A survey of floral structure in *Drypetes* Vahl (Putranjivaceae) and related genera

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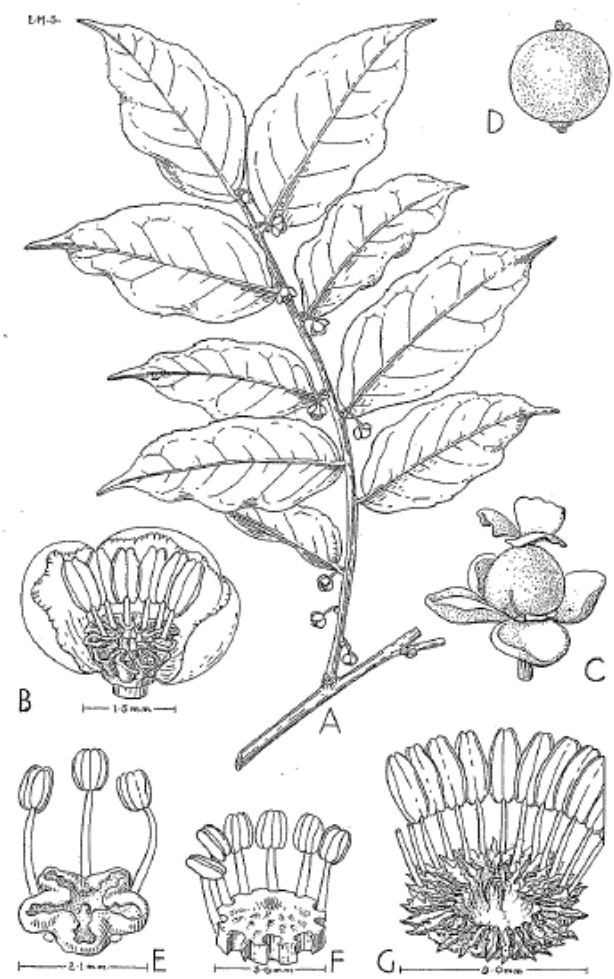

Image from Keay, R.W.J. 1958. Scytopetalaceae - Umbelliferae. In Hutchinson, J., Dalziel, JE, eds. *Flora of West Tropical Africa* (Revised)

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Abstract

The pan-tropical *Drypetes* Vahl is a genus of 225 species of predominantly understorey rain forest trees recently segregated from Euphorbiaceae Juss. *s.l.* and placed within Putranjivaceae Meisn. with *Putranjiva* and *Sibangea*. Generic limits within Putranjivaceae remain unclear, notably between *Drypetes* and *Sibangea*. Within *Drypetes* rates of species discovery are high and yet the genus is somewhat neglected in the literature and many herbarium samples remain undetermined. Using herbarium material, this study examined approximately one third of the known species. Consistent floral characters that separate the three genera in Putranjivaceae are sepal shape, aestivation and persistence; stamen and locule numbers; ovary shape; the form of the stigma and the presence or absence of an intrastaminal nectiferous disk. *Drypetes* exhibits variability in floral characters: stamen number and placement is notably labile, and locule numbers, stigma and disk shapes are variable. Geographical differences in floral characters emerge, but conclusions are tentative in view of the restricted sampling. Limited phylogenetic studies hypothesise that *Sibangea* is nested within a clade of African *Drypetes* which argues for further study of this interesting, but neglected, group.

Key words: Malpighiales; Euphorbiaceae; Putranjivaceae; *Drypetes*; *Sibangea*; *Putranjiva*; placement; floral morphology; geographical differences; herbarium collections.

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1. Introduction

The genus *Drypetes* was established by Vahl (1807) with a single West Indian species, *D. glauca*. The generic name was derived from the Latin *drupa* 'overripe olive', from the Greek *druppa* 'olive' in allusion to the fruits of the type species. At the present time, *Drypetes* Vahl is a pan-tropical genus of 225 species (Govaerts, 2012) of predominantly understorey forest trees, with occasional canopy species, of tropical and sub-tropical wet or dry rain forest habitats or communities with significant levels of rain forest elements. The habit extends from primary forests, evergreen or occasionally deciduous forests, from littoral forest up to 1650m in the Himalayas and *Drypetes* can be abundant along streams and riverbanks (Chakrabarty *et al*, 1997; Forster, 1997).

Figure 1. Distribution of *Drypetes*.

Rates of species discovery in the genus remain high, particularly in the centres of diversity in South East Asia – with over a 100 species ranging from India and eastwards to Australasia – and Central Africa with 77 species. The Americas are less richly represented in terms of diversity with 21 species delimited to date. Table 1 shows the World Checklist of Putranjivaceae breakdown of the species distribution of *Drypetes* (Govaerts, 2012).

Table 1. Global distribution of *Drypetes* (from Govaerts, 2012)

Continent	Species of *Drypetes*
Tropical Asia	99
Temperate Asia	14
Australasia	5
Pacific	9
Africa	77
North America	4
South America	17

The Old World *Drypetes* were previously assigned to *Cyclostemon* Blume (1825) on the basis of the definition of the central body of the male flower. This body was defined in the former as a rudimentary ovary and as a disk in the latter. Hutchinson (1912) however, recognised no distinction between the two genera stating that the central body 'is identical in form and structure, and is usually a flat fleshy, or more rarely cupular disk, with or mostly without a small concave production in the middle which, as pointed out by Baillon, could scarcely be looked upon as a rudimentary ovary' (Hutchinson, 1912). Hutchinson (1912) also remarked that stamen number in the American species of *Drypetes* is not a useful character to distinguish from *Cyclostemon* from Africa, as both genera mostly exhibit the same or double the number of the sepals. The genera are no longer segregated and *Drypetes* is the accepted name for this taxon with the name *Cyclostemon* having the status of synonym (WCSP, 2012).

In terms of general description *Drypetes* are evergreen with simple; mostly oblong-elliptic; entire; denticulate or serrulate; occasionally pubescent; pinnately-veined leaves which are mostly basally asymmetric and short-petioled. The stipules are two in number, usually small, and caducous. The inflorescence is axillary or cauliflorous, arranged in fascicles with apetalous pedicellate or sessile unisexual flowers. Nested within the rosids, the loss of the petals is considered an advanced character (Hutchinson, 1969) as is the reduction to unisexual flowers. The fruits are drupaceous, indehiscent, sub-globose or ovoid with a mostly fleshy and thick but occasionally thin fruit wall.

1.1. The order Malpighiales

Drypetes has long been of taxonomic interest by virtue of the presence of mustard oils within the genus which, from a taxonomic perspective, presented the possibility that a close relationship with Brassicales existed. However, it is now accepted that *Drypetes* is unique in being the only known lineage outside of the Brassicales to have independently evolved the

glucosinate pathways that give rise to the mustard oils, with the consequence that the early association of *Drypetes* with Brassicales, based on this single character, is unfounded (Rodman *et al*, 1998; Johnson *et al*, 2009).

Drypetes, is in the Putranjivaceae Meisn., recently split from Euphorbiaceae *s.l.* and nested within the order Malphigiales. Malphigiales was first identified by Chase *et al*, (1993) with molecular phylogenetic analyses providing support for a clade not recognised in any previous classification (Soltis *et al*, 2005). The order has enlarged considerably since 1993 and Malpighiales is now a mainly tropical assemblage consisting of 32 to 42 families, according to which clades within the order are afforded the taxonomic rank of family. In the APG III system, 35 families are recognized (APG III, 2009) accounting for ~16 000 species, approximately 7.8% of the eudicots (Stevens, 2001). To obtain a sense of the magnitude of morphological variation in the order, the 42 families that Wurdack and Davis (2009) recognise within Malpighiales have previously been assigned to 13 orders in morphology-based classifications *sensu* Cronquist (1981).

The form and habitat of *Drypetes* is consistent in character with the mainly tropical assembly of the Malphigiales clade which constitute a large percentage (~40%) of species in the shaded, shrub and small tree understorey layer of pan-tropical rainforests. In a molecular study of calculated divergence times within the Malphigiales clade to hypothesise that closed-canopy rainforests existed well before the K/T boundary (Davis *et al*, 2005) the estimated age of Putranjivaceae is 86.7-77.8 Ma. The authors argue that the contemporaneous emergence of multiplicitous families within Malphigiales which today constitute this large percentage of tropical rain forest understorey, suggests, contrary to the accepted theory that modern tropical rain forests did not originate until after the K/T extinction event, that modern tropical rain forests emerged from the mid-Cretaceous (~110-90 Ma) period. Davis *et al* (2005) argue that although later Cenozoic events such as climatically optimal conditions during the Paleocene-Eocene transition (~50 Ma) and, to a lesser extent, during the mid-Miocene (~15 Ma), the Quarternary (1.6-0 Ma) glacial cycles along with major geological events such as the closure of the Tethys Seaway, Paleogene land connections across the North Atlantic, the Neogene Andean uplift and the closure of the Isthmus of Panama contributed to the diversification of many rain forest clades, their age estimates for Malphigiales suggest that its major lineages originated well before the K/T boundary. Davis *et al* (2005) state that Malphigiales originated in the late Aptian (114 Ma) (Figure 2) with most major clades diversifying shortly after as a

result of adaptations to survive and reproduce under a closed forest canopy. The alternative, that pre-existing lineages within Malphigiales entered the rain forest habitat independently would require that the diverse morphological and physiological adaptations to survive and thrive in this environment evolved independently in most of the 29 major lineages and that all of their non-rain forest ancestors became extinct (Davis *et al*, 2005).

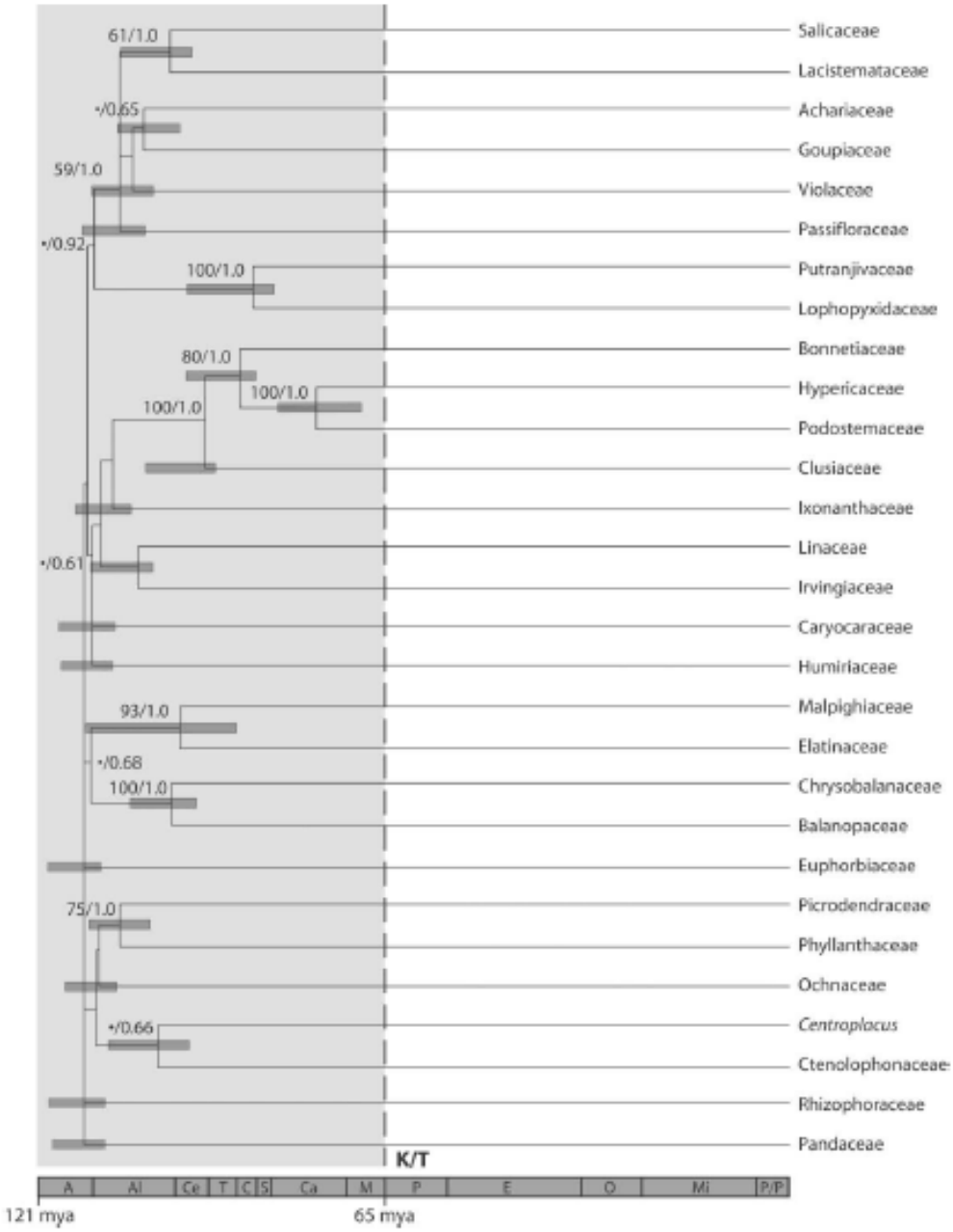


Figure 2. Chronology of Malpighiales (from Davis *et al*, 2005). Legend: A = Aptian, Al = Albian, Ce = Cenomanian, T = Turonian, C = Coniacian, S = Santonian, Ca = Campanian, M = Maastrichtian, P = Paleocene, E = Eocene, O = Oligocene, Mi = Miocene, P/P = Pliocene/Pleistocene.

The difficulty in determining deep relationships within Malphigiales appears to be related to the ancient and rapid origin of the group during the mid-Cretaceous (Davis *et al*, 2005;

Wurdack and Davis, 2009). This explosive radiation of Malphigiales, with the ~16 000 species spanning tremendous morphological and ecological diversity ranging from submerged thalloid aquatics (Podostemaceae), holoparasites (Rafflesiaceae), amentiferous wind-pollinated taxa (Salicaceae) and leafless cactus-like succulents (Euphorbiaceae) underscores the assertion that the order is one of the most surprising angiosperm clades discovered in broad molecular phylogenetic studies (Wurdack and Davis, 2009). Non-molecular synapomorphies for Malphigiales remain unclear and levels of homoplasy appear to be high for most morphological characters that have been investigated in the order, suggesting that the elucidation of synapomorphies for the order may be difficult (Wurdack and Davis, 2009). Although Ronse de Craene (2010) affirms that Malpighiales are typical rosids with pentamerous flowers, free petals, diplostemonous, a mostly three- to five-carpellate ovary with free styles, it remains the case that finding common morphological characters is challenging (Ronse de Craene, 2010). Bearing in mind the large proportion of species within Malphigiales that, at the familial level have been contained with the classical Euphorbiaceae Juss. *s.l.* (~8 000 species) it is perhaps not surprising that classification above the familial level has historically been problematic.

1.2. The family Euphorbiaceae *s.l.*

As with the situation at the ordinal rank, affinities within Euphorbiaceae *s.l.* have long been unclear with precise circumscription complicated by the considerable diversity of vegetative floral and fruit forms (Hoffman *et al*, 2006). Euphorbiaceae *s.l.* were defined by a few shared morphological characters including unisexual flowers with syncarpous superior ovaries, apical-axile placentation with one or two epitropous ovules per locule. Characters that are usually present, as stated by Hoffmann *et al* (2006) include alternate stipulate leaves, actinomorphic flowers, the presence of a floral disk, pistillode and obturator, as well as a tricarpellate, explosively dehiscing schizocarp leaving a central columella. This fruit type, although strongly modified in a number of genera (*Drypetes* and closely related genera do not share this fruit type) is a unique characteristic of Euphorbiaceae *s.l.* and taxa that possess it can be instantly identified as this group.

Notwithstanding the above, it remains that affinities within the group have been historically problematic. The situation was, perhaps, most elegantly and cogently described in an essay entitled “Notes on the Euphorbiaceae” by George Bentham, read before the Linnean Society of London in 1878, within which the author made the following statement:

"*Two men, indeed, both of high standing in the science, and with comparatively ample materials at their command, have recently worked up the order with great care and attention independently of each other, and I would readily have followed the lead of either of them, but that the two have so frequently come to conclusions diametrically opposed to each other, that I have been compelled to steer a course of my own through a labyrinth of tribes, subtribes, genera, sections, or vaguely indicated affinities*." (Bentham, 1878).

The two botanists were Henri Baillon and Jean Müller, and it is telling that botanists of such standing held such divergent views of the circumscription and affinities of the Euphorbiaceae.

Despite the inherent problems associated with the extensive group, progress was made in the delimitation of discreet sections within Euphorbiaceae *s.l.* The first great insight was provided by Adrien de Jussieu in 1824 who subdivided the Euphorbiaceae in to six well-circumscribed sections based upon ovule number, stamen insertion, presence of petals and inflorescence type (Webster, 1987). Although Jussieu did not name his sections, they were recognised and afforded formal status as tribes by subsequent workers. Classification based upon these six tribes provided the template for all later work on affinities within Euphorbiaceae. In the opinion of Webster (1987) Jussieu's most significant insight was recognition of the taxonomic importance of ovule number and the distinction between taxa with uniovulate and biovulate ovary locules has been accepted as fundamental by subsequent workers (Webster, 1987).

From the 1950s onwards, systematics of Euphorbiaceae *s.l.* was greatly advanced by Webster whose classification incorporating palynological, karyological, phytochemical and anatomical characters (Webster, 1975; 1994b) became widely adopted. Webster's classification is still, however, underpinned by ovule number and gave rise to the segregation of Euphorbiaceae *s.l.* in to a grouping of two biovulate subfamilies (Phyllanthoideae and Oldfieldioideae) and three uniovulate subfamilies (Acalyphoideae, Crotonoideae and Euphorbioideae). Within this taxonomic framework, *Drypetes* (along with *Lingelsheimia*, *Sibangea* and *Putranjiva*) were placed within tribe Drypeteae of the subfamily Phyllanthoideae) on the grounds of biovulate locules, predominantly alternate simple, entire or dentate, stipulate leaves, fasciculate flowers, an intrastaminal disk (absent in *Putranjiva*)

and the drupaceous fruit (dehiscent in *Lingelsheimia*). This inclusive *sensu lato* circumscription of Euphorbiaceae developed by Webster was followed and extended by Radcliffe-Smith (2001). Within Drypeteae the four genera were delimited as follows:

KEY TO THE GENERA OF TRIBE DRYPETEAE

1a. Ovary 3-locular; fruit capsular; styles bifid, style-branches slender ..... 34. *Lingelsheimia*
1b. Ovary mostly 1- or 2-locular; fruit drupaceous; styles not bifid.
2a. Disk present; stamens mostly 4 or more; styles stigmatiform.
3a. Pistillate sepals imbricate in bud, deciduous in fruit ..... 35. *Drypetes*
3b. Pistillate sepals open in bud, persistent in fruit ..... 36. *Sibangea*
2b. Disk absent; stamens mostly 2 or 3; styles petaloid-dilated ..... 37. *Putranjiva*

Figure 3. Tribe Drypeteae (from Webster, 1994b).

Not all plant morphologists, however, agreed with the inclusive *sensu lato* circumscription of Euphorbiaceae. Meeuse (1990) contended that dismemberment of the group was a desirable in the interests of elucidating more homogenous and clearly defined taxonomic units. Meeuse (1990) argued that the recognition of a smaller Euphorbiaceae comprising of only the uniovulate subfamilies, Acalyphoideae, Crotonoideae and Euphorbioideae (*sensu* Webster, 1975; 1994b) was imperative and unavoidable. Hence was formed the emergence of a delimitation that is recognisable in the age of molecular phylogenetics.

1.3. The emergence of Putranjivaceae

Chase *et al* (1993) were the first to indicate the potential polyphyletic nature of Euphorbiaceae *s.l.* However, because this study included only two widely divergent species, uniovulate *Euphorbia polychroma* A. Kern (Euphorbiaceae *s.s.*) and biovulate *Putranjiva roxburghii* Wall., the prospect remained that their non-sister placement was an artefact of inadequate sampling and/or suboptimal analysis of a large data set (Wurdack *et al*, 2004). Additional taxon sampling studies (see Wurdack *et al*, 2004) led to the original APG system (1998) reclassifying Euphorbiaceae *s.l.* in to three families: Euphorbiaceae, Putranjivaceae (from Phyllanthoideae tribe Drypeteae) and Pandaceae (from Acalyphoideae tribe Galearieae. Further dismemberment ensued with the removal of the two remaining biovulate lineages as Phyllanthaceae (from Phyllanthoideae excluding tribe Drypeteae) and Picrodendraceae (from Oldfieldioideae).

Following these changes, APG II (2003) recognised three biovulate families (Phyllanthaceae; Picrodendraceae; Putranjivaceae) and two uniovulate families (Euphorbiaceae *s.s.*; Pandaceae) from the earlier Euphorbiaceae *s.l.* (Figure 4).

EUPHORBIACEAE SENSU STRICTO	*Acalyphoideae* (excluding *Dicoelieae* and *Galearieae*) + *Crotonoideae* + *Euphorbioideae sensu* Webster (1994) and Radcliffe-Smith (2001)
PANDACEAE	*Acalyphoideae-Galearieae sensu* Webster (1994) and Radcliffe-Smith (2001)
PHYLLANTHACEAE	*Phyllanthoideae sensu* Webster (1994) excluding *Drypetes*, *Phyllanoa* Croizat, *Putranjiva* Wall., *Sibangea* Oliv. but including *Croizatia* Steyerm., *Dicoelia* Benth., *Tacarcuna* Huft; *sensu* Radcliffe-Smith (2001) also excluding *Centroplacus* Pierre
PICRODENDRACEAE	*Oldfieldioideae sensu* Webster (1994) and Radcliffe-Smith (2001) excluding *Croizatia* and *Paradrypetes* Kuhlm.
PUTRANJIVACEAE	*Phyllanthoideae-Drypeteae sensu* Webster (1994) and Radcliffe-Smith (2001) excluding *Lingelsheimia* Pax
Excluded taxa	*Centroplacus* (*Centroplacaceae*), *Paradrypetes* (incertae sedis near *Rhizophoraceae*), *Phyllanoa* (*Violaceae*; Hayden & Hayden 1996)

Figure 4. Revised circumscriptions of segregate families (*sensu* APG 2003) from Euphorbiaceae *s.l.* (from Hoffmann *et al*, 2006).

The revised circumscription of Putranjivaceae excludes the small, poorly known Afromalagasy genus *Lingelsheimia* Pax. *Lingelsheimia* had been linked to *Drypetes* on the basis of high stamen number (15-35) and the staminate disk lobes surrounding the filament bases. The geographical separation of *Lingelsheimia* from the now known congeneric *Danguyodrypetes* along with the typical euphorbiaceous schizocarp in *Lingelsheimia* being unknown had prolonged the association between *Lingelsheimia* and *Drypetes*. Indeed, Webster (1994b) does state that *Lingelsheimia* appears to be anomalous in his Drypeteae and with the information available at the time was unable to associate *Lingelsheimia* with *Danguyodrypetes*. Presciently, however he does state that *Lingelsheimia* should possibly be placed within tribe Phyllantheae. The differences between *Lingelsheimia* and *Drypetes* lay in the disk, the breeding system, the shape of young branches, leaf margin and leaf base, stipules, ovary locule number, shape of the stigmas, fruit type and seed invagination (Kathriarachchi *et al*, 2005) and molecular phylogenetic analyses of Kathriarachchi *et al* (2005) now embed *Lingelsheimia* firmly within Phyllanthaceae. Hence, Putranjivaceae (comprising *Putranjiva*, *Drypetes* and *Sibangea*) emerges as a discreet taxonomic unit.

In terms of the closest relative to Putranjivaceae, molecular analyses (Wurdack *et al*, 2004) support a sister-group relationship to Lophopyxidaceae remarking that both families are isolated lineages with Putranjivaceae appearing to be more distantly related to the other former members of Phyllanthoideae. Further studies (Tokuoka and Tobe, 2006; Soltis *et al*,

2011) show a well-supported (BS = 100%) isolated sister group of Lophopyxidaceae + Putranjivaceae (Figure 5).

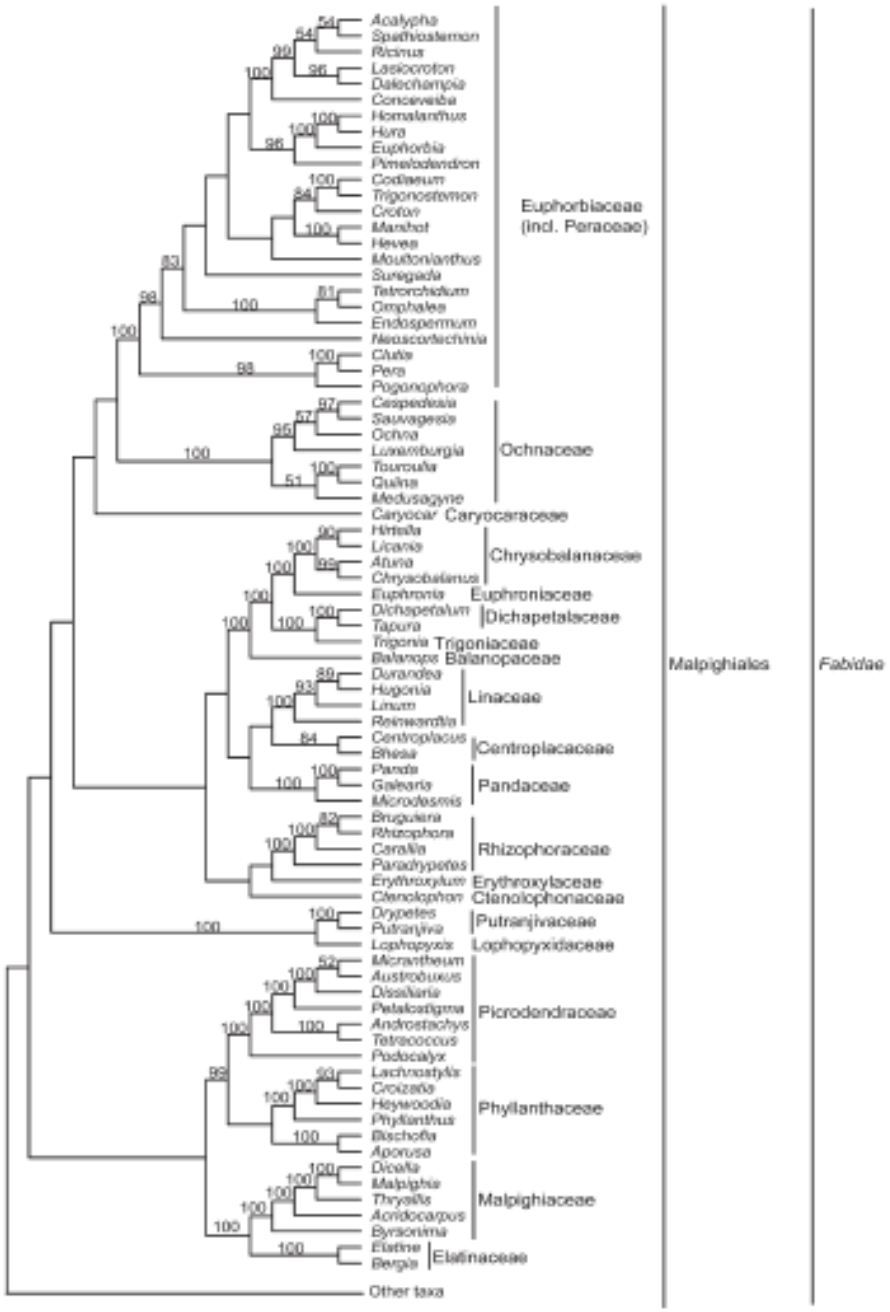


Figure 5. Maximum likelihood majority rule consensus tree (from Soltis *et al*, 2011).

In addition to the well supported Lophopyxidaceae + Putranjivaceae clade, Figure 5 also shows a well-supported (BS = 100%) sister group relationship of *Putranjiva* + *Drypetes*. In terms of the relationship of the African genus *Sibangea* within the family, notably its relationship with *Drypetes*, this has long been a matter of opinion and conjecture which

remains unresolved. *Sibangea*, established by Oliver in 1883, differs from *Drypetes* in having fewer stamens, a unilocular ovary with a subpeltate capitate stigma, and narrow sepals which are open in bud and persistent in the fruit (whereas *Drypetes* has broad, cupular, closely imbricate sepals which are readily caducous). Hutchinson (1912) included *Sibangea* in *Drypetes* on the basis that that many *Drypetes* have a unilocular ovary. Radcliffe-Smith (1978) was of the opinion that *Sibangea* remains distinct from *Drypetes* and re-established the genus. The analyses of Wurdack *et al* (2004) indicate, however, that *Sibangea* nests within a paraphyletic *Drypetes* (Figure 6) and the authors state that *Sibangea* should be subsumed under that genus. *Putranjiva*, probably sister to *Drypetes* + *Sibangea* (Wurdack *et al*, 2004; Tokuoka and Tobe, 2006; Soltis *et al*, 2011) (Figure 5), is a tropical Asian genus containing four species of small to medium sized trees. Flowers are dioecious, apetalous with an open calyx and a disk is absent. The ovary is 2- to 3-locular and the male flowers have 2-3 stamens.

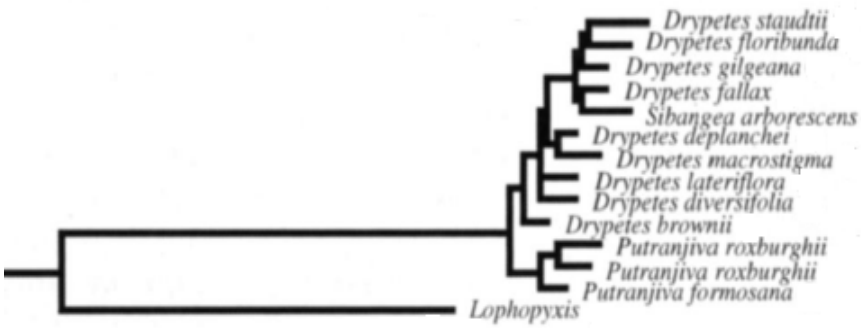


Figure 6. Phylogram of Putranjivaceae (from Wurdack *et al*, 2004).

1.4. Aims

This study undertakes a survey of floral characters across Putranjivaceae using material from herbarium specimens to address two key questions. The first of these asks whether there are consistent floral characters which can be used to separate the three genera in Putranjivaceae. The second asks do floral characters – such as sepal number and shape, disc size, disc shape, number of stamens, carpel number and degree of fusion of the styles – vary across the genus *Drypetes*.

2. Materials and methods

2.1. Materials

This investigation is based upon sampling of bud and flower material from 121 herbarium accessions gathered under appropriate consents from the Royal Botanic Garden Edinburgh (25 samples), the Royal Botanic Gardens, Kew (92 samples) and the Natural History Museum, London (four samples). Of these samples, 97 of the 121 were obtained from herbarium sheets with the remainder from spirit collections. With only two spirit samples (from recently collected material – Harris, DJ. 9754 and 9761 – stored in 70% alcohol) from Edinburgh, the majority of the spirit material was obtained from Kew. The Kew spirit specimens are stored in 'Kew Mix', containing 53% industrial methylated spirit (98/99% total alcohols), 37% water, 5% formaldehyde solution (38%w/w) and 5% glycerol. Spirit material collected from Kew was transferred in to 'Copenhagen Mix' (70% industrial methylated spirit, 28% water and 2% glycerol) for study. The dry material was rehydrated overnight (between 8-24 hours) in a mixture (6:1) of 10% aqueous solution of Aerosol OT (Merck Index 11, 3398) and acetone, rinsed and placed in 70% alcohol for study.

Table 2. Source and pre-treatment of material used for this study

Herbarium	Sheet material	Spirit material	Total
K	70	22	92
E	23	2	25
BM	4	0	4
Total	97	24	121

2.2. Methods

The material was examined and dissected under a camera-mounted Stemi 2000C binocular microscope. Images were captured with an Axiocam MRc5 camera and processed by Zeiss AxioVision version 4.7 software. The full set of digitally stored scaled images collated for this study are indexed by collector name and number and are appended to this report on two DVDs. Images reproduced in the report are extracts from the stored images and, by necessity, the scale has been cropped or is illegible. In view of the nature of this study, it was envisaged from its inception that the photographic record (of over 450 images captured) would form a separate, but integral part of the report. It is recommended, therefore, that the results are used in conjunction with these images. Floral characters are systematically catalogued (Appendix 1) and comparison of characters between genera presented in the results. The terminology for the description of hairs follows that of Hickey and King (2000). Due to the undetermined nature of the majority of the herbarium material, the specimens are referenced and indexed by

collector as opposed to the herbaria filing names. The country of origin from the herbarium label is maintained with other label information for the samples in Appendix 1. In Appendices 2 and 3 the continent of origin of the samples follows the World Checklist of Selected Plant Families designation (WCSP, 2012). The label information of the specimens subject to this study have been entered in to a BRAHMS database as part of a significantly larger data set assembled by Zoë Goodwin (University of Oxford) as part of a doctoral thesis to monograph the genus *Drypetes*. Result data from this study is to be uploaded to the BRAHMS database and data cleaning of the existing database has been undertaken as appropriate. Herbarium samples filed under *Drypetes* that are clearly not of this genus have been identified in the results.

3. Results

Of the 121 floral samples collected from in their respective herbaria, 113 are filed under *Drypetes* sp., four under *Putranjiva roxburghii* Wall., three under *Sibangea* Oliv. and one under *Lophopyxis maingayi* Hook.f.

Table 3. Filing names and numerical breakdown of samples

Filing name	Number
Drypetes spp.	113
Putranjiva roxburghii Wall.	4
Sibangea arborescens Oliv.	2
Sibangea similis (Hutch.) Radcl.-Sm.	1
Lophopyxis maingayi Hook. f.	1

Of the 113 *Drypetes*, 108 are named species covering 72 species and two varieties, covering only one third of the genus which is a limiting factor in this study. The remaining five are named to genus only. The 72 named species includes *D. cernua* (two samples, Cuming, 148; Weber, 1052) and *D. solida* (one sample, Elmer, 7006). Neither of these names exists in the literature and these specimens do not appear to be *Drypetes*. Cuming 148, filed as *D. cernua*, has male and female flowers present with fused stamen filaments in the male flower with no disk present in either gender. Weber 1052, filed as *D. cernua*, has only female flowers present with no disk. Elmer 7006, filed as *D. solida*, has bisexual flowers with no disk. Several other specimens studied (Table 4) appear to have been incorrectly identified as *Drypetes*: Elmer 13175, filed as *D. cumingii* (Baill.) Pax & K.Hoffm. has a corolla present; Curtiss 686, filed as *D. ilicifolia* (DC.) Krug & Urb., has bisexual flowers with a corolla and a disk is absent; Sayers NGF 13223, filed as *D. lasiogynoides* Pax & K.Hoffm. has an oblong, two-whorled, trimerous calyx, fused stamens and a disk is absent; Furuse 4834, filed as *D. karapinensis* (Hayata) Pax & K.Hoffm. has two fused stamens and a disk is absent; Newman LAO 301, filed as *D.* cf. *assamica* (Hook.f.) Pax & K. Hoffm. has bisexual flowers, a corolla and a disk is absent. Zenker 3721 is filed as *D. similis* Hutch. This is a synonym of *Sibangea similis* (Hutch.) Radcl.-Sm. Unisexual flowers within Table 4 are included in the gender-specific character matrices for comparison which aims to better circumscribe the study group. Of the remaining 104 'true *Drypetes*' 83 samples are male and 21 female.

Table 4. Samples incorrectly labelled as *Drypetes*

Filing name	Collector	No. samples	Reason
D. cernua	Cuming, 148; Weber, 1052	2	Male and female flowers present; fused stamen filaments; no disk; no publication of the name
D. solida	Elmer, 7006	1	Bisexual flowers; no disk; no publication of the name
D. cumingii	Elmer, 13175	1	Corolla present; no disk
D. ilicifolia	Curtiss, 686	1	Bisexual flowers; corolla present; no disk
D. lasiogynoides	Sayers, NGF 13223	1	K3+3 oblong; fused stamen filaments; no disk
D. karapinensis	Furuse 4834	1	Two fused stamens; no disk
D. cf. *assamica*	Newman, LAO 301	1	Bisexual flowers; corolla present; no disk
D. similis	Zenker, 3721	1	Synonym of *Sibangea similis*

The information gathered from specimens records the floral formula and a description of the nature of the material collected (bud or flower) with measurements. For the E specimens, most of the sampling was taken in May 2012 from the plant material on the sheets and the arrangement of flowers on the plant is described. For the K and BM material most of the sampling in May 2012 was from capsules and the arrangement of flowers on the plant is not described. The characters recorded are the number, shape and size of the sepals and the nature of any pubescence on the abaxial side of the sepal only, unless otherwise stated. Aside from their number, the stamens are not described. This is due to the fact that much of the material used is bud material and the stamens are not fully developed. Additionally, stamen form is not, generally, a diagnostic feature of the group. The arrangement of the stamens, however, is commented upon, as appropriate. For female flowers, the size and shape of the gynoecium and the presence or absence of hairs is recorded. The fused or free nature of the styles is recorded with measurements along with the number and form of the stigma. The shape and size of the disk is recorded along with the presence or absence of hairs. In the male flowers measurement of disk diameter is recorded, whereas in the female flower the depth of the disk 'skirt' is recorded (as the disk always envelops the base of the gynoecium). For the mature female disk the form is recorded along with the presence or absence of hairs. General notes are made which refer to other specimens in the study and/or to relevant protologues or floral accounts as appropriate. Spot characters (e.g. large stamens, long pedicels) are recorded as appropriate. The full set of results is presented at Appendix 1 with these results summarised in male and female character matrices contained at Appendix 2 and Appendix 3 respectively. Disk diameter measurements of male flowers is at Appendix 4.The two samples

in Table 4 with bisexual flowers are not included in the gender specific matrices. Also not included in the matrices are the three poor quality samples Corner, SFN 33148; How, 70335 and Merrill, 9209.

3.1. Male floral characters

A total of 86 samples possessed male flowers, these were examined for calyx, stamen and disk characters.

3.1.1. Calyx

The sepals are predominantly (sub)-orbicular, culcullate and imbricate (Figure 7A). Eight samples are open in bud (Figure 7B) or valvate (Bourdillon, 1595; JJFE de Wilde, 8476; Lace, 4718; Le Testu, 9306; Ram, *s.n.*; DW Thomas, 672; Worthington, 940; Zenker, 3721).

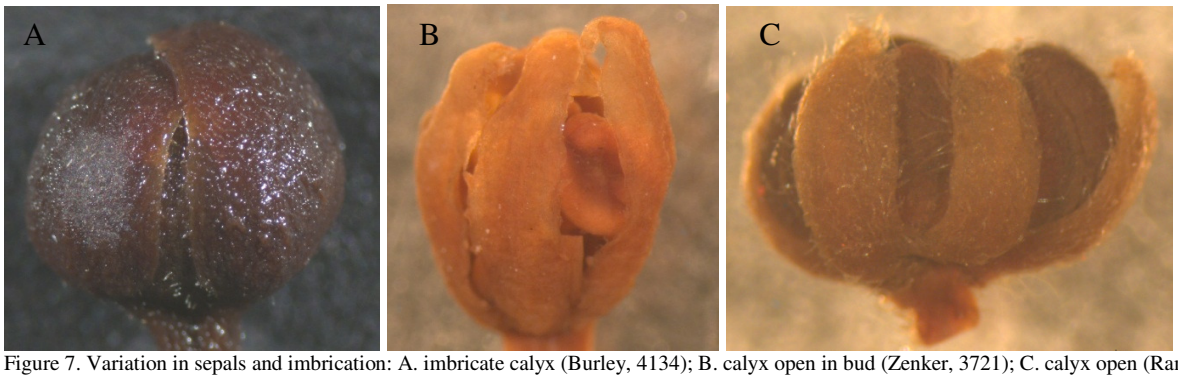


Figure 7. Variation in sepals and imbrication: A. imbricate calyx (Burley, 4134); B. calyx open in bud (Zenker, 3721); C. calyx open (Ram, *s.n.*).

3.1.2 Calyx merism

Sepal merism is K4 or K5, occasionally K4-5. K4 is the more common condition (Table 5). In the female flower K5 is the more common condition (Table 9). In *Drypetes* where both male and female flowers of the same species have been sampled the respective genders share the same calyx merism.

Table 5. Sepal merism in the male flower (all samples): number (and percentage)

K4	K5	K4-5	Other*	Total
49 (57%)	30 (35%)	5 (6%)	2 (2%)	86 (100%)

*These two samples are Sayers NGF 13223 (K3+3) & Cuming 148 (K6) (see Table 4) but are included in the character matrix as they have unisexual flowers.

3.1.3. Calyx shape

Although there is a range of shapes, calyx shape is predominately (sub)-orbicular (Table 6).

Table 6. Sepal shape in the male flower (all samples): number (and percentage)

(Sub)-orbicular	Ovate	Elliptic	Oblong	Oblong-acute	Oblong-obtuse	Ligulate	Total
73 (90%)	1 (1.2%)	2 (2.4%)	3 (3.6%)	3 (3.6%)	1 (1.2%)	3 (3.6%)	86 (100%)

3.1.4. Calyx indumentum

Sepals of 53 of the 86 samples have hairs on the abaxial surface. The hairs range from very sparsely to densely pubescent, sparsely pilose, lanate, sericeous and velutinous.

Figure 8. Apical ciliate hairs (Caldwell, 8).

Apical ciliate hairs (Figure 8) have no correlation to the presence or absence of hairs on the abaxial surface of the sepals. Apical ciliate hairs on the sepal are found in the following 14 samples:
Akpapla, 1100; anon., 30; Balansa, *s.n.*; Bourdillon, 1595; Brenan, 8574; Breteler, 829; Caldwell, 8; Greenway, 10447; 10964; Harris, 4941; Reineck, *s.n.*; Strey, 9244; NW Thomas, 2911; Worthington, 92; 5168.

3.1.5. Androecium

All anthers observed are introse except those for Lace, *s.n.* and Ram, (*s.n.*) which are extrorse.

3.1.5.1 Stamen merism

Stamen number ranges from three (Breteler, 829; JJFE de Wilde, 8476; Lace, *s.n.*; Ram, *s.n.;*) to 106 (anon., 30 *s.n.*) (Table 7) with the majority, totalling 37 (41%), possessing between 9 and 16.

Table 7. Stamen merism (all samples): number (and percentage)

A≤4	A5-8	A9-12	A13-16	A17-20	A≥21	Total
15 (16.5%)	15 (16.5%)	19 (21%)	18 (20%)	12 (13%)	12 (13%)	91 (100%)

Note: some samples cover a range of categories so the total is greater than the 86 samples in the matrix.

3.1.5.2 Stamen arrangement

The stamens are predominantly arranged in one whorl. There are 15 instances where stamen initiation occurs inside of the outer stamen whorl. There is only one sample where the stamens are arranged in two regular alternate whorls (Harris, 2876) in a A4+4 pattern (Figure 9A).

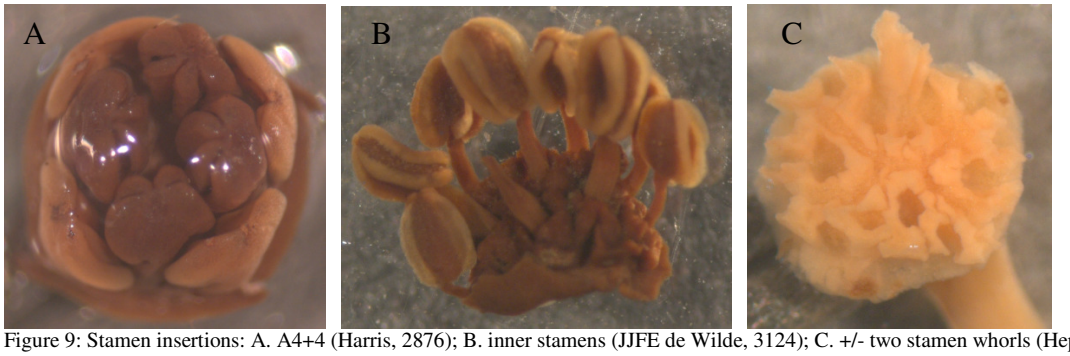


Figure 9: Stamen insertions: A. A4+4 (Harris, 2876); B. inner stamens (JJFE de Wilde, 3124); C. +/- two stamen whorls (Hepper, 7425).

There are four examples (Akpapla, 1100; Brenan, 8574; JJFE de Wilde, 3124; Hepper, 7425) where the arrangement of stamens is not regularly two-whorled (as exhibited by Harris 2876) but exhibit a 'loose', more or less two-whorled arrangement (Figure 9B & C).

There are three examples (Brenan, 8436; 9296; Harris, 4953) where the arrangement of stamens occurs at three different circumferential loci in a 'loose', more or less three-whorled arrangement (Figure 10).

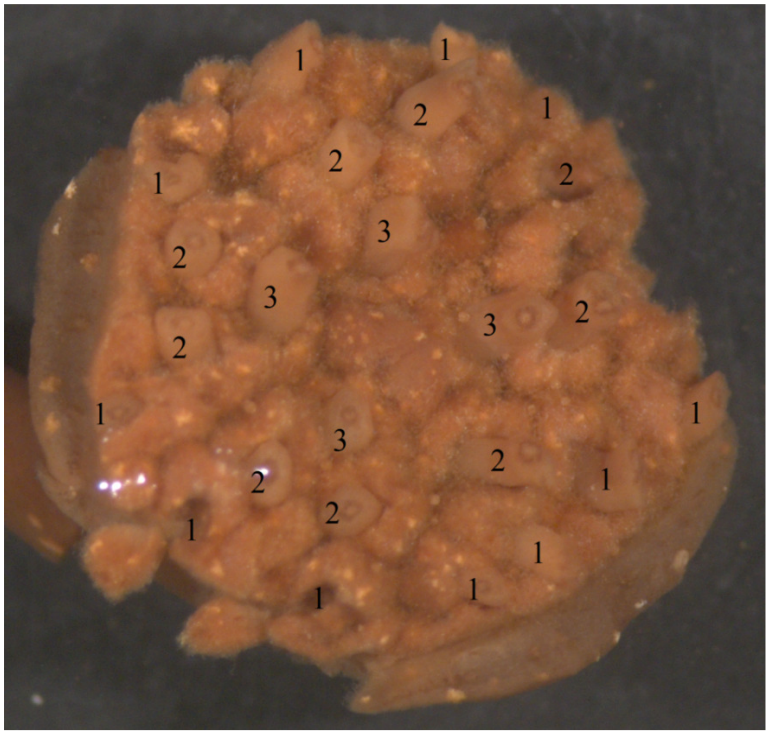


Figure 10. Three whorls of stamens, outer whorl (1) to inner whorl (3); note the rudimentary ovary (Harris, 4953).

Seven samples (Deighton, 6137; Harris, 2310; Louis, 3261; Onochie, FHI 34825; DW Thomas, 361; van Harten, 317; Wood, SAN16144) have stamens predominantly in single whorl but with some stamen initiation towards the centre of flower, these few inner stamens not forming an identifiable second whorl (Figure 11A & B).

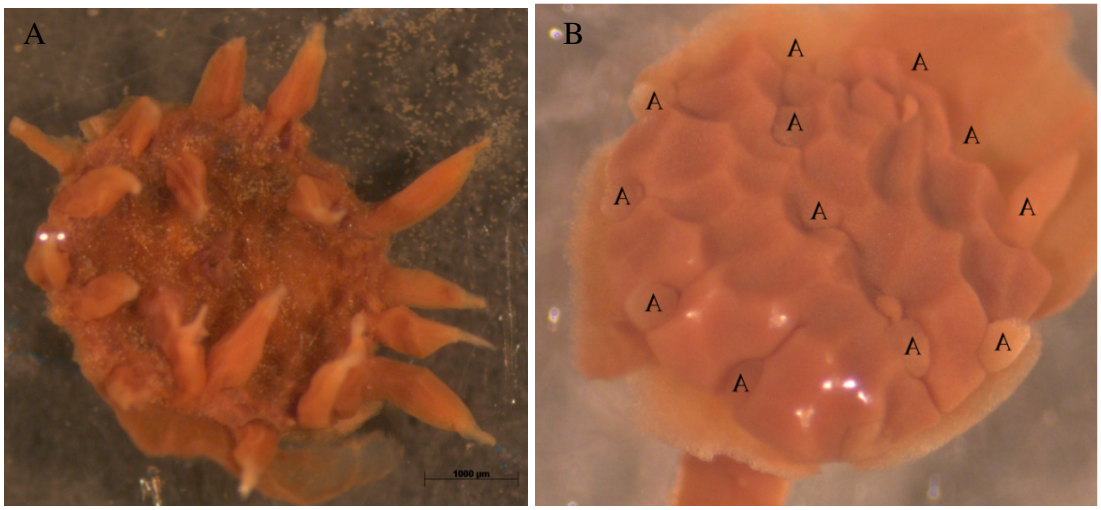


Figure 11. Inner stamens formed sporadically and not as part of a second inner whorl: A. unannotated (Deighton, 6137); B. filament stumps (A) (van Harten, 317).

Three samples (Deighton, 6137; JJFE de Wilde, 8476; Kerr, 20390) show an instance of multiple stamen initiation at the same locus (Figure 11A).

3.1.6. Disk

The disk shapes observed can be categorised in to four types: flat (Figure 12A), shallowly cupular (Figure 12B), cupular (Figure 12D & 12E) and convolute-cupular (Figure 12C). In the samples in which a disk was present 33 are flat, 17 shallowly cupular, 24 cupular and 7 convolute-cupular (Table 8). The disk in Harris 9754 was not identifiable due to immaturity of this sample. Hairs are present or absent in all disk types, the nature and position of the hairs is described in Appendix 1.

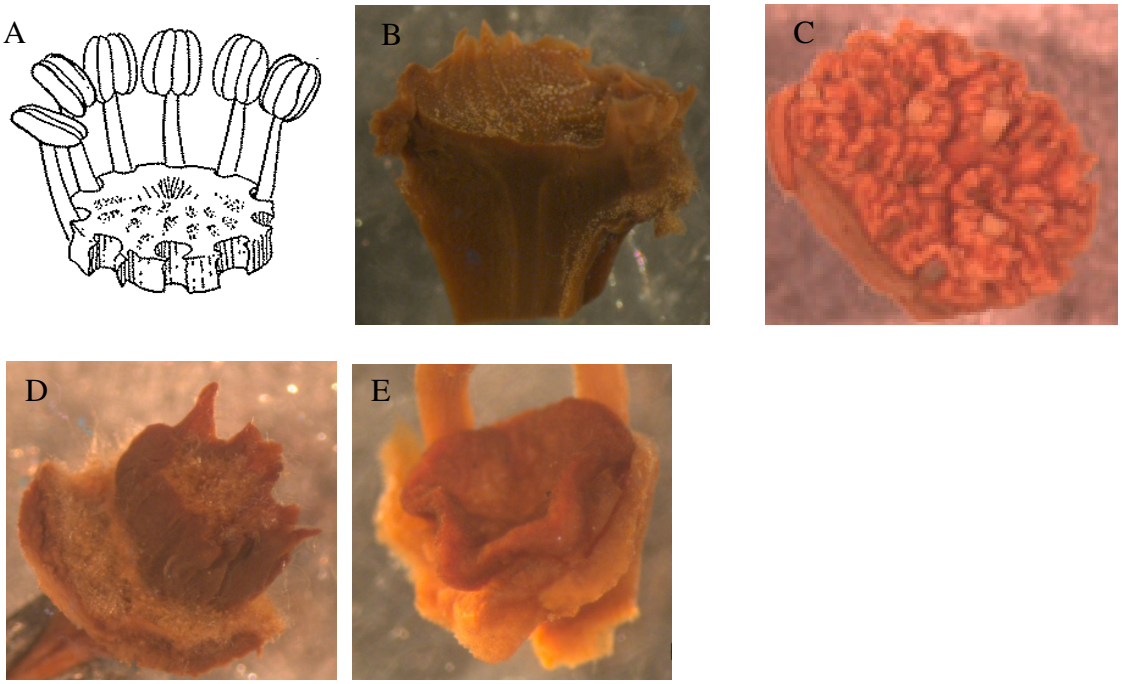


Figure 12. Variation in the shape of the disk in male flowers: A. flat (image of Latilo, FHI 15285 from Keay, 1958: p. 383); B. shallowly cupular L.S. (Larsen, 32656); C. convolute-cupular (Brenan, 8436); D. papery and thin cupular (Geesink, 9336); E. thick and fleshy cupular (Zenker, 3721).

Table 8. Male disk types of samples filed under *Drypetes*: number (and percentage)

Flat	Shallow cupular	Cupular	Convolute-cupular	Total
33 (40.75%)	16 (19.75%)	25 (30.8%)	7 (8.6%)	81 (100%)

3.2. Female floral characters

A total of 28 samples possessed female flowers, these were examined for calyx, gynoecium, style, stigma and disk characters.

3.2.1. Calyx

The 75% of the samples that have the calyx remaining possess sepals that are predominantly (sub)-orbicular, culcullate and imbricate. For the samples that have more a more linear aspect to the sepals King 8683 has a valvate arrangement and Mildbraed 9020 has an open arrangement of the sepals. For the remaining samples that have more a more linear aspect to the sepals (Diraviam, 26358; Fischer, *s.n.*; Ramos, 24459) the calyces are fully open and although it is not possible to comment upon the precise arrangement of the sepals in bud, the sepals are basally imbricate in the open flower.

3.2.1.1. Calyx merism

Sepal merism is K4 or K5, with K5 the more common condition (Table 9). In the male flower K4 is the more common condition (Table 5). In *Drypetes* where both male and female flowers of the same species have been sampled the respective genders share the same calyx merism.

Table 9. Sepal merism in the female flower (all samples): number (and percentage)

K4	K5	K4-5	Other*	Total
11 (39.3%)	15 (53.6%)	0 (0%)	2 (7.1%)	28 (100%)

*These two samples are Cuming, 148 and Weber, 1052; both K(6) (see Table 4) but are included in the character matrix as they have unisexual flowers.

3.2.1.2. Calyx shape

Although there is a range of shapes, calyx shape is predominately (sub)-orbicular (Table 10).

Table 10. Sepal shape in the female flower (all samples): number (and percentage)

(Sub)-orbicular	Ovate	Long-ovate	Oblong	K deciduous	Other*	Total
14 (50%)	1 (3.6%)	1 (3.6%)	3 (10.7%)	7 (25%)	2 (7.2%)	28 (100%)

*These two samples are Cuming, 148 and Weber, 1052; both K(6) (see Table 4) but are included in the character matrix as they have unisexual flowers.

3.2.1.3. Calyx indumentum

Sepals of 12 of the 28 samples have hairs on the abaxial surface. The hairs range from very sparsely to densely pubescent, to velutinous. Only one sample (Talbot, 1645) has apical ciliate hairs on the sepal.

3.2.2. Gynoecium

The gynoecia are syncarpous, superior and predominantly globose. Ovate (Figure 13A; Brandis, *s.n.*; Ernst, 1869), long-ovate (Figure 13B; King, 8683) and oval (Figure 13C; Sumithraarachchi, 355) forms are also recorded. The gynoecia mostly have hairs present, ranging from sparsely to densely pubescent, sparsely pilose to pilose, tomentose, lanate, densely lanate and velutinous. The gynoecia of seven samples (Brenan, 8474; Coombe, 183; Forster, 7679; Mildbraed, 9020; Pilz, 2342; Sumithraarachchi, 355; Worthington, 940) are glabrous.

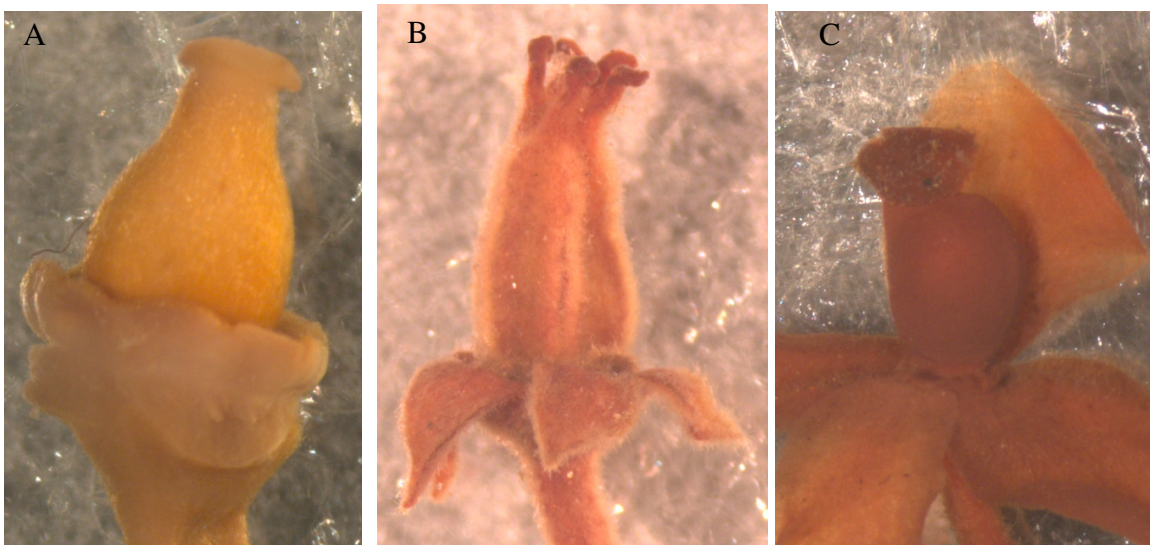


Figure 13. Variation in the shape of the gynoecium: A. ovate (Ernst, 1869); B. long-ovate (King, 8683); C. oval (Sumithraarachchi, 355).

3.2.2.1 Gynoecium: carpel number

A range of carpel number from 1-7 was observed, however the majority have 2 or 3 carpels (Table 11).

Table 11. Carpel number (and percentage) (all samples)

G1	G(2)	G(3)	G(5)	G(6)	G(7)	Total
4 (13.8%)	11 (38%)	10 (34.5%)	2 (6.9%)	1 (3.4%)	1 (3.4%)	29 (100%)

Note: total 29 as Kuswata is recorded as G(2)-(3) and is entered in both columns.

3.2.3. Styles

The styles can be free (Figure 14A), fused (Figure 14B), part-fused or absent; most exhibited free styles (Table 12).

Table 12. Degree of style fusion (all samples): number (and percentage)

Free	Fused	Part fused	No style	1 not known (immature material)	Total
15 (53.6%)	6 (21.4%)	3 (10.7%)	3 (10.7%)	1 (3.6%)	28 (100%)

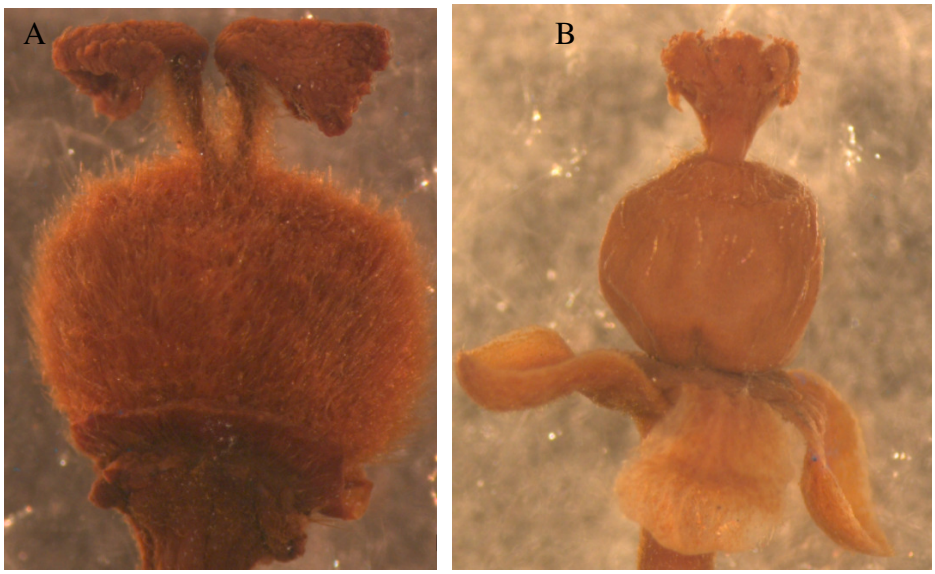


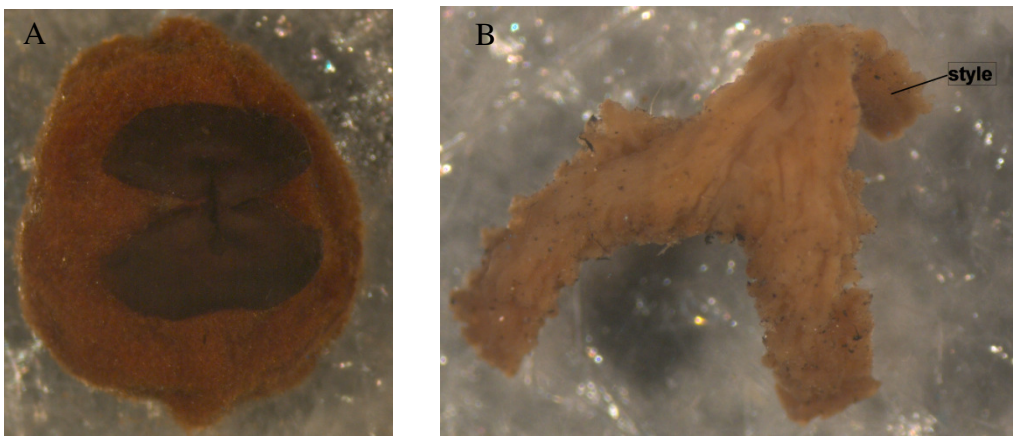
Figure 14. Variation in styles: A. free (Ramos, 24459; B. fused (Fischer, *s.n.*).

3.2.4. Stigma

The stigma is simple in all but four samples where it is bifid (Figure 15B). A range of stigma shapes are present (Table 13) including simple reniform (Figure 15A), irregular fan-square shaped (Figure 15C) and ligulate (Figure 15D).

Table 13. Stigma shapes observed (all samples)

Stigma shape	Samples
Bifid (forked)	Brandis, *s.n.*; Cuming, 148; Weber, 1052; Worthington, 940
Triangular	Bates, 1774; Congdon, *s.n.* 58403; Elmer, 12695; Harris, 9761; Ismail, KEP 100121; Jacobs, 5072
Fan-shaped	Brenan, 9297; Haber, 10965; Ramos, 24459; Talbot, 1645
Fan to square	Brenan, 8474; Coombe, 183
Reniform	Congdon, *s.n.* 58403; Deighton, 1414; Forster, 7679; Louis, 402; Ridsdale, 397
(Semi)-circular	Diraviram, 26358; Fischer, *s.n.*
Circular	Ernst, 1869; Mildbraed, 9020; Sumithraarachchi, 355
Subulate	King, 8683
Obovate	Kuswata, 97
Ligulate	Pilz, 2342



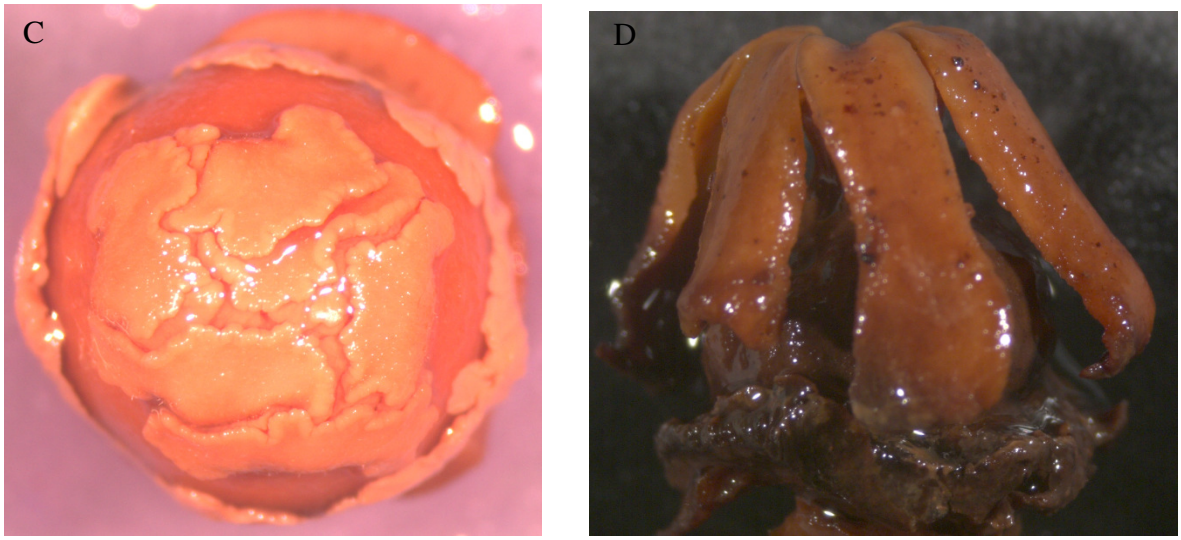


Figure 15. Variation in the shape of the stigma: A. simple reniform (Ridsdale, 397); B. bifid (Brandis, s.n.); C. irregular fan-square (Coombe, 183); D. ligulate (Pilz, 2342).

3.2.5. Disk

In female flowers the disk is situated at the base of the ovary and, in bud, is constrained to encircling the ovary base as a cupular band of tissue which is referred to here as the 'skirt'. This skirt, which ranges from 0.3mm to 4mm in depth, may remain as a cupular structure or may flatten as the flower develops (Figure 16A-D). An intermediate position occurs where the disk forms a shallowly cupular structure which briefly cups the base of the ovary. Table 14 shows the allocation of disk types in the female samples.

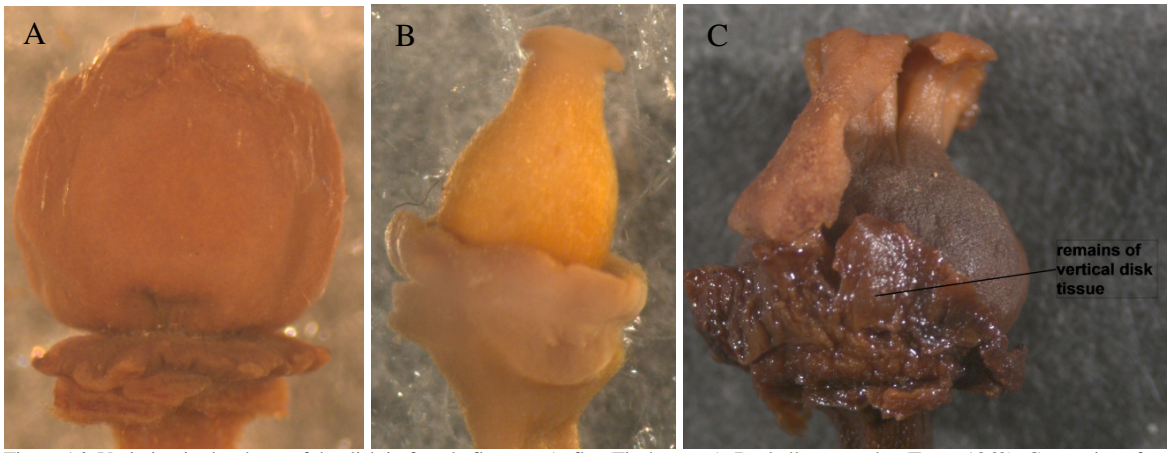


Figure 16. Variation in the shape of the disk in female flowers: A. flat (Fischer, *s.n.*); B. shallow-cupular (Ernst, 1869); C. remains of cupular disk (Pilz, 2342).

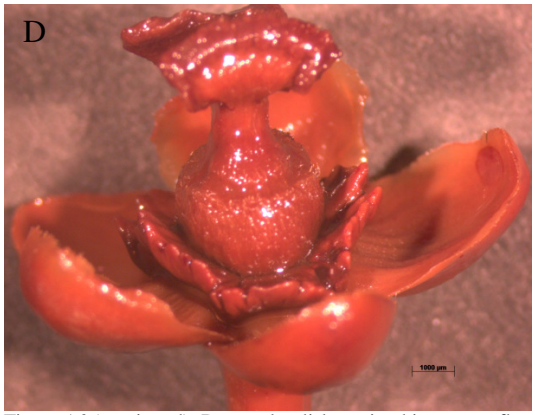


Figure 16 (continued): D. cupular disk retained in mature flower (Brenan, 9297).

Table 14. Disk types in the female flower (all samples)

Disk type	No.	Samples
Flat	9 (32%)	Bates, 1744; Diraviam, 26358; Elmer, 12695; Fischer, *s.n.*; Haber, 10965; Harris, 9761; Mildbraed, 9020; Ridsdale, 397; Sumithraarachchi, 355
Shallowly cupular	7 (25%)	Deighton, 1414; Ernst, 1869; Forster, 7679; Jacobs, 5072; Louis, 402; Ramos, 24459; Talbot, 1645
Cupular	8 (29%)	Brenan, 8474; 9297; Congdon *s.n.* 58403; Coombe, 183; Ismail, KEP 100121; King, 8683; Kuswata, 97; Pilz, 2342
Disk absent	4 (14%)	Brandis, *s.n.*; Cuming, 148; Weber, 1052; Worthington, 940

Table 15 shows the *Drypetes* samples where both male and female flowers of the same species have been studied. Although the results across *Drypetes* show a gender difference in calyx merism (Tables 5 & 9) this is not true for the respective genders of the same species where calyx merism is consistently the same.

Table 15. Calyx merism of conspecific male and female *Drypetes*.

Species	Samples	K no.
D. afzelii (Pax) Hutch	Deighton, 1414; 6137; Small, 825	5
D. deplanchei (Brongn. & Gris) Merr. (syn. *D. australasica* (Müll.Arg.) Pax & K.Hoffm.)	Balansa, s.n.; Forster, 7679; Mackee, 12223; 12308; Stoddart, 4722	4
D. gardneri (Thwaites) Pax & K.Hoffm.	Bourdillon, 1595; Sumithraarachchi, 355; Worthington, 5168	4
D. glauca Vahl	Ernst, 1869; Reineck, *s.n.*	4
D. gossweileri S. Moore	Brenan, 8474; 8475; Coombe, 183	5
D. laciniata (Pax) Hutch.	Harris, 9754; Louis, 402; van der Burgt, 667	4
D. longifolia (Blume) Pax & K. Hoffm. (syn. *D. macrophylla* (Blume) Pax & K. Hoffm.)	anon. 30; Burley, 4134; Ismail, KEP 100121	5
D. microphylla (Merr.) Pax & K.Hoffm.	Charlie, SAN 23789; Ramos, 24459	4
D. molunduana Pax & K.Hoffm.	Akpapla, 1100; Brenan, 8574; 9296; 9297; Talbot, 1645	5
D. polyantha Pax & K.Hoffm.	Harris, 2310; Harris, 9761	5
D. sepiaria (Wight & Arn.) Pax & K.Hoffm.	Diraviam, 26358; Fischer, *s.n.;* Worthington, 92	4
D. ugandensis (Rendle) Hutch.	Bates, 1774; Mildbraed, 7688	5

3.3. Comparison of character states between genera

Table 16 shows the character states of the genera studied.

Table 16. Character matrix of the genera of Putranjivaceae and *Lophopyxis*

Character	*Drypetes*	*Sibangea*	*Putranjiva*	*Lophopyxis*
Mono-dioecious	monoecious	monoecious	monoecious	mono-dioecious*
K no.	4-5	4-5	4-5	5
K shape	(sub)-orbicular	oblong or elliptic	ligulate	long-ovate
K aestivation	imbricate	open or valvate	open	valvate
♀ K deciduous	yes	persistent in fruit	yes	?
Corolla	no	no	no	yes/no*
A number	3-106 (introrse)	3-5 (introrse)	2-3 (extrorse)	5 (introrse)
G number	1-7 (mostly 2-3)	1	3	5
G shape	globose	ovate	ovate	long-ovate
Style	free, (part)-fused	free	free	free
Stigma	entire	entire	bifid	subulate
Disk present	yes	yes	no	yes

The single *Lophopyxis* sample studied here does not accord to the literature which records *Lophopyxis* as monoecious with a disk present (see Discussion). In this sample both female and hermaphrodite flowers are observed. In the female flower the corolla is absent and a disk

is present and a corolla is present in the hermaphrodite flower but a disk is absent. Hence, it is not possible to determine the true state of the characters marked * in Table 16. However, data from Table 16 does provide a summary of useful characters that can be used to separate the three genera in Putranjivaceae.

3.4. Comparison of character states of *Drypetes* between continents

The results show, for samples filed under *Drypetes*, that in the male flowers a 4-merous calyx is twice as common in the Asia-Tropical samples than a 5-merous calyx, a difference not shown in African samples. The Pacific samples are all 4-merous with three of the four Southern American samples 4-merous. In the female flowers all but one of the African *Drypetes* samples have a 5-merous calyx and in Asia-Tropical samples a 4-merous calyx is approximately three times as common as a 5-merous calyx (Table 17).

Table 17. Gender-related sepal merism and geographic distribution in *Drypetes*

	Male flowers				Female flowers			
Continent	Africa	Asia-Tropical	Pacific	Southern America	Africa	Asia-Tropical	Pacific	Southern America
K4	22	22	3	3	1	8	0	1
K5	20	11	0	1	9	3	0	1

As shown in Table 8, 40.75% (31/81) of male *Drypetes* exhibited a flat disk. This percentage increases to 53.7% (22/41) in the African male *Drypetes* (Table 18). The Asia-Tropical male *Drypetes* only exhibit a flat disk in 25% (8/32) of the samples. The cupular disk is present in 37.5% (12/32) of the Asia-Tropical samples, whilst in the African samples only 24.4% (10/41) have the cupular disk. The convolute-cupular disk occurs in 14.6% (6/41) of the African samples and in only 3.1% (1/32) in the Asia-Tropical samples. Significantly, 85.7% (6/7) of convolute-cupular disks found in this study are found in African samples, with only 14.3% (1/7) found in the Asia-Tropical samples. The female disk tends to the cupular form in 62.5% (5/8) of the African samples whereas in the Asia-Tropical samples the tendency is towards a predominantly flat disk in 45.5% (5/11) of the samples or shallowly cupular form in 36% (4/11) of the samples, whereas the cupular form occurs in only in only 18% (2/11) of the samples (Table 19).

Table 18. Male disk types of samples filed under *Drypetes* within and between continents

	Flat	Shallowly cupular	Cupular	Convolute-cupular	Total
Africa	22	3	10	6	41
Asia-Tropical	8	11	12	1	32
Pacific	1	1	2	0	4
Southern America	2	1	1	0	4
Total	33	16	25	7	81

Table 19. Female disk types of samples filed under *Drypetes* within and between continents

	Flat	Shallowly cupular	Cupular	Total
Africa	2	1	5	8
Asia-Tropical	5	4	2	11
Pacific	0	0	0	0
Southern America	1	1	0	2
Total	8	6	7	21

Stamen numbers in *Drypetes* show fairly equal distribution in the A9-21. In the A≥21 category sit 22.6% (7/31) of Asia-Tropical samples and 10.5% (4/38) African samples. The lower stamen numbers columns A≤4, A5-8 are 75% occupied by African species (Table 20). The lower range columns A≤4, A5-8 show 75% occupancy by African samples. In terms of stamen arrangement, all but one of the 16 instances of stamens being in more than one whorl occur in African species (Appendix 2).

Table 20. Stamen numbers of *Drypetes* and continental distribution

	A≤4	A5-8	A9-12	A13-16	A17-21	A≥21	Total
Africa	5	10	7	7	5	4	38
Asia-Tropical	0	5	8	7	4	7	31
Pacific	0	2	1	0	0	0	3
Southern America	1	2	0	1	0	0	4

4. Discussion

The discussion centres upon attempting to address the two key questions that this study aims to resolve. The first of these questions asks whether there are consistent floral characters which can be used to separate the three genera in Putranjivaceae? The second question asks do floral characters – such as sepal number and shape, disk size, disk shape, number of stamens, carpel number and degree of fusion of the styles – vary across the genus *Drypetes*?

4.1. Floral characters of the three genera in Putranjivaceae

In respect of the first question that this study aims to resolve, although the sampling of *Putranjiva* (four samples, all of *P. roxburghii* within a genus of four species) and *Sibangea* (three samples, covering two of the three species in the genus) is somewhat limited, the results do show the emergence of consistent floral characters that can be used to separate these genera from each other, and both genera from *Drypetes*. These distinguishing characters will now be discussed.

The flowers of all three genera in the Putranjivaceae have a 4- or 5- merous calyx and are apetalous (Merino Sutter *et al*, 2006). The results in this study are consistent with this and, therefore, calyx merism is not a character that is useful in separating the genera.

The results do show, however, that a 4-merous calyx is more common in the male flowers, whereas a 5-merous calyx is more common in the female flowers of *Drypetes* (see Tables 5 and 9). For samples filed under *Drypetes* the results show there are geographical differences in calyx merism (see Table 17). In the male Asia-Tropical samples, a 4-merous calyx occurs twice as frequently as a 5-merous calyx, a difference not shown in African samples. The Pacific samples are all 4-merous with three of the four Southern American samples 4-merous. In the female flowers all but one of the African *Drypetes* samples have a 5-merous calyx and in the Asia-Tropical samples a 4-merous calyx is approximately three times as common as a 5-merous calyx. With such limited sampling, it is not certain what this signifies, although it may be evidence of further floral reduction of the flower in the South East Asia centre of diversity. The sample size may be too small in respect of Southern America to tentatively advance a hypothesis on reduction of calyx lobes.

In terms of shape, from the results of this study, *Drypetes* have sepals that are predominantly (sub)-orbicular, and, when ovate, the sepal is generally broad. The literature is consistent in this respect. The few exceptions are discussed below in the discussion which deals with the consistency of characters across *Drypetes*. By contrast, the sepals of *Sibangea* are observed here as consistently oblong or elliptic. This is consistent with the accounts of *S. similis* Hutch. (as *D. similis* Hutchinson, 1912; as *S. similis* Radcliffe-Smith, 1978) and for *S. pleioneura* Radcl.-Sm. (Radcliffe-Smith, 1978) where the sepals of the female flower are described as oblong or oblong-lanceolate. Imbrication is an important character that delimits *Drypetes* (imbricate) from *Sibangea* (open or valvate) and *Putranjiva* (open). In assigning the new species *D. moliwensis* Cheek & Radcl.-Sm. – which shares many attributes of *Sibangea* – to *Drypetes* the imbricate sepals are a key character in determining the genus, which is discussed below. The observations here in respect of the differing sepal shapes of *Drypetes* and *Sibangea* are supported in the literature. Also supported here is the non-imbricate sepal aestivation of *Sibangea* based upon Mildbraed, 9020; Thomas, 672 (open) and JJFE de Wilde, 8476 (valvate).

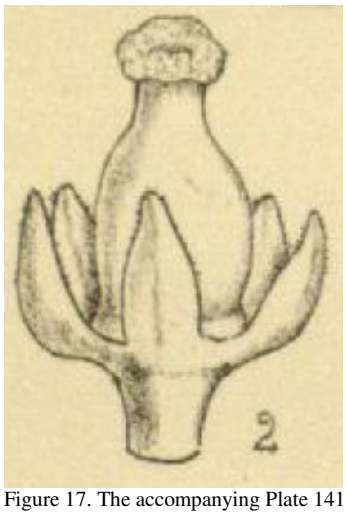


Figure 17. The accompanying Plate 1411 to *S. arborescens* showing the calyx lobes (from Hooker, 1883).

Radcliffe-Smith (1978) remarks that *Sibangea* is 'very close' to *Drypete*s, the chief differences being the female sepals being open in bud and persistent in the fruit. The calyx is largely intact in the one female *Sibangea* sample studied here (Mildbraed, 9020), whereas the calyces of *Drypetes* specimens examined in this study are consistently deciduous. This confirms Radcliffe-Smith's observations.

The two female samples of *Putranjiva* used in this study have a deciduous calyx and thus the observations here relate to the two male samples. The sepals here are 4-5, ligulate and open in bud (not valvate or imbricate). Radcliffe-Smith (2001) describes the *Putranjiva* calyx as 'deeply 3-6-lobate, lobes imbricate, unequal'. Meisner (1836-1843) gives the sepal number as 4-5 and does not mention the aestivation. Müller (1866), however, states that sepals of *Putranjiva roxburghii* Wall. are 3-5 in the male flower and 5-6 in the female flower. Interestingly, Müller (1866) places *P. roxburghii* in his sub-section Euputranjiva whilst his wider Putranjiva has a sepal range of 2-5 in the male and 4-6 in the female with sepal aestivation as 'slightly' imbricate for the whole group. Neither of the above two sources provide a description of the sepal shape. Hence, calyx merism observed in this study is consistent with the literature. The ligulate sepals observed and described here, are, it is believed, an improvement upon the description in the literature and provide a useful character to separate *Putranjiva* from the predominantly (sub)-orbicular sepals of *Drypetes* and the oblong-(lanceolate) or elliptic sepals of *Sibangea*. The observations here in respect of sepal aestivation disagree with the literature. Sepal aestivation in *P. roxburghii* is not imbricate or 'slightly' imbricate, but open. The persistence of the calyx in *Sibangea* is, however, a useful character to separate this genus from the deciduous calyces of *Drypetes* and *Putranjiva*.

Stamen numbers are noticeably higher in the majority of *Drypetes* (Table 7) when compared with *Sibangea* and *Putranjiva*. This is consistent with the literature where the general tendency towards higher stamen numbers is recognised as a useful character for *Drypetes* in comparison with *Sibangea* and *Putranjiva*. The stamen numbers recorded for samples filed under *Drypetes* in this study range from 3-106. Aside from merism, the arrangement of stamens of 16 of the 78 *Drypetes* samples within the male character matrix (Appendix 2) show some form of diplo- or triplostemony.

In his description of the genus *Sibangea* based upon *S. arborescens* Oliv., Hooker (1883) records a stamen number of 3. Hutchinson (1912), describing *D. similis* records the stamen number as 4-5, whilst Pax and Hoffman (1922) record 4-6 stamens. The results of this study are largely consistent with the literature with the two *S. similis* (Hutch.) R.-Sm. & Sm. samples (Thomas, 672; Zenker, 3721) having 4-5 stamens and the single *S. arborescens* sample (JJFE de Wilde, 8476) having 3-4 stamens. For stamen number in *Putranjiva*, Meisner (1836-1843) records 3 and Müller (1866) 2-3 stamens. Both of the male samples filed under *P. roxburghii* Wall. in this study have 3 stamens.

Of the 28 samples in the female character matrix, the ovary is predominantly 2- or 3-locular with only four samples exhibiting higher locule numbers with a further four having a unilocular ovary. The ratio of 2- to 3-locular ovaries in Putranjivaceae is 10:8. This is of interest as both Webster (1994b) and Radcliffe-Smith (2001) separate out the present genera of Putranjivaceae from *Lingelsheimia* Pax in their respective keys (see Figure 3 for key of Webster, 1994b) of tribe Drypeteae of their sub-family Phyllanthoideae on the basis of the ovary being mostly 1- or 2-locular (with *Lingelsheimia* 3-locular). Although it is now known that *Lingelsheimia* is not a closely related genus (Kathriarachchi, *et al* 2005), it remains the case, on the basis of the results here, subject to the caveat of the limited sampling of this study, that a 3-locular ovary may be more common in the Putranjivaceae than suggested by Webster (1994b) Radcliffe-Smith (2001).

Both female samples filed under *Putranjiva* (Brandis, *s.n.*; Worthington, 940) have a 3-locular ovary. Meisner (1836-1843) records a 2-locular ovary in *Putranjiva*, whilst Müller (1866) records the ovary as 2- or 3-locular. The *Drypetes* species sampled here show a 11:6 ratio of 2- to 3-locular ovaries (in addition to three unilocular samples, and one each of 5-, 6- and 7-locules). Hence, as with the situation at the family level, subject to the caveat of the limited sampling of this study, a 3-locular ovary may be more common in *Drypetes* than suggested by Webster (1994b) and Radcliffe-Smith (2001).

The single female *Sibangea* sample (Mildbraed, 9020) has a unilocular ovary. This is consistent with the literature. Hooker (1883), describing *Sibangea* based upon *S. arborescens* records a unilocular gynoecium, as does Radcliffe-Smith (1978) describing *S. pleioneura*. The protologue for *S. similis* (Hutchinson, 1912) does not record locule number. Of the Putranjivaceae studied here only three samples are recorded as having sessile stigma, one being the *Sibangea* mentioned previously, the other two filed under *Drypetes* (Ernst, 1869; Ismail, KEP 100121). In *Drypetes* in this study, the styles are free in 8 samples, fused in 6 and part-fused in 3 samples. With such limited sampling it is difficult to detect a distributional trend in degree of style fusion, but Appendix 3 does show that four of the nine Asia-Tropical samples have fused styles (with the remaining five free) whilst only two of the nine African samples have fused styles (with five free and two part-fused).

In two specimens (Elmer, 12695; Kuswata, 97) the style is very short and difficult to distinguish. When this situation is encountered it may be preferable to adopt the terminology of Tokuoka and Peng (1997) who, in their description of *D. integerrima* (Koidz.) Hosok. refer to a stigmatiform style. This may be a more helpful and realistic portrayal of their observations rather than the rather unhelpful and ambiguous description of the style as 'sub-sessile' in the protologue of *D. subcubica* (J.J.Sm.) Pax & K.Hoffm. (in H.G.A.Engler, Pflanzenr., IV, 147, XV: 250 (1922)). There is a range of stigma shapes observed in this study which is presented in Table 13. In the unilocular *Drypetes* the stigma is reniform in Forster, 7679 and circular in Ernst,1869 and Sumithraachchi, 355. In the *Sibangea* sample the stigma is also circular. Interestingly, in Diraviam, 26358 and Fischer, *s.n.* – filed under *D. sepiaria* (Wight & Arn.) Pax & K.Hoffm. – the protologue (in H.G.A.Engler, Pflanzenr., IV, 147, XV: 271 (1922)) says that the stigma can be both semi-circular or circular, as observed in the specimens examined here. In such instances, it is useful to bear in mind Radcliffe-Smith's comments (Radcliffe-Smith, 2001) that *Drypetes* exhibits considerable anatomical variation. In terms of characters that can be used to separate the three genera in Putranjivaceae, the bifid stigma is, within the family, unique to *Putranjiva* and is a useful character in distinguishing the genus from *Drypetes* and *Sibangea* where the stigma is entire.

The disk in the three male *Sibangea* samples is cupular, whilst the disk in the solitary female *Sibangea* sample matures in to a flat, fleshy structure. The most significant aspect of the disk in Putranjivaceae is that its absence in *Putranjiva* is useful character to separate out *Drypetes* and *Sibangea*, both genera having a disk present.

The samples in this study include one sample (King, 8683) of *Lophopyxis maingayi* Hook.f. The monotypic family Lophopyxidaceae H. Pfeiff. is sister to the Putranjivaceae (Wurdack *et al*, 2004; Tokuoka and Tobe, 2006; Soltis *et al*, 2011) and the sample is included to compare morphological features between the two families. Unlike the predominantly understorey trees of Putranjivaceae, *Lophopyxis* is a climbing shrub or liana up to 8(-30)m long in which the axillary branchlets are transformed in to strong woody tendrils (Lemmens and Bunyapraphatsara, 2003) and is found in the primary and secondary forests of the Malesian biogeographical region. The protologue for *L. maingayi* (in Hooker's Icon Pl. 18. t. 1714 (1887)) and Sluemer (1971) record the flowers as unisexual but with flowers of each gender found on the same plant (with the plant described as monoecious). This establishes an immediately observed separation from the dioecious plants of Putranjivaceae. Both of the

above sources also record the presence of a disk. A corolla is stated as present which is much smaller than the calyx. In his protologue Hooker (1887) tentatively placed *Lophopyxis* in Euphorbiaceae adding that he is 'very doubtful as to the affinities of this curious plant'. *Lophopyxis* has had uncertain placement since its delimitation and until recently was placed in Celastraceae. In the morphological study of that group (Simmons and Hedin, 1999) resolve *Lophopyxis* as nested within Euphorbiaceae on the basis of the unisexual flower, pendulous ovule attachment, and obturators present thus re-establishing Hooker's placement. As discussed previously molecular phylogenetic studies (Wurdack *et al*, 2004; Tokuoka and Tobe, 2006; Soltis *et al*, 2011) now place the monotypic Lophopyxidaceae as sister to Putranjivaceae.

Both female and hermaphrodite flowers are observed in the *Lophopyxis* sample in this study. In the female flower the corolla is absent and a central cupular disk is present. A corolla is present in the hermaphrodite flower but a disk is absent. This does not accord to the literature. Hooker (1887); Mabbeley (2008); Sleumer (1971) record, between them, *Lophopyxis* as monoecious with a disk present. This situation is very curious and warrants further investigation as this genus remains poorly known. A limiting factor in this study is the paucity of herbarium samples for this species. It is interesting that hermaphrodite flowers are observed and it is possible that *L. maingayi* is trioecious. In terms of additional floral differences from Putranjivaceae, the sepals and 5-locular, ribbed gynoecium are long-ovate and noticeably more elongate than the general pattern in Putranjivaceae. The stigma are subulate and reflexed, the subulate condition is not observed in Putranjivaceae.

4.2. Floral characters within the genus *Drypetes*

The second question that this study aims to resolve is, do floral characters – such as sepal number, sepal shape, disk size, disk shape, number of stamens, carpel number and degree of fusion of the styles – vary across the genus *Drypetes*?

As discussed previously the sepal number is consistently four or five within *Drypetes*. The shape of the sepal is predominantly (sub)-orbicular and imbricate and when this rarely varies the sepal is usually broad-ovate. There are, however, exceptions: the oblong sepal (Bourdillon, 1595; Kerr, 18795), oblong-acute (Harmon, 41; Le Testu, 9306), oblong-obtuse (Zenker, *s.n*. 01 Jul 1908), elliptic (Mackee, 12308). However, some variation is to be

expected in a genus of 225 species. Bearing in mind Radcliffe-Smith's comments (Radcliffe-Smith, 2001) that *Drypetes* exhibits considerable anatomical variation the predominance of the (sub)-orbicular, imbricate sepal is a feature that distinguishes most of the species within *Drypetes* from their closest relatives.

The disk shape is variable and it has been necessary to categorise the disk in to four types in order to attempt to bring some order to the group. In the flat disk the disk margin often protrudes between the filament bases. In the developmental process of protruding between the filaments the disk margin may be vertical and in doing so the beginnings of the convolute-cupular disk is formed. This is possibly influenced by the position of the stamens, as, if there are stamens towards the centre of the flower (inside of the outer whorl of stamens) the disk which is intrastaminal has to maintain this position by invaginating around the stamens to the extent that the vertical folds of the disk margin covers the entire centre of the disk (Figures 12C & 18).

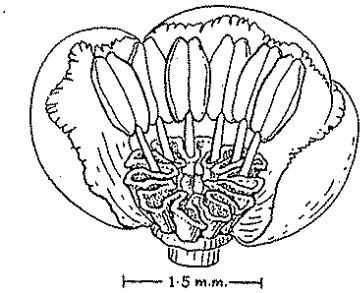


Figure 18. If stamen increase were to occur centripetally, the vertical disk margin would have to remain intrastaminal; this may be to the extent that the margin covers the entire centre of the disk (image from Keay, 1958: p. 383)

Variability occurs within the disk categories employed in this study. A useful depiction of this is the different cupular disks, one papery and thin, the other thick and fleshy (Figures 12D, 12E). The shallowly cupular disk refers to disks with an open centre with a low, erect margin (Figure 12B). From the specimens examined in this study it is apparent that disk shape is variable within the group. In the male flower disk size ranges from 0.45mm diameter (Worthington, 5168) to 6.5mm diameter (Oates, 103) (Appendix 4), the latter larger by a factor of 14. The full range between these parameters is covered by the disk diameters recorded and, therefore, the disk size within *Drypetes* can be said to be variable. The disk skirt in the female flowers ranges from 0.3mm to 4mm in depth (Appendix 3), the latter deeper by a factor of 13 which is consistent with the extremes encountered in the male flower. Again, the full range between these parameters is covered and the disk size can be

said to be variable. In terms of shape, the spatial arrangement of the female disk (always at the base of the ovary) means that upon maturity the disk can flatten or remain as loosely encircling the ovary as a cupular or shallowly cupular structure. Geographical tendencies appear to exist relating to disk form (see Tables 18 & 19). The general trend in African male samples is towards the flat disk, with 53.7% of the samples having such a disk, with only 25% of the Asia-Tropical male samples exhibiting a flat disk. The majority of the Asia-Tropical male samples have a shallowly cupular or cupular disk. However, in the male samples studied the majority (87.5%) of the convolute-cupular disks observed are from African species. The general trend in the female disk is towards the cupular form in the African species (62.5%) whereas in the Asia-Tropical species the trend is towards a flat (45.5%) or shallowly cupular (36%) disk.

In terms of the number of locules within the ovary, this has been discussed above. The only points to emphasise are that although the ovary is most commonly 2- to 3-locular the range within the study is variable, covering unilocular, 5-, 6- and 7-locular ovaries. These higher locule numbers are from the two African species *D. gossweileri* S. Moore (6- to 7-locules) and *D. staudtii* (Pax) Hutch. (5-locular). The observation from this study is that unilocular African species are uncommon, which is consistent with the literature (Cheek *et al*, 2000). The degree of fusion of the styles within *Drypetes* has been discussed previously.

Stamen number in *Drypetes* is highly variable, ranging from 3-106. With such high stamen numbers there is evidently a high degree of polystemony within *Drypetes*, which is nested within the rosids which are a largely diplostemonous group. In the male flower of *Drypetes*, assuming an A4-5 Bauplan, there is opportunity for lateral increase of stamens and, in the absence of a gynoecium, a further lack of spatial constraint in the centre of the flower. This is evidenced by the observation in this study of stamen increase from single loci within the outer whorl along with numerous examples of stamen initiation inside of the outer whorl nearer to the centre of the flower. Only very rarely does the expansion of stamens nearer to the middle of the flower form an approximation of discreet secondary or tertiary whorls. More commonly observed is stamen increase nearer the centre of the flower in a fashion whereby it is difficult to discern regular whorls of stamen initiation. Only in one sample (van Harten, 317) is a stamen present in the centre of the flower (Figure 11B). In the samples studied it remains unclear whether there is initiation of stamens centripetally as there is no unequivocal evidence that the stamens nearer to the centre of the flower have developed later

than those in the outer whorl. Until developmental studies are undertaken the pattern of stamen initiation in the polystemonous androecium of *Drypetes* remains enigmatic, although possibly not unique in Malpigiales, as the manner in which the flat disk protrudes around the filament bases in *Drypetes* does resemble the disk arrangement found in the male flower of the southern African *Dovyalis caffra* Warb. (Salicaceae Mirb.) (L Ronse de Craene, RBGE, pers. comm.).

Stamen numbers in *Drypetes* show no strong continental trends across much of the range (Table 20). However, with increased sampling sizes there may be significance in the findings in this study that the proportion of Asia-Tropical samples being in the A≥21 range is twice that of the African samples. There is also a tendency for the lower stamen numbers (in the A≤4, A5-8 ranges) to be from African species (Table 20). Additionally, in terms of stamen arrangement, all but one of the 16 instances of stamens showing diplo- or triplostemonous tendencies occur in African species (Appendix 2).

Interestingly, in *Drypetes*, the samples showing diplo- or triplostemonous tendencies are highest in the A13-16 category (Appendix 2). Of the 12 samples in highest stamen category (≥21) only two samples (Harris, 4953 with 28 stamens; Louis, 3261 with 20-25 stamens) are recorded as diplo- or triplostemonous. The samples exhibiting the highest stamen numbers (up to 106 in anon. 30) retain the stamens in one whorl. Furthermore, even in the outwardly uncomplicated sample Harmon 41 which shows an antesepalous K5 A5 arrangement, the protologue (Poiteau, 1815) for the species (*D. alba* Poit.) states that the stamens in the species can be ante- or alternisepalous. This suggests loss of either of the diplostemonous whorls in the species. The androecium of *Drypetes* is labile and highly variable and an interesting and significant feature of the group and worthy of further study.

4.3. Observations and further comments

The 4:1 ratio of male to female flowers in this study is worthy of comment, subject to the caveat of the limited sampling of this study. A personal observation is that male samples suitable for sampling were more prevalent in the herbaria, which may be due to the female samples being too far advanced in terms of fruit formation to be of use in a floral survey. Or, the gender imbalance could be due to collection bias in the field as a result of varying visibilities of the flowers related to pollinator behaviour. However, Johnson *et al* (2009) note that flowering male trees of *D. natalensis* (Harv.) Hutch. in South Africa are more abundant

than female flowering trees and produce about ten-fold more flowers (Johnson *et al*, 2009). This study did not support the hypothesis that female trees mature more slowly than male trees as mean stem diameters did not differ between flowering individuals of the sexes. Johnson et al (2009) tentatively suggest that the sex ratio is close to 50:50 in the population and that the male bias in terms of floral abundance is due to some female trees being non-reproductive in dry years. It would, therefore, be interesting to assess the male to female flower ratio in wet rain forest habitats where water availability is not a limiting factor, as is the case in the South African study.

The disk in *Drypetes* consists of nectiferous tissue (Tokuoka and Peng, 1997). The form of the disk throughout *Drypetes* suggests that the flowers tend to have exposed nectar and generalist pollination systems which are visited by a wide range of insect species (Johnson *et al*, 2009). As well as being of interest in the only lineage outside of the Brassicales to have independently evolved mustard oils, the floral scent of *D. natalensis* is also unusual on account of the presence of isothiocyanates, compounds that arise from glucosinate pathways that give rise to the mustard oils. This leads the flowers (of *D. natalensis*) to produce an extremely pungent sulphurous odour that can be detected by humans several hundred metres from flowering trees (Johnson *et al*, 2009). Hutchinson (1920) makes reference to this after his description of *D. natalensis* where he adds that 'the flowers are yellow and very fetid and offensive'. Anecdotal evidence suggests that the flowers of *Drypetes* do not generally produce scents of this nature (D. J. Harris, RBGE, pers. comm.)

The comment referred to previously from the protologue of *D. alba* (Poiteau, 1815, relating to sample Harmon, 41) is unusual in that this is the only example within the protologues of *Drypetes* observed in this study where the arrangement of stamens is alluded to. There are numerous examples in the notes to the results in Appendix 1 where it is commented upon that the relevant protologue does not address this matter. Rather, the protologues generally restrict themselves to providing a stamen number, sometimes only recording, for example, that they are 'very numerous' (protologue to *D. dewildei* Airy Shaw, Airy Shaw (1978) relating to sample WWJO de Wilde, 15689) or that they are 'inserted around the disk' (protologue to *D. arguta* (Müll.Arg.) Hutch., Hutchinson (1920) relating to sample Strey, 9244). This general impreciseness of the protologues is also not uncommon in respect of the disk where the description may only state, for example, that 'a disk is present' (protologue to *D. hainanensis* Merr., Merrill, 1925 relating to sample Kerr, 20390).

Sometimes a new species is described in the absence of any floral characters. The protologue to *D. ochrothrix* Airy Shaw, Airy Shaw (1968) relating to sample Kerr 18795, for example, states that neither the male or female flowers have been seen. The available supporting literature for this species (Phuphathanaphong and Chayamarit, 2006) only states that the 'disk is central'. Additionally, the protologues are not consistent in character mapping, allied to the fact that flowers of one of both genders of a species have not been seen. Details of protologues where the flowers have not been seen are recorded in Appendix 1 and the available supporting literature sourced wherever possible, but regional floral accounts, when available, do not always provide the information omitted from the protologues. For these reasons, it is mostly difficult to be unequivocal as to how many of the samples in this study have the correct species identification in the herbarium. Crucially, of course, this problem is substantially compounded by the fact that this study has no access to the raft of vegetative characters that, within the group, are integral to correct identification to species level. All that has been possible in this study is to highlight omissions and potential inconsistencies in the notes to the samples in Appendix 1.

No modern monograph for *Drypetes* exists and the genus has been largely neglected since the work of Pax and Hoffman (1922). Since this publication nearly 100 new species of *Drypetes* have been described with rates of species discovery remaining high. As is evident in this study there are specimens labelled in herbaria as *Drypetes* that are clearly not of this genus or even within Putranjivaceae (see Table 4). Additionally, there are type specimens of *Drypetes* that are not *Drypetes* (Keay, 1958: p. 382). Many *Drypetes* specimens lay undetermined in herbaria; for example, at the Missouri Botanic Garden, 26% (470 out of 1767 accessions) of *Drypetes* are filed as *Drypetes* sp. (correct as at July 2012). This, along with the lack of a modern treatment of the group, is indicative of the neglect of *Drypetes* and the group is in much need of revision as well as further consideration of the relationship of *Drypetes* to *Sibangea*.

In terms of the relationship of *Drypetes* to *Sibangea*, this remains unresolved. As commented upon previously, Radcliffe-Smith (1978) re-established *Sibangea,* whilst the analyses of Wurdack *et al* (2004) indicate a paraphyletic *Drypetes* with *Sibangea* nested within a clade of African *Drypetes* (Figure 6) with the authors stating that *Sibangea* should be subsumed under that genus.

Of further interest in respect of the relationship of *Drypetes* to *Sibangea* is the unilocular African species *D. moliwensis* Cheek & Radcl.-Sm. The protologue for *D. moliwensis* (Cheek *et al*, 2000) recognises that unilocular African species of *Drypetes* are uncommon. This is consistent with the observations of this study as none of the three unilocular *Drypetes* samples studied here (Ernst, 1869; Forster, 7679; Sumithraarchchi, 355) are African species. The protologue for *D. moliwensis* (Cheek *et al*, 2000) further recognises that *D. moliwensis*, in terms of locule number and narrow sepals, shows affinities with *Sibangea*. In the keying out of *D. moliwensis* the species falls midway between the final leads of Keay's last couplet (Keay, 1958: p. 381) which either leads to *Sibangea* or *Drypetes*. The assignation to *Drypetes* is based upon the observation that the sepals, although narrow, are not as narrow of those of *Sibangea*, and that they are imbricate along with the observation that unilocular ovaries are also found in the African species *D. aylmeri* Hutch. & Dalziel. Hence, *D. moliwensis* is of interest as the species demonstrates that the boundary between these genera may not be so clear cut which lends perspective to the opposing views of Radcliffe-Smith (1978) and Wurdack et al (2004) and argues for further research of the tantalising boundary, if one exists, between the two genera.

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Appendix 1 – Results

Index to Filing Names

Accepted names and synonyms with publishing information; Index to Filing Names		Page
Drypetes Vahl	Eclog. Amer. 3: 49 (1807)	A15, 25, 36
Drypetes afzelii (Pax) Hutch	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 685 (1912)	A18, 41
Drypetes alba Poit.	Mém. Mus. Hist. Nat. 1: 157 (1815).	A25
Drypetes arguta (Müll.Arg.) Hutch.	in W.H.Harvey & O.W.Sonder, Fl. Cap. 5(2): 404 (1920)	A43
Drypetes assamica (Hook.f.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 241 (1922)	A38
Drypetes australasica (Müll.Arg.) Pax & K.Hoffm. (synonym of *Drypetes deplanchei*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 270 (1922)	A22, 42
Drypetes aylmeri Hutch. & Dalziel	Fl. W. Trop. Afr. 1: 288 (1928)	A45
Drypetes brownii Standl.	Trop. Woods 20: 20 (1929)	A14
Drypetes capillipes (Pax) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 260 (1922)	A27
Drypetes castilloi (Merr.) Merr.	Pl. Elmer. Born.: 140 (1929)	A23
Drypetes cernua	Name not published	A16, 46
Drypetes chevalieri Beille ex Hutch. & Dalziel	Fl. W. Trop. Afr. 1: 287 (1928)	A11

Drypetes cockburnii Airy Shaw	Kew Bull. 25: 502 (1971)	A46
Drypetes crassipes Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 241 (1922)	A34
Drypetes cumingii (Baill.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 238 (1922).	A20
Drypetes deplanchei (Brongn. & Gris) Merr.	J. Arnold Arbor. 32: 199 (1951)	A9, 35
Drypetes dewildei Airy Shaw	Kew Bull. 32: 380 (1978)	A18
Drypetes dinklagei (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 683 (1912).	A42, 44
Drypetes diopa (Hiern) Brenan	Kew Bull. 8: 92 (1953)	A26
Drypetes elata (Bedd.) Pax & K.Hoffm. (synonym of *Drypetes venusta*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 268 (1922)	A10
Drypetes fallax Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 242 (1922)	A27
Drypetes fanshawei Sandwith	Kew Bull. 7: 258 (1952)	A46
Drypetes floribunda (Müll.Arg.) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 687 (1912)	A28
Drypetes gabonensis Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 680 (1912)	A14
Drypetes gardneri (Thwaites) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 270 (1922)	A43, 48
Drypetes gilgiana (Pax) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 261 (1922)	A17
Drypetes glauca Vahl	Eclog. Amer. 3: 49 (1807)	A21, 40
Drypetes gossweileri S. Moore	J. Bot. 58: 271 (1920)	A12, A16

Drypetes grandifolia (C.B.Rob.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 245 (1922)	A40
Drypetes hainanensis Merr.	J. Arnold Arbor. 6: 134 (1925)	A28, 30
Drypetes hoaensis Gagnep.	Bull. Soc. Bot. France 71: 259 (1924)	A36
Drypetes ilicifolia (DC.) Krug & Urb.	Krug & Urb., Bot. Jahrb. Syst. 15: 352 (1892)	A17
Drypetes indica (Müll.Arg.) Pax & K.Hoffm.	Pax & K.Hoffm. in H.G.A.Engler, Pflanzenr., IV, 147, XV: 278 (1922)	A23
Drypetes ivorensis Hutch. & Dalziel	Fl. W. Trop. Afr. 1: 287 (1928)	A45
Drypetes karapinensis (Hayata) Pax & K.Hoffm. (synonym of *Drypetes indica*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 248 (1922)	A23
Drypetes kikir Airy Shaw	Kew Bull. 23: 60 (1969)	A8
Drypetes klainei Pierre ex Pax	Bot. Jahrb. Syst. 43: 219 (1909)	A33
Drypetes laciniata (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 677 (1912)	A27, 33, 45
Drypetes laevis (Miq.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 240 (1922)	A42
Drypetes lasiogynoides Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 272 (1922)	A39, 41
Drypetes lateriflora (Sw.) Krug & Urb.	Bot. Jahrb. Syst. 15: 354 (1892)	A25
Drypetes leonensis Pax	Bot. Jahrb. Syst. 43: 219 (1909)	A34
Drypetes littoralis (C.B.Rob.) Merr.	Philipp. J. Sci. 29: 380 (1926)	A24, 36
Drypetes longifolia (Blume) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr.,	A8, 14,

	IV, 147, XV: 245 (1922)	29
Drypetes macrophylla (Blume) Pax & K.Hoffm. (synonym of *Drypetes longifolia*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 247 (1922)	A8, 14, 29
Drypetes macrostigma J.J.Sm.	Bull. Jard. Bot. Buitenzorg, III, 6: 85 (1924)	A29
Drypetes magnistipula (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 689 (1912)	A48
Drypetes malabarica (Bedd.) Airy Shaw	Kew Bull. 23: 56 (1969)	A41
Drypetes maquilingensis (Merr.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 240 (1922)	A47
Drypetes megacarpa (Merr.) Pax & K.Hoffm. (synonym of *Drypetes grandifolia*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 248 (1922)	A40
Drypetes microphylla (Merr.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 237 (1922)	A15, 40
Drypetes mindanaensis (Merr.) Pax & K.Hoffm. (synonym of *Drypetes sibuyanensis*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 248 (1922)	A19
Drypetes molunduana Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 258 (1922)	A7, 13, 44
Drypetes natalensis (Harv.) Hutch.	in W.H.Harvey & O.W.Sonder, Fl. Cap. 5(2): 404 (1920)	A24
Drypetes natalensis var. *natalensis*		A24
Drypetes natalensis var. *leiogyna*	Mem. New York Bot. Gard. 9: 70 (1954)	A24
Drypetes neglecta (Koord.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 242 (1922)	A32
Drypetes oblongifolia (Bedd.) Airy Shaw	Kew Bull. 23: 57 (1969)	A38
Drypetes occidentalis (Müll.Arg.) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 683 (1912)	A26
Drypetes ochrothrix Airy Shaw	Kew Bull. 21: 361 (1968)	A29

Drypetes ovalis (J.J.Sm. ex Koord. & Valeton) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 269 (1922)	A9, 31
Drypetes parvifolia (Müll.Arg.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 262 (1922)	A28
Drypetes paxii Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 681 (1912)	A49
Drypetes pendula Ridl.	Bull. Misc. Inform. Kew 1923: 365 (1923)	A16, 32
Drypetes polyantha Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 259 (1922)	A26, A28
Drypetes preussii (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 686 (1912)	A38, 44
Drypetes principum (Müll.Arg.) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 684 (1912)	A32, 37, 43, 49
Drypetes prunifera Airy Shaw	Kew Bull. 19: 304 (1965)	A23
Drypetes sepiaria (Wight & Arn.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 271 (1922)	A19, 22, 47
Drypetes sibuyanensis (Elmer) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 247 (1922)	A19
Drypetes similis Hutch. (synonym of *Sibangea similis* (Hutch.) Radcl.-Sm.)	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 679 (1912)	A48
Drypetes solida	Name not published	A20
Drypetes spinosodentata (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 688 (1912)	A33, 34
Drypetes staudtii (Pax) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 685 (1912).	A39
Drypetes subcubica (J.J.Sm.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 250 (1922)	A31
Drypetes subsessilis (Kurz) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 248 (1922)	A8

Drypetes travancorica (Bourd.) Santapau & S.K.Jain (synonym of *Drypetes gardneri*)	Indian Forester 92: 643 (1966)	A11
Drypetes ugandensis (Rendle) Hutch.	in D.Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 687 (1912)	A10, 36
*Drypetes urophyll*a Pax & K.Hoffm. (synonym of *Drypetes leonensis*)	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 254 (1922)	A34
Drypetes venusta (Wight) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 268 (1922)	A10
Drypetes wightii (Hook.f.) Pax & K.Hoffm.	in H.G.A.Engler, Pflanzenr., IV, 147, XV: 273 (1922)	A21
Lophopyxis maingayi Hook.f.	Hooker's Icon Pl. 18. t. 1714 (1887)	A30
Putranjiva roxburghii Wall.	Tent. Fl. Napal.: 61 (1826)	A11, 31, 39 , 47
Sibangea arborescens Oliv.	Hooker's Icon. Pl. 15: t. 1411 (1883)	A17, 37
Sibangea similis (Hutch.) Radcl.-Sm.	Kew Bull. 32: 481 (1978)	A44

Explanatory notes to results:

The results are arranged alphabetically by collector. The filing name, date of collection and country of origin of the specimens is taken from the herbarium label. The herbarium barcode is provided when known. Dry specimens from Kew herbarium sheets do not have a barcode and are stated as 'K'. Specimens from Kew with a barcode are from the spirit collection. Two of the four BM specimens have a barcode; the other two are referred to as BM only. All E specimens are barcoded except for two recent collections (March 2012) by Harris, D.J.

The first entry in the description describes the nature of material dissected, either bud or flower. Position and arrangement of flowers is stated when witnessed from material removed from E herbarium sheets.

Sepals are imbricate and culculate unless stated otherwise. The stamens are in one whorl unless other stated, but specimens with higher stamen numbers in one whorl are confirmed as such. Anthers are introrse unless stated otherwise. The terminology of Hickey and King (2000) is used to describe the types of hairs present.

'Notes' make reference to other specimens within the study and protologues and regional floral accounts as appropriate. Status of synonyms is in accordance with the World Checklist of Selected Plant Families (WCSP, 2012). Publication detail for all protologues are included in the Index to Filing Names.

Akpapla, GK 1100	**16 Mar 1948**	***Drypetes molunduana* Pax & K.Hoffm.**	**Nigeria**	**K**

K5 C0 A10 G0

Bud globose 3-4mm; sepals (sub-) orbicular 2mm, sparsely pubescent with apical ciliate hairs; stamens in +/- two whorls; disk cupular, 2mm diameter, glabrous, of irregular, fleshy, raised angular peaks extruded between filament bases; rudimentary gynoecium present.

Note: compare Brenan 9296 where the stamens are in three whorls; the other male *D. molunduana* (Brenan 8574) in the results has stamens in two whorls; the protologue of *D. molunduana* states stamens 12-18 but does not mention their arrangement.

Ambriansyah W324	**27 Aug 1990**	***Drypetes kikir* Airy Shaw**	**Indonesia**	**K**

K4 C0 A10 G0

Bud 2mm; sepals (sub-) orbicular 2mm, papery, sparsely pubescent; disk cupular, 0.5mm diameter, glabrous, margin plicate, apex irregularly crenate.

anon. 30	**23 Mar 1912**	***Drypetes longifolia* (Blume) Pax & K.Hoffm.**	**Malaysia**	**K**

K5 C0 A90-106 G0

Opening bud, sub-globose 5mm high x 8mm wide; sepals (sub-) orbicular 4mm, fleshy, sparsely pubescent with apical ciliate hairs; stamens increase in one whorl; disk shallowly cupular, 5mm diameter, thin, pubescent, centre open, margin low erect up to 0.25mm, margin apex irregularly crenate, occasionally protruding between filament bases where space permits.

Note: compare Burley & Turkirin 4134 where the stamen number is ~26 and the bud (3mm) and disk (2mm) are much smaller; the protologue of *D. longifolia* states 30-50 stamens.

Ayyappan, N 125	**15 Feb 1998**	***Drypetes subsessilis* (Kurz) Pax & K.Hoffm.**	**India**	**K**

K5 C0 A18 G0

Bud globose 5mm; sepals (sub-) orbicular 4mm, shiny glabrous with marginal ciliate hairs; stamens in one whorl; disk cupular, 2.5mm diameter, glabrous, margin a cylindrical collar 0.8mm high, apex with acute, irregular teeth.

Balachandran, N 406	**01 May 1996**	***Drypetes ovalis* (J.J.Sm. ex Koord. & Valeton) Pax & K.Hoffm.**	**India**	**K**

K5 C0 A12 G0

Bud globose 4mm; sepals (sub-) orbicular 2mm, pubescent; disk flat, very thin, 1.25mm diameter, glabrous with marginal crenate lobes.

Note: compare Kostermans 22071, where the disk is cupular, 0.5mm diameter, with broad crenate lobes with lanate hairs in disk centre; the protologue of *D. ovalis* records flowers not seen.

Balansa, M. *s.n.*	**01 Jul 1868**	***Drypetes deplanchei* (Brongn. & Gris) Merr.**	**New Caledonia**	**E00310677**

K4 C0 A8 G0

Bud globose 2.5-3.5mm in axillary clusters; sepals (sub-) orbicular 2.5-3.5mm, glabrous with apical ciliate hairs; disk flat, 1mm diameter, glabrous, fleshy with obtuse marginal lobes protruding between filaments.

Note: compare Mackee 12308 where the sepals are elliptic; the other male *D. deplanchei* in these results, Mackee 12223 and Stoddart 472 2have sepals as per Balansa *s.n.*; the protologue of *D. deplanchei* deals with nomenclatural matters, with no description; the protologue for the synonym *Drypetes australasica* (Müll.Arg.) Pax & K.Hoffm. records sepals as broad-elliptical; the stamen number as 5-12 and the disk as glabrous with a raised and undulating margin. *D. deplanchei* was first described as *Eleocarpus deplanchei* Brongn. & Gris (by Merrill E.D. [1951] *J. Arnold Arbor*. 32: 197);

Barber, C 5656	**21 Jan 1903**	***Drypetes elata* (Bedd.) Pax & K.Hoffm.**	**India**	**K**

K5 C0 A11 G0

Bud globose 2-4mm; sepals (sub-) orbicular 3mm, pubescent, soft; disk shallowly cupular, 1.75mm diameter, glabrous, marginal lobes protruding between filament bases; rudimentary gynoecium present.

Note: *D. elata* is a synonym of *Drypetes venusta* (Wight) Pax & K.Hoffm.; the protologues of both names record oblong sepals.

Bates, GL 1774	**Sep 1922**	***Drypetes ugandensis* (Rendle) Hutch.**	**Cameroon**	**K**

K5 C0 A0 G(3)

Flower 8mm diameter; sepals (sub-) orbicular 5mm, coriaceous, sparsely haired; gynoecium globose 4mm, densely lanate with three vertical sutures; styles free 0.3mm; stigma 3, triangular 2mm x 1.7mm; disk flat, skirt 1mm, entire, lanate.

Bourdillon, TF 37	**Feb 1887**	***Drypetes elata* (Bedd.) Pax & K.Hoffm.**	**India**	**K**

K4 C0 A7 G0

Bud globose 4mm; sepals (sub-) orbicular 3mm, pubescent; disk shallowly cupular, 2mm diameter, glabrous, crenate marginal lobes protruding between filament bases.

Note: *D. elata* is a synonym of *Drypetes venusta* (Wight) Pax & K.Hoffm.; the protologues of both names record oblong sepals.

Bourdillon, TF 1595	**25 Apr 1905**	***Drypetes travancorica* (Bourd.) Santapau & S.K.Jain**	**India**	**K000246693**

K4 C0 A12 G0

Flower 5mm diameter; sepals oblong 3mm x 1mm, not imbricate, papery, glabrous with apical ciliate hairs; disk shallowly cupular, 1mm diameter, glabrous, margin briefly elevated, +/- incurved.

Note: The protologue of *D. travancorica* states +/- 25 stamens; *D. travancorica* is a synonym of *Drypetes gardneri* (Thwaites) Pax & K.Hoffm.; compare Worthington, TB. 5168 where sepals are (sub)-orbicular and glabrous, the stamens are 21 in number, the disk cupular measuring 0.45mm diameter in an 8mm diameter flower.

Brandis, D *s.n.*	**Apr 1900**	***Putranjiva roxburghii* Wall.**	**Burma**	**K**

K4 C0 A0 G(3)

Young fruits ovate 3mm x 4mm, sparsely pubescent; K deciduous; styles free 1mm; stigma 3, 3.5mm in length, bifurcated mid-way; no disk.

Brenan, JPM 8436	**09 Dec 1947**	***Drypetes chevalieri* Beille ex Hutch. & Dalziel**	**Nigeria**	**2113.000 (K)**

K4 C0 A20 G0

Open bud 6mm diameter x 5mm deep; sepals (sub-) orbicular 4.5mm, finely pubescent; stamens in +/- three whorls; disk 5mm diameter, glabrous, convolute- cupular, crenate-convolute longitudinal fleshy folds, covering the centre of the disk, the apices extruded around filament bases; rudimentary gynoecium present as a small conical projection.

Brenan, JPM 8474	**11 Dec 1947**	***Drypetes gossweileri* S. Moore**	**Nigeria**	**15727.000 (K)**

K5 C0 A0 G(7)

Bud globose 10mm; sepals (sub-) orbicular 7-10mm, fleshy, finely pubescent; gynoecium globose 6mm, glabrous; disk cupular, skirt up to 2mm, glabrous, irregularly plicate, sometimes overlapping, thin or fleshy in parts, irregularly crenate or toothed margin; styles free 1-1.5mm; stigma 7, fan to square, 4mm x 3mm, with pronounced irregular notched margins, stigma overlapping.

Note: the protologue of *D. gossweileri* states female flowers not seen; the protologue for the synonym *D. armoracia* Pax & K. Hoffm. does record a 5-6 locule gynoecium; the material dissected (from bud) was glabrous; the *D. armoracia* protologue records that the ovary is velvety; all three specimens sampled exhibited G7.

Brenan, JPM 8475	**11 Dec 1947**	***Drypetes gossweileri* S. Moore**	**Nigeria**	**K 16821.000 (K)**

K5 C0 A35 G0

Mature flower 20mm diameter; K pronouncedly reflexed; sepals (sub-) orbicular 10mm, velutinous; stamens in one whorl; disk cupular, 6mm diameter, glabrous, disk centre open, flat, disk margin of vertical, fully plicate, folds 1mm high, enclosing filament bases, margin apex irregularly toothed; rudimentary gynoecium present as a small conical projection.

Note: the protologue of *D. gossweileri* states ‘about 40 stamens’.

Brenan, JPM 8574	**22 Dec 1947**	***Drypetes molunduana* Pax & K.Hoffm.**	**Nigeria**	**4340.000 (K)**

K5 C0 A14 G0

Open flower 10mm diameter; sepals (sub-) orbicular 4mm, sparsely pubescent with apical ciliate hairs; stamens +/- in two whorls; disk convolute-cupular, 4mm diameter, glabrous, margin deeply convoluted covering entire centre of disk, extruding between filament bases, apices of margin forming irregular, fleshy, raised angular peaks.

Note: compare Brenan 9296 where the stamens are in three whorls; the other male *D. molunduana* (Akpapla 1100) in these results has stamens in two whorls; the protologue of *D. molunduana* states stamens 12-18 but does not mention their arrangement.

Brenan, JPM 9296	**12 Mar 1948**	***Drypetes molunduana* Pax & K.Hoffm.**	**Cameroon**	**5191.000 (K)**

K5 C0 A16 G0

Open flower 11-12mm diameter; sepals (sub-) orbicular 4mm, glabrous; stamens +/- in three whorls; disk convolute-cupular, 3.75mm diameter, glabrous, margin deeply convoluted covering entire centre of disk, extruding between filament bases, apices of margin forming irregular, fleshy, raised angular peaks.

Note: compare the other two male *D. molunduana* in the results, Akpapla 1100 and Brenan 8574, where the stamens are in two whorls; the protologue of *D. molunduana* states stamens 12-18 but does not mention their arrangement.

Brenan, JPM 9297	**12 Mar 1948**	***Drypetes molunduana* Pax & K.Hoffm.**	**Cameroon**	**4339.000 (K)**

K5 C0 A0 G(2)

Open flower 13mm diameter; sepals (sub-) orbicular up to 5mm, glabrous, fleshy; gynoecium globose up to 4mm diameter with pilose hairs; style fused at base for 0.5mm, bifurcated for 0.75mm; stigma 2, fan-shaped 4mm x 2mm; disk skirt 2mm, of more or less 5 discontinuous variably crenate, notched and plicate lobes, glabrous.

Breteler, FJ 829	**15 Dec 1960**	***Drypetes gabonensis* Hutch.**	**Cameroon**	**K**

K4 C0 A3 G0

Opening bud globose 3mm; sepals ovate 2.6mm x 2mm, apex acute, sparsely pubescent with apical ciliate hairs; large stamens 5mm x 0.3mm; disk cupular 0.75mm diameter, glabrous, thin, three broadly-rounded lobes protruding between filament bases.

Burley, JS. & Turkirin 4134	**28 Mar 1990**	***Drypetes longifolia* (Blume) Pax & K.Hoffm.**	**Indonesia**	**E00074664**

K4-(5) C0 A~26 G0

Male bud globose 3mm in axillary clusters; sepals (sub-) orbicular 3.75mm, pronouncedly imbricate, each sepal enveloping >50% of bud, pubescent; stamens in single whorl; disk shallowly cupular, 2mm diameter, with low ~0.2mm erect margin, margin apex irregularly broadly-toothed, pubescent in centre.

Note: compare anon. 30 where the stamens are 90-106 in number and the bud is larger and sub-globose, 5mm high x 8mm wide, and the disk is larger, 5mm diameter; the protologue of *D. longifolia* states 30-50 stamens.

Caldwell, AL 8	**24 Apr 2002**	***Drypetes brownii* Standl.**	**Belize**	**E00202875**

K4 C0 A14-16 G0

Bud sub-globose 3.5mm high x 4.5mm wide in axillary clusters; sepals (sub-) orbicular 3mm with apical ciliate hairs; disk flat, 2.5mm diameter, pubescent, obtuse marginal lobes protruding between filaments; rudimentary gynoecium present as a small conical projection.

Notes: an anomalous specimen; both of the flowers examined exhibit one or two structures situated *within* the disk in addition to the rudimentary gynoecia; these structures show features of both ovarian and staminate tissue: grooved like a carpel with an anther-like apex.

Charlie, FR SAN 23789	**11 Apr 1960**	***Drypetes microphylla* (Merr.) Pax & K.Hoffm.**	**Borneo**	**K**

K4 C0 A12-15 G0

Bud globose 3mm; sepals (sub-) orbicular 3mm, velutinous; disk shallowly cupular, 1mm diameter, pubescent, disk flattening in older flowers.

Note: the protologue of *D. microphylla* states the stamen number as 8-12 with the description of the male disk limited to *discus parvus, pubescens* ('disk small, pubescent').

Congdon, C *s.n.*	**25 Nov 1990**	***Drypetes* sp.**	**Tanzania**	**58380.000 (K)**

K5 C0 A12 G0

Bud globose 4mm; sepals (sub-) orbicular 3mm, glabrous; disk flat, 2.5mm diameter, glabrous, thin, with shallow depressions, truncate marginal lobes protruding between filament bases.

Note: the thin disk is difficult to distinguish from the receptacle.

Congdon, C *s.n.*	**25 Nov 1990**	***Drypetes* sp.**	**Tanzania**	**58403.000 (K)**

K5 C0 A0 G(3)

Bud globose 5mm; sepals (sub-) orbicular 4mm, glabrous; gynoecium globose 3.8mm diameter, sericeous; style not seen; stigma 3, triangular or reniform 2.3mm x 1.3mm; disk cupular, a continuous thin glabrous band, skirt 0.5mm deep, irregularly and minutely crenate.

Note: The material is too immature to detect the presence of a style as a discreet structure; the stigma are adpressed to the gynoecium in this young specimen.

Coombe, DE 183	**14 Mar 1955**	***Drypetes gossweileri* S. Moore**	**Nigeria**	**15733.000 (K)**

K5 C0 A0 G(6)

Bud globose 10mm; sepals (sub-) orbicular 7-10mm, fleshy, finely pubescent; gynoecium globose 6mm, glabrous; disk cupular skirt 2-4mm deep, glabrous, irregularly plicate, sometimes overlapping, thin or fleshy in parts, irregularly crenate or toothed margin; styles free 1-1.5mm; stigma 6, highly irregular, fan to square-shaped 4mm x 3mm with pronounced irregular notches and margins.

Note: the protologue for *D. gossweileri* states female flowers not seen; the protologue for the synonym *D. amoracia* Pax & K. Hoffm. does record a 5-6 locule gynoecium; the material dissected (from bud) was glabrous; the *D. amoracia* protologue records that the ovary is velvety.

Corner, EJH SFN 33148	**29 Aug 1937**	***Drypetes pendula* Ridl.**	**Singapore**	**K**

Male flower; not dissected due to poor quality ('gone over' flower).

Cuming, H 148	**01 Jul 1831**	***Drypetes cernua***	**Philippines**	**E00310646**

K(6) C0 A0 G(3)

K(6) C0 A(3) G0

Female and male flowers present; flowers axillary, solitary, occasionally in pairs; calyx papery, partially fused $^{3}/_{4}$-$^{1}/_{2,}$ lobes entire or sometimes irregularly crenate, apices +/- acute, glabrous, bluish on herbarium sheet; ovary 2mm across, 3-lobed; style/stigma 3, composed of 3 double-pronged coiled 'horns'; no disk; synandrium in male flowers; no disk in flower of either gender.

Note: there is no publication for the name *Drypetes cernua*; in view of the presence of male and female flowers along with the fused calyx and the lack of disk material, it is possible that specimens Weber 1052 and Cuming 148 are *Breynia cernua* (Poir.) Müll.Arg.

Curtiss, AH 686	**18 Mar 1905**	***Drypetes ilicifolia* (DC.) Krug & Urb.**	**Cuba**	**E00421817**

K5 C5 A10 G(5)

Axillary racemose inflorescence; flower 4mm wide, 5mm long; sepals, long ovate 2mm x 6mm, acute, glabrous; corolla convolute; anthers 4-5mm long; gynoecium deeply lobed, single style 3mm; no disk.

Note: all features of this specimen indicate that Curtiss 686 is not a *Drypetes* and further investigation will be required to identify this specimen. It has been suggested (L Ronse de Craene, RBGE, pers. comm.) that Curtiss 686 may be an Ochnaceae.

de Wilde, JJFE 3124	**09 Oct 1961**	***Drypetes gilgiana* (Pax) Pax & K.Hoffm.**	**Ivory Coast**	**K**

K4 C0 A12 G0

Flower 5mm diameter; sepals (sub-) orbicular 2.5mm, glabrous with marginal ciliate hairs; stamens +/- in two whorls; disk 2mm diameter, glabrous, convolute-cupular, margin crenate-convolute longitudinal fleshy folds covering the centre of the disk, the apices extruded around filament bases.

de Wilde, JJFE 8476	**25 Sep 1975**	***Sibangea arborescens* Oliv.**	**Cameroon**	**K**

K4-5 C0 A3-4 G0

Bud globose 2.5mm; sepals elliptic 2.5mm x 1.2mm, valvate, fleshy, sparsely pubescent; stamens antesepalous when isomerous; disk cupular 2mm diameter, glabrous, undulate, of broadly-crenate marginal lobes with central cone, thick, fleshy.

de Wilde, WJJO 15689	**21 Mar 1975**	***Drypetes dewildei* Airy Shaw**	**Indonesia**	**K**

K5 C0 A~60 G0

Bud globose 6mm; sepals (sub-) orbicular 6-7mm, coriaceous, velutinous; stamens in one whorl; disk shallowly cupular, 6mm diameter, pubescent, flat central area, margin of 0.5mm briefly elevated +/- incurved longitudinally crimped vertical folds.

Note: the protologue of *D. dewildei* states stamens 'very numerous' and disk size as 4-5 mm in diameter.

Deighton, FC 1414	**27 Oct 1928**	***Drypetes afzelii* (Pax) Hutch.**	**Sierra Leone**	**K**

K5 C0 A0 G2

Young fruit; gynoecium globose 4.8mm, lanate; K deciduous; style fused 0.65mm; stigma 2, reniform 3.5mm x 1.25mm; disk skirt 1mm, shallowly cupular, pilose.

Deighton, FC 6137	**15 Oct 1954**	***Drypetes afzelii* (Pax) Hutch.**	**Sierra Leone**	**K**

K5 C0 A~20 G0

Bud globose 5mm; sepals (sub-) orbicular 3mm; glabrous with sparse marginal ciliate hairs; stamens predominantly in single whorl with some inner stamens towards centre of flower, the few inner stamens not forming an identifiable second whorl, stamens irregularly crowded in parts; disk flat, 3.5mm diameter, +/- sparse lanate hairs, rugose, crenate or truncate marginal lobes protruding between filament bases where space permits; rudimentary gynoecium present as a small conical projection in one specimen.

Note: the irregular crowding of stamens arises from >1 stamen at the same locus; the presence and form of the marginal lobing protruding between the filament bases appears to be dependent upon spatial constraints imposed by the filament position and increase; the protologue states male flowers unknown/not seen; the protologue for the synonym *Cyclostemon afzelii* Pax does not mention male flowers.

Diraviam 26358	**07 Feb 1980**	***Drypetes sepiaria* (Wight & Arn.) Pax & K.Hoffm.**	**India**	**K**

K4 C0 A0 G(2)

Open flower 4mm diameter, solitary and in pairs; sepals oblong 2mm x 1mm, pubescent, papery; gynoecium globose 2.5mm, sparsely pilose; style fused, 0.3-0.5mm an enrolled inverted cone with vertical fissure where edges meet; stigma 2(?), decurrent, later opening circular and peltate or semi-circular; disk skirt 0.5mm, circular, flat, glabrous, margin crenate.

Note: from the material available it was uncertain whether the stigma are semi-circular 2 or circular 1; the stigma had become damaged with a portion removed or splits from the edge to the centre giving the impression of divided stigma (the latter two are, perhaps, the likeliest scenario – although it is uncertain how the enrolled style could form an entire circular stigma); the protologue states the stigma can be both circular or semi-circular (with no mention of the style); the protologue for the synonym *Hemicyclia sepiaria* Wight & Arn. records two sessile semi-circular stigma.

Edano, GE PNH 11111	**04 Sep 1948**	***Drypetes mindanaensis* (Merr.) Pax & K.Hoffm.**	**Philippines**	**K**

K4 C0 A9-10 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm with sparse sericeous hairs abaxially, velutinous adaxially, marginal ciliate hairs; disk cupular, 1mm diameter, glabrous, margin vertical, irregularly plicate up to 0.5mm deep, with irregular apical teeth.

Note: *D. mindanaensis* is a synonym of *Drypetes sibuyanensis* (Elmer) Pax & K.Hoffm.

Elmer, ADE 7006	**15 Nov 1904**	***Drypetes solida***	**Philippines**	**E00310659**

K5 C0 A8 G1

Bud oval 3mm x 2.5mm in axillary clusters; sepals oval 4mm x 2mm, pubescent; oblong 1mm x 0.5mm apically pilose interstaminal structures present; gynoecium ovate, 0.75mm across; style, 0.75mm; stigma capitate 1mm diameter, no disk.

Note: the interstaminal structures are possibly staminoidal; there is no publication for the name *Drypetes solida*; in view of the hermaphrodite flower with no clear disk Elmer, ADE 7006 is not a *Drypetes* and further investigation will be required to identify this specimen.

Elmer, ADE 12695	**15 Feb 1911**	***Drypetes cumingii* (Baill.) Pax & K. Hoffm.**	**Philippines**	**E00310653**

K4 C0 A0 G(2)

Young fruits globose 2-3mm in axillary clusters, densely pubescent; K deciduous; style short 0.3mm, fused; stigma 2, triangular, 1mm x 1mm, margins lightly crenate; disk skirt 0.5mm, glabrous, entire, flat, thin, margin undulate.

Elmer, ADE 13175	**15 May 1911**	***Drypetes cumingii* (Baill.) Pax & K. Hoffm.**	**Philippines**	**E00310654**

K4 C5 A20 G0

Male bud globose 3-4mm in axillary clusters; sepals (sub-) orbicular 3mm, glabrous; 5 darkened petals with pale margins; no disk.

Note: the presence of a corolla suggests that specimen Elmer, ADE. 13175 is not a *Drypetes* and further investigation will be required to correctly identify this specimen.

Ernst, WR 1869	**12 Jul 1965**	***Drypetes glauca* Griseb.**	**Dominica**	**BM**

K4 C0 A0 G1

Flower 3mm diameter; sepals (sub-) orbicular 3mm, glabrous, fleshy with marginal ciliate hairs; gynoecium ovate 2.2mm x 1.8mm (including short, 0.5mm apical 'column'), pubescent; no style; stigma sessile, capitate, circular 1mm; disk skirt 0.75mm, glabrous, thick, fleshy, shallowly cupular, margin, even, broadly-crenate.

Note: the protologue of *D. glauca* records the absence of a style with sessile stigma; and *discus planus* ('disk flat'); the top of the gynoecium – the 'apical column' – is considered here to be part of the gynoecium and not a discreet style.

Fischer, CEC 4057	**18 Feb 1917**	***Drypetes wightii* (Hook.f.) Pax & K.Hoffm.**	**India**	**K**

K4 C0 A7 G0

Bud globose 1.8mm; sepals (sub-) orbicular 1.4mm, fleshy, pubescent; disk flat, 0.5mm diameter, pubescent, thick, raised, fleshy, irregular, truncate marginal lobes protruding between filament bases.

Note: 7 stamens present in all three buds sampled; the protologue states stamen number as 6-10 (as well sepals 4-7, oblong).

Fischer, C *s.n.*	**09 Apr 1923**	***Drypetes sepiaria* (Wight & Arn.) Pax & K.Hoffm.**	**India**	**E00310585**

K4 C0 A0 G(2)

Flower 4mm diameter, axillary, solitary and in pairs; sepals oblong 2mm x 1mm, pubescent; gynoecium globose 2.5mm, sparsely pilose; style fused, 0.3-0.5mm an enrolled inverted cone with vertical fissure where edges meet; stigma 2(?), decurrent, later opening circular and peltate or semi-circular; disk skirt 0.5mm, glabrous, circular, thick, flat, crenate margin.

Note: one ovule per locule (one aborted?); from the material available it was uncertain whether the stigma are semi-circular 2 or circular 1; the stigma had become damaged with a portion removed or splits from the edge to the centre giving the impression of divided stigma (the latter two are, perhaps, the likeliest scenario – although it is uncertain how the enrolled style could form an entire circular stigma); the protologue states the stigma can be both circular or semi-circular (with no mention of the style); the protologue for the synonym *Hemicyclia sepiaria* Wight & Arn. records two sessile semi-circular stigma.

Forster, PI 7679	**03 Dec 1990**	***Drypetes australasica* (Müll.Arg.) Pax & K.Hoffm.**	**Australia**	**K**

K4 C0 A0 G1

Bud globose 3mm; sepals (sub-) orbicular 2mm, glabrous with sparse marginal ciliate hairs; gynoecium globose, 2mm, glabrous; style 0.1mm; stigma reniform, smooth, 1.7mm x 0.75mm; disk skirt 0.5mm, glabrous, thin, shallowly cupular, margin broadly-crenate shallow lobes.

Note: *D. australasica* is a synonym of *Drypetes deplanchei* (Brongn. & Gris) Merr.
D. deplanchei was first described as *Eleocarpus deplanchei* Brongn. & Gris (by Merrill E.D. [1951] *J. Arnold Arbor*. 32: 197)

Furuse, M 4834	**19 Mar 1974**	***Drypetes karapinensis* (Hayata) Pax & K.Hoffm.**	**Japan**	**K**

K4 C0 A(2) G0

Bud globose up to 1mm; sepals (sub-) orbicular 0.9mm, imbricate, sparsely pubescent; synandrium; no disk.

Note: the stamen number, synandrium and the lack of a disk indicate that this specimen is not a *Drypetes*; *D. karapinensis* is a synonym of *Drypetes indica* (Müll.Arg.) Pax & K.Hoffm.

Geesink, R 9336	**30 Aug 1981**	***Drypetes prunifera* Airy Shaw**	**Borneo**	**K**

K4 C0 A14-15 G0

Bud globose 4mm; sepals 4-5mm (sub-) orbicular, glabrous with marginal ciliate hairs; stamens in one whorl; disk cupular, 2mm diameter, a cylindrical collar up to 1mm deep, margin plicate with irregular acute apical teeth; long-pilose hairs in disk centre.

Note: The protologue of *D. prunifera* records 22 stamens and that the disk is flat, naked and not elevated; Geesink, R. 9336 thus requires re-evaluation as the identification may be incorrect.

Gibet, A SAN 35801	**14 Apr 1963**	***Drypetes castilloi* (Merr.) Merr.**	**Borneo**	**K**

K4 C0 A11-15 G0

Bud globose 2.5mm; sepals (sub-) orbicular 2mm, pubescent with marginal ciliate hairs; disk flat, 0.5mm diameter, glabrous, fleshy, with sharply defined crowded shallow depressions.

Greenway, PJ 10447	**08 Jan 1962**	***Drypetes natalensis* var. *leiogyna* Brenan**	**Kenya**	**43801.000 (K)**

K5 C0 A12 G0

Open flower 14mm diameter; sepals (sub-) orbicular 4mm, glabrous with sparse apical ciliate hairs.

Note: not described further; poor quality specimen; very black (looks charred/burned).

Greenway, PJ & Kirrika, EPK 10964	**04 Nov 1963**	***Drypetes natalensis* var. *natalensis***	**Tanzania**	**43794.000 (K)**

K5 C0 A20 G0

Open flower 8mm diameter; sepals (sub-) orbicular 4mm, glabrous with sparse apical ciliate hairs; stamens in one whorl; disk flat, 5mm diameter, fleshy, glabrous, sharply ridged, truncate marginal lobes protruding between filament bases.

Gutierrez, HG PNH 80789	**26 May 1963**	***Drypetes littoralis* (C.B.Rob.) Merr.**	**Philippines**	**K**

K4 C0 A15-17 G0

Bud globose 3-4mm; sepals (sub-) orbicular 3mm, papery, pubescent; stamens in one whorl; disk cupular, 2.5mm diameter, glabrous, flat centre, margin very thin, translucent plicate vertical folds up to 0.5mm high, apex +/- entire.

Haber, WA 10965	**27 Dec 1991**	***Drypetes lateriflora* (Sw.) Krug & Urb.**	**Costa Rica**	**BM000648637**

K5 C0 A0 G(2)

Young fruits globose 2.5mm, K deciduous; gynoecium globose 2.25mm, velutinous; style 0.8mm, fused basally, bifurcates at 0.55mm; stigma 2, fan-shaped 1.7mm x 0.8mm; disk skirt 0.5mm, pubescent, flat, margin entire.

Note: the protologue for *D. lateriflora* does not describe the disk; Pax and Hoffmann (1922) only state *discus cum ovario pubescens* ('disc with a pubescent ovary'); the Flora Costaricensis (Burger and Huft, 1999) does not mention the disk; the Flora de Nicaragua (Levin, 2009) records an annular and ciliate disk which is consistent with this sample.

Hansen, B 12994	**20 Mar 1968**	***Drypetes* sp.**	**Thailand**	**K**

K4 C0 A~43 G0

Bud globose 7mm; sepals (sub-) orbicular 5mm, coriaceous, sparsely pubescent; stamens in one whorl; disk shallowly cupular, 4mm diameter, centre open, margin low, up to 0.5mm, erect, irregularly crenate, +/- undulate, pubescent in centre.

Harmon, PK 41	**03 Jan 1990**	***Drypetes alba* Poit.**	**Costa Rica**	**BM000618902**

K5 C0 A5 G0

Flowers over-mature, disintegrating, not measured; sepals oblong-acute 1.5mm x 0.5mm, sparsely pubescent; stamens antesepalous; disk flat, 1mm across, pubescent.

Note: the protologue for *D. alba* states that the stamens in *D. alba* can be ante- or alternisepalous.

Harris, DJ 2310	**12 May 1990**	***Drypetes polyantha* Pax & K.Hoffm.**	**Central African Republic**	**60063.000 (K)**

K5 C0 A18 G0

Open flower 12mm diameter; sepals (sub-) orbicular 6mm, glabrous; stamens predominantly in single whorl with some inner stamens towards centre of flower, the few inner stamens not forming an identifiable second whorl; disk flat, 5mm diameter, glabrous, woody, with irregular angular peaks.

Harris, DJ 2321	**13 May 1990**	***Drypetes occidentalis* (Müll.Arg.) Hutch.**	**Central African Republic**	**K**

K5 C0 A? G0

Flower 5mm diameter, sepals (sub-) orbicular 2mm, coriaceous, pubescent; disk cupular, 2mm diameter, glabrous, open and horizontal centrally, rugose here, margin vertical, plicate up to 1mm deep, margin apex irregularly crenate, glabrous.

Note: the samples were over-mature flowers with most of the stamens having become detached; the protologue of *D. occidentalis* states 'male flowers not known'; the protologue for the synonym *Cyclostemon occidentalis* Müll. Arg. does not describe the male flowers; Oliver (1912) states 'male flowers not known' as do Pax and Hoffman (1922); Keay (1958) does not describe the male flowers.

Harris, DJ 2876	**27 Apr 1991**	***Drypetes diopa* (Hiern) Brenan**	**Central African Republic**	**60044.000 (K)**

K4 C0 A4+4 G0

Bud globose 3-4mm; sepals (sub-) orbicular 2mm, glabrous with marginal ciliate hairs; stamens in two alternate whorls; disk flat, 2mm diameter, glabrous, fleshy, large irregular truncate lobes protruding between filament bases.

Harris, DJ 4941	**24 May 1994**	***Drypetes fallax* Pax & K.Hoffm.**	**Central African Republic**	**E00259050 60030.000 (K)**

K4 C0 A12 G0

Bud globose 3mm in axillary clusters; sepals (sub-) orbicular 3mm, glabrous with sparse apical ciliate hairs; stamens in single whorl; disk flat, 2.5mm diameter, glabrous, fleshy with irregular surface grooves, truncate marginal lobes protruding between filament bases.

Harris, DJ 4953	**27 May 1994**	***Drypetes capillipes* (Pax) Pax & K.Hoffm.**	**Central African Republic**	**60032.000 (K)**

K5 C0 A28 G0

Open flower 15mm diameter; bud sub-globose 5mm high x 7mm wide; sepals (sub-) orbicular 5mm, glabrous with sparse marginal ciliate hairs; stamens +/- in three whorls; disk convolute-cupular, 5mm diameter, glabrous, crenate-convolute longitudinal fleshy folds, covering the centre of the disk, the apices extruded around filament bases; rudimentary gynoecium present.

Note: the protologue for *D. capillipes* states stamens +/- 25; long pedicels (up to 7cm).

Harris, DJ 9754	**27 Mar 2012**	***Drypetes laciniata* (Pax) Hutch.**	**Republic of Congo**	**E**

K4 C0 A8 G0

Buds globose 2mm, cauliflorous; sepals (sub-) orbicular 2mm, strongly imbricate, woody, velutinous; no clearly discernible disk in most buds (too immature?); densely lanate central area present.

Note: The protologue states K5 A5 in male flower (and male flowers on younger branchlets) and ‘disk-glands transversely oblong, pilose towards the top on the inner face. Centre of the flower densely brown-setose’; K4 in female flowers (females on older branchlets) with disk very thick and leathery, 4-lobed’.

Harris, DJ 9761	**29 Mar 2012**	***Drypetes polyantha* Pax & K.Hoffm.**	**Republic of Congo**	**E**

K5 C0 A0 G(3)

Open flower 12mm diameter; sepals (sub-) orbicular 5mm, glabrous; ovary, globose 4.5mm, 3-lobed velutinous; style 0.5mm, fused; stigma tripartite, lobes triangular 2mm; disk skirt 1mm, flat, hirsute, woody, margin of 5 shallow, wide antesepalous lobes.

Hepper, FN 2292	**13 Mar 1958**	***Drypetes floribunda* (Müll.Arg.) Hutch.**	**Nigeria**	**6613.000 (K)**

K5 C0 A12 G0

Open flower 8mm diameter; sepals (sub-) orbicular 3mm, glabrous; disk (in bud) flat, rugose, smoother in older flowers where 3mm diameter, glabrous, disk margin irregularly lobed, lobes protruding through available spaces between filament bases.

Hepper, FN 7425	**04 Nov 1982**	***Drypetes parvifolia* (Müll.Arg.) Pax & K.Hoffm.**	**Ghana**	**K**

K4 C0 A12-15 G0

Buds globose 4mm; sepals (sub-) orbicular 4mm, glabrous; stamens +/- in two whorls; disk shallowly cupular, 1.5mm diameter, glabrous, of crenate-convolute longitudinal fleshy folds, covering the centre of the disk, the apices extruded around filament bases.

How, FC 70335	**Jul 1933**	***Drypetes hainanensis* Merr.**	**China**	**K**

Male flower; poorly rehydrated, not dissected.

Ismail, R KEP 100121	**23 Apr 1967**	***Drypetes longifolia* (Blume) Pax & K.Hoffm.**	**Malaysia**	**K**

K5 C0 A0 G(3)

Bud globose 5mm; sepals (sub-) orbicular 5mm, woody, glabrous with ciliate marginal hairs; gynoecium globose 3.1mm, woody, densely pubescent; no style, stigma 3, sessile, triangular 1.9mm x 1.2mm; disk skirt 1mm, cupular, glabrous, margin +/- entire.

Note: the protologue of *D. longifolia* refers to the stigma as sessile, oblong, crisply-crenate; only two buds were collected and their quality/rehydration was poor, being very brittle.

Jacobs, M 5072	**05 Aug 1958**	***Drypetes* cf. *macrostigma* J.J.Sm.**	**Borneo**	**K**

K5 C0 A0 G(3)

Open flower 12mm diameter; sepals (sub-) orbicular 5mm, glabrous, coriaceous; gynoecium globose 4.5mm densely pubescent; styles free, 1.2mm; stigma 3, +/- triangular up to 4 x 3mm, fleshy; disk skirt 1mm, glabrous, thin, shallowly cupular, margin irregularly crenate.

Kerr, AFG 18795	**31 Mar 1930**	***Drypetes ochrothrix* Airy Shaw**	**Thailand**	**K**

K4 C0 A16-18 G0

Open flower 8mm diameter; sepals oblong 4mm x 2mm pubescent, disk cupular, 0.5mm diameter, of up to six vertical semi-circular glabrous fleshy lobes <0.2mm high, the open side adaxial (rather than encircling the filament bases), scattered long-pilose hairs in disk centre.

Note: the protologue of *D. ochrothrix* states that neither female nor male flowers seen; the Flora of Thailand (Phuphathanaphong and Chayamarit, 2006) states stamens 20-25 and only that the disk is central.

Kerr, AFG 20390	**08 Mar 1931**	***Drypetes hainanensis* Merr.**	**Thailand**	**E00310599**

K4 C0 A(17)-18 G0

Buds globose up to 3mm in sessile axillary clusters; sepals (sub-) orbicular, up to 2.5mm, pubescent; stamens irregularly crowded in single whorl; disk flattened, 1mm diameter, glabrous, fleshy, irregular marginal lobes.

Note: there appears to be a secondary increase of stamens from individual stamen loci; the marginal lobes appear irregular due to spatial constraints imposed by this increase; the protologue states that fruit aside, '*floribus ignoti*' ('flowers unknown/not seen'); the Flora of Thailand (Phuphathanaphong and Chayamarit, 2006) records the sepals as spathulate, 6-8mm x 3-4 mm, stamens c.12 and only that a disk is present.

King, G 8683	**15 Mar 1886**	***Lophopyxis maingayi* Hook.f.**	**Malaysia**	**E00421818**

K5 C0 A0 G(5)

K5 C5 A5 G(5)

Terminal inflorescence with clustered buds/flowers and coiled tendrils. Mixture of buds and young fruits on same inflorescence; female flowers opening first.

Both female and hermaphrodite flowers seen. Female flower 1.25mm diameter; sepals long-ovate, 1.5mm long, acute, pubescent; gynoecium long-ovate or elongate 2.25mm x 0.75mm with longitudinal ridges aligned with septa, velutinous; styles free 1mm in length, stigma 5, subulate, reflexed; disk skirt 0.5mm, cupular, lanate, 5-lobed, each with central notch, thick, fleshy.

Hermaphrodite flowers only seen from bud material; K and G as above, corolla lobes present; no disk in hermaphrodite flowers.

Kostermans, AJGH 22071	**08 May 1965**	***Drypetes ovalis* (J.J.Sm. ex Koord. & Valeton) Pax & K.Hoffm.**	**Indonesia**	**K**

K4 C0 A8 G0

Bud globose 2.5mm; sepals (sub-) orbicular 2mm, sparsely pubescent with sparse marginal ciliate hairs; disk cupular, 0.5mm diameter, the margin of broad-crenate lobes, lanate hairs in disk centre.

Note: compare Balachandran 406; where that disk is flat, very thin, 1.25mm diameter, glabrous with marginal crenate lobes; the protologue of *D. ovalis* records flowers not seen.

Kuswata, KE 97	**01 May 1961**	***Drypetes subcubica* (J.J.Sm.) Pax & K.Hoffm.**	**Indonesia**	**K**

K4 C0 A0 G (2)-(3)

Young fruits, round 2.5mm or oblong 2mm x 2.5mm, with obtuse apex, velutinous with longitudinal fissures; K deciduous; styles free, very short, <0.2mm; stigma 3, obovate, 0.9mm x 0.8mm; disk skirt 2mm, thin, papery, cupular, broadly-crenate vertical lobe-like remnants with dense apical ciliate hairs.

Note: the protologue of *D. subcubica* describes the disk as: *discus magnus, tenuis, cupuliformis, longe dense ciliatus* – 'disk large, thin, cupuliform, densely ciliate'; Kuswata, KE. 97 is a developing fruit with the papery disk disintegrating; the remnants of the disk accord with the protologue; the protologue records the stigma as 'sub-sessile'; the oblong nature of the gynoecium may be due to inadequate rehydration.

Lace, JH 4718	**16 Mar 1909**	***Putranjiva roxburghii* Wall.**	**Burma**	**E00310520**

K4-(5) C0 A3 G0

Flowers grouped on axillary racemes in dense clusters; open flower 2mm diameter; sepals ligulate 1-1.5mm x 0.3-0.5mm, sparsely pubescent, open in bud (not imbricate or valvate); large globular extrorse anthers; no disk.

Lakim, T SAN 15908	**14 Aug 1962**	***Drypetes neglecta* (Koord.) Pax & K.Hoffm.**	**Borneo**	**K**

K4 C0 A~8-10 G0

Bud globose 2mm; sepals (sub-) orbicular 2mm, papery, pubescent; disk cupular 1mm diameter, glabrous, centre open, margin low, ~0.5mm, thin, vertical, plicate, apex +/- entire.

Note: the protologue of *D. neglecta* states a stamen number of +/-13 and *discus planus* 'disk flat'.

Larsen, K 32656	**26 Feb 1974**	***Drypetes pendula* Ridl.**	**Thailand**	**K**

K5 C0 A16 G0

Bud globose 4mm; sepals (sub-) orbicular 4mm, glabrous, fleshy, stamens in one whorl; disk shallowly cupular, 2.5mm diameter, glabrous, centre open, margin erect, low, up to 0.5mm, thin, apex irregularly toothed.

Latilo, MG FHI 15285	**10 Nov 1949**	***Drypetes principum* (Müll.Arg.) Hutch.**	**Nigeria**	**15734.000 (K)**

K4 C0 A10 G0

Bud globose 3-4mm; sepals (sub-) orbicular 2.5mm, velutinous with marginal ciliate hairs; disk 3.5mm diameter, flat, fleshy with shallow depressions, truncate marginal lobes protruding between filament bases, disk centre with persistent long-pilose hairs.

Note: compare Talbot 679 where the disk is shallowly cupular with an erect margin; the two other male *D. principum* in these results, Morton 277 and Zenker *s.n.* (01 Jul 1912), accord with Latilo FHI 15285 in respect of the disk; the protologue of *D. principum* states that the stamen number is 8-10, but does not describe the disk shape in the male flower, recording that it is 'small, nearly glabrous, except centre, which is long-pilose'.

Le Testu, GMPC. 9306	**30 Sep 1933**	***Drypetes klainei* Pierre ex Pax**	**Gabon**	**K**

K4 C0 A4 G0

Flower 2.5mm diameter; sepals oblong-acute 1.5mm x 0.8mm, valvate, pubescent; stamens antesepalous; disk flat, 1mm diameter, glabrous, composed of one central and five peripheral fleshy raised 'cushions', the margins of the latter sometimes enveloping the filament bases.

Note: the protologue for *D. klainei* does not provide a description – only the name; Oliver (1912) states the sepals are ovate.

Louis, AM 402	**05 Nov 1983**	***Drypetes laciniata* (Pax) Hutch.**	**Gabon**	**K**

K4 C0 A0 G(2)

Flower 10mm diameter; sepals (sub-) orbicular 5mm, coriaceous, pubescent; gynoecium globose 4mm, lanate, woody; styles free 0.75mm; stigma 2, reniform 3.8mm x 2mm; disk skirt 2mm, thick, coriaceous, shallowly cupular, disk margin of four broadly-crenate shallow antesepalous lobes, pilose hairs towards centre of disk.

Louis, JLP 3261	**10 Feb 1937**	***Drypetes spinosodentata* (Pax) Hutch.**	**Zaire**	**K**

K(4)-5 C0 A20-25 G0

Bud globose 5mm; sepals (sub-) orbicular 5mm, glabrous; stamens predominantly in single whorl with some inner stamens towards centre of flower, the few inner stamens not forming an identifiable second whorl; disk flat, with rugose surface, 4mm diameter, sparsely pubescent, irregular marginal lobes protruding between filament bases.

Note: compare Louis 14337 where the stamens are all in a single whorl; the protologue for *D. spinosodentata* states sepals 5; stamens about 25.

Louis, JLP 3290	**15 Feb 1937**	***Drypetes urophylla* Pax & K.Hoffm.**	**Zaire**	**K**

K4 C0 A4 G0

Bud globose 2mm; sepals (sub-) orbicular 1mm, pubescent; stamens antesepalous; disk cupular, 1mm diameter, glabrous, centre open, margins erect, forming a thin, loosely plicate cone with obtuse apical lobing.

Note: *D. urophylla* is a synonym of *Drypetes leonensis* Pax

Louis, JLP 14337	**17 Mar 1939**	***Drypetes spinosodentata* (Pax) Hutch.**	**Zaire**	**K**

K5 C0 A24-26 G0

Bud globose 5mm; sepals (sub-) orbicular 5mm, glabrous; stamens in one whorl; disk flat, with rugose surface, 3.75 mm diameter, sparsely pubescent, irregular marginal lobes protruding between filament bases.

Note: compare Louis 3261 where there are stamens inside of the outer whorl with some inner stamens towards centre of flower; the protologue for *D. spinosodentata* states sepals 5; stamens about 25.

Luang S 26129	**05 Dec 1966**	***Drypetes crassipes* Pax & K.Hoffm.**	**Borneo**	**K**

K5 C0 A12 G0

Bud globose 5mm; sepals (sub-) orbicular 3mm, fleshy, glabrous; disk cupular, 3mm diameter, glabrous, disk centre open, flat, disk margin vertical, plicate, 1mm high, enclosing filament bases, margin apex +/- level.

Mackee, HS 12223	**09 Mar 1965**	***Drypetes deplanchei* (Brongn. & Gris) Merr.**	**New Caledonia**	**K**

K4 C0 A7-11 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm, imbricate glabrous with sparse marginal ciliate hairs; disk shallowly cupular, 1.25mm diameter, thin, glabrous with raised obtuse marginal lobes protruding between filament bases.

Note: stamen number variable: 7, 9, 10, 11 in the four buds dissected; compare Mackee 12308 where the sepals are elliptic; the other male *D. deplanchei* in these results, Balansa *s.n*. and Stoddart 4722 have sepals as per Mackee 12223; the protologue for *D. deplanchei* deals with nomenclatural matters, with no description; the protologue for the synonym *Drypetes australasica* (Müll.Arg.) Pax & K.Hoffm. records sepals as broad-elliptical; *D. deplanchei* was first described as *Eleocarpus deplanchei* Brongn. & Gris (by Merrill E.D. [1951] *J. Arnold Arbor*. 32: 197).

Mackee, HS 12308	**22 Mar 1965**	***Drypetes deplanchei* (Brongn. & Gris) Merr.**	**New Caledonia**	**K**

K4 C0 A~8 G0

Open flower 5mm diameter, of open form: sepals elliptic 4mm x 1.5mm only basally imbricate, sparsely pubescent with marginal ciliate hairs; disk cupular, 0.8mm diameter, glabrous, margin thin, plicate, apex irregularly toothed/crenate.

Note: compare Balansa *s.n*, Mackee 12223 and Stoddart 4722 where the sepals are (sub)-orbicular; the protologue for *D. deplanchei* deals with nomenclatural matters, with no description; the protologue for the synonym *Drypetes australasica* (Müll.Arg.) Pax & K.Hoffm. records sepals as broad-elliptical, the stamen number as 5-12; the disk of Mackee, HS. 12308 did not rehydrate satisfactorily; *D. deplanchei* was first described as *Eleocarpus deplanchei* Brongn. & Gris (by Merrill E.D. [1951] *J. Arnold Arbor*. 32: 197).

McWhirter, JH 250	***s.dat.***	***Drypetes* sp.**	**Madagascar**	**32195.000 (K)**

K4 C0 A4 G0

Bud globose 2mm; open flower 4mm diameter; sepals (sub-) orbicular 1mm with lanate hairs; stamens antesepalous; disk 1.5mm diameter, glabrous, smoothly flat, thin, broadly-crenate disk margin protruding between filament bases.

Merrill, ED 9209	**Apr 1913**	***Drypetes littoralis* (C.B.Rob.) Merr.**	**Indonesia**	**K**

Poor quality material – not dissected.

Middleton, DJ 2411	**23 Jan 2004**	***Drypetes hoaensis* Gagnep.**	**Thailand**	**E00348650**

K4 C0 A16-18 G0

Open flower 4mm diameter in axillary clusters with long pedicels; sepals (sub-) orbicular 2.5mm, glabrous with sparse marginal ciliate hairs; stamens crowded in one whorl; disk cupular, c.0.5mm diameter, glabrous, thin.

Note: the crowded stamens around the small disk is causing spatial constraints for discrete disk formation; the sepals have a slightly corrugated surface; this may be due to poor rehydration.

Mildbraed, J 7688	**Apr 1914**	***Drypetes ugandensis* (Rendle) Hutch.**	**Cameroon**	**K**

K5 C0 A16-21 G0

Bud globose 4mm; sepals (sub-) orbicular 4mm, glabrous; stamens in one whorl; disk shallowly cupular, 3mm diameter, glabrous, margins of crisp-convolute longitudinal folds, covering centre of disk.

Mildbraed, J 9020	**Apr 1914**	***Sibangea arborescens* Oliv.**	**Cameroon**	**K**

K5 C0 A0 G1

Flower 5mm diameter; sepals oblong 2.5mm x 1.2mm, sparsely pubescent, open (not valvate or imbricate); gynoecium ovate 2mm diameter x 3.5mm (including 1mm long x 0.8mm wide apical 'column'), glabrous, bilovulate; no style; stigma sessile capitate, peltate, oblique, circular 1.2mm with central depression; disk skirt 1mm, flat, entire, thick, fleshy, glabrous.

Note: the protologue of *S. arborescens* makes no mention of a style, yet does not specify the stigma as sessile; Radcliffe-Smith (1978) in his resurrection of the genus *Sibangea* does not make reference to these structures; the top of the gynoecium – the 'apical column' – is considered here to be part of the gynoecium and not a discreet style.

Morton, JK 277	**23 Nov 1965**	***Drypetes principum* (Müll.Arg.) Hutch.**	**Sierra Leone**	**K**

K4 C0 A8 G0

Bud globose 4mm; sepals (sub-) orbicular 3mm, velutinous with marginal ciliate hairs; disk flat, 3mm diameter, fleshy, truncate marginal lobes protruding between filament bases, disk centre with persistent long-pilose hairs.

Note: compare Talbot 679 where the disk is shallowly cupular with an erect margin; the two other male *D. principum* in these results, Latilo FHI 15285 and Zenker *s.n.* (01 Jul 1912), accord with Morton 277 in respect of the disk; the protologue of *D. principum* states that the stamen number is 8-10, but does not describe the disk shape in the male flower, recording that it is 'small, nearly glabrous, except centre, which is long-pilose'.

Newman, MF. LAO 301	**18 Feb 2005**	***Drypetes* cf. *assamica* (Hook.f.) Pax. & K.Hoffm.**	**Laos**	**E00208182**

K5 C5 A5 G(5)

Bud globose 1.5mm, unopened flowers 2mm diameter in cauliflorous and axillary positions; sepal short-oblong, 1mm x 0.75mm, dark spotted with ciliate apical hairs; corolla fleshy with apical appendage, dark spotted, tinged pink; stamens garish pink; gynoecium deeply lobed, dark spotted; style stout, fused, pubescent; no disk.

Note: all features of this specimen indicate that Newman, MF. LAO 301 is not a *Drypetes* and further investigation will be required to identify this specimen.

Oates, JF 103	**1975**	***Drypetes oblongifolia* (Bedd.) Airy Shaw**	**India**	**K**

K5 C0 A~57-64 G0

Flower 10mm diameter; sepals (sub-) orbicular 5mm, coriaceous, pubescent with marginal ciliate hairs; stamens in one whorl; disk shallowly cupular, 6.5mm diameter, coriaceous, pubescent, centre open, flat, margin briefly elevated with obtusely toothed apex.

Note: the protologue of *D. oblongifolia* does not provide a description; Chakrabarty *et al* (1997) state the sepals as 4-5 in number, oblong to ovate, with the stamen number as 30-40.

Onochie, CFA FHI 34825	**13 Mar 1955**	***Drypetes preussii* (Pax) Hutch.**	**Nigeria**	**5188.000 (K)**

K5 C0 A16 G0

Bud sub-globose 3mm high x 5mm wide; sepals (sub-) orbicular 4mm, glabrous; stamens predominantly in single whorl with some inner stamens towards centre of flower, the 3-4 inner stamens not forming an identifiable second whorl; disk flat, 4mm diameter, glabrous, fleshy with shallow depressions, truncate marginal lobes protruding between filament bases.

Pilz, GE 2342	**21 Mar 1980**	***Drypetes staudtii* (Pax) Hutch.**	**Nigeria**	**K**

K5 C0 A0 G(5)

Mature flowers/early fruits; K deciduous with coriaceous remnants; gynoecium globose 6mm, woody, glabrous; styles free, 2mm; stigma 5, ligulate, up to 8mm x 2.3mm, profoundly reflexed; disk disintegrating, remnants cupular, skirt 3mm, glabrous.

Note: there is no description of the female flower in the protologue of *D. staudtii*, nor in the protologue for the synonym *Cyclostemon staudtii* Pax; the species is included in Pax and Hoffmann (1922) but, again, they record that female flowers and fruit are *ignoti* 'unknown/not seen'; Keay (1958) does not describe the female flowers.

Pullen, R 8199	**02 Sep 1969**	***Drypetes lasiogynoides* Pax & K.Hoffm.**	**Papua New Guinea**	**K**

K4 C0 A14 G0

Bud globose 4mm; sepals (sub-) orbicular 3mm, fleshy, glabrous; disk flat, 0.8mm diameter, glabrous, fleshy, irregular broad-crenate marginal lobes, centre of disk with irregular raised 'hillock' of fleshy tissue.

Note: there is potentially secondary stamen increase in no discernible pattern; the spatial constraints of the small flower may account for this along with the irregular disk lobing where marginal extrusion occur where space permits; the protologue makes no reference to the central raised area of the disk but does record the disk as sparsely hairy.

Ram, K (*s.n.*)	**25 Apr 1948**	***Putranjiva roxburghii* Wall.**	**India (cultivated)**	**E00411702**

K4-(5) C0 A3 G0

Flowers grouped on axillary racemes in dense clusters; open flower 2mm diameter; sepals ligulate 1-1.5mm x 0.3-0.5mm, sparsely pubescent, open in bud (not imbricate or valvate); large globular extrorse anthers, ~0.75mm; no disk.

Ramos, M **BS 24158**	**Feb** **1916**	***Drypetes megacarpa*** **(Merr.) Pax &** **K.Hoffm.**	**Philippines**	**K**

K4 C0 A~30 G0

Bud globose 7-9mm; sepals (sub-) orbicular, coriaceous, sparsely pubescent with marginal ciliate hairs; stamens in one whorl; disk shallowly cupular, 4.5mm diameter, pubescent, flat, open centrally, margin briefly elevated 0.7mm +/- incurved shallowly acute lobes.

Note: *D. megacarpa* is a synonym *Drypetes grandifolia* (C.B.Rob.) Pax & K.Hoffm.

Ramos, M **BS 24459**	**Feb** **1916**	***Drypetes microphylla*** **(Merr.) Pax &** **K.Hoffm.**	**Philippines**	**K**

K4 C0 A0 G(2)

Open flower 12mm; sepals ovate 5mm x 2.5mm, pubescent; gynoecium globose 3.7mm, tomentose; styles free, 0.8mm; stigma 2, fan-shaped 2.2mm x 1.5mm, rugose with crenate margins; disk skirt up to 0.5mm, glabrous, +/- shallowly cupular, margin crenate, undulate.

Reineck, EM ***s.n.***	**15 May** **1896**	***Drypetes glauca* Vahl**	**Brazil**	**E00310747**

K4 C0 A8 G0

Open flower 3mm diameter, axillary, solitary, occasionally in pairs; sepals (sub-) orbicular 1.5mm, sparsely pubescent with apical ciliate hairs; disk shallowly cupular, 2.75mm diameter, with raised obtuse marginal lobes protruding between filaments, +/- overlapping here, lanate hairs at centre of disk.

Note: in respect of the disk, the protologue of *D. glauca* only states *discus planus* ('disk flat').

Ridsdale, CE 397	**12 Jul 1976**	***Drypetes malabarica* (Bedd.) Airy Shaw**	**India**	**K**

K5 C0 A0 G(2)

Young fruits globose up to 8mm, lanate; sepals (sub-) orbicular 5-6mm velutinous, coriaceous; style fused, 1mm; stigma 2, +/-reniform, 3.8mm x 1.6mm; disk skirt 1mm, glabrous, flat, +/- entire.

Sayers, CD NGF 13223	**06 Mar 1964**	***Drypetes* aff. *lasiogynoides* Pax & K.Hoffm.**	**Papua New Guinea**	**E00310664**

K3+3 C0 A(4) G0

Male bud elongate 2mm x 1mm in axillary clusters; sepals oblong-acute 1mm x 0.5mm, sparsely pilose; stamens fused in to a tube; no disk.

Note: the nature of the calyx (merism and form), the presence of a fused stamen tube and the absence of a disk suggests that specimen Sayers NGF 13223 is not a *Drypetes* and further investigation will be required to correctly identify this specimen.

Small, D 825	**24 Oct 1952**	***Drypetes afzelii* (Pax) Hutch.**	**Sierra Leone**	**16820.000**

K5 C0 A16 G0

Buds globose 4-5mm; sepals (sub-) orbicular 3-4mm glabrous with marginal ciliate hairs; stamen whorl irregular; disk flat, 4.5mm diameter, glabrous, with shallow depressions, truncate marginal lobes protruding between filament bases; rudimentary gynoecium present.

Note: There is evidence of stamen increase centripetally (as with Deighton, FC. 6137); the protologue for *D. afzelii* states male flowers unknown/not seen; the protologue for the synonym *Cyclostemon afzelii* Pax does not mention male flowers.

Soejarto, DD 95	**25 Sep 1962**	***Drypetes laevis* (Miq.) Pax & K.Hoffm.**	**Indonesia**	**K**

K5 C0 A12 G0

Bud globose 3mm; flower 9mm diameter; sepals 4mm (sub-) orbicular, pubescent; stamens in one whorl; disk convolute-cupular, 2mm diameter, glabrous, margin deeply convoluted, covering entire centre of disk, apices erect crenate/irregularly dentate lobes.

Staudt, A 143	**01 Jul 1894**	***Drypetes dinklagei* (Pax) Hutch.**	**Cameroon**	**E00310686**

K4 C0 A8 G0

Bud globose 2.5mm in cauliflorous axillary clusters; sepals (sub-) orbicular 2.5mm, densely pubescent; disk flat, 1.25mm diameter, thick, with truncate marginal lobes protruding between filaments, centre of disk densely pilose.

Stoddart, DR 4722	**03 Oct 1973**	***Drypetes australasica* (Müll.Arg.) Pax & K.Hoffm.**	**Australia**	**K**

K4 C0 A6 G0

Bud globose 2mm; sepals (sub-) orbicular 2mm with scattered hairs; disk cupular, 0.5mm diameter, glabrous, with raised crenate lobes protruding between the filament bases.

Note: compare Mackee 12308 where the sepals are elliptic; the other male *D. deplanchei* in these results, Balansa *s.n.*, Mackee 12223 have sepals as per Stoddart 472: *D. australasica* is a synonym of *Drypetes deplanchei* (Brongn. & Gris) Merr.; the protologue for *D. australasica* (Müll.Arg.) Pax & K.Hoffm. records sepals as wide elliptical; *D. deplanchei* was first described as *Eleocarpus deplanchei* Brongn. & Gris (by Merrill E.D. [1951] *J. Arnold Arbor*. 32: 197).

Strey, RG 9244	**11 Nov 1969**	***Drypetes arguta* (Müll.Arg.) Hutch.**	**South Africa**	**E00310726**

K4 C0 A15-17 G0

Open flower 5mm diameter in clusters at base of young shoots; sepals (sub-) orbicular 2mm, finely pubescent with apical ciliate hairs; stamens +/- in 2 whorls; disk convolute-cupular, 2.5mm diameter, margin deeply convoluted, covering entire centre of disk, apices erect, crenate, ciliate, extruding between filament bases.

Note: The protologue of *D. arguta* states K5; stamens 'inserted around the disk'; 'disk fleshy, densely rusty-tomentose'.

Sumithraarach-chi, DB 355	**28 May 1951**	***Drypetes gardneri* (Thwaites) Pax & K.Hoffm.**	**Sri Lanka**	**K**

K4 C0 A0 G1

Flower 6mm diameter; sepals (sub-) orbicular 3mm, densely pubescent; gynoecium oval 1.5mm x 1.1m, glabrous; style eccentric, 0.5mm in length, stout; stigma +/- circular 1mm, enveloping the style apex; disk skirt ~0.3-4mm, flat, thin, glabrous, margin entire, 1mm.

Talbot, PA 679	**1911**	***Drypetes principum* (Müll.Arg.) Hutch.**	**Nigeria**	**K**

K4 C0 A8 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm, pubescent; disk shallowly cupular, 3.5mm diameter, with thin plicate erect margin up to 0.5mm deep, the apex broadly-dentate, disk densely pilose in centre.

Note: the disk is markedly different from the flat disks of Latilo 15285; Morton 277; Zenker *s.n.* (01.Jul 1912); the protologue of *D. principum* states that the stamen number is 8-10, but does not describe the disk shape in the male flower, recording that it is 'small, nearly glabrous, except centre, which is long-pilose'.

Talbot, PA 1645	**1912**	***Drypetes molunduana* Pax & K.Hoffm.**	**Nigeria**	**K**

K5 C0 A0 G(2)

Bud globose 4mm; sepals (sub-) orbicular 3mm, fleshy, sparsely pubescent with apical ciliate hairs; gynoecium globose 4mm, pilose; style fused at base for 0.5mm, bifurcated for 0.75mm; stigma 2, fan-shaped 3mm x 2mm; disk skirt up to 1.8mm, shallowly cupular, fleshy, glabrous, margin variably crenate.

Note: see Brenan 9297, a maturer specimen with features more clearly defined.

Thomas, DW 361	**Mar 1979**	***Drypetes preussii* (Pax) Hutch.**	**Cameroon**	**45481.000 (K)**

K5 C0 A14 G0

Bud 5mm across x 3mm deep; sepals (sub-) orbicular 3-4mm, glabrous with sparse marginal ciliate hairs; stamens predominantly in single whorl with some inner stamens towards centre of flower, the 3-4 inner stamens not forming an identifiable second whorl; disk flat, 4mm diameter, fleshy, glabrous, peaked surface with shallow depressions, truncate marginal lobes protruding between filament bases.

Thomas, DW 672	**Mar 1979**	***Sibangea similis* (Hutch.) Radcl.-Sm.**	**Cameroon**	**K**

K5 C0 A(4)-5 C0

Bud short-oblong 2.5mm diameter x 3mm; sepals oblong 3mm x 1.3mm, open in bud, glabrous; stamens antesepalous; disk cupular, 1.75mm diameter, fleshy, glabrous, broad-crenate lobes protruding between filament bases.

Thomas, DW 673	**1979**	***Drypetes dinklagei* (Pax) Hutch.**	**Cameroon**	**45482.000 (K)**

K4 C0 A8 G0

Bud sub-globose 3mm high x 4mm wide; sepals (sub-) orbicular 2mm, densely pubescent; disk flat, 2.5mm diameter, thick, with truncate marginal lobes protruding between filament bases, centre of disk densely pilose.

Thomas, NW 2911	**07 Oct 1914**	***Drypetes aylmeri* Hutch. & Dalziel**	**Sierra Leone**	**K**

K4 C0 A7 G0

Bud globose 2.5-3mm; sepals (sub-) orbicular 2mm, glabrous with sparse apical ciliate hairs; disk flat, 1.5mm diameter, thick, glabrous, with irregular angular peaks, marginal lobes protruding between filament bases.

van der Burgt, XM 667	**16 Mar 2004**	***Drypetes laciniata* (Pax) Hutch.**	**Cameroon**	**K**

K4 C0 A8 G0

Bud globose 3.5-4mm; sepals (sub-) orbicular 3mm, pubescent; disk flat, fleshy, 3mm diameter, sericeous, truncate marginal lobes protruding between filament bases.

Note: the protologue for *D. laciniata* states stamen number as 5.

van Harten, AM 317	**01 Feb 1964**	***Drypetes ivorensis* Hutch. & Dalziel**	**Liberia**	**K**

K5 C0 A12 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm, glabrous with sparse marginal ciliate hairs; stamens predominantly in single whorl with some inner stamens towards centre of flower, the inner stamens not forming an identifiable second whorl; disk flat, 2mm diameter, fleshy, glabrous, with irregular angular peaks, extruded around inner stamens, truncate marginal lobes protruding between filament bases.

Villa, G 1360	**03 Mar 2002**	***Drypetes fanshawei* Sandwith**	**Ecuador**	**BM**

K4 C0 A4 G0

Flower 3.5mm diameter; sepals (sub-) orbicular 1.8mm, sparsely pubescent; stamens thick, 0.4mm, alternisepalous; disk cupular, 2mm diameter, undulate, of 4 broadly-crenate marginal lobes protruding between filament bases, thick, fleshy, pubescent towards centre with a small central raised nodule, possibly a rudimentary gynoecium.

Note: the protologue states the disk as glabrous and that no rudimentary gynoecium is present; there is uncertainty as to whether the raised central nodule is a rudimentary gynoecium or is disk tissue.

Weber, CM 1052	**Mar 1911**	***Drypetes cernua***	**Philippines**	**E00310652**

K(6) C0 A0 G(3)

Female flower 6mm diameter, axillary, solitary; calyx papery, partially fused $^{3}/_{4}$-$^{1}/_{2,}$ lobes entire or sometimes irregularly crenate, apices +/- acute, glabrous, bluish on herbarium sheet; ovary 2mm across, 3-lobed; style/stigma composed of 3 double-pronged coiled 'horns'; no disk.

Note: There is no publication for the name *Drypetes cernua*; in view of the presence of male and female flowers (females only in this sample) along with the fused calyx and the lack of disk material, it is possible that specimens Weber, CM 1052 and Cuming, H 148 are *Breynia cernua* (Poir.) Müll.Arg.

Whitmore, TC FRI20638	**12 Mar 1972**	***Drypetes cockburnii* Airy Shaw**	**Malaysia**	**K**

K5 C0 A8 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm, velutinous with sparse marginal ciliate hairs; disk cupular, 1.8mm diameter, glabrous, centre open, flat, margin laxly plicate, vertical 0.3mm deep, apex unlobed.

Note: the protologue of *D. cockburnii* states 15-17 stamens.

Wood, GHS SAN16144	**30 Mar 1955**	***Drypetes maquilingensis* (Merr.) Pax & K.Hoffm.**	**Borneo**	**K**

K4 C0 A16 G0

Bud globose 4mm; sepals (sub-) orbicular 4mm, glabrous with marginal ciliate hairs; stamens predominantly in one whorl, with some inner stamens towards centre of flower, the few inner stamens not forming an identifiable second whorl; disk flat, 3mm diameter, thin, glabrous.

Note: the protologue of D. *maquilingensis* states sepals are elliptic-ovate; stamen number 12-15; no disk description.

Worthington, TB 92	**10 Apr 1939**	***Drypetes sepiaria* (Wight & Arn.) Pax & K.Hoffm.**	**Sri Lanka**	**K**

K4 C0 A8 G0

Bud globose 3mm; sepals (sub-) orbicular 2mm, papery, pubescent with apical ciliate hairs; disk flat, 1.5mm diameter, glabrous, with irregular fleshy angular peaks.

Worthington, TB 940	**14 May 1940**	***Putranjiva roxburghii* Wall.**	**Sri Lanka**	**K**

K4 C0 A0 G(3)

Young fruits; poor quality, specimen not dissected.

Worthington, TB 5168	**20 Mar 1951**	***Drypetes gardneri* (Thwaites) Pax & K.Hoffm.**	**Sri Lanka**	**K**

K4 C0 A21 G0

Flower 8mm diameter; sepals (sub-) orbicular 3-4mm, papery, sparsely pubescent with apical ciliate hairs; stamens in one whorl; disk cupular, 0.45mm diameter, thin, glabrous, margin incurved.

Note: compare Bourdillon, TF 1595 where the sepals are oblong, glabrous, the stamen number is 12, the disk shallowly cupular, 1mm in diameter in a smaller (5mm diameter) flower.

Zenker, GA 3721	**01 Jul 1908**	***Drypetes similis* Hutch.**	**Cameroon**	**E00310711**

K5 C0 A5 G0

Bud 2.5mm diameter x 3.5mm long in crowded axillary clusters; sepals ligulate 3mm x 0.75mm, open in bud (readily exposing inner flower), glabrous; disk cupular, 1.25mm diameter, glabrous, fleshy, with broad rounded marginal lobes protruding between filaments.

Note: the ligulate sepals suggest that Zenker, GA 3721 is a species of *Sibangea*. Indeed, *D. similis* Hutch. is a synonym of *Sibangea similis* (Hutch.) Radcl.-Sm.

Zenker, GA 4528	**01 Jul 1912**	***Drypetes magnistipula* (Pax) Hutch.**	**Cameroon**	**E00310695**

K4 C0 A4 G0

Bud globose 3mm in axillary clusters, sepals (sub-) orbicular 3mm with sparsely pubescent with sparse marginal ciliate hairs; stamens alternisepalous; disk 2mm diameter, flat, margin with four briefly elevated lobes protruding between the filament bases, lobe apices shallow-acute; lanate hairs at centre of disk.

Note: The protologue of *D. magnistipula* states that the disk is ‘annular, glabrous’.

Zenker, GA *s.n*	**01 Jul 1908**	***Drypetes paxii* Hutch.**	**Cameroon**	**E00310701**

K4 C0 A4-(5) G0

Flower 2mm diameter in axillary clusters; sepals oblong-obtuse 1mm wide x 1.5mm long, finely pubescent with dense marginal ciliate hairs; disk cupular, 0.75mm diameter, glabrous, margin vertical, thin, papery, laxly plicate up to 0.5mm deep, margin apex with acute teeth.

Note: the protologue of *D. paxii* states that the stamen number is 4; disk is toothed, pubescent adaxially, glabrous abaxially.

Zenker, GA *s.n.*	**01 Jul 1912**	***Drypetes principum* (Müll.Arg.) Hutch.**	**Cameroon**	**E00310707**

K4 C0 A4-7 G0

Bud globose 3-4mm, in cauliflorous and axillary positions; sepals (sub-) orbicular 2.5mm, glabrous; variable stamen numbers (4, 5, 7 in the three buds dissected); disk shallowly cupular or flat, 1.5mm diameter, fleshy, glabrous with broad rounded marginal lobes protruding between filaments.

Note: compare Talbot 679 where the disk is shallowly cupular with an erect margin; the two other male *D. principum* in these results, Latilo FHI 15285 and Morton 277, accord with Zenker *s.n.* (01 Jul 1912) in respect of the disk; the protologue of *D. principum* states that the stamen number is 8-10, but does not describe the disk shape in the male flower, recording that it is ‘small, nearly glabrous, except centre, which is long-pilose’.

Appendix 2 – Male character matrix

	Calyx					Stamen no. (whorls >1); *= rudimentary G present						Disk(✓= hairs present)				
Collector	K4	K5	K round	Kp	Kg	A ≤4	A 5-8	A 9-12	A 13-16	A 17-20	A ≥21	F	SC	C	CC	Continent
Akpabla, GK 1100		✓	✓	✓				✓(2)*						✓		Africa
Ambriansyah W324	✓		✓	✓				✓						✓		Asia-Tropical
anon. 30		✓	✓	✓							90-106		✓			Asia-Tropical
Ayyappan, N. 125		✓	✓		✓					✓				✓		Asia-Tropical
Balachandran, N. 406		✓	✓	✓				✓				✓				Asia-Tropical
Balansa, M. s.n,	✓		✓		✓		✓					✓				Pacific
Barber, C. 5656		✓	✓	✓				✓*					✓			Asia-Tropical
Bourdillon, T.F. 37	✓		✓	✓			✓						✓			Asia-Tropical
Bourdillon, T.F. 1595	✓		oblong		✓			✓					✓			Asia-Tropical
Brenan, J.P.M. 8436	✓		✓	✓						✓(3)*					✓	Africa
Brenan, J.P.M. 8475		✓	✓	✓							35*			✓		Africa
Brenan, J.P.M. 8574		✓	✓	✓					✓(2)						✓	Africa
Brenan, J.P.M. 9296		✓	✓		✓				✓(3)						✓	Africa
Breteler, F.J. 829	✓		ovate	✓		✓3								✓		Africa
Burley, J.S. & Turikin 4134	✓	✓	✓	✓							26		✓			Asia-Tropical
Caldwell, A.L. 8	✓		✓	✓					✓*			✓				Southern America
Charlie, F.R. SAN 23789	✓		✓	✓				✓12-	✓-15				✓			Asia-Tropical
Congdon, C. s.n. 58380 (K)		✓	✓		✓			✓				✓				Africa
Cuming, H. 148					✓	✓3										Asia-Tropical
de Wilde, J.J.F.E. 3124	✓		✓		✓			✓(2)							✓	Africa
de Wilde, J.J.F.E. 8476	✓	✓	elliptic	✓		✓3-4								✓		Africa
de Wilde, W.J.J.O. 15689		✓	✓	✓							~60		✓			Asia-Tropical
Deighton, F.C. 6137		✓	✓		✓					✓(2)*		✓				Africa
Edaño, G.E. PNH 11111	✓		✓	✓				✓						✓		Asia-Tropical
Fischer, C.E.C. 4057	✓		✓	✓			✓					✓				Asia-Tropical
Furuse, M. 4834	✓		✓	✓		✓2										Asia-Temperate
Geesink, R. 9336	✓		✓		✓				✓					✓		Asia-Tropical
Gibet, A. SAN 35801	✓		✓	✓				✓11-	✓-15			✓				Asia-Tropical
Greenway, P.J. 10964		✓	✓		✓					✓		✓				Africa
Gutiérrez, H.G. PNH 80789	✓		✓	✓					✓15-	✓-17				✓		Asia-Tropical
Hansen, B. 12994	✓		✓	✓							~43		✓			Asia-Tropical
Harmon, P.K. 41		✓	oblong-acute	✓			✓					✓				Southern America
Harris, D.J. 2310		✓	✓		✓					✓(2)		✓				Africa
Harris, D.J. 2321		✓	✓	✓		?	?	?	?	?	?			✓		Africa

	Calyx					Stamen no. (whorls >1); *= rudimentary G present						Disk (✓= hairs present)				
	K4	K5	K round	Kp	Kg	A ≤4	A 5-8	A 9-12	A 13-16	A 17-20	A ≥21	F	S C	C	C C	Continent
Harris, D.J. 2876	✓		✓		✓		✓(2)					✓				Africa
Harris, D.J. 4941	✓		✓		✓			✓				✓				Africa
Harris, D.J. 4953		✓	✓		✓						28(3) *				✓	Africa
Harris, D.J. 9754	✓		✓	✓			✓					?	?	?	?	Africa
Hepper, F.N. 2292		✓	✓		✓			✓				✓				Africa
Hepper, F.N. 7425	✓		✓		✓			✓(2) 12-	✓(2) -15				✓			Africa
Kerr, A.F.G. 18795	✓		oblong	✓					✓	✓				✓		Asia-Tropical
Kerr, A.F.G. 20390	✓		✓	✓						✓		✓				Asia-Tropical
Kostermans, A.J.G.H. 22077	✓		✓	✓			✓							✓		Asia-Tropical
Lace, J.H. s.n.	✓	✓	ligulate	✓		✓3										Asia-Tropical
Lakim, T. SAN 15908	✓		✓	✓			✓ 8-	✓ -10						✓		Asia-Tropical
Larsen, K. 32656		✓	✓		✓				✓				✓			Asia-Tropical
Latilo, M.G. FHI 15285	✓		✓	✓				✓				✓				Africa
Le Testu, G.M.P.C. 9306	✓		oblong -acute	✓		✓4						✓				Africa
Louis, J.L.P. 3261	✓	✓	✓		✓					✓20- (2)	20-25 (2)	✓				Africa
Louis, J.L.P. 3290	✓		✓	✓		✓4								✓		Africa
Louis, J.L.P. 14337		✓	✓		✓						24-26	✓				Africa
Luang S 26129		✓	✓		✓			✓						✓		Asia-Tropical
MacKee, H.S. 12223	✓		✓		✓		✓ 7-	✓ -11					✓			Pacific
MacKee, H.S. 12308	✓		elliptic	✓			✓							✓		Pacific
McWhirter, J.H. 250	✓		✓	✓		✓4						✓				Africa
Middleton, D.J. 2411	✓		✓		✓				✓ 16-	✓ -18				✓		Asia-Tropical
Mildbraed, J. 7688		✓	✓		✓				✓ 16-	✓ -17-20-	16-21		✓			Africa
Morton, J.K. SL 2777	✓		✓	✓			✓					✓				Africa
Oates, J.F. 103		✓	✓	✓							~57-64		✓			Asia-Tropical
Onochie, C.F.A. FHI 34825		✓	✓		✓				✓(2)			✓				Africa
Pullen, R. 8199	✓		✓		✓				✓			✓				Asia-Tropical
Ram, K. s.n.	✓	✓	ligulate	✓		✓3										Asia-Tropical
Ramos, M. BS 24158	✓		✓	✓							~30		✓			Asia-Tropical
Reineck, E.M. s.n.	✓		✓	✓			✓						✓			Southern America
Sayers, D. NGF 13223			oblong -acute	✓		✓4										Asia-Tropical
Small, D. 825		✓	✓		✓				✓			✓				Africa
Soejarto, D.D. 95		✓	✓	✓				✓							✓	Asia-Tropical
Staudt, A 143	✓		✓	✓			✓					✓				Africa

	Calyx					Stamen no. (whorls >1); *= rudimentary G present						Disk (✓= hairs present)				
	K4	K5	K round	Kp	Kg	A ≤4	A 5-8	A 9-12	A 13-16	A 17-20	A ≥21	F	SC	C	CC	Continent
Stoddart, D.R. 4722	✓		✓	✓			✓							✓		Asia-Tropical
Strey, R.G. 9244	✓		✓	✓					✓ 15-(2)	✓-17 (2)					✓	Africa
Talbot, P.A. 679	✓		✓	✓			✓						✓			Africa
Thomas, D.W. 361		✓	✓		✓				✓(2)			✓				Africa
Thomas, D.W. 672		✓	oblong		✓	✓ 4-	✓ -5							✓		Africa
Thomas, D.W. 673	✓		✓	✓			✓					✓				Africa
Thomas, N.W. 2911	✓		✓		✓		✓					✓				Africa
van der Burgt, X.M. 667	✓		✓	✓			✓					✓				Africa
van Harten, A.M. 317		✓	✓		✓			✓(2)				✓				Africa
Villa, G. 1360	✓		✓	✓		✓4 *								✓		Southern America
Whitmore, T.C. FRI 20638		✓	✓	✓			✓							✓		Asia-Tropical
Wood, G.H.S. SAN 16144	✓		✓		✓				✓(2)			✓				Asia-Tropical
Worthington, T.B. 92	✓		✓	✓			✓					✓				Asia-Tropical
Worthington, T.B. 5168	✓		✓	✓							21			✓		Asia-Tropical
Zenker, G.A. s.n. 01 Jul 1908	✓		oblong -obtuse	✓		✓ 4-	✓ -5							✓		Africa
Zenker, G.A. s.n. 01 Jul 1912	✓		✓		✓	✓ 4-	✓ -7					✓	✓			Africa
Zenker, G.A. 3721		✓	ligulate		✓		✓							✓		Africa
Zenker, G.A. 4528	✓		✓	✓		✓4						✓				Africa

Legend: K round = calyx (sub)–orbicular; Kp = calyx pubescent; Kg = calyx glabrous; Disk: F = flat; SC = shallow cupular; C = cupular; CC = convolute-cupular

Notes: in the stamen no. column, (whorls >1) does not refer to whorls in the strictest sense; the (2) or (3) figures show the presence of stamens internally from the outer stamen whorl at 2 or 3 loci towards centre of flower; the ✓ bold tick in disk section denotes some form of pubescence associated with the disk

Appendix 3 – Female character matrix

	Calyx					Gynoecium – carpel no.						**Styles**		Stigma bifid	Disk	Mature disk			
Collector	K 4	K 5	K round	K p	K g	1	2	3	5	6	7	Free	Fused		Skirt mm	F	SC	C	Continent
Bates, G.L. 1744		✓	✓	✓				✔				✓			1	✔			Africa
Brandis, D. s.n.	✓		?	?	?			✔				✓		✓					Asia-Tropical
Brenan, J.P.M. 8474		✓	✓	✓							✓	✓			2			✓	Africa
Brenan, J.P.M. 9297		✓	✓		✓		✔					✓ part	✓ part		2			✓	Africa
Congdon, C. s.n. 58403		✓	✓		✓			✔				?	?		0.5			✓	Africa
Coombe, D.E. 183		✓	✓	✓						✓		✓			2-4			✓	Africa
Cuming, H. 148					✓			✓				✓		✓					Asia-Tropical
Deighton, F.C. 1414		✓	?	?	?		✔						✓		1		✔		Africa
Diraviam 26358	✓		oblong	✓			✓						✓		0.5	✓			Asia-Tropical
Elmer, A.D.E. 12695	✓		?	?	?		✓						✓		0.5	✓			Asia-Tropical
Ernst, W.R. 1869	✓		✓		✓	✔						-	-		0.75		✓		Southern America
Fischer, C.E.C. s.n.	✓		oblong	✓			✔						✓		0.5	✓			Asia-Tropical
Forster, P.I. 7679	✓		✓		✓	✓						✓			0.75		✓		Asia-Tropical
Haber, W.A. 10965		✓	?	?	?		✔					✓ part	✓ part		0.5	✔			Southern America
Harris, D.J. 9761		✓	✓		✓			✔					✓		1	✔			Africa
Ismail, R. KEP 100121		✓	✓		✓			✔				-	-		1			✓	Asia-Tropical
Jacobs, M. 5072		✓	✓		✓			✔				✓			1		✓		Asia-Tropical
King, G. 8683		✓	long-ovate	✓					✔			✓			0.5			✔	Asia-Tropical
Kuswata , K.E. 97	✓		?	?	?		✔	✔				✓			2			✔	Asia-Tropical
Louis, A.M. 402	✓		✓	✓			✔					✓			2		✔		Africa
Mildbraed, J. 9020		✓	oblong	✓		✓						-	-		1	✓			Africa
Pilz, G.E. 2342		✓	?	?	?				✓			✓			3			✓	Africa
Ramos, M. BS 24459	✓		ovate	✓			✔					✓			0.5		✓		Asia-Tropical
Ridsdale, C.E. 397		✓	✓	✓			✔						✓		1	✓			Asia-Tropical
Sumithraarachchi, DB. 355	✓		✓	✓		✓						✓			0.3-0.4	✓			Asia-Tropical
Talbot, P.A. 1645		✓	✓	✓			✔					✓ part	✓ part		1.8		✓		Africa
Weber, C.M. 1052					✓			✓				✓		✓					Asia-Tropical
Worthington, T.B. 940	✓		?	?	?			✔				✓		✓					Asia-Tropical

Legend: K round = calyx (sub)–orbicular; Kp = calyx pubescent; Kg = calyx glabrous; Disk: F = flat; SC = shallow cupular; C = cupular

Notes: a ✓ bold tick in the mature disk and gynoecium columns denotes some form of pubescence associated with these structures; when the K is deciduous , ? is placed in the K round, Kp, Kg columns

Appendix 4 - Disk diameter of male flowers

Collector	Disk diameter mm
Akpabla, GK 1100	2
Ambriansyah W324	0.5
anon. 30	5
Ayyappan, N. 125	2.5
Balachandran, N. 406	1.25
Balansa, M. s.n,	1
Barber, C. 5656	1.75
Bourdillon, T.F. 37	2
Bourdillon, T.F. 1595	1
Brenan, J.P.M. 8436	5
Brenan, J.P.M. 8475	6
Brenan, J.P.M. 8574	4
Brenan, J.P.M. 9296	3.75
Breteler, F.J. 829	0.75
Burley, J.S. & Turikin 4134	2
Caldwell, A.L. 8	2.5
Charlie, F.R. SAN 23789	1
Congdon, C. s.n. 58380	2.5
de Wilde, J.J.F.E. 3124	2
de Wilde, W.J.J.O. 15689	6
Deighton, F.C. 6137	3.5
Edaño, G.E. PNH 11111	1
Fischer, C.E.C. 4057	0.5
Geesink, R. 9336	2
Gibet, A. SAN 35801	0.5
Greenway, P.J. 10964	5
Gutiérrez, H.G. PNH 80789	2.5
Hansen, B. 12994	4
Harmon, P.K. 41	1
Harris, D.J. 2310	5
Harris, D.J. 2321	2
Harris, D.J. 2876	2
Harris, D.J. 4941	2.5
Harris, D.J. 4953	5
Harris, D.J. 9754	?
Hepper, F.N. 2292	3
Hepper, F.N. 7425	1.5
Kerr, A.F.G. 18795	0.5
Kerr, A.F.G. 20390	1
Kostermans, A.J.G.H. 22077	0.5
Lakim, T. SAN 15908	1

Larsen, K. 32656	2.5
Latilo, M.G. FHI 15285	3.5
Le Testu, G.M.P.C. 9306	1
Louis, J.L.P. 3261	4
Louis, J.L.P. 3290	1
Louis, J.L.P. 14337	3.75
Luang S 26129	3
MacKee, H.S. 12223	1.25
MacKee, H.S. 12308	0.8
McWhirter, J.H. 250	1.5
Middleton, D.J. 2411	0.5
Mildbraed, J. 7688	3
Morton, J.K. SL 2777	3
Oates, J.F. 103	6.5
Onochie, C.F.A. FHI 34825	4
Pullen, R. 8199	0.8
Ramos, M. BS 24158	4.5
Reineck, E.M. s.n.	2.75
Small, D. 825	4.5
Soejarto, D.D. 95	2
Staudt, A 143	1.25
Stoddart, D.R. 4722	0.5
Strey, R.G. 9244	2.5
Talbot, P.A. 679	3.5
Thomas, D.W. 361	4
Thomas, D.W. 673	2.5
Thomas, N.W. 2911	1.5
van der Burgt, X.M. 667	3
van Harten, A.M. 317	2
Villa, G. 1360	2
Whitmore, T.C. FRI 20638	1.8
Wood, G.H.S. SAN 16144	3
Worthington, T.B. 92	1.5
Worthington, T.B. 5168	0.45
Zenker, G.A. s.n. 01 Jul 1908	0.75
Zenker, G.A. s.n. 01 Jul 1912	1.5
Zenker, G.A. 4528	2