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The Genus *Rhaphidophora* Hassk. (Araceae-Monsteroideae-Monstereae) in Peninsular Malaysia and Singapore

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Abstract

An alpha-taxonomic account of *Rhaphidophora* in Peninsular Malaysia and Singapore is presented as a precursor to the forthcoming Flora Malesiana *Araceae* treatment. Fifteen species, two newly described, *R. corneri*, and *R. nicolsonii*, are recognized. An extensive new synonymy is proposed: *R. pteropoda* (syn. *Scindapsus pteropodus*) is synonymized with *R. angustata*; *R. celatocaulis* (syn. *Pothos celatocaulis*), *R. copelandii*, *R. korthalsii* var. *angustiloba*, *R. latifolia*, *R. maxima*, *R. palawanensis* Furtado *non* Merr., *R. ridleyi* (syn. *R. grandis* Ridl. *non* Schott), *R. tenuis*, and *R. trinervia* with *R. korthalsii*; *R. fluminea* with *R. beccarii*; *R. apiculata* Alderw. *non* K. Krause with *R. maingayi*; *R. celebica* with *R. minor*; *R. burkilliana* with *R. montana*; *R. batoensis*, *R. gracilipes*, *R. hallieri*, *R. kunstleri*, *R. megasperma*, *R. pilosula*, and *R. scortechinii* with *R. puberula*; *R. gratissima* (syn. *R. sylvestris* var. *obtusata*), *R. lingulata* (syn. *Monstera lingulata*, *Scindapsus lingulatus*), *R. motleyana*, *R. wrayi*, and *Scindapsus aruensis* with *R. sylvestris*. Dichotomous keys to genera and species are provided. All species except *R. falcata* are illustrated.

Contents

Introduction

Rhaphidophora Hassk. (including *Afrorhaphidophora* Engl.; c. 3 species in tropical Africa) comprises. c. 100 species of small to large, occasionally enormous, root-climbing lianes (*sensu* Schimper, 1903), rarely rheophytes, distributed from tropical West Africa eastwards to the western Pacific, north to southern Japan (Ryukyu Islands), and south to Northern Australia. *Rhaphidophora* is one of the largest aroid genera in tropical Asia, and has several nodes of diversity: the Himalaya (SE Nepal to NE Vietnam, roughly 17° – 23° N), West Malesia (including southernmost peninsular Thailand), the Philippines, and East Malesia.

This is the first in a series of papers intended to present a complete alpha-taxonomy of the genus *Rhaphidophora* in Asia. Accounts for each of the Himalaya, Thailand, Indochina, the Philippines, Borneo, the Indonesian archipelago, and Papuasia are being prepared and will be published separately. All morphological terms employed follow Stearn (1992).

History

Since establishment by Hasskarl (1842), *Rhaphidophora* has been dogged by interpretative confusion arising from the generic descriptions published by Hasskarl between 1842 and 1848. This confusion led to several papers aiming to settle the nomenclatural identity of *Rhaphidophora*, e.g., Brown (1882), Bakhuizen (1958), and Nicolson (1978). Although Nicolson (1978) laid to rest the problem of interpreting Hasskarl's genus, it is worth repeating the basic arguments and details here.

Hasskarl's original generic description (Hasskarl, 1842a) was sparse. Another, more detailed description followed in *Tijdschrift Nat. Gesch. & Phys.* (Hasskarl, 1842b), and a further very sparse description in *Catalogus plantarum...Horto Botanico Bogoriensi...* (Hasskarl, 1844). These descriptions agree on the main diagnostic feature of Hasskarl's new genus: a unilocular, uniovular ovary. However this matches exactly the diagnoses of the earlier *Scindapsus* Schott (Schott & Endlicher, 1832), and also, incidentally, the later *Amydrium* Schott (including *Epipremnopsis* Engl. – see Nguyen & Boyce, 1999) However, by the time Hasskarl published an extensive description of a *Rhaphidophora* species, *R. lacera* (Hasskarl, 1848), he had altered his generic description stating that his earlier observations were in error, and that *Rhaphidophora* was characterized by possessing a two locular ovary in which each locule has two ovules; exactly the situation in the later *Epipremnum* Schott (Schott, 1857; Boyce, 1998).

Indeed, specimens in BO annotated by Hasskarl as *R. lacera* are of the common and widespread *Epipremnum pinnatum* (L.) Engl., (see Boyce, 1998). The above might lead one to conclude that based on the diagnoses and annotated specimens the name *Rhaphidophora* (*sensu* Hasskarl, 1848) is the correct name for *Epipremnum* (Schott, 1857). However, this is not so. In publishing *Rhaphidophora* Hasskarl (1842a) cited *Pothos pertusa* Roxb. [syn. *Rhaphidophora pertusa* (Roxb.) Schott] as a synonym of the generic type of his new genus. This has two results. The first is that Hasskarl should have taken up the epithet *pertusa* for his new species. *Rhaphidophora lacera* Hassk. is thus is illegitimate. The second is that the element cited by Hasskarl pertains to a species from South India and Sri Lanka, which has two intrusive placentae each bearing numerous ovules, and thus does not agree with any of Hasskarl's diagnoses of *Rhaphidophora*. Nicolson (1978) concluded that the specimen cited by Hasskarl should be regarded as typical for the genus *Rhaphidophora* over the descriptive diagnoses. Therefore *Rhaphidophora* as currently defined has two intrusive placentae each bearing several to many ovules with the type *R. pertusa* of which *R. lacera* is a synonym.

Since establishment of *Rhaphidophora,* almost all authors have accepted it as a 'good' genus. The one exception is Miquel (1856) who merged *Rhaphidophora* with *Scindapsus* at the rank of subgenus. No one took up this new rank in subsequent treatments.

The last full revision of *Rhaphidophora* was that of Engler & Krause (1908). Since then numerous regional accounts have been produced, including China (Li, 1979), India (Sivadasan, 1982; Deb, 1983), Nepal (Hara, 1978), Bhutan (Noltie, 1994), Fiji (Nicolson, 1979), Sri Lanka (Nicolson, 1988) and Australia (Hay, 1993). To date no critical account of the genus has been prepared for Peninsular Malaysia (but see Hooker, 1893; Ridley, 1907, 1925; Henderson, 1954), Borneo (but see Alderwerelt, 1920, 1922; Miquel, 1856a & b; Ridley, 1905; Merrill, 1921), Java (but see Koorders, 1911; Backer & Backhuizen, 1968), the Philippines (but see Merrill, 1923), New Guinea (but see Engler & Krause, 1910, 1912; Krause & Alderwerelt, 1924; Hay, 1981, 1990), the Himalaya (but see Hooker, 1893; Hara *et al.*, 1978; Boyce, in press) nor Thailand and Indochina (but see Gagnepain, 1942).

Geography and Endemism

Malesian *Rhaphidophora* species divide into two distributional groups. One comprises taxa with limited distributions, sometimes narrowly endemic, more usually restricted to one or more geographically adjacent landmasses,

and displaying limited morphological variation. The other group comprises species with extensive distributions and, usually, a wide range of variation.

The species with restricted distributions occurring in Peninsular Malaysia are *Rhaphidophora corneri* P.C. Boyce and *R. nicolsonii* P.C. Boyce (both known from one location each in the Malay Peninsula); *R. angustata* Schott and *R. crassifolia* Hook.*f.* (scattered but never abundant in Malay Peninsula and possibly Sumatera); *R. falcata* Ridl. and *R. tetrasperma* Hook.*f.* (Peninsular Malaysia and the far south of Thailand, *R. falcata* known from two collections, *R. tetrasperma* from six) and *R. maingayi* Hook.*f.* (Peninsular Malaysia, southern peninsular Thailand and Sumatera.)

Widespread taxa represented in the Malay Peninsula include *R. korthalsii* Hassk. (common throughout Malesia and into the western Pacific, extending north into southern peninsular Thailand), *R. minor* Hook.*f.* (widespread but not common in western and central Malesia but absent from Maluku and in the Philippines known only from Palawan), *R. puberula* Engl. (localized in Peninsular Malaysia, Sumatera and Borneo), *R. foraminifera* (Engl.) Engl. (uncommon in Malay Peninsula, Sumatera and northern Borneo), *R. beccarii* Engl. (widespread and generally abundant in west Malesia, north to southern peninsular Thailand and east to Borneo but absent from Java and Nusa Tenggara), *R. montana* (Blume) Schott (common throughout Malesia and extending into southern Thailand, though absent from the Philippines), *R. lobbii* Schott (widespread but never common in Peninsular Malaysia, Singapore, Borneo, Sumatera and Palawan) and *R. sylvestris* (Blume) Engl. (relatively common throughout Malesia and extending north to southern Thailand, but absent from the Philippines, Sulawesi and Maluku). Within this group of widespread species, *R. minor* and *R. lobbii* are remarkably unvarying, *R. foraminifera*, *R. beccarii* and *R. puberula* are morphologically quite stable (although *R. beccarii* displays varying degrees of neoteny and sporadic leaf lamina perforation occurs in *R. puberula*), but *R. montana*, *R. sylvestris* and especially *R. korthalsii* display a bewildering range of variation the taxonomic implications of which are still very imperfectly understood.

Thus Peninsular Malaysia has two endemic species, two species otherwise only in Sumatera, two species known also from southern Thailand and eight species with distributions extending variously to Borneo, the Philippines and the western Pacific.

Structure and Terminology

The position of the inflorescence and the architecture of the shoot it

terminates are useful characters for assigning species names. Although *Monstereae* (and *Anadendreae)* appear architecturally less diverse than *Potheae*, shoot morphology nevertheless presents challenges for description due to the plants' often great size and complex shoot organisation, coupled with an inherent architectural variability in some taxa. Broadly speaking the shoot architecture of adult *Rhaphidophora* plants can be categorized into three types:

i. Physiognomically monopodial clinging non-flowering stems rooting along their entire length giving rise to variously elaborated free sympodial lateral stems flowering terminally (e.g., *R. lobbii*, *R. puberula*, *R. angustata*)

ii. Physiognomically unbranched sympodial clinging stems flowering terminally and free lateral stems usually not occurring other than as a result of physical damage (e.g., pulled down by weight of foliage) and then free stems usually soon climbing again (e.g., *R. korthalsii*)

iii. Physiognomically monopodial clinging stems and clinging sympodial lateral stems but only sympodial lateral stems flowering (e.g., *R. foraminifera*).

Species belonging to the second and third of these types are rare in Peninsular Malaysia, with only *R. korthalsii* and *R. nicolsonii* present for i. and *R. foraminifera* for ii. The remaining fourteen Peninsular Malaysian species all conform to the first type. When species of the first type are examined it appears that they are not heterogeneous as a group, suggesting that type i. architecture has evolved repeatedly, but that phylogenetic analysis is required. For the purposes of identifying species, it is a useful character.

Leaf shape varies from uniformly oblong elliptic throughout the genus (e.g., *R. montana*) to pinnately divided (e.g., *R. tetrasperma*), perforated (e.g., *R. corneri*) or a combination of all three (e.g., forms of *R. korthalsii*). If used with care, the shape of the leaves can be very useful in identifying plants to species level. The leaf selected should be a mature leaf taken either from an upper part of a clinging stem, but not a leaf subtending a flowering event, or from the mid-point of a free lateral stem. Leaf measurements given in the descriptions below are for leaves from these positions but smaller leaves will often be found on herbarium specimens, usually as a result of collecting a specimen of a convenient size for preservation, and will often be considerably smaller than the dimensions given here.

Some terms employed here and elsewhere may be unfamiliar. Below is a list of definitions (taken from Boyce, 1998):

Physiognomically unbranched stems
Fertile stems, of variable length, with the *appearance* of being unbranched but that are actually sympodia with growth terminating by a, sometimes aborted, inflorescence. Such stems may be clinging and orthotropous (or nearly so) or free and plagiotropic to pendent.

Clasping roots
Short specialized roots that anchor a climber, hemiepiphyte or epiphyte to its substrate, generally a tree or rock.

Feeding roots
Specialized roots arising from aerial stems which, extending down to the soil, transport nutrients to the plant.

Shingle climber
A type of juvenile morphology found in climbers, in which the petiole is very short and the leaf blade relatively broad and more-or-less overlapping with its neighbours to resemble the tiles (or shingles) of a roof; such plants are found climbing up larger tree trunks; e.g., *R. korthalsii.*

Interprimary veins
A vein approximately parallel to and situated between the primary lateral veins and larger than secondary veins.

Longitudinal orientation (of stigmas)
Linear stigmas set parallel to the long axis of the spadix.

Trichosclereids
Literally a hair-like sclereid; fibre cells (cells with thick, lignified walls) which are very slender and elongated so as to be visible to the naked eye as hair-like structures. On tearing the leaf blade they can be observed protruding from the torn edge.

Identification

Lianescent aroids are often collected under incorrect names in Asia (see, e.g., Boyce, 1998; Nguyen & Boyce, 1999 for further discussion). Part of the problem with accurate identification arises from an apparent lack of readily observable critical characters, a difficulty exacerbated by the

tendency of key-writers to concentrate on fertile characters, which are difficult to observe, and interpretively ambiguous vegetative characters. I have attempted where possible to concentrate on readily observable characters in the keys presented here. In particular, I have employed the feature typical of most monsteroid genera, trichosclereids. All monsteroid genera (except *Amydrium*) have abundant trichosclereids (sparse and scattered in *Amydrium*). These are readily observable by tearing a mature leaf lamina and looking for 'hairs' protruding from the damaged edges and are an extremely reliable character in Asia as a means of assigning a genus to the tribe *Monstereae*. For a discussion on identifying lianes of the tribe *Potheae* see Boyce (1998).

The keys presented below should go some way towards easing the identification of the smaller-inflorescenced lianescent aroids to genus in Asia. However, while it has proved relatively easy to key these out by this method, species with large inflorescences have proved very intractable and here I have had to resort to critical floral characters in order to produce a reliable key for those taxa. As we gain a better insight into unvarying (or at least unambiguous) vegetative and macrofloral characters I hope to be able to produce more user-friendly keys for these larger flowered taxa.

Keys to species are less problematic, but earlier keys (e.g., Hooker, 1893; Ridley, 1905; Engler & Krause, 1908) tended to concentrate on leaf shape as a means of separating *Rhaphidophora* species. This leads to difficulties. Earlier monographers were generally dealing with fewer taxa and far fewer collections than today and additionally it is frequently unclear which leaf, from what position on the plant, is being employed in the key. This latter problem is exacerbated by leaves collected for herbarium specimens frequently being chosen for their suitability for drying and mounting (i.e. small enough) rather than for their taxonomic usefulness. This difficulty has led to the comment, not altogether unjustified, that these early identification tools are keys to individual leaves rather than to species. Having said that, there is little doubt that the ability to identify aroid lianes by vegetative characters alone is very desirable given that climbers are frequently encountered sterile in the field or, where fertile, the inflorescences are seldom within easy reach and often, once brought down from the canopy are found to be either too immature or too old to be of much use. Thus, wherever possible, leaf characters, combined with easily observed shoot architecture are employed together with inflorescence characters in the keys provided here.

The key that follows is designed to help separate the monsteroid and anadendroid lianes, genera that are frequently confused in herbaria.

Key to the Genera of Anadendreae and Monstereae in Peninsular Malaysia and Singapore

1a. Inflorescence small; spathe mostly less than 9 cm long just prior to opening **2**

1b. Inflorescence moderate to large; spathe mostly more than 9 cm long just prior to opening **4**

2a. Spathe in bud slender with long and slender peduncle, conspicuously long-beaked (beak to a third length of entire spathe), opening with inside conspicuously glossy-waxy, white, greenish white or purple. Flowers with a membranous perigon of fused tepals (i.e. flowers perigoniate). Ripe fruits berry-like, dark red. Trichosclereids absent ..... ***Anadendrum***

2b. Spathe in bud stout with short to long peduncle, not conspicuously long-beaked, or if beak present then less than a sixth length of entire spathe, opening with inside only moderately waxy yellow, orange, greenish or white. Flowers naked (i.e. flowers aperigoniate). Ripe fruits not berry-like, stylar region mostly abscissing to reveal ovary cavity, if berry-like *and* stylar region not abscissing then fruits ripening white or orange. Trichosclereids present (but sparse in *Amydrium*) **3**

3a. Trichosclereids abundant (many 'hairs' apparent when a mature leaf lamina is torn). Leaf with petiole broadly canaliculate, sheath margins broad, spreading, persistent, extending to apical geniculum; leaf lamina thinly coriaceous, often variegated silvery grey. Ripe fruits with stylar region abscissing ..... ***Scindapsus***

3b. Trichosclereids sparse (very few 'hairs' apparent when a mature leaf lamina is torn). Leaf with petiole narrowly canaliculate or terete, sheath margins narrow, erect or slightly inrolled, soon drying and degrading into weak fibres, then falling to leave an obscure scar, sheath either with free ligules extending beyond apical geniculum or sheath at most extending only to half way along petiole, if the latter then remainder of petiole terete with two prominent adaxial keels extending to apical geniculum; leaf lamina variously textured. Ripe fruits with stylar region not abscissing ..... ***Amydrium***

4a. Trichosclereids sparse (very few 'hairs' apparent when a mature leaf lamina is torn). Higher order venation completely reticulate. Ripe fruits with stylar region not abscissing Ovary 1-locular, placenta 1, intrusive-parietal, ovules 2 ..... ***Amydrium***

4b. Trichosclereids abundant (many 'hairs' apparent when a mature leaf lamina is torn). Higher order venation striate or reticulate. Ripe fruits with stylar region abscissing. Ovary never as above combination..... **5**

5a. Fruits with a solitary seed. Ovules solitary, placentation basal. ..... ***Scindapsus***
5b. Fruits with more than one seed. Ovules 4–6 or more, placentation intrusive-parietal. **6**

6a. Seeds many, ellipsoid, straight, 1.3–3.2 mm long, 0.6–1.0 mm wide; testa brittle, smooth. Ovules 8 or more, superposed on 2 (rarely 3) intrusive parietal placentas. ..... ***Rhaphidophora***
6b. Seeds few, curved, 3–7 mm long, 1.5–4.0 mm wide; testa bony and ornamented. Ovules 4(–6) at base of a single intrusive parietal placenta. ..... ***Epipremnum***

Field techniques

Specific taxonomy of *Rhaphidophora* is problematic in part because the species are too often inadequately collected, and the specimens are often sterile and almost invariably lacking the differing morphological phases that the climbing aroids display at different stages of maturity. Moreover, most species are rarely collected either because of natural scarcity or, more often, because they are passed by as 'too difficult' to collect. While it is true that aroids generally, and aroid lianes in particular, do not lend themselves to convenient preparation for herbarium specimens, they are no worse to deal with than many of the larger compound-leaved trees and are considerably less tedious to handle than, for example, rattans, groups, which are amply represented in herbaria worldwide.

As with all flowering plants the provision of fertile material is an essential prerequisite to making a taxonomically useful herbarium voucher. Before any material is collected from a particular plant, field notes should be prepared, describing the life form of the plant (climber or rheophyte), the position of the inflorescences (on adherent or free shoots), together with geographical and ecological notes as appropriate. As the collecting progresses, make notes of any characters that will be obscured or altered by the drying process such as venation of leaves (impressed, raised), the dimensions of fleshy or juicy organs, exudate, odours, and all colours should be painstakingly noted. If photographic records can be made also, so much the better, but nothing can replace the careful noting of field data.

When it comes to gathering plant material, collection of representative

pieces of the plant to display different phases of growth, e.g., shingling shoots, foraging shoots, is very important. Leaves with extreme dimensions along with those of average size and those displaying variations in perforation and pinnation should also be gathered. Ideally inflorescences in different stages should be taken, together with semi-mature and mature fruits.

There is little point in gathering flowering material of aroids only to dry the specimens in such a way that the spadix is invisible. If material allows, two inflorescences, one at female receptivity and one at male anthesis should be gathered in 70% alcohol in addition to collecting fertile specimens for drying. If there are insufficient inflorescences for making spirit and dried collections half the spathe should be removed longitudinally to reveal the whole spadix but cut in such a manner as to leave the top the spathe intact. Do not cut the spadix into longitudinal slices for drying unless absolutely necessary. Material prepared in such a manner distorts badly when dried and is usually useless for taking measurements.

Ideally you should end up with herbarium vouchers and spirit collections that, combined with extensive field notes, permit one to visualize the particular species in almost as much detail as if the plant were seen growing.

RHAPHIDOPHORA

Rhaphidophora Hassk., Flora 25 (2) Beibl. 1 (1842) 11; Schott, Gen. Aroid. (1858) 77 & Prodr. Syst. Aroid. (1860) 377–388; Miquel, Ann. Mus. Bot. Lugd.-Bat. 3 (1867) 81–82; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 238–248; Engl. in Beccari, Malesia, vol. 1 (1882) 266–272, Tab. xix 6–9, xx 1–5; Benth. & Hook. *f.*, Gen. Pl. 3(2) (1883) 993–993; Engl. & Prantl, Nat. Pflanzenfam. T. 2, Ab. 3 (1889) 119–120; Hook.*f.* in Hook.*f.*, Fl. Brit. India, vol. 6 (1893) 543–548; Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 1 (1897) 58; Ridl., J. Straits Branch Roy. Asiat. Soc. 44: 185–187 (1905) & Mat. Fl. Malay Penins. 3 (1907) 39–46; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 17–53; Engl. & Prantl, Nat. Pflanzenfam. Nachtr. 3 (1908) 29; Koorders, Exkursfl. Java, vol. 1 (1911) 253–255; Merrill, J. Straits Branch Roy. Asiat. Soc., special number (1921) 88–90 & Enum. Philipp. Flower. Pl., vol. 1 (1923) 175–177; Ridl., Fl. Malay Penins., vol. 5 (1925) 120–124; Henderson, Malayan Wild Flowers, Monocots, (1954) 238–239, Fig. 142; Backer, Beknopte Fl. Java, vol. 17 (1957) 13–15; Backer & Bakh.f., Fl. Java, vol. 3 (1968) 106–107; Nicolson in A.C. Sm., Fl. Vitiensis Nova, vol. 1 (1979) 443–445, Fig. 88; Hay in R.J. Johns & Hay, Students' Guide Monocot. Papua New Guinea. Part 1 (1981) 68–72 , Fig. 29; Schott, Icones aroideae

et reliquiae (IDC Microfilm) (1983) fiche nos. 28–31, 121; Hay, Aroids of Papua New Guinea (1990) 83–87, Figs. 34, 35, Pl. XIVb, XV & Telopea 5 (1993) 293–300; Hay *et al.* Checklist & botanical bibliography of the aroids of Malesia, Australia and the tropical western Pacific. Blumea, suppl. 8 (1995) 111–127; Mayo *et al.*, Genera *Araceae* (1997) 118–121, Pl. 14, 109 D — *Scindapsus* Schott subgen. *Rhaphidophora* (Hassk.) Miq., Flora Ned. Indië 3 (1856) 185 — Type: *Rhaphidophora lacera* Hasskarl, *nom. illeg. pro. Pothos pertusus* Roxb. [= *Rhaphidophora pertusa* (Roxb.) Schott]

Scindapsus Schott subgen. *Pothopsis* Miq., Flora Ned. Indië 3 (1856) 187 — Type: *Scindapsus sylvestris* (Blume) Kunth [= *Rhaphidophora sylvestris* (Blume) Engl.]

[*Raphidophora* Hassk., Cat. Hort. Bogor. (1844) 58, *orth .var.*]

Medium-sized to very large, occasionally enormous, slender to robust, leptocaul or pachycaul, homeophyllous or heterophyllous, rarely neotenic (e.g., some populations of *R. beccarii*), root-climbing lianes, very seldom clustering and rheophytic (e.g., *R. beccarii*); *cut surfaces* producing clear, odourless sticky juice either drying ± invisibly or coagulating into yellowish, translucent jelly and eventually hardening to an brittle amber-like mass; *seedling stage* mostly not observed but where known either leafy at germination and probably skototropic (see Strong & Ray, 1975; c.f. *Pothos*, Boyce, in press) by an alternating series of congested leafy and elongated leafless shoots (e.g., *R. angustata* Schott) or germinating to give rise to a non-skototropic shingling juvenile shoot (e.g., *R. korthalsii* Hassk); *pre-adult plants* often forming modest to extensive terrestrial colonies of varying morphological and physiological form such that descriptive generalizations are nearly impossible, largest terrestrial colonies generally occurring in places of less than optimum adult growth potential (e.g., depauperate tree canopy, dry, exposed sites,); *adult shoot architecture* broadly divisible into three types (but see *R. corneri* below): i. physiognomically monopodial clinging non-flowering stems rooting along their entire length giving rise to variously elaborated free sympodial lateral flowering stems (e.g., *R. lobbii*, *R. puberula*, *R. angustata*), *or* ii. all stems physiognomically unbranched sympodial clinging and flowering (e.g., *R. korthalsii*), *or* iii. physiognomically monopodial and sympodial lateral stems clinging but only sympodial lateral stems flowering (e.g., *R. foraminifera*). *Stems* with internodes of various lengths separated by variously prominent leaf scars, smooth or asperous or densely pubescent to ramentose (the last not in Malaysia), older stems sub-woody or somewhat corky or with distinctive matt to sub-lustrous pale brown papery epidermis, with or without variously textured prophyll,

cataphyll and petiolar sheath fibre either at the apices or along the newer sections, rarely with cataphylls and prophylls deliquescing to black mucilage later drying to leave fragmentary parchment-like remains on petioles, developing laminas, inflorescences; *flagellate foraging stems* occurring in some species, often exceedingly long, reaching the ground then rooting, variously foraging and climbing again; *clasping roots* sparsely to densely arising from the nodes and internodes, strongly adherent to substrate; *feeding roots* rare to abundant, smooth, pubescent or prominently scaly, later often becoming woody, strongly adherent to substrate or free; *leaves* distichous or spiralled, evenly distributed or scattered or clustered distally; *cataphylls and prophylls* sub-coriaceous to membranaceous, either soon drying and falling or degrading or deliquescing to variously textured sheaths and fibres, these where present variously clothing upper stem before eventually decaying and falling; *petiole* canaliculate to weakly carinate, smooth or pubescent, with variously prominent apical and basal genicula; *petiolar sheath* prominent, extending either partly to or fully to or overtopping the geniculum, occasionally one side greatly expanded and auriculate, especially in juvenile plants, at first membranaceous to coriaceous, soon completely or along the margins drying chartaceous, sometimes degrading to untidy variously netted or simple fibres and later variously falling to leave a scar or disintegrating marginally or completely; *lamina* sub-membranous to stiffly chartaceus or coriaceus, lanceolate or oblong, ± oblique, base decurrent to unequal or cordate, apex acute to acuminate, entire to regularly pinnatifid or perforated, if pinnate then divisions pinnatifid to pinnatisect (Stearn, 1992: 324), midrib often ± naked between segments, lamina occasionally with small to well developed perforations adjacent to the midrib and primary veins, these sometimes extending to lamina margin (fenestrations then occasionally additional to fully developed pinnae), rarely abaxially pubescent when expanding, rarely strongly concolorous at maturity (the last not in Malaysia); *midrib* usually prominent, raised abaxially and prominently sunken, sometimes flush, rarely slightly raised adaxially; *primary venation* ± pinnate; *interprimaries* mostly present, sub-parallel to primaries and sometimes indistinguishable from them (e.g., *R. monticola* - Philippines) but usually less prominent and often drying paler, usually glabrous, occasionally pubescent with domatia in the axils of the primary and secondary veins; *secondary venation* striate (e.g., *R. monticola* – Philippines) to reticulate (e.g., *R. korthalsii*), variously prominent, often very difficult to distinguish from primary venation (e.g., *R. angustata*); *tertiary venation* where visible reticulate to tessellate; *inflorescences* solitary to several together, first inflorescence subtended by a (usually fully developed) foliage leaf and/or a very rapidly disintegrating cataphyll, subsequent inflorescences usually each subtended by a prophyll

and cataphyll, more rarely by a prophyll and partially to almost fully formed foliage leaf (but not in Peninsular Malaysia), inflorescences at anthesis naked by disintegration of subtending cataphyll or partially to almost completely obscured by netted and sheet-like fibres; *peduncle* terete to laterally compressed; *spathe* ovate to narrowly or broadly canoe-shaped, stoutly to rather weakly beaked, barely gaping to opening almost flat at anthesis and then usually deciduous before anthesis is complete, occasionally persisting into the early stages of infructescence development (e.g., *R. angustata*), rarely drying and persistent (e.g., *R. novoguiensis* – New Guinea), stiff to rather soft or stoutly coriaceous, dirty-white, greenish, cream or yellow; *spadix* sub-globose to clavate-cylindrical, cylindrical or fusiform, sessile or stipitate, often obliquely inserted on peduncle, tapering towards the apex; *flowers* bisexual, naked; *ovary* 1- to partially 2-locular, lower part ± bilaterally compressed, upper part variously cylindrical and variously angled, most often rhombohexagonal, those upper- and lowermost on the spadix often sterile and bereft of stigma, those uppermost frequently either scattered or partially fused to each other and forming an appendix; *ovules* few to many, anatropous, funicle long, placentae parietal to basal, sometimes ± sub-axile, partial septa variably intrusive; *stylar region* well developed, usually broader than ovary, usually truncate apically, rarely elongate-conic; *stigma* sticky at female anthesis, punctiform, broadly elliptic or oblong and then, orientation circumferential or longitudinal with respect to spadix; *stamens* 4–6; *filaments* strap-shaped; *anthers* usually prominently exserted from between pistils at male anthesis, rarely not exserted and pollen extruded from between ovaries, dehiscing by a longitudinal slit; *infructescence* with stylar regions greatly enlarged, transversely dehiscent, the abscission developing at the base of the enlarged to massive stylar region and this falling to expose the ovary cavity with the many seeds embedded in variously coloured sticky pulp; *seeds* oblong, testa thin, smooth, embryo axile, straight, endosperm copious; *pollen* dicolpate, extended monosulcate to fully zonate, ellipsoid or hamburger-shaped, medium-sized (mean 33 μm, range 24–55 μm), exine foveolate, sub-reticulate, rugulate, fossulate, scabrate, retiscabrate, verrucate, or psilate(Grayum, 1984); *chromosomes* 2n = 60, 120 (42, 54, 56)(Petersen, 1989, 1993, 1994).

Distribution: Tropical and subtropical Africa, South and South East Asia, Malesia, Australia and the tropical western Pacific.

Habitat: Lianescent bole-climbers, lithophytes, rarely rheophytes, usually in well drained subtropical and tropical wet, humid, or seasonally moderately dry primary and established secondary evergreen forest at low to mid-montane elevations.

Etymology: Greek *rhaphis*, *rhaphidos* (needle) and *pherô* (I bear); refers to the macroscopic (to 1 cm long), needle-like unicellular trichosclereids present in tissues.

Key to Adult Flowering Rhaphidophora plants in Peninsular Malaysia and Singapore

1a. Leaf lamina variously pinnately divided and/or perforated 2
1b. Leaf lamina entire 8

2a. Plants flowering on adherent stems 3
2b. Plants flowering on free stems 5

3a. Flowering plants climbing 4
3b. Flowering plants rheophytic, not climbing ..... **2. R. beccarii**

4a. Leaf lamina of mature plants slightly to extensively perforated, perforations round to rhombic, extending c. 1/4 of lamina width on each side of the midrib, abaxial surface of lamina with pubescent veins; active shoot apices with black mucilage ..... **6. R. foraminifera**
4b. Leaf lamina of mature plants pinnatisect, the pinnae often perforated basally and appearing stilted, lamina always glabrous; active shoot apices with sparse to copious netted fibre ..... **7. R. korthalsii**

5a. Abaxial surface of lamina and apical geniculum minutely pubescent ..... **12. R. puberula**
5b. Lamina and apical geniculum not as above 6

6a. Leaf lamina up to 53 x 47 cm, sparsely to ± entirely deeply pinnatipartite to nearly pinnatisect, occasionally with large rhombic perforations adjacent to midrib 7
6b. Leaf lamina up to 15 x 8 cm, entire or with a few, large ovate to rhomboid or trapezoid perforations extending almost to the margin ..... **3. R. corneri**

7a. Petiolar sheath extending 1/2–3/4 along petiole; lamina coriaceous, sparsely to rarely ± entirely pinnatipartite, or pinnatisect ..... **11. R. nicolsonii**
7b. Petiolar sheath extending to base of apical geniculum, lamina sparsely to ± entirely deeply pinnatipartite to nearly pinnatisect, occasionally with large rhombic perforations adjacent to midrib ..... **14. R. tetrasperma**

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8a. Abaxial surface of lamina and apical geniculum pubescent ..... **12. R. puberula**

8b. Lamina and apical geniculum not as above 9

9a. Flowering shoots consisting of scattered fans of large litter-trapping leaves carried on short stout shoots and held at about 90° to the ± leafless main stem ..... **1. R. angustata**

9b. Flowering shoots not as above 10

10a. Plant climbing 11

10b. Plant rheophytic ..... **2. R. beccarii**

11a. Stems scabrid to asperous; spathe exterior minutely puberulent ..... **8. R. lobbii**

11b. Stems smooth; spathe exterior glabrous 12

12a. Apices of active stems with netted prophyll, cataphyll and petiolar sheath ..... **9. R. maingayi**

12b. Apices of active stems naked 13

13a. Spadix at anthesis 3.5–6 cm long, cylindrical to weakly clavate 14

13b. Spadix at anthesis 9–20 cm long, tapering apically .... **10. R. montana**

14a. Spadix cylindrical 15

14b. Spadix weakly clavate ..... **13. R. sylvestris**

15a. Leaf lamina thickly coriaceous to almost fleshy, falcate-elliptic-lanceolate to falcate-oblong or falcate-oblanceolate, 4.5–25.5 x 1.5–5 cm; margins slightly reflexed, this becoming greatly accentuated in dried material ..... **4. R. crassifolia**

15b. Leaf lamina thinly coriaceous, narrowly falcate-elliptic to falcate-lanceolate or falcate-oblanceolate, 2.5–16 x 1.2–3 cm, margins flat, leaf drying pale straw-coloured ..... **9. R. minor**

The Species

1. Rhaphidophora angustata Schott

Rhaphidophora angustata Schott, Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 128; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 241; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 25 — Type: Indonesia, '?Java', *P.W. Korthals* 206 (L, holo).

Scindapsus pteropodus Teijsm. & Binn., Natuurk. Tijdschr. Ned.-Indië. 27 (1864) 23; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 254 — *Rhaphidophora pteropoda* (Teijsm. & Binn.) Engl., Bull. Soc. Tosc. Ortic. 4 (1879) 268 & in Beccari, Malesia 1 (1882) 268; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 25–26; Ridl., Fl. Malay Penins. 5 (1925) 123, **synon. nov.** — Type: Indonesia, Sumatera, Loeboe-Aloeng, *Teijsmann s.n.* (BO, holo; K, iso).

Rhaphidophora laetevirens Ridl., J. Bot. 40 (1902) 37 & Mat. Fl. Malay Penins. 3 (1907) 43 — Type: Malaysia, Penang, Bk Penara, 1896, *Ridley s.n.* (SING, lecto; selected here). Ridley cites two conspecific syntypes, the other [Selangor, Kuala Lumpur Caves, *Ridley s.n.*] has not been traced, and thus I have chosen the fertile Penang specimen as the lectotype.

Large, occasionally enormous, robust, semi-leptocaul, homeophyllous liane to 20 m; *seedling stage* leafy at germination and skototropic by alternating series of congested leafy and elongated leafless shoots; *pre-adult plants* almost never forming terrestrial colonies; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, sparsely leafy, non-flowering stems and short, free, sympodial, densely leafy, potentially flowering stems; *stems* smooth, bright green, without prophyll, cataphyll and petiolar sheath fibre, internodes to 20 x 3.5 cm on adherent shoots, considerably shorter on free shoots, separated by prominent oblique leaf scars, older stems sub-woody; *flagellate foraging stems* exceedingly long with internodes to 50 cm or more and nodes with semi-persistent cataphylls; *clasping roots* densely arising from the nodes and internodes of clinging stems, prominently pubescent; *feeding roots* rare, adherent, pubescent; *leaves* weakly spiralled on adherent and flagelliform shoots, those on free shoots distichous into dense few to many-leaved fans; *cataphylls and prophylls* sub-coriaceous, soon drying and falling; *petiole* deeply canaliculate, 8–24 x 1.2–2.5 cm, smooth, apical and basal genicula prominent; *petiolar sheath* prominent, extending to or occasionally, by means of a terminal brief ligule, overtopping the apical geniculum, ± long persistent and drying chartaceous; *lamina* entire, falcate-lanceolate to falcate-oblong, oblique, 15–61 x 4–20 cm, sub-chartaceous, base acute to unequal, apex acute to slightly acuminate; *mid-rib* prominently raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially, somewhat impressed adaxially, the leaf appearing slightly quilted; *interprimaries* sub-parallel to primaries, slightly raised abaxially, slightly impressed adaxially; *secondary venation* weakly reticulate, slightly raised; *tertiary venation* invisible; *inflorescence* solitary from the centre of the fanned leaves of a free shoot, subtended by a fully developed foliage leaf; *peduncle* terete,

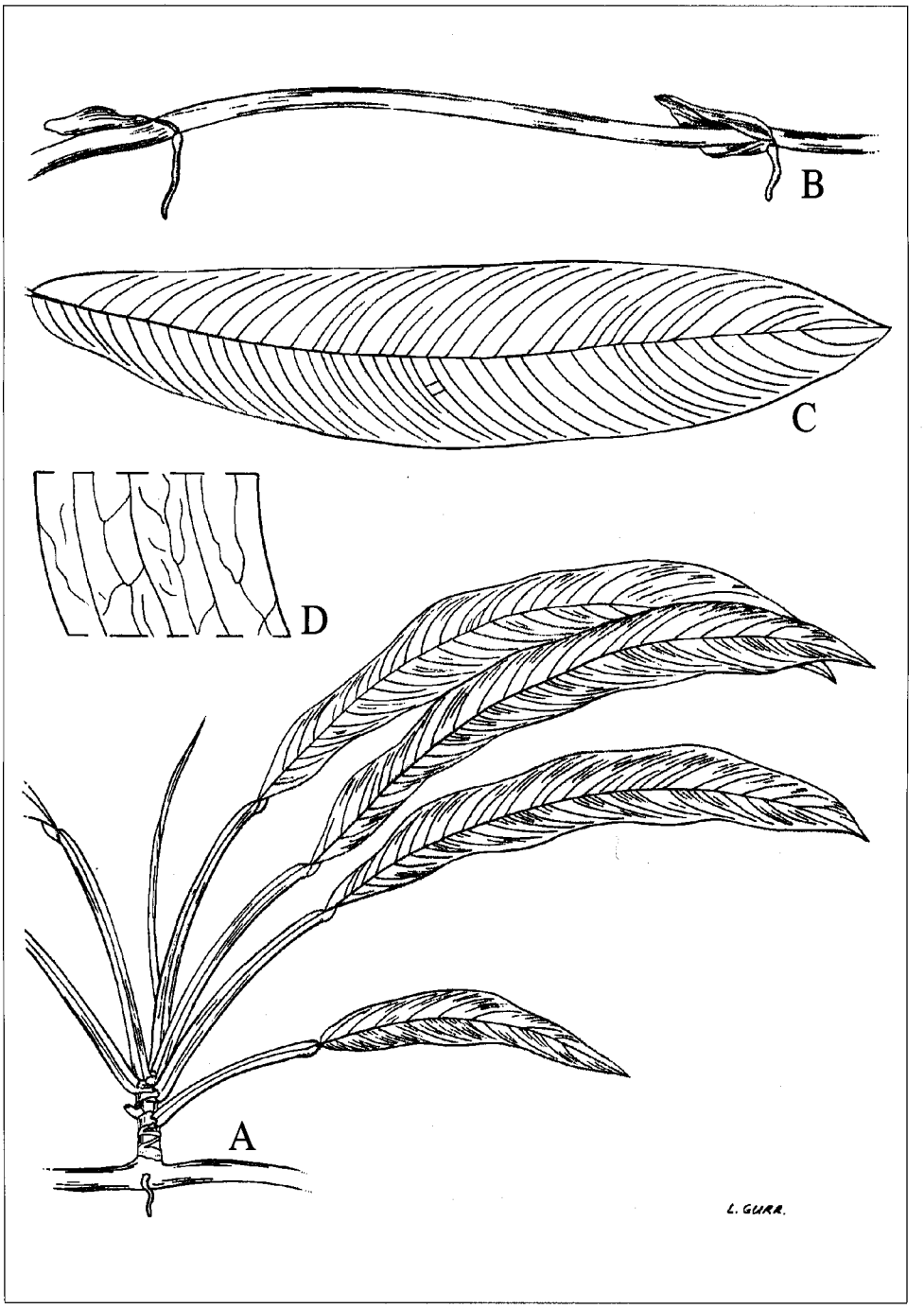

Figure 1. Rhaphidophora angustata Schott
A. fertile shoot x $^{1}/_{6}$; B. foraging shoot x $^{1}/_{2}$; C. leaf lamina x $^{2}/_{9}$; venation detail x 4. All from *Nicolson 927.*

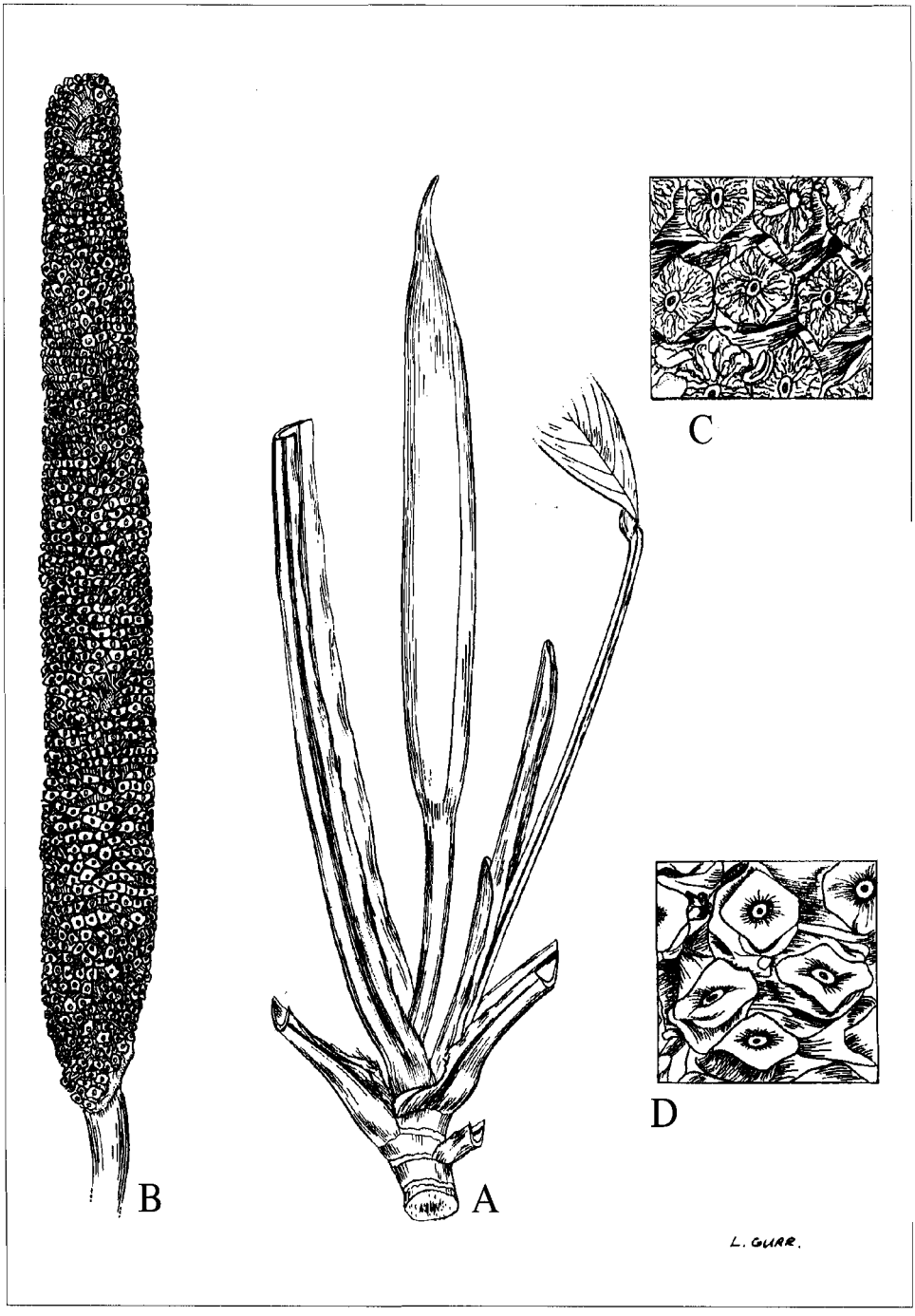

Figure 2. Rhaphidophora angustata Schott
A. flowering shoot x $^1/_3$; B. inflorescence, spathe fallen x $^1/_3$; C. spadix detail, late anthesis x 6; D. spadix detail, early fruiting x 4. All from *de Wilde & de Wilde-Duyfjes 13634.*

11–13 x 1–1.2 cm; *spathe* narrowly canoe-shaped, stoutly beaked, 16–29 x 2–3.5 cm, stiffly fleshy, greenish to white, gaping basally at anthesis and then persistent partly into fruit development although eventually falling to leave a large oblique scar at the base of the spadix; *spadix* cylindrical, sessile, obliquely inserted on peduncle, 12–23 x 1.5–2 cm, dirty white; *stylar* region rather well developed, mostly rhombohexagonal, 2–2.2 x 2 mm, truncate; *stigma* punctiform, ca. 0.3 mm diam., but ovaries on lowermost part of spadix with longitudinally orientated elongated stigmas ca. 1 x 0.25 mm; *anthers* not exserted at anthesis, pollen extruded from between ovaries; *infructescence* 14–20 x 2.5–3.5 cm, dark green before ripening.

Distribution: Peninsular Malaysia (Penang, Perak, Selangor) and Sumatera.

Habitat: Primary to disturbed, moist to wet, lowland to upper hill dipterocarp forest along rivers, on lofty trees and rocks on both acid and base substrates. 125 – 1500 m altitude.

Notes: 1. A frequently very high-climbing species unmistakable by the scattered fans of large bright-green soft-textured litter-trapping leaves carried on short stout shoots and held at about 90° to the ± leafless main stem. The large slender inflorescences arise from these fans.

2. Long known by the later name *R. pteropoda*, the epithet *R. angustata* must now be applied to this species. The type of *R. angustata* is sterile (the specimen is an immature fan of leaves but is unmistakably the same species as that later described by Teijsmann and Binnendijk as *Scindapsus pteropodus*) and of unknown provenance. In the protologue Schott cites the type as '*Sumatra occidentalis*' but the specimen label states '?Java', although *R. angustata* has never been collected wild in Java.

3. The syntype seen of Ridley's name *R. laetivirens* exactly matches *R. angustata*. It is quite inexplicable that Ridley considered it to represent an undescribed species, although later (Ridley, 1925) he merged it with *R. angustata* (as *R. pteropoda*).

Other specimens seen: PENINSULAR MALAYSIA: Perak - *Scortechini s.n.* (K); Bk. Larut *Wray 2457* (SING), *Derry sub. Curtis 3713*, (K, SING), *Boyce 692*, (K, KEP); Selangor - Hutan Lipur Kanching *Boyce s.n.* (sight record – no voucher); Kepong, track to Bk. Lagong. ca. 1 km from GDZ Guest House, *Boyce 1064* (K, KEP).

2. Rhaphidophora beccarii (Engl.) Engl.

Rhaphidophora beccarii (Engl.) Engl. in Bot. Jahrb. Syst. 1 (1881) 181 & in Beccari, Malesia 1 (1882) 270, Tab. xix 6 – 9; Hook.*f.*, Fl. Brit. India 6 (1893) 546; Ridl., Mat. Fl. Malay Penins. 3 (1907) 44; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 46; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 382; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 341; Ridl., Fl. Malay Penins. 5 (1925) 124; Henderson, Malayan Wild Flowers, Monocots, (1954) 238, Fig. 142 C, D — *Epipremnum beccarii* Engl. in Bull. Soc. Tosc. Ortic. 4 (1879): 268 (1879) — Type: Malaysia, Sarawak, Kuching, Oct. 1865, *Beccari p.b. 833* (cited as '*832*' by Engler, 1879) (FI, holo)

Rhaphidophora fluminea Ridl., J. Straits Branch Roy. Asiat. Soc. 44 (1905) 186; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 37, **synon. nov.** — Type: Malaysia, Sabah, Bongaya, Dec. 1897, *H.N. Ridley s.n.* (SING, holo)

Rhaphidophora borneensis Engl., *Araceae exsicc. et illustr. n.* 195, see Engl, Bot. Jahrb. Syst. 7, Beibl. 15 (1886) 1 — Type: Indonesia, Kalimantan, Mindai to Pramassan, 19 June 1882, *H. Grabowski s.n.* (B†, holo; BM, iso).

Small to medium-sized, heterophyllous, sometimes homeophyllous, creeping rheophyte, very rarely short liane, to 75 cm; *seedling stage* a non-skototropic shingling shoot, soon becoming spreading-leafy; *pre-adult plant* initially with ± apressed shingle-leaves, later with leaves erect or spreading and at this stage plants resembling adult in all but overall size and leaf division; *adult shoots* all sympodial, clinging and flowering but main axis comprised of longer modules than axillary axes; *stems* smooth, mid- to dark green, with very sparse petiolar sheath fibre, internodes 1–7 x c. 1 cm, separated by variously prominent slightly oblique leaf scars; *flagellate foraging stems* absent; *clasping roots* very densely arising from the nodes and internodes of clinging stems, pubescent; *feeding roots* very strongly adherent, densely scaly; *leaves* distichous, apressed and shingling to erect or spreading and scattered on pre-adult shoots, tending to become distally clustered on adult shoots; *cataphylls and prophylls* membranaceous, soon drying and falling; *petiole* narrowly canaliculate to carinate, 8–31 x 0.3–1.5 cm, smooth, apical and basal genicula prominent; *petiolar sheath* prominent, extending to the apical geniculum, variably persistent and mostly degrading into semi-persistent weak fibres; *lamina* entire in seedling and pre-adult individuals, entire, pinnatipartite or pinnatisect in adult plants, narrowly-lanceolate to oblong-elliptic, slightly oblique, 21–51 x 2–23 cm, sub-coriaceous to slightly fleshy, base decurrent, apex acuminate with a moderately prominent tubule;

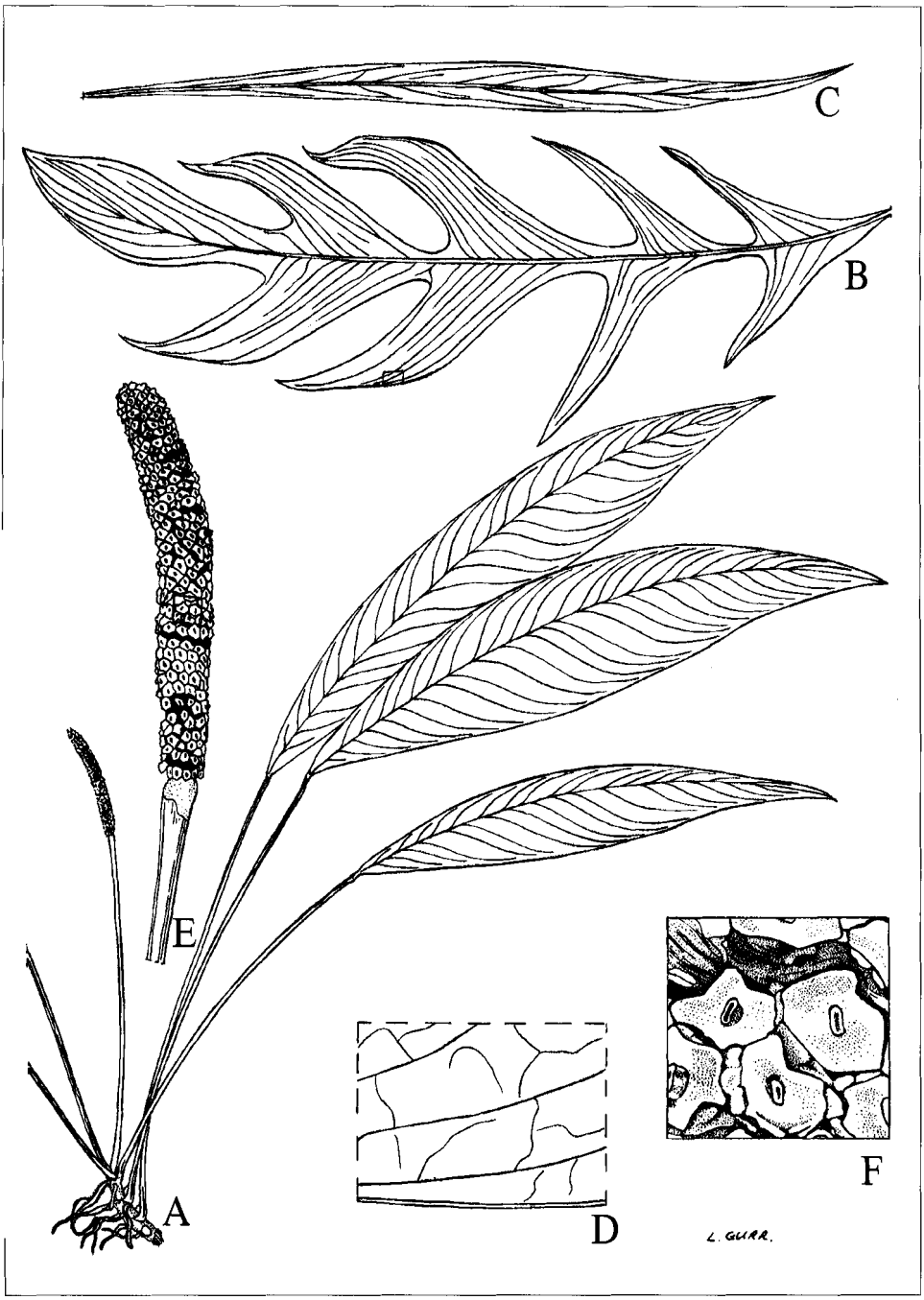

Figure 3. Rhaphidophora beccarii (Engl.) Engl.
A. habit x $^1/_4$; B. leaf lamina x $^1/_4$; C. leaf lamina x $^1/_4$; D. venation detail x 4; E. inflorescence, spathe fallen x 1; F. spadix detail, post female receptivity, pre-anthesis x 8. A, E & F from *Stone 9637*; B & D from *Ridley s.n.*; C from *Kiew 1982*.

mid-rib prominently raised abaxially, sunken adaxially; *primary venation* pinnate, raised abaxially, slightly impressed adaxially; *interprimaries* subparallel to primaries, slightly raised abaxially, ± flush adaxially, often forming a weak reticulum; *secondary venation* prominently reticulate, slightly raised; *tertiary venation* a network of broadly spaced tessellate veins arising at c. 90° from the mid-rib and crossing the primaries and interprimaries; *inflorescence* one to three together, subtended by a prominent cataphyll degrading to fibres before anthesis; *peduncle* terete, 8–12 x 0.2–0.4 cm; *spathe* narrowly canoe-shaped, stoutly beaked, 6.5–7 x 1–1.5 cm, stiffly fleshy, greenish to dull white, swiftly falling at anthesis; *spadix* cylindrical, sessile, inserted perpendicular to peduncle, 4.5–7 x 0.6–1 cm, dull whitish; *stylar* region rather well developed, mostly rhombohexagonal, c. 1–1.5 x 1–1.5 mm, truncate; *stigma* elliptic, longitudinally orientated, occasionally almost circular, c. 0.5 x 0.3 mm, often very prominent especially in dried material; *anthers* exserted at anthesis; *infructescence* 7–9 x 1–2 cm, mid-green when ripe.

Distribution: Peninsular Malaysia (Johore, Kelantan, Negri Sembilan, Pahang, Penang, Perak, Selangor, Terengganu), Thailand (southern peninsula), Sumatera and throughout Borneo.

Habitat: Rheophytic on rocky wooded streambanks, on rocks in streams and rivers, on soft mud, sandy beds and bare rock on limestone or granite in primary to disturbed old secondary lowland to hill and swamp forest. 70–900 m altitude.

Notes: 1. One of only two certainly obligate rheophytic species (the other is *R. wentii* Eng. & K. Krause – New Guinea), *R. beccarii* is immediately recognizable by its adult growth form, creeping along water courses or attached on rocks in the water, and by the usually pinnately divided leaf laminas.

2. Although the pinnately divided leaf is typical of adult plants, entire, stenophyllous, lanceolate-leaved flowering plants are not rare. Such plants have been referred to as *R. fluminea* and occur either as pure stands or as mixed populations with the pinnate-leaved form (*SFN 33128* is an excellent example of the latter phenomenon). They are treated here as a neotenic manifestation of *R. beccarii*.

3. *Rhaphidophora borneenis* Engler, based on *H. Grabowski s.n.* from Kalimantan, is a broad-leaved form of typical (i.e., divided-leaf) *R. beccarii*.

Other specimens seen: PENINSULAR MALAYSIA: Johore - G. Pulai, Sg. Ayer Hitam, above bridge at base of hill, *Sinclair SFN 10832* (E, SING); G. Panti *Corner SFN 30961* (BO, SING), *Bogner 366* (K, M), Kangka Sedili Kechil, *Corner SFN s.n.* (SING); Sg Salat on Sg Endau, *Kiew 1982* (KEP); Kelantan - Gua Musang, *UNESCO Limestone Expd. 281* (K, L, SING); Negri Sembilan, Ulu Bendol, FR north of road, *Holttum SFN 9842* (SING), G. Beremban, Sg. Bendol, *Furtado SFN 33128* (B, BO, K, L, SING); Pahang - Bentong, *Furtado SFN 33111* (K, P); Sg Talian, *Ridley 2387* (K); Taman Negara, *ALM, Zai & Ham s.n.* (UKMB), Sg Tahan at Lata Berkoh, *Stone 13824* (KLU); Sg Yu, *Hardial & Nor 27* (K, L, SING), Sg Pertang, Ulu Tembeling, *Henderson SFN 22120* (BO, SING); Sg Cheka, *Holttum SFN 24764* (BO, SING); Sg Jeletoh, *Hardial & Nor 95* (L, SING); Penang - *Dalhousie s.n.* (E), road from Penara Bukit to Ayer Hitam, *Ridley s.n.* (SING); Perak - *Scortechini s.n.* (E, LE), Matang, Bubu F.R., compartment 77, banks of Sg Wang, *Boyce 696* (K, KEP); Sg Tampang, foot of G. Chantik, Gopeng, *Furtado SFN s.n.* (P, SING);); Bk Larut Besar, *Kunstler 2874* (FI, K, P); Larut, *Kunstler 3955* (K, L, P), *Kunstler 3963* (L); *Kunstler 10155* (BM, K), Temangoh, banks of Kertam river, *Ridley 14369*, (BM, SING), Sg Chenderiang, *Shah & Shuker 3414* (KEP, SING); Selangor - Ulu Kerling, *Hardial 13* (K, SING); Ulu Lui, Langat, *Hassan & Kasim UKMB 09039* (UKMB; Ulu Langat, Ulu Pansoon, *Kasim et al. 439* (UKMB); Sg Lalang F.R., Seminyih, *Kiew* 652 (KEP), Bk Lagong F.R., *Blanc 459* (KEP); stream half a mile before Klang Gates Resevoir, *Nicolson 1138* (L, SING, US);); Rawang, *Ridley 7611* (K); Genting Bidai, *Ridley* 7664 (K, SING); Ulu Gombak, *Ridley s.n.* (K), *Ridley s.n.* (K); Templer Park, *Samek UKMB 09947* (UKMB), *Stone 9637* (KLU, L), *Stone 12125* (KLU); 16th mile Ulu Gombak road at the Universiti of Malaya Field Studies Centre, *Stone FSC 321* (L), *Stone 15384* (MO, KEP), *Chin 1011* (L); G. Tangkau, Pansom, Ulu Langat, *Umbai (for Hilliard) KL 1158* (KEP); Terengganu - Batu Biwa, *Kiew 2348* (KEP).

3. Rhaphidophora corneri P.C.Boyce, *sp. nov.*

Rhaphidophora corneri differt a speciebus ceteris laminis foliorum parvis oblongo-lanceolatis nervatura reticulata prominente plerumque perforationibus nonnullis amplis ovatis vel rhomboideis vel trapezoideus; inflorescentiis ex sympodiis floralibus elongatis distantibus orientibus; sympodiis in apicibus ramorum lateralium liberorum positis — TYPUS: Malaysia, Terengganu, Ulu Kajang, 13 Nov. 1935, *E.J.H. Corner SFN 30441* (SING, holo).

Small, slender, heterophyllous?, leptocaul (?), liane of unknown ultimate height; *seedling stage* and *pre-adult plant* unknown; *adult shoot* known from flowering portions only, these either very long sympodia or physiognomically monopodial (not clear from specimen), free but producing one or two stout feeding roots from each node (adult plant thus perhaps resembling *Scindapsus scortechinii* and therefore representing an architectural type hitherto unrecorded in *Rhaphidophora*); *stems* smooth, without prophyll, cataphyll and petiolar sheath fibre, internodes to 1–9 x 0.5–0.7 cm, separated by prominent corky leaf scars; *flagellate foraging stems* not observed (absent?); *clasping roots* not observed; *feeding roots* one or two per node, non-adherent (always?), stout, corky; *leaves* distichous, erect or spreading on adult shoots; *cataphylls and prophylls* membranaceous, soon drying and falling; *petiole* narrowly canaliculate, 6–9 x 0.2–0.3 cm, smooth, apical and basal genicula prominent; *petiolar sheath* obscure except for basal-most portion, extending (always?) to the apical geniculum, sheath of newest leaf degrading into a very few feeble fibres, sheath soon (?) falling to leave a proportionally wide, corky scar basally on the petiole; *lamina* entire or with a few, large ovate to rhomboid or trapezoid perforations extending almost to the margin, 11–15 x 6–8 cm, oblong-lanceolate, slightly oblique, sub-coriaceous, base obtuse to weakly cordate, apex acute to acuminate with a slightly prominent apiculate tubule; *mid-rib* prominently raised abaxially, slightly raised adaxially; *primary venation* pinnate but distal-most veins becoming weakly reticulate and not reaching leaf margin, raised abaxially, raised, but weakly so, adaxially; *interprimaries* weakly reticulate to sometimes sub-parallel to primaries, slightly raised abaxially, weakly raised adaxially, often forming a weak reticulum; *secondary venation* reticulate, slightly raised abaxially, weakly raised adaxially; *tertiary venation* prominently reticulate; *inflorescence* two (more?) together, each subtended by a prominent swiftly falling cataphyll, and arising sequentially on an elongated reiterative floral sympodia at the tip of (probably) plagiotropic free lateral shoots; *peduncle* terete, 1–1.3 x 0.2–0.25 cm; *spathe* canoe-shaped, thick, stout-beaked, c. 2.7–2.9 x 0.7–0.8 cm; *spadix* cylindrical, sessile, inserted slightly obliquely on peduncle, c. 2 x 0.42 cm; *stylar* region well developed, rounded-rhombohexagonal, c. 3–3.2 x 1.95–2 mm, convex to truncate, smoothly rounded; *stigma* impressed irregularly elliptic, longitudinally orientated, c. 1 x 0.5 mm; *anthers* exserted (?) at anthesis; *infructescence* not observed.

Distribution: Peninsular Malaysia (Terengganu). Endemic, known only from the type collection.

Habitat: Unknown.

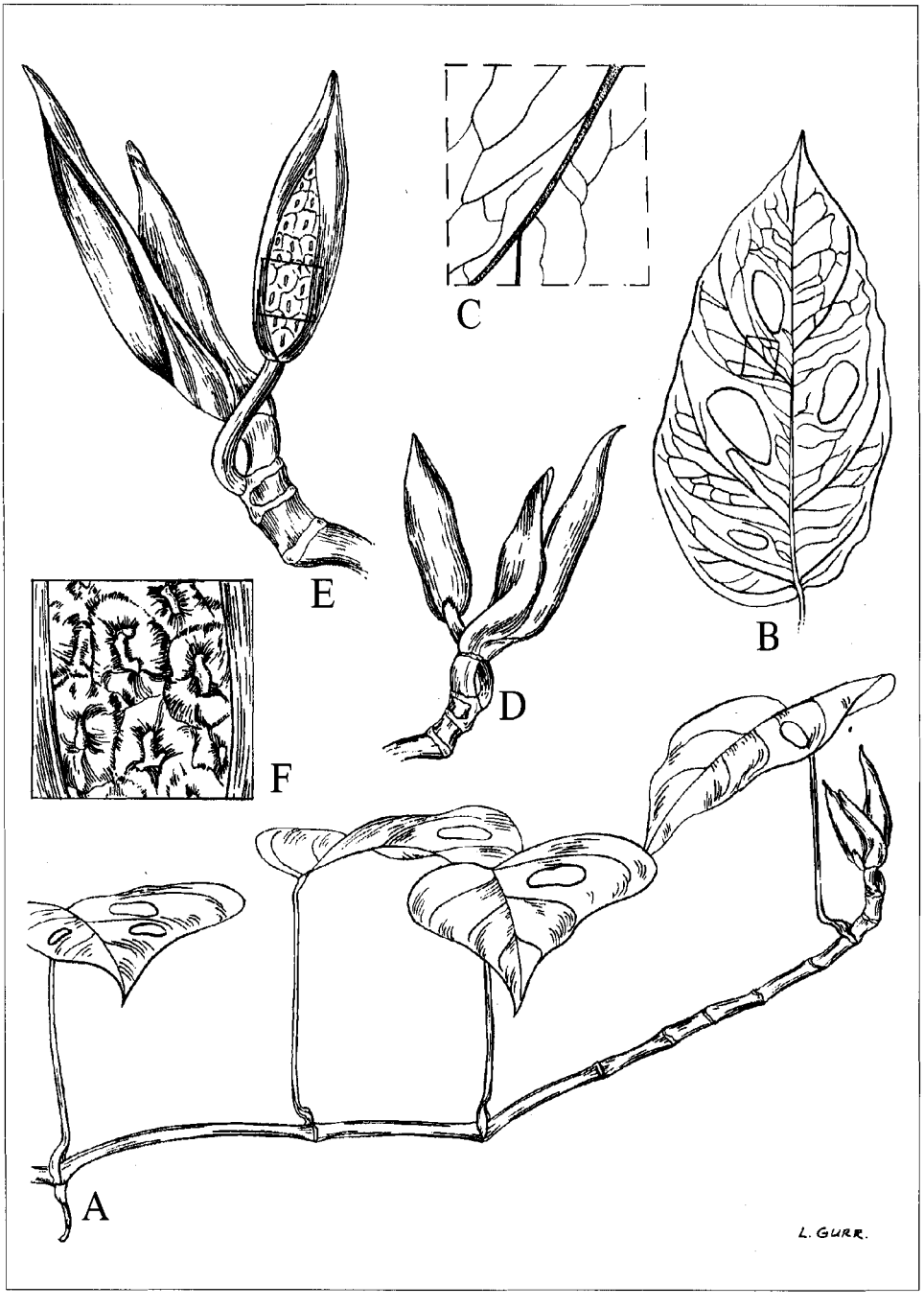

Figure 4. Rhaphidophora corneri P.C. Boyce
A. habit x $^1/_2$; B. leaf lamina x $^1/_2$; C. venation detail x 3; D. tip of flowering shoot with two inflorescences, abaxial view x 1; E. tip of flowering shoot with two inflorescences, adaxial view x $1^1/_2$; F. spadix detail, post female receptivity, pre-anthesis x 6. All from *Corner SFN30441.*

Notes: 1. The manner of inflorescence production in *R. corneri* is unique in the genus. The inflorescences arise sequentially from an elongated reiterative floral sympodium on the tips of (probably) plagiotropic free lateral shoots with each new inflorescence carried some distance from that preceeding. The specimen studied bears the scars of several inflorescences together with two developing inflorescences at different stages of maturity, suggesting that the sympodia reiterate over a long period of time. The only other species with a similar type of inflorescence production (but there on the adherent orthotropic shoots and with the inflorescences congested) are the New Guinea *R. ledermannii* Engl. & K. Krause and *R. versteegii* Engl. & K. Krause.

2. Although represented by just the collection cited above I have no hesitation in describing this species as new. *Rhaphidophora corneri* is a remarkable species, unique in the genus by the manner of inflorescence production (see note above), and small leaves with dense reticulate veins, and large perforations (in the latter feature the species resembles *Amydrium hainanense* (C.C. Ting & C.Y. Wu ex H. Li *et al.*) H. Li (see Nguyen & Boyce, 1999). It would be very desirable to learn more about this plant from additional field collections.

3. *Rhaphidophora corneri* is named for the late Prof. E.J.H. Corner, a giant among botanists of Asia. Furtado first proposed the name *in sched.*, but it was never published.

4. Rhaphidophora crassifolia Hook.*f.*

Rhaphidophora crassifolia Hook.*f.*, Fl. Brit. Ind. 6 (1893) 543; Ridl., Mat. Fl. Malay Penins. 3 (1907) 42; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 22, Fig. 5; Ridl., Fl. Malay Penins. 5 (1925) 122 — Type: Malaysia, Perak, Batang Padang District, Batang Padang, August 1884, *Kunstler 8111* (K, holo).

Large, occasionally very large, moderately robust, semi-pachycaul homeophyllous liane to 10 m; *seedling stage* a non-skototropic shingling shoot; *pre-adult plants* rarely forming small terrestrial colonies of apressed shingling shoots; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and short to moderately elaborated, free, sympodial, densely leafy, flowering stems; *stems* smooth, climbing stems rectangular in cross section, the angles winged, the surfaces between sulcate, the stem twisting to give a barley-sugar effect,

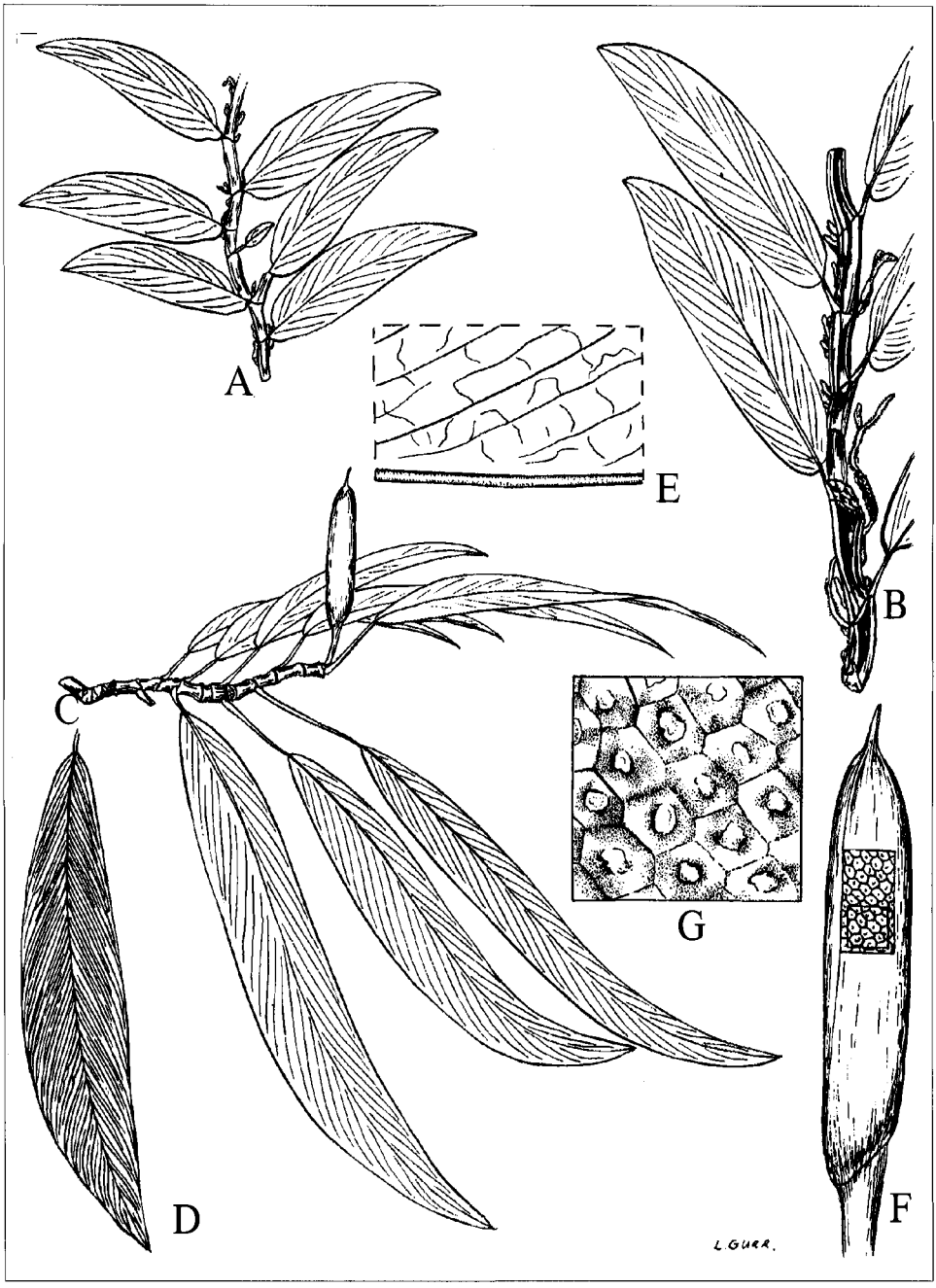

Figure 5. Rhaphidophora crassifolia Hook.*f.*
A. Pre-adult shoot x $^{3}/_{4}$; B. adult, sterile shoot x $^{3}/_{4}$+; C. flowering shoot x $^{1}/_{3}$; D. leaf lamina x $^{1}/_{2}$; E. venation detail x 4; F. inflorescence, just prior to spathe opening x 1; G. spadix detail, pre-female receptivity x 6. A & B from *Boyce 1226*; C - E from *Ngadiman SFN 36774*; F & G from *Corner SFN 29318*.

free stems more or less terete to weakly four-angled in cross section, often branching extensively, growing to considerable lengths and then pendent under their own weight, green, later dull brown, without prophyll, cataphyll and petiolar sheath fibre but active apices coated with clear mucilage, internodes to 10 x 2 cm on adherent shoots, usually shorter and less stout on free shoots, separated by prominent slightly oblique leaf scars, older stems woody; *flagellate foraging stems* absent; *clasping roots* densely arising from the nodes and internodes of clinging stems, densely pubescent; *feeding roots* rather rare, adherent, pubescent; *leaves* weakly spiralled on adherent and proximal portions of free shoots, densely distichous distally on flowering shoots; *cataphylls and prophylls* membranaceous, very quickly drying and falling; *petiole* shallowly canaliculate to grooved adaxially, 4–7 x 0.2–0.3 cm, smooth, with a slight apical and somewhat prominent basal geniculum; *petiolar sheath* prominent, extending to and encircling the apical geniculum, very swiftly drying and falling to leave a continuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, falcate-elliptic-lanceolate to falcate-oblong or falcate-oblanceolate, 4.5–25.5 x 1.5–5 cm, thickly coriaceous to almost fleshy, upper surfaces glossy, lower surfaces matt, base sub-ovate to acute or briefly decurrent, apex sub-acute with a prominent apiculate tubule, margins slightly reflexed, this becoming greatly accentuated in dried material; *mid-rib* barely raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially; *interprimaries* parallel to primaries, very slightly raised abaxially and adaxially; *secondary* and *tertiary venation* ± invisible in fresh material, barely visible in dried specimens; *inflorescence* solitary, subtended by a fully developed foliage leaf; *peduncle* compressed-cylindric-clavate, 1.7–2.5 x 0.2–0.3 cm; *spathe* cigar-shaped, stoutly short-beaked, 4–6.5 x 1–1.7 cm, thickly fleshy, dull green to dull yellow, swiftly falling at female receptivity; *spadix* cylindrical, sessile, inserted level on peduncle, 3.5–6 x 0.5–1.3 cm, dirty white; *stylar* region rather well developed, mostly rhombohexagonal, 0.8–1 x c. 1 mm, truncate; *stigma* punctiform, c. 0.3 mm diam.; *anthers* barely exserted at anthesis, pollen extruded from between ovaries; *infructescence* not observed.

Distribution: Peninsular Malaysia (Johore, Negri Sembilan, Selangor) and southern peninsular Thailand.

Habitat: Primary lowland rainforest, dry *Dryobalanops* forest, peat forest, wet evergreen forest. 10–90 m altitude.

Notes: 1. *Rhaphidophora crassifolia* is one of the species here included in

the informal Hongkongensis Group, an assemblage species defined by clinging stems rectangular in cross-section, simple, lanceolate to elliptic, frequently falcate leaves, usually rapidly falling cataphylls and prophylls and petiolar sheaths, the latter shedding to leave a continuous scar around the top of the apical geniculum, and small to medium-sized cigar-shaped inflorescences carried on the tips of free lateral stems. The group is taxonomically very difficult in part because the various species recognized are separated by quantitative differences and in part because, being mostly high climbing lianes, they are often woefully inadequately collected. I have taken a pragmatic approach with their taxonomy for Peninsular Malaysia, recognizing only those species that can be keyed out (even then, often with some difficulty). While this is clearly far from satisfactory and has resulted in a large number of synonyms, in particular with *R. sylvestris* and *R. montana*, it means that identifications can be made with some confidence, a situation near impossible if all names are regarded as 'good'.

2. In Peninsular Malaysia, *R. crassifolia* is most easily confused with *R. sylvestris* with which it shares decidedly falcate leaves and small (less than 7 cm long) inflorescences. It may be distinguished from *R. sylvestris* in the considerably thickened leaves, drying with prominently recurved margins, by the glossy adaxial and matt abaxial leaf surfaces, and by the indistinct venation, an artefact of the fleshy leaves and, in the field, by the prominently angled, twisted adherent stems.

3. Confusion with *R. montana* is possible. Generally *R. montana* is a plant far larger in all its parts, especially in the larger inflorescences and longer spadix.

4. The similar *R. maingayi* Hook.*f.* may be distinguished by the shoot apices covered with persistent untidy fibre derived from the degraded prophylls, cataphylls and petiolar sheaths.

5. Work is underway with DNA studies of the Hongkongensis Group to resolve the phylogeny of the group and, it is hoped, shed light on the species boundaries.

Other specimens seen: PENINSULAR MALAYSIA: Johore - Pengkalan Raja, Pontian, *Ngadiman SFN 36774* (B, BO, L, K, P, SING); Sg Kayu Ara, Mawai-Jemaluang road, *Corner SFN 29318* (K, KEP, SING); Negeri Sembilan - Pasoh FR *La Frankie 2185* (KEP); Selangor - Genting Sempah 22 mile, Ulu Gombak FR, *Stone 5738* (KLU).

5. Rhaphidophora falcata Ridl.

Rhaphidophora falcata Ridl., J. Asia. Soc. Straits Br. 44 (1905) 198; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 37 — Type: Thailand, Bangtaphan, *Keith s.n.* (SING, holo).

Distribution: Peninsular Malaysia (Penang) and southern Thailand.

Medium, slender, leptocaul homeophyllous liane(?) to unknown ultimate height; *seedling*, *pre-adult plants* and *adult shoot*; *stems* smooth, terete, without prophyll, cataphyll and petiolar sheath fibre, internodes 1–2 x 0.5–0.7 cm, separated by rather well-defined, slightly oblique leaf scars, older stems woody; *flagellate foraging stems* not observed; *roots* sparsely arising from the nodes and internodes of stems, densely pubescent; *cataphylls and prophylls* very quickly drying and falling; *petiole* adaxially basally canaliculate, otherwise grooved, 11–19 x 0.2–0.5 cm, smooth, apical genicula very prominent, basal geniculum poorly defined; *petiolar sheath* very prominent basally, extending c. half way along the petiole, swiftly drying and but seemingly persistent; *lamina* entire, lanceolate-falcate, very slightly oblique, 16–20 x 2–2.5 cm, stiffly coriaceous, base acute to cuneate, apex acute, with a prominent apiculate tubule; *mid-rib* prominently raised abaxially, slightly sunken adaxially; *primary venation* densely pinnate, slightly raised abaxially and adaxially; *interprimaries* parallel to primaries and hardly less prominent, slightly raised abaxially and adaxially; *secondary* and *tertiary venation* reticulate to sub-tessellate in dried specimens; *inflorescence* solitary (always?), subtended by a fully developed foliage; *peduncle* and *spathe* not observed; *spadix* cylindrical, sessile, inserted ± level on peduncle, c. 2.5 x 1.3 cm; *stylar* region, rounded, 1.5–1.7 x 1.6–2 mm, truncate; *stigma* punctiform, raised, c. 0.7 x 0.8 mm diam.; *anthers* not observed; *infructescence* not observed.

Habitat: Unknown.

Notes: 1. Recognized as distinct, despite the dearth of material and information, due to the falcate, stiffly coriaceous leaves, unique in the genus. This species will be illustrated in the account of Thai *Rhaphidophora*.

2. The life form of *R. falcata* is not clear from the meagre material available. The *Cantley* collection (erroneously labelled '*Haniff*?') cited by Ridley (1905) has traces of sandy mud on the stems and roots, suggesting that the plant is terrestrial and perhaps rheophytic, and thus implying a relationship to, for example, *R. beccarii* and *R. wentii*.

Other specimens seen: PENINSULAR MALAYSIA: Penang - *Cantley s.n.* (SING).

6. Rhaphidophora foraminifera (Engl.) Engl.

Rhaphidophora foraminifera (Engl.) Engl., Pflanzenr. 37 (IV.23B) (1908) 45; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 197–198; Ridl., Fl. Malay Penins. 5 (1925) 123–124 — *Epipremnum foraminiferum* Engl., Bot. Jahrb. Syst. 25 (1898) 11 — Type. Neotype: Malaysia, Perak, Taiping, based of Maxwell Hill Road, *Nicolson 1047* (L neo; BH, BO, US isoneo designated here – see discussion below).

Moderate to large, robust, pachycaul, homeophyllous liane to 15 m; *seedling stage* not observed; *pre-adult plants* frequently (always?) forming extensive terrestrial colonies; *adult shoot* architecture comprised of elongated, clinging, physiognomically monopodial, densely leafy, non-flowering (always?) stems and shorter clinging, sympodial, densely leafy, flowering stems; *stems* smooth, mid-green, with cataphylls and prophylls deliquescing to black mucilage drying to leave fragmentary parchment-like remains on petioles, developing laminae, inflorescences, internodes 1–7 x 0.5–3.5 cm, separated by prominent straight to slightly oblique leaf scars; *flagellate foraging stem* absent; *clasping roots* densely arising from the nodes and internodes, pubescent; *feeding roots*, adherent, exceedingly robust, densely pubescent with dense verticels of prominent corky ramenta; *leaves* distichous; *cataphylls and prophylls* membranaceous, soon deliquescing; *petiole* canaliculate, 22–52 x 0.4–1 cm, smooth for the most part but upper 2–4 cm and apical geniculum densely pubescent, apical geniculum prominent, basal geniculum less so; *petiolar sheath* prominent, extending to apical geniculum, ± short-persistent, degrading to weak, slightly netted fibres; *lamina* entire to slightly or extensively perforated, perforations round to rhombic, extending c. $^1/_4$ of lamina width on each side of the midrib, ovate to oblong-lanceolate or oblong-elliptic, slightly oblique, pubescent abaxially when young, 7–53 x 6–19 cm, membranaceous to sub-coriaceous, base rounded, acute to slightly decurrent, apex acute to acuminate; *mid-rib* prominently raised and densely pubescent abaxially, ± flush adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially, the leaf appearing slightly quilted, pubescent in younger leaves, this indumentum mostly shed in older leaves; *interprimaries* sub-parallel to primaries, less prominent, slightly raised abaxially, slightly impressed adaxially; *secondary venation* reticulate, slightly raised; *tertiary venation* tessellate, slightly raised; *inflorescence* mostly subtended by one or two large cataphylls, these swiftly deliquescing into

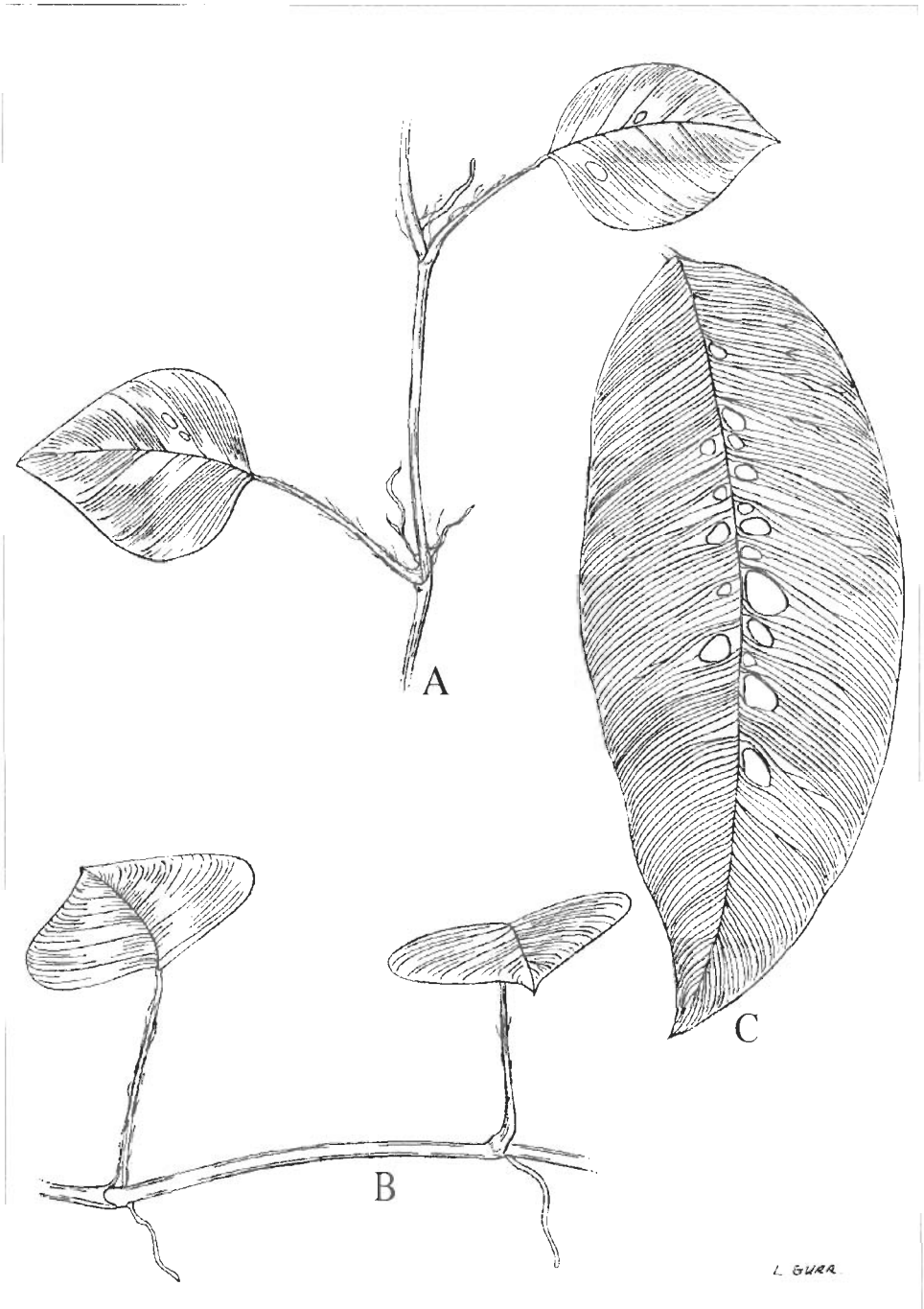

Figure 6. Rhaphidophora foraminifera (Engl.) Engl.
A. pre-adult climbing shoot x $^1/_4$; B. pre-adult terrestrial shoot x $^1/_3$; C. leaf lamina x $^1/_4$. A & B from *Nicolson 941*; C from *Boyce 722*.

black mucilage, this drying and adhering patchily to developing spathe, rarely subtended by a ± fully developed foliage leaf; *peduncle* terete, 3–13 x 0.5–1.5 cm; *spathe* canoe-shaped, stoutly beaked, 10–27 x 1.5–13 cm, stiffly fleshy, dull pale to dark yellow, wide gaping at anthesis and then briefly persistent though maturation of the stamens, eventually falling to leave a large ± scar at the base of the spadix; *spadix* cylindrical, sessile, slightly obliquely inserted on peduncle, 7–17 x 1.3–2.5 cm, dull greenish yellow; *stylar* region moderately developed, rounded to rhombohexagonal, 1–2 x 1–1.5 mm, shortly conical when fresh, drying truncate; *stigma* punctiform or elliptic and transversely orientated, raised at anthesis but excavated in dry material, c. 0.3 mm diam.; *anthers* slightly exserted at anthesis; *infructescence* 8–15 x 2–3 cm, dark green before ripening to greenish yellow.

Distribution: Peninsular Malaysia (Pahang and Perak), Sumatera, and throughout Borneo.

Habitat: Disturbed forest, moist hill dipterocarp forest, on rocks (granite and limestone) in shaded position. 50–1035 m altitude.

Notes: 1. The type specimen of *Epipremnum foraminiferum* was sent to Berlin from Bogor in 1897 (*fide* Engler, 1898). No such specimen is extant in Berlin and the type must be considered lost. The collection chosen as the neotype is fertile and matches *Engler 5307*, a sterile collection, which is annotated as *R. foraminifera* in Engler's handwriting and matches Engler's usage of the name *R. foraminifera*.

2. There are two *Rhaphidophora* species in Peninsular Malaysia with perforated leaves and variously pubescent leaves: *R. foraminifera* and *R. puberula*. They may be distinguished by the position of the inflorescence (on short adherent shoots in *R. foraminifera*, on short free shoots in *R. puberula*), by the presence of black mucilage produced by the deliquescing cataphylls and prophylls (present in *R. foraminifera*, absent in *R. puberula*), in leaf size of mature flowering-sized plants (to 53 x 19 cm in *R. foraminifera*, 34 x 10.5 cm in *R. puberula*), by the more or less rounded (*R. foraminifera*) and oblong (*R. puberula*) stylar regions, and in overall size of the plant (*R. foraminifera* is a bole climber to 15 m whereas *R. puberula* seldom climbs higher than 3 m and frequently forms large, spreading masses on rocks).

3. Perforated leaves occur in a number of otherwise rather different looking *Rhaphidophora* species (e.g. *R. foraminifera. R. puberula*, *R. corneri*, *R. subfalcata* M. Hotta, *R. ledermannii*, *R. veersteegii*) suggesting that, while a

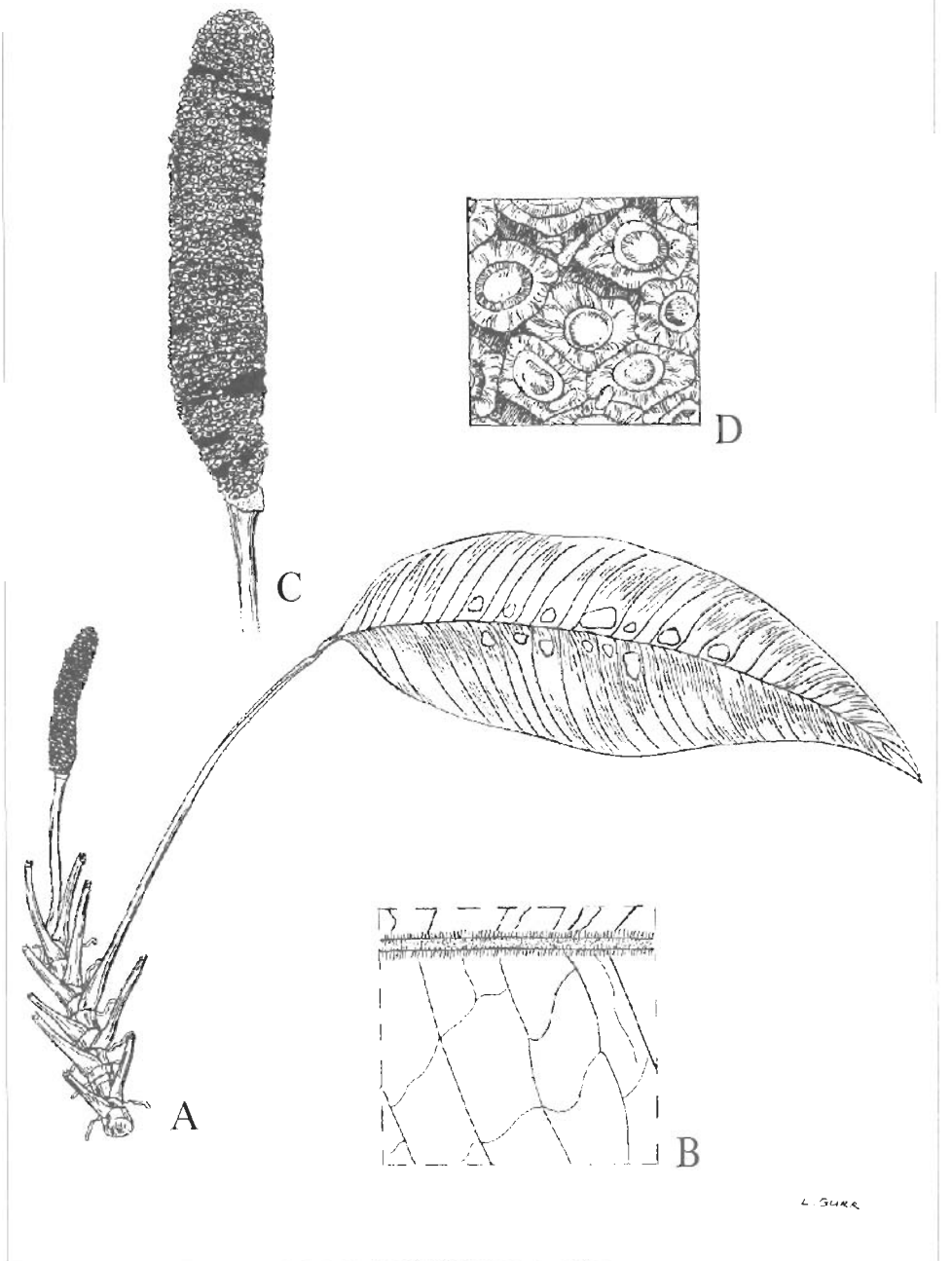

Figure 7. Rhaphidophora foraminifera (Engl.) Engl.

A, flowering shoot x $^{2}/_{15}$; B, venation detail x 6; C, inflorescence, spathe fallen x $^{2}/_{3}$; D, spadix detail, anthesis x 6. **A**, C & D from *Boyce 722*; B from *Croat 53118*.

useful diagnostic tool, lamina perforation cannot be used to specify groups within *Rhaphidophora.*

Other specimens seen: PENINSULAR MALAYSIA: Pahang - Taman Negara, Batu Luas (limestone) *Kiew 13519* (KEP); Perak - *Ridley s.n.* (BM); Bk Larut, *Boyce 690* (K, KEP), *Hay, Anthony & Banka 9073* (NSW, KEP), Taiping, Maxwell Hill, *Engler 5307* (B).

7. Rhaphidophora korthalsii Schott

Rhaphidophora korthalsii Schott, Ann. Mus. Bot. Lugd.-Bat. 1(1863) 129; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 246; Hook.*f.*, Fl. Brit. India 6 (1893) 548; Ridl., Mat. Fl. Malay Penins. 3 (1907) 45; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 341; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 49–51, Fig. 21; Ridl., Fl. Malay Penins. 5 (1925) 123; Henderson, Malayan Wild Flowers, Monocots, (1954) 238–239, Fig. 142 B — Type: Indonesia, Java, *P.W. Korthals s.n.* (L, holo; L, P, iso).

Pothos celatocaulis N.E. Br., Gard. Chron. 13 (1880) 200, **synon. nov.** — *Rhaphidophora celatocaulis* (N.E. Br.) Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 382; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 198, **synon. nov.** — Type: Malaysia, NW Borneo (Sabah), *Burbidge s.n.*, *Hort. Veitch no. 215* (K, holo; K, iso).

Rhaphidophora maxima Engl., Bull. Soc. Tosc. Ortic. 4 (1879) 269 & in Beccari, Malesia 1 (1882) 271, Tab. xx 1 – 5; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 48 – 49; K. Krause & Alderw., Nova Guinea 14 (1924) 214, **synon. nov.** — Type: Sarawak, Gunung Gading, July 1866, *Beccari PB2314* (FI, lecto; selected here). Engler lists two syntypes in describing *R. maxima*. That chosen is the more complete of the two, clearly conspecific, collections. The other is *Beccari PP443* [Irian Jaya, Soron (FI)].

Rhaphidophora tenuis Engl., Bot. Jahrb. Syst. 1 (1881) 181 & in Beccari, Malesia 1 (1882) 271–272; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 53, **synon. nov.** — Types: Malaysia, Sarawak, *Beccari* PB1977 (FI lecto; B isolecto; selected here). Of the two conspecific syntypes cited by Engler, that chosen is more complete. The other, *Beccari PB2714* (B, FI) also originates in Sarawak.

Rhaphidophora korthalsii Schott *var. angustiloba* Ridl. ex Engl. & K. Krause in Engler, Pflanzenr. 37 (IV.23B) (1908) 49, **synon. nov.** — Type: Malaysia,

Sarawak, Matang, July 1903, *Ridley s.n.* (SING, lecto; selected here). Engler cites two syntypes, the other, *Engler 5267* [Selangor, Batu Caves] was not found in Berlin and is assumed destroyed.

Rhaphidophora copelandii Engl., Bot. Jahrb. Syst. 37 (1905) 115; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 49, **synon. nov.** — Type: Philippines, Mindanao, Davao, Mt Apo, April 1904, *Copeland 1193* (PNH, holo†; B iso).

Rhaphidophora grandifolia K. Krause, Bot. Jahrb. 44, Beibl. 101 (1910) 11. Type: Philippines, Negros, Negros Orientale, Dumaguete (Cuernos Mts), March 1908, *Elmer 9464* (PNH, holo†; B, E, K, L, LE, MO, iso).

Rhaphidophora trinervia Elmer, Leafl. Philipp. Bot. 8 (1919) 3073, **synon. nov.** — Type: Philippines, Laguna, Los Baños (Mt Maquiling), June – July 1917, *Elmer 18057* (PNH, holo†; FI, K, L, MO, P, iso).

Rhaphidophora ridleyi Merr., J. Str. Br. Roy. As. Soc. Special Edition (Enum. Pl. Borneo) (1921) 90, **synon. nov.** — [*Rhaphidophora grandis* Ridl., J. Straits Branch Roy. Asiat. Soc. 49 (1907) 51, *nom. illeg., non* Schott 1858 (India)], **synon. nov.** — Type: Malaysia, Sarawak, Tambusan, Sept. 1905, *Ridley 12414* (SING, holo).

Rhaphidophora latifolia Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 341; K. Krause & Alderw., Nova Guinea 14 (1924) 213, **synon. nov.** — Type: Indonesia, Irian Jaya, Pionierbivak, 23 July 1920, *Lam 711* (BO, holo; L, iso).

Rhaphidophora palawanensis Merr, Philipp. J. Sci. 26 (1925) 451, **synon. nov.** — Type: Philippines, Palawan, Malampaya Bay, Oct. 1922, *Merrill BS 11570* (PNH, holo†; B, K, P, iso)

Rhaphidophora trukensis Hosok., J. Jap. Bot. 13 (1937) 195, **synon. nov.** — Type: Federated States of Micronesia, Chuuk (Truk) Island, near Orrip, 29 July 1939, *Hosokawa 8334* (TI , holo).

[*Epipremnum multicephalum* Elmer, Leafl. Philipp. Bot. 10 (1938) 3624, *nom. nud., descr. Angl.* — Based on: Philippines, Luzon, Sorsogon, Trosin (Mt Bulusan), May 1916, *Elmer 16061* (FI, K, L, MO, P, PNH†)].

Very large, occasionally enormous, slender to rather robust, pachycaul, heterophyllous liane to 20 m; *seedling stage* a non-skototropic shingling

Figure 8. Rhaphidophora korthalsii Schott
A. pre-adult shoot x $^1/_4$; B. pre-adult shingling shoot x $^1/_4$. A from *Boyce 679*; B from *Nicolson 1712*.

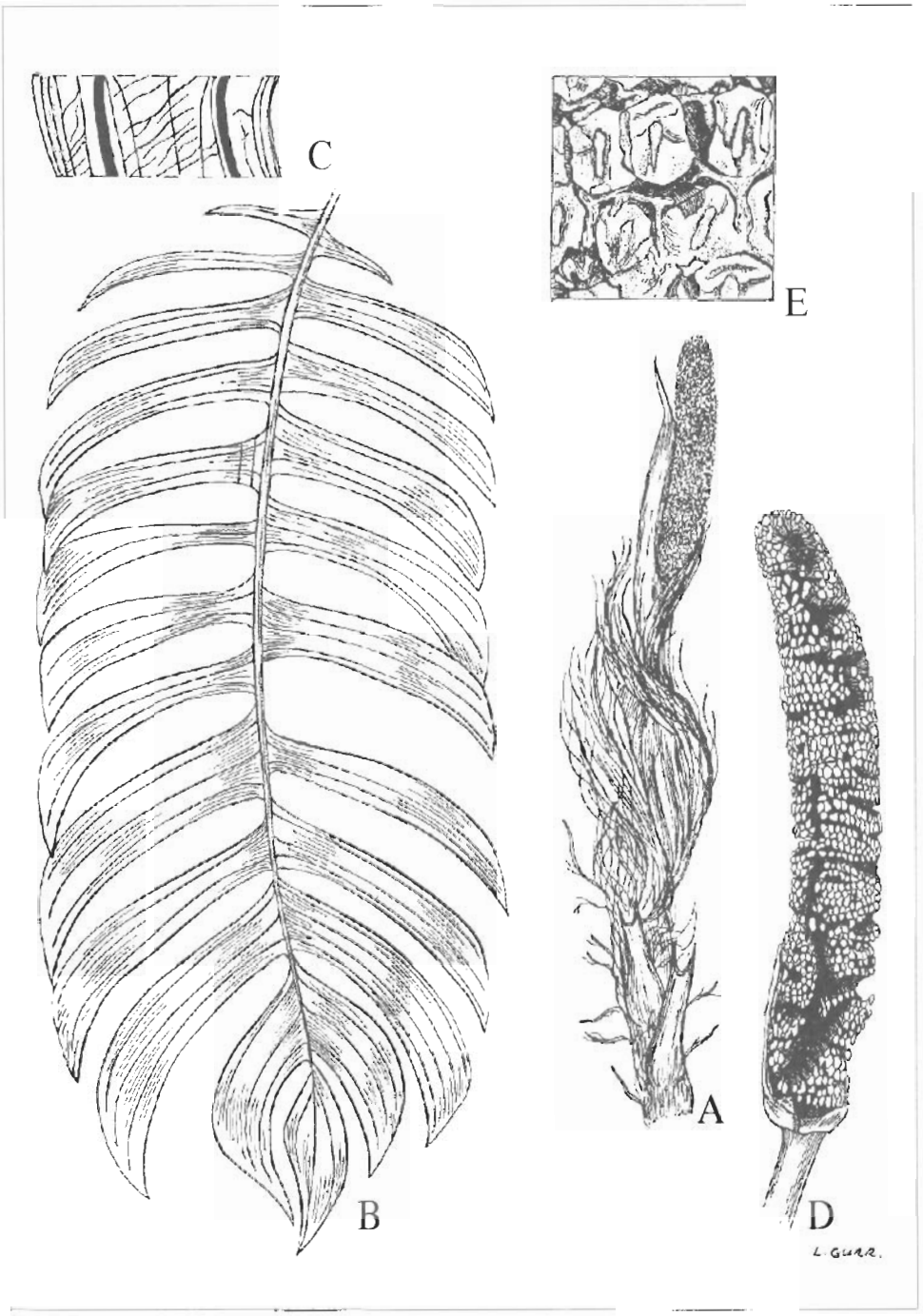

Figure 9. Rhaphidophora korthalsii Schott
A. flowering shoot, leaves removed x $^1/_2$; B. leaf lamina x $^1/_4$; C. venation detail x 2; D. inflorescence, spathe removed x 1; E. spadix detail, post floral x 8. All from *Kerr 15051*.

juvenile shoot; *pre-adult plants* never forming terrestrial colonies; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, densely leafy, flowering stems; *stems* smooth, bright green, with sparse to copious prophyll, cataphyll and petiolar sheath fibre, especially at the stem apices, internodes to 15 x 3.5 cm, separated by prominent oblique leaf scars, older stems sub-woody; *flagellate foraging stems* absent; *clasping roots* densely arising from the nodes and internodes, prominently pubescent; *feeding roots* abundant, adherent and free, very robust, densely ramentose-scaly; *leaves* distichous; *cataphylls and prophylls* membranaceous, soon drying degrading to intricately reticulate fibres, these only very slowly falling; *petiole* shallowly grooved, upper part ± terete, (1–) 9–65 x 0.2–1.5 cm, smooth, apical and basal genicula prominent; *petiolar sheath* prominent, membranaceous, strongly to slightly unequal on one side, extending almost to or reaching the apical geniculum, of ± short-duration, soon degrading into persistent netted fibres, these eventually falling to leave a prominent, slightly corky scar; *lamina* of seedlings overlapping in the manner of roof shingles, entire, lanceolate, 5–11 x 3.5–6 cm, base slightly cordate, lamina of pre-adult and adult plants free, entire, pinnatipartite, pinnatisect or pinnatifid, 10–44 x 14–94 cm, broadly oblong-elliptic to oblong lanceolate, slightly oblique, membranaceous to chartaceous or sub-coriaceous, base truncate and very briefly decurrent, apex acute to acuminate, individual pinnae 1–10 cm wide, frequently perforated basally adjacent to the mid-rib, thus appearing stilted; *mid-rib* very prominently raised abaxially, slightly sunken adaxially; *primary venation* pinnate, raised abaxially, somewhat impressed adaxially, 2–4 primary veins per pinna; *interprimaries* sub-parallel to primaries, slightly raised abaxially, slightly impressed adaxially; *secondary venation* strongly reticulate, slightly raised; *tertiary venation* invisible; *inflorescence* solitary to several together, first inflorescence subtended by a membranaceous prophyll and one or more cataphylls, these swiftly degrading to netted fibres, subsequent inflorescences subtended by one or more swiftly degrading cataphylls, the whole forming a mass of developing and open inflorescences and developing infructescences partially concealed by persistent netted cataphyll and prophyll remains; *peduncle* slightly laterally compressed to terete, 6–26 x 1–1.5 cm; *spathe* narrowly canoe-shaped, stoutly beaked, 10–30 x 3–5 cm, stiffly fleshy, greenish to dull yellow, gaping wide at female receptivity and then swiftly falling to leave a large straight scar at the base of the spadix; *spadix* cylindrical, sessile, inserted ± level on peduncle, 9–26 x 1.5–2 cm, dull green to dirty white; *stylar* region rather well developed, mostly rhombohexagonal, 1.5–2 x c. 2 mm, slightly conical; *stigma* punctiform to slightly elliptic, if the latter then mostly longitudinally orientated, c. 0.3–0.5 x 0.2–0.4 mm; *anthers* barely exserted at anthesis; *infructescence* 14–27 x 3–

3.5 cm, dark green ripening to dull orange, stylar tissue abscising to reveal orange ovary cavity pulp.

Distribution: Peninsular Malaysia (Kelantan, Pahang, Penang, Perak, Selangor, Terengganu), Singapore. Widespread throughout tropical south Asia from Sumatera and southern Thailand to Borneo and the Philippines eastwards through the tropical western Pacific.

Habitat: Disturbed lowland primary or secondary dipterocarp forest, lower and upper hill forest, wet pre-montane and montane forest, on granite, sandstone, clay and limestone, occasionally in freshwater swamp forest. 10–1700 m altitude.

Notes: 1. *Rhaphidophora korthalsii* is a very widespread and variable species, hence the extensive synonymy. However, as with *Epipremnum pinnatum* (L.) Engl. (Boyce, 1998) there are several geographical elements that, given more intensive study, might warrant formal taxonomic recognition. Unfortunately current herbarium material is inadequate to confirm these plants' status and more field observations are needed.

2. Sterile herbarium material lacking the pre-adult stage may prove difficult to distinguish from *Epipremnum pinnatum*. Mature leaves of 'typical' *E. pinnatum* never have more than one primary lateral vein per pinna and the stems of *R. korthalsii* lack the prominent irregular whitish longitudinal crests and older stems the distinctive matt to sub-lustrous pale brown papery epidermis typical of *E. pinnatum*. The feeding roots of *R. korthalsii* are prominently scaly while those of *E. pinnatum* are lenticellate-corky. The pre-adult stage of *R. korthalsii* is a shingle climber with oblong-elliptic to ovate, slightly falcate upwards pointing leaves overlapping in the manner of roof tiles.

3. Fertile material of *R. korthalsii* and *Epipremnum pinnatum* is readily separated by the shape of the style apex (round versus trapezoid) and the shape and orientation of the stigma (± punctiform and circumferential versus strongly linear and longitudinal) and, if fruits are mature, by seed characters. The fruits of *R. korthalsii* each contain many small ellipsoid seeds with a brittle, smooth testa whereas *E. pinnatum* has fruits with two large, strongly curved seeds with a bony and ornamented testa.

4. In Peninsular Malaysia confusion with *R. tetrasperma* and *R. nicolsonii* is possible. The former is readily separable by the generally smaller and comparatively broader adult leaves (to 42 x 38 cm), and by the individual

pinnae lacking the prominent parallel primary lateral veins and in never being perforated close to the midrib. *Rhaphidophora nicolsonii* is distinguished by the ovate leaves and by the petiolar sheath extending $^1/_2$ – $^3/_4$ along the petiole.

Other specimens seen: PENINSULAR MALAYSIA: Kelantan - Tanah Merah, Pergau Dam site, logging road to Sg Renyok Intake, *Boyce 667* (K, KEP); Pahang - Cameron Highlands, *Henderson SFN 23475* (K, SING); Fraser's Hill, *Henderson SFN 11426* (BO, SING), *Nur SFN 11079* (BO, SING); Taman Negara, between Sg Putih and Kuala Tahan, *Soepadmo 809* (KLU); Pulau Tioman, Teker to Joara, *Stone 11977* (KLU, MO); Bk Koman, *Zai & Kasim UKMB 02914* (UKMB); G. Senyum (limestone), *Henderson SFN 22318* (BO, SING); Penang - Government Hill, *Maingay 2213* (K); Perak - Kledang Saiang Reserve, *Arnot 33687* (KEP); Bk Larut, *Boyce 679* (K, KEP), *Kunstler 6893* (CAL, K, UC), *Ridley 11419* (K); G. Hijau, *Burkill & Haniff SFN 12586* (K, SING); Ipoh, above Perak Hill Temple, *Chin 997* (KLU) Tanjong Pondok FR, 12 miles north of Taiping, *Nicolson 1075* (SING, US); Selangor - Ulu Gombak, mile 22 on new highway, *Croat 53280* (MO); Dusan Mangis, Gombak FR, *Farah s.n.* (UKMB); Selangor, between Fraser's Hill and the Semangkok Pass, *Burkill FMS 7761* (BO, K, SING); Templer Park, *Hassan 25* (UKMB); Anak Takun (limestone), Templer Park, *Hassan & Latif 140;* Terengganu - Bk Besi, Dunggun, *Mk. Ar. UKMB 04958* (UKMB); (UKMB); SINGAPORE: 'Singapore', *Wallich 9109* (K); Bk Timah, *Hullett 906* (K), *907* (K), *Ridley s.n.* (SING); Seletar FR, near pipe line, *Sinclair SFN 5480* (E, SING); Seletar FR, behind Mee Soon village, *Sinclair SFN 5516* (E, SING); Northeast end of MacRitchie Reservoir, *Sinclair SFN s.n* (E, L, P, SING).

8. Rhaphidophora lobbii Schott

Rhaphidophora lobbii Schott, Prodr. Syst. Aroid. (1860) 379; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 240; Hook.f., Fl. Brit. India 6 (1893) 544; Ridl., Mat. Fl. Malay Penins. 3 (1907) 41–42; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 33–34; Ridl., Fl. Malay Penins. 5 (1925) 122; Henderson, Malayan Wild Flowers, Monocots, (1954) 238, Fig. 142 A — [*Rhaphidophora lobbii* Schott, Bonplandia 5(2) (1857) 45, *nom. tant.*] — *Scindapsus lobbii* (Schott) Ender, Index Aroid. (1864) 74 — Type: Singapore, *Lobb 44* (K, holo).

Small to moderate, somewhat slender, leptocaul, homeophyllous liane to 5 m; *seedling* leafy at germination and skototropic by alternating series of

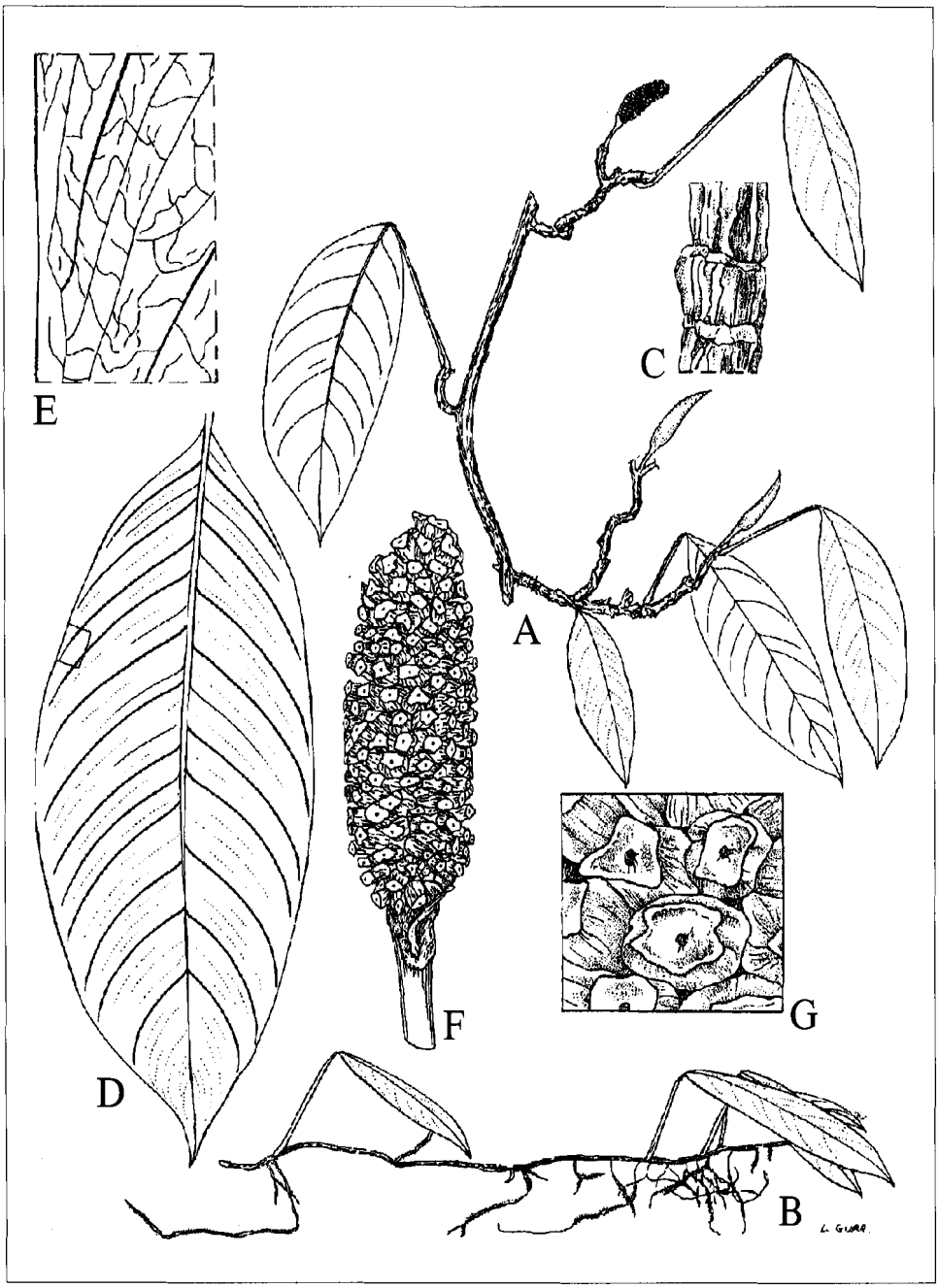

Figure 10. Rhaphidophora lobbii Schott
A. portion of stem with two flowering shoots x $^1/_3$; B. pre-adult terrestrial shoots x $^1/_3$; C. stem detail x 3; D. leaf lamina x $^3/_4$; E. venation detail x 4; F. inflorescence, spathe fallen x 2; G. spadix detail, early fruiting x 8. A & C from *Kunstler 10571*; B from *Boyce 995*; D & E from *Nauen s.n.*; F & G from *Alvins 270*.

congested leafy and elongated leafless shoots; *pre-adult plants* forming diffuse terrestrial colonies; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and long moderately elaborated, free, sympodial, densely leafy, flowering stems; *stems* puberulent-scabrid to asperous, especially on older growth, climbing stems weakly rectangular to ± terete in cross section, free stems ± terete in cross section, often branching extensively and growing to moderate lengths pendent under their own weight, dull brown, without prophyll, cataphyll and petiolar sheath fibre, internodes to 13 x 0.6 cm on adherent and free shoots, flowering shoots with much shorter internodes, separated by weak to rather prominent, slightly oblique leaf scars, older stems woody; *flagellate foraging stems* absent; *clasping roots* sparsely arising from the nodes and internodes of clinging stems, densely pubescent; *feeding roots* rather rare, sometimes adherent but often free, pubescent; *leaves* weakly spiralled and often sparsely arranged on adherent and proximal portions of free shoots, densely spirally-distichous distally on flowering shoots; *cataphylls and prophylls* membranaceous, very quickly drying and falling; *petiole* grooved adaxially, 4–9.5 x 0.2–0.3 cm, smooth, with a moderate apical and prominent basal geniculum; *petiolar sheath* slightly prominent, extending beyond the apical geniculum by two ligules, very swiftly drying and falling in strips to leave a continuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, narrowly elliptic to elliptic-lanceolate to oblong or oblanceolate, 6–24 x 2–10 cm, very softly coriaceous, upper surfaces slightly glossy, lower surfaces pale satin-matt, drying markedly discolorous, dark brown above, pale brown below, base cuneate to acute or sub-ovate, briefly decurrent, apex acute to ovate-acuminate, with a prominent apiculate tubule; *midrib* slightly raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially, prominent (dark veins against pale lamina) in dried material; *interprimaries* parallel to, but much less distinctive than, primaries, very slightly raised abaxially; *secondary and tertiary venation* ± invisible in fresh material, barely visible in dried specimens, reticulate; *inflorescence* solitary, subtended by a fully developed foliage leaf and a very quickly falling cataphyll; *peduncle* compressed-cylindric, 1.5–5 x 0.15–0.4 cm; *spathe* cigar-shaped, stoutly long-beaked, 3–5 x 0.4–1 cm, thickly fleshy, exterior minutely puberulent, dull green to yellowish, swiftly falling at female receptivity to leave a substantial, slightly oblique, scar; *spadix* slender cylindrical, sessile, inserted level on peduncle, 3–3.5 x 0.4–0.5 cm, dull yellow-white; *stylar* region rather well developed, mostly rhombohexagonal, 1.9–2.4 x c. 2 mm, truncate; *stigma* punctiform, c. 0.3 mm diam., prominent in dried material; *anthers* barely exserted at anthesis, pollen extruded from between ovaries; *infructescence* oblong-

cylindric, 2.5–4 x 1–1.2 cm.

Distribution: Peninsular Malaysia (Kedah, Malacca, Pahang, Perak, Selangor, Terengganu), Singapore, southern Thailand, Sumatera, throughout Borneo extending to the Philippines (Palawan) and Sulawesi.

Habitat: Lowland to hill dipterocarp forest on wet to inundated soils, peat swamp and fresh water swamp forest. 10–200 m altitude.

Notes: 1. A distinctive climber by the combination of the slender, asperous stems and softly leathery leaves, a combination of characters unknown in any other Malaysian *Rhaphidophora*. In dry material the strongly discolorous leaves, combined with the primary veins prominently darker than the abaxial leaf surface, are unmistakable.

2. *Rhaphidophora lobbii* is widespread and often common in Peninsular Malaysia and that there are not more collections is puzzling. Only one collection is recorded for Pasoh F.R. (*Boyce* 1338), particularly odd given that in Pasoh substantial stands of *R. lobbii* occur in partially inundated ground close to the boardwalk leading from the laboratory and guest accommodation complex.

3. *Rhaphidophora lobbii* is habitually found in wet to inundated ground, an unusual habitat for a monsteroid liane.

Other specimens seen: PENINSULAR MALAYSIA: Kedah - Ayer Tunjang, *Furtado s.n.* (SING); near Keroh, *Nauen s.n.* (SING); Malacca - 'Malacca', *Griffith 5961* (K), *Maingay 3252* (K, L); Selandor, *Alvins 270* (SING); Negeri Sembilan - Pasoh FR, trail to and environs of Canopy Walkway, *Boyce 1338* (K, KEP); Pahang - Sg Renoris, Taman Negara *Fitt 9* (K); Sg Lembing, *Hardial 2* (K, SING); Lancang, Bk Rengit, *Zainudin C18* (UKMB); Perak – 'Perak' *Scortechini 135b* (K); Ulu Bubong, *Kunstler 10571* (K); Bk Larut, *Kunstler 2019* (BM, K), *Kunstler 2677* (K); Selangor - Banting, Telok FR, *Kassim & Zainudin s.n.* (UKMB); Terengganu - Kemaman, Ulu Kajang, *Corner s.n.* (SING). SINGAPORE: 'Singapore', *Schwabe s.n.* (B); Bk Timah, *Ridley s.n.* (SING); Chan Chu Kang, *Ridley s.n.* (SING); Krangi, *Ridley s.n.* (SING); Selitar, *Ridley s.n.* (SING).

9. Rhaphidophora maingayi Hook.*f.*

Rhaphidophora maingayi Hook.*f.*, Fl. Brit. Ind. 6 (1893) 543; Ridl., Mat.

Fl. Malay Penins. 3 (1907) 43; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 37; Ridl., Fl. Malay Penins. 5 (1925) 123 — Type: Malaysia, Malacca, 28 July 1868, *Maingay 2972* (K, holo; L iso).

Rhaphidophora apiculata Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 383, *nom. illeg., non* K. Krause (1912, New Guinea), **synon. nov.** — Based on: Indonesia, Sumatera, Sibolangit, Borem Bander Ceroe, 15 Feb. 1917, *Lörzing 4733* (BO).

Large, occasionally very large, robust, pachycaul homeophyllous liane to 20 m; *seedling stage* a non-skototropic shingling shoot; *pre-adult plants* occasionally forming small terrestrial colonies of appressed shingling shoots; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and long, moderately elaborated, free, sympodial, densely leafy, flowering stems later pendent under their own weight; *stems* smooth, climbing stems rectangular in cross section, the angles often winged, the surfaces between slightly convex, free stems spreading, irregularly four-angled in cross section, sometime irregularly terete, branching little, growing moderate lengths, green, later mid-brown, with very sparse to very copious untidy prophyll, cataphyll and petiolar sheath fibre at the apices of active shoots, internodes to 13 x 2.5 cm on adherent shoots, shorter and less stout on free shoots, separated by large oblique leaf scars, older stems woody; *flagellate foraging stems* infrequent, often of great length, ± rectangular in cross section; *clasping roots* densely arising from the nodes and internodes of clinging stems, densely pubescent; *feeding roots* rare, adherent, pubescent; *leaves* distichous to distichous-spiralled on adherent and free shoots, those distal on flowering shoots densely so; *cataphylls and prophylls* membranaceous, very quickly drying and degrading into netted and tangled fibres; *petiole* deeply grooved adaxially, 5–23 x 0.25–0.5 cm, smooth, apical and basal genicula weakly defined; *petiolar sheath* very prominent, extending to and encircling the apical geniculum, briefly ligulate, very swiftly drying and degrading into netted untidy fibres, eventually falling to leave a continuous conspicuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, elliptic to elliptic-lanceolate or falcate-oblong, 8–43 x 2.5–15 cm, coriaceous, upper surfaces semi-glossy, lower surfaces matt, base sub-acute to decurrent, apex sub-acute with a somewhat prominent apiculate tubule, margins very slightly reflexed in dried material; *mid-rib* raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially; *interprimaries* parallel to primaries and only slightly less prominent, very slightly raised abaxially and adaxially; *secondary* and *tertiary venation* ± obscure in fresh

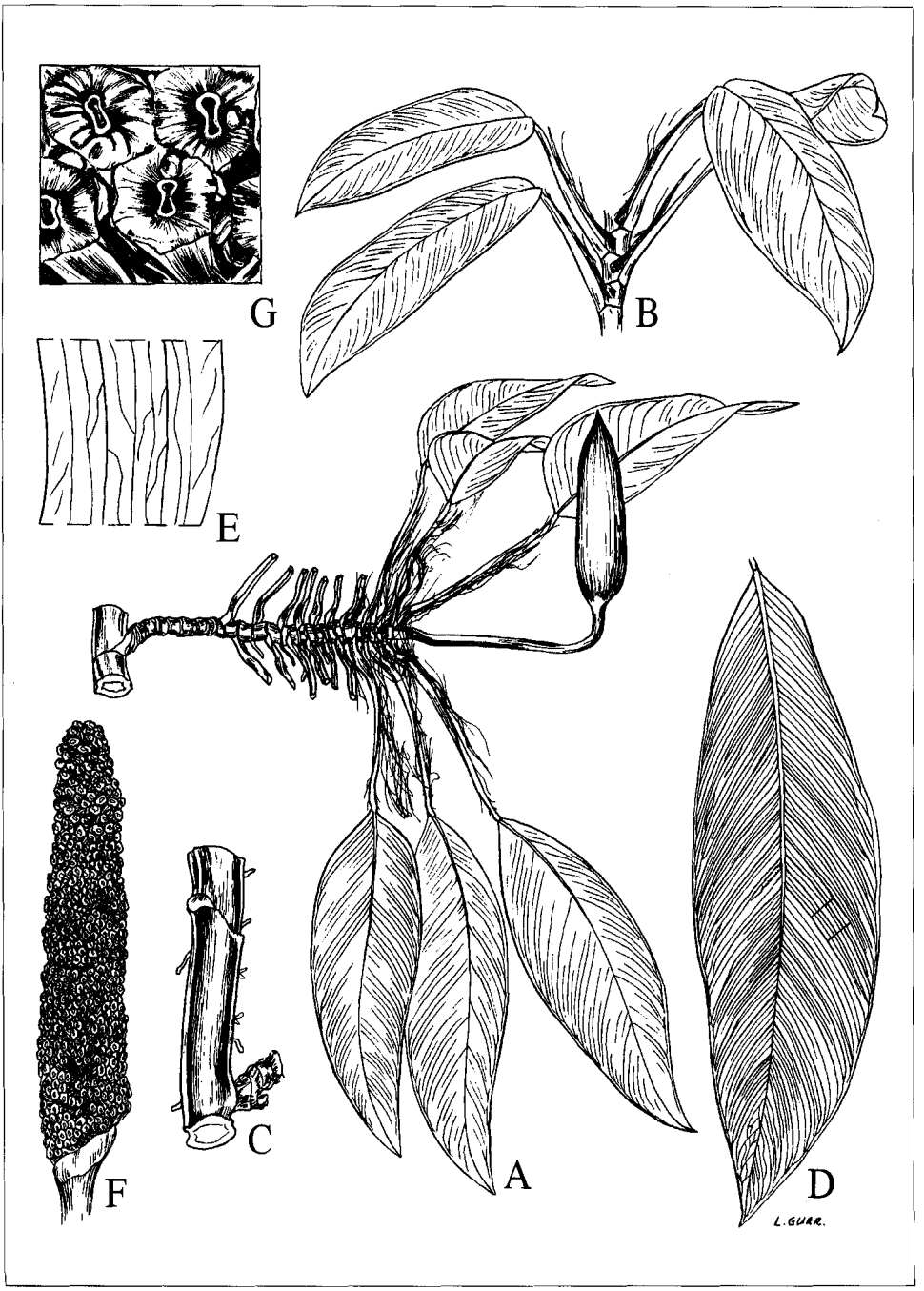

Figure 11. Rhaphidophora maingayi Hook.*f.*
A. flowering shoot x 1/3; B. portion of adult, sterile shoot x 1/6; C. stem cross section detail x 1/3; D leaf lamina x 1/2; E. venation detail x 2; F. inflorescence, spathe fallen x 3/4; G. spadix detail, post anthesis x 8 All from *Boyce 664*.

material, visible as a faint reticulum in dried specimens; *inflorescence* solitary, subtended by a fully developed foliage leaf and sparse to copious netted petiolar sheath, prophyll and cataphyll fibre; *peduncle* compressed-cylindric, 10–15 x 0.3–0.5 cm; *spathe* canoe-shaped, stoutly short-beaked, 12–22 x 2.5–6.5 cm, thickly stiff-fleshy, exterior dull green with black bruising, white with yellow margins internally, swiftly falling at female receptivity; *spadix* tapering-cylindrical, ± sessile, inserted level on peduncle, 9–10 x 1.5–1.7 cm, cream; *stylar* region, mostly rhombohexagonal, 1.5–2 x 1.7–2.1 mm, truncate; *stigma* slightly longitudinally elliptic, raised, c. 0.3 mm diam.; *anthers* barely exserted at anthesis, pollen extruded from between ovaries; *infructescence* not seen.

Distribution: Peninsular Malaysia (Kelantan, Malacca, Penang, Selangor), southern Thailand and Sumatera.

Habitat: Open disturbed forest remnants on steep slopes, on sandstone. 755 m altitude.

Notes: 1. Plants of the *R. montana* complex with copious prophyll, cataphyll and petiolar sheath fibre at the apices of active shoots are here referred to *R. maingayi* but might represent an undescribed species since the type of *R. maingayi* (*Maingay 2972*) bears only a very few such fibres. However, while the typical form of these fibre-bearing plants is extremely distinctive, there exists a range of intermediates with considerably less fibre that encompass the plant represented by *R. maingayi* and almost intergrade with the fibre-free plants of typical *R. montana.*

2. *Rhaphidophora maingayi* is virtually indistinguishable from *R. montana* (q.v.) but for the presence of very sparse to copious netted prophyll, cataphyll and petiolar sheath remains at the shoot apices. While this seems a weak character it does serve to distinguish the species in habitat and, indeed, *R. maingayi* and *R. montana* are sympatric but do not intergrade in northern Peninsular Malaysia (e.g., *Boyce* 661 and *Boyce* 664) and southern Thailand (Boyce, *pers. obs.*)

3. Alderwerelt's *R. apiculata*, a *nom. illeg.* antedated by *R. apiculata* K Krause (New Guinea), is almost certainly conspecific (and treated here as such) with *R. maingayi* but is odd in drying with curiously olive-greenish yellow leaves.

Other specimens seen: PENINSULAR MALAYSIA: Kelantan - Tanah Merah, Pergau Dam site, logging road to Sg Long Intake 1, *Boyce 664* (K,

KEP); Malacca - Panchor, *Goodenough 1296* (SING); Penang - Pulau Betong, *Curtis 2885* (K, SING); Selangor - Kuala Selangor, Sg Tinggi, *Nur* SFN *s.n.* (SING).

10. Rhaphidophora minor Hook.*f.*

Rhaphidophora minor Hook.f., Fl. Brit. Ind. 6 (1893) 544; Ridl., Mat. Fl. Malay Penins. 3 (1907) 41; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 21, Fig. 4; Ridl., Fl. Malay Penins. 5 (1925) 121–122; Henderson, Malayan Wild Flowers, Monocots, (1954) 238, Fig. 142 A — Type: Malaysia, Malacca, *Griffith 5988* (K, lecto; K, P, isolecto, selected here). Hooker cited three clearly conspecific syntypes. That chosen is the most complete specimen with developing and mature inflorescences and infructescences. The other collections cited by Hooker are *Scortechini s.n.* [Perak (CAL)] and *Maingay 3041* [Malacca (K)].

Rhaphidophora celebica K. Krause, Notizbl. Bot. Gart. Berlin-Dahlem. 11 (1932) 331 —Type: Indonesia, Sulawesi, northwest of the island, near Toli-Toli, Jan. 1910, *Schlechter 20698* (B, holo).

[*Rhaphidophora palawanensis* Furtado, *nom. nud. in sched. non.* Merr. (1925)]

Small to moderate, slender, leptocaul, homeophyllous liane to 6 m; *seedling* not observed; *pre-adult plants* forming diffuse terrestrial colonies; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and long moderately elaborated, free, sympodial, densely leafy, flowering stems; *stems* smooth, flexuous, climbing stems ± terete, occasionally weakly 4-angled in cross section, free stems somewhat laterally compressed in cross section, often branching extensively, growing to considerable lengths and pendent under their own weight with flowering tips upturned, without prophyll, cataphyll and petiolar sheath fibre, internodes to 13 x 1.2 cm on adherent and free shoots, flowering shoots with much shorter internodes, separated by weak straight leaf scars, older stems woody; *flagellate foraging stems* absent; *clasping roots* arising sparsely or singly from the clinging stems, pubescent; *feeding roots* solitary from nodes, free, stout, slightly pubescent; *leaves* weakly distichous and sparsely arranged on adherent and proximal portions of free shoots, moderately densely distichous distally on flowering shoots; *cataphylls and prophylls* membranaceous, very quickly drying and falling; *petiole* grooved adaxially, 3 – 6 x 0.1 – 0.25 cm, smooth,

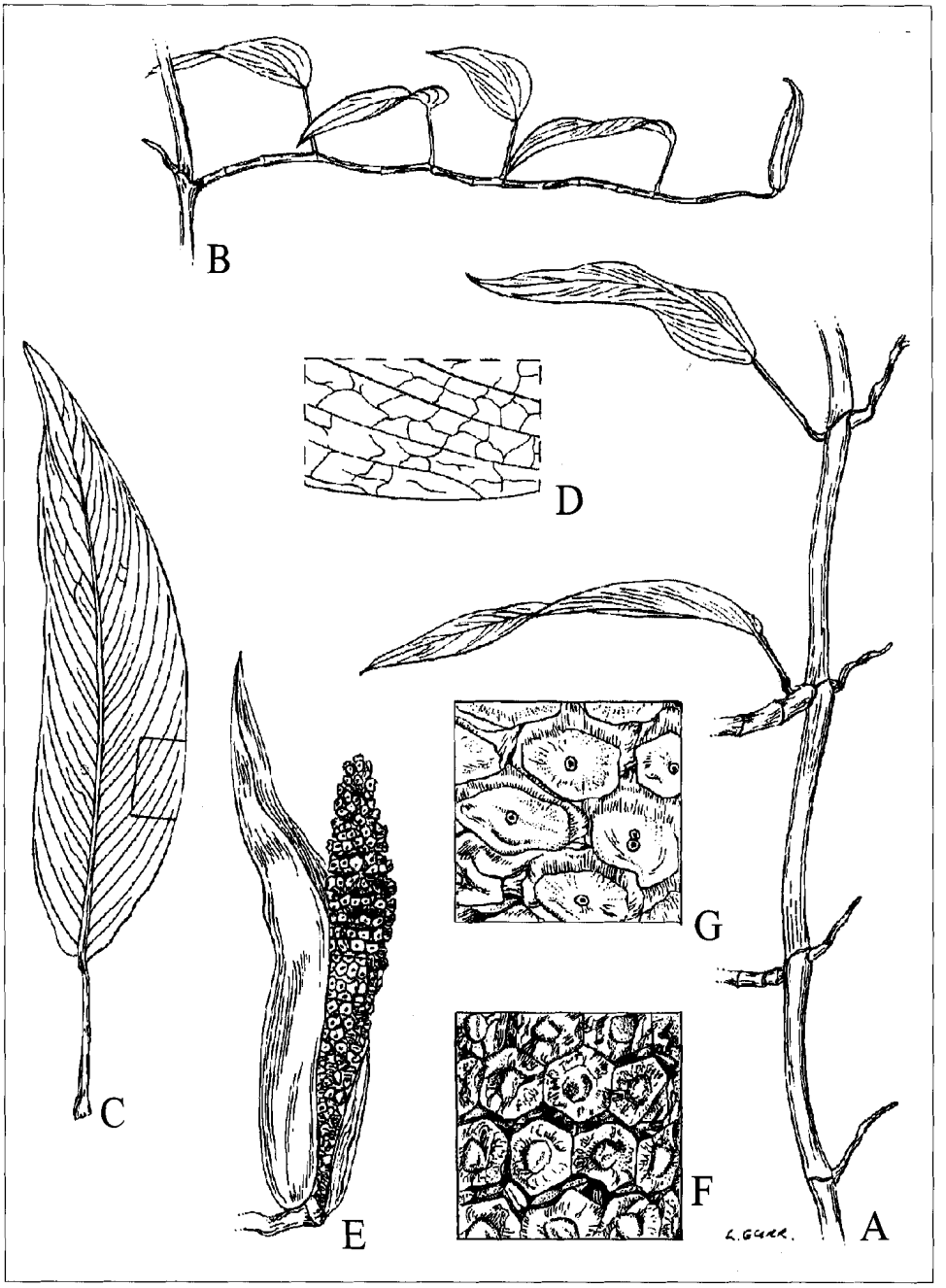

Figure 12. Rhaphidophora minor Hook.*f.*
A. portion of adult, sterile shoot x $^1/_3$; B. flowering shoot x $^1/_6$; C. leaf lamina x $^2/_3$; D. venation detail x 2; E. inflorescence, spathe just beginning to abscise x $1^1/_2$; F. spadix detail, post female receptivity, pre-anthesis x 8; G. spadix detail, early fruiting x 5. A, C – F from *Kerr 14700*; B, G from *Niyomdham et al. 1062.*

with a slight apical and prominent basal geniculum; *petiolar sheath* slightly prominent, extending beyond the apical geniculum by two small ligules, very swiftly drying and falling in strips to leave a continuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, narrowly falcate-elliptic to falcate-lanceolate or falcate-oblanceolate, 2.5–16 x 1.2–3 cm, thinly coriaceous, drying pale straw-coloured, base cuneate to acute or sub-ovate, apex acute with a prominent tubule; *midrib* raised abaxially, slightly raised adaxially; *primary venation* pinnate, slightly raised on both surfaces prominent (raised)in dried material; *interprimaries* sub-parallel to, but much less distinctive than, primaries, sometimes degrading into weakly reticulate venation, very slightly raised abaxially; *secondary and tertiary venation* ± invisible in fresh material, barely visible in dried specimens, reticulate; *inflorescence* solitary, subtended by a fully developed foliage leaf and a very quickly falling cataphyll; *peduncle* compressed-cylindric, 3–4 x 0.3–0.5 cm; *spathe* cigar-shaped, stoutly long-beaked, 3–9 x 1–1.5 cm, thin, dull green to dull yellow, swiftly falling at female receptivity to leave a large, straight, scar; *spadix* slender cylindrical, sessile, inserted level on peduncle, 2.5–7 x 0.5–0.6 cm, dull yellow-white; *stylar* region rather well developed, mostly rhombohexagonal, 1.4–2 x c. 2 mm, truncate; *stigma* punctiform, c. 0.3 mm diam., slightly prominent in dried material; *anthers* well-exserted at anthesis; *infructescence* oblong-cylindric, 4.5–7 x 1–2.5 cm.

Distribution: Peninsular Malaysia (Johore, Malacca, Pahang, Perak), Singapore, southern Thailand, Sumatera, throughout Borneo, into the Philippines (Mindanao, Palawan), and Sulawesi.

Habitat: Lowland forest, along stream margins, sometimes in swampy soil. 10–100 m altitude.

Note: In the fresh state confusion with *R. sylvestris* is possible, although the thinner, more prominently veined leaf and long beaked spathe of *R. minor* are diagnostic. Dried material of *R. minor* is notable for the uniformly pale straw coloured leaves.

Other specimens seen: PENINSULAR MALAYSIA: Johore - Pontian, Kukup FR, *Ahmed KEP 96213* (KEP); Jalan Mersing, *Kadim & Noor 223* (K, L, SING); Sungai Mawai, off Sedili Besar river, near Mawai Baharu, Kota Tinggi, *Maxwell 78-274* (L, SINU); Sg Tebrau, *Ridley 11631* (SING); Kampong Kelantan, Kota Tinggi, *Shah & Noor 860* (L, K, SING). *Sinclair SFN 10790* (E, K, L, SING); Johore river floodplain, *Stone 8692* (KLU); Malacca - Bk Kayu Luang, *Alvins 5843* (SING); Pahang - Ayer Etam

Pekai, *Ridley s.n.* (SING); Pulau Tioman, Joara Bay, south corner, *Burkill s.n.* (SING); Perak - Sg Krian Estate, *Spare SFN 33280* (K, SING). SINGAPORE: Tuas, *Ridley 4608* (BM, K); Pulau Sarimbun, *Sinclair SFN 5833* (E, L, SING).

11. Rhaphidophora montana (Blume) Schott

Rhaphidophora montana (Blume) Schott, Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 128; Engl. in A. & C. DC., Monogr. Phan. 2 (1879) 240–241; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 40–41; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 386–387 — *Calla montana* Blume, Catalogus (1823) 62 — *Scindapsus montanus* (Blume) Kunth Enum. pl. 3 (1841) 64 ('*montana*') — [*Rhaphidophora sylvestris* (Bl.) Engl. var. *montana* (Bl.) Nicolson, *comb. ined. in sched. var.*] — Type: Indonesia, Java, Antjal, *Blume s.n.* (L, lecto; L isolecto, selected here). No type was explicitly cited by Blume at the time of publication, nor in the later printing of the protologue in Flora (1825) 147. At L there are two Blume sheets agreeing very well with the protologue. There has been much unnecessary confusion over *Calla montana* and the application of the name *Anadendrum montanum* Schott (= A. *microstachyum* (de Vriese & Miq.) Alderw. & Backer. See Alderwerelt, 1920.

Rhaphidophora angulata (Miq.) Schott, Prodr. Syst. Aroid. (1860) 379 — *Scindapsus angulatus* Miq., Fl. Ned. Ind. 3 (1856) 219 — Type: Indonesia, Sumatera, Doekoe, *P.W. Korthals s.n.* (U, holo).

Rhaphidophora fallax Schott, Ann. Mus. Bot. Lugd.-Bat. 1 (1863) 128, **synon. nov.** — Type: Indonesia, Java, *Zippelius s.n.* (L, holo; K, L, P, iso).

Rhaphidophora elliptica Ridl., J. Straits Branch Roy. Asiat. Soc. 44 (1905) 186; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 39 – 40, **synon. nov.** — Type: Malaysia, Sarawak, Bau, July 1903, *Ridley* s.n. (SING, holo).

Rhaphidophora burkilliana Ridl., Fl. Mal. Pen. 5 (1925) 121, **synon. nov.** — Type: Malaysia, Selangor, Batu Caves, 2 Oct. 1922, *Nur SFN 8965* (SING, holo; BM, K, iso).

Large, occasionally very large, robust, pachycaul homeophyllous liane to 15 m; *seedling stage* a non-skototropic shingling shoot; *pre-adult plants* occasionally forming small terrestrial colonies of appressed shingling shoots;

adult shoot architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and long, moderately elaborated, free, sympodial, densely leafy, flowering stems later pendent under their own weight; *stems* smooth, climbing stems rectangular in cross section, the angles often strongly winged, the surfaces between more-or-less flat, free stems spreading, four-angled in cross section, branching little, growing to short or moderate lengths, green, later mid-brown, without fibre at the apices of active shoots, internodes to 16 x 2.5 cm on adherent shoots, usually shorter and less stout on free shoots, separated by large oblique leaf scars, older stems woody; *flagellate foraging stems* frequent, often of great length, ± rectangular in cross section; *clasping roots* densely arising from the nodes and internodes of clinging stems, densely pubescent; *feeding roots* rare, adherent, pubescent; *leaves* distichous-spiralled on adherent and free shoots, those distal on flowering shoots densely so; *cataphylls and prophylls* membranaceous, very quickly drying and falling; *petiole* deeply grooved adaxially, 10–23 x 0.25–0.5 cm, smooth, apical and basal genicula weakly defined; *petiolar sheath* very prominent, extending to and encircling the apical geniculum, briefly ligulate, very swiftly drying and falling to leave a continuous conspicuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, elliptic to elliptic-lanceolate or falcate-oblong, 8–43 x 2.5–15 cm, coriaceous, upper surfaces glossy, lower surfaces semi-matt, base sub-acute to decurrent, apex sub-acute with a somewhat prominent apiculate tubule, margins very slightly reflexed in dried material; *mid-rib* raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially; *interprimaries* parallel to primaries and only slightly less prominent, very slightly raised abaxially and adaxially; *secondary* and *tertiary venation* ± obscure in fresh material, visible as a faint reticulum in dried specimens; *inflorescence* solitary, subtended by a fully developed foliage leaf and one or more cataphylls; *peduncle* compressed-cylindric, 10–15 x 0.3–0.5 cm; *spathe* canoe-shaped, stoutly very short-beaked, 12–22 x 2.5–6.5 cm, thickly stiff-fleshy, dull yellow, paler internally, swiftly falling at female receptivity; *spadix* tapering-cylindrical, ± sessile, inserted level on peduncle, 9–20 x 1.5–2 cm, cream; *stylar* region, mostly rhombohexagonal, 1.9–2.2 x 1.9–2.3 mm, truncate; *stigma* punctiform to slightly longitudinally elliptic, raised, c. 0.3 mm diam.; *anthers* barely exserted at anthesis, pollen extruded from between ovaries; *infructescence* 9–17 x 1.5–2.5 cm.

Distribution: Peninsular Malaysia (Kedah, Kelantan, Malacca, Pahang, Selangor), Singapore, southern Thailand, Sumatera, Java, Nusa Tenggara, throughout Borneo, Sulawesi, and Maluku.

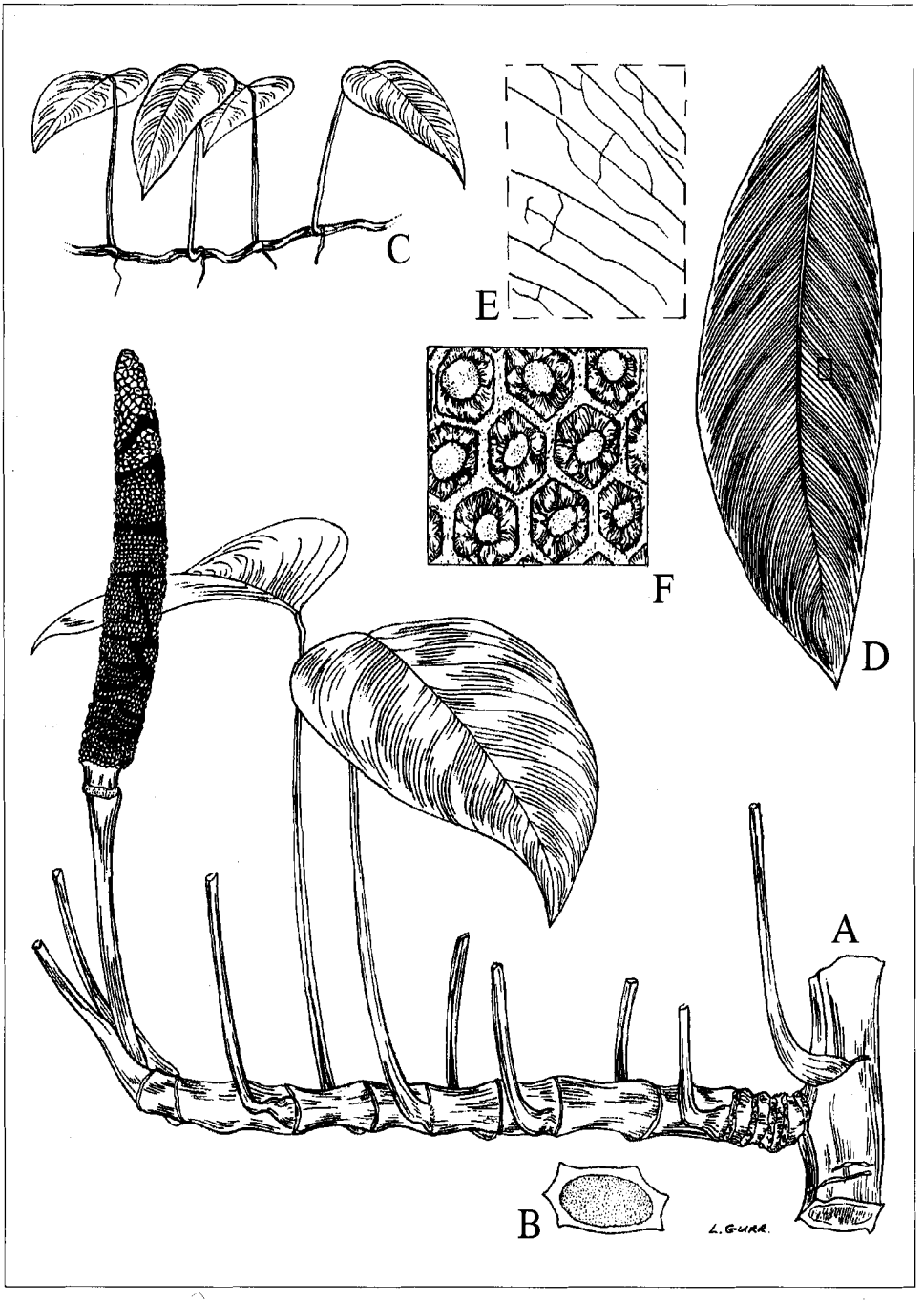

Figure 13. Rhaphidophora montana (Blume) Schott
A. flowering stem x $^{1}/_{2}$; B. stem cross-section x $^{2}/_{3}$; C. pre-adult terrestrial shoot x $^{1}/_{2}$; D. leaf lamina x $^{1}/_{3}$; E. venation detail x 4; F. spadix detail, post female receptivity, pre-anthesis x 6. A & B, D – F from *Kanda s.n.*; C from *Nicolson 943*.

Habitat: Open to closed, primary to disturbed secondary forest, often on steep slopes on heavy soils over granite, sandstone or limestone. 90–1180 m altitude.

Notes: 1. A taxonomically difficult species in the Hongkongensis Group that, although easy to recognize in its typical manifestation (shoot apices without fibre, spreading stiff elliptic leaves and a tapering cylindrical spadix to 9–16 cm long) exists in a range of forms displaying subtle differences in leaf shape, inflorescence size, and mostly known from fewer than three, usually inadequate, collections, all usually collected without shoot apices. It is the extremes of these forms have been described as distinct species.

2. The use of traditional morphology has proved a most unsatisfactory method for delimiting *R. montana*. With an alpha-taxonomy now being established, there are excellent opportunities for further study of the *R. montana* complex using macromolecular data, field observations, and statistical techniques to further resolve this group.

Other specimens seen: PENINSULAR MALAYSIA: Kedah - Pulau Langkawi, Tanjong, Pulau Langgong, *Boey 527* (KLU); Kelantan - Tanah Merah, Pergau Dam site, logging road to Sg Long Intake 1, *Boyce 661* (K, KEP); Malacca, *Ms de St Pollias et de La Croix 270* (P); Pahang - Taman Negara, dam site, *Latiff et al. 10* (UKMB); Selangor - Ulu Gombak, *Ridley s.n.* (K), Mile 14, *Kasim & Rahim 739* (UKMB), c. Mile 15, *Croat 53313* (MO), Mile 22 on new highway, *Croat 53282* (MO); Bk Takun (limestone), *Harun 32* (UKMB); Ulu Kuang, *Provencher 11* (KLU); UKM Campus FR, Bangi, *Zainudin & Rahim s.n.* (UKMB). SINGAPORE: Singapore Botanic Gardens, 'Garden Jungle', *Sinclair SFN 4831* (E, SING), *Croat 53239* (MO) *Nicolson 1006* (L, SING, US); Bk Timah, *Ridley s.n.* (SING), *Croat 53247* (MO); Chan Chu Kang, *Goodenough s.n.* (SING).

12. Rhaphidophora nicolsonii P.C. Boyce, *sp. nov.*

Rhaphidophora nicolsonii similis *R. tetrasperma* differt laminis foliorum maioribus manifeste magis coriaceis, vagina petiolari circa tres quartae longitudinid petioli attingente, spadice maiore, regione stylari rotundata — TYPUS: Malaysia, Pahang, Cameron Highlands, milestone 43, near Brinchang village, 21 July 1961, *Nicolson 1186* (US, holo; B, BH, K, L, SING, iso).

Large, robust, pachycaul, heterophyllous liane of unknown ultimate height;

seedling stage not observed; *pre-adult plants* (occasionally?) forming terrestrial colonies; *adult shoot* architecture comprised of elongated, clinging, physiognomically monopodial, densely leafy, flowering stems; *stems* smooth, without cataphyll and petiolar sheath fibre, internodes to 6 x 2–3 cm, separated by prominent oblique leaf scars; *flagellate foraging stems* not observed; *clasping* and *feeding roots* not observed; *leaves* weakly spiral-distichous; *cataphylls and prophylls* membranaceous, soon drying and falling; *petiole* shallowly grooved, upper part ± terete, 45–70 x 0.5–0.7 cm, smooth, apical and basal genicula very prominent; *petiolar sheath* prominent, extending 1/2 – 3/4 along petiole, soon falling to leave a prominent, slightly corky scar; *lamina* sparsely to rarely ± entirely pinnatipartite, or pinnatisect, 28–53 x 26–47 cm, broadly ovate to ovate-lanceolate to lanceolate, coriaceous, base truncate and very weakly cordate, apex acute to acuminate, individual pinnae up to 4 cm wide, but often leaves with only one division per side and thus pinnae accounting from up to 3/4 of entire lamina, lamina drying strongly discolorous, mid-brown adaxially, pale brown abaxially; *midrib* very prominently raised abaxially, slightly sunken adaxially; *primary venation* pinnate, raised abaxially, slightly impressed adaxially; *interprimaries* sub-parallel to primaries and only slightly less prominent, slightly raised abaxially, slightly impressed adaxially; *secondary venation* sub-parallel to interprimaries, slightly raised; *tertiary venation* reticulate; *inflorescence* solitary (always?); *peduncle* terete, to 19 x 1.5 cm; *spathe* not observed, probably falling swiftly; *spadix* stoutly cylindrical, sessile, inserted decurrently from 2 cm on peduncle, 14 x 2 cm, green; *stylar* region well developed, mostly rhombohexagonal, c. 2 x 2 mm, truncate, margins deflexed; *stigma* punctiform, c. 0.5 x 0.4 mm; *anthers* not observed; *infructescence* not observed.

Distribution: Peninsular Malaysia (Pahang). Endemic.

Habitat: Sub to upper montane forest. 1500–2000 m altitude.

Notes: 1. In general aspect, *R. nicolsonii* resembles *R. tetrasperma* but is readily distinguished by the larger, considerably more coriaceous leaves, by the petiolar sheath extending to, at most, three quarters along the length of petiole and in the larger spadix and rounded stylar region. If the inflorescence of *R. nicolsonii* proves to be solitary per flowering event this will be a further distinguishing character.

2. Outside of Malaysia *R. nicolsonii* appears to be related to *R. pertusa* (S India, Sri Lanka), *R. glauca* (Roxb.) Schott and *R. decursiva* (Roxb.) Schott (trans-Himalaya) and *R. grandis* Schott (western Himalaya) differing from

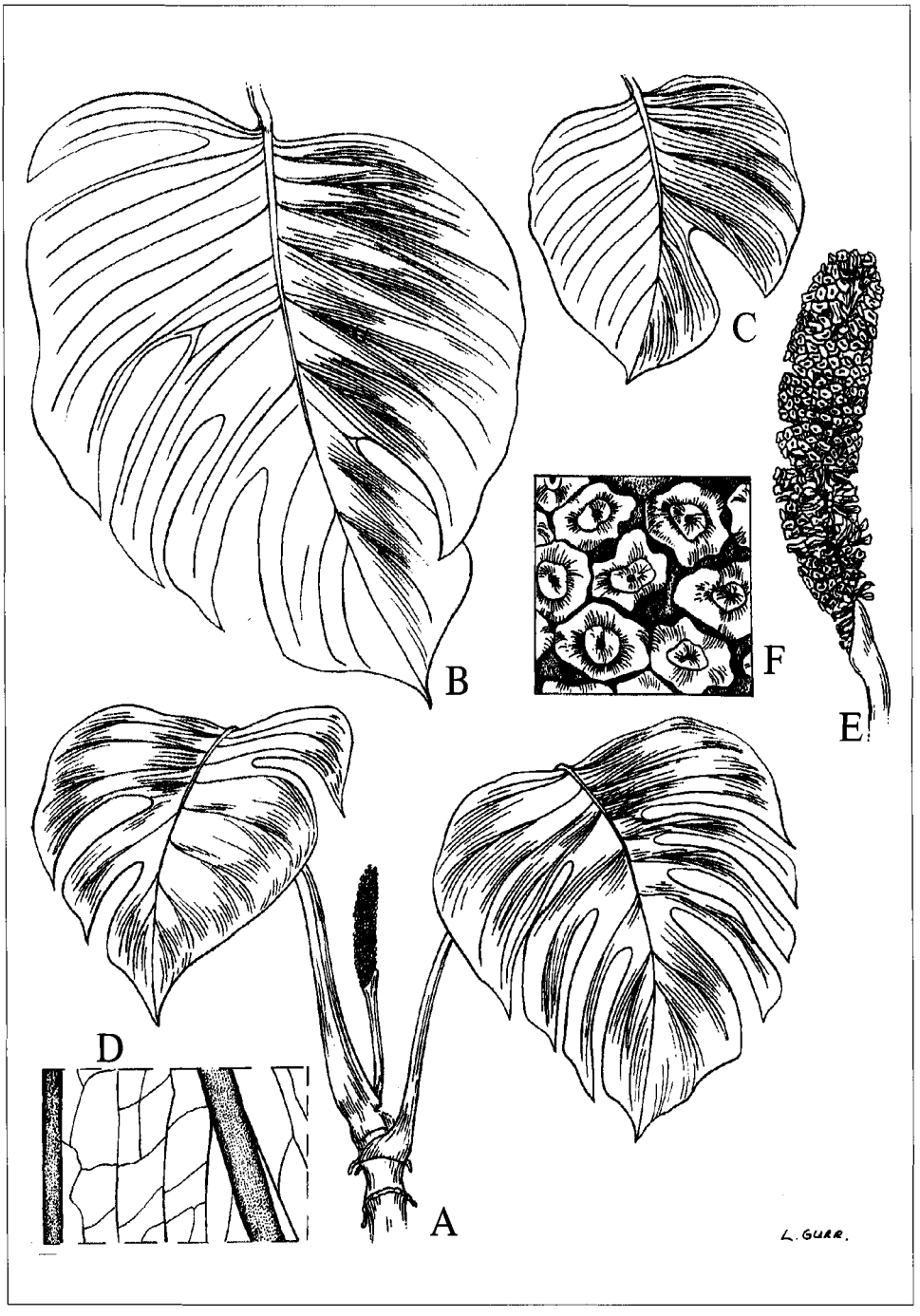

Figure 14. Rhaphidophora nicolsonii P.C. Boyce
A. flowering shoot x $^{2}/_{9}$; B. leaf lamina x $^{1}/_{6}$; C. leaf lamina x $^{1}/_{6}$; D. venation detail x 3; E. inflorescence, spathe fallen x $^{2}/_{3}$; F. spadix detail, post anthesis x 4. All from *Nicolson 1186.*

these species in degrees of leaf division, venation and texture and in inflorescence characters.

Other specimens seen: PENINSULAR MALAYSIA: Pahang - G. Brinchang, *Kiew RK4722* (SING); G. Berumban, *Wray 1579* (SING).

13. Rhaphidophora puberula Engl.

Rhaphidophora puberula Engl., Bot. Jahrb. Syst. 1 (1881) 180 & in Beccari, Malesia 1 (1882) 269–270; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 30; — Type: Indonesia, Sumatera, Padang, Ajer Mantjoer, Aug. 1878, *Beccari s.n.* (FI, holo; B, iso).

Rhaphidophora scortechinii Hook.*f.*, Fl. Brit. India 6 (1893) 545; Ridl., Mat. Fl. Malay Penins. 3 (1907) 42–43; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 23; Ridl., Fl. Malay Penins. 5 (1925) 122–123, **synon. nov.** — Type: Malaysia, Perak, *Scortechini 347* (K, holo; CAL, iso).

Rhaphidophora kunstleri Hook.*f.*, Fl. Brit. Ind. 6 (1893) 546; 548; Ridl., Mat. Fl. Malay Penins. 3 (1907) 43; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 30; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 338; Ridl., Fl. Malay Penins. 5 (1925) 123, **synon. nov.** — Type: Malaysia, Perak, Bk Larut, July 1883, *Kunstler 4538* (K, lecto; selected here). There are four conspecific collections labelled 'Type' in Hooker's handwriting at Kew. That chosen is in flower, with an expanded but still in *situ* spathe with part of the spadix visible and therefore is the most informative. The other collections are all by Kunstler from Perak: *Kunstler 532* Goping (K); *6796* Larut (K) and *8426* Taiping (K, SING).

Rhaphidophora gracilipes Hook.*f.*, Fl. Brit. Ind. 6 (1893) 545; Ridl., Mat. Fl. Malay Penins. 3 (1907) 41; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 30, Fig. 10; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 384; Ridl., Fl. Malay Penins. 5 (1925) 121, **synon. nov.** — Type: Malaysia, Perak, June 1886, *Kunstler 10271* (K, lecto; BM, SING, isolecto, selected here). The collection chosen is in flower with an intact spathe and the spadix visible and thus most useful for determination purposes. The other, clearly conspecific, syntypes of *R. gracilipes* are *Kunstler 2102* [Perak, Larut (BO, K)], *Kunstler 7940* [Perak (K)] and *Scortechini 1103* [Perak (K)].

Rhaphidophora megasperma Engl., Bot. Jahrb. Syst. 25 (1881) 8; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 29, Fig. 9; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 383, **synon. nov.** — Type: Indonesia, Kalimantan, Tumbang Hiang, 2 Sept. 1881, *H. Grabowski 48* (B, holo).

Rhaphidophora batoensis Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 27, **synon. nov.** — Type: Indonesia, Sumatera, Kepulauan Batu, 25 Sept. 1896, *Raap*370, (BO, lecto; B, isolecto, selected here). Engler cites two conspecific syntypes. The collection chosen is in flower (BO) and mature fruit (B). The other syntype, *Raap 325* (immature flower, BO), is also from Kepulauan Batu.

Rhaphidophora hallieri Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 385; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 196, **synon. nov.** — Type: Kalimantan, *Hallier 1187* (BO, holo; BO iso).

Rhaphidophora pilosula Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 386; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 196, **synon. nov.** — Type: Cult. Bogor Bot. Gard, June 1919, *Alderwerelt s.n.* (BO, holo).

Distribution: Peninsular Malaysia (Pahang, Perak, Selangor), Sumatera (including Kepulauan Batu and Kepulauan Mentawi), Nusa Tenggara, and throughout Borneo.

Moderate to large, rather robust, semi-pachycaul homeophyllous liane to 5 m; *seedling stage* not observed; *pre-adult plants* often forming small terrestrial colonies; *adult shoot* architecture comprised of elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and short, usually unbranched, free, sympodial, densely leafy, flowering stems; *stems* smooth, terete in cross section, with very sparse prophyll, cataphyll and petiolar sheath fibre, this soon falling, internodes to 13 x 1.5 cm on adherent shoots, usually shorter and stouter on free shoots, separated by large, straight, corky leaf scars, older stems woody; *flagellate foraging stems* absent; *clasping roots* sparsely arising from the nodes and internodes of clinging stems, pubescent; *feeding roots* rare, adherent, pubescent; *leaves* distichous on adherent and free shoots; *cataphylls and prophylls* membranous, quickly drying and degrading into very sparse fibres, these soon falling; *petiole* deeply grooved to basally canaliculate, 9–33 x 0.2–3 cm, with the distal portion and apical geniculum minutely pubescent, especially when newly expanded, apical and basal geniculum moderately prominent; *petiolar sheath* very prominent, extending to just below the apical geniculum, swiftly drying and degrading into sparse, soon-falling; *lamina* entire to slightly perforated,

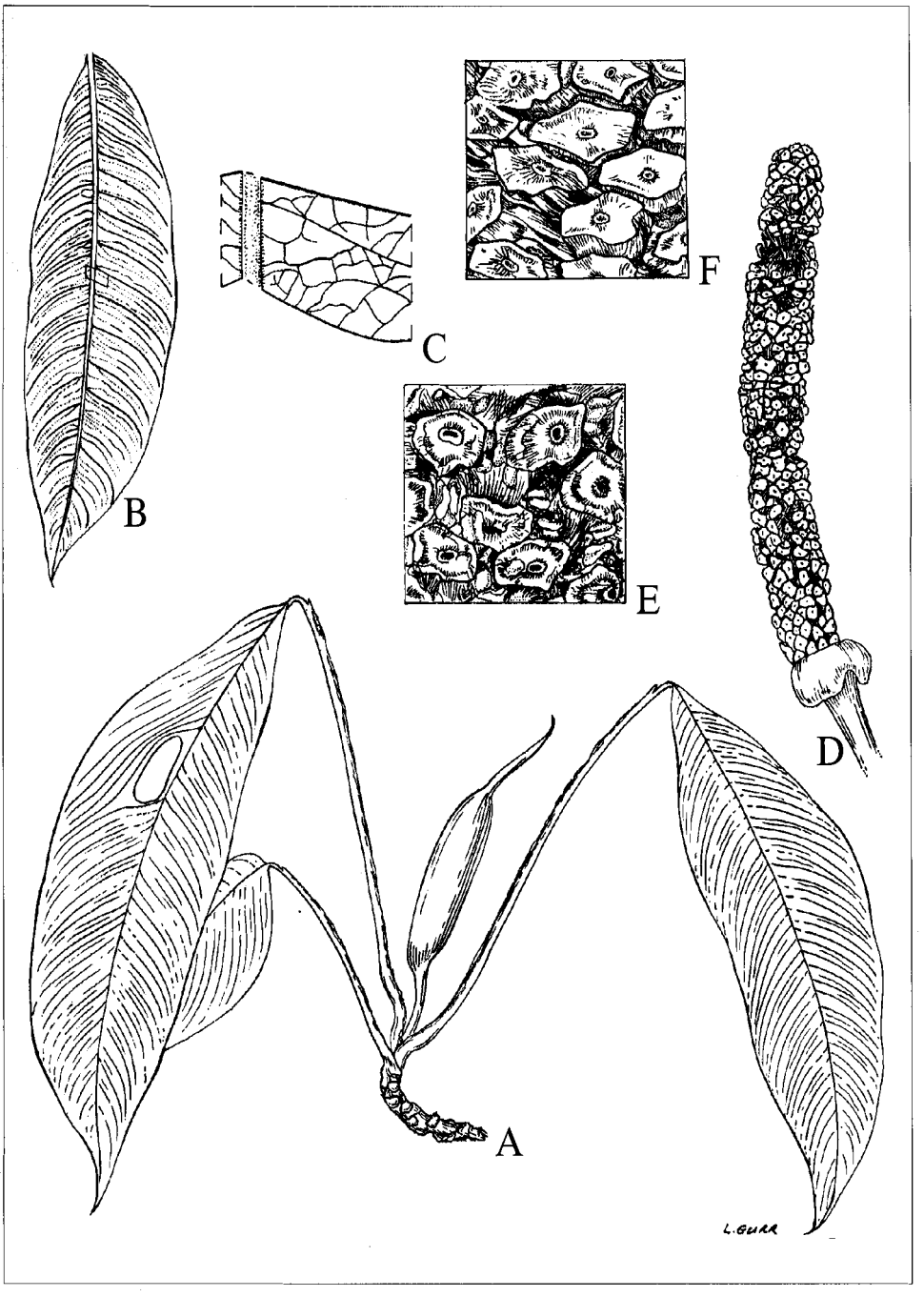

Figure 15. Rhaphidophora puberula Engl.
A. flowering shoot x $^1/_2$; B. leaf lamina x $^1/_3$; C. venation detail x 6; D. inflorescence, spathe removed; E. spadix detail, post anthesis x 6; spadix detail, early fruiting x 4. A & F from *Ridley 14444*; B – E from *Burkill 6267.*

perforations round to rhombic, extending c. $^1/_5$ – $^1/_4$ of lamina width on each side of the midrib, ovate to oblong-lanceolate or oblong-elliptic, oblique to falcate, minutely pubescent abaxially when young, 8–34 x 3.5–10.5 cm, thinly coriaceous to sub-chartaceous, base unequal, rounded, acute to slightly decurrent, apex acute to acuminate; *midrib* prominently raised and pubescent abaxially, ± sunken adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially, the leaf appearing slightly quilted, pubescent in younger leaves, indumentum mostly shed in older leaves; *interprimaries* sub-parallel to primaries, very slightly less prominent, slightly raised abaxially, slightly impressed adaxially; *secondary venation* tessellate to weakly reticulate, slightly raised; *tertiary venation* not visible; *inflorescence* solitary, very rarely two together, fragrance of frangipani and pineapple (*fide Hay et al.* 9029), subtended by a fully developed foliage leaf and, if more than one inflorescence, then second preceded by a large cataphyll; *peduncle* strongly compressed-cylindric, 4–9 x 0.4–0.6 cm; *spathe* canoe-shaped, stoutly long-beaked, 5.5–19 x 1–6.5 cm, stiff-fleshy, dull green to dull yellow, pale yellow internally, falling (after?) female receptivity to leave a large, straight scar; *spadix* very weakly clavate cylindrical, sometimes slightly curved, sessile, inserted ± level on peduncle, 3–11.5 x 1–1.6 cm, cream; *stylar region* mostly hexagonal, 1.5–2 x 2.1–2.5 mm, truncate; *stigma* punctiform, prominent, 0.5–0.75 x 0.45–0.75 mm; *anthers* exserted at anthesis; *infructescence* stoutly oblong-cylindrical, 4.5–14 x 1.5–2 cm.

Habitat: On trees and rocks in primary and secondary lowland to mid-elevation dipterocarp forest, often on steep slopes, on granite and limestone. 15–350 m altitude.

Notes: 1. Given the overall uniformity of the species, it is quite extraordinary that *R. puberula* should have been redescribed no fewer than seven times mostly on minor differences of leaf shape.

2. Superficially similar to *R. foraminifera*, especially in the perforate-leaf forms, *R. puberula* can be readily distinguished from *R. foraminifera* by the production of inflorescences on free lateral shoots and in having the active shoot apices without the characteristic black mucilage of *R. foraminifera*. Generally, flowering plants of the perforate-leaved forms of *R. puberula* have smaller leaves that are noticeably *less* perforated than those of *R. foraminifera*.

Other specimens seen: PENINSULAR MALAYSIA: Pahang - 8 miles south of Kuala Lipis, *Burkill & Haniff SFN 17065* (SING, UC); Perak - Batu Togoh, *Wray 2161* (SING); Upper Perak, *Wray 3605* (SING); Kuala

Kangsar, logging road up G. Bubu from Manong, *Boyce 704* (KEP); Ipoh, at 4th mile on Gopeng Road, *Burkill SFN 6267* (SING); Tambun, near Ipoh, on way to Tanjung Rambutan, *Hay, Anthony & Banka 9029* (NSW, KEP); Terong, *Ridley 14434* (K, SING); Perak, Tong Temple, Chemor, 4 miles north of Ipoh, *Sinclair SFN 9852* (E, L, SING); Selangor - Ulu Lui, Langsat, *Hassan & Kasim s.n.* (UKMB); Ulu Langat, Bk Jangkang, Kampong Pansom, *Umbai (for Hilliard) KL 1681* (K, KEP, L).

14. Rhaphidophora sylvestris (Blume) Engl.

Rhaphidophora sylvestris (Blume) Engl. in A. & C., DC, Monogr. Phan. 2 (1879) 239 & in Beccari, Malesia 1 (1882) 268; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 22–25, Fig. 6 (*'silvestris'*); Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 383; Ridl., Fl. Malay Penins. 5 (1925) 122 — *Calla sylvestris* Blume, Catalogus (1823) 62 — *Scindapsus sylvestris* (Blume) Kunth, Enum. pl. 3 (1841) 64 — [*Scindapsus angustifolius* Hassk., Flora 25 (2), Beibl. 1 (1842) 12, *nom. illeg.* — *Rhaphidophora angustifolia* (Hassk.) Schott in Bonplandia 5 (1857) 45, *nom. illeg.* based on the type of *Calla sylvestris* Blume] — Type: Indonesia, Java, *Blume 178* (L, lecto; 2 sheets; LE, isolecto, selected here). No type was explicitly cited by Blume at the time of publication, nor in the later printing of the protologue in Flora (1825) 147. At L there are two sheets collected by Blume under no. 178, and an un-numbered Reinwardt sheet, of appropriate chronology. Given that the the protologue appears to have been compiled from both the Blume and Reinwardt collections, these are here regarded as syntypes and typified accordingly.

Scindapsus lingulatus Hassk., Flora 25(2) Beibl. 1 (1842) 12; Schott, Prodr. Syst. Aroid. (1860) 378; Engl. in A. & C., DC, Monogr. Phan. 2 (1879) 248, **synon. nov.**— *Rhaphidophora lingulata* (Hassk.) Schott, Bonplandia 5 (1857) 45, **synon. nov.** — *Monstera lingulata* (Hassk.) C. Koch ex Ender, Index Aroid. (1864) 74, **synon. nov.** — Type: Indonesia, Java, *Hasskarl s.n.* (not traced and, as with many Hasskarl names, it is quite possible that a specimen was never prepared). Neotypification of *S. lingulatus* will be done when revising *Rhaphidophora* for Java.

Scindapsus aruensis Engl., Bull. Soc. Tosc. Ortic. 4 (1879) 270, **synon. nov.** — Type: Indonesia, Melaku, Aru Islands, Gabu-lengaw, May 1873, *Beccari s.n.* (FI, holo).

Rhaphidophora wrayi Hook.*f.*, Fl. Brit. India 6 (1893) 544; Ridl., Mat. Fl. Malay Penins. 3 (1907) 42; Engl. & K. Krause in Engl., Pflanzenr. 37

(IV.23B) (1908) 34; Ridl., Fl. Malay Penins. 5 (1925) 122, **synon. nov.** — Type: Malaysia, Perak, Larut, Besar, April 1882, *Kunstler 2939* (K, lecto; selected here). Hooker cites several conspecific syntypes. Unfortunately, the sheet (one of two sheets for the collection) of *Wray 662* explicitly cited by Hooker as '*Wray* mixed with 662' (the other sheet of the mixed collection *Wray 662* is the holotype of *Anadendrum montanum* Schott var. *longirostre* Hook.*f.*) is infertile and cannot be considered nomenclaturally useful despite the eponymous epithet. The collection chosen is the only syntype in which the spadix size and details can be readily seen and is the most useful for purposes of identification. The other syntypes are: *Scortechini 521* Perak (K), *Kunstler 6956* Perak (BM, K); *Wray* 'mixed with *662*' Perak (BM, K).

Rhaphidophora gratissima Becc., Nelle Foreste di Borneo (1902) 604, **synon. nov.** — *Rhaphidophora sylvestris* (Blume) Engl. var. *obtusata* Engl., Malesia 1 (1883) 268, **synon nov.** — Type: Malaysia, Sarawak, Kuching, Nov.1865, *Beccari PB952* (FI & FI spirit 423, holo; K, iso).

Rhaphidophora motleyana Engl. & K. Krause in Engler, Pflanzenr. 37 (IV.23B) (1908) 25, **synon. nov.** — Type: Indonesia, Kalimantan, Bangarmassin, 1857–1858, *Motley 741* (K, holo).

Distribution: Peninsular Malaysia (Negri Sembilan, Pahang, Penang, Perak, Selangor), Sumatera, Java, Nusa Tenggara, throughout Borneo, and Maluku.

Medium to large, occasionally very large, moderately robust, leptocaul to semi-pachycaul homeophyllous liane to 20 m; *seedling stage* a non-skototropic shingling shoot; *pre-adult plants* very seldom forming small terrestrial colonies of shingling shoots; *adult shoot* architecture comprised of greatly elongated, clinging, physiognomically monopodial, leafy, non-flowering stems and long, moderately elaborated, free, sympodial, densely leafy, flowering stems later pendent under their own weight; *stems* smooth, climbing stems rectangular in cross section, the angles often slightly winged, the surfaces between slightly concave, free stems rectangular to sub-terete in cross-section, green, later mid-brown, without prophyll, cataphyll and petiolar sheath fibre, internodes to 2.5–5 x 0.5–1 cm on adherent shoots, usually less stout on free shoots, separated by weakly defined, slightly oblique leaf scars, older stems woody; *flagellate foraging stems* frequent, often of great length, ± rectangular in cross section; *clasping roots* densely arising from the nodes and internodes of clinging stems, pubescent; *feeding roots* very rare, adherent, pubescent; *leaves* distichous on adherent and free shoots, those distal on flowering shoots densely so; *cataphylls and*

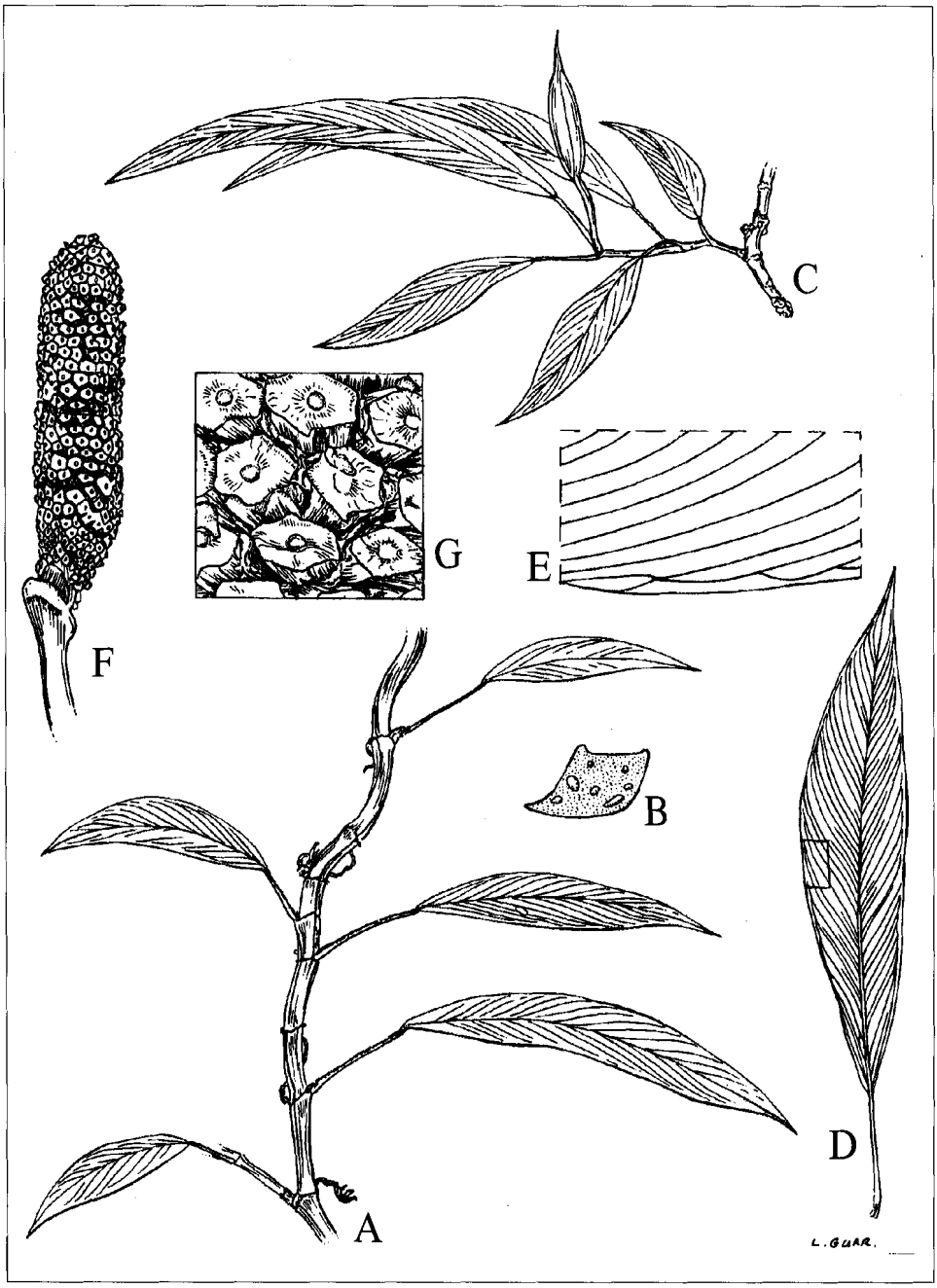

Figure 16. Rhaphidophora sylvestris (Blume) Engl.
A. portion of adult sterile stem x $^1/_3$; B. stem cross-section x 1; C. flowering shoot x $^1/_3$; D. leaf lamina x 1; E. venation detail x 4; F. inflorescence, spathe fallen x 1; G. spadix detail, post anthesis x 4. A & B from *Backer 11199*; C, F & G from *de Wilde & de Wilde-Duyfjes 13830*; D & E from *Afriastini 2399.*

prophylls membranous, very quickly drying and falling; *petiole* deeply grooved adaxially, 1–8.5 x 0.15–0.3 cm, smooth, apical and basal genicula weakly defined; *petiolar sheath* very prominent, extending to and encircling the apical geniculum, briefly ligulate, very swiftly drying and falling to leave a continuous conspicuous scar from the petiole base, around the top of the apical geniculum and back to the base; *lamina* entire, lanceolate-elliptic to falcate-lanceolate, slightly to markedly oblique, 4.5–32 x 1.75–8.5 cm, thinly coriaceous, upper surfaces slightly glossy, lower surfaces semi-matt, base sub-acute to briefly truncate, apex acute to slightly attenuate, with a prominent apiculate tubule; *midrib* slightly raised abaxially, slightly sunken adaxially; *primary venation* pinnate, slightly raised abaxially and adaxially; *interprimaries* parallel to primaries and only slightly less prominent, very slightly raised abaxially and adaxially; *secondary* and *tertiary venation* ± obscure in fresh material, visible as a faint reticulum in dried specimens; *inflorescence* solitary, subtended by a fully developed foliage; *peduncle* compressed-cylindric, 2–8.5 x 0.15–0.5 cm; *spathe* cigar-shaped, stoutly very short-beaked, 4.5–7.5 x 1–3 cm, thinly stiff-fleshy, dull yellow, paler internally, swiftly falling at female receptivity; *spadix* weakly clavate-cylindrical, sessile, inserted ± level on peduncle, 3–6 x 1–2.5 cm; *stylar* region, mostly rhombohexagonal, 1–2 x 1.5–2 mm, truncate; *stigma* punctiform, raised, c. 0.25–0.3 mm diam.; *anthers* exserted at anthesis; *infructescence* 6–8 x 2–2.5 cm.

Habitat: Damp to wet hills to sub-montane forest. 1100–1400 m altitude.

Notes: *Rhaphidophora sylvestris* is most similar to *R. montana* and *R. crassifolia*. From *R. montana* it may be distinguished by the narrower leaves, the lack of shoot tip fibre and by the shorter (3.5–6 cm compared with 9–16 cm in *R. montana*), clavate-cylindrical spadix. Overall *R. crassifolia* is very similar in appearance but may be readily identified by the considerably thicker leaves, especially notable in dried specimens, and the twisted primary adherent stem. Additionally, *R. crassifolia* is a species of lowland habitats.

Other specimens seen: PENINSULAR MALAYSIA: Negeri Sembilan - Langgang FR, *Kiew 2379* (KEP); Pahang - Fraser's Hill, on Selangor border, *Burkill & Holttum FMS 7859* (BO, K, SING), *Burkill & Holttum SFN 7862* (SING); below Fraser's Hill, Tras Valley, *Holttum SFN 11487* (SING), Richmond, *Shah & Noor 671* (K, SING), trail down the slope after RISDA office, *Zainudin, Muzni & Sharif 4634* (UKMB); Cameron Highlands, *Henderson SFN 23271* (BO, SING), Boh Plantations, *Nur SFN 32827* (KEP, MO, SING, UC), Ulu Telom, *Jaamat FMS 27284* (KEP); ravine 10 miles from Berinchang, *Bowen 11* (KLU); Penang - Government Hill Road,

Burkill SFN 4313 (K, SING); Perak – Maxwell Hill (Bk Larut), *Boyce 680* (K, KEP), *Burkill & Haniff SFN 12975* (K, SING), (Taiping Hills), *Ridley 11418* (BM, K, SING); (Trees Cottage), *Ridley 2960* (K); G. Hijau, *Stone 14391* (KLU).

15. Rhaphidophora tetrasperma Hook.*f.*

Rhaphidophora tetrasperma Hook.*f.*, Fl. Brit. India 6 (1893) 548; Ridl., Mat. Fl. Malay Penins. 3 (1907) 44–45; Engl. & K. Krause in Engl., Pflanzenr. 37 (IV.23B) (1908) 48; Ridl., Fl. Malay Penins. 5 (1925) 124 — Type: Malaysia, Perak, *Scortechini 169b* (K, holo).

Distribution: Peninsular Malaysia (Kelantan, Perak), and southern Thailand.

Small to medium-sized, rather slender, semi-pachycaul, heterophyllous liane to 5 m; *seedling stage* a non-skototropic shingling juvenile shoot; *pre-adult plants* very rarely forming terrestrial colonies; *adult shoot* architecture comprised of elongated, weakly clinging, physiognomically monopodial, flexuous, moderately leafy, non-flowering stems and weakly adherent or, more commonly, free lateral flowering stems; *stems* smooth, without prophyll, cataphyll and petiolar sheath fibre, internodes to 14 x 1 cm, separated by prominent straight leaf scars; *flagellate foraging stems* not observed; *clasping roots* sparsely produced from nodes and internodes; *feeding roots* stout, produced singly or in pairs from most nodes of free shoots; *leaves* weakly spiral-distichous; *cataphylls and prophylls* membranous, soon drying and falling; *petiole* shallowly grooved, 10–34 x 0.2–0.4 cm, smooth, apical and basal genicula slightly prominent; *petiolar sheath* prominent, extending to base of apical geniculum, soon falling to leave a prominent, slightly corky scar; *lamina* sparsely to ± entirely deeply pinnatipartite to nearly pinnatisect, occasionally with large rhombic perforations adjacent to midrib, 12–42 x 9.5–38 cm, broadly ovate to ovate-lanceolate, thinly coriaceous, base truncate or very weakly cordate, apex acute to acuminate, individual pinnae up to 6 cm wide; *midrib* prominently raised abaxially, slightly sunken adaxially; *primary venation* pinnate, raised abaxially, slightly impressed adaxially; *interprimaries* diverging from primaries, much less prominent, slightly raised abaxially, very slightly impressed adaxially; *secondary venation* weakly reticulate, very slightly raised; *tertiary venation* barely visible; *inflorescence* few together, subtended by two prominent cataphylls, these soon falling; *peduncle* terete, 2–2.5 x 0.3–0.4 cm; *spathe* canoe-shaped, 3–3.5 x 0.8–1.5 cm, stiffly fleshy, apparently falling swiftly, white with adherent black cataphyll remnants; *spadix*

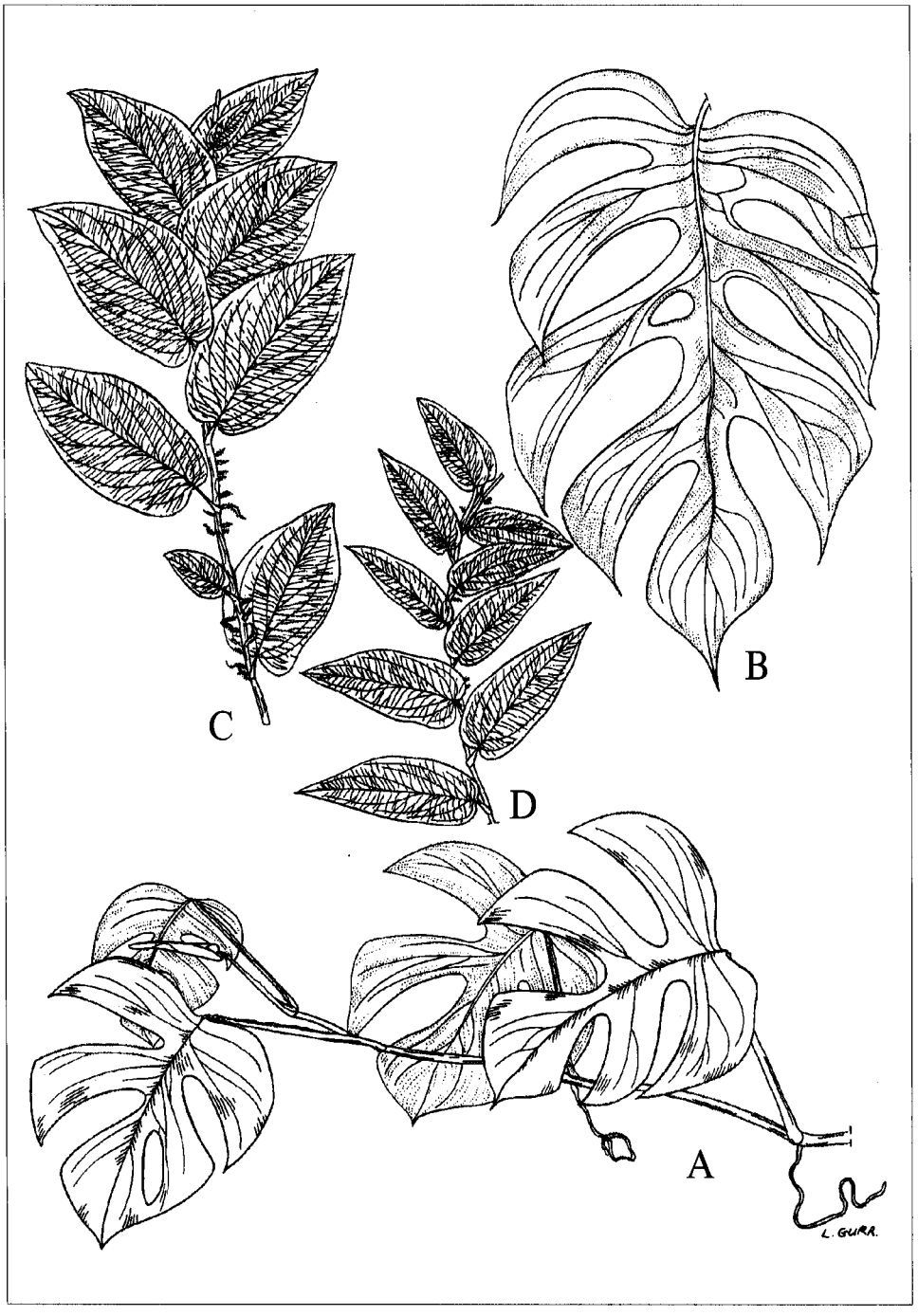

Figure 17. Rhaphidophora tetrasperma Hook.*f.*
A. pre-adult stem x $^1/_4$; B. leaf lamina x $^1/_3$; C. shingling shoot x $^1/_4$; D. shingling shoot x $^1/_4$. All from *Boyce 1224*.

cylindrical, sessile, inserted slightly decurrently on peduncle, 3–3.5 x 0.75–1 cm, white; *stylar* region well developed, mostly rhombohexagonal, c. 2 x 2 mm, truncate, margins deflexed; *stigma* elliptic, longitudinally orientated, c. 1 x 0.2 mm; *anthers* exserted at anthesis; *infructescence* not observed.

Habitat: Disturbed rather dry to moist or wet forest on sandstone and granite. 190–760 m altitude.

Notes: As noted under *R. nicolsonii* above, *R. tetrasperma* most closely resembles *R. nicolsonii* but may be readily distinguished by petiole sheath and leaf lamina characters.

Other specimens seen: PENINSULAR MALAYSIA: Kelantan - Tanah Merah, Pergau Dam site, logging road to Sg Long Intake 1, *Boyce 652* (K, KEP); Perak, - Bidor *Corner SFN s.n.* (SING); Sg Batang Padang, Tapah Hill Reserve, *Furtado SFN 33100* (SING).

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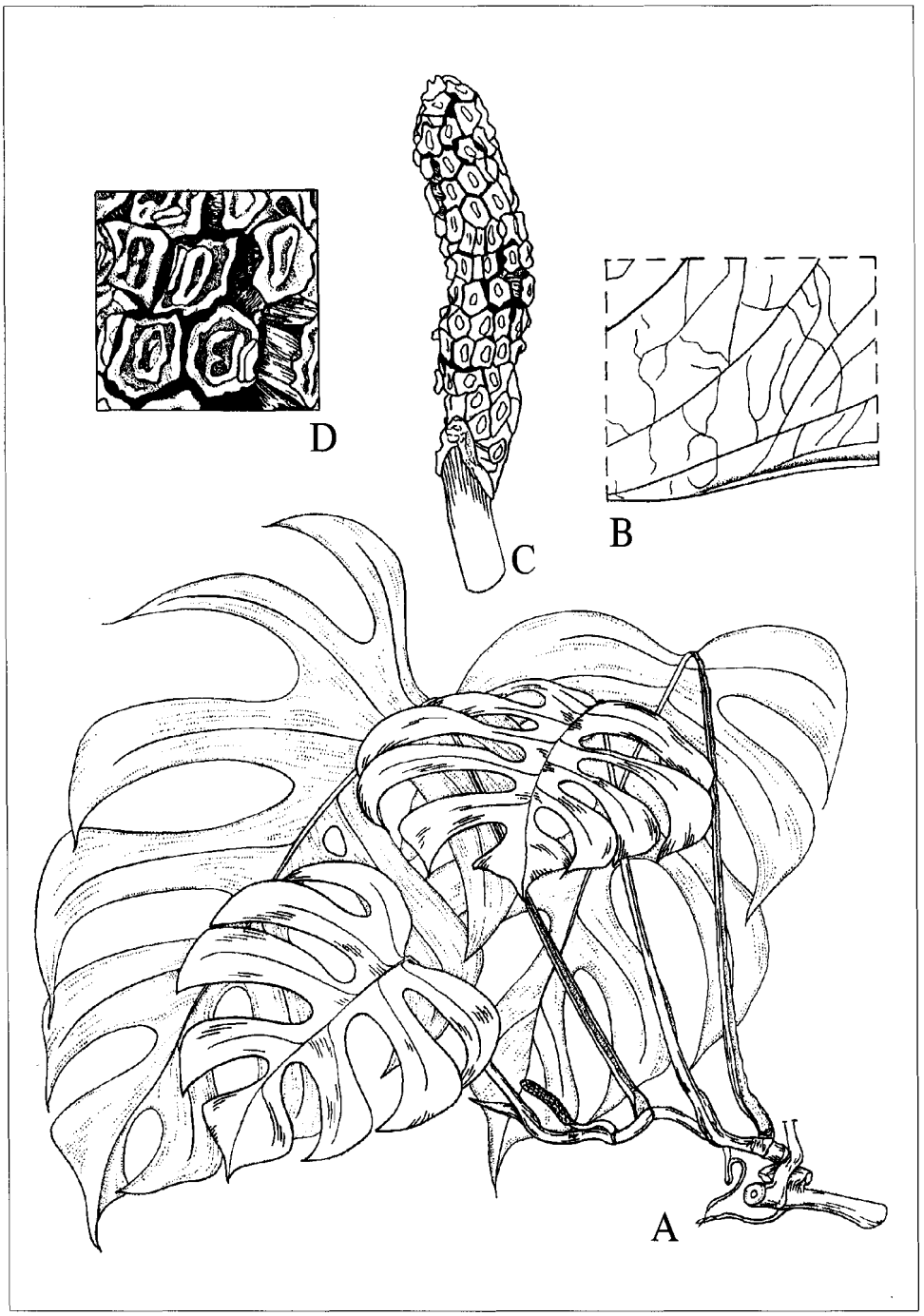

Figure 18. Rhaphidophora tetrasperma Hook.*f.*
A. Flowering shoot x $^1/_3$; B. venation detail x 3; C. inflorescence, spathe fallen x 2; D. spadix detail, post anthesis x 3. All from *Boyce 1224*.

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