.22; d, Timber and Forest Disease Survey 12,123, 69.NY.24 (holotype of *G. sessile*). — e. *G. ahmadii*, Ahmad (Fungi of W. Pakistan 14,329), 58.LAH.15. — f, g. *G. colossus*: f, Welden 2408, 66.L.25; g, Oersted, 58.UPS.1 (Holotype).

The *Ganoderma lucidum* complex, viz. those species whose cutis of the basidioma is of the hymenioderm type, has long been a stumbling block for taxonomists. Too much stress has been laid on whether the basidiomata are sessile or stipitate. *Ganoderma lucidum* was considered the stipitate and *G. resinaceum* the sessile form. This distinction is not borne out by the microscopic characters. When one examines in detail a rather large set of specimens one is struck by the clear-cut differences shown by the spores, to which Haddow (*1931*) had already called attention some forty years ago and which the author of the present paper also stressed at the Third European Mycological Congress at Glasgow in 1963 (Steyaert, *1967a*).

There are spores with relatively few, long and thick echinulae and others with numerous, short and thin echinulae (Steyaert, *1967a*: figs. 17 and 18). Haddow called these the "rough" and the "smooth" types and associated *G. lucidum* and *G. oregonense* with the first and *G. sessile* with the second type. The author confirms what Haddow wrote (p. 39): "The writer, therefore, unhesitatingly concludes that *G. lucidum* and *G. sessile* are distinct species each of which is found in Europe and America . . .."

While the types of *G. resinaceum*, *G. sessile*, and of other species are still in existence there is unfortunately no type specimen of *G. lucidum*, although there is an illustration of it. The binomial *G. lucidum* stems from *Boletus lucidus* published in Curtis's "Flora londinensis", 1781 (Steyaert, *1961b*). A beautiful plate in colour of a pedicellate basidioma collected in Peckham, in the South London area, illustrates the text. As the specimen does not exist anymore the illustration is to be considered the substitute type. Unfortunately it does not reveal the morphology of the spore. It is possible however to form an opinion of it in an indirect way. On the other hand the types of *G. resinaceum* Boud. apud Pat. (see following species) and *G. sessile* Murrill have spores undistinguishable from each other; in both they are of the "smooth" type, viz. with relatively numerous, short, and thin echinulae. Attempts to find a neotype for *G. lucidum* in the type locality (Peckham) have failed; only a public park remains. A remnant of woodland in a neighbouring area gave no better results. Karsten, who published the genus *Ganoderma* in 1881 has left a specimen in H. This specimen has spores of the "rough" type. Thus if Karsten's specimen is selected as the neotype it will be possible to arrive at a satisfactory *modus vivendi* for distinguishing between the two species.

Basidioma sessile dimidiate or stipitate either centrally, excentrally, or laterally. Pileus up to 200 mm in diam.; upper surface radially and concentrically plicate, usually irregular, sometimes warty, usually laccate, shiny, from Brick Red (Ridgway) to Blackish Brown (Ridgway); margin usually thick, white in actively growing specimens, turning yellowish, orange, and reddish brown from the extreme outline inward, of same colour as upper surface in mature specimens, then somewhat reflexed. Stipe blackish brown, up to some 100 mm long. (Stipes are not an exclusive characteristic of *G. lucidum*).

Section: 15–20 mm thick at mid-radius, thicker at the base; cutis thin, black, shiny; context about as thick as tube layer, but thicker toward the base, Pale Ochraceous Buff (Ridgway) in the upper parts, usually lighter, nearly white when fresh

to Russet (Ridgway) in a narrow layer close to the tube layer; tube layer about 10 mm thick, Tawny (Ridgway).

Cutis hymeniodermiform, its elements (when fully developed, viz. when upper surface is shiny black brown) up to 50 × 9 μ, swollen by melanoid substances easily soluble in KOH. Pores more or less rounded, often very irregular, 120–195–390 μ; dissepiments 10–65–390 μ thick; distance between axes 195–265–400 μ. Basidiospores obovoid, chamois, 8.5–10.8–13 × 5.5–7–8.5 μ, echinulae comparatively few, long and thick (Fig. 6a).

There may be some variation in the size of the elements of the cutis. Normally they fall within the extremes given above, but in some specimens they may be much shorter and more blunt. They may also vary in size within one specimen, the shorter elements being found in the more recently formed parts of the basidioma. In the stipe—when there is one—the elements are always the longest.

In the Harper specimen the cutis is a brownish yellow, very fragile and brittle. The cutis elements are barely 15 μ long.

There is also variation in the colour of the context. Karsten's specimen has a context practically totally white while the tube layer is of a very light cocoa colour. The more southward on the European continent, the more coloured the context becomes; a Portuguese specimen (Pinto-Lopes 863) has the context variegated with brown stripes; the context of an African specimen from the slopes of Mount Ruwenzori has patches of shades of a light reddish brown. Perhaps the darkening of the colour of the context is due to the gradual increase in the mean temperature from north to south, and from the higher to the lower altitudes.

SELECTED SPECIMENS EXAMINED.—FINLAND: Aboa, Runsala, s. hosp., P. A. Karsten (Fungi Fenn. exs. 239 in H) a. 1858.

[EUROPE], s. loc., s. coll., s. dat. (Herb. Persoon, L 910.263–590, as *Polyporus laccatus*), 54.L.2.

U.S.A.: Illinois, s. loc., on *Quercus coccinea* var. *tinctoria*, E. T. & S. A. Harper, 66.L.21.

GANODERMA RESINACEUM Boud. apud Pat.
Figs. 6b, c, Pl. 11 f. 41

Ganoderma resinaceum Boud. *apud* Pat. *in* Bull. Soc. mycol. Fr. **5**: 72. 1889.
Ganoderma chaffangeonii Pat. *in* Bull. Soc. mycol. Fr. **5**: 74. 1889.
Ganoderma sessile Murrill *in* Bull. Torrey bot. Club **29**: 604. 1902; in N. Am. Fl. **9**: 120. 1908.
Polyporus polychromus Copel. *in* Annls mycol. **2**: 507. 1904. — *Ganoderma polychromum* (Copel.) Murrill *in* N. Am. Fl. **9**: 119. 1908.
Ganoderma praelongum Murrill *in* N. Am. Fl. **9**: 121. 1908.
Ganoderma argillaceum Murrill *in* N. Am. Fl. **9**: 122. 1908.
Ganoderma subperforatum Atk. *in* Bot. Gaz. **46**: 337. 1908.

Under *Ganoderma lucidum* we have discussed the distinction between two spore types: the *G. resinaceum* spores, as evidenced by Boudier's specimen at PC, are of what Haddow called the "smooth" type. The word 'smooth' is properly speaking

incorrect as there are numerous, short and thin echinulae between endo- and episporium, as is revealed by the use of an oil immersion objective but not with a dry one of relatively low magnification. In the latter case the spores appear to be smooth, whereas the echinulae are visible in the "rough" or *G. lucidum* type of spores.

Basidioma dimidiate to flabelliform, substipitate to long stipitate, usually laterally, sometimes centrally stalked; pileus very variable in size, may reach 220 mm in breadth or 150 mm in radius in the middle, often very irregular in shape; upper surface shiny laccate, May's Maroon (Ridgway) or nearly black in fully mature pilei, may have a thick white margin when these are not mature, gradually turning yellow, red, brown, and finally black from the margin toward the base.

Section: cutis thin, about 100 μ thick, shiny black. Context from white to Cinnamon Buff (Ridgway) in the upper parts but with zone close to tube layer Cacao Brown (Ridgway).

Cutis of the hymenioderm type with subcylindrical elements 45–55 × 9–12 μ. Pores from somewhat rounded to very irregular 90–210–760 μ; dissepiments 20–35–50 μ; distance between axes 180–275–440 μ. Basidiospores from subellipsoid to broadly ovoid, chamois, 8–10.6–13 × 6.5–7.1–9.5 μ with short, thin, closely packed echinulae.

Considering the characters of the basidiomata and paying special attention to those of the spores (sizes, colour, type of echinulation), it becomes evident that *G. resinaceum* has a respectable synonymy. The distribution of this species then becomes extended from Venezuela through the West Indies, North America to the Euro-Asiatic continent and to Central Africa, but in the latter continent it is restricted in the tropical regions to the central highlands.

The typification of *G. sessile* is open to doubt. Although the specimen on *Liquidambar styraciflora* mentioned above is marked as the type in the New York herbarium it was not listed by Murrill when he described the species. His list is to be taken as one of examples of the specimens that were sent to him; none of these bears indications that would point to the type. It is possible that Murrill himself indicated the type in the herbarium but he did not publish his choice until later (1908: 120), selecting Ellis & Ev., Fungi columb. 202.

SPECIMENS EXAMINED.—FRANCE: Blois (Blesiacum, *fide* Pat. *in* Bull. Soc. mycol. Fr. **5**: 72. 1889), s. hosp., J. L. E. Boudier (Holotype), s. dat., 69.PC.1.

U.S.A.: Louisiana, St. Tammamy parish, Slidell, A. L. Welden 257 (distributed as *G. sessile*, Murrill from NO) 19-I-1956, 66.L.22; s. loc., on dead fallen trees of *Liquidambar styraciflora*, s. coll. (Timber and Forest Disease Survey 12,123; as *G. sessile* Murrill), s. dat., 69.NY.24, — California, Searsville, on *Quercus lobata*, E. B. Copeland (holotype of *G. polychromum* (Copel.) Murrill), X-1902, 55.NY.23. — Ohio, Chillicote, growing among *Datura stramonium*, M. E. Haid & G. F. Atkinson (CUP 19,560; holotype of *G. subperforatum* Atk.), 69.CUP.5.

CUBA: Prov. Santiago de Cuba, Alto Cedro, S. F. Earle & W. A. Murrill 536 (holotype of *G. praelongum* Murrill), 19-20-III-1905, 55.NY.15; Prov. de Habana,

vecindad de Santiago de las Vegas, Fecha, F. S. Earle 658 (holotype of *G. argillaceum* Murrill), 56VII-1904, 55.NY.19.

VENEZUELA: s. loc., s. hosp., J. Chaffangeon (holotype of *G. chaffangeonii* Pat.), s. dat., 53.PC.40.

GANODERMA COLOSSUS (Fr.) C. F. Baker
Figs. 6f, g, Pl. 11 fig. 42

Polyporus colossus Fr. *in* Nova Acta Soc. Sci. upsal. III **1**: 56. 1851. — *Dendrophagus colossus* (Fr.) Murrill *in* Bull. Torrey bot. Club **32**: 473. 1905. — *Tomophagus colossus* (Fr.) Murrill *in* Torreya **5**: 197. 1905. — *Ganoderma colossus* (Fr.) C. F. Baker, V Cent. Fungi. Malay. No. 425. 1918, on sheet with index to the series.

Ganoderma obockense Pat., Hymen. Eur. 63. 1887; *in* Bull. Soc. mycol. Fr. **3** (3): 119. 1887.

Polyporus hollandii Mass. *in* Bull. misc. Inf. Kew **1901**: 163.

Basidioma dimidiate, bulky, up to 350 mm in radius and 90 mm thick, soft, tender, light-weight; upper surface dull to somewhat shiny, Mars Yellow (Ridgway) to approximately Buffy Brown (Ridgway); pore surface probably white when in full growth but quickly a dark Buffy Brown or Buffy Citrine (Ridgway) when dried.

Section: cutis very thin, dark dull yellow, scaling off easily; context usually two thirds of the thickness of the basidioma, Chamois (Ridgway); tube-layer up to 30 mm thick, Buffy Brown (Ridgway).

Cutis hymeniodermiform; elements club-shaped, about 40 μ long and 7–8 μ thick at the top. Pores round to irregular, 180–315–420 μ in diam.; dissepiments 20–72–180 μ thick; distance between axes 345–385–480 μ. Basidiospores ovoid, chamois, 13–16.3–19.5 × 8–9.7–12.5 μ; echinulae about 1 μ long at the sides, up to 4 μ long at the apex which does not collapse at maturity or exceptionally only slightly so. Gasterospores globular, covered with short, stumpy spines or ridges, chamois, 16–18–21 μ.

Murrill, considering the tumid aspect of the basidioma, was of the opinion that segregation of the present species from *Ganoderma* was justified. He called the new genus *Tomophagus* after the name *Dendrophagus* had been found preoccupied. It is easy to agree that the outer morphology of this particular species is very much at variance with that of the bulk of the species of *Ganoderma*. Yet, when the anatomical features are considered it is impossible to find any outstanding characters departing from those of *Ganoderma*: the cutis anatomy is hymeniodermiform, the context hyphae have all the features of those of *Ganoderma*, viz. the skeletal hyphae produce hyaline, thinner hyphae that form the cutis elements, and the spores are also typical of *Ganoderma*, although their features are considerably amplified. On the other hand, even if it is true that exclusion of *G. colossus* on the basis of its deviating anatomy is not justified, there is little doubt that the species has quite an isolated position in the genus. It belongs evidently to the group of species with a hymeniodermiform cutis, of which *G. lucidum* is the outstanding representative. The outer morphology of *G. colossus* would justify setting up within this group a sub-group. *Ganoderma nevadense* Murrill could be placed in its neighbourhood because apparently its morphology shows many similarities but such a grouping of species would need further study.

SPECIMENS EXAMINED.—COSTA RICA: pr. Puntanera, ad caudices *Cedrelae odoratae*, A. S. Oersted (Holotype), s. dat., 58.UPS.1.

MEXICO: Yautepec, Town Plaza, on *Platanus*, P. A. Lemke, 17-VIII-1961.

SURINAME: Santo Boma Banana Expt Stn, s. hosp., A. L. Welden 2408 (Fungi of Suriname 00304, in L), 9-VII-1961, 66.L.25.

SENEGAL: s. loc., on *Acacia adansonii*, s. coll., s. dat., 53.PC.32.

NIGERIA: 20 miles south of Ibadan, on *Gmelina arborea*, s. coll., 12-V-1953, 55.K.78; Old Calabar, s. hosp., J. A. Holland 21 (holotype of *Polyporus hollandii* Mass.), s. dat., 54.K.28.

CHAD: dist. Baguirmi, s. loc., s. hosp., A. J. B. Chevalier 11,422, VIII-1902, 53.PC.33.

CAMEROONS: s. loc., s. hosp., T. D. Maitland 29, 1929, 55.K.28.

ZAIRE: s. loc., s. hosp., Dewèvre s. n. (BR), 1897; Ubangi, Binga, sur troncs brulés, M. Goossens-Fontana 2053 (BR), s. dat.; s. loc., s. hosp., M. Goossens-Fontana 959 (BR), s. dat.

PAKISTAN: Lahore, Botanic Garden, on bamboo stumps, S. Ahmad (Fungi of W. Pakistan 8050, 8058), 3-I-1954, 58.LAH.6, 13; Lahore, on stump of *Morus alba*, S. Ahmad (Fungi of W. Pakistan s.n.), 62.LAH.1; Sialkot, Marala headworks, on trunk of *Ficus religiosa*, S. Ahmad (Fungi of W. Pakistan 21,219), 6-IX-1968, 68.LAH.3, 4.

INDIA: Bombay, on stump of *Tectona grandis*, Chanda 1/54, 12-X-1954, 58.DD.17.

CEYLON: Tirukovil, s. hosp. Petch 5827, s. dat., 55.K.29.

Humphreya Steyaert, *gen. nov.*

Basidioma convexo-infundibuliforme, meso- vel pleuropodum, brunneo-griseum. Contextus melleus, hyphis peri- vel pantoclinis.[2]

Cutis circa 150 μ crassa, distincte delimitata, substantia melanoidea illae generis *Ganoderma* similis sed magis cornea, glauca et natura distincte diversa. Basidiosporae bitunicatae, episporium endosporiumque cristis reticulatis vel disjunctis separata.

SPECIES TYPICA. — *Ganoderma lloydii* (Pat. & Har.) Trott.

Basidioma convex funnel-shaped, centrally or laterally stipitate, greyish brown. Context and tube-layer concolorous, honey coloured, hyphae peri- or pantoclinal.[2] Cutis more or less than 150 μ thick, sharply defined; melanoid substance similar to that in *Ganoderma* but more horny, glaucous, of distinctly different composition. Basidiospores bitunicate, the epi- and endosporium separated by reticulate or disjointed cristae.

Dedicated to the memory of Dr. C. J. Humphrey, pioneer of the anatomical study of the genus *Ganoderma*.

[2] While admitting in the mycological terminology the anatomical notions 'anticlinal' and 'periclinal' for hyphal dispositions respectively perpendicular and parallel to the cutis it should be realized that there are however structures in which the hyphae bend, zig-zag and intertwine freely; such an arrangement is not covered by these two terms. For this type of hyphal growth the author suggests the word 'pantoclinal'.

Ever since the author first examined *Ganoderma lloydii* in detail this species appeared so different from typical *G. lucidum* that strong doubts were entertained whether it belonged to the genus *Ganoderma*; all anatomical characters showed marked differences. When it appeared that *Humphreya endertii* and *H. coffeatum* (both, *vide infra*) had similar characters the doubt became stronger. It then became clear that it was justified to segregate the three species and to set up a new genus for them.

It seems questionable, considering these anatomical characters, whether the genus *Humphreya* is closely related to *Ganoderma* and even whether it can be included in the Ganodermataceae.

We shall see below that the same problem arises when *Amauroderma*, as currently understood, is considered. Whereas only two species, viz. *A. longipes* (Lév.) Torrend and *A. renidens* (Bres.) Torrend, have a cutis of the hymenioderm type, only the second species has a context anatomy similar to that of *Ganoderma*, with brown skeletal hyphae. In contradistinction *A. longipes* has a context with pantoclinal hyphae. Its spores also appear widely different in that they do not have an episporium and are therefore unitunicate. We will also see below that all the other species of *Amauroderma* have an anatomy very different from that of *Ganoderma*.

At least one conclusion can be drawn from what is said above: spore structure by itself is not sufficient for grouping species into genera and genera into families; they must be seconded by other, mainly anatomical, characters. *Humphreya* is a case in point.

Humphreya lloydii (Pat. & Har.) Steyaert, *comb. nov.*

Fig. 7a, Pl. 12 fig. 43

Amauroderma lloydii Pat. & Har. *in* Bull. trimest. Soc. mycol. Fr. **28**: 281. 1912. — *Ganoderma lloydii* (Pat. & Har.) Trott. *in* Sacc., Syll. Fung. **23**: 407. 1925.

Basidioma stipitate, mesopodial; pileus convex-infundibuliform, up to 120 mm in diam; dorsal surface with many radial, ramified folds, dull Clay Color (Ridgway) to Sepia (Ridgway), in the latter case sometimes near the centre with narrow Dark Olive (Ridgway) rings. Pore surface white, usually remaining so upon drying; stipe may reach the formidable length of more than 500 mm, but is only 10–15 mm thick, usually about 200 mm long and 5–10 mm thick, dull Clay Color (Ridgway).

Section: cutis very hard, dull dark olive, 60 μ thick; context varying in thickness with the folds of the surface, 1–4 mm, probably white when fresh, Light Buff (Ridgway) when dry, often with a dark olive layer of melanoid substances near the tube layer of up to 1 mm thick; tubes up to 5–6 mm long, concolorous with context; under the cortex of the stipe sometimes a layer of melanoid substances which continue upwards in the pileus as a dark line over the tube layer.

Cutis anamixodermiform, sharply defined, composed of the same hyphae as the context, the extremities somewhat inflated, impregnated by melanoid substances scarcely soluble in KOH. Context with periclinal or sometimes pantoclinal hyphae; hyphae 3–4 μ thick, thick-walled, not producing skeletal hyphae. Pores round, 60–190–310 μ in diam.; dissepiments 10–95–280 μ thick; distance between axes about 285 μ. Spores ovoid, light yellowish, 12.5–16–20 × 8–10.5–15 μ, with crests in honeycomb pattern.

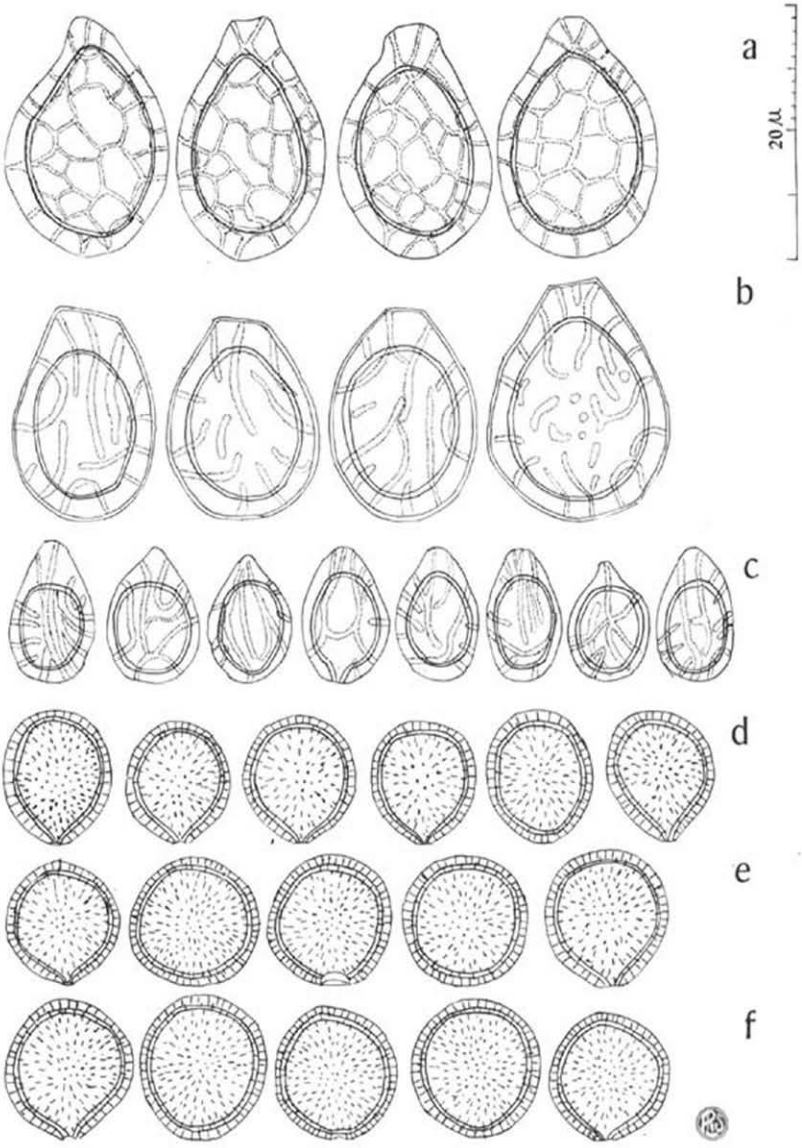


Fig. 7

Those who are familiar with *Ganoderma* will be struck immediately by the unusual appearance of the specimens of this species. The surfaces are nowhere glossy or shiny. On the contrary these appear to be velvety, especially of the stipes, which in *Ganoderma* are practically always very shiny. Some deformities of the pileus that may take the appearance of a stipe should not be so considered; these pileal abnormalties are always much more massive than a true stipe. These false stipes are all horizontal and their dorsal surface cannot be distinguished from that of the pileus, whereas in *G. lucidum* when a pileus is produced on a stipe, whether it be vertical or horizontal, the stipe assumes characters of its own that makes it sharply distinguishable from the pileus. True stipes in *Ganoderma* are always glossier than the pileus and as a rule darker.

In *H. lloydii* pileus and stipe are equally velvety in appearance and strictly of the same shade and colour.

SPECIMENS EXAMINED.—WEST AFRICA, s. loc., s. hosp., s. coll., s. dat., 53.PC.32. CAMEROONS: Tiko, s. hosp., Dunlap, 29-I-1926, 54.K.33.

ZAIRE: Ubangi, Binga, sol humide de la forêt, en bordure (marécageuse) de rivière. M. Goossens-Fontana 1094 (BR), 1939; Ubangi, Boketa-Gemena, galerie forestière de l'Ubangi, s. hosp., H. van Oosten 3B, 6B (BR), X-1955; distr. Haut-Congo, Yangambi, on *Paramacrolobium coeruleum*, B. Fassi 995 (BR), VI-1956.

Humphreya endertii Steyaert, *sp. nov.*

Fig. 7b, Pl. 12 fig. 44

Basidioma convexum, verticaliter pleurostipitatum, circa 30 mm diam.; pagina dorsalis umbrina; pagina ventralis alba, in sicco cinnamomea.

Sectio: cutis vix distincta, cornea, circa 100 μ crassa, umbrina; contextus melleus, 2–3 mm crassus; tubulorum stratum 1, usque ad 15 mm crassum, isabellinum; stipes minimus 120 × 5 mm.

Cutis hyphis periclinis vel subpericlinis dense intermixtis, substantia melanoidea brunneo-fulva imbutis. Hyphae contextus[3] pantoclinae dense intermixtae, flexuosae. Pori circulares, 140–165–200 μ diam, dissepimentis 30–50–80 μ, axibus circa 215 μ distantibus. Basidiosporae obovatae, melleae, maximae, 16–17.25–15 μ, endosporio cristulato.

Basidioma convex, laterally and vertically stipitate, about 30 mm in diam.; upper surface Cinnamon Brown (Ridgway), pore surface white, Cinnamon when dry.

Section: cutis sharply delimitated, hard, about 100 μ thick, umber; context

[3] The context hyphae are not exactly periclinal although none can be taken as anticlinal. The hyphae certainly have a general horizontal trend but they are densely interwoven.

EXPLANATION OF FIGURE 7

Fig. 7. Basidiospores. — a. *Humphreya lloydii*, 53.PC.32 (Holotype). — b. *H. endertii*, Endert (BO 6268), 66.L.38 (Holotype). — c. *H. coffeatum*, Blanchet, 53.PC.11 (holotype of *Polyporus opacus*). — d. *Magoderna infundibuliforme*, Maitland, 70.K.1 (Holotype). — e, f. *M vansteenisii*: e, van Steenis 10,170, 66.L.61 (Holotype), 66.L.62.

Cinnamon Buff (Ridgway), 2–3 mm thick; tubes up to 15 mm long, in one layer, Tawny Olive (Ridgway). Stipe about 120 × 5 mm.

Cutis hyphae periclinal or subpericlinal, densely interwoven, agglomerated by a tawny-brown melanoid substance. Context hyphae peri-pantoclinal, subparallel, flexuous Pores round, 140–165–200 μ in diam.; dissepiments 30–50–80 μ thick; distance between axes about 215 μ. Basidiospores ovoid, chamois, 16–17.25–19.5 × 11–12.15–15 μ, bitunicate with cristulate endosporium.

This species is as yet known only by one specimen; it is so characteristic that one cannot but consider it to be an as yet unknown species.

Although the basidioma recalls by many features—periclinal hyphae, texture of the cutis, spore type, never sessile—those of *H. lloydii* these also distinguish them from *Ganoderma*.

SPECIMEN EXAMINED.—INDONESIA: Kalimantan (Borneo), West-Koetai, s. hosp., F. H. Endert (Holotype BO 6268; fragment in BR), 1925, 66.L.28.

Humphreya coffeatum (Berk.) Steyaert, *comb. nov.*

Fig. 7c, Pl. 12 figs. 45, 46

Polyporus coffeatus Berk. *in* Ann. Mag. nat. Hist. **3**: 385. 1839. — *Fomes coffeatus* (Berk.) Cooke *in* Grevillea **15**: 51. 1886. — *Ganoderma coffeatum* (Berk.) Murrill *in* Bull. Torrey bot. Club **32**: 367. 1905.

Polyporus opacus B. & Mont. *in* Annls Sci. nat. (Bot.) III **11**: 236. 1849.[4] — *Fomes opacus* (B. & Mont.) Cooke *in* Grevillea **13**: 118. 1885. — *Ganoderma opacum* (B. & Mont.) Pat. *in* Bull. Soc. mycol. Fr. **5**: 67. 1889.

Basidioma stipitate, vertically pleuropodial; pileus convex, about 40 mm in diam.; dorsal surface sometimes concentrically subundulate, either Buckthorn Brown (Ridgway) or Saccardo Umber (Ridgway); margin thick, grooved.

Section: cutis about 130 μ thick, sharply delimitated, dark brown; context 2–6 mm thick, probably white when fresh, Cream Buff (Ridgway) when dry; one-layered, concolorous with context, up to 5 mm thick.

Cutis of the anamixoderm type with hyphae anticlinal and with short hyaline extracuticular hyphae in unweathered specimens. Context with thick, hyaline skeletal hyphae. Pores round, small, 90–100–120 μ; dissepiments about 35 μ thick; distance between axes about 135 μ. Basidiospores bitunicate, with cristulate endosporium, 9.5–10.8–11.5 × 6.5–7–8 μ.

SPECIMENS EXAMINED.—BRAZIL: Bahia, s. hosp., Blanchet, s. dat., 51.PC.11.

TRINIDAD: Caroni River, St. Joseph, on buried wood, Dennis & Baker, X-1949, 66.L.23.

CUBA: Tetas de Santa Tereza, ad truncum emortuis arboris frondosis, F. Kotlaba, 17-III-1967, 68.PR.10.

---

[4] The type specimen in Paris is unfortunately reduced to fragments so one cannot but rely on Berkeley and Montagne's description and on the anatomical details observed from the débris. The description of the outer morphology given in this paper is based on Dennis & Baker's and Kotlaba's specimens.

AMAURODERMA Murrill

The genus *Amauroderma* as currently understood still has many unsatisfactory aspects as to its homogeneity with regard to anatomical features and also because of aberrations of the spore structure of some species. The spores of *Amauroderma*, yielding the principal character delimitating the genus, are understood to be globose, bitunicate, with numerous short echinulae between epi- and endosporium. When this type of spores is accepted as typical some species, such as *A. longipes* (Pat.) Torrend with unitunicate, cristate spores, can be readily excluded.

But even when restricted to species with globose, bitunicate, echinulate spores there is so much variation in the anatomy of the context and cutis that it is impossible not to conclude that the genus in its present circumscription is still very strongly artificial. The various types of anatomy found in the genus as conceived by Furtado (*1968*) can be separated as follows:—

I. Context and cutis with anticlinal hyphae.
   1. Cutis hymeniodermiform as in *Ganoderma*.—*A. renidens* (Bres.) Torrend.
   2. Cutis hyphae anticlinal but septate, remote from the *Ganoderma* type.—*A. conjunctum* (Lloyd) Torrend, *A. elmerianum* Murrill, *A. infundibuliforme* Wakef., *A. praetervisum* (Pat.) Torrend, *A. subrugosum* (Bres. & Pat.) J. S. Furtado, *A. fasciculatum* (Pat.) Torrend. This last species has an oblong spore with relatively few, thick, moderately long echinulae.
   3. Cutis hyphae sub-anticlinal, subhyaline, slanting and swollen at the tips; somewhat reminiscent of a hymenioderm but the elements not densely crowded together.—*Polyporus rugosus* Bl. & Nees, (syn., *Ganoderma sprucei* Pat., *fide* Spruce 44).

II. Context hyphae periclinal.
   1. No distinct cutis anatomy.—*Polyporus variabilis* Berk. (*fide* Paris specimen Lepricur 965, not mentioned by Furtado), *A. expallens* (Bres.) J. S. Furtado (*fide* Maitland, Mazeras area, Kenya, BPI), *A. calcigenum* (Berk.) Torrend, *A. camerarium* (Berk.) J. S. Furtado, *A. exile* (Berk.) Torrend, *A. macrosporum* J. S. Furtado, *A. oblongisporum* J. S. Furtado, *A. schomburgkii* (Mont. & Berk.) Torrend, *typus generis*.
   2. Cutis composed of spheroid cells.
      a. No free extracuticular hyphae.—*A. rude* (Berk.) Torrend var. *rude*, *A. sikorae* (Bres.) J. S. Furtado.
      b. Free extracuticular hyphae.—*A. rude* (Berk.) Torrend var. *intermedium* (Bres. & Pat.) J. S. Furtado.
   3. Cutis densely compressed, hyphae slanting upwards.—*A. bataanense* Murrill, *A. omphalodes* (Berk.) Torrend.
   4. Long free extracuticular hyphae, more or less in wisps.—*A. trichodermatum* J. S. Furtado ("*trichodematum*").

III. Context hyphae pantoclinal.
   1. No free extracuticular hyphae.—*A. boleticeps* (Pat. & Gaill.) Torrend. *A. pseudoboletus* (Speg.) J. S. Furtado.
   2. Cutis with subanticlinal, interwoven hyphae.—*Polyporus leptopus* Pers. (*fide* Gaudichaud's type specimen in Paris), Pl. 15 fig. 57.

The above arrangement of species according to their most striking features shows, with the exception of group I, 1, distinct anatomical differences with *Ganoderma*. Group II, 1, with the type species of *Amauroderma*, must be taken as the nucleus of

Amauroderma, which is therefore characterized by its context with periclinal hyphae and lack of a distinct cutis. The hyphae themselves have very thick, slightly coloured walls. These hyphae may have short, contorted ramifications but there are no other types of hyphae, either thicker- or thinner-walled. This type of anatomy puts this group taxonomically in a remote position from *Ganoderma*. Assuming that group I, 1 is anatomically close to *Ganoderma*, then groups I, 2 and I, 3 have much less relationship with it, and the entire group III is decidedly remote from it.

Two species have not yet been mentioned, i.e. *Ganoderma subresinosum* (Murrill) Humphrey and *Ganoderma lignosum* Pat. They will be examined now. Both these species have ovoid, bitunicate spores with an echinulation similar to that of *Amauroderma*. The apical echinulae are identical to all the other on the spore and the apex itself is not collapsible at maturity. The spores of these two species show therefore a closer affinity to those of *Amauroderma* than to those of *Ganoderma*. When the anatomy of the two is compared a similar conclusion can be arrived at. *Ganoderma subresinosum* has a context and cutis anatomy showing similarities with those of *A. infundibuliforme*, whereas *G. lignosum* shows some relationship to the typical *Amauroderma* group as to context and cutis anatomy. All the same both the context and the cutis of *G. lignosum* also have peculiarities of their own. Thus the cutis layer, which is only 30 μ thick, is made up of very thin periclinal hyphae impregnated with a melanoid substance, and the context consists of three layers, the uppermost, under the cutis, about 350 μ thick, is made up of periclinal hyphae, while the one below it is of about the same thickness and composed of pantoclinal hyphae. Below this second layer the hyphae are all periclinal. This kind of anatomy is not comparable with that of any of the species of *Amauroderma* described up till now.

A feature that should be stressed, and which is common to both G. *subresinosum* and *G. lignosum*, is that they have dimidiate basidiomata, whereas all species of *Amauroderma*, or those currently regarded as such, have stipitate pilei.

Although their spore characters put them in close relationship to *Amauroderma*, the absence of stipes should apparently exclude them from that genus. This would suggest grouping them in a single genus but this would contradict the features of their anatomy which are as widely divergent as possible. No solution with regard to *G. lignosum* will be offered now; this should be postponed until more and better knowledge has been gained of other species. However with regard to *G. subresinosum* a solution is offered below by grouping it with two other species in the new genus *Magoderna*.

Before closing this discussion, attention should be called to *A. rubeolum* (Bres.) Otieno, which according to Furtado is a synonym of *A. sikorae* (Bres.) J. S. Furtado. If one refers to Bresadola's type specimen in Vienna the synonymy is correct. However, if one refers to Furtado's illustration of the cuticular anatomy of *A. sikorae* it must be concluded that there is some discrepancy; his illustration shows a cutis made up of haphazardly disposed spheroid cells. This is not in agreement with the anatomy revealed by Bresadola's type specimen, which has for each hypha a characteristic short chain of fuliginous cells in the cutis itself and above it a short hyaline hypha.

AMAURODERMA RUGOSUM (Bl. & Nees) Torrend

Polyporus rugosus Bl. & Nees *in* Nova Acta phys.-med. Acad. Caes. Leop.-Carol. **13** (1): 21. 1826; Fr., Elench. Fung. **1**: 74. 1828. — *Ganoderma rugosum* (Bl. & Nees) Pat. *in* Bull. Soc. mycol. Fr. **5**: 68. 1889. — *Amauroderma rugosum* (Bl. & Nees) Torrend *in* Broteria (Ci. nat.) **18**: 127. 1920, in obs.

Porotheleum rugosum Berk. *in* Hook. J. Bot. **8**: 237. 1856, non *Amauroderma rugosum* (Bl. & Nees) Torrend 1920. — ≡ *Ganoderma sprucei* Pat. *in* Bull. Soc. mycol. Fr. **10**: 75. 1894. — *Amauroderma sprucei* (Pat.) Torrend *in* Broteria (Ci. nat.) **18**: 125. 1920.

A considerable confusion has arisen with regard to this species. In 1826, Blume & Nees published the binomial *Polyporus rugosus* for a Javanese collection. Fries took up the name in 1828; in 1838 he admitted two varieties, an African and a Javanese but he did not mention a specimen for the African (Guinean) plant. In 1851 he placed Afzelius' Guinean collection in *P. rugosus* without distinguishing varieties.

In 1856, Berkeley studied a Brazilian fungus (Spruce 44), which he described as a new species, *Porothelium rugosum*. There is every reason to assume that he fortuitously gave the same specific epithet to his fungus; he does not mention Blume & Nees' Javanese fungus. The Brazilian and the Javanese fungi could well belong to the same species considering their morphology, although *P. rugosus* from Java often has mesopodial fruitbodies whereas those from Brazil are pleuropodial.

In 1889 when Patouillard published the recombination *Ganoderma rugosum* (Bl. & Nees) Pat. he referred to Blume & Nees von Esenbeck's description and illustration; the new combination was introduced in connection with a Guianan collection (Leprieur 862). Since he referred to Blume & Nees' publication there can be no doubt that Patouillard considered the South American and the Javanese collections to be one and the same species. In 1894, Patouillard took up the name *Porothelium rugosum* Berk.; this is the Brazilian taxon based on Spruce 44. He changed the name to *Ganoderma sprucei* Pat. because he considered that there already existed an epithet 'rugosum' in a combination with the generic name *Ganoderma*, without however specifying the combination. It may be assumed that he had in mind the combination he published in 1889. It is necessary to point out that Patouillard's description of 1889 contains some contradictions. He described the spores as "ovales, fortement échinées, 11 × 8 μ . . . et par ses spores presque rondes." In case the sizes he gave were correct, the spores would indeed be ellipsoid although he ended by saying that they are nearly round. Since he referred to Blume & Nees' plate VII of *Polyporus rugosus* this clearly indicates that he was not dealing with a species of *Ganoderma* but with one that is currently placed in *Amauroderma*. Therefore the last words of his description of the spores should be taken as correct.

In 1968 Furtado, in his thesis on the genus *Amauroderma*, self-evidently listed *Porothelium rugosum* Berk. in the synonymy of *Amauroderma sprucei* (Pat.) Torrend; like Patouillard he rejected the specific epithet 'rugosum Berk.' apparently in view of the existence of the earlier homonym. It is impossible to obtain unquestionable proof that *Porothelium rugosum* Berk. (≡ *G. sprucei* Pat.) and *Ganoderma rugosum* (Bl. & Nees) Pat. sensu Patouillard were really one and the same species since Leprieur's

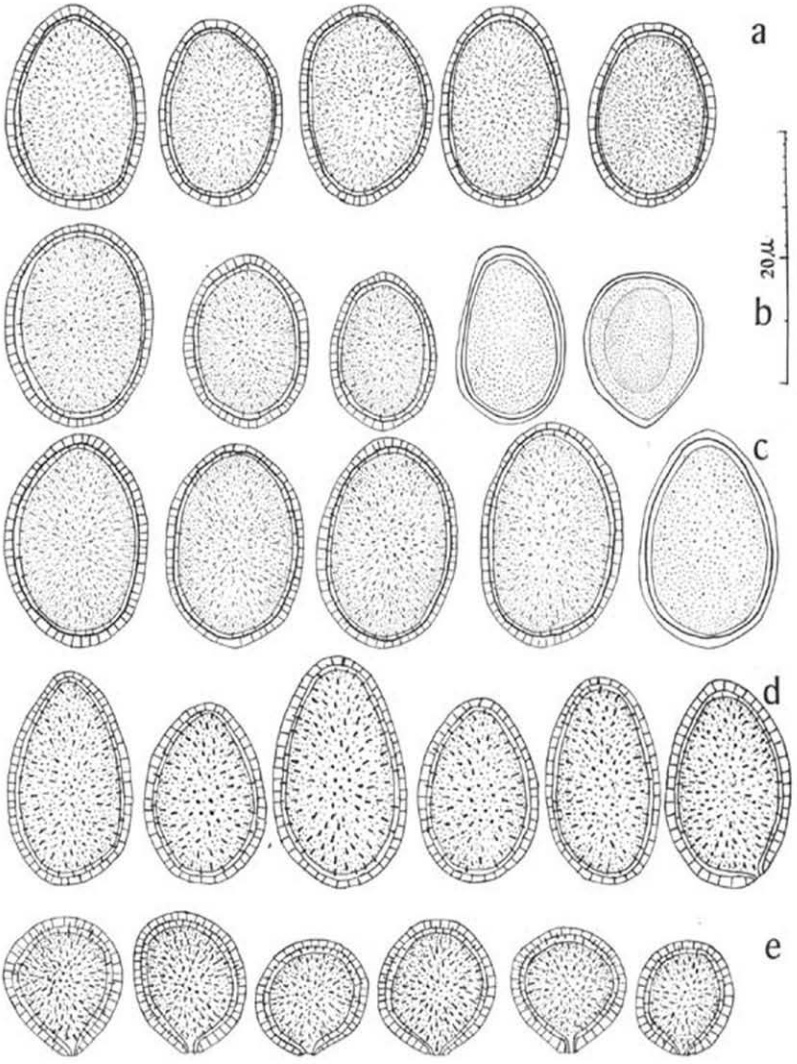


Fig. 8. Basidiospores. — a–d. *Magoderna subresinosum*: a, b, Mondih (BO 12,473), 66.L.28 & 42; c, Brooks, 62.K.54; d, Goossens-Fontana 184, BR (holotype of *Polyporus mamelliporus*). — e. *Amauroderma preussi*, Fassi 556, BR.

specimen 862 seems to be lost; in any case inquiries and visits to the museum in Paris have not brought it forth. The only fact substantiating their conspecifity is that (as stated above) Patouillard referred to Blume & Nees' illustration in connection with *Ganoderma sprucei*.

When Torrend transferred *G. sprucei* Pat. to the genus *Amauroderma* he did not realize that there existed no obstacle to recombine the epithet of the basionym *Porothelium rugosum* with the generic name *Amauroderma*.

It should be noticed that Lloyd's figure 404 (*1912*) shows a specimen of Spruce 44, from the Museum in Paris, which is a portion of the type of *Porothelium rugosum* (≡ *G. sprucei*). This specimen is pleuropodial whereas Blume & Nees' illustration shows mesopodial as well as pleuropodial basidiomata. Conditions of growth may sometimes induce a normally mesopodial species to develop an aberrant shape; no overrated importance should be attributed to this feature.

It has been thought appropriate to fix the emended species by giving a description of Spruce 44.

Basidioma meso- or pleuropodially stipitate, pileus convex; upper surface radially deeply corrugated and bumpy, Mummy Brown (Ridgway), 30–50 mm in diam.; stipe about 50 mm long and 4–5 mm thick, concolorous with the pileus or of some lighter, more yellow shade.

Section: cutis dull Mummy Brown, about 70 μ thick; context Chamois (Ridgway), 3–5 mm thick; tube layer concolorous with the context, 4–6 mm thick.

Cutis with hyphae directed obliquely and ending in a swollen apex somewhat reminiscent of the elements of a hymeniodermiform cutis but not densely aggregated as in the latter, with moderately conspicuous septa, 20–30 × 5–6 μ. Context hyphae periclinal near the cutis but pantoclinal and freely intertwining in the middle of the context and near the tube layer, yellowish, 2–3 μ thick. Pores round, 90–112.5–130 μ in diam.; dissepiments 40–65–90 μ thick; distance between axes about 180 μ. Basidiospores subspherical, yellowish, 8–7.8–9.00 × 6.5–7.0–7.5 μ.

This species is temporarily kept in *Amauroderma* although the cutis anatomy is very close to that of *A. elmerianum* Murrill, which is at variance with that of *A. schomburgkii* (Mont. & Berk.) Torrend, which includes the type species of *Amauroderma*.

SPECIMENS EXAMINED.—BRAZIL: s. loc., s. hosp., Spruce 44, s. dat., 53.PC.45; s. loc., s. hosp., Spruce 48, s. dat., 63.K.116.

GUIANA: Bartica, s. hosp., D. H. Linder (BO 16,814), 7-XII-1923, 66.L.100.

Amauroderma preussii (P. Henn.) Steyaert, *comb. nov.*

Fig. 8e, Pl. 14 figs. 55, 56

Ganoderma preussii P. Henn. *in* Bot. Jb. **14**: 342. 1891. — *Fomes preussii* (P. Henn.) Sacc., Syll. Fung. **11**: 89. 1895.

Ganoderma sikorae Bres. *in* Zahlbr. *in* Annls naturh. Hofmus. Wien **26**: 157. 1912. — *Amauroderma sikorae* (Bres.) J. S. Furtado, Revisão Gên. Amauroderma 280. 1968.

Ganoderma rubeolum Bres. *in* Mycologia **17**: 73. 1925. — *Amauroderma rubeolum* (Bres.) Otieno *in* Sydowia **22**: 177. 1969.

Basidioma stipitate, meso- or more often pleuropodial; pileus subcircular to circular, radially finely plicate, somewhat concentrically undulate, Cinnamon Brown (Ridgway), in large specimens with concentric darker shades, up to 90 mm in diam.; margin recurved, enveloping the tube layer, horizontally grooved, vertically plicate; stipe up to 280 mm long and up to 8 mm in diam. at the base, Dresden Brown (Ridgway).

Section: cutis dull dark brown, about 180 μ thick, context of about equal thickness as tube layer, Antimony Yellow (Ridgway); tube layer Bister (Ridgway), up to 5 mm thick.

Cutis hyphae slanting, with 4–5 fuliginous cells, extending externally as a free, hyaline hypha usually almost appressed to the cutis or slanting upward, near the base of the pileus nearly anticlinal. Context hyphae periclinal, subhyaline, 3–5 μ thick. Basidiospores spherical with thin, short echinulae between endo- and episporium, subhyaline, 7–9.1–11.5 × 6.5–8.5–10 μ. Pores round, 90–116–160 μ in diam.; dissepiments 10–57–110 μ thick; distance between axes about 180 μ.

Amauroderma preussii is temporarily kept in the genus *Amauroderma* although the cutis has a distinctive anatomy different from typical species of *Amauroderma*.

Although Furtado mentions one specimen from New Guinea *A. preussii* appears to be mainly an African species. The type is the third mentioned in this paper that escaped destruction in the Berlin herbarium.

SPECIMENS EXAMINED.—CAMEROONS: Barombi Station, ad truncos, Preuss s.n. (Holotype), s. dat., 70.B.3.

UGANDA: Magomba Forest, ad truncos, T. D. Maitland 398 (holotype of *Amauroderma rubeolum* Bres.), s. dat., 56.BPI. 2.

ZAIRE: Yangambi, sur débris ligneux au sol, B. Fassi 411, 412 (BR), 5-III-1956; Yangambi, sur sol, B. Fassi 556 (BR), 26-III-1956; Yangambi, sur sol, B. Fassi 676 (BR), 17-III-1956; Yangambi, sur *Garcinia punctata*, B. Fassi 819 (BR), VI-1956; Yangambi, s. hosp., B. Fassi 1107 (BR), IX-1957; Yangambi, sur feuilles mortes de *Gilbertiodendron dewevrei*, B. Fassi 1111 (BR), 15-IX-1957.

MALAGASY (Madagascar): pr. Antananarivo, ad truncos, J. Sikora (holotype of *Ganoderma sikorae* Bres.), s. dat., 71.W.1.

Haddowia Steyaert, *gen. nov.*

Basidioma stipitatum, forma et colore Ganodermatis simile; cutis hymeniodermiformis; sporae illis Ganodermatis valde distinctae; costis longitudinalibus ornatae, costae cristis longitudinalibus 2 a parietibus transversalibus junctis constitutae, sporarum costae paries exterior nullus. Contextus sicut tubulorum stratum albus, in sicco stramineus.

SPECIES TYPICA.—*Amauroderma longipes* (Lév.) Torrend.

Basidioma stipitate, similar in shape and colour to those of the species of *Ganoderma* with hymeniodermiform cutis, differing in the spores, which are longitudinally costate; costae made up of two longitudinal crests connected by transverse membranes; no outer wall to the spores which appear unitunicate.

The name is a tribute to W. R. Haddow (*1931*) in view of his careful studies in the genus *Ganoderma*.

Haddowia longipes (Lév.) Steyaert, *comb. nov.*
Figs. 9a, b, c, Pl. 13 fig. 47

Polyporus longipes Lév. *in* Annls Sci. nat. (Bot.) III **5**: 124. 1846. — *Amauroderma longipes* (Lév.) Torrend *in* Broteria (Ci. nat.) **18**: 33, 135. 1920.
Polyporus costatus Lloyd, Mycol. Writ. **4** (Letter 56): 9, 1915; Mycol. Writ. **6**: 889. 1919. — *Amauroderma costatum* (Lloyd) Torrend *in* Broteria (Ci. nat.) **18**: 136. 1920, in obs.

Basidioma stipitate, pleuropodial or excentrally mesopodial; pileus 40–55 mm in diam., stipe up to 180 mm long and 5 mm thick; stipe and upper surface of pileus Blackish Brown (Ridgway), laccate, upper surface rugulose, slightly radially plicate.
Section: cutis very thin, 20–30 μ thick, blackish brown; context white (straw-coloured when dry), 4–5 mm thick; tube layer concolorous with context, up to 5 mm thick.
Cutis hymeniodermiform, its elements obovoid, swollen by melanoid substances, approximately 20 × 6 μ; context without brown skeletal hyphae. Pores irregularly rounded, more or less polygonal, 590–700–780 × 320–500–650 μ; dissepiments 30–45 μ thick; distance between axes about 550 μ. Basidiospores ellipsoid, yellowish, 12–15.3–19 × 10–12–14.5 μ.

Photographs of *Polyporus longipes* were published by Lloyd, Mycol. Writ. **6** (Mycol. Notes 62): pl. 154 figs. 1742, 1743, 1920.

SPECIMENS EXAMINED.—FRENCH GUIANA: s. loc., sur troncs, s. coll., s. dat., 53.PC.13 (Holotype); près St Laurent du Maroni, s. hosp., R. Heim 657, 24-VIII-1952, 53.PC.12.
KENYA: Mazeras, Mwashi River area, growing up from dead roots, T. D. Maitland 556, III-1921, 55.K.68.

Haddowia aëtii Steyaert, *sp. nov.*
Fig. 9d. Pl. 13 fig. 48

Basidioma verticaliter stipitatum plusminusve mesopodum; pileus usque ad 40–50 mm diam, 15 mm crassus; stipes et pagina superior fusco-nigri, laccati; pagina superior leviter rugulosa.
Sectio: cutis 20–30 μ crassa, fusco-nigra; contextus albus, in sicco stramineus, 2–4 mm crassus; tubuli contextus concolores, usque ad 10 mm longi.
Cutis anatomice hymeniodermiformis, elementis longi obovoideis vel subcylindraceis, substantia melanoidea instructis, circa 20 × 6 μ. Hyphis pantoclinis, sine hyphis brunneis. Pori irregulariter circulares, 360–415–480 × 360–410–450 μ, dissepimentis 30–40–70 μ crassis, axibus circa 465 μ distantibus. Basidiosporae subsphaeroideae, costatae, unitunicatae, melleae, 9.5–10.1–11 × 8–8.6–9.5 μ.

Basidioma vertically, excentrically mesopodial; pileus 40–50 mm in diam., 15 mm thick; stipe and dorsal surface Blackish Brown (Ridgway), laccate, dorsal surface slightly rugulose.
Section: cutis 20–30 μ thick, blackish brown, context white, straw-coloured when dry, 2–4 mm thick; tubes concolorous with context, up to 10 mm long.
Cutis hymeniodermiform; its elements long obovoid or subcylindrical, swollen by melanoid substances, and about 20 × 6 μ. Hyphae pantoclinal, without brown skeletal hyphae. Pores irregularly rounded, 360–415–480 × 360–410–450 μ; disse-

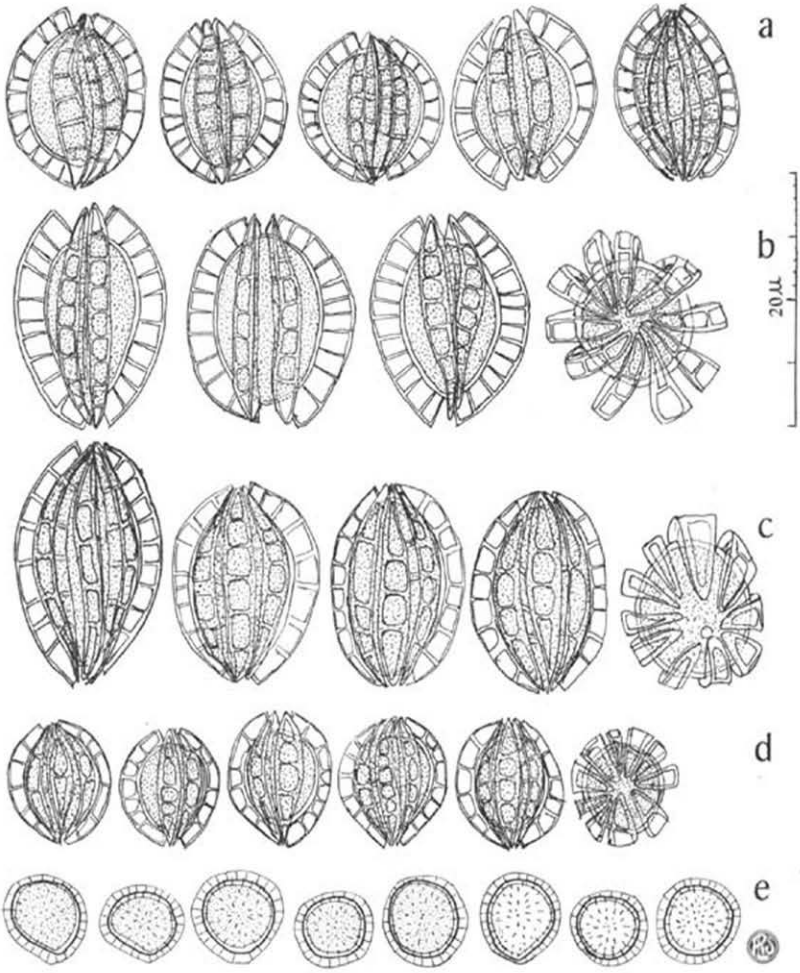


Fig. 9. Basidiospores. — a–c. *Haddowia longipes*: a, 55.PC.13 (Holotype); b, Heim 657; 53.PC.12; c, Maitland 556, 55.K.68. — d. *H. aëtii*, Aët (Exp. M. E. Walsh) 122, 66.L.46. — e. *Amauroderma rugosum*, Linder (BO 16,814), 66.L.100.

piments 30–40–70 μ thick, distance between axes about 450 μ. Basidiospores subspherical, costate, unitunicate, 9.5–10.1–11 × 8–8.6–9.5 μ.

Comments on the two species of *Haddowia*.

There seems to be some variation in the anatomy of the cutis. In some specimens the elements are very thick, more or less obovoid (the two Guianan specimens cited above for *H. longipes*), whereas in the African material of *H. longipes* and the Asiatic *H. aëtii* these elements are more cylindrical and narrower, with the apex more or less swollen. Such a case of variation has previously been observed in *Ganoderma weberianum* but in that case the variation seems to be concurrent with a more or less intense production of gasterospores, whereas in *Haddowia* these have not yet been reported. In both cases however the variation seems the result of the greater or fewer number of context hyphae curving upward to produce the cutis elements.

The spore morphology attracts attention. When they are observed with the top of the spore closest to the eye no episporium can be seen and only hiatuses are noticed between the costae produced on what is known as the endoporium in *Ganoderma*. Before expressing a definite statement on the absence of an episporium however the initial stages of the spore development should be observed; these might possess an ephemeral episporium. Confirmation of the absence of the outer spore wall could probably mean that *Haddowia* must be removed from the neighbourhood of *Ganoderma* although they seem to be related by some anatomical features.

SPECIMEN EXAMINED.—INDONESIA: K a l i m a n t a n (Borneo), Sangkulirang, s. hosp., Aët (exp. M. E. Walsh) 122, (BO; Holotype), middle 1937, 66.L.46.

Magoderna Steyaert, *gen. nov.*

Basidioma dimidiatum vel pleuropodum. Contextus bubalinus; hyphae in contextus zonis superioribus et in cute anticlinae, ibi cum inflatae tum hymenioderma constituantes. Sporae ovato-ellipsoideae usque ad sphaericae, bitunicatae; echinulis aequilongis inter endosporium episporiumque ubique insertis minutae.

SPECIES TYPICA.—*Fomes subresinosus* Murrill.

Basidioma dimidiate or pleuropodial; context Light Buff (Ridgway); tube layer Buckthorn Brown (Ridgway); hyphae bending anticlinally near the cutis, anticlinal in the latter. Spores ovoid-ellipsoid to spherical, bitunicate, episporium separated from endosporium by echinulae of equal lengths all around the spore.

The name *Magoderna* is an anagram of *Ganoderma*.

Because of its spores *Magoderna* is much closer to *Amauroderma* than to *Ganoderma*, but the anticlinal disposition of the subcuticular and cuticular hyphae differentiates it from *Amauroderma*.

The spores of *M. subresinosum*, although slightly ovoid or ellipsoid can be distinguished from those of *Ganoderma* by the echinulae which are uniformly distributed all around the spore with no particularities in the apex, whereas in *Ganoderma* the episporium bulges out at the apex and is either not supported by echinulae or separated from the endosporium by much longer echinulae. In the former case the

apex collapses and gives a truncate appearance to the spore. As to the cutis hyphae, those of *Magoderna* are produced directly by context hyphae whereas in *Ganoderma* the brown skeletal hyphae first produce hyaline hyphae which terminate as swollen ends filled with melanoid substances. These swollen ends constitute the elements of the hymenioderm.

Magoderna infundibuliforme (Wakef.) Steyaert, *comb. nov.*
Fig. 7d, Pl. 13 fig. 49

Amauroderma infundibuliforme Wakef. *in* Bull. misc. Inf. Kew **1917**: 309. — *Ganoderma infundibuliforme* (Wakef.) Sacc. & Trott. *apud* Trott. *in* Syll. Fung. **23**: 406. 1925.

Basidioma infundibuliform, mesopodial; upper surface of pileus radially plicate, Hair Brown (Ridgway), up to 80 mm in radius from the centre; pore surface Light Mouse Gray (Ridgway),[5] covering incompletely the underside of the funnel, leaving a narrow radial zone from the stipe to the margin of cuticular tissue apparently as the result of the junction of the two extreme edges of the pileus[6]; stipe relatively short, 50 × 5 mm, concolorous with upper surface of pileus.[7]

Section: cutis dull grey, about 100 μ thick, brittle; context thin, 1–2 mm thick, light Buff (Ridgway), with one or two parallel deposits of melanoid substances in the middle; tubes one-layered, 3–4 mm thick. Saccardo Umber (Ridgway).

Cutis hymeniodermiform, hyphae anticlinal, distinctly septate, impregnated with fuliginous melanoid substances up to the middle of the inflated extremities, the upper part of the latter hyaline and hymeniodermiform, up to 5 μ thick. Context hyphae very lightly chamois coloured, 3–4 μ thick; no distinct skeletal hyphae. Pores round, 90–125–170 μ in diam.; dissepiments 20–35–60 μ thick; distance between axes about 160 μ. Basidiospores spherical or slightly obovoid, light chamois, 9–9.9–10.5 × 8–8.5–9 μ.

Maitland added the following note to the specimens he collected: "Only one was standing out from the tree, the others were bracketed against the dead trunk as can be seen in the accompanying specimen. The stalks were glossy when gathered, much like the pileus of *Fomes mastoporus* but when exposed to sun and air soon became dull."

SPECIMENS EXAMINED.—BUGANDA: Bumpenge Forest, on base of erect dead tree, T. D. Maitland 24A, I-1915, 70.K.1.

Magoderna subresinosum (Murrill) Steyaert, *comb. nov.*
Figs. 8a, b, c, d, Pl. 13 figs. 50, 51

Fomes subresinosus Murrill *in* Bull. Torrey bot. Club **35**: 410. 1908. — *Ganoderma subresinosum* (Murrill) Humphrey *in* Mycologia **30**: 332. 1938. — *Trachyderma subresinosum* (Murrill) Imaz. *in* Bull. Govt Forest Exp. Stn Japan No. 57: 119. 1952.

---

[5] Maitland indicates that the hymenium was purplish when collected.

[6] This might perhaps indicate that the pileus is not always funnel-shaped.

[7] In Maitland's notes the stalk was indicated as glossy when collected but becoming dull soon afterward.

Ganoderma simulans Wakef. *in* Bull. misc. Inf. Kew **1922**: 161.
Polyporus mamelliporus Beeli *in* Bull. Soc. r. Bot. Belg. **42**: 62. 1929.

Basidioma dimidiate to pleuropodial; pileus up to 110 mm in radius, sometimes several small pilei on congregate stipes arising from a common base; upper surface black, very shiny, densely radially plicate, indurated; margin usually thick, recurved and horizontally plicate or recurved and deeply and very irregularly vertically indented; pore surface from Cinnamon Buff (Ridgway) to Buffy Brown (Ridgway), limited by a raised cuticular margin. Stipe usually short (longest measured, 50 mm, but basidiomata appear to have been broken off above the point of attachment on the host).

Section: cutis indurated, heavily impregnated with melanoid substances; context variable in thickness, from one to two-thirds of the thickness of the pileus, usually Light Buff (Ridgway), sometimes in old specimens spotted by deposits of melanoid substances; tube layer up to 15 mm thick, Tawny (Ridgway), finely vertically striated Warm Buff (Ridgway).

Cutis hyphae anticlinal, the extremities swollen, fuliginous in the lower part, the upper remaining hyaline, the swollen hypha about 4 μ thick, collected into a hymenioderm covered by a deposit of melanoid substances 4–6 μ thick and easily detachable on sectioning the cutis. Pores round, surrounded by 'sclerified' cells (probably a deposit of some melanoid substance) which at first form a perfect, thin circle which later widens irregularly up to the point that the whole dissepiment is involved, 60–185–310 μ in diam.; dissepiments 10–95–300 μ in diam.; distance between axes 190–280–375 μ. Basidiospores subovoid to ellipsoid, bitunicate, pale yellowish, between epi- and endosporium with short echinulae of the same length all around the spore, 12.5–16–20 × 8–10.5–11.75 μ.

There appears to be some important variation in the sizes of the pores and the dissepiments, sizes that fluctuate much more than in the species of *Ganoderma*.

The known distribution extends from the Philippines to West Africa through Malaysia, Burma, India, Ceylon, Kalimantan and Eastern and Central Africa. No specimen is available from the American tropics and there seems to be no mention of this species in the literature from there. It is also surprising that in the Bogor collections no specimens are found from Java and Sumatra which have been intensively explored botanically.

Imazeki included this species in the genus *Trachyderma* of which name *T. tsunodae* Imazeki is the type. This species has spores of the *Ganoderma* type with a bulging apex. The cutis anatomy is also very much at variance with that of *M. subresinosum*; it can also be distinguished from that of the species of *Ganoderma*. *Trachyderma tsunodae* certainly stands apart from *Ganoderma* but *M. subresinosum* can be grouped with other species into a distinct genus.

SPECIMENS EXAMINED.—PHILIPPINE ISLANDS: Luzon, Prov. Bataan, Lamao Forest Reserve, s. hosp., F. W. Foxworthy (Bur. Sci. 1628) (Holotype), X-1906, 70.NY.1, 62.K.55; Prov. Rizal, Bosoboso, s. hosp., M. Ramos (Bur. Sci, 1215), VII-1906, 70.NY.2; Prov. Rizal, s. loc., s. hosp., H. S. Yates (Bur. Sci. 25,001), IX-1915, 62.K.53; s. loc., s. hosp., E. D. Merrill (ex Herb. J. Bresadola), 1908, 62.K.52.

INDIA: s. loc., s. hosp., s. coll. (comm. S. R. Bose), V-1948, 62.K.58.

CEYLON: Ritigala, s. hosp., Petch? (label is in his handwriting) 4814, 25-IV-105, 62.K.60; Peradenyia, s. hosp., Petch? (label is in his handwriting) 2470, 62.K.61, 62.

MALAYSIA: Sungei Choh, on rotten wood in rubber estate, F. T. Brooks, 19-IX-1914, 62.K.54.

BURMA: Mergui, s. hosp., s. coll., s. dat., 62.K.56.

INDONESIA: K a l i m a n t a n (Borneo), Karimata, s. hosp., Mondih (BO 12,473) III-1931, 66.L.28, 42.

ZAIRE: s. loc., s. hosp., F. Demeuse (BR), s. dat.; Kwango, s. loc., s. hosp., H. Vanderyst 16,861 (BR), 1925; Kisantu (Kimakundi), s. hosp., H. Vanderyst 15,067 (BR), s. dat.; Kasai, Kole, croissant sur un arbre mort, J. Claessens 976 (BR), XII-1909; Prov. Equateur, Eala, sur bois mort, P. Staner 473 (BR), VIII-1930; Eala, s. hosp., M. Goossens-Fontana 184 (BR) (holotype of *Polyporus mamelliporus* Beeli), 1923; s. loc. (either Eala or Ubangi), s. hosp., M. Goossens-Fontana 70 (BR), s. dat.; Bokumu sur Ruki, s. hosp., Father Lootens 40 (BR), 14-VII-1954; Ubangi, Bongabo, on *Gilbertiodendron dewevrei*, B. Fassi 835, 840, 845 (BR); Ubangi, Gwaka, on *Gilbertiodendron dewevrei*, B. Fassi 807 (BR), 2-V-1956; Prov. Orientale, Yangambi, on *Irvingia grandifolia*, B. Fassi 797 (BR), 26-VI-1956; Yangambi, B. Fassi 821 (BR), s. dat.; Yangambi, on *Gilbertiodendron dewevrei*, B. Fassi 846 (BR), 9-XI-1956; Yangambi, Lusambilo, sur *Paramacrolobium coeruleum*, B. Fassi 1465 (BR), 19-VII-1958; Banalia, Afata, on *Gilbertiodendron dewevrei*, B. Fassi 878 (BR), 18-1-1957; Prov. Kivu, Parc National Albert, Mt. Hoyo, Saga-saga, s. hosp., P. Van Schuytbroeck (P.N.A. 012,534, 012,551 (BR)).

KENYA: Mazera, Mwashi River, s. hosp., T. D. Maitland 556, III-1921, 54.K. 10, 69.K.101, 102, (Lloyd Mycol. Coll. 26,833) (holotype of *Ganoderma simulans* Wakef.), 51.BPI.9; Mau Forest natn. Park, Rasongo Forest, alt. 900 m, on floor, H. K. Brown 1020, 25-IV-1964, 65.K.106.

Magoderna vansteenisii Steyaert, *sp. nov.*

Fig. 7e, f, Pl. 14 figs. 52, 53

Basidioma pulvinatum, longe stipitatum, pileo 15–60 mm diam., pagina dorsalis fusconigra, languida, pauce gibbosa, circulatim undulata; stipes longus et tenuis, 110–380 mm longus et 3–8 mm crassus, paginae dorsali concolor.

Sectio: cutis grisea, circa 60 μ crassa; contextus roseo-bubalinus, 1/2–1/4 pilei crassitudine; tubuli 4–8 mm longi, in strato unico, sepiaceus.

Cutis hymeniodermiformis, elementis hyalinis, cylindraceis circa 15 μ longis, 4–5 μ crassis; hyphae hymeniodermati suppositae fuscae, conspicue septatae, circa 4 μ crassae. Pori circulares, 110–135–170 μ diam.; dissepimentis 30–60–90 μ crassis; axibus circa 195 μ distantibus. Basidiosporae sphaericae, luteae, 10–10.4–12 μ diam.

Basidioma pulvinate, with regular or irregular margin, long stipitate; upper surface dull, Blackish Brown (Ridgway), slightly bumpy and undulate in circles; margin incurved and encircling the tube layer; stipe long and thin, 110–380 mm long, 3–8 mm thick, concolorous with upper surface.

Section: cutis grayish, about 60 μ thick; context Pinkish-Buff (Ridgway), one quarter to one half of the thickness of the pileus; tubes 4–8 mm lomg, one-layered, Bister (Ridgway).

Cutis hymeniodermiform, its elements cylindrical, hyaline, about 15 μ long and 4–5 μ thick; hyphae under the hymenioderm anticlinal, fuscous, conspicuously septate, about 4 μ thick. Pores round, 110–135–170 μ in diam.; dissepiments 30–60–90 μ thick; distance between axes about 195 μ. Basidiospores spherical, very lightly yellowish, 10–10.4–12 μ in diam.

Magoderna vansteenisii has a cutis anatomy that cannot be distinguished from that of *M. infundibuliforme*. There is however a difference in pore size, which is smaller in the latter species. As to the habit the distinction is considerable. The pileus of *M. infundibuliforme* is funnel-shaped and relatively large whereas that of *M. vansteenisii* is pulvinate, horizontal, and small. The stipes are also distinctly different: in *M. infundibuliforme* they are short and thick whereas in the other species they are long and thin.

SPECIMENS EXAMINED.—INDONESIA: Sumatra, Átjeh, Gajolanden, Goenong Goh, Lemboeh, alt. 1000–1800 m, s. hosp., C. G. G. J. van Steenis 10,170 (BO 16,679), 18-II-1937, 66.L.61 (Holotype), 66.L.62.

SOLOMON ISLANDS, Vanikoro, on rotten branches on ground, C. J. Hadley (CSIRO-DFP. 5499), 7-VI-1955, 63. CSIRO-DFP. 22.

Addendum

Referring to K. Aoshima's paper on *Ganoderma* and *Amauroderma* (Bull. Tokyo Sci. Mus. **14**: 428—437. 1971) it should be noted that *G. lauterbachii* P. Henn. — if Aoshima's contention that this epithet is a synonym of *G. rivulosum* is correct—is still postdated to *Fomes weberianus* Bres. & P. Henn. (Saccardo, Syll. Fung. **9**: 174. 1891). *Ganoderma lauterbachii* P. Henn. should then be included in the synonymy of the latter. The type specimen that was in Berlin has unfortunately been destroyed. What has been said above of *G. subtornatum* Murrill should caution one when subsidiary types are examined. The specimen studied by the author under the name of *G. lauterbachii* (i. e. C. G. Lloyd collection no 23968, RLS. 69.BPI.3) does indeed point to *G. weberianum* Bres. & P. Henn. but it is a specimen where no gasterospore has been observed. The cutis elements are therefore tightly appressed one against another and are therefore long and thin. In other respects the basidioma agrees fully with those of *G. weberianum* where few or no gasterospores have been found; in particular the basidiospores are morphologically alike. It should be noticed that the specimen in Lloyd's collection was collected in Brazil and not in New Guinea.

Concerning *G. applanatum* (Pers. ex S. F. Gray) Pat. and *G. lucidum* (W. Curtis ex Fr.) Karst., the present author is of the opinion that the two species are not distributed in the Indonesian and New Guinea areas (see the comments regarding these two species). Amongst the many specimens examined from these regions none corresponds to either of the two species. The former is replaced by *G. tornatum* (Pers.) Bres. and the latter by several other species. Both are distributed only in temperate zones or at high altitudes in the tropical or subtropical regions.

REFERENCES

BERKELEY, M. J. (1856). Decades of fungi. Decades LIX–LX. Rio Negro fungi. *In* Hook. J. Bot. **8**: 237.

BLUME, C. L. & T. F. L. NEES VON ESENBECK (1826). Fungi javanici. *In* Nova Acta phys.-med. Acad. Caes. Leop.-Carol. **13** (1): 20.

BRESADOLA, G. (1912). *Ganoderma* (*Amauroderma*) *Sikorae*. *In* A. Zahlbruckner, Schedae ad «Kryptogamas exsiccatas» editae a Museo Palatino Vindobonensi. *In* Annln K.K. naturh. Hofmus., Wien **26**: 157.

BRUMMELEN, J. VAN (1967). A world monograph of the genera *Ascobolus* and *Saccobolus* (Ascomycetes, Pezizales). *In* Persoonia (Suppl.) **1**: (ii) & 260 pp.

FRIES, E. M. (1921). Systema mycologicum .... **1**. Lundae. — (1838). Epicrisis systematis mycologici seu Synopsis Hymenomycetum. "1836–1838".

FURTADO, J. S. (1968). Revisão do gênero *Amauroderma* (Polyporaceae). Estudos baseados nas microestructuras do basidiocarpo. São Paulo. (ii) & v & 384 pp. — Tese Univ. Sao Paulo.

GRAFF, P. W. (1921). Philippine Basidiomycetes—IV. *In* Bull. Torrey bot. Cl. **48**: 285–295.

HADDOW, W. R. (1931). Studies in *Ganoderma*. *In* J. Arnold Arb. **12**: 25–46.

HUMPHREY, C. J. & S. LEUS (1931). A partial revision of the *Ganoderma applanatum* group, with particular reference to its oriental variants. *In* Philipp. J. Sci. **45**: 483–589.

HUMPHREY, C. J. & S. LEUS-PALO (1932). Studies and illustrations in the Polyporaceae. III. Supplementary notes on the *Ganoderma applanatum* group. *In* Philipp. J. Sci. **49**: 159–184.

IMAZEKI, R. (1939). [Japanese title] Studies on *Ganoderma* of Nippon. *In* Bull. Tokyo Sci. Mus. **1**: 29–52.

—— (1952). A contribution to the fungus flora of Dutch New Guinea. *In* Bull. Govt Forest Exp. Stn Japan No. 57: 87–128.

LANGERON, M. (1925). Précis de microscopie .... Quatrième édition ....

LLOYD, C. G. (1912). Synopsis of the stipitate polyporoids. Cincinnati, Ohio. ii pp. & pp. 95–208 [& *in* Mycol. Writ. **3** & *in* Bull. Lloyd Libr. **20** (Mycol. Ser. 6)].

—— (1915a). Synopsis of the genus *Fomes*. Cincinnati, Ohio. pp. 209–288 (& *in* Mycol. Writ. **4**).

—— (1924. Mycological Writings **7** (Mycological Notes No. 71): 1237–1268.

MERRILL, E. D. (1917). An interpretation of Rumphius's Herbarium amboinense. Manilla. (Publ. Dep. Agric. nat. Resources Bur. Sci. **9**). P. 58.

PATOUILLARD, N. T. (1887a). Contributions à l'étude des Champignons extra-européens. *In* Bull. Soc. mycol. Fr. **3**: 119–120.

—— (1887b). Les Hyménomycètes d'Europe .... Paris.

—— (1889). Le genre *Ganoderma*. *In* [Bull.] Soc. mycol. Fr. **5**: 64–80.

—— (1894). Espèces critiques d'Hyménomycètes. *In* Bull. Soc. mycol. Fr. **10**: 75–81.

SACCARDO, P. A. (1916). Hymeniales (....). *In* Fl. ital. crypt. (Fungi) Fasc. 15: 1006–1012.

STEVENSON, J. A. & E. K. CASH (1936). The new fungus names proposed by C. G. Lloyd. *In* Bull. Lloyd Libr. Mus. **35** (= Mycol. Ser. **8**).

STEYAERT, R. L. (1946). Une technique rapide permettant le montage au baume de matériel botanique. *In* Parasitica **2**: 137–138.

—— (1947). A technique for obtaining quickly permanent mounts of nonembedded botanical material. *In* Science **105**: 47–48.

—— (1961a). Genus *Ganoderma* (Polyporaceae) taxa nova — I. *In* Bull. Jard. bot. Bruxelles **31**: 69–83.

—— (1961b). Note on the nomenclature of fungi and, incidentally, of *Ganoderma lucidum*. *In* Taxon **10**: 251–252.

—— (1962). Genus *Ganoderma* (Polyporaceae) taxa nova—2. *In* Bull. Jard. bot. Bruxelles **32**: 89–104.

—— (1967a). Considérations générales sur le genre *Ganoderma* et plus spécialement sur les espèces européennes. *In* Bull. Soc. r. Bot. Belg. **100**: 189–211.
—— (1967b). Les *Ganoderma* palmicoles. *In* Bull. Jard. bot. natn. Belg. **37**: 465–492.
TORREND, C. (1920a). Les Polyporacées de Brésil. Polyporacées stipitées. *In* Brotéria (Sér. bot.) **18**: 23–43.
—— (1920b). Les Polyporacées de Brésil. Polyporacées stipitées. *In* Brotéria (Sér. bot.) **18**: 121–143.

INDEX OF FUNGUS NAMES MENTIONED IN THE TEXT

New names are in **bold-face** type

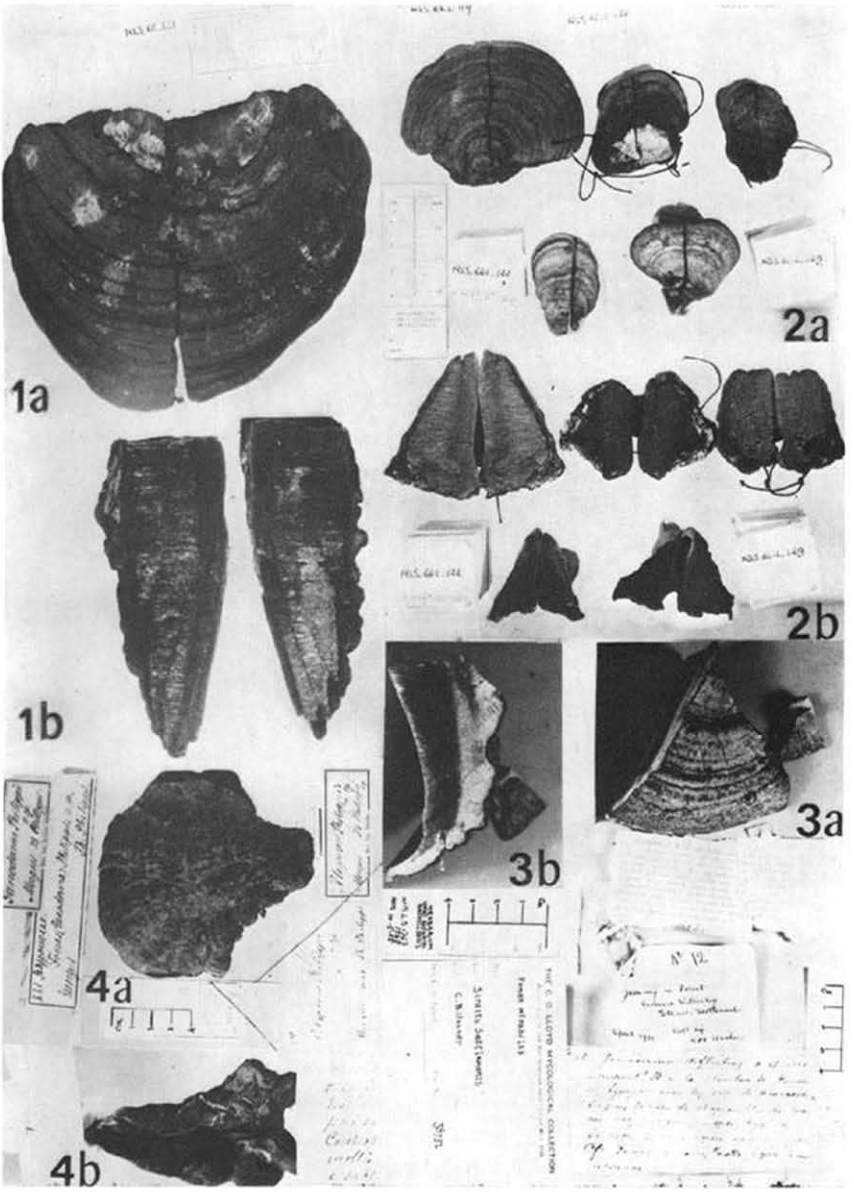


Fig. 1. *Ganoderma kosteri*, 66.L.1 (Holotype); a, upper surface; b, section. — Fig. 2. *G. vanheurnii*, 66.L.119 (Holotype): a, upper surface; b, section. — Fig. 3. *G. mirabile*, Lloyd Mycol Coll. 38,731, 55.BPI.10; a, upper surface; b, section. — Fig. 4. *G. philippii*, 70.B.4 (Holotype): a, upper surface; b, section.

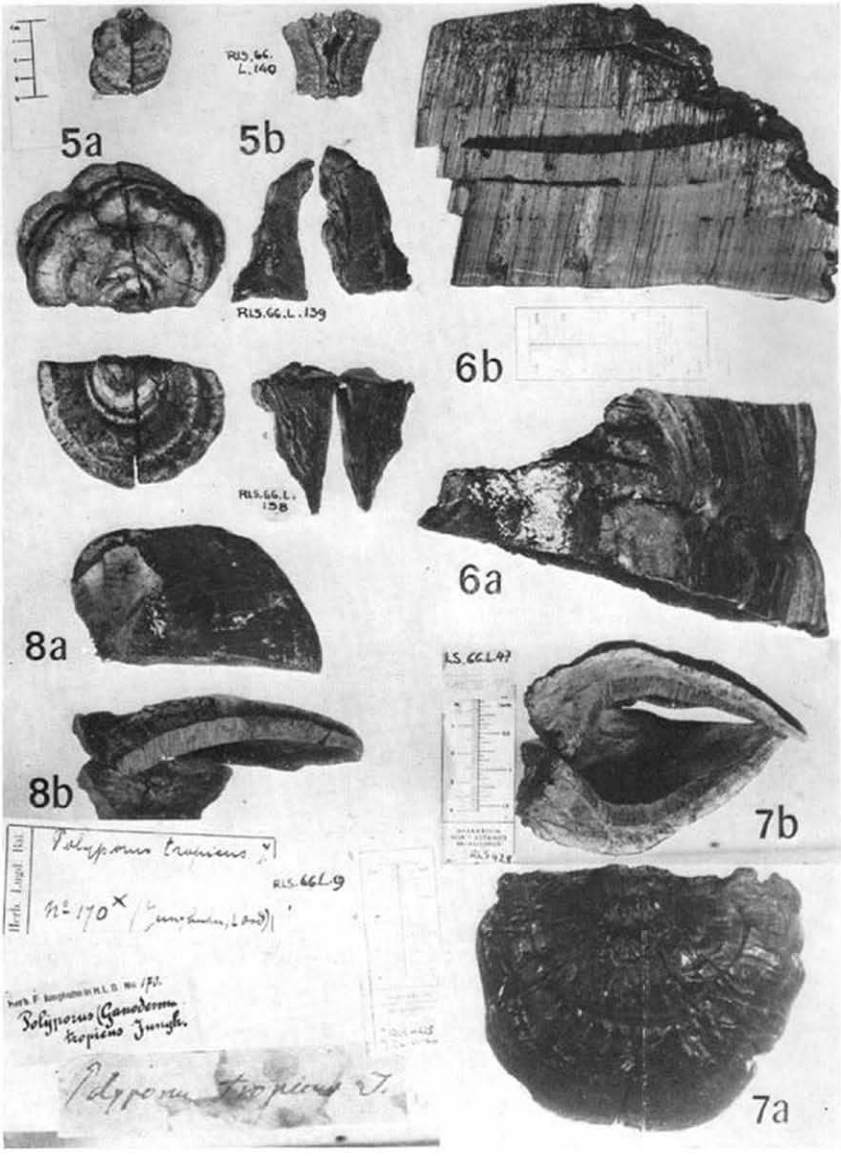


Fig. 5. *Ganoderma donkii*, 66.L.138 (Holotype), 66.L.139 & 140 (Isotypes); a, upper surface; b, section. — Fig. 6. *G. puglisii*, BR (Holotype); a, upper surface; b, section. — Fig. 7. *G. bruggemanii*, 66.L.47 (Holotype); a, upper surface; b, section. — Fig. 8. *G. tropicum*, 66.L.9 (Holotype); a, upper surface; b, section.

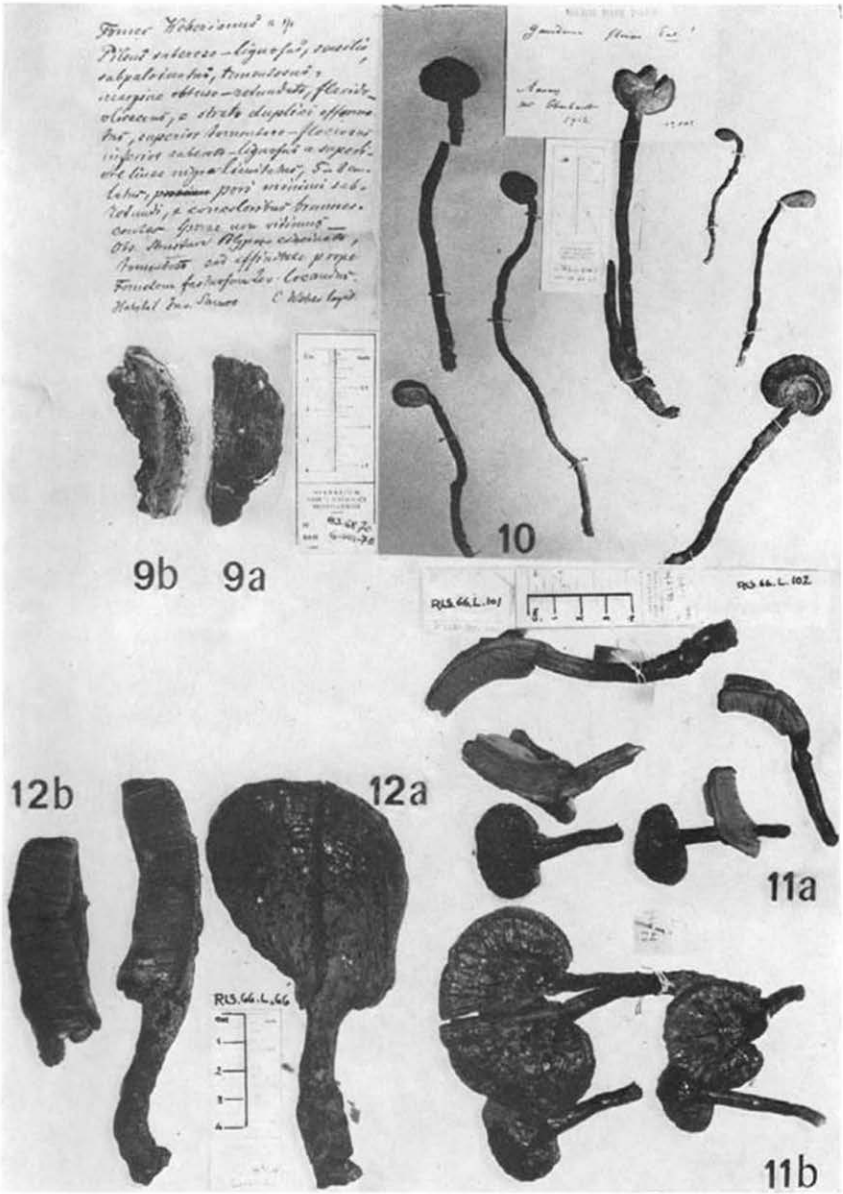


Fig. 9. *Ganoderma weberianum*, Weber, 70.B. 5; a, upper surface; b, section. — Fig. 10. *G. flexipes*, 53.PC.44 (Holotype). — Fig. 11. *G. trulla*, 66.L.101 (Holotype), 66.L.102 (Isotype): a, upper surface; b, section. — Fig. 12. *G. trulliforme*, 66.L.66 (Holotype); a, upper surface; b, section.

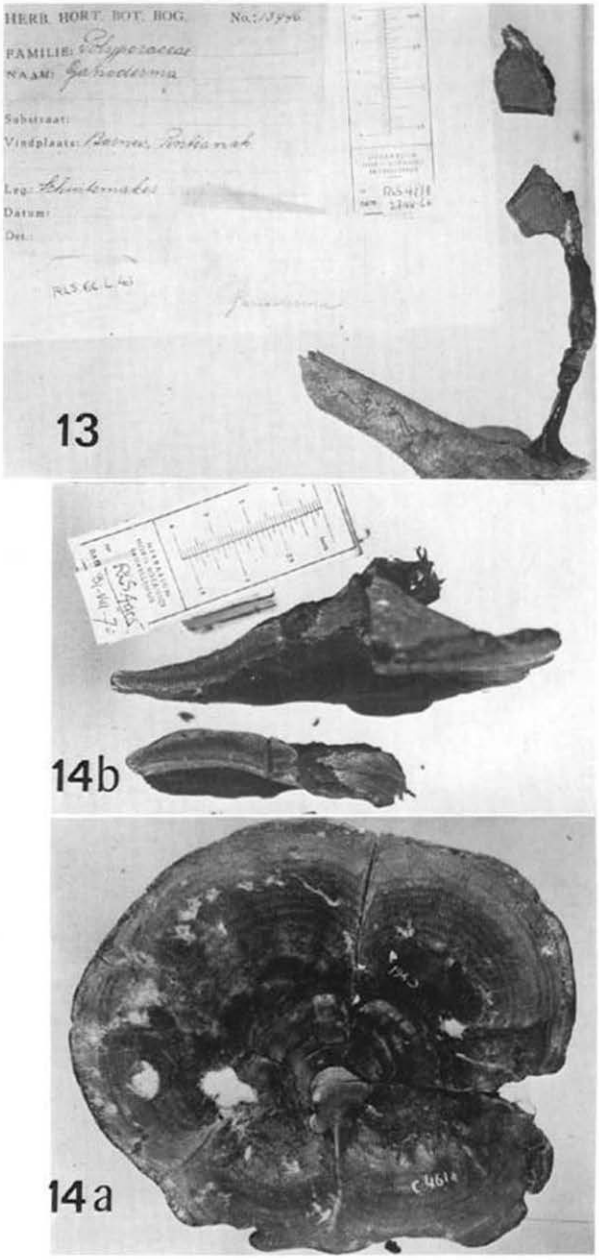
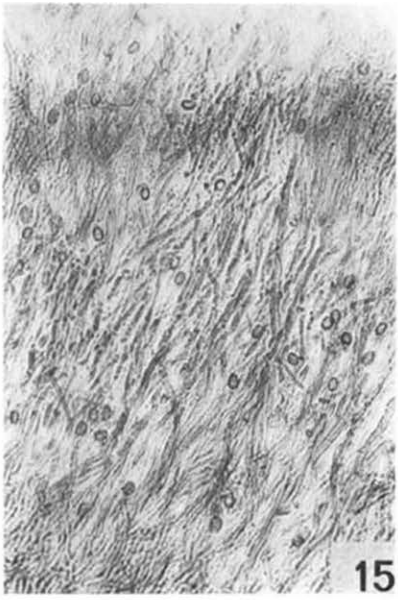
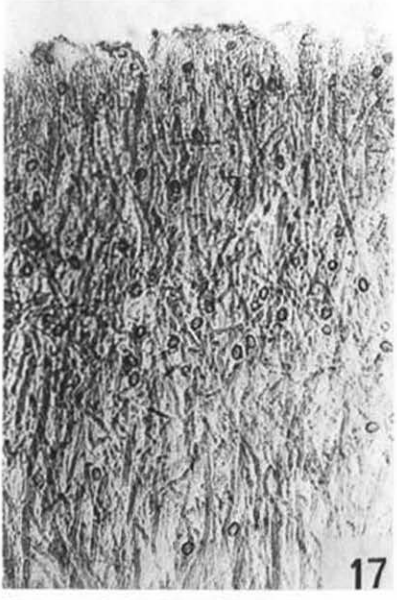
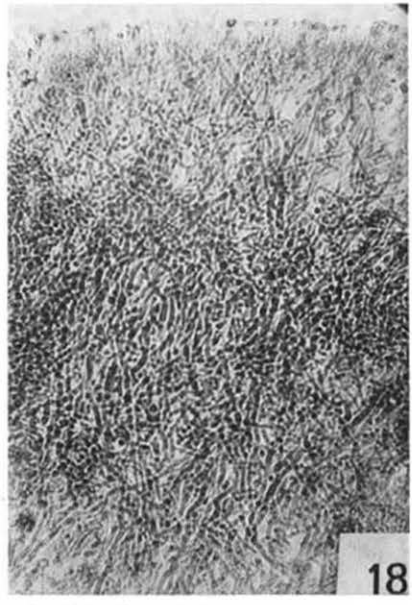


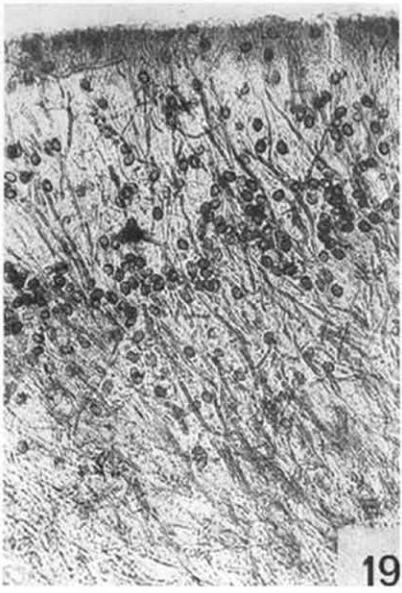
Fig. 13. *Ganoderma amboinense*, 66.L.43 (Neotype). — Fig. 14. *G. ahmadii*, 58.LAH.15 (Holotype), 58.LAH.16 & 17 (Isotypes); a, upper surface; b. section.

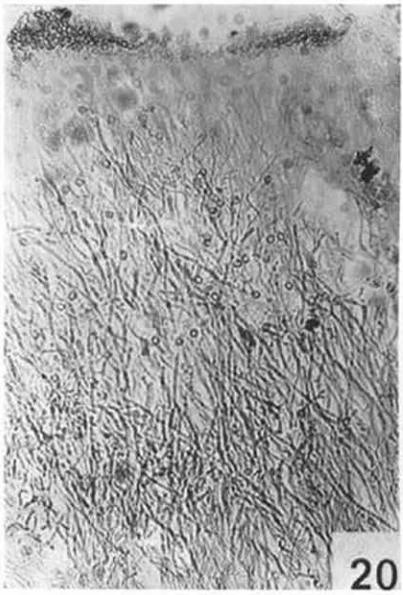




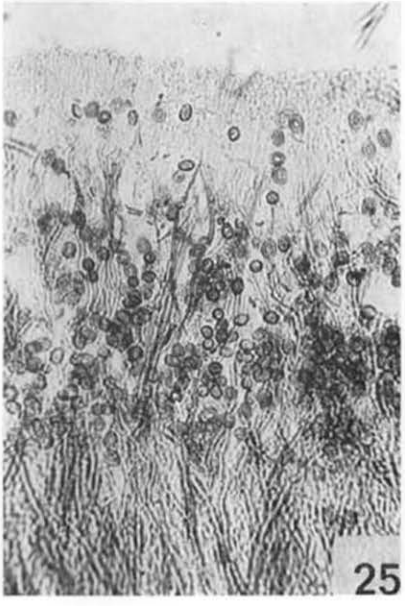


Figs. 15–18. Sections of the cutis, × 130. — 15. *Ganoderma brownii*, 69.NY.17 (Holotype). — 16. *G. donkii*, 66.L.138 (Holotype). — 17. *G. kosteri*, 66.L.1. — 18. *G. vanheurnii*, 66.L.119 (Holotype).

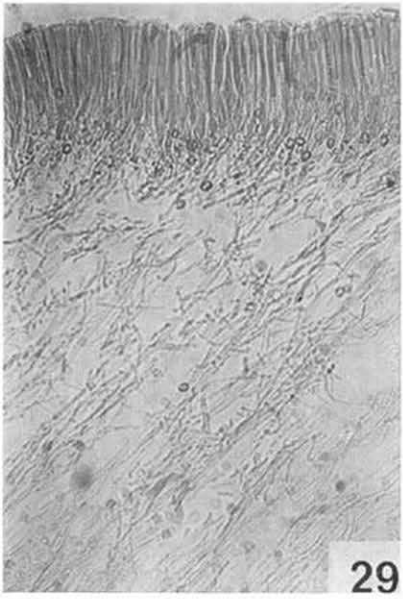




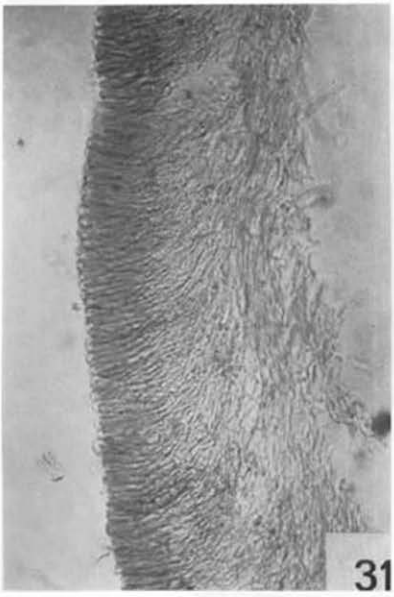
Figs. 19–22. Sections of the cutis, × 130. — 19. *Ganoderma manoutchehrii*, BR (Holotype). — 20. *G. mirabile*, 55.BPI.10 (Holotype), — 21. *G. philippii*, 70.B.4 (Holotype). — 22. *G. philippii*, 66.L.87.

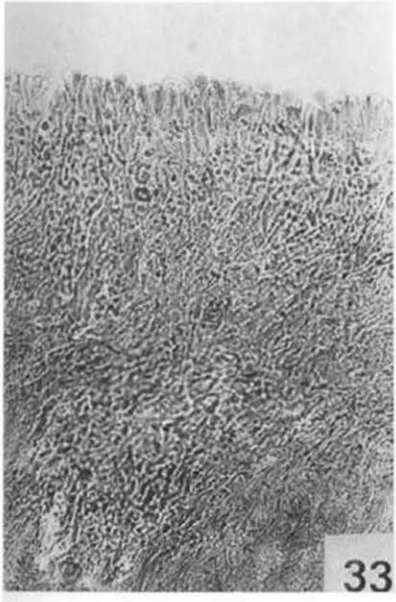


Figs. 23–26. Sections of the cutis, × 130. — 23, 24. *Ganoderma williamsianum*, 66.L.15; 24, wavy context hyphae. — 25. *G. puglisii*, BR (Holotype). — *G. bruggemanii*, BO (Holotype).

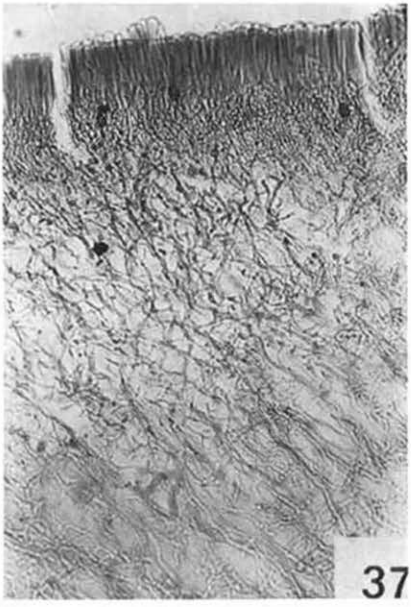


Figs. 27–30. Sections of the cutis, × 130. — 27, 28. *Ganoderma tropicum*, 66.L.9; 27, not lixiviated in KOH; 28, lixiviated in KOH. — 29. *G. weberianum* (Holotype), cutis when gasterospores are few or absent. — 30. *G. weberianum*, 66.L.71, cutis when gasterospores are abundant.

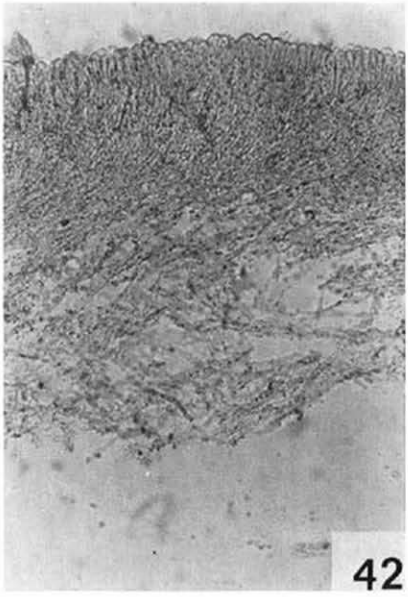




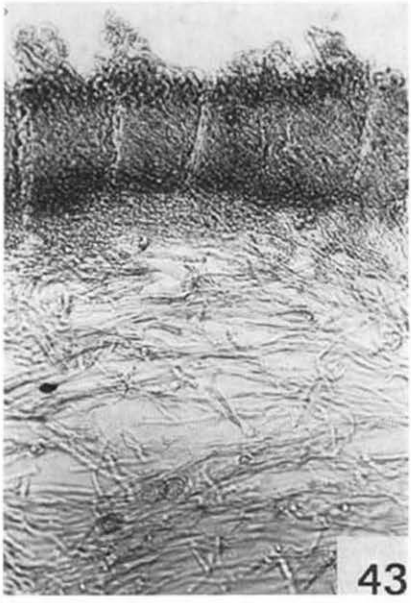
Figs. 31–34. Sections of the cutis, × 130. — 31. *Ganoderma flexipes* (Holotype). — 32. *G. trulla*, 66.L.102 (Holotype). — 33. *G. trulliforme*, 66.L.66. (Holotype). — 34. *G. petchii*, 69.K.87 (Holotype).



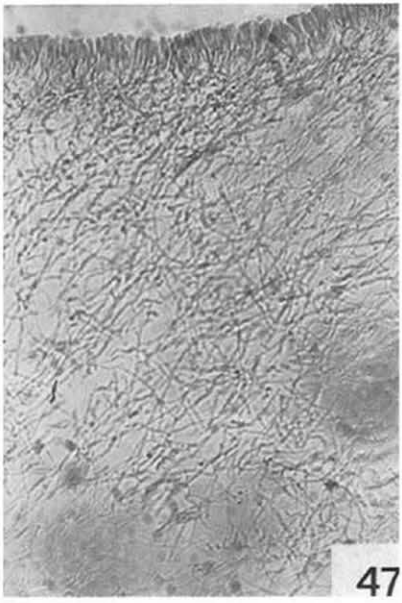
Figs. 35–38. Sections of the cutis. × 130. — 35. *Ganoderma amboinense*, 66.L.43 (Neotype). — 36. *G. subtornatum*, 59.NY.10 (Holotype). — 37. *G. lamaoense*, 69.NY.26. — 38. *G. leytense*, 62.K.48 (Holotype).

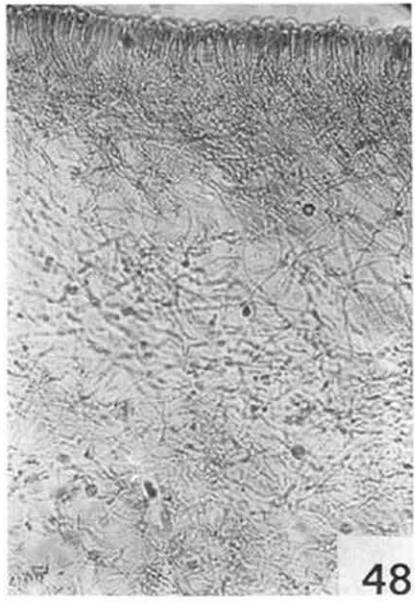


Figs. 39–42. Sections of the cutis, × 130. — 39. *Ganoderma leytense*, 65.L.30. — 40. *G. ahmadii*, 58.LAH.15 (Holotype). — 41. *G. resinaceum*, 66.L.22. — 42. *G. colossus*, 66.L.25.



Figs. 43–46. Sections of the cutis, × 130. — 43. *Humphreya lloydii*, van Oosten 3B. — 44. *H. endertii*, 66.L.38 (Holotype). — 45. *H. coffeatum*, 66.L.23. — 46. *H. coffeatum*, 68.PR.10.





Figs. 47–50. Sections of the cutis, × 130. — 47. *Haddowia longipes*, 53.PC. 13 (Holotype). — 48. *H. aëtii*, 66.L.46 (Holotype). — 49. *Magoderma infundibuliforme*, 70.K.1 (Holotype). — 50. *M. subresinosum*, 70.NY.1 (Holotype).

Figs. 51–54. Sections of the cutis, × 130. — 51. *Magoderma subresinosum*, 66.L.42. — 52. *M. vansteenisii* (Holotype). — 53. *M. vansteenisii*, 63.CSIRO-DFP. 22. — 54. *Amauroderma rugosum*, 53.PC.45.

Figs. 55–57. Sections of the cutis. — 55. *Amauroderma preussii*, Fassi 556 (× 55); context hyphae pericline, cutis hyphae slanting upwards, in upper left corner (close to base of pileus) practically anticline. — 56. *A. preussii*, 56.BPI.2 (× 500); context hyphae passing into level of cutis and giving rise to fuliginous cells; beyond the cutis continuing as free hyphae, but soon broken and abraded. — 57. *Polyporus leptopus*, 53.PC.32 (× 130).