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## A revision of *Licuala* (*Palmae*) in the Malay Peninsula

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**Summary.** *Licuala* is represented by 41 species, including 15 newly described, in the Malay Peninsula. Three new varieties are also described. Keys to and descriptions of all species and varieties, and listings of representative specimens, are provided.

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*Licuala*, a genus of small to medium-sized palms, and only rarely arborescent, is easily recognised by its characteristic fan-shaped fronds with segments that split right down to the hastula (the arcuate, often ridge-like, structure at the junction of the blade with the petiole on the upper surface). All species of *Licuala* are forest-floor plants and generally will not persist under open conditions. They are most common in the lowland forest, although some species are also found in other forest types.

The genus consists of about 130 species and is mainly Southeast Asian in distribution. It occurs from Vanuatu, the Solomon Islands and Queensland (Australia), westwards through the islands of Indonesia, New Guinea, Borneo, the Philippines, the Malay Peninsula, Thailand, Cambodia, Laos, Vietnam, south China, Myanmar, Bangladesh, north-east India and the Andaman Islands. New Guinea and the Sunda shelf territories of Borneo and the Malay Peninsula (the last including Peninsular Malaysia, Singapore and peninsular Thailand) appear to have the most species.

The name *Licuala* is derived from the Makassar (Moluccan) name *léko wala* (Backer 1936). It was first described by Rumphius (1741) in his *Herbarium Amboinense*, based on *L. arbor*, but this was pre-Linnean, so that Wurmb's *L. spinosa*, described in 1780 (Wurmb 1780), was the first post-Linnean species of the genus. Blume's (1836) revision of the genus listed eight species, but a number of these are synonyms of *L. spinosa* and *L. pumila*. Of the nine species in the *Historia Naturalis Palmarum* of Martius (1838), two were new. Griffith (1844) described a further four new species from the Malay Peninsula in his revision for the Palms of British East India. Further additions to the genus were made by Miquel (1861), Wendland & Drude (1875) and Beccari (1877).

In 1886, Beccari published the first comprehensive account of the genus. He included 36 species, of which 13 were newly described. He added more species later (Beccari 1921) and altogether recognised 71 species of *Licuala* in his monograph of Asiatic palms (Beccari 1931). Subsequently, even more species have been described (e.g., Burret 1939, 1940, 1941; Furtado 1940; Ridley 1907, 1925; Gagnepain 1937). The most recent revision of the genus for the Malay Peninsula is by Furtado (1940), who enumerated 24 species, including nine new. Since then, there has been very little work on the genus apart from a few publications of new species, viz., *L. tanycola* from Irian Jaya (Moore 1969), *L. lanata* from Borneo (Dransfield 1980), and *L. dransfieldii* (Kiew 1989) and *L. thoana* (Saw & Dransfield 1990) from Peninsular Malaysia.

The present account recognises 41 species in the Malay Peninsula, including 15 new species. Herbarium acronyms used under "Specimens examined" below are those accredited with the International Association for Plant Taxonomy, except that used for the herbarium of the Department of Biology, Faculty of Science and Environmental Studies, of the Universiti Pertanian Malaysia (UPM).

## SYSTEMATIC PART

**LICUALA** Wurm. in Verh. Bat. Genootsch. 2: 469 (1780); Thunb. in Kongl. Vetenskaps Nya Handlingar, 3: 287 (1782); Roxb., Flora Indica 2: 179 (1832); Blume, Rumphia 2: 37 (1836); Mart., Hist. Nat. Palm. ed. 1: 234 (1838); Griff., in Calcutta J. Nat. Hist. 5: 321 (1844); Mart., Hist. Nat. Palm. ed. 2: 234 (1849); Griff., Palms of British India 117 (1850); Miq., Flora Ind. Bat. 1: 254 (1861); Becc., Malesia 1: 80 (1877), Malesia 3: 69 (1886); Becc. & Hook. f., Fl. Brit. India 6: 430 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 159 (1907); Becc. in Webbia 5: 22 (1921); Ridl., Fl. Mal. Pen. 5: 24 (1925); Blatt., Palms of British India and Ceylon 86 (1926); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 186 (1933); Furtado in Gard. Bull. Straits Settlements 11: 31 (1940). Type species: *L. spinosa* Wurm.

*Pericycla* Blume, Rumphia 2: 47 (1838). Type: *P. penduliflora* Blume (= *Licuala penduliflora* (Blume) Miq.).

*Dammera* Lauterbach & K.M. Schumann in K.M. Schumann & Lauterbach, Die Flora der Deutschen Schützgebiete in der Südsee 201 (1901). Lectotype: *D. ramosa* Lauterbach & K.M. Schumann (= *Licuala ramosa* (Lauterbach & K.M. Schumann) Becc. (non Blume) = *L. beccariana* Furtado).

Very small to medium-sized, solitary or clustered, acaulescent to shrubby, rarely treelike, armed or unarmed, pleioanthic, hermaphroditic (very rarely dioecious) palms. Stem erect, decumbent, or very short and subterranean, ringed with close leaf scars, partly obscured by

remains of leaf sheaths, sometimes bearing short bulbil-like shoots at nodes near base of stem. Leaves palmate, marcescent; leaf sheath disintegrating into web of fibres; petiole adaxially channeled near base, rounded or channeled distally, abaxially rounded or angled, armed along margins with triangular spines, rarely unarmed, covered with caducous dense indumentum; adaxial hastula well developed, usually triangular, abaxial hastula absent; frond entire or split variously along abaxial ribs to very base to produce single to multiple-fold, wedge-shaped reduplicate segments, these in turn with very short splits along the abaxial folds and slightly longer splits along adaxial folds; central segment usually entire, sometimes bifid, rarely trifid, sometimes petiolulate; ribs often with caducous indumentum, transverse veinlets usually conspicuous. Inflorescence interfoliar, much shorter than leaves to much longer than leaves, varied in aspect and degree of branching, from spicate to branched to 2 orders, rarely to 3; peduncle short to very long, bearing a basal 2-keeled tubular prophyll, and 0–3 or more, similarly tubular closely sheathing, glabrous or tomentose peduncular bracts; rachis bracts usually tubular, sometimes much inflated, splitting on one side, sometimes not; subsequent orders of bracts minute; first-order branches spicate or branched to further second-order branches; rachillae few to *c.* 30 or more, crowded or patent, glabrous to variously scaly or hairy, wiry to swollen, sometimes ornamented with longitudinal ridges, bearing spirally arranged, distant or very crowded flowers. Flowers solitary or in groups of up to 5 or more, sessile or on short floral stalks, each subtended by a minute triangular bract, maturing almost simultaneously or sequentially within each floral cincinnus; calyx loosely to tightly enclosing corolla, sometimes stalked at base, cylindrical, cyathiform, obconical, truncate, irregularly splitting, or with 3 neat triangular pointed, bifid or rounded lobes, striate, sometimes not, glabrous or variously hairy; corolla usually exceeding calyx, tubular at base, divided into 3 thick triangular valvate lobes, glabrous to variously hairy, usually marked near tip of adaxial face with impressions of anthers; stamens 6, epipetalous, filaments distinct, somewhat flattened, or united into a conspicuous tube tipped with 6 equal or biseriate short and long teeth bearing erect or pendulous anthers, or androecial ring 3-lobed, 3 anthers borne on short distinct filaments, 3 borne at sinuses between lobes, anthers rounded or oblong, very small to moderate, latrorse; pollen elliptic monosulcate, with smooth rugulate, coarsely pitted, reticulate or foveate, tectate exine; gynoecium tricarpellate, glabrous to variously hairy, carpels wedge-shaped, distinct in ovarian region, united distally in a long, slender columnar style, ovules basally attached, anatropous. Fruits globose, ovoid, narrow, straight, spindle-shaped or curved, perianth whorls usually persistent, 1–3 discrete carpels developing, abortive carpels frequently carried with stigmatic remains at tip of fertile carpel, otherwise remaining at base; epicarp frequently brightly coloured, dull or shining, shagreen, rarely corky-warty, mesocarp fleshy, thin to thick, endocarp thin, crustaceous. Seed basally attached; endosperm homogeneous, penetrated by a smooth or greatly lobed intrusion of seed coat, in species with spindle-shaped fruit intrusion running almost the length of seed in middle; embryo lateral. Germination remote-tubular; eophyll strap-shaped, plicate, (sub)truncate and minutely lobed at apex.

KEY TO *LICUALA* SPECIES IN THE MALAY PENINSULA

- 1 Flowers large, more than 14 mm long; stamens free, staminal ring lacking.....  
 .....**1. *L. peltata***  
 Flowers smaller, less than 10 mm long, stamens united at the base into a conspicuous  
 ring.....2
- 2 Ovary hairy.....3  
 Ovary glabrous.....20
- 3 Flowers on floral stalks, calyx with abruptly narrowed (“pedicelliform”) base, ovary  
 very sparsely hairy.....**2. *L. sallehana***  
 Flowers not on floral stalks, calyx without pedicelliform base, ovary with moderate to  
 dense hairs.....4
- 4 Rachilla and calyx covered with ferruginous hairs; immature fruits pink.....5  
 Rachilla and calyx covered with white to golden or translucent hairs, immature fruits  
 green.....9
- 5 First-order branch strictly spicate; rachilla tuberculate, covered with fine (less than 0.2  
 mm long) hairs; calyx also covered with similar hairs.....**3. *L. kemamanensis***  
 First-order branch rebranching, or if spicate, hairs on rachilla and calyx coarser (more  
 than 0.3 mm long), rachilla not tuberculate.....6
- 6 Corolla small, less than 3 mm long, covered with scattered fine hairs 0.1–0.2 mm long;  
 ovary covered with scattered fine (*c.* 0.1 mm long) hairs only at the apex above rim.....  
 .....**4. *L. egregia***  
 Corolla larger, more than 4 mm long, densely covered with coarser hairs more than 0.3  
 mm long; ovary completely covered with dense hairs or dense hairs confined to a ring  
 around rim but not on the apex.....7
- 7 Leaves entire, sometimes segmented; inflorescence short, 22–45 cm long; ovary hairy  
 only in a ring around rim; fruits ellipsoid when fresh.....**5. *L. thoana***  
 Leaves always segmented; inflorescence more than 50 cm long; ovary completely  
 covered with hairs; fruits globular when fresh.....8
- 8 Solitary palm, sometimes suckering at the base, suckers never codominant; first-order  
 branch always rebranching; mature fruits small, *c.* 11 × 7 mm when dried.....  
 .....**6. *L. ferruginea***  
 Strongly clustering palm, with about equal-sized shoots in a cluster; first-order branch  
 mainly spicate; mature fruits larger, *c.* 17 × 13 mm when dried.....**7. *L. bayana***

- 9 Flowers strictly or mainly solitary, rarely in pairs near base of rachilla..... 10  
 Flowers in groups of 2 or more, sometimes solitary towards apex of rachilla..... 15
- 10 Rachis, rachilla and calyx densely covered with 1–1.5-mm-long shaggy hairs.....  
 ..... **8. L. lanuginosa**  
 Rachis, rachilla and calyx not covered with such hairs: if hairy, hairs less than 0.5 mm  
 long..... 11
- 11 First-order branch spicate; fruit surface shagreen..... **9. L. kamarudinii**  
 First-order branch rebranching; fruit surface smooth..... 12
- 12 Small palm, petiole less than 1 m long; central segment sometimes petiolulate;  
 inflorescence less than 40 cm long; calyx neatly lobed to about half of length, apex  
 pointed..... **10. L. triphylla**  
 Larger palms, petiole more than 1 m long; central segment never petiolulate;  
 inflorescence more than 40 cm long; calyx truncate, irregularly split to splitting into 3  
 bifid lobes..... 13
- 13 Acaulescent, strongly clustering palm; first-order branch with 3–6 secondary branches,  
 rather lax; calyx covered with moderately long hairs (c. 0.5 mm long).....  
 ..... **11. L. ahlidurii**  
 Stemmed, solitary palm; first-order branch with 6–20 secondary branches, compact;  
 calyx glabrescent or if hairy, hairs less than 0.4 mm long..... 14
- 14 Rachilla subulate, fracti-flexuous (“zigzag”) especially towards apex, glabrescent;  
 calyx glabrescent but covered with a sparse, reddish brown, caducous, amorphous  
 indumentum..... **12. L. fractiflexa**  
 Rachilla terete, not fracti-flexuous, covered with simple hairs; calyx covered with  
 scattered simple hairs..... **13. L. longipes**
- 15 First-order branch rebranching, at least at the basal part of the rachis..... 16  
 First-order branch strictly spicate..... 18
- 16 Rachilla fracti-flexuous (“zigzag”), covered with amorphous indumentum; fruits  
 ellipsoid, more than 3 times longer than wide..... **14. L. kiahii**  
 Rachilla straight to rather wiry, covered with simple hairs; fruits globose to ovoid, less  
 than 1.5 times longer than wide..... 17
- 17 First-order branch always clearly rebranching; rachilla wiry, to 16 cm long; flowers  
 arranged in groups of up to 5(–7), apex of corolla narrowly acuminate.....  
 ..... **15. L. tenuissima**

- First-order branch sometimes bifid in the basal part of the rachis, but mainly spicate; rachilla rigid and not wiry, to 9 cm long, flowers arranged in groups of up to 3; apex of corolla acute to obtuse.....**16. L. pusilla** (in part)
- 18 Inflorescence less than 12 cm long; rachilla less than 6 cm long.....**17. L. ruthiae**  
 Inflorescence more than 20 cm long; rachilla more than 7 cm long.....19
- 19 Petiole drying pale greenish brown, rachilla less than 10 cm long, only slightly tuberculate in fruiting specimens; flowers arranged in groups of up to 3; mature fruit surface smooth.....**16. L. pusilla** (in part)  
 Petiole drying reddish brown, rachilla 12–18 cm long, tubercles very pronounced in fruiting specimens; flowers arranged in groups of 5(–7); mature fruit surface shagreen.....**18. L. khoonmengii**
- 20 Corolla glabrous.....21  
 Corolla hairy.....28
- 21 First-order branch rebranching.....22  
 First-order branch spicate.....23
- 22 Solitary palm, if (rarely) clustering, suckers never as large as main shoot; rachilla (mainly) glabrous or covered with simple hairs; calyx truncate with very short pointed lobes, not striate; filaments more than 0.6 mm long. Plant of well-drained inland forest.....**19. L. glabra**  
 Strongly clustering palm; rachilla covered with stellate hairs; calyx with 3 distinct, pointed or bifid lobes, striate when dried; filament short, less than 0.4 mm long. Plant of swamp forest.....**20. L. paludosa**
- 23 Calyx cup-shaped (cyathiform) with pedicelliform base.....24  
 Calyx cylindrical, lacking pedicelliform base.....25
- 24 Petiole unarmed, calyx lobed to about half its length, lobe-apices rounded; pedicelliform base less than 1.5 mm long; ovary turbinate. Montane species, endemic to Terengganu.....**21. L. moyseyi**  
 Petiole spiny, calyx with 3 very short pointed lobes; pedicelliform base c. 1.5–3 mm long, ovary fusiform. Lowland species endemic to Kemaman district, Terengganu.....  
 .....**22. L. corneri**
- 25 Rachilla covered with scattered fine hairs less than 0.1 mm long.....26  
 Rachilla covered with medium to coarse hairs c. 0.3–1 mm long.....27
- 26 Calyx fine-hairy, lobes subtruncate with very short-pointed apices.....  
 .....**23. L. mustapana**

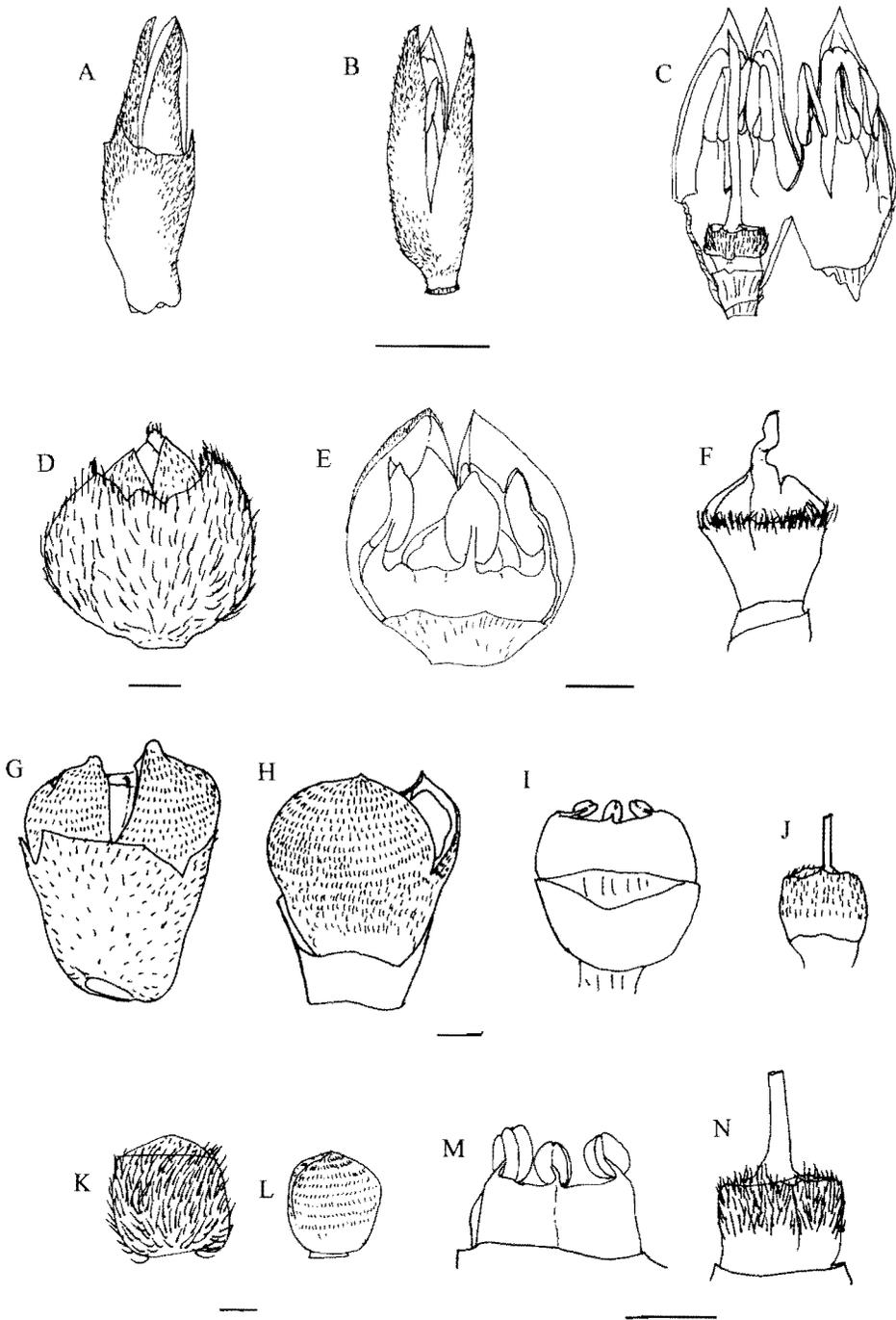
- Calyx glabrous, irregularly split.....**24. L. pahangensis**
- 27 Petiole drying greenish brown, rachilla covered with scattered *c.* 0.3–0.6-mm-long hairs, flowers solitary or in pairs on short floral stalks; calyx glabrous, distinctively trilobed with cuspidate apex.....**25. L. palas**  
 Petiole drying dark reddish brown, rachilla densely covered with coarse shaggy hairs at least 0.5–1 mm long; flowers strictly solitary, sessile; calyx glabrous, sometimes hairy, truncate to irregularly splitting.....**26. L. terengganuensis**
- 28 Flowers on short floral stalks; calyx obconical, loosely enclosing corolla tube in dried specimens.....29  
 Flowers not on floral stalks, calyx cylindrical, or, if flowers on floral stalk, then calyx cup-shaped; in both cases calyx tightly enclosing corolla tube.....32
- 29 Inflorescence reduced to a single first-order branch; corolla striate.....**27. L. scortechinii**  
 Inflorescence with 3 or more first-order branches; corolla not striate.....30
- 30 Rachis bract much inflated, splitting to more than half its length on one side; first-order branch never simple, with 4 or more secondary branches.....**28. L. mirabilis**  
 Rachis bract not inflated, splitting slightly on one side; first-order branch mainly spicate, or sometimes with up to 3 secondary branches.....31
- 31 Inflorescence erect, first-order branch mainly spicate, rarely branched, branches erect; calyx covered with sparse hairs less than 0.4 mm long, base pedicelliform.....**29. L. kunstleri**  
 Inflorescence patent, first-order branch with 1–3 secondary branches, rather patent; calyx covered with scattered coarse hairs *c.* 0.5–0.8 mm long, without pedicelliform base.....**30. L. acutifida**
- 32 Inflorescence much longer than leaves, more than 1 m long; corolla with patent hairs.....33  
 Inflorescence shorter than leaves, less than 1 m long; corolla with strictly appressed to appressed-patent hairs.....34
- 33 Petiole armed throughout length with large spines (spines more than 5 mm long near petiole base); first-order branch with 3–6 secondary branches; flowers in groups of 1–3, rachilla and calyx with scattered coarse hairs; corolla densely hairy. Lowland species.....**31. L. spinosa**  
 Petiole armed in lower half with small spines (spines less than 5 mm long near petiole base); first-order branch with 13–18 secondary branches; flowers strictly solitary; rachilla, calyx and corolla with scattered fine hairs. Montane species.....**32. L. patens**

- 34 Inflorescence much reduced a simple (unbranched) or bifurcating axis.....**33. L. kingiana**  
 Inflorescence well developed with two or more first-order branches .....35
- 35 Inflorescence patent to pendulous; rachis, rachilla and calyx densely covered with shaggy, white, very coarse (1–2-mm-long) hairs.....**34. L. cameronensis**  
 Inflorescence patent or erect, never pendulous; rachis, rachilla and calyx sometimes hairy but never lanuginose, hairs less than 0.8 mm long.....36
- 36 First-order branch spicate.....37  
 First-order branch rebranching.....39
- 37 Rachilla glabrous, surface cracking into angular plates in dried specimens.....**35. L. whitmorei**  
 Rachilla hairy, surface not cracked in dried specimens.....38
- 38 Flowers small, less than 5 mm long, calyx cylindrical.....**36. L. ridleyana**  
 Flowers larger, more than 7 mm long, calyx cyathiform.....**37. L. tiomanensis**
- 39 Flowers large, more than 7 mm long, calyx cyathiform.....**38. L. longicalycata**  
 Flowers smaller, less than 5 mm long, calyx cylindrical to sometimes with slightly constricted base.....40
- 40 Flowers in groups of 1–3; calyx cylindrical with slightly constricted base.....**39. L. modesta**  
 Flowers strictly solitary; calyx cylindrical.....41
- 41 Rachilla and calyx hairy.....**40. L. malajana**  
 Rachilla and calyx glabrous.....**41. L. stongensis**

**1. *Licuala peltata* Roxb. ex Buch.-Ham.**

Mem. Wern. Nat. Hist. Soc. 5: 313 (1824); Becc. & Hook. f., Fl. Brit. India 6: 430 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 163 (1907); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 131 (1933); Furtado in Gard. Bull. Straits Settlements 11: 44 (1940). Lectotype (selected here): *Wallich Catalogue* 8617A, India, Calcutta, cultivated in Botanic Garden (component on left side of the sheet). (Fig. 1 A–C)

Solitary. Stem to *c.* 6 m tall or more, *c.* 10 cm diameter. Petiole *c.* 2–4 m long, *c.* 15–30 mm wide near base, *c.* 11–15 mm wide at apex; spines irregularly spaced, to *c.* 10 mm long or longer, along nearly whole length of petiole; abaxially bearing rather waxy and scaly indumentum, drying dark reddish brown. Frond large, peltate, orbicular, *c.* 120–182 cm



**Fig. 1.** A–C *Licuala peltata* (from Whitmore TCW 3157A). A. Flower bud. B. Flower with calyx removed. C. Dissected flower showing the gynoecium and androecium. D–F *Licuala thoana* (from FRI 36354). D. Flower bud. E. Calyx and a petal removed revealing the androecium. F. Ovary. G–J *Licuala ferruginea* (from FRI 39979). G. Flower. H. Calyx removed revealing corolla. I. Calyx and corolla removed revealing the androecium. J. Ovary. K–N *Licuala lanuginosa* (from SFN 37068). K. Flower bud. L. Corolla, calyx removed. M. Androecium. N. Ovary. Scale bar 1 mm for all.

across, thick-leathery, shiny on both surfaces when fresh; segments *c.* 7–30, all nearly same size, lateral margins straight; lateral segments 4–7-costulate, *c.* 70–100 × 10–25 cm; central segment entire or divided into 2, sessile, 15–20-costulate, *c.* 75–100 × 20–35 cm or wider. Inflorescence patent, longer than leaves, to *c.* 3 m or longer, with 3–7 first-order branches; peduncle *c.* 85 cm long, 17 mm wide near base; prophyll *c.* 18 × 1.7 cm, mouth splitting into a few shallow lobes only; peduncular bracts absent; rachis somewhat robust, not sinuous; rachis bracts strictly tubular, not inflated, *c.* 40 × 1.5 cm at base, thick-coriaceous, densely caducous stellate-hairy; rachis-bract mouth splitting irregularly but neatly toothed; first-order branch close to rachis-bract mouth; rachillae to *c.* 65 cm long, *c.* 5 mm across at base, pendulous, unornamented, densely covered with golden-brown, *c.* 0.5–1.2-mm-long simple hairs. Flowers solitary, on prominent floral stalks *c.* 2–3 × 1 mm, *c.* 4–5 per cm; buds ellipsoid, *c.* 15–17 × 5–7 mm, maturing almost simultaneously; flower calyx cyathiform, *c.* 6–7 × 4 mm, densely covered with *c.* 0.2–0.4-mm-long hairs, base cuneate, thickened, apex truncate with 3 short-acuminate lobes, chartaceous; corolla *c.* 12 × 6 mm, thick, densely covered with patent simple pale brown hairs up to *c.* 0.2–0.4 mm long, lobes *c.* 6.5 × 5 mm, apex acute; staminal ring lacking; filaments equal, thick, narrowly triangular, flattened, adnate directly to corolla tube just below lobes, *c.* 4–4.5 mm long, *c.* 2 mm wide at base, anthers linear-sagittate, non-versatile, *c.* 3.6 × 1.6 mm; ovary cylindrical, truncate at apex, 2 × 2.2 mm, densely covered with *c.* 0.2–0.4-mm-long patent silvery hairs, style filiform, 8–10 mm long. Fruits ellipsoid, *c.* 12–19 × 9–10 mm, glabrous, green ripening orange-red, smooth; seeds ellipsoid, *c.* 12–13 × 7–9 mm.

**DISTRIBUTION.** Bangladesh, NE India extending into Myanmar, Thailand and north Peninsular Malaysia; also known in the Andaman Islands, India.

**HABITAT.** Moist deciduous forest. In north-west Peninsular Malaysia, it is common on the lower slopes of some limestone hills.

**SPECIMENS EXAMINED**—**THAILAND.** Chum Paun, Siep Zaem, *Kerr* 16228 (K); Kantang, *Haniff & Nur* 4720 (K); Krabi, Ban Ao Luk, *Hansen & Smitinand* 12036 (K); Ranung, Tam Tieng, *Kerr* 11726 (K); Salut, Kuan Po, *Kerr* 13758 (K); Saung Ka Lia, *c.* 35 km north of Wangka, *Kostermans* 437 (K); Surat Thani, Phanom, *Smith & Sumawong* GC 71 (K); Satul, *Suvanakoses* 1600 (K); Trang, Khao Nam Prai, *Dransfield & Bhoonab* JD 5449 (K). **PENINSULAR MALAYSIA.** Perlis, Mata Ayer F.R. (Forest Reserve), *Lim* H1608 (KEP), *Saw* FRI 40038 (KEP); Kedah, Sik, Pedu Dam, *Lim* H1598 (KEP).

Like *L. peltata*, *L. distans* Ridl. too has rather large flowers and an androecium lacking a staminal ring. Both species are found in south Thailand. *Licuala distans* differs from *L. peltata* in its rebranched first-order branches and glabrous flowers.

***Licuala peltata* var. *sumawongii* L.G. Saw var. nov. a varietate typica foliis semper indivisis differt. Typus: Smith & Sumawong GC 148, Thailand, Bangkok, Nonburi, The Sumawong Botanical Gardens (holotypus K).**

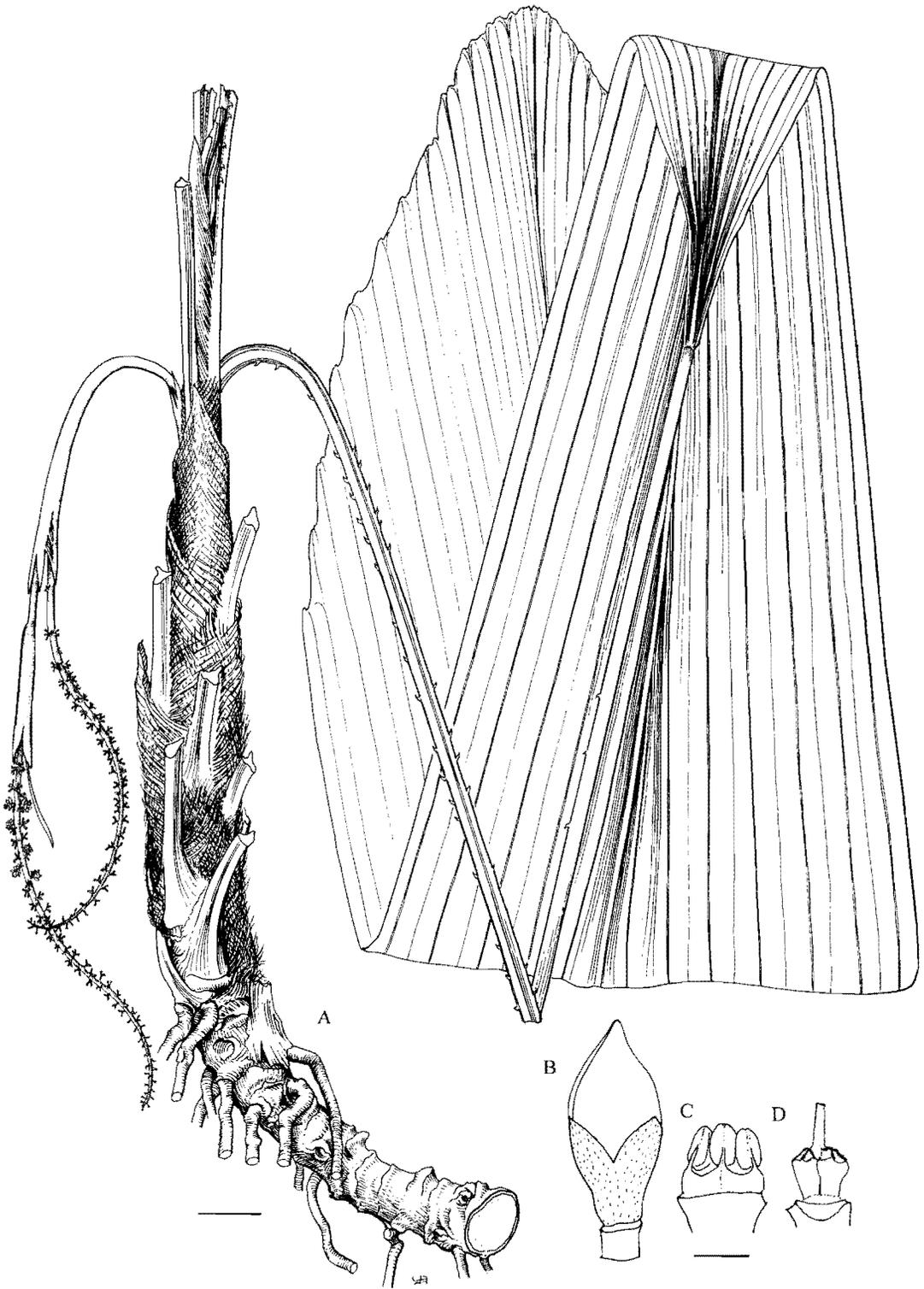
Differs from the typical variety in its entire, unsegmented frond. Endemic to peninsular Thailand.

**SPECIMENS EXAMINED—PENINSULAR THAILAND.** Bangkok, Nonburi, The Sumawong Botanical Gardens, *Smith & Sumawong* GC 148 (holotype K). **PENINSULAR MALAYSIA.** Penang, Penang Botanic Gardens (cultivated), *Lim s.n.* 12 February 1994 (KEP).

Some immature plants in the Singapore Botanic Gardens have incomplete splits from the margin but not right to the hastula, very unusual in *Licuala*. In more mature individuals, these splittings cease. This variety is now rather common in botanic gardens and private collections, often incorrectly identified as *L. elegans*. It has been distributed mainly by W. Sumawong, whom the epithet honours.

**2. *Licuala sallehana* L.G. Saw sp. nov.** *dense caespitosa colonialis saepe decumbens, lamina folii integra, lanceolata vel rhomboidea, inflorescentia patenti brevissima, ad 13 cm longa, in 1 ordinem ramificanti 1 vel 2 ramis primariis, floribus in turmis pedicellatis 3 vel minus dispositis, flore basin cueato, apice acuto, calyce 2 × 1.8 mm, corolla c. 3.8 × 3.5 mm, ovario turbinato, apice limbo, glabrescenti, sed pilis sparsis paucis supra limba, fructu globosa, juventute rubro, dein viride maturescenti nigro, scabrello distinctissima. Typus: Saw FRI 39877, Peninsular Malaysia, Terengganu, Ulu Terengganu (Extension) F.R. (holotypus KEP; isotypus K).* (Fig. 2)

Densely clustered and colonial. Stems reed-like to 1.5 m or less tall, often decumbent, c. 1.5 cm wide; with c. 6–20 leaves in crown. Leaf sheath ligule rather fragile, marcescent (breaking up into fine, loose reticulate fibres); petiole c. 30–140 cm, c. 6–7 mm wide near base, c. 5–6 mm wide towards apex, drying pale greenish brown, spines along lower half of petiole, spines triangular, reflexed to about perpendicular to petiole axis, c. 3 mm long; frond entire, lanceolate to rhomboid, c. 50–77 × 13–20 cm, 18–20-costulate, abaxial surface glaucous in fresh leaves, drying paler brown than adaxial surface. Inflorescence patent, very short to c. 14 cm long, branched to first or second order with 2–3 first-order branches; peduncle c. 10 cm long, c. 4 mm wide near base; prophyll 3–5 × 0.5–0.7 cm; peduncular bracts absent; rachis not sinuous, covered with reddish brown indumentum; rachis bract to 3–6 × 0.6 cm at base, tubular, tightly sheathing, neatly splitting into 2 to 5 apical lobes and on one side, covered with reddish brown hairs; first-order branches close to mouth of rachis bract, distance between the lowest two c. 2–4 cm; rachilla c. 7–15 cm long, c. 1.3 mm diameter, covered with less than 0.1-mm-long scattered, simple, brown hairs. Flowers in groups of 4 or less on prominent 1–3 mm floral stalks; cincinni 6–7 per cm; buds ellipsoid, with tapered base, apex pointed; calyx vase-shaped, 2–3 × 1.8–2 mm, with 3 pointed lobes, sparsely covered with fine brown, simple hairs; corolla c. 3.8 × 3.5 mm, thick, glabrescent to sparsely covered with fine brown hairs, lobes c. 2.5 × 1.7 mm, apex pointed; staminal ring c. 0.6–0.7 mm high, apex undulate, filaments subulate, base broad, to c. 0.5 mm long,



**Fig. 2.** *Licuala sallehana* var. *sallehana*. **A.** Habit of plant with an inflorescence. **B.** Flower bud. **C.** Calyx and corolla removed, showing androecium. **D.** Ovary. All from FRI 39877. Scale bar 2 cm for A, 1 mm for B–D.

anthers c. 0.8 mm long; ovary turbinate, rimmed at apex, c. 0.7 mm high, glabrescent but with sparse fine hairs on apex above rim, style filiform, 1 mm long. Fruit globose, c. 0.8 to 1.3 cm across, green, ripening almost black with shagreen surface, very immature fruits in newly fertilized flowers bright red; seed globose, 7–11 mm across.

**DISTRIBUTION.** Endemic to Peninsular Malaysia, only known from the type locality.

**HABITAT.** Lowland forest understorey. Common where it occurs, in valley bottoms and lower slopes.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Hulu Terengganu, Ulu Terengganu (Extension) F.R., Comp. 43, *Suppiah* FRI 11876 (KEP), *Saw* FRI 39877 (holotype KEP, isotype K), *Zainuddin* AZ 4672 (UKMB).

This is the most elegant species of *Licuala* in the Malay Peninsula distinctive in the genus by its lanceolate, entire leaves, but these are so similar to those of immature *Johannesteijsmannia* that it can easily be mistaken for the latter in the field. *Licuala sallehana* differs from *Johannesteijsmannia* in its clustering habit and lateral margins on the frond lacking spines (all *Johannesteijsmannia* spp. are solitary and have spines on the lateral frond margins). In Peninsular Malaysia only one other species, *L. thoana*, occasionally has mature individuals with entire fronds; its fronds, however, are spatulate, i.e., the outer margin is rounded. *Licuala thoana* has quite different flowers and is related to *L. ferruginea*.

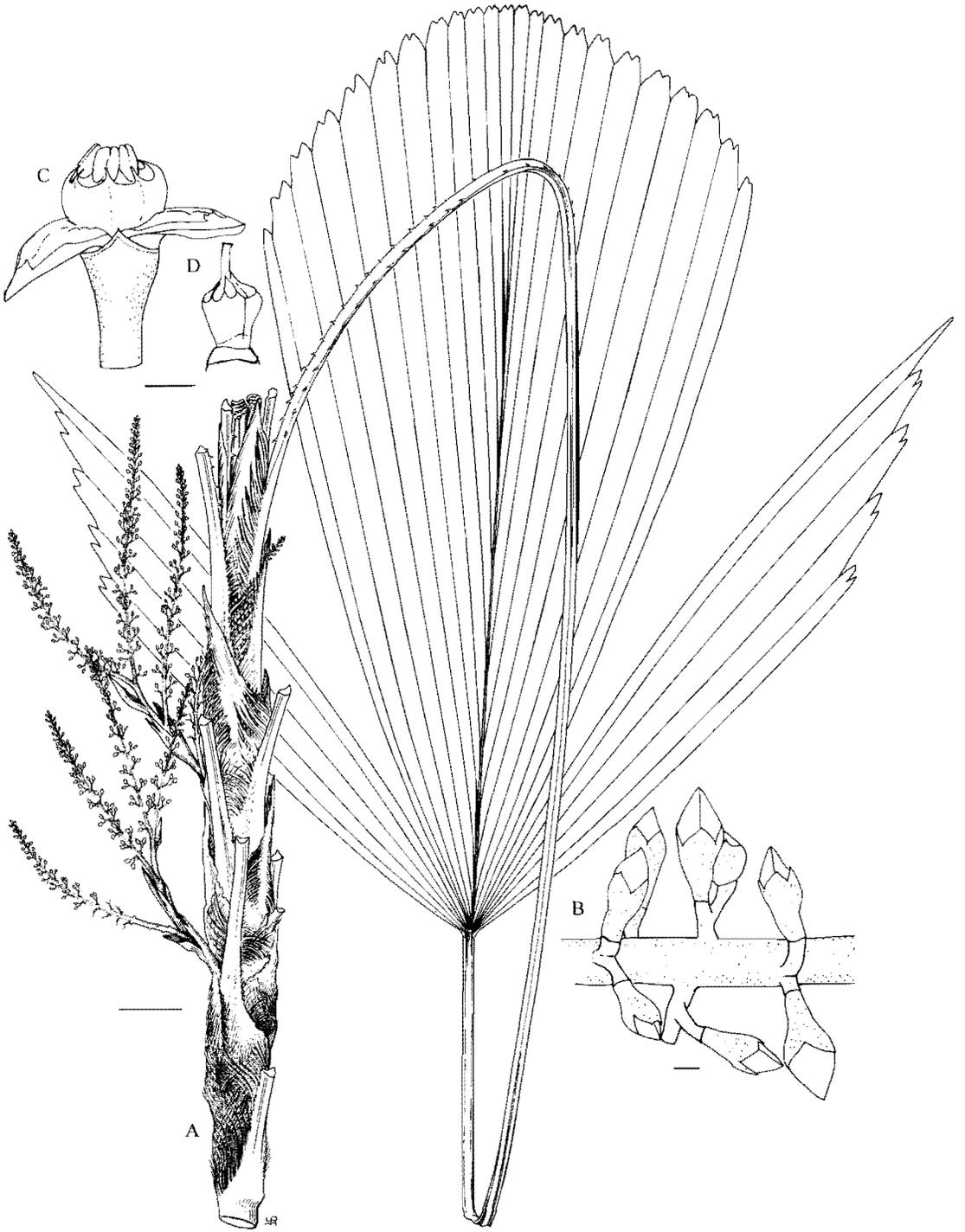
The species epithet honours Dr. Salleh Mohamad Nor, former Director-General of the Forest Research Institute Malaysia, for his contribution to conservation efforts in Malaysia.

***Licuala sallehana* var. *incisifolia* L.G. Saw var. nov. habitu, inflorescentia et floribus *L. sallehanae* affinis sed folia segmentis numerosis, inflorescentia condensata, inflorescentia partiale apicale interdum furcata differt. Typus: *Saw* FRI 39897, Peninsular Malaysia, Terengganu, Ulu Terengganu (Extension) F.R. (holotypus KEP; isotypus K). (Fig. 3)**

**DISTRIBUTION.** Endemic to Terengganu in Peninsular Malaysia.

**HABITAT.** Lowland forest understorey. Common where it occurs, in valley bottoms near streams and lower slopes.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Besut, Kuala Terengganu–Besut Road, *Sinclair & Kiah* SFN 40454 (SING); Setiu, Ulu Nerus F.R., Compartment 79, *Dransfield et al.* JD 6507 (K, KEP), *Saw* FRI 39897 (holotype KEP; isotype K); Terengganu Mountains, Terengganu River near Kuala Kerbat, *Whitmore* FRI 20253 (KEP).



**Fig. 3.** *Licuala sallehana* var. *incisifolia*. **A.** Habit of plant with inflorescences. **B.** Rachilla with flowers. **C.** Open flower bud showing the androecium. **D.** Ovary. All from FRI 39897. Scale bar 2 cm for A, 1 mm for B–D.

This variety differs from the typical variety by its dissected fronds, more condensed inflorescence and apical first-order branch which sometimes rebranches into two. *Licuala sallahana* var. *sallahana* has entire fronds, longer inflorescences and strictly spicate first-order branches. I have included *Whitmore* FRI 20253 in this variety, although the specimen has only an infructescence with some fruits and a frond, which is not quite sufficient to make a good identification. The plant was described as being a solitary rosette *palas* which differs from the general habit of the *L. sallahana* var. *incisifolia* population from Ulu Nerus. The infructescence, general leaf character and fruits, however, fit this variety.

### 3. *Licuala kemamanensis* Furtado

in Gard. Bull. Straits Settlements 11: 50 (1940). Type: *Corner* 30520, Peninsular Malaysia, Terengganu, Kemaman, Sungai Nipa (holotype SING; isotype BM).

Solitary, acaulescent. Stem subterranean. Petiole *c.* 60 cm long, *c.* 5–6 mm wide near base, *c.* 4 mm wide at apex, drying light greenish brown; spines *c.* 2 mm long or less along approximately lower half of petiole; frond orbicular, *c.* 50 cm wide, segments *c.* 11–12, lateral margins straight; lateral segments 2–3-costulate, *c.* 30–32 × 2.5–3 cm; central segment entire, sessile, about the same size as lateral segments, 3–4-costulate. Inflorescence erect, shorter than leaves, *c.* 30–62 cm long, bearing 2–3 first-order branches only; peduncle *c.* 10–35 cm long, *c.* 5 mm across near base; prophyll tubular, to *c.* 11 × 0.7 cm, coriaceous, tightly sheathing with neatly split mouth, densely covered with caducous reddish brown and silvery stellate hairs; peduncular bracts absent; rachis straight, densely covered with ferruginous simple hairs and amorphous indumentum; rachis bract similar to prophyll, *c.* 9 × 0.7 cm, splitting on one side to almost half of length; first-order branches away from the mouth of rachis bract, flexuous; rachillae to *c.* 15 cm long, *c.* 2 mm diameter, densely covered with less than 0.2-mm-long simple rusty ferruginous hairs. Flowers solitary, sessile, on swollen tubercles on longitudinal ridges; cincinni *c.* 13 per cm; on available fruiting specimens, calyx vase-shaped to cylindrical, base thickened, covered with scattered less than 2-mm-long simple brown hairs; corolla densely covered with less than 0.1-mm-long patent golden brown simple hairs. Fruit globose, sparsely covered with fine brown hairs, crimson to pink when immature, *c.* 9–11 mm across, smooth in fresh specimen and *c.* 9 × 8 mm in dried herbarium specimen; seed globose, *c.* 7 mm across.

DISTRIBUTION. Endemic to Terengganu in Peninsular Malaysia.

HABITAT. A species of lowland dipterocarp forest in undulating terrain.

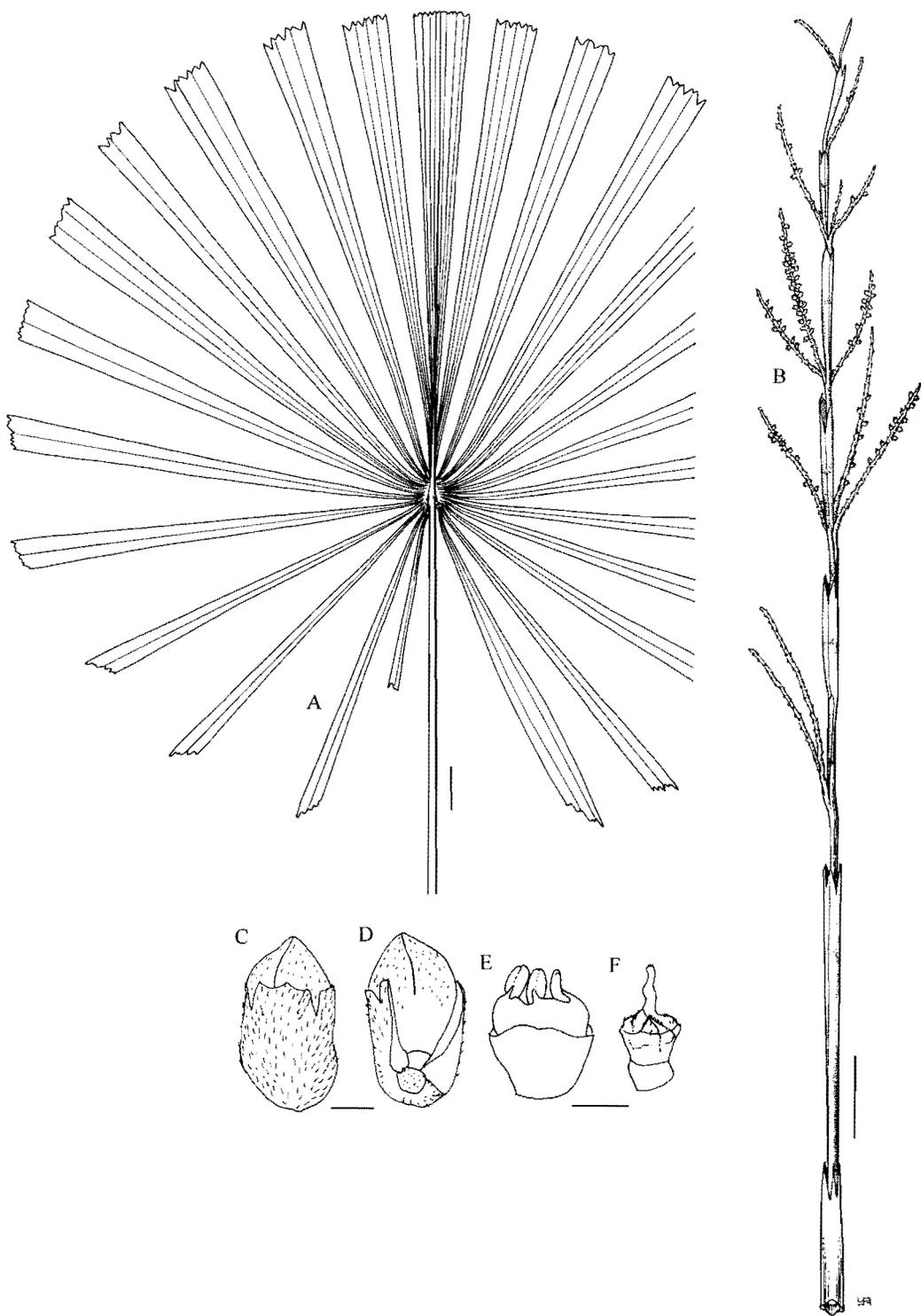
**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Kemaman, Sungai Nipa, *Corner* 30520 (holotype SING; isotype BM), *Dransfield* JD 5215 (KEP); Kemaman Hills, *Whitmore* FRI 20359 (KEP); Sri Bangun, near Bukit Besi, *Sinclair & Kiah* SFN 39864 (E, SING).

No flowering material has been collected yet. The floral description given above is based upon calyx and corolla persisting on fruiting specimens. This species is similar to *L. bayana* and *L. thoana* with their spicate first-order branches and pink to crimson immature fruits. *Licuala kemamanensis* differs from these species in its erect inflorescence, neatly splitting and tightly sheathing rachis bract, and the rachillae with flowers on swollen longitudinal tubercles. Both *L. bayana* and *L. thoana* have patent inflorescences, slightly inflated rachis bracts that break into fibres at their mouth with flowers and fruits on unornamented rachilla surfaces.

**4. *Licuala egregia* L.G. Saw sp. nov.** *L. ferrugineae similis, sed inflorescentia erecta vi e patenti, calyce minore (c. 3 × 2.3 mm vice c. 3.5 × 4 mm) apice cuspidato vice irregulariter fisso, corolla minore (c. 2.8 × 2.1 mm vice c. 4 × 4 mm) apice sparse tomentosa, annulo staminodiale brevior ad c. 0.5 mm alta, et ovario glabrescenti tomentoso tantum apice differt.* Typus: Saw FRI 37564, Peninsular Malaysia, Pahang, Kuantan, Beserah F.R., Bukit Pelindung (holotypus KEP). (Fig. 4)

Solitary, acaulescent, medium-sized. Stem subterranean with very short internodes. Leaves c. 15 in crown; petiole c. 166 cm, c. 6 mm wide towards apex, drying pale greenish brown, spines along lower approximately three-quarters of petiole; frond c. 90 cm wide, peltate-orbicular; segments c. 23 with almost straight lateral margins; lateral segments 2–4-costulate, 48–55 × 3–6.5 cm; central segment sessile, c. 8-costulate, 55 × 6 cm. Inflorescence erect, shorter than leaves, c. 80 cm long, branched to second order with 6 first-order branches; peduncle c. 30 cm long; prophyll c. 9 × 1.2 cm or longer; peduncular bracts lacking; rachis densely covered with thick caducous rusty ferruginous stellate hairs; rachis bracts tubular with gradual-tapered base, tightly sheathing, slightly flattened, to c. 14 × 0.8 cm, neatly splitting into 1–2 apical lobes and on one side, covered c. 0.5–1-mm-long silvery hairs with reddish brown bases; first-order branches slightly above mouth of the rachis bracts, c. 12 cm apart with c. 3 or less second-order branches; rachillae to c. 10–14 cm long, c. 1.5–2 mm wide, densely covered with simple, rusty ferruginous hairs, c. 0.2–0.4 mm long; cincinni c. 5–6 per cm. Flowers solitary and in pairs on short tubercles, sessile, maturing about simultaneously; calyx cylindrical, striate when dry, 3 × 2.3–2.5 mm, apex truncate, splitting neatly into 3 cuspidate lobes, covered with scattered c. 0.2–0.3-mm-long golden, simple hairs; corolla striate when dry, c. 2.8–3 × 2.2–2.5 mm, covered with scattered 0.1–0.2-mm-long simple, golden hairs, lobes with pointed apex, c. 1.5 × 1.6 mm; staminal ring c. 0.5 mm high, filaments subulate, c. 0.3–0.4 mm long, anthers c. 0.6–0.7 mm long; ovary turbinate, truncate at apex, c. 0.9–1 × 1.2 mm, sparsely covered less than 0.1-mm-long hairs only at apex, glabrous elsewhere, style filiform, c. 0.9–1 mm long. Fruits unknown.

**DISTRIBUTION.** Only known from the type locality, where one individual was seen. The species may have either a very scattered distribution or the type locality may be the limit of its normal distribution. The species epithet refers to its rarity at the type locality.



**Fig. 4.** *Licuala egregia*. **A.** Frond. **B.** Inflorescence. **C.** Flower bud. **D.** Calyx partly removed revealing corolla. **E.** Androecium. **F.** Ovary. All from FRI 37564. Scale bar 5 cm for A–B, 1 mm for C–F.

HABITAT. Lowland dipterocarp forest.

The hair type of the inflorescence, rachilla and flower suggests that *L. egregia* is closely related to *L. ferruginea*. However, young fruits are needed to confirm this, as *L. ferruginea* and its allies produce pink immature fruits. *Licuala egregia* can be differentiated from *L. ferruginea* by its erect inflorescences, smaller calyx (c.  $3 \times 2.3$  mm) with cuspidate apex, smaller corolla (c.  $2.8 \times 2.1$  mm) covered with scattered hairs, an c. 0.5-mm-high staminal ring, and an ovary which is sparsely hairy only at its apex. In contrast, *L. ferruginea* has patent inflorescences, larger (c.  $3.5 \times 4$  mm) calyx with irregularly split trilobed calyx, larger corolla (c.  $4 \times 4$  mm) densely covered with hairs, a 1-mm-high staminal ring and an ovary that is completely and densely covered with hairs.

##### 5. *Licuala thoana* L.G. Saw & J. Dransf.

in Gard. Bull. Singapore 42: 71. Type: Saw FRI 36354, Peninsular Malaysia, Johor, Labis F.R. (holotype KEP; isotype K). (Fig. 1 D–F)

Solitary, acaulescent. Stem subterranean, c. 30 cm wide. Leaves c. 8 in crown; petiole 0.3–2 m or more long, c. 7–10 mm wide near base, c. 5–7 mm wide at apex, drying light greenish brown, spines along nearly all the lower half of petiole, spines narrowly triangular, patent, c. 5 mm long; frond usually entire, sometimes divided into 3–5 segments, surface dull on both sides; in segmented individuals c. 110–170 cm wide, lateral segments narrower than the central, 2–4-costulate, c.  $80\text{--}96 \times 9$  cm, lateral margins straight; central segment or in entire leaf individuals frond undivided, sessile, broadly paddle-shaped with strongly curved outer margin, 15–30-costulate, c.  $34\text{--}104 \times 25\text{--}39$  cm. Inflorescence patent, shorter than leaves, c. 21–45 cm long, branched to first- and sometimes to second-order, bearing 2–4 first-order branches; peduncle c. 19–25 cm long; prophyll strongly 2-keeled, strictly tubular, apex somewhat fibrous, closely sheathing, to c.  $10 \times 1.5$  cm, densely covered with rusty brown caducous stellate hairs; peduncular bracts absent; rachis sinuous, bending at primary branches especially towards the apex, densely covered with caducous ferruginous stellate hairs; rachis bract similar to prophyll, to c.  $9 \times 1.3$  cm; first-order branches in or near mouth of rachis bract, mainly spicate, rarely branched to 3 secondary branches; rachillae to c. 14 cm long, c. 2–3 mm diameter, flexuous, unornamented, densely covered with rusty hairs and amorphous indumentum. Flowers solitary, sessile, densely arranged, c. 3–5 per cm, maturing about simultaneously, bud ovoid, c.  $5 \times 5$  mm; calyx urceolate, c.  $3 \times 3$  mm, base thickened, coriaceous above, with 3 gibbous, rounded to triangular lobes, covered with dense shaggy brown simple hairs to 0.3 mm long; corolla very thick, explanate at anthesis, only slightly longer than calyx, tubular in basal 2 mm, with 3 triangular lobes c.  $2 \times 3$  mm, densely covered with fine patent golden brown simple hairs; staminal ring truncate, c. 0.7 mm high, filaments thin, filiform, c. 0.6 mm long, anthers somewhat apiculate at apex, c.  $1.2 \times 0.8$  mm long; ovary covered with a ring of dense golden brown fine hairs, turbinate,  $2 \times 1.5$  mm, style filiform, 1 mm long. Mature fruits not known, immature fruit with 1–3

carpels developing, ovoid, crimson to pink, *c.* 13 × 9 mm when fresh and *c.* 11 × 6 mm in available dried herbarium material, seed ovoid, *c.* 10 × 6 mm.

**DISTRIBUTION.** Endemic to the Sungei Kinchin basin of the Johor–Pahang border and Ulu Besut in Terengganu, Peninsular Malaysia.

**HABITAT.** An understorey palm of lowland dipterocarp forest, very common along the Sungei Kinchin flood plain. The palm persists in forest that has been logged although showing signs of frond-yellowing when exposed.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Johor, Labis F.R., Sungei Kinchin, *Saw* FRI 36354 (holotype KEP, isotype K); Pahang, Lesong F.R., Sungei Kinchin, *Saw* FRI 37529 (KEP), FRI 37544 (KEP) & FRI 38528 (KEP); Terengganu, Ulu Besut, *Cockburn* FRI 8343 (KEP); Ulu Setiu, *Lim* FRI 37652 (KEP).

Flowers and fruits of *L. thoana* approach those of *L. ferruginea* and *L. bayana*. The characters which distinguish this species include its usually entire, paddle-shaped leaves, short inflorescence with typically simple (unbranched) first-order branches and ellipsoid fruits and seeds. Both *L. ferruginea* and *L. bayana* are more robust palms with large leaves divided into many segments and larger inflorescence with mainly globular fruits. *Licuala bayana* has also typically spicate first-order branches, it however, has a strongly clustering habit instead of being solitary as in *L. thoana*.

## 6. *Licuala ferruginea* Becc.

in Hook. f., *Fl. Brit. India* 6: 432 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 162 (1907); Becc. in *Webbia* 5: 32 & 46 (1921); Ridl., *Fl. Mal. Pen.* 5: 26 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 180 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 47 (1940). Lectotype: *King's collector* 3041, Peninsular Malaysia, Perak, Sunki (FI, isoelectotypes BM, CAL, K).  
(Fig. 1 G–J)

Large, acaulescent. Solitary, sometimes with small suckers (but never as large as main shoot). Leaves (5–)8–15(–20) in crown; petiole 1.5–3 m or more long, *c.* 13–20 mm wide near base, *c.* 6–15 mm wide towards apex, drying light greenish brown, spines along lower half of petiole, spines narrowly triangular, reflexed, *c.* 5 mm long near base; frond, medium to large size, orbicular, *c.* 100–180 cm wide, both surfaces dull when fresh; segments *c.* 10–25, lateral margins straight; lateral segments 2–4-costulate, *c.* 55–120 × 7–10 cm; central segment entire, sessile, larger than rest, 9–18-costulate, 66–130 × 10–35 cm. Inflorescence erect to patent, shorter than leaves, *c.* 50–100 cm long; branched to second-order with 4–6 first-order branches; peduncle *c.* 17–30 cm long; prophyll tubular with marcescent or fibrous apex, tightly sheathing, to *c.* 12–16 × 2–2.5 cm, densely covered with caducous ferruginous stellate hairs; peduncular bracts absent; rachis sinuous bending at

primary branches, densely covered with caducous ferruginous stellate hairs; rachis bract similar to prophyll, to  $c. 12-20 \times 1.6-2.5$  cm; first-order branches in mouth of rachis bract, at base with 3-5 secondary branches; rachilla to  $c. 30$  cm long and  $c. 1.5-4$  mm wide, rather unornamented, flexuous, densely covered with ferruginous,  $c. 0.3-0.5$ -mm-long hairs. Flowers solitary, sessile, maturing about simultaneously; cincinni  $c. 4-9$  per cm; bud subglobular,  $c. 5 \times 4.5$  mm; calyx vase-shaped,  $c. 3.5 \times 4$  mm, base thickened, chartaceous above, apex trilobed to splitting irregularly, densely covered with simple  $c. 0.3$ -mm-long ferruginous hairs; corolla  $c. 4 \times 4$  mm, lobes deltoid, thick, apex obtuse,  $c. 3.5 \times 2$  mm, densely covered with  $c. 0.3$  mm long, simple, patent, golden brown hairs; staminal ring truncate,  $c. 1$  mm high, filaments short, filiform,  $c. 0.5$  mm long, anthers reniform with rounded or retuse apex,  $c. 0.7$  mm long; ovary densely covered with golden brown  $c. 0.2$ -mm-long hairs, cylindrical, apex truncate,  $1.5 \times 2$  mm, style filiform,  $1.2$  mm long. Fruit globose, crimson to pink ripening dark purple to black,  $c. 15-17 \times 12-15$  mm when fresh and  $c. 11 \times 7$  mm when dried; seed globose to ovoid,  $c. 8 \times 7$  mm across.

**DISTRIBUTION.** Peninsular Malaysia, Singapore and Sumatra.

**HABITAT.** Lowland species of moist alluvial and seasonal swamp forests. Where it is found, it can strongly dominate the understorey vegetation. In Pasoh F.R. in Peninsular Malaysia, for example, this species has the highest density among all woody angiosperms. It is also quite habitat-specific as it can completely disappear even a short distance away from its preferred habitat. It has also been recorded in valleys of foothills of some coastal hill forests in Pahang. This is probably due to the extension of its range from the lowland forest adjacent to such hills. In Sumatra, the species has been recorded on ridge tops on sandstone and hill dipterocarp forests. It is not fully understood as to why such distribution is noted in Sumatra, outside its preferred habitat as seen in the Malay Peninsula.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, Changkat Jong F.R., Ng FRI 5669 (KEP); Sunki, *King's collector* 3041 (lectotype FI; isolectotypes BM, CAL, K); Terengganu, Bukit Bauk F.R., *Whitmore* FRI 3910 (KEP); Kemaman, Bukit Kajang, *Corner* SFN 30398 (K, SING); Pasir Gajah, MARDI Station, *Saw & Baya* FRI 37576 (KEP); Pahang, Aur F.R., *Whitmore* FRI 3625 (KEP); Bukit Sagu, *Nur* SFN 25167 (SING); Jengka F.R., *Poore* 1212 (KLU, SING); Krau Game Reserve, *Whitmore* FRI 3568 (KEP); Kuantan, Baloh F.R., *Meijer & Yong* KEP 94922 (K, KEP, SING); Tasek Bera, *Gianno* 560 (L); Tasek Chini, *Saw* FRI 39938 (KEP); Negeri Sembilan, Ayer Kuning, *Symington* KEP 24380 (SING); Fort Iskandar, *Stone* 7166 (KLU); Pasoh F.R., *Saw* FRI 37266 (KEP); Sungei Menyala F.R., *Whitmore* FRI 15199 (KEP); Johor, Arong F.R., *Ng* FRI 5221 (KEP); Gunong Belulut, north, *Holttum* SFN 10605 (SING); Jemaluang Road, Sungai Kayu Ara, *Corner* SFN 28688 (K, SING); Kluang F.R., *Dransfield* 853 (K, KEP); Labis F.R. (Endau-Rompin Park), *Whitmore* FRI 176 (KEP, SING). **SINGAPORE.** Bukit Timah, *Ridley* 3512 (SING); Sungei Tinang, *Mat s.n.* 1899 (SING); Upper MacRitchie Reservoir, *Maxwell* 81-108 (AAU, L, KLU, SING). **SUMATRA.** Jambi, Kg. Penetai, *Dransfield* 2631 (L); Pasir Mayang, *Vreeken-Bujis* 1 (L); Lingga Arch., *Bunnemeyer* 7387 (L); Palembang, *Grashoff*

882 (FI), *Thorennar* T60 (L); Sijunjung, Muro Kulampi, *Dransfield & Moge* 3984 (K); Yambi, S. Kejarung, *Laumonier* YL 790 (K).

*Licuala ferruginea* is closely related to *L. thoana*, *L. kemamanensis*, *L. bayana* and the Sumatran *L. ferruginoides* Becc., all of which have a rusty tomentose inflorescence and flowers. Typical of this group, are the crimson to pink immature fruits. All other species of *Licuala* have green immature fruits. *Licuala ferruginoides* has rather large flowers, up to 7 mm long, other species all have flowers less than 5 mm in length. *Licuala ferruginea* has rebranched first-order branches, and is never spicate. The other species have mainly spicate first-order branches. *Licuala bayana* and *L. thoana* may occasionally have second-order branches.

**7. *Licuala bayana* L.G. Saw sp. nov.** *L. ferrugineae similis sed habitu dense caespitoso, inflorescentiis partialibus spicatis fructibus maximis ad 20 mm diametro et seminibus ad 13 mm diametro differt.* *Typus: Saw & Baya FRI 37583, Peninsular Malaysia, Terengganu, Dungun, Jerangau F.R. (holotypus KEP).* (Fig. 5)

Clustering with 2–5 subdominant shoots. Acaulescent, stem subterranean. Leaves *c.* 4–8 per shoot; petiole *c.* 2.4–2.5 m long, *c.* 20 mm wide near base, *c.* 7–10 mm wide at apex, drying light greenish brown, spines no more than 1 mm long along approximately the lower half of petiole; frond semi-orbicular to orbicular, *c.* 100–150 cm wide, segments *c.* 3–7, lateral margins straight; lateral segments 6–7-costulate, *c.* 76–87 × 13–17 cm; central segment entire, sessile, larger than laterals, 28–34-costulate, 89–93 × 40–50 cm or wider. Inflorescence patent, shorter than leaves, *c.* 40–70 cm long, bearing mainly 5–7 first-order branches, sometimes to second; peduncle *c.* 17–23 cm long, *c.* 6–9 mm wide near base; prophyll tubular, slightly inflated with closely sheathing, fibrous apex, to *c.* 17 × 1.5 cm, densely covered with caducous ferruginous stellate hairs; peduncular bracts absent; rachis somewhat sinuous bending at primary branches especially towards apex, densely covered with ferruginous stellate hairs; rachis bract similar to prophyll, *c.* 17 × 1.7 cm; rachillae to *c.* 30 cm long, *c.* 5 mm wide, originating in or near mouth of rachis bract, flexuous, unornamented, densely covered with simple, rusty ferruginous, *c.* 0.3–0.5-mm-long hairs. Flowers solitary, *c.* 4–6 per cm, sessile subtended by triangular to lanceolate 1–3-mm-long rachilla bracts, maturing about simultaneously; calyx vase-shaped, *c.* 3 × 3.5 mm, base thickened, chartaceous above, apex trilobed, rounded, covered with scattered to dense *c.* 0.3–0.5-mm-long simple brown hairs; corolla *c.* 3.5 × 2.5 mm, thick, apex acute, *c.* 2.4 × 1.5 mm, densely covered with *c.* 0.3–0.5-mm-long patent golden brown simple hairs; staminal ring truncate, *c.* 1 mm high, filaments and anthers unknown; ovary densely covered with golden brown less than 0.2-mm-long hairs, cylindrical, truncate at apex, 1.2 × 1.5 mm, style filiform, 1.2 mm long. Fruits globose to ovoid, sparsely covered with fine brown hairs, crimson to pink ripening dark purple to black, *c.* 25 × 22 mm, smooth in fresh specimen and *c.* 17 × 13 cm in dried herbarium specimen; seed globose to ovoid, *c.* 15 × 13 mm.

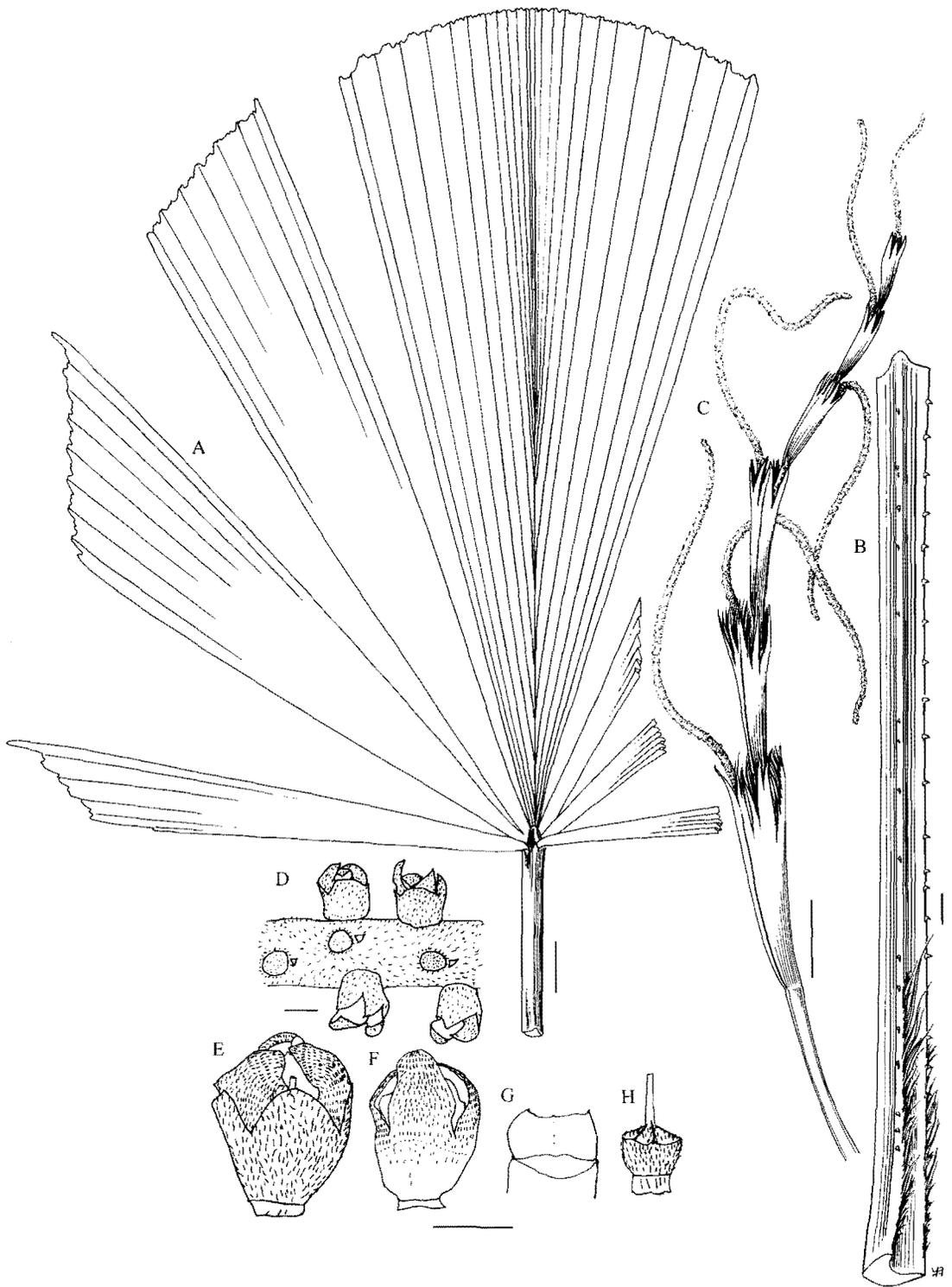


Fig. 5. *Licuala bayana*. A. Frond. B. Petiole base. C. Inflorescence. D. Rachilla with old flowers. E. Flower. F. Corolla with calyx removed. G. Calyx and corolla removed revealing staminal ring, anthers had dropped off. H. Ovary. All from FRI 37583. Scale bar 5 cm for A-C, 2 mm for D-H.

**DISTRIBUTION.** Endemic to Peninsular Malaysia, so far only known from the type collection.

**HABITAT.** Lowland dipterocarp forest. It is particularly common in areas of seasonal swamp where it dominates the forest floor. In drier areas or in areas of better drainage, it grows sympatrically with *L. malajana* Becc.

This is a distinctive species, related to *L. ferruginea*. *Licuala bayana* is different from *L. ferruginea* in its strongly clustering habit, generally spicate first-order branches and with exceptionally large fruits, 20 mm or more across. *Licuala ferruginea* is a solitary palm but may sometimes sucker with small shoots at its base, but never with co-dominant shoots as seen in this species, its first-order branch is always rebranched and its fully formed fresh fruits are no more than 15 mm across. The species epithet honours my field assistant Mr Baya Busu.

### 8. *Licuala lanuginosa* Ridl.

in J. Roy. Asiatic Soc. Straits Br. 44: 203 (1905); Ridl., Mat. Fl. Mal. Pen. 2: 165 (1907); Becc. in Webbia 5: 33 & 46 (1921); Ridl., Fl. Mal. Pen. 5: 30 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 181 (1933); Furtado in Gard. Bull. Straits Settlements 11: 54 (1940). Lectotype: *Ridley* 12198, Peninsular Malaysia, Johor, Gunong Pulai (K; isoelectotypes FL, SING). (Fig. 1 K-N)

Acaulescent. Stems clustering with 2–4 or more subdominant shoots, subterranean with very short internodes, in older individuals J-shaped, *c.* 30 mm wide. Leaves *c.* 8–12 per shoot; sheath with a rather fragile ligule and disintegrating into coarse fibres; petiole *c.* 1–2.5 m long, *c.* 10 mm wide near base, *c.* 4–8 mm wide towards apex; spines irregularly spaced, no more than 2 mm long on lower half or more of petiole; frond *c.* 60–90 cm wide, semi-orbicular to orbicular; segments *c.* 5–9, lateral margins straight; lateral segments 3–5-costulate, *c.* 40–70 × 5–9 cm; central segment entire, sessile, slightly larger than rest, 10–14-costulate, *c.* 42–75 × 10–16 cm. Inflorescence erect, shorter than leaves, *c.* 60–100 cm long, branched to second order; peduncle *c.* 33–45 cm long, *c.* 4–8 mm wide at base; prophyll tubular, slightly inflated with close sheathing, fibrous apex, to *c.* 12 × 1.1 cm or larger, covered densely with 1–1.5 mm long, caducous, silvery shaggy stellate hairs; peduncular bracts absent; rachis straight, not sinuous, covered with similar hairs as prophyll; rachis bract lanceolate, *c.* 7–12 × 0.7–2.3 cm, flattened but slightly inflated, coriaceous with pointed rather fibrous mouth with similar indumentum as prophyll; first-order branches 3–4, placed away from mouth of rachis bract; second-order branches rather lax and patent; rachillae to *c.* 25 cm long, *c.* 4 mm wide, flexuous, densely covered with coarse, silvery, shaggy simple hairs, unornamented. Flowers solitary, sessile, *c.* 4.5–8.5 per cm, maturing about simultaneously, mature bud cylindrical, *c.* 4 × 3–3.5 mm; calyx cylindrical, *c.* 3 × 3–3.5 mm, thickened at base, chartaceous towards apex, densely covered

with more than 1-mm-long shaggy, silvery, simple hairs, apex truncate to splitting irregularly into *c.* 3 lobes; corolla *c.* 3.5 × 2.5 mm, thick, densely covered with more than 0.5 mm long, appressed, regularly wavy, golden brown, simple hairs on apical half, glabrescent towards base, lobes *c.* 2 × 2.2 mm, apex acute; staminal ring truncate, *c.* 0.8 mm high, filaments filiform, *c.* 0.4 mm long, anthers *c.* 0.5 mm long; ovary densely covered with *c.* 0.5-mm-long golden brown hairs, cylindrical, truncate at apex, 1–1.5 × 1.2–1.5 mm, style filiform, 1.2 mm long. Fruit globose, glabrous, green when immature, *c.* 11 mm across with smooth surface in fresh specimens and *c.* 8 mm across in dried herbarium specimen; seed globose *c.* 7 mm across.

**DISTRIBUTION.** Endemic to Johor in Peninsular Malaysia.

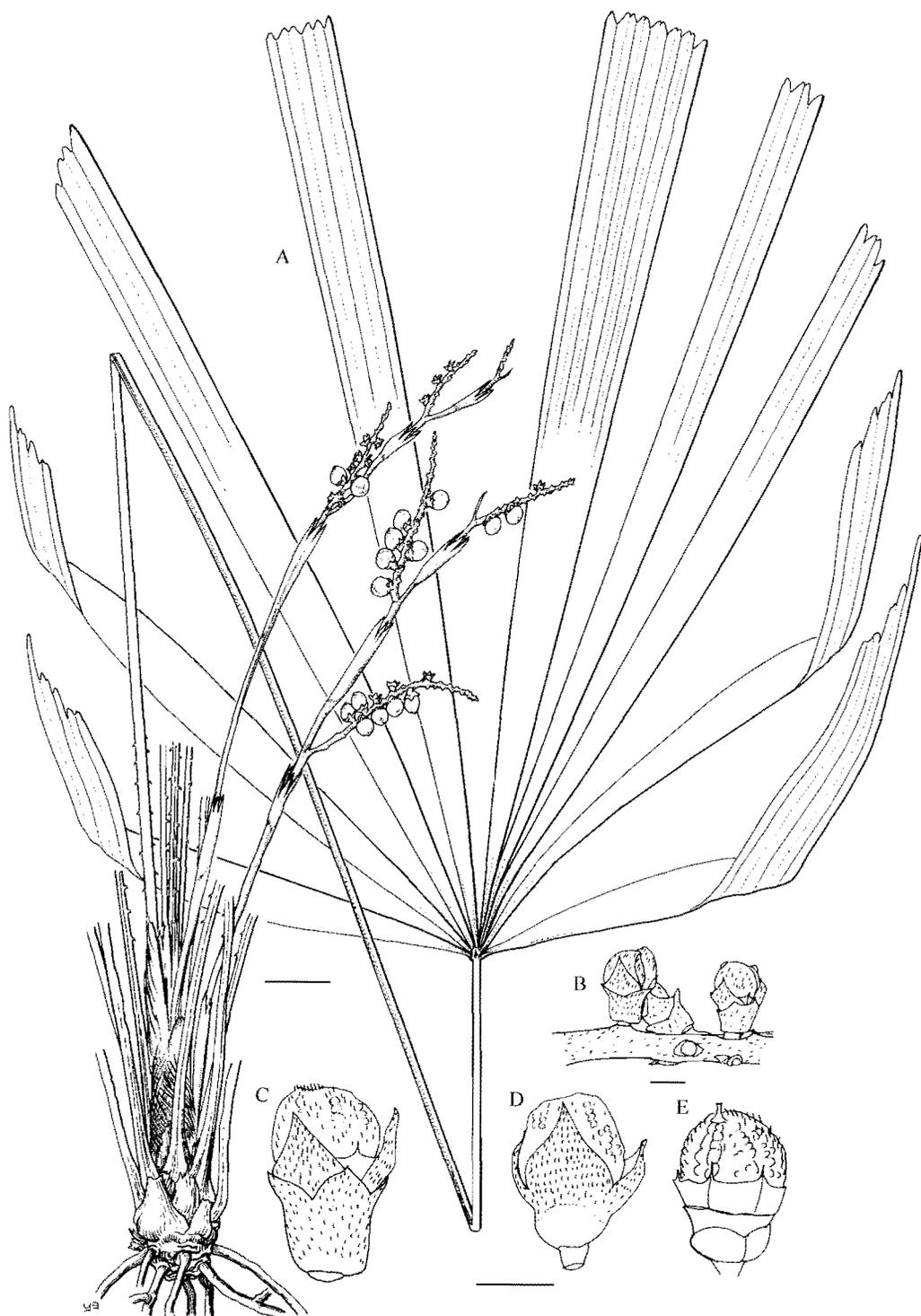
**HABITAT.** Lowland to hill dipterocarp forest to *c.* 740 m. It is also found on old flood terraces. In undulating terrain, the species is more common on upper slopes and ridges.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Johor, Gunong Belumut, *Dransfield* 842 (KEP), Gunong Muntahak, *Nur* SFN 19968 (SING); Gunong Panti, *Ridley s.n.* December 1892 (SING); Gunong Pulau, *Ridley* 12198 (lectotype K; isolectotypes FI, SING); Kulai (base of Gunong Pulau), *Tan* 8 (SING); Kluang, Lenggong F.R., *Saw et al.* FRI 37438 (KEP); Linggui F.R., *Saw* FRI 37482 (KEP); Pontian Kechil, Bukit Tinjau Laut, *Corner* SFN 37068 (SING).

This a very distinctive species with its very tomentose erect inflorescence. One other species with a similar tomentose inflorescence is *L. cameronensis*. However, this is a solitary species with an erect stem and pendulous inflorescence with spicate first-order branches and a glabrous ovary. *Licuala lanuginosa* has a clustering, acaulescent habit, an erect inflorescence and a hairy ovary. *Licuala lanata* Dransfield from Borneo has very similar habit, with also an erect inflorescence and similarly tomentose inflorescence and flowers. The main differences between them are that *L. lanuginosa* has 2–4 first-order branches and a hairy ovary while *L. lanata* has only one first-order branch and a glabrous ovary.

**9. *Licuala kamarudinii* L.G. Saw sp. nov.** *L. triphyllae* similis sed inflorescentiis partialibus spicatis floribus in rachillis arcte aggregatis et fructibus tuberculatis differt. *Typus:* Saw FRI 37533, Peninsular Malaysia, Pahang, Rompin, Lesong F.R., Sungei Kinchin (holotypus KEP). (Fig. 6)

Small, solitary, acaulescent. Stem subterranean with very short internodes, in older individuals J-shaped, *c.* 2–2.5 cm wide. Leaves *c.* 6–12 in crown; petiole *c.* 40–100 cm, *c.* 4–5 mm wide near base, *c.* 2–3 mm wide towards apex, drying reddish brown; spines narrowly triangular and acutely reflexed, less than 2 mm long, along lower third of petiole; fronds *c.* 35–60 cm wide, semi-orbicular to peltate-orbicular; segments of two distinct



**Fig. 6.** *Licuala kamarudini*. **A.** Habit with infructescences. **B.** Rachilla with some immature fruits. **C.** An immature fruit with persistent calyx and corolla. **D.** Calyx removed revealing corolla. **E.** Young fruit and staminal ring. A from FRI 38529, B–D from FRI 37533. Scale bar 2 cm for A, 2 mm for B–E.

forms, either *c.* 3–5 with pronounced curved lateral margins, or *c.* 7–11 with straight lateral margins; lateral segments 3–7-costulate, 23–30 × 2–5.5 cm; central segment, entire, sessile, 5–22-costulate, 24–36 × 5–20 cm, distinctly folded near hastula in fewer-segmented fronds. Inflorescence patent, shorter than leaves, to *c.* 15–25 cm long, branched to first order with 2–3 first-order branches; peduncle *c.* 11–13 cm; prophyll 6–8 × 0.5 cm; peduncular bracts sometimes lacking; rachis patent, covered with caducous reddish brown hairs; rachis bracts tubular, tightly sheathing, to *c.* 4 × 0.5 cm, neatly splitting into 2–5 apical lobes only, covered with silvery shaggy hairs; first-order branches close to mouth of rachis bract, *c.* 2.5–4.5 cm apart; rachilla to *c.* 3.3–4.5 cm long, *c.* 1–1.5 mm wide, densely covered with simple, coarse, brown hairs. Flowers on rather small tubercles, solitary, sessile, *c.* 13 per cm, maturing about the same time; calyx cylindrical, 2.5 × 2.5 mm, splitting neatly into 3 pointed lobes, covered with scattered 0.5–0.8-mm-long reddish brown, simple hairs; corolla thick, in very immature fruits to 4 × 2.5 mm, densely covered with coarse, simple, brown hairs, lobes pointed at apex, *c.* 2 × 2.5 mm; staminal ring *c.* 1 mm high, filaments filiform. In very immature fruits, surface strongly tuberculate, densely covered with reddish brown hairs. Fruit globose, slightly hairy, surface shagreen, *c.* 7 mm across, green, ripening orange, seed globose, 6 mm across.

**DISTRIBUTION.** Endemic to south central Pahang in Peninsular Malaysia.

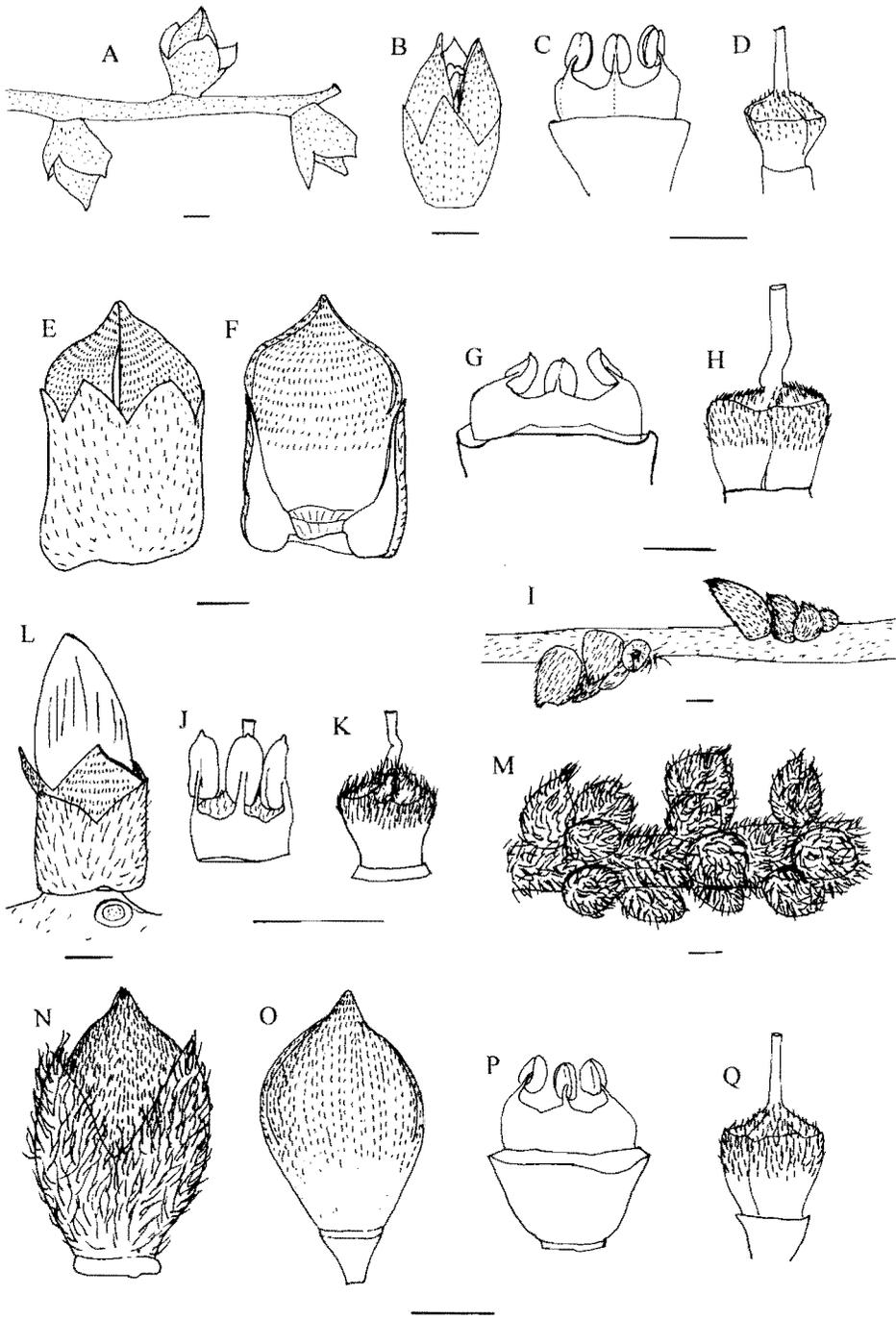
**HABITAT.** An understory palm, restricted in distribution but common where it occurs. In both localities of Sungei Kinchin and Tasik Chini, it has only been found on river banks and the sides of the lake in lowland dipterocarp forest.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Pahang, Rompin, Lesong F.R., Sungei Kinchin, *Saw* FRI 37533 (holotype KEP), FRI 38525 (KEP), FRI 38529 (KEP); Pekan, Tasik Chini, *Saw* FRI 39937 (KEP).

The population in Sungei Kinchin comprises mainly the few-segmented leaf form. The population in Tasik Chini and a small pocket of individuals in Sungei Kinchin belong to the many-segmented leaf form. This species is quite close to *L. triphylla*, from which it is distinguished by its spicate first-order branch in the inflorescence and its tuberculate fruits. In *L. triphylla*, the inflorescence is branched to second order and its fruit surface matte but not tuberculate. The specific epithet honours my research assistant, Mr Kamarudin Salleh who has accompanied me on many field excursions hunting *Licuala*.

#### 10. *Licuala triphylla* Griff.

in Calcutta J. Nat. Hist. 5: 332 (1845); Griff., Palms of British India 126 (1850); Becc. & Hook. f., Fl. Brit. India 6: 432 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 163 (1907); Becc. in Webbia 5: 33 & 46 (1921); Ridl., Fl. Mal. Pen. 5: 28 (1925); Becc. in Ann. Roy. Bot. Gard.



**Fig. 7.** A–D *Licuala triphylla* (from Dransfield 822). A. Rachilla with mature flower buds. B. A mature flower. C. Androecium. D. Ovary. E–H *Licuala longipes* (from FRI 37268). E. Flower. F. Calyx dissected revealing corolla. G. Androecium. H. Ovary. I–L *Licuala kiahii*. I. Rachilla with flowers. J. Androecium from an immature flower bud. K. Ovary. L. An immature fruit. (I–K from FRI 20003, L from FRI 37528.) M–Q *Licuala pusilla* (from Kloss & Ridley 62). M. Rachilla with some flower buds. N. Flower bud. O. Calyx removed revealing the corolla. P. Androecium. Q. Ovary. Scale bar 1 mm throughout.

Calcutta 8: 183 (1933); Furtado in Gard. Bull. Straits Settlements 11: 68 (1940). Type: *Griffith s.n.*, Peninsular Malaysia, Malacca, Ayer Panas (holotype BR). (Fig. 7 A–D)

*L. ternata* Griff. ex. Mart., Hist. Nat. Palm. 3: 238 & 318, 2nd ed., (1849). Type: *Griffith s.n.*, Peninsular Malaysia, Malacca, Ayer Panas (holotype BR).

*L. pygmaea* Merrill in University of California Publications in Botany 15: 20 (1920); Furtado in Gard. Bull. Straits Settlements 11: 68 (1940). Type: *Elmer* 21635, Borneo, Sabah, Tawau, Elphinstone Province (holotype K; isotype L).

*L. triphylla* var. *integrifolia* Ridley in Mat. Fl. Mal. Pen. 2: 164 (1907); Becc. in Webbia 5: 33 & 46 (1921); Ridley in Fl. Mal. Pen. 5: 28 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 183 (1933); Furtado in Gard. Bull. Straits Settlements 11: 68 (1940). Type: *Ridley s.n.* 1891, Peninsular Malaysia, Pahang, Lubok Pelang (holotype SING).

Solitary small, acaulescent. Stem subterranean with very short internodes, in older individuals J-shaped, *c.* 2 cm wide. Leaves *c.* 6–10 in crown; petiole *c.* 50–100 cm long, *c.* 5–6 mm wide near base, *c.* 2–3 mm wide towards apex, drying reddish brown; spines irregularly spaced and sized, thin, reflexed, no more than 4 mm long along the lower third of petiole; frond small, leathery with a rather dull adaxial surface when fresh, *c.* 22–50 cm wide, segments *c.* 3–10, lateral margins straight, central segment larger than rest, entire, petiolulate, sometimes not, 10–20-costulate, *c.* 15–34 × 7–11 cm, lateral segments 3–5-costulate, *c.* 17–30 × 5–6 cm. Inflorescence patent, shorter than leaves, *c.* 15–40 cm long, branched to second order bearing 3–4 first-order branches; prophyll rather small, *c.* 3–5 × 0.5 cm, tubular, flattened; peduncle *c.* 11–18 cm long, *c.* 3 mm wide near base; peduncular bract 1, tubular, slightly flattened, not inflated, apically splitting into neat but irregular lobes, coriaceous, 4–7 × 0.2–0.5 cm, densely covered with caducous stellate *c.* 0.5–0.8-mm-long hairs; rachis somewhat flexuous, not sinuous; rachis bract similar to peduncular bract, *c.* 5–8 × 0.3–0.5 cm; first-order branches, close to or slightly away from mouth of rachis bract, bearing 2–5 secondary branches; rachilla *c.* 3–8 cm long, *c.* 1 mm wide, rather thin and wiry, unornamented, covered with scattered less than 0.3-mm-long simple hairs. Flowers solitary (rarely in pairs), sessile, *c.* 2–3 per cm, maturing about simultaneously; mature bud ellipsoid, *c.* 4 × 2.5 mm; calyx vase-shaped, *c.* 2–2.5 × 2–2.5 mm, base flattened, thickened, densely covered with *c.* 0.3–0.4 mm simple brown hairs, membranous towards apex with 3 acute lobes, lobes *c.* 1 × 2 mm; corolla *c.* 4 × 2.5 mm, thick, densely covered less than 0.2-mm-long patent, simple, brown hairs on upper two-thirds, glabrescent towards base, lobes *c.* 2.5 × 2 mm, apex acute; staminal ring *c.* 0.5 mm high, apex undulate, filaments subulate, *c.* 0.4 mm long, anthers *c.* 0.5 mm long; ovary vase-shaped, truncate at apex, 1.2 × 1.5 mm, densely covered on upper half with *c.* 0.2 mm appressed white hairs, style filiform, *c.* 1 mm long. Fruit globose, glabrous, green, ripening orange, *c.* 10 mm across, surface rather wrinkled in dried specimens but matte in fresh; seed globose, *c.* 7 mm across.

DISTRIBUTION. Peninsular Thailand, Peninsular Malaysia and Borneo.

HABITAT. A lowland dipterocarp forest understorey species, preferring undulating terrain of up to 670 m.

**SPECIMENS EXAMINED—PENINSULAR THAILAND.** Labu Mine near Banongsta, Charan *et al.* TCW 3131 (K); Pattani, Betong, Kerr 7526 (BM, K); Kao Kalakiri, Kerr 14921 (BM, K); Ranong, Klong Naka Sanctuary, Larsen & Larsen 33309 (AAU, K); Surat Thani, Phanom, Kao Sok Nature Park, Smith & Sumawong GC 77 (K). **PENINSULAR MALAYSIA.** Kedah, Sik, Rasip FRI 37407 (KEP); Weng, Bukit S'blak, Furtado SFN 33069 (BM, K, L, SING); Perak, Bujong Malacca, Curtis *s.n.* August 1898 (SING); Bukit Tapah F.R., Saw FRI 37376 (KEP); Dindings, Gunong Tunggul, Ridley *s.n.* May 1896 (SING); Kroh, Bukit Merbau, Furtado SFN 33041 (SING); Perak River, King's collector 852 (FI); Pahang, Chini F.R., Cockburn FRI 11091 (KEP); Gunong Senyum, Henderson SFN 22356 (SING); Krau Game Reserve, Kuala Lompat, Whitmore FRI 12873 (KEP); Pulau Tujoh, Ridley *s.n.* 1891 (SING); Taman Negara, Sungai Tembeling, Dransfield JD 693 (K); Terengganu, Kuala Terengganu, 87 km Besut road, Dransfield JD 6505 (KEP); Setiu, Ulu Setiu F.R., Saw FRI 39883 (KEP); Selangor, Klang Gates Ridge Kiew RK 1172 (UPM); Ulu Kerling, Kunstler 8723 (K); Negeri Sembilan, Pasoh F.R., Saw FRI 37269 (KEP); Port Dickson, Sungai Menyala, Whitmore FRI 15206 (KEP); Tampin, Burkill SFN 3212 (K, SING); Malacca, Ayer Panas, Griffith *s.n.* (holotype BR); Bukit Beruang, Curtis *s.n.* May 1901 (SING); Chabau, Alvins 2306 (SING); Johor, Kluang F.R., Dransfield JD 822 (K, KEP); Muar, Bukit Keyara, Ridley *s.n.* 1902 (SING); Ma'Okil F.R., Dransfield & Fong JD 5018 (KEP); Pontian Kechil, Bukit Tinjau, Corner SFN 37079 (SING); Sungai Tebrau, Ridley 13234 (BM, SING). **SINGAPORE.** Changi, Ridley *s.n.* 1891 (SING). **BORNEO.** Sabah, Tawau, Elmer 21635 (K, L); Sandakan, Ulu Dusun Agriculture Station, Dransfield *et al.* JD 5758 (K, SAN).

Species related to *L. triphylla* are *L. tenuissima*, *L. ruthiae* and *L. kamarudinii*. All these are very small understorey *Licuala* with a similar acaulescent and solitary habit. *Licuala ruthiae* and *L. kamarudinii* have very short inflorescences and simple spicate first-order branches. Although *Licuala tenuissima* has branched first-order branches, its flowers are arranged in groups of up to five, whereas those of *L. triphylla* are predominantly solitary. Finally, *L. triphylla* normally has petiolulate mid-segments, while the others do not. The petiolulate mid-segment is, however, not a very consistent character. There are individuals of *L. triphylla* in the field and some herbarium collections without the petiolulate mid-segments.

Note that there are two collections of *Scortechini* 531b in Florence (FI) with this same number. The other specimen of *Scortechini* 531b is *L. pusilla*.

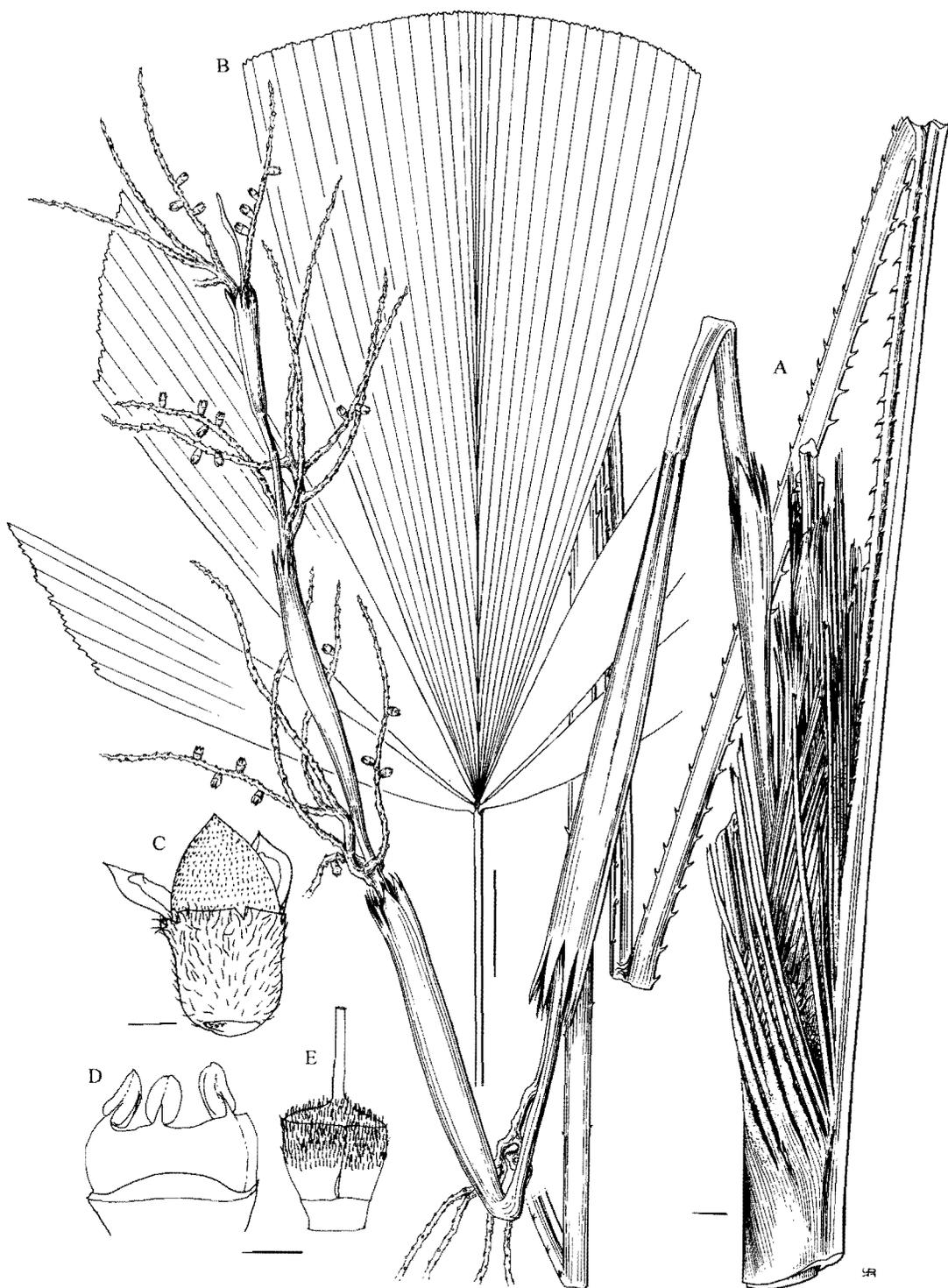
**11. *Licuala ahlidurii* L.G. Saw sp. nov. inflorescentia *L. malajanae* similis, sed habitu acaulescenti inflorescentia erecta et ovario tomentoso differt. Typus: Saw FRI 39860, Peninsular Malaysia, Terengganu, Dungun, Bukit Bauk F.R. (holotypus KEP; isotypi A, K, L, QRS, SAN, SAR). (Fig. 8)**

Acaulescent, clustering with 7 or more subdominant shoots. Stems subterranean, J-shaped in more mature individuals, c. 4.2 cm diameter, c. 6 cm with leaf sheaths. Leaves c. 5–10 per shoot; petiole c. 1.2–2.2 m long, to c. 10 mm wide near base, c. 5–6 mm wide towards apex, drying reddish brown; spines to c. 4 mm long, along c. lower two-thirds of petiole; frond semi-orbicular, c. 100–130 cm wide, segments c. 5–7, lateral margins straight; lateral segments 3–7-costulate, c. 57–70 × 11–16 cm; central segment much larger than laterals, entire, sessile, 20–27-costulate, 60–86 × 30–55 or sometimes wider. Inflorescence erect, shorter than leaves, c. 75–122 cm long, branched to second order bearing 4–5 first-order branches; peduncle c. 35–66 cm long, c. 6–9 mm wide at base; prophyll tubular, flattened, c. 16 × 1.8 cm; peduncular bracts absent; rachis somewhat rigid, not sinuous; rachis bracts at base c. 12–19 × 1.1–1.8 cm, tubular, flattened, coriaceous with slightly fibrous mouth, covered with caducous, c. 0.5–1-mm-long stellate hairs; first-order branches close to or away from the mouth of rachis bract, rather lax with 3–6 secondary branches; rachillae to c. 18 cm long, c. 2 mm wide, covered with scattered c. 0.3–0.5-mm-long simple hairs. Flowers solitary, sessile, seated on swollen tubercles, c. 5–7 per cm, maturing about simultaneously; calyx cylindrical, c. 2.5–3 × 2.5 mm, base flattened, thickened, apex truncate with irregularly shallow splits, covered with scattered c. 0.5-mm-long silvery simple hairs; corolla c. 4–4.5 × 2.5–3 mm, thick, densely covered on upper two-thirds with c. 0.5 mm or less long, patent wavy golden brown hairs, glabrescent towards base; lobes c. 2–2.5 × 2.5–3 mm, apex acuminate; staminal ring undulate, c. 1 mm high, filaments subulate, c. 0.5 mm long, anthers c. 1 mm long; ovary turbinate, truncate at apex, c. 1.5–2 × 1.8 mm, densely covered in upper half with c. 0.5-mm-long appressed to patent golden hairs, style filiform, 1 mm long. Fruit ovoid, glabrous, green, ripening red, c. 20 × 11 mm with surface smooth in fresh specimen; seed globose c. 7 mm across.

**DISTRIBUTION.** Endemic to Bukit Bauk, Terengganu in Peninsular Malaysia.

**HABITAT.** This species dominates the understorey of the stands of *Dryobalanops aromatica* Gaertn. f. (Dipterocarpaceae) on Bukit Bauk. It is only found on slopes and ridges at the foot of this hill, and absent at higher elevations. It is found growing sympatrically with *L. glabra* (acaulescent form) and *L. terengganuensis*.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Dungun, Bukit Bauk F.R., *Dransfield* JD 5189 (KEP, KLU), *Kasim* KL 5062 (KLU), *Poore* 5062 (K), *Saw* FRI 39860 (holotype KEP; isotypes A, K, L, QRS, SAN, SAR), *Saw & Baya* FRI 37570 (K, KEP, SAN, SAR), *Whitmore* FRI 3957 (KEP), *Zainudin* 5062 (UKMB).

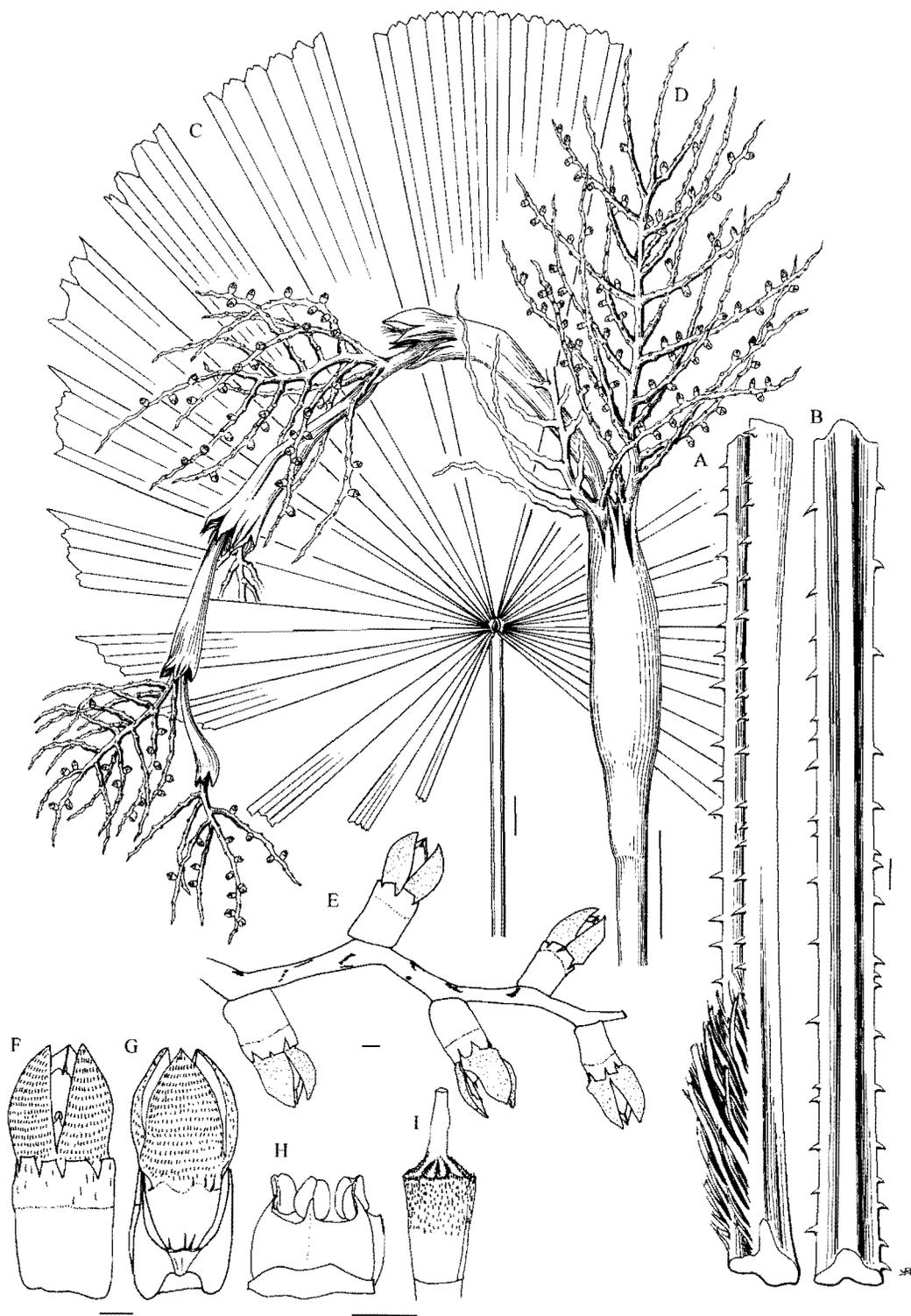


**Fig. 8.** *Licuala ahlidurii*. **A.** Leaf sheath and petiole with inflorescence. **B.** Frond. **C.** Flower. **D.** Androecium. **E.** Ovary. A–B from FRI 39860, the rest from *Poore* 5062. Scale bar 1 cm for A, 5 cm for B, 1 mm for C–E.

The species is similar to *L. malajana*; both species have branched first-order branches, hairy calyx and corolla. *Licuala ahlidurii* is, however, distinctive with its acaulescent habit, very wide mid-segment compared with the other lateral segments, erect inflorescence and finally with its hairy ovary. *Licuala malajana* is stemmed, has more or less equal sized segments, a patent inflorescence and glabrous ovary. The species epithet is named in honour of Dr John Dransfield; *ahli duri* is a Malay phrase meaning a specialist of thorns, referring aptly to his expertise in thorny rattans.

**12. *Licuala fractiflexa* L.G. Saw sp. nov.** *L. longipedi similis sed rachillis subulatis fractiflexis glabrescentibus floribus majoribus 6 mm longis excedentibus calyce glabrescenti recedit.* *Typus: Saw & Baya FRI 37585, Peninsular Malaysia, Terengganu, Dungun, Jerangau F.R. (holotypus KEP; isotypi K, SAN).* (Fig. 9)

Solitary, large, acaulescent to short-stemmed. Stems to *c.* 0.5 m high, *c.* 9–10 cm wide. Leaves *c.* 15–28 in crown; petiole *c.* 1.7–3.3 m long, *c.* 15–30 mm wide near base, *c.* 8–15 mm wide towards apex; spines rather irregular in spacing and size, no more than 7 mm long along lower half or more of petiole, abaxially bearing rather waxy and scaly indumentum, drying dark reddish brown; frond large, *c.* 120–180 cm wide, peltate orbicular, thick leathery, shiny on both surfaces; segments *c.* 11–15, lateral margins straight; lateral segments 3–5-costulate, *c.* 75–105 × 16–25 cm; central segment entire, sessile, much larger than laterals, 15–20-costulate, *c.* 78–110 × 30–60 cm, sometimes wider. Inflorescence erect, shorter than leaves, *c.* 40–80 cm long, with second-order branching, bearing 3–6 first-order branches; peduncle *c.* 20–40 cm long, *c.* 10–15 mm wide near base; prophyll tubular, flattened, *c.* 3 cm wide, mouth fibrous; peduncular bracts absent; rachis somewhat robust, sinuous, bending at primary branches; rachis bract tubular, slightly flattened, inflated, apically fibrous and splitting irregularly, *c.* 16–20 × 2–2.5 cm, coriaceous, densely matted with caducous stellate, reddish brown, appressed, wavy, *c.* 0.5–1-mm-long hairs; first-order branches close to mouth of rachis bract, bearing rather compact 12–18 secondary branches; rachillae to *c.* 16 cm long, *c.* 2 mm diameter, rather subulate, glabrous but at first sparsely covered with reddish brown caducous amorphous indumentum. Flowers solitary, sessile, seated on ridges of fracti-flexuous rachilla, *c.* 2 per cm, maturing almost simultaneously; mature buds cylindrical, *c.* 6–7.5 × 3.2–3.5 mm; calyx cylindrical, *c.* 4 × 3.5 mm, glabrescent with sparse *c.* 0.2–0.4-mm-long hairs towards apex, base flattened, thickened, apex truncate and shallow-irregularly splitting; corolla *c.* 6 × 4 mm, densely covered with *c.* 0.3–0.4 mm or less long, appressed golden brown hairs on upper two-thirds, glabrescent towards base, lobes thick, *c.* 3 × 2.5 mm, apex acute; staminal ring undulate, *c.* 1 mm high, filaments rather subulate, *c.* 0.5 mm long, anthers *c.* 0.6 mm long; ovary densely covered on upper half with *c.* 0.2 mm appressed golden hairs, cylindrical, truncate at apex, *c.* 1.8 × 1 mm, style filiform, 1 mm long. Fruit globular, glabrous, smooth, green ripening reddish orange, *c.* 11–12 × 10–11 mm; seed globular *c.* 7 × 5.5 mm.



**Fig. 9.** *Licuala fractiflexa*. **A-B** Petiole. **C**. Frond. **D**. Inflorescence. **E**. Rachilla with flowers. **F**. Flower. **G**. Calyx dissected revealing corolla. **H**. Androecium. **I**. Ovary. All from FRI 37585. Scale bar 1 cm for A-B, 5 cm for C-D, 1 mm for E-I.

DISTRIBUTION. Endemic to Terengganu in Peninsular Malaysia.

HABITAT. Lowland dipterocarp forest, on undulating slopes and well drained soils.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Dungun, *Lim* 92/1238 (KEP); Dungun, Bukit Besi, after Gajah Mati Estate, *Saw & Kamaruddin* FRI 37635 (KEP); Jerangau F.R., *Saw & Baya* FRI 37585 (holotype KEP; isotypes K, SAN); Jabor–Jerangau highway, km 132, *Zainudin et al.* AZ 3891 (UKMB); Sungai Loh near Kuala Datok, *Cockburn* FRI 10676 (KEP), *Whitmore* FRI 8913 (KEP); Hulu Terengganu, Ulu Brang, *Whitmore* FRI 12530 (KEP); Kemaman, Chukai, close to Sungai Nipa, *Kiew* RK 2656 (UPM); Sungai Nipa F.R., *Dransfield* JD 5203 (K, KEP); Pasir Gajah, MARDI station, *Saw & Baya* FRI 37574 (KEP); Rasau Kerteh, Ulu Chukai F.R., *Chan* FRI 16858 (KEP); Ulu Bendong, Kajang, *Corner* SFN 30111 (SING).

Together with *L. longipes*, it is among the largest species of *Licuala* in Peninsular Malaysia. It is quite similar to *L. longipes* differing by its subulate, fracti-flexuous and glabrescent rachilla, larger flowers over 6 mm long and glabrescent calyx. *Licuala longipes* has a rather straight, not distinctly subulate, rather hairy rachilla, smaller flowers less than 6 mm long and a hairy calyx.

### 13. *Licuala longipes* Griff.

in Calcutta Journal Nat. Hist. 5: 330 (1844); Mart., Hist. Nat. Palm. ed. 2: 237 (1845); Griff., Palms of British India 126 (1850); Becc. & Hook. f., Fl. Brit. India 6: 431 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 162 (1907); Becc. in Webbia 5: 28 & 42 (1921); Ridl., Fl. Mal. Pen. 5: 27 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 155 (1933); Furtado in Gard. Bull. Straits Settlements 11: 57 (1940). Lectotype (selected here): *Griffith s.n.*, Peninsular Malaysia, Malacca, Ophir, Mons Miring (BR). (Fig. 7 E–H)

Solitary, large. Stems erect to c. 1 m or more tall, c. 8 cm wide, rarely with small suckers at base. Leaves c. 11–24 in crown; petiole c. 1.8–3 m long, c. 15–20 mm wide near base, c. 8–12 mm wide at apex, drying dark reddish brown; spines rather regularly spaced and uniform in size, no more than 7 mm long along lower half or more of petiole; frond c. 120–180 cm wide, peltate, orbicular, thick leathery with an oily-shiny adaxial surface when fresh; segments c. 20–28, lateral margins straight; lateral segment 2–4-costulate, c. 65–95 × 5–6 cm; central segment entire, sessile, sometimes petiolulate, slightly larger than rest, c. 14–15-costulate, c. 73–110 × 13–20 cm, sometimes wider. Inflorescence erect, shorter than leaves, c. 50–85 cm long, branched to second order bearing 4–7 first-order branches; peduncle c. 20–40 cm long, c. 10–18 mm wide at base; prophyll unknown; peduncular bracts absent; rachis somewhat rigid, sinuous, bending at primary branches; rachis bracts tubular, slightly flattened, loosely sheathing, apically slightly fibrous and splitting

irregularly, coriaceous, c. 18–36 × 2.2–2.5 cm at base, densely covered with caducous stellate c. 0.5–1-mm-long hairs; first-order branches bearing 6–20 rather compact secondary branches, originating close to mouth of rachis bract; rachillae to c. 16 cm long, c. 1–3 mm wide, thin to rather swollen, covered with sparse to scattered less than 0.2-mm-long simple hairs. Flowers solitary, sessile in shallow pits of swollen rachillae, pits lacking in thinner rachillae, c. 5–11 per cm, maturing about simultaneously; mature buds cylindrical, c. 4–5 × 3 mm; calyx cylindrical, c. 3 × 3 mm, base flattened, thickened, apex splitting shallowly into 3 bifid lobes, covered with scattered c. 0.3–0.4-mm-long simple silvery hairs; corolla c. 4.2 × 3 mm, thick, densely covered with c. 0.3–0.4-mm-long or less appressed golden brown simple hairs on upper half, glabrescent towards base, lobes c. 2 × 2.5 mm, apex acuminate; staminal ring undulate, c. 0.5 mm high, filaments filiform with broad triangular base, c. 0.5 mm long, anthers c. 0.6 mm long; ovary densely covered on upper half with c. 0.2 mm appressed golden hairs, cylindrical, truncate at apex, 1.5 × 1.7 mm, style filiform, 1.5 mm long. Fruit globose, glabrous, green, ripening orange to red, c. 10 mm across, smooth in fresh specimens; seed globose c. 8 mm across.

**DISTRIBUTION.** South-west Peninsular Malaysia and south-east Sumatra.

**HABITAT.** Lowland dipterocarp species, preferring areas with undulating terrain. The species may grow sympatrically with other species of *Licuala*. In Pasoh F.R., for example, it grows together with *L. ferruginea*, *L. kunstleri* and *L. triphylla*. In the Ulu Seriting F.R., *L. longipes* is found on the lower slopes while *L. ridleyana* occurs on the ridges and in some intermediate areas they grow together.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Selangor, Bangi F.R., *Razali* RS 8 (UPM); Negeri Sembilan, Beremban, *Furtado* SFN 33125 (L, SING); Bukit Tinggi, Berembun F.R., *Whitmore* FRI 4582 (KEP); Gunong Angsi, *Nur* SFN 11571 (SING); Pasoh F.R., *Saw* FRI 37267 (KEP); Sakai Reserve, Johol, *Palmer* 29 (SING); Tampin Hill, *Burkill* SFN 1171 (SING); Pahang, Mentakap west, *Holtum* SFN 24560 (SING); Termerloh, Titi Bungor, *Henderson* FMS 10559 (SING); Malacca, Ayer Panas, *Goodenough* s.n. July 1893 (BM, SING); Batang F.R., *Anthony* SA 876 (UPM); Bukit Tampin, *Goodenough* 1962 (SING); Mouth Ophir (Gunong Ledang), *Griffith* 59 (BM, E, K); Mons Miring, *Griffith* s.n. (lectotype BR); Selandan *Ridley* 10793 (SING); Johor, Gunong Ledang F.R., *Saw* FRI 37718 (KEP). **SUMATRA.** Jambi Province, Dusun Pemuyin, *Laumonier* YL 6329 (K); Muarabungo, Pasir Mayang, *Torquebiau* ET 1009 (K).

The species is distinct from other species of *Licuala* in its much branched first-order branches. The closest related species is *L. fractiflexa*. This species, too, has a much branched first-order branch. The rachilla of *L. fractiflexa* is, however, glabrescent, subulate and with a distinctive zigzag pattern towards the apex. The Sumatran specimens are slightly different from Peninsular Malaysian ones, the petiole drying green and their inflorescences are much longer, recorded at c. 2 m long; Peninsular Malaysian specimens have petioles

drying reddish brown and the inflorescences generally do not grow beyond 1 m. The flowers are, however, similar and the Sumatran specimens are included in this species.

#### 14. *Licuala kiahii* Furtado

in Gard. Bull. Straits Settlements 11: 52 (1940). Type: *Kiah* SFN 32137, Peninsular Malaysia, Johor, Sungai Kayu (holotype SING; isotypes A, BM, K). (Fig. 7 I-L)

Small, solitary, acaulescent. Stem subterranean with very short internodes, in older individuals J-shaped, *c.* 1.5–2.2 cm wide. Leaves *c.* 9–10 in crown; sheath disintegrating into fine reticulate fibres; petiole *c.* 38–70 cm long, *c.* 4–5 mm wide near base, *c.* 3–4 mm wide towards apex, drying reddish brown; spines rather irregularly spaced and sized, no more than 3 mm long along lower half of petiole; frond small, split, leathery with a rather dull adaxial surface when fresh, orbicular, *c.* 20–30 cm in wide; segments 3–5, mid-segment slightly larger than rest, lateral margins slightly concave; lateral segments 3–5-costulate, *c.* 8–20 × 3–5 cm; central segment entire, sessile, 12–20-costulate, *c.* 13–21 × 9–10 cm. Inflorescence patent, shorter than leaves, *c.* 25–35 cm long, branched to second order with 3–4 first-order branches; peduncle *c.* 10–17 cm long, *c.* 2–3 mm across near base; prophyll tubular, flattened, *c.* 4–7 × 0.4–0.5 cm; peduncular bract sometimes absent; rachis not sinuous; rachis bract *c.* 4–5 × 0.4–0.5 cm, tubular, slightly flattened, not inflated, splitting apically into neat but irregular lobes, coriaceous, densely covered with caducous, stellate *c.* 0.5–0.8-mm-long hairs; first-order branches bearing 2–5 rather loose and patent secondary branches, originating close to mouth of rachis bract; rachillae to *c.* 4–8 cm long, *c.* 1–2 mm diameter, unornamented, fracti-flexuous in mature flowering and fruiting specimens, covered with scattered less than 0.2-mm-long stellate and simple, reddish brown hairs. Flowers in groups of up to 6 in rather loose cincinni, sessile, maturing sequentially within each cincinnus, *c.* 1–1.3 per cm; immature bud ellipsoid; calyx in available very immature fruits cylindrical, *c.* 2.5 × 2.5 mm, covered with dense *c.* 0.5–0.8 mm silvery and reddish brown simple hairs, base flattened, thickened, membranous towards apex with 3 acute lobes, lobes *c.* 1 × 2 mm; corolla *c.* 2.5 × 2 mm, thick, densely covered with 0.3–0.5-mm-long patent, brown and white, simple hairs on apical half, glabrescent towards base, lobes *c.* 1 × 2 mm, apex acute; staminal ring undulate at apex, filaments filiform with broad triangular base, anthers *c.* 0.5 mm long with cuspidate apex; ovary vase-shaped, truncate at apex, densely covered on upper half with *c.* 0.3–0.5-mm-long patent golden hairs, style filiform. Fruit ellipsoid, glabrous, green, ripening red, *c.* 22 × 9 mm smooth; seed ellipsoid *c.* 16 × 6 mm.

**DISTRIBUTION.** Endemic to the Johor–Pahang border in Peninsular Malaysia.

**HABITAT.** Lowland dipterocarp forest. Very common where it is found. In Labis F.R., Johor and adjoining Lesong F.R., Pahang it grows sympatrically with *L. glabra* var.

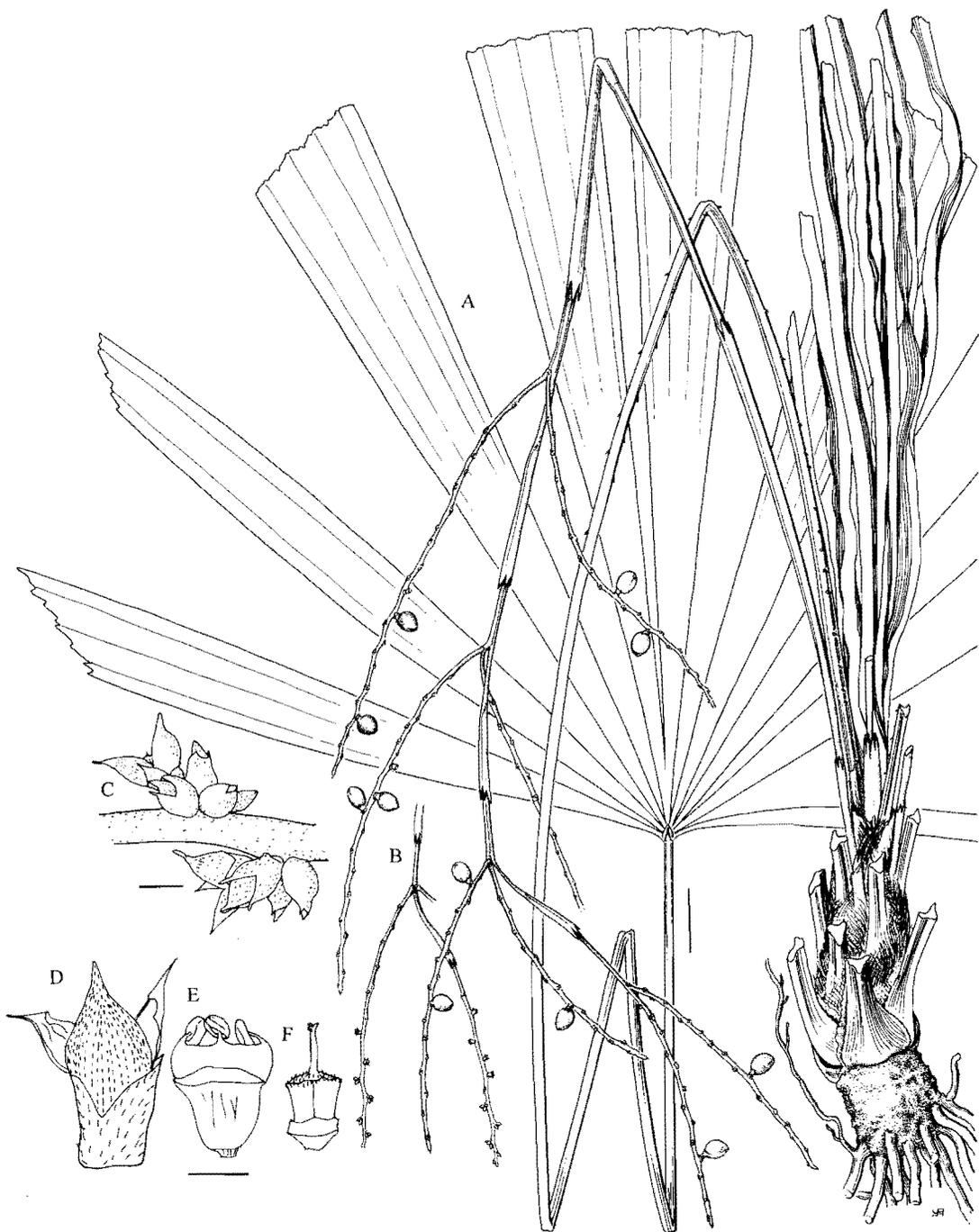
*selangorensis*, *L. thoana*, *L. ridleyana* and *L. kamarudinii*. This area has a remarkable diversity of *Licuala* species. *Licuala longicalycata*, which is also found in this locality, tends to grow away from these other species.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Johor, Labis F.R., Endau-Rompin Park, path to Kuala Marong, *Kiew* RK 1760 (UPM); Panti East F.R., *Dransfield & Fong* JD 5039 (K, KEP); Sungai Kayu, *Kiah* SFN 32137 (holotype SING; isotypes A, BM, K); Pahang, Lesong F.R., *Saw* FRI 37528 (KEP), *Whitmore* FRI 15852 (KEP) & FRI 20003 (KEP).

The collections still lack good flowering material, the floral description was based upon very immature flower buds and very immature fruits. This is a rather unusual species by its ellipsoid fruits; all other species in the Malay Peninsula have globular to ovoid fruits. There are only two other species of *Licuala* with similar ellipsoid fruits: *L. mattenensis* Becc. in Sarawak and an undescribed Sabah species represented by *Saw* FRI 37693 (KEP, SAN). However, *L. kiahii* differs from them in the following: it has a branched first-order branch, a rachilla that is fracti-flexuous and flowers arranged in groups of up to six. The other two species have spicate first-order branches, a rachilla that is not fracti-flexuous and solitary flowers.

**15. *Licuala tenuissima* L.G. Saw sp. nov.** *L. triphylla* similis sed rachillis gracilibus ad 16 cm longis floribus in greges usque ad 5(-7) dispositis et apice corollae acuminata differt. *Typus:* *Saw* FRI 39881, Peninsular Malaysia, Terengganu, Setiu, Ulu Setiu F.R. (holotypus KEP; isotypi A, K, L, QRS, SAN, SAR, SING). (Fig. 10)

Solitary small, acaulescent. Stem subterranean with very short internodes, in older individuals J-shaped, *c.* 2.5 cm wide. Leaves *c.* 7-10 in crown, sheath disintegrating into fine reticulate fibres; petiole *c.* 50-150 cm long, *c.* 5-6 mm wide near base, 3 mm towards apex, drying reddish brown; spines irregularly spaced and sized, no more than 3 mm long along lower half of petiole; frond small, leathery with a rather dull adaxial surface when fresh, peltate orbicular, *c.* 50-70 cm wide; segments *c.* 9-18, all about the same size, lateral margins straight; lateral segments 2-3-costulate, *c.* 26-37 × 2-3.5 cm; central segment entire, sessile, 4-10-costulate, *c.* 28-49 × 3.5-4 cm. Inflorescence erect, within crown, *c.* 25-60 cm long, branched to second order with 2-4 first-order branches; peduncle *c.* 12-38 cm long, *c.* 4-5 mm across near base; prophyll rather small, *c.* 3-5 × 0.5 cm, tubular; peduncular bract 1, *c.* 8-9 × 5-7 mm, tubular, slightly flattened, coriaceous with irregularly but neatly split mouth, densely covered with caducous, stellate, *c.* 0.5-0.8-mm-long hairs; rachis somewhat flexuous with similar hairs, but simple and not caducous; rachis bracts similar to peduncular bract, *c.* 7-8 × 0.5 cm; basal first-order branches close to or slightly away from mouth of rachis bract with 2-4 rebranches, branches rather loose and patent; rachilla to *c.* 16 cm long, *c.* 1 mm diameter, rather thin and wiry, unornamented, covered



**Fig. 10.** *Licuala tenuissima*. **A.** Habit with an infructescence. **B.** Part of an inflorescence. **C.** Rachilla with flowers. **D.** An open flower. **E.** Androecium. **F.** Ovary. All from FRI 39881. Scale bar 2 cm for A–B, 1 mm for C–F.

with less than 0.3-mm-long scattered, simple, reddish brown hairs; cincinni rather loosely arranged, *c.* 1.5–1.6 per cm; rachilla bracts lacking. Flowers in groups of up to 5(–7), sessile, maturing sequentially within each cincinnus, mature bud ellipsoid, *c.* 3–4 × 1.5 mm; calyx vase-shaped, *c.* 2 × 1.5 mm, base flattened, thickened, membranous towards apex with 3 acuminate lobes, lobes *c.* 1 × 1.2, covered with sparse, *c.* 0.3–0.4-mm-long brown, simple hairs; corolla *c.* 3.5 × 1.5 mm, thick, densely covered with less than 0.1-mm-long simple, patent, brown hairs on apical half, glabrescent towards base, lobes *c.* 2 × 1.5 mm, apex acuminate; staminal ring *c.* 0.5 mm high, undulate, filaments filiform with broad triangular base, *c.* 0.4 mm long, anthers *c.* 0.5 mm long; ovary densely covered on upper half with *c.* 0.2-mm-long golden hairs, vase-shaped, truncate apically, 1 × 1 mm, style filiform, *c.* 1 mm long. Fruit ovoid, glabrous, green, ripening orange, *c.* 10 × 8 mm with tuberculate surface; seed ovoid *c.* 9 × 6 mm.

**DISTRIBUTION.** Endemic to Peninsular Malaysia (in the states of Terengganu and Pahang).

**HABITAT.** A lowland dipterocarp forest species, common along streams and river banks. In Ulu Setiu F.R., *L. tenuissima* grows sympatrically with *L. triphylla* and *L. palas*. In Ulu Nerus F.R., it is sympatric with *L. sallehana* var. *incisifolia* and also *L. palas*. The species is rather common where it is found and occurs in very high densities.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Setiu, Ulu Nerus F.R., *Saw* FRI 39898 (KEP); Ulu Setiu F.R., *Lim* FRI 37651 (KEP), *Saw* FRI 39881 (holotype KEP; isotypes A, K, L, QRS, SAN, SAR, SING); Pahang, Sungai Telom, Bukit Cheraga, *Whitmore* FRI 20017 (KEP); Taman Negara, path from Kuala Kenyim to Gua Lias, *Whitmore* FRI 8525 (KEP).

The species is similar to *L. triphylla*, from which it differs in its rather long wiry rachilla up to 16 cm long, flowers arranged in groups of up to 5(–7) and corolla with an acuminate apex; in contrast *L. triphylla* has shorter rachillae *c.* 3–8 cm long, predominantly solitary flowers and a corolla with acute apex.

## 16. *Licuala pusilla* Becc.

Malesia 3: 194 (1889); Becc. & Hook. f., *Fl. Brit. India* 6: 433 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 164 (1907); Becc. in *Webbia* 5: 31 & 45 (1921); Ridl., *Fl. Mal. Pen.* 5: 28 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 174 & pl. 85 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 66 (1940). Lectotype (selected here): *Scortechini* 531b, Peninsular Malaysia, Perak (FI). (Fig. 7 M–Q)

Solitary, acaulescent, small. Stem subterranean with very short internodes, in older individuals J-shaped, *c.* 2 cm wide. Leaves *c.* 7–17 in crown, leaf sheath fibres breaking into

fine individual strands, petiole *c.* 60 to 100 cm, *c.* 4–5 mm wide at base to 2–3 mm across towards apex, drying pale greenish brown; spines narrowly triangular, erect to reflexed, irregular in size, to 3 mm long near base, along lower half of petiole; frond semi-orbicular to peltate-orbicular, *c.* 35 cm wide; segments 5–13(–15), about equal in size with rather straight lateral margins; lateral segments 2–4-costulate, 24–32 × 2–3 cm; central segment entire, sessile, 2–12-costulate, 24–32 × 2–6 cm. Inflorescence patent, shorter than leaves, *c.* 25–53 cm long, branched to first order and sometimes second order with 2–4 first-order branches; peduncle *c.* 14–30 cm long; prophyll *c.* 10–15 × 0.5–0.8 cm; peduncular bracts absent; rachis rigid, not sinuous, densely covered with silky white 0.5–1-mm-long hairs; rachis bracts tubular, *c.* 5–9 × 0.3–0.6 cm, densely covered with caducous silky white rather coarse velvety hairs, mouth tightly sheathing, splitting apically into *c.* 2–5 neat lobes and slightly on one side; first-order branches spicate to sometimes bifid in basal branches, originating close to or slightly away from mouth of rachis bract; rachilla up to 9 cm long, *c.* 2 mm wide, densely covered with coarse, pale golden brown, velvety, simple hairs. Flowers in groups of 1–3 on swollen bases, solitary towards apex of rachilla, maturing sequentially within each cincinnus, cincinni *c.* 4–5 per cm; calyx vase-shaped to urceolate, 2–2.6 × 2 mm, chartaceous, not striate, apex splitting into three lobes, densely covered with 0.5–1-mm-long pale golden brown, simple hairs; corolla *c.* 3 × 2–2.5 mm, rather thick, covered with appressed to patent wavy, golden brown hairs on upper two thirds, glabrescent towards base, lobes *c.* 2 × 2 mm, apex acute; staminal ring *c.* 0.8–0.9 mm high, undulate, filaments filiform with broad triangular base, *c.* 0.5 mm long, anthers reniform, *c.* 0.5 mm long; ovary densely covered with coarse silky white hairs mostly on upper parts, turbinate, 1.4–1.7 × 1.2–1.3 mm, style filiform, 1 mm high. Fruit globose, green, ripening orange, surface smooth, covered with sparse coarse hairs.

**DISTRIBUTION.** Endemic to the central west Peninsular Malaysia.

**HABITAT.** Lowland to hill dipterocarp forest where it has scattered distribution. It can be quite common as small populations, for example, in the Bukit Cheraka F.R. and Ayer Hitam F.R., Selangor.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, *Scortechini* 531b (lectotype FI); Sunki, *King's collector* 3028 (CAL, K); Ulu Bubong, *King's collector* 10213 (K, BM); Selangor, Kanching F.R., *Foxworthy & Burkill s.n.* 30 November 1928 (SING); Puchong, Air Hitam F.R., *Kiew* RK 1076 (UPM); Rantau Panjang F.R., *Kloss & Ridley* 62 (K); Gombak, Ulu Gombak F.R., *Saw* FRI 37353 (KEP); Petaling, Bukit Cheraka F.R., *C.M. Low* FRI 31105 (KEP); Negeri Sembilan, Gunung Angsi, *Ridley s.n.* July 1904 (SING); Malacca, Sungei Udang, *Goodenough* 1360 (SING).

There are two leaf segmentation forms which are consistent within populations seen in the field. The typical ones have many-segmented fronds with 13–15 segments. There is a population in Ulu Gombak F.R., Selangor that has fewer segments, 5–9 with very fine

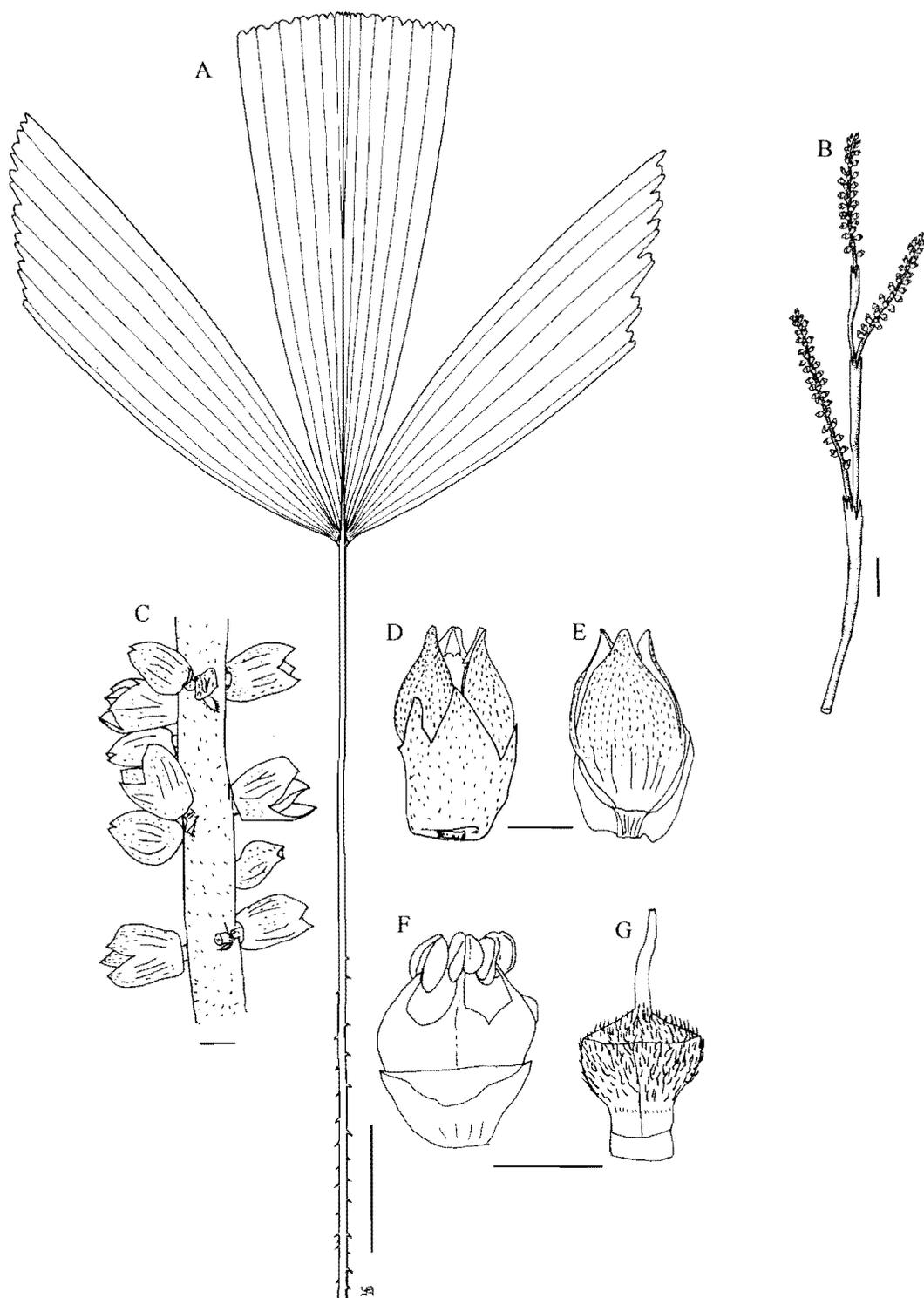
spines on the petiole compared with larger spines of the typical form. In both variants, there is no difference in the inflorescence and floral expression. Note that in Florence (FI), there are two collections with the same number of *Scortechini* 531b, the other set of this number is *L. triphylla*. This species is similar to *L. khoonmengii*; see discussion under that species for differences.

**17. *Licuala ruthiae* L.G. Saw sp. nov.** *palma pusilla inflorescentia breve usque ad c. 11.5 cm long, 2–3 inflorescentiis partialibus spicatis, rachilla breve ad 6 cm longa, calyce c. 2.5 × 2 mm, cylindricale, vel aliquantum urceolato, cmopte trilobato, pilis brunneis simplicibus disperse tecto, corolla c. 2.8–3 × 1.8 mm, tomentosa, ovario pilis argenteis grossis dense tecto, versus basim glabrescenti, 0.8–1.3 × 1–1.5 mm, stylo filiforme 1–1.2 mm longo.* *Typus: Kiew RK 2659, Peninsular Malaysia, Terengganu, Chukai, Sungai Nipa (holotypus UPM).* (Fig. 11)

Solitary, small, acaulescent. Leaves *c.* 5 in crown, petiole *c.* 50 cm long, to *c.* 3 mm wide near base, *c.* 2 mm wide towards apex, drying throughout reddish brown; spines along lower half of petiole, to *c.* 2 mm long, narrowly triangular and slightly reflexed, irregular in size and spacing; frond small, semi-orbicular, *c.* 35 cm in wide, segments few to many, 3–4 to *c.* 9 with slightly curved lateral margins, central segment slightly larger than rest; in individuals with 3–4 segments, lateral segments 5–7-costulate, 20 × 4–6 cm, central segment entire, sessile, 12–13-costulate, 20 × 8–9 cm; in individuals with *c.* 9 segments, the lateral segment *c.* 2–costulate, 22 × 1–1.6 cm, central segment, *c.* 7–costulate, 22 × 4 cm. Inflorescence patent, shorter than leaves, *c.* 11.5 cm long, branched to first order with 2–3 first-order branches; peduncle *c.* 5–8 cm long; prophyll *c.* 4 × 0.3 cm; peduncular bracts absent; rachis not sinuous, densely covered with coarse silvery stellate hairs; rachis bracts tubular, *c.* 3 × 0.3 cm, densely covered with coarse silvery stellate hairs, mouth tightly sheathing, splitting apically into 2–5 lobes only; first-order branches originating near mouth of rachis bracts, *c.* 3.5 cm apart; rachillae up to 6 cm long, *c.* 1 mm wide in dried specimens, relatively unornamented, covered with scattered fine simple reddish-brown hairs; cincinni *c.* 8 per cm. Flowers in pairs near base, solitary towards apex, maturing about simultaneously; calyx *c.* 2.5 × 2 mm, cylindrical to slightly urceolate, chartaceous, striate, covered with scattered simple brown hairs, neatly lobed, lobes triangular, *c.* 1 mm long; corolla *c.* 2.8–3 × 1.8 mm, thick, covered with scattered simple, silvery white hairs, lobes *c.* 1–2 × 1.7 mm, apex pointed; staminal ring *c.* 0.5 mm high, filaments filiform with a broad triangular base, *c.* 0.5 mm long, anthers reniform, *c.* 0.5 mm long; ovary densely covered with coarse, silvery white hairs, glabrescent towards base, club-shaped, 0.8–1.3 × 1–1.5 mm, style filiform, 1 to 1.2 mm high. Young fruits green.

**DISTRIBUTION.** Endemic to south Terengganu in Peninsular Malaysia.

**HABITAT.** Lowland forest, of scattered distribution.



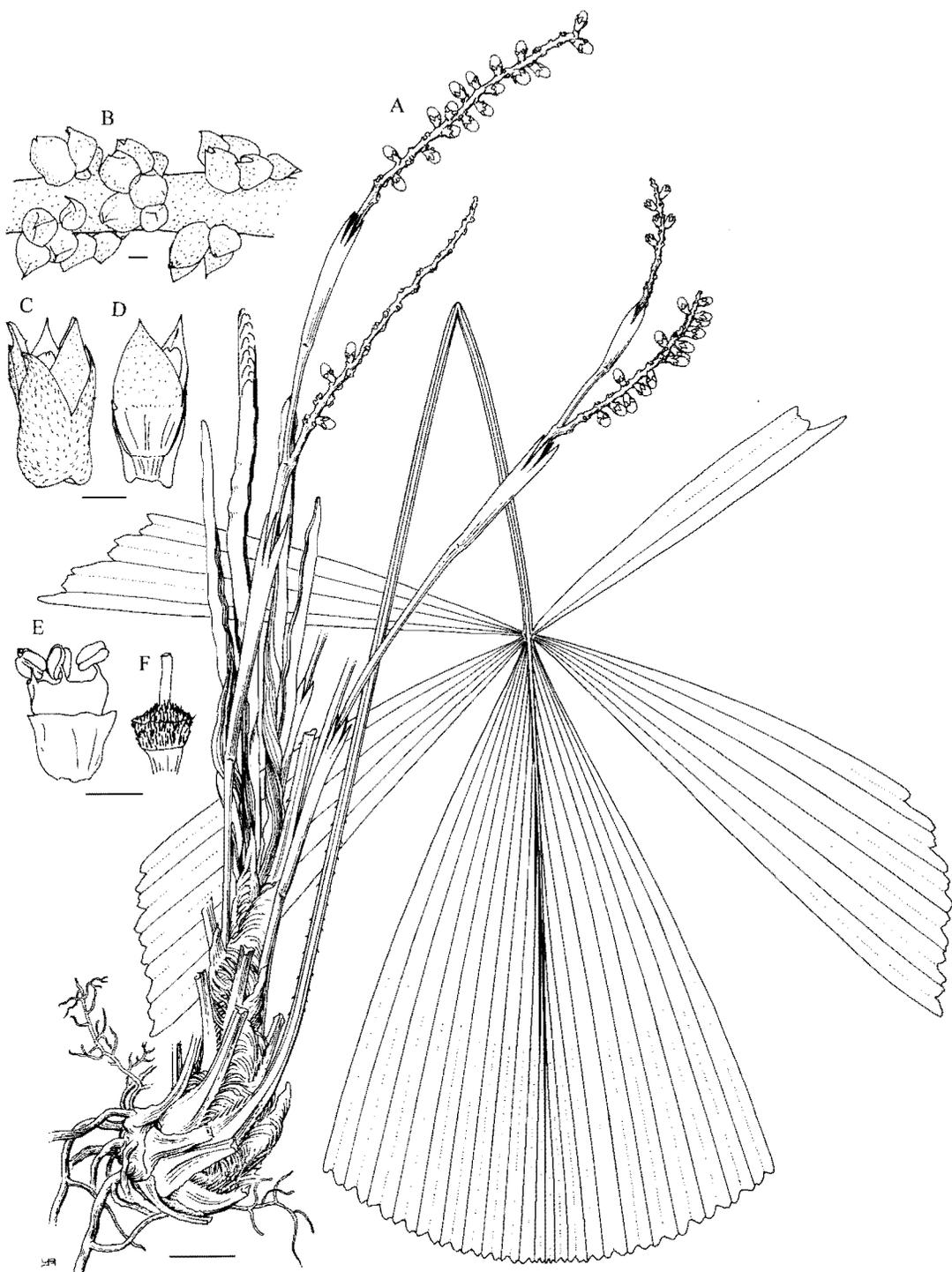
**Fig. 11.** *Licuala ruthiae*. **A.** Frond. **B.** Inflorescence. **C.** Rachilla with flowers. **D.** Flower. **E.** Calyx dissected off revealing corolla. **F.** Androecium. **G.** Ovary. A–C from Kiew RK 2659, the rest from Kiew RK 2659. Scale bar 5 cm for A, 1 cm for B, 1 mm for C–G.

**SPECIMENS EXAMINED**—PENINSULAR MALAYSIA. Terengganu, Chukai, Sungai Nipa, *Dransfield* JD 5202 (KEP), *Kiew* RK 2659 (holotype: UPM), RK 2668 (UPM).

This species is poorly represented, only known from the type locality. It is, however, very distinctive by its very small inflorescence. The only other species with such condensed inflorescences is *L. sallehana*. *Licuala sallehana* has pedicellate flowers on branched floral stalks and glabrescent ovaries; *L. ruthiae* has sessile flowers and very coarsely hairy ovaries. The inflorescence type and flowers of *L. ruthiae* are in fact more similar to those of *L. pusilla* than the above mentioned species. *Licuala pusilla*, however, has coarser hairs upon its rachilla, calyx and corolla. Together with the smaller inflorescence, *L. ruthiae* on the whole has smaller flowers, and club-shaped ovaries as opposed to turbinate ovaries in *L. pusilla*. There appear to be two leaf forms in this species, the more common one trifoliate to occasionally 4 segmented and the other variant with about 9 segments. The species is named in honour of the collector, Dr. Ruth Kiew.

**18. *Licuala khoonmengii* L.G. Saw sp. nov.** *L. pusillae* similis sed petiolo sicco rubiginoso, rachilla longiore 12–18 cm longa, floribus in gregibus usque ad 6 ferenti, fructificanta tuberculis conspicuis, annulo staminale truncato fructibus scabrellis differt. *Typus*: Saw & Kamarudin FRI 37630, Peninsular Malaysia, Terengganu, Ulu Terengganu F.R., Sekayu Recreation Forest (holotypus KEP). (Fig. 12)

Solitary, acaulescent, small. Stem subterranean with very short internodes, in older individuals J-shaped, c. 2 cm wide. Leaves c. 5–14 in crown, sheath lacking a conspicuous persistent ligule and disintegrating into fine individual strands; petiole c. 32–102 cm long, c. 5–7 mm wide at base to 3–4 mm across towards apex, drying reddish brown, unarmed to armed with few spines along lower third of margin, spines narrowly triangular, erect to reflexed, irregular in size, to 3 mm long near base; frond small, semi-orbicular to peltate-orbicular, c. 32–48 cm wide; segments 3–7(–9), approximately equal in size with slightly curved lateral margins; lateral segments 2–4-costulate, 15–35 × 4–8 cm; central segment entire, sessile, 11–16-costulate, 17–36 × 6–22 cm. Inflorescence patent, shorter than leaves, c. 20–44 cm long, branched to only 2–4 first-order branches; peduncle c. 24–33 cm long; prophyll c. 9–11 × 1–1.2 cm; peduncular bracts sometimes absent; rachis rigid, not sinuous, covered with scattered silky white 0.5–1-mm-long hairs; rachis bracts tubular, flattened, two-keeled, c. 8–15 × 0.5–0.8 cm, covered with scattered caducous silky white coarse hairs, mouth loosely sheathing, splitting on one side, apex pointed; first-order branches close to or slightly away from mouth of rachis bract; rachillae up to 12–18 cm long, c. 1–2 mm wide, covered with 0.2–0.5-mm-long silvery-translucent stellate hairs. Flowers in groups of up to 5(–7), solitary towards apex, on slightly swollen tubercles which is very prominent in fruiting specimens, maturing sequentially within each cincinnus, cincinni c. 4–6 per cm; calyx cylindrical, 2.6–3.2 × 1.6–2 mm, chartaceous, not striate, covered with scattered 0.4–0.7-mm-long simple hairs, splitting into three pointed neat lobes; corolla c. 2.5–3.2 ×



**Fig. 12.** *Licuala khoonmengii*. **A.** Habit with infructescences. **B.** Rachilla with flowers. **C.** Flower. **D.** Corolla, calyx partly dissected away. **E.** Androecium. **F.** Ovary. A from FRI 37623, B–F from FRI 37630. Scale bar 2 cm for A, 1 mm for B–F.

1.4–2 mm, rather thick, covered with patent white hairs in upper two thirds, glabrescent towards base, lobes *c.* 2 × 2 mm, apex acuminate; staminal ring *c.* 0.5–0.7 mm high, truncate, filaments filiform, *c.* 0.3 mm long, anthers reniform, *c.* 0.5 mm long; ovary turbinate to club-shaped 1–1.5 × 0.5–1 mm, densely covered with coarse silky white hairs mostly on upper parts, style filiform, 1 mm high. Fruits globose, *c.* 0.8–1 cm across, green, ripening orange with shagreen surface; seed globose, *c.* 0.6 cm across.

**DISTRIBUTION.** Endemic to the state of Terengganu in Peninsular Malaysia.

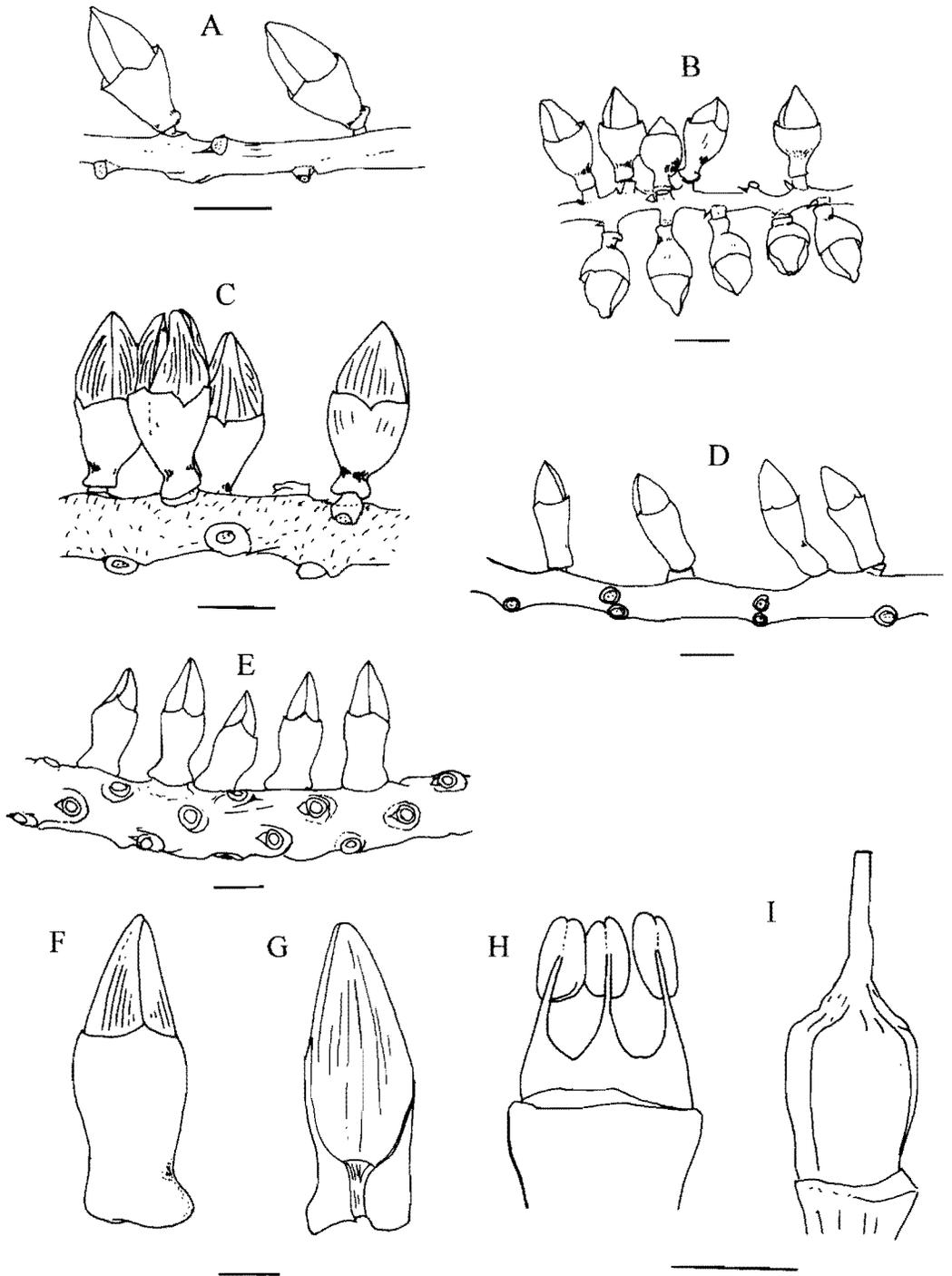
**HABITAT.** Lowland and mountain forest. Included in this species are collections from Gunong Mandi Angin and Gunong Padang, at altitude above 700 m collected by T.C. Whitmore. In Ulu Terengganu, where this species occurs in abundance, it is commonly found on lower hill slopes, in very moist areas. Where it occurs, the population density is very high. Elsewhere, this species occurs sporadically.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Hulu Terengganu F.R., Sekayu, *Saw & Kamarudin* FRI 37623 (KEP), FRI 37630 (holotype: KEP); Hulu Terengganu (Extension) F.R., Comp. 43, *Saw* FRI 39876 (KEP); Gunong Mandi Angin, eastern face, *Whitmore* FRI 12057 (KEP); Kuala Terengganu, Sungei Tong F.R., *Meijer & Yong* KEP 94778 (K, KEP); Dungun, Bukit Bauk F.R., *Saw* FRI 39863 (KEP); Setiu, Chalok Forestry Complex, *Saw* FRI 39895 (KEP); Ulu Berang, Gunong Padang, *Whitmore* FRI 12697 (KEP).

The species is similar to *L. pusilla* but can be differentiated with the following characters. *L. pusilla* has petioles drying pale greenish brown; rachillae less than 10 cm long, slightly tuberculate in fruiting specimens; flowers in groups of up to 3; staminal ring undulate; mature fruits with rather smooth surfaces. In contrast, *L. khoonmengii* has petioles drying reddish brown; longer rachillae 12–18 cm long, very pronounced tubercles in fruiting specimens; flowers in groups of up to 6; truncate staminal ring and fruits that matures with shagreen surface. This species is named in honour of my good friend and fellow botanist, Dr. Wong Khoon Meng.

### 19. *Licuala glabra* Griff.

in *Calcutta J. Nat. Hist.* 5: 329 (1844); Mart., *Hist. Nat. Palm.* ed. 2: 237 (1845); Griff., *Palms of British India* 124 (1850); Becc. & Hook. f., *Fl. Brit. India* 6: 432 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 161 (1907); Becc. in *Webbia* 5: 34 & 48 (1921); Ridl., *Fl. Mal. Pen.* 5: 26 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 192 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 49 (1940). Type: *Griffith s.n.*, Peninsular Malaysia, Malacca, Mons Miring (Mount Ophir) (holotype BR). (Fig. 13)



**Fig. 13.** Variation in rachillae and flowers of *Licuala glabra*. **A.** var. *glabra* from Gunong Ledang (from Griffith 58). **B.** var. *selangorensis* with floral stalks (from FRI 38527). **C.** var. *glabra* with sparsely hairy rachilla from Peninsular Thailand (from Charan et al. TCW 3114). **D.** var. *glabra* from Kemaman, Terengganu with very slender flowers (from FRI 37575). **E–I** var. *glabra* from Gua Musang, Kelantan with swollen rachilla (from FRI 37398). **F.** Flower bud. **G.** Corolla with calyx partly dissected away. **H.** Androecium. **I.** Ovary. Scale bar 2 mm for A–E, 1 mm for F–I.

*L. longepedunculata* Ridl. in J. Roy. Asiatic Soc., Straits Branch 41: 42 (1903); Mat. Fl. Mal. Pen. 2: 161 (1907); Fl. Mal. Pen. 5: 26 (1925). Lectotype (selected here): Wray, Jr. 254, Peninsular Malaysia, Perak, Gunong Batu Puteh (SING).

Solitary, rarely clustering, generally stemmed, rarely acaulescent. Stems to 4 m tall, sometimes more, *c.* 2–3.5 cm wide, 3–5 cm wide with leaf sheaths. Leaves *c.* 9–28 in crown, leaf sheath with rather prominent ligule in younger leaves but disintegrating into coarse fibres in older leaves, sword leaves sometimes covered with white wax; petiole *c.* 50–200 cm long, *c.* 5–20 mm wide near base, *c.* 2–6 mm wide towards apex, drying pale greenish to pale reddish brown; spines along lower half or more of petiole, triangular and reflexed to patent, largest near base to *c.* 6 mm long; frond *c.* 50–110 cm wide, surface dull when fresh, peltate-orbicular; segments variable in number, *c.* 6–33; lateral segments 1–6-costulate, 25–60 × 1–10 cm; central segment about equal in size to or much larger than laterals, undivided to divided into 2 or sometimes 3 lobes, each 2–15-costulate, 26–62 × 2–16 cm. Inflorescence patent, longer than leaves, *c.* 70–200 cm long, branched to second order, bearing 4–7 first-order branches; peduncle *c.* 30–100 cm long, *c.* 5–10 mm wide at base; prophyll tubular, *c.* 14–24 × 0.7–2 cm, flattened, not inflated, closely sheathing, mouth with neat apical splits only; peduncular bracts sometimes absent; rachis somewhat rigid, not sinuous, glabrescent; rachis bracts glabrous to glabrescent, strictly tubular, not inflated, *c.* 12–22 × 0.4–0.8 cm, coriaceous, mouth splitting obliquely into 2 apical pointed lobes, not fibrous; first-order branch close to mouth of rachis bract, bearing (2–)3–6 rather patent secondary branches; rachillae to *c.* 6–12 cm long, *c.* 1–3 mm wide, rather thin and wiry, to swollen and subulate, glabrous, sometimes with scattered hairs. Flowers solitary or in pairs, sessile, maturing about simultaneously, on tubercles or sometimes short floral stalks 1–2 mm long or sometimes in shallow pits of swollen rachilla, cincinni *c.* 5.5–11.8 per cm; bud *c.* 4.5–5.2 × 1.5–2 mm; calyx cyathiform to urceolate, glabrous, *c.* 2–3 × 1.5–2 mm, base thickened and broad to not thickened and narrowly constricted at base, sometimes pedicelliform, apex with 3 very short pointed lobes, appearing truncate; corolla *c.* 3.5–4 × 1.5–2 mm, glabrous, lobes thick, apex acute to blunt, *c.* 2–2.5 × 1.5 mm; staminal ring undulate, *c.* 0.4–0.5 mm high, filaments subulate, *c.* 0.5–0.8 mm long, anthers *c.* 0.6–0.7 mm long; ovary glabrous, turbinate, apex tapered, 1.2–1.5 × 1–1.5 mm, style filiform, 1–1.2 mm long. Fruit ellipsoid, glabrous, pale green, ripening dull orange, *c.* 1–1.5 × 0.6–1 cm, surface smooth; seed ovoid, *c.* 8 × 7 cm.

**DISTRIBUTION.** The Malaya Peninsula (including peninsular Thailand).

The species is extremely variable in its vegetative and inflorescence morphology. It is, however, very distinctive in its flowers. Among the species with compound first-order branches, no other species of *Licuala* approaches this species. The species is distinctive by its glabrescent inflorescence, particularly the glabrous flowers.

## KEY TO VARIETIES

- Mid-segment about the same size as the other segments, entire, if bifid then segments more than 14 .....var. **glabra**  
Mid-segment much larger than lateral segments, distinctly bifid and segments generally less than 14 .....var. **selangorensis**

var. **glabra**

(Fig. 13 A, C–I)

DISTRIBUTION. Peninsular Thailand and central to north Peninsular Malaysia.

HABITAT. Found in a wide range of habitats, from lowland to hill dipterocarp forest, but preferring hill ridges.

**SPECIMENS EXAMINED—PENINSULAR THAILAND.** Betong, Gunong Ina, *Kerr* 7578 (BM, K); Kampong Bukit, *Kiah* SFN 24256 (SING); Nikom Waeng nr. Sungai Golok, *Charan, Chanlong & Whitmore* TCW 3114 (K), *Larsen & Larsen* 32658 (K). **PENINSULAR MALAYSIA.** Kelantan, Kuala Belis–Gua Musang Track, *Henderson* SFN 29725 (SING); Gua Musang, Sungai Nenggiri, *Saw* FRI 37398 (KEP); Batu Papan F.R., *Saw & Kamarudin* FRI 37596 (KEP); Gunong Ayam F.R., *Saw & Kamarudin* FRI 37606 (KEP); Sungai Perias at Kuala May, *Whitmore* FRI 4145 (KEP); Terengganu, Sungai Terengganu near Kuala Panchor, *Whitmore* FRI 20562 (KEP); Dungun, Bukit Bauk F.R., *Dransfield* JD 5183 (K, KEP), *Saw* 39865 (K, KEP, L, SAN, SAR), *Suppiah* FRI 28311 (KEP), *Whitmore* FRI 3958 (KEP); Kemaman, Pasir Gajah, *Saw & Baya* FRI 37575 (KEP); Rasau Kerteh, Ulu Chukai Jungle Reserve, *Meijer & Yong* KEP 94937 (KEP); Pahang, Gunong Benom, *Whitmore* FRI 3176 (KEP); north-west Pahang, Sungai Telom, *Whitmore* FRI 20026 (KEP), FRI 20048 (KEP); Jengka Logging Complex, *Yap* FRI 28422 (KEP); Karak F.R., *Best* SFN 13884 (SING); Kuantan, Bukit Sekilau, *Saw* FRI 37555 (KEP); Berserah F.R., *Saw* FRI 37563; Lepar F.R., *Putz* FRI 23635 (KEP); Raub, Cheroh Road, *Whitmore* FRI 12239 (KEP); Sabai Estate, *Palmer* 13/3 (SING); Taman Negara, Gunong Tahan, *Kiew* RK 2477 (UPM), Wray's camp, *Dransfield* 676 (K, KEP); Sungai Tahan, *Palmer* 15 (SING); Ulu Sat, *Whitmore* FRI 15207 (KEP); Ulu Sepia, *Whitmore* FRI 15293 (KEP), FRI 15354 (KEP); Perak, Gunong Batu Puteh, *King's collector* 8148 (FI, K); Slim Hills F.R., *Whitmore* FRI 721 (KEP, SING); Selangor, Bukit Kutu *Ridley* 7894 (BM, SING); Malacca, Gunong Ledang (Mount Ophir), *Griffith s.n.* (holotype BR), 58 (BM, K); Johor, Gunong Ledang (Mount Ophir), *Saw* FRI 37717 (KEP).

There is a number of rather distinctive forms within the typical variety but the overlapping ranges of characters make it difficult to separate them effectively. However, field observations have shown that in a population, the vegetative and floral characters are quite consistent. The different forms are found in the following localities:

- i. Gunong Ledang (Malacca and Johor) (Fig. 13 A).  
This form is characterized by the rather small plants with fine leaf segments, lateral segments with 1–2 costae, c. 2–3 cm wide, the mid-segment undivided and rachillae rather wiry.
- ii. Hills around Kuantan, namely, Bukit Sikilau and Beserah F.R.  
Similar to form (i) except larger and with the mid-segment divided into two.
- iii. North west Pahang (*Whitmore* FRI 20026 and FRI 20048) to Gunong Tahan, Pahang (*Dransfield* 676 and *Kiew* RK 2477) and into Gua Musang, Kelantan (*Henderson* SFN 29725, *Saw* FRI 37398, *Saw & Kamarudin* FRI 37596) (Fig. 13 E–I).  
Here the fronds are larger than in the previous two forms, similarly dissected but wider. The characteristic feature is the swollen, rather thick and glabrous rachilla with flowers in shallow pits, quite different from forms (i) and (ii). Within this group are two collections with similar rachillae but with scattered simple hairs and the first-order branch is either spicate or with two secondary branches (*Yap* FRI 28422 and *Whitmore* FRI 12239).
- iv. Ulu Sat and Ulu Sepai, Taman Negara, and three collections from Thailand (Fig. 13 C).  
This form has hairy rachillae and flowers seated on tubercles (e.g., *Whitmore* FRI 15207, FRI 15293, FRI 15354, *Kerr* 7578, *Charan et al.* TCW 3114 and *Larsen & Larsen* 32658).
- v. Bukit Bauk, Terengganu.  
This distinctive form is differentiated from the rest by its acaulescent habit. The segments are generally of about equal size; mid-segments are bifid, sometimes splitting into three lobes. There are, however, two collections with rather wider mid-segments, viz.: *T. Suppiah* FRI 28311 and *Whitmore* FRI 3958. Young fronds and sword leaves are covered with white wax. It is most common on ridges, especially at higher elevations where it dominates the forest understorey. It is also found growing sympatrically with *L. ahlidurii* at lower elevations.

var. **selangorensis** Becc.

(Fig. 13 B)

in *Webbia* 5: 35 & 48 (1921); *Ridley* in *Fl. Mal. Pen.* 5: 26 (1925); *Becc.* in *Ann. Roy. Bot. Gard. Calcutta* 8: 194 (1933); *Furtado* in *Gard. Bull. Straits Settlements* 11: 50 (1940).  
Type: *Ridley* 12117, Peninsular Malaysia, Selangor, Semangko (holotype FI; isotypes K, SING).

**DISTRIBUTION.** Endemic to Peninsular Malaysia.

**HABITAT.** Upper hill dipterocarp and lower montane forest, distributed up to 1400 m altitude, although in Johor, it is found mainly in lowland dipterocarp forest.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Hulu Terengganu, Ulu Brang, Gunong Padang, *Whitmore* FRI 12550 (KEP), FRI 12807 (KEP);

Mandi Angin Expedition, *Cockburn* FRI 10674 (KEP); Pahang, Bentong, Gunong Mengkuang, *Wyatt-Smith* KEP 93120 (KEP); Chini F.R., *Bray* FRI 11637 (KEP); Fraser's Hill, *Saw* FRI 39903 (KEP), *Stone* 5999 (KLU); Genting Highlands, *Saw* FRI 37348 (KEP); Gunong Bunga Buah, *Saw* FRI 34452 (KEP); Gunong Tapis, Ulu Sungai Kelio *Cockburn* FRI 10896 (KEP); Lesong F.R., Ulu Endau, *Saw* FRI 37540 (KEP); Selangor, Genting Simpah, *Whitmore* FRI 4537 (KEP); Gunong Semangkok *Ridley s.n.* April 1894 (SING), 12117 (holotype FI; isotypes K, SING), 15881 (SING); Johor, Labis F.R., *Dransfield* 3549 (SING), *Whitmore* FRI 202 (KEP, SING); Gunong Belumut, *Dransfield* 843 (K, KEP); Kluang F.R., *Cockburn* FRI 7519 (KEP), *Kochummen* FRI 2197 (KEP); Kluang to Mersing road, *Holtum* 10601 (K, SING); Lenggong F.R., *Dransfield s.n.* 28 October 1967 (KLU).

The character of the bifid mid-segment is not completely exclusive in this variety. The acaulescent form in Bukit Bauk has also a bifid mid-segment, and so do the populations from Bukit Sikilau and Berserah F.R., Kuantan, Pahang (e.g., *Saw* FRI 37555 and FRI 37563), but these have many more segments that are all of about the same size and have not been considered as part of this variety.

Within this variety, there are three population variants that can be recognised but which have overlapping characters. The most abundant form has the characteristic segments with curved lateral margins and is found in Pahang, Selangor and Johor, excluding the population in the Labis F.R. Further, within this form, some of the collections have moderately to sparsely hairy rachillae. As these collections overlap in other characters with the rest of the specimens that have glabrous rachillae, I have considered them to be part of the character range of this particular form (e.g., *Cockburn* FRI 7519, *Dransfield* 843, *Saw* FRI 34452, FRI 37348, *Whitmore* FRI 202).

The form from Labis F.R., Johor, is a larger plant than the previous form with larger but less dissected fronds (c. 6–8 segments; the previous variant has 8–10 segments) and flowers seated on distinctive short floral stalks (the previous form typically has flowers on tubercles). Although in extreme cases, the two forms appear very different, the overlap in many characters allow them to be considered as mere forms of the same variety.

Finally, a form from the mountains of Terengganu (Gunong Padang and Gunong Mandi Angin) is a larger palm compared to the previous two forms, with larger petioles, fronds (with up to 14 segments) and longer inflorescences.

## 20. *Licuala paludosa* Griff.

in Calcutta J. Nat. Hist. 5: 323 (1844); Mart., Hist. Nat. Palm. ed. 2: 237 (1849); Griff., Palms of British India 118 (1850); Becc. & Hook. f., Fl. Brit. India 6: 431 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 160 (1907); Becc. in Webbia 5: 29 & 43 (1921); Ridl., Fl. Mal. Pen.

5: 25 (1925); Blatter, Palms of British India and Ceylon 94 (1926); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 159 (1933); Furtado in Gard. Bull. Straits Settlements 11: 65 (1940). Lectotype (selected here): *Griffith s.n.* 1842, Peninsular Malaysia, Malacca, Tanjong Cling (BR).

*L. amplifrons* Miq. in J. Bot. Neerlandaise 1: 12 (1861). Type: *Diepenhorst* 2100, Sumatra, West Sumatra, Tekou (holotype BO; isotype FI).

*L. paniculata* Ridl. in J. Royal Asiatic Soc. Straits Branch 41: 42 (1904); Ridl., Mat. Fl. Mal. Pen. 2: 165 (1907); Becc. in Webbia 5: 29 & 43 (1921); Ridl., Fl. Mal. Pen. 5: 30 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 161 (1933). Type: *Ridley s.n.* 1892, Peninsular Malaysia, Perak, Hermitage Hill (holotype SING).

Clustering with many subequal shoots, suckering basally, shoots to 7 m or more tall, to *c.* 5 cm wide. Leaves *c.* 9–10 in crown, sheath disintegrating into coarse reticulate fibres; petiole *c.* 1–2.5 m long, *c.* 6–15 mm wide near base, *c.* 4–9 mm wide at apex, drying pale greenish brown; spines along lower half of petiole, narrowly triangular and patent to reflexed, spacing close, drying dark brown to black, largest near base, no more than 5 mm long; frond peltate-orbicular, *c.* 100–150 cm wide, segments *c.* 6–12(–25), all about same size; lateral segments 2–6-costulate, 42–85 × 3.5–11 cm; central segment slightly larger than rest, divided into two lobes, each *c.* 7–9-costulate, 47–88 × 10–15 cm, joined in basal *c.* 8–14 cm. Inflorescence erect to patent, longer than leaves, extending beyond crown, *c.* 1.5–2 m long, branched to second order, bearing *c.* 5–6 first-order branches; peduncle *c.* 28–60 cm long, *c.* 15–20 mm across basally; prophyll tubular, *c.* 25–38 cm or more long, *c.* 2 cm wide, coriaceous, flattened, not inflated with closely sheathing, neatly split mouth, densely covered with stellate caducous ferruginous hairs; peduncular bracts present; rachis somewhat rigid, not sinuous; rachis bracts similar to prophyll, *c.* 17–25 × 1.2 cm, rachis-bract mouth splitting apically with a few pointed lobes only; first-order branches close to or slightly away from mouth of rachis bract, bearing 4–8 rather patent secondary branches; rachilla unornamented, *c.* 20–40 cm long, *c.* 1–2 mm wide, rather wiry, covered with scattered, less than 0.1-mm-long stellate, brown hairs. Flowers solitary to groups of 2–3, sessile, maturing about simultaneously, cincinni *c.* 2–4 per cm; bud *c.* 2.7–3.5 × 2.5–3 mm; calyx urceolate to cyathiform, *c.* 2.5 × 2.5–3 mm, glabrous, striate when dry, apex neatly lobed with 3 pointed to bifid lobes, lobed to about half of the calyx; corolla *c.* 2.5 × 2.4 mm, thick, glabrous, striate, lobes acute, *c.* 1.5 × 2 mm; staminal ring truncate, *c.* 0.5 mm high, filaments subulate, *c.* 0.3 mm long, anthers *c.* 0.5 mm long; ovary glabrous, turbinate, apex truncate, 1 × 1 mm, style filiform, 1 mm long. Fruit globose, glabrous, dark green, ripening orange to red, *c.* 8 mm, smooth; seed globose, *c.* 6 mm across.

DISTRIBUTION. Indo-China, the Malay Peninsula (including peninsular Thailand), Sumatra and Borneo.

HABITAT. Swamp forests. It is also recorded in low *kerangas* forest in Sabah.

**SPECIMENS EXAMINED—INDO-CHINA.** Boika, *Lecomte & Finet* 1200 (FI). **PENINSULAR THAILAND.** Narathiwat, Sungai Padi, Sala Ton Prone Swamp, *Smith & Sumawong* GC 97 (K); south of Narathiwat, *Larsen & Larsen* 33091 (AAU, K); Phu-Quoc Island, *Pierre* 4839 (FI). **PENINSULAR MALAYSIA.** Perak, Hermitage Hill. *Ridley s.n.* 1892 (SING); Sg. Krian Estate, *Spare* SFN 33288 (K, KEP, SING); Taiping, *King's collector (Kunstler)* 8534 (BM, K, FI); Pahang, Muadzam Shah, 12 km road from Segamat, *Saw* FRI 38521 (KEP); Selangor, Sungai Tinggi, *Nur* SFN 34076 (BM, K, KEP); Malacca, *Griffith* 55 (BM, K); Johor, Desaru complex, *Yap* FRI 27195 (KEP); Senawi, *Ridley* 11212 (SING); Jason bay, Sungai Rhu Reba, *Corner* SFN 28485 (K); Rompin, Menchali F.R., *Meijer & Fong* KEP 94894 (K, KEP). **BORNEO.** *Merrill (native collector)* 311 (FI); Sabah, Kimanis F.R., *Keith* 10241 (K), *Moore, Jr. & Meijer* 9186 (K); Forest on Beaufort Hill, *Moore, Jr. & Meijer* 9192 (K); Brunei, Belait, Teraja Longhouse, *Wong* WKM 521 (K); Tutong, Lamunin, Ladan Hills F.R., *Wong* WKM 1645 (K); Sarawak, Billiton, *Riedel* 1876 (FI); Bintulu, on banks of Bintulu River, *Beccari* PB 4041 (FI); Serian, Kampong Entayan, *Kurun* 132/61 (K); Kalimantan, Bangarmassing, *Motley* 1203 (K). **SUMATRA.** Djambi, Sungai Air Hitam, Suaka Margasatwa Berbak, E. coast, *Dransfield* 2554 (L), *Laumonier* TFB 1818 (K); Palembang, *Grashoff* 630 (FI); Siberut Island, *Boden-Kloss* 14614 (K); West Sumatra, Muarasakai, *Laumonier* TFB 466 (K); Tekou, *Diepenhorst* 2100 (FI).

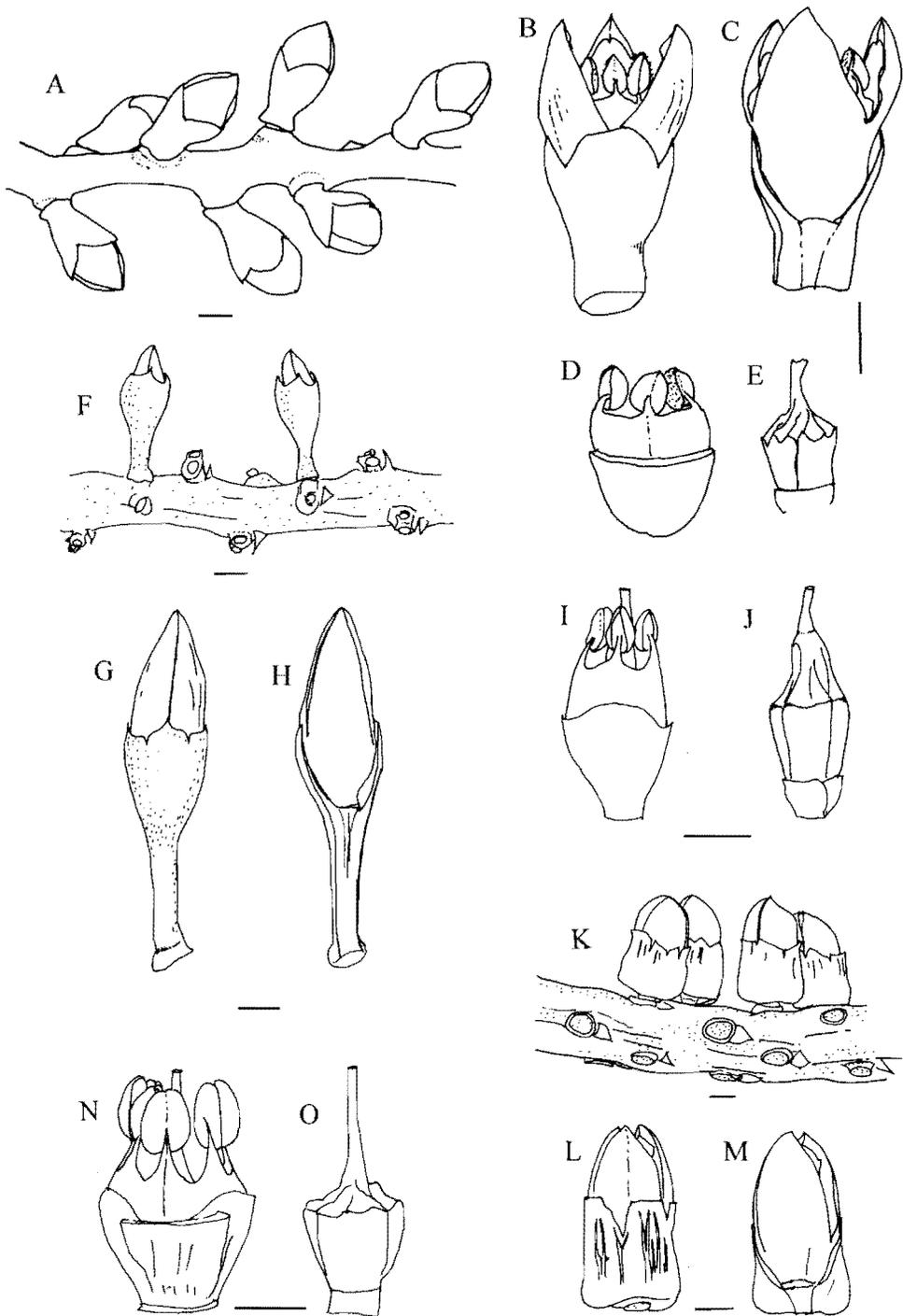
Beccari (1920) described a variety *L. paludosa* var. *winkleriana* based on *Winkler* 3323, from Djilu, Kalimantan, said to differ from the typical variety by its incurved filaments. However, *Spare* SFN 33288 has also incurved filaments, although other specimens examined did not, and it is regarded here that the incurved filament is mainly a developmental stage and may not be a consistent taxonomic character. As I was unable to examine the type specimen for this variety, I have not yet come to a final conclusion on its status. Although Beccari (1931) noted that this is a somewhat variable species as regards its leaf segmentation, the flowers are, however, very consistent in their urceolate to cyathiform shape, membranous calyces and, more importantly, their glabrous calyces, corollas and ovaries. This species is similar to *L. spinosa* and *L. patens*. They have a similar inflorescence type and similarly shaped flowers. See discussion under *L. patens* for differences.

## 21. *Licuala moyseyi* Furtado

in Gard. Bull. Straits Settlements 11: 61 (1940). Type: *Kiah & Moysey* SFN 31840, Peninsular Malaysia, Terengganu, Gunong Padang (holotype SING; isotype K).

(Fig. 14 A–E)

Solitary, acaulescent. Petiole unarmed, *c.* 75–90 cm, *c.* 5 mm wide near base, *c.* 3 mm wide towards apex; drying pale greenish brown; frond small, *c.* 27 cm wide, orbicular; segments



**Fig. 14.** A–E *Licuala moyseyi* (from FRI 44837). A. Rachilla with some mature flower buds. B. Flower. C. Corolla with calyx partly removed. D. Androecium. E. Ovary. F–J *Licuala corneri*. F. Rachilla with flowers. G. Flower bud. H. Flower with calyx partly dissected revealing corolla. I. Androecium. J. Ovary. (F from Kiew RK 2661, the rest from Corner s.n. 20 Nov. 1935.) K–N *Licuala pahangensis* (from FRI 36285). K. Rachilla with flowers. L. A mature flower. M. Calyx partly dissected showing corolla. N. Androecium. O. Ovary. Scale bar 1 mm for all.

7–9; lateral segments 3–5-costulate, 14–22 × 2.5–3.5 cm, lateral margin straight, widest at apex; central segment much larger than laterals, entire, sessile, 16–18-costulate, 23–24 × 13–15 cm, apical margin curved. Inflorescence patent, *c.* 50–75 cm long, with 3–4 first-order branches only; prophyll 15 × 0.3–0.7 cm; peduncle *c.* 25–36 cm long; peduncular bracts 13.5 × 0.5 mm; rachis not sinuous, sparsely covered with caducous reddish brown scales; rachis bract at base to *c.* 10–15 × 0.3–0.5 cm, tubular, slightly flattened, glabrescent to sparsely covered with reddish brown, caducous, stellate scales, mouth tightly sheathing, splitting on one side, apex pointed; first-order branches close to mouth of rachis bract, *c.* 7–10 cm apart; rachillae up to 15 cm long, *c.* 1.5 mm wide, sparsely covered with less than 0.1-mm-long reddish-brown indumentum. Flowers in groups of predominantly 2–3, solitary towards apex, maturing sequentially within each cincinnus, on lax branched tubercles *c.* 0.5 mm high, subtended by inconspicuous rachilla bracts, cincinni *c.* 3–4 per cm; bud ellipsoid, with tapered base and pointed apex; calyx vase-shaped, 3–3.5 × 2 mm, sparsely covered with fine brown, simple hairs, base pedicelliform to *c.* 1 mm long, apex with 3 neatly rounded lobes, lobes to *c.* 1 mm long; corolla *c.* 3 × 2 mm, glabrous, lobes *c.* 1.5 × 1.8 mm; staminal ring truncate, *c.* 0.6 mm high, filaments narrowly triangular to filiform, *c.* 0.3 mm long, anthers *c.* 0.8 mm long; ovary glabrous, turbinate, rimmed towards apex, *c.* 1 mm high, style filiform, 0.8–1 mm long. Fruit ovoid, *c.* 12 mm length, 6 mm wide, ripening scarlet, fleshy; seed ovoid, *c.* 10 × 5 mm.

**DISTRIBUTION.** Endemic to Peninsular Malaysia, only known from two mountain tops in Terengganu.

**HABITAT.** Montane forest in moist gullies and slopes. On Gunong Lawit, the species was noted growing gregariously.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Ulu Brang, Gunong Padang, *Kiah & Moysey* SFN 31840 (holotype SING, isotype K), *Whitmore* FRI 12665 (KEP), Ulu Besut, Gunong Lawit, *Saw & Dransfield* FRI 44837 (KEP, SAN, SAR, K, L, A, AAU, QRS, SING).

The species is closely related to *L. corneri* in its similar inflorescence type and pedicelliform flowers. *Licuala moyseyi*, however, has an unarmed petiole, a much shorter pedicelliform base to the flowers, rounded calyx lobes and a turbinate ovary, instead of the longer pedicelliform base, pointed calyx lobes and the spindle-shaped ovary of *L. corneri*.

## 22. *Licuala corneri* Furtado

in Gard. Bull. Straits Settlements 11: 47 (1940). Type: *Corner* SFN 30072, Peninsular Malaysia, Terengganu, Kemaman, Ulu Bendong in Kajang (holotype SING; isotype K).

(Fig. 14 F–J)

Solitary. Stems to 2 m tall, *c.* 2 cm wide. Petiole *c.* 1 m, *c.* 5 mm wide near base, *c.* 3 mm wide towards apex, drying pale greenish brown; spines along lower third of petiole, thinly triangular, reflexed, about regular in shape and size, small, to 1 mm long; frond medium-sized, orbicular, *c.* 50 cm wide; segments 12–17, all about equal size; lateral segments 1–4-costulate, 27–32 × 2.5–3 cm, lateral margin straight to slightly curved, widest towards apex; central segment entire, sessile, 4-costulate, 29–32 × 2.5–3 cm, truncate at apical margin. Inflorescence patent, *c.* 35–80 cm long, with 3–4 first-order branches only; prophyll 10 × 0.9 cm; peduncle *c.* 13–54 cm long; peduncular bracts absent; rachis not sinuous, glabrescent to sparsely covered with reddish brown indumentum; rachis bracts at base to *c.* 18 × 0.5 cm, tubular, flattened, glabrescent to sparsely covered with reddish brown stellate scales, mouth tightly sheathing, splitting neatly breaking into 1–3 apical lobes and on one side; first-order branches close to the mouth of rachis bract, *c.* 12–20 cm apart; rachillae up to 17 cm long, *c.* 2–3 mm wide, covered with less than 0.2-mm-long reddish-brown to golden-brown, simple hairs. Flowers mostly in pairs on branched tubercles *c.* 0.5–0.8 mm high, maturing sequentially within each cincinnus, cincinni *c.* 5–6 per cm; buds ellipsoid, with tapered base and pointed apex; calyx vase-shaped with pedicelliform base, to *c.* 6 × 2.5 mm including pedicelliform base, base *c.* 2.5–3 mm long, splitting neatly into 3 shallow pointed lobes, no longer than 0.5 mm, covered with scattered less than 0.2-mm-long brown, simple hairs; corolla *c.* 4.8 × 2 mm, thick, lobes narrowly deltoid, pointed at apex, *c.* 3.5 × 1.8 mm; staminal ring *c.* 0.6 mm high, filaments narrowly triangular, short, *c.* 0.5 mm long, anthers *c.* 0.8 mm long; ovary glabrous, fusiform, tapered at apex, *c.* 2.3 mm long, style filiform, 0.5 mm long. Immature fruit ovoid, *c.* 6 mm length, 4–5 mm wide.

**DISTRIBUTION.** Endemic to Peninsular Malaysia, only known in the state of Terengganu.

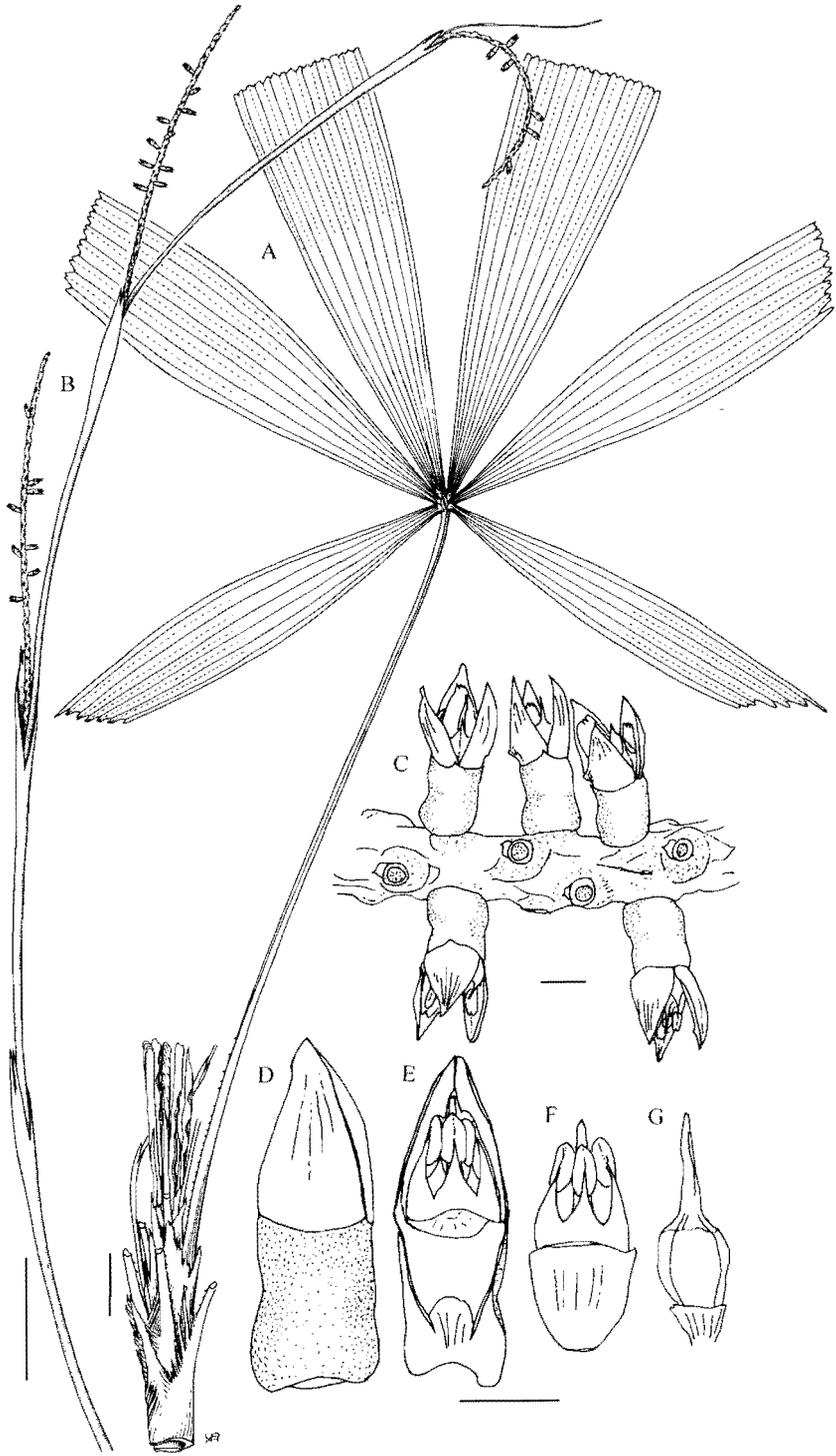
**HABITAT.** Lowland forest.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Kemaman, Ulu Bendong in Kajang, *Corner* SFN 30072, (holotype SING, isotype K); Chukai, Sungei Nipa, *Corner s.n.* 20 Nov. 1935 (SING), *Kiew* RK 2661 (UPM).

*Licuala corneri* is similar to *L. moyseyi*, see the discussion under that species for differences.

**23. *Licuala mustapana* L.G. Saw sp. nov.** *L. pahangensi* similis sed segmento medio folii bifido calyce vadosissime lobato 3 apicibus acutis pilis tenuis tecto differt. *Typus:* Saw FRI 39878, Peninsular Malaysia, Terengganu, Hulu Terengganu F.R., Sekayu recreation forest (holotypus KEP; isotypi A, K, L, QRS, SAN). (Fig. 15)

Solitary. Stems to 1.2 m tall. Leaves *c.* 10–20 in crown, sheath disintegrating into coarse fibres; petiole *c.* 64–130 cm, *c.* 6–7 mm wide near base, *c.* 4–5 mm wide towards apex,



**Fig. 15.** *Licuala mustapana*. **A.** Shoot with frond. **B.** Inflorescence. **C.** Rachilla with flowers. **D.** A mature flower. **E.** Calyx and corolla partly removed revealing the androecium and gynoecium. **F.** Androecium and gynoecium. **G.** Ovary. A, C–G from FRI 39878, B from FRI 37633. Scale bar 5 cm for A–B, 2 mm for C–G.

drying reddish brown near base to pale greenish brown towards apex; spines approximately regularly spaced and sized, triangular, reflexed, no more than 2 mm long, along lower third of petiole; frond peltate-orbicular, *c.* 61–83 cm wide; segments few, 6–8, approximately equal in size with slightly curved lateral margins; lateral segments 6–8-costulate, 36–46 × 8–9 cm; central segment slightly larger than rest, sessile, divided into two lobes, joined basally for *c.* 2 cm, each lobe about equal, 7–10-costulate, 35–47 × 11–15 cm. Inflorescence patent to pendulous below crown, shorter than leaves, to *c.* 36–100 cm long, with 2–4 first-order branches only; peduncle *c.* 25–50 cm long; prophyll 15–23 × 0.6 cm; peduncular bracts sometimes lacking; rachis not sinuous, glabrescent to sparsely covered with caducous reddish brown scales; rachis bract at base to *c.* 16 × 0.4 cm, tubular, flattened, with similar indumentum as rachis, mouth tightly sheathing, splitting neatly apically into *c.* 2 lobes and on one side; first-order branches close to mouth of rachis bract, *c.* 8–16 cm apart; rachilla 7–16 × 2–3 mm, covered with scattered, less than 0.1-mm-long brown, simple hairs. Flowers solitary, sessile, on swollen tubercles, creamy yellow with pink ovary and stamens, *c.* 9 per cm, maturing about simultaneously; calyx cylindrical, 3.5 × 2.5 mm, thickly fleshy, striate when dry, covered with scattered, less than 0.1-mm-long reddish brown, simple hairs, with 3 pointed very short lobes; corolla *c.* 6 × 2.2 mm, thick, glabrous, striate when dry, lobes pointed at apex, *c.* 4 × 2 mm; staminal ring *c.* 1 mm high, filaments thick and narrowly triangular, anthers reniform, *c.* 1 mm long; ovary glabrous, (sub)ellipsoid, not distinctly truncate, 1.5 mm high, style tapered, 2.4 mm long. Fruit globular, glabrous, smooth, *c.* 10 × 9 mm, green, ripening orange; seed globose, 7 mm across.

**DISTRIBUTION.** Endemic to the Terengganu mountains and Gunong Tahan, Pahang in Peninsular Malaysia.

**HABITAT.** Restricted to upper slopes and ridges in lowland dipterocarp forest in Hulu Terengganu and mossy montane forest on Gunong Mandi Angin and Gunong Tahan.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Hulu Terengganu F.R., Sekayu recreation forest, *Saw* FRI 37633 (KEP) and FRI 39878 (holotype KEP; isotypes A, K, L, QRS, SAN); Gunong Mandi Angin, *Whitmore* FRI 12087 (KEP), *Cockburn* FRI 10812 (KEP); Pahang, Gunong Tahan, Taman Negara, *Kamarudin* FRI 42283 (KEP, A, K, L, QRS, SAN) and FRI 42290 (KEP, A, K, L, QRS, SAN).

This species superficially resembles *Licuala glabra* var. *selangorensis* in its habit and leaf dissection but differs quite distinctively in its spicate first-order branches, and much larger cylindrical calyx that is hairy. The inflorescence and flowers, however, are quite similar to *L. pahangensis* but can be differentiated by the following characters: *L. mustapana* has leaves with the central segment divided in two, instead of the undivided central segment of *L. pahangensis*, and calyx that is very shallowly lobed with three pointed tips and covered with fine hairs instead of a glabrous calyx that is truncate to irregularly split. This species is named in honour of my constant field companion Mr Mustapa Datah whose help in the search for Peninsular Malaysian *Licuala* is much appreciated.

## 24. *Licuala pahangensis* Furtado

in Gard. Bull. Straits Settlements 11: 66 (1940). Type: *Henderson* SFN 22305, Peninsular Malaysia, Pahang, base of Gunong Senyam (holotype SING). (Fig. 14 K–N)

Solitary. Stems to 1.5 m tall. Leaf sheath fibres not breaking into fine individual strands, petiole *c.* 150 cm long, 8–10 mm wide near base, *c.* 3.5–5 mm wide near apex, drying pale greenish brown, armed with spines along lower half of petiole, spines narrowly triangular, reflexed, largest near base, to 4 mm long; frond medium-sized, *c.* 60–100 cm wide, peltate-orbicular, leaflets 21–25, approximately equal in size with slightly curved lateral margins; lateral segments 2–3-costulate, 30–50 × 3 cm; central segment entire, 3–4-costulate, 30–50 × 3–3.5 cm. Inflorescence patent, shorter than leaves, *c.* 50–100 cm long, with 2–3 first-order branches only; prophyll *c.* 12 × 1 cm; peduncle *c.* 30–60 cm long; peduncular bracts sometimes absent; rachis not sinuous, covered with sparse caducous reddish brown stellate scales; rachis bract at base 18 × 0.7 cm, tubular, flattened, covered with sparse, caducous, reddish brown, stellate scales, rachis-bract mouth tightly sheathing, splitting neatly into *c.* 1–2 apical lobes and on one side; first-order branches close to mouth of rachis bract, *c.* 12–20 cm apart; rachilla 10–16 cm long, *c.* 2–3 mm diameter, covered with less than 0.1-mm-long brown, simple hairs, ornamented with longitudinal ridges between flowers. Flowers solitary, sessile, densely arranged (*c.* 15.8 per cm), creamy yellow, maturing about simultaneously; bud cylindrical with rounded apex and flat base; calyx cylindrical, *c.* 3.2 × 3 mm, thick and fibrous, strongly striate when dry, apex truncate, irregularly split, glabrous; corolla *c.* 4 × 2.5 mm, glabrous, lobes elliptic, pointed at apex, *c.* 3 × 1.5 mm; staminal ring *c.* 0.5 mm high; filaments triangular in shape, anthers reniform, *c.* 0.8 mm long; ovary glabrous, turbinate, distinctly truncate at apex, 1.5 × 1.4 mm, style filiform, 1.7 mm long; fruit ovoid, glabrous, smooth, in an immature specimen *c.* 10 × 7 mm, green, seed ovoid *c.* 0.7 × 0.6 mm.

**DISTRIBUTION.** Endemic to south-west Pahang, Peninsular Malaysia, is restricted to the Krau Game Reserve and vicinity.

**HABITAT.** Lowland dipterocarp forest.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Pahang, base of Gunong Senyam, *Henderson* SFN 22305 (holotype SING); Krau Game Reserve, Kuala Lompat, *Saw* FRI 36285 (KEP), *Whitmore* FRI 3534 (KEP); south side, Bt. Tapah, *Whitmore* FRI 12835 (KEP), near Jenut Belebang, *Whitmore* FRI 3485 (KEP), Bukit Rengit *Saw* FRI 37368 (KEP); Pulau Chengei, *Ridley s.n.* 1891 (SING); Tanjong Antan (Pahang River), *Ridley s.n.* 1891 (SING); Temerloh, Titi Bungor, *Henderson* FMS 10623 (SING).

This species is similar to a number of new taxa with very similar inflorescences and flowers, but differs mainly in the habit, type and degree of hairiness of the rachilla and flowers. For example, *L. pahangensis* resembles *L. mustapana* and *L. whitmorei* in its solitary habit and

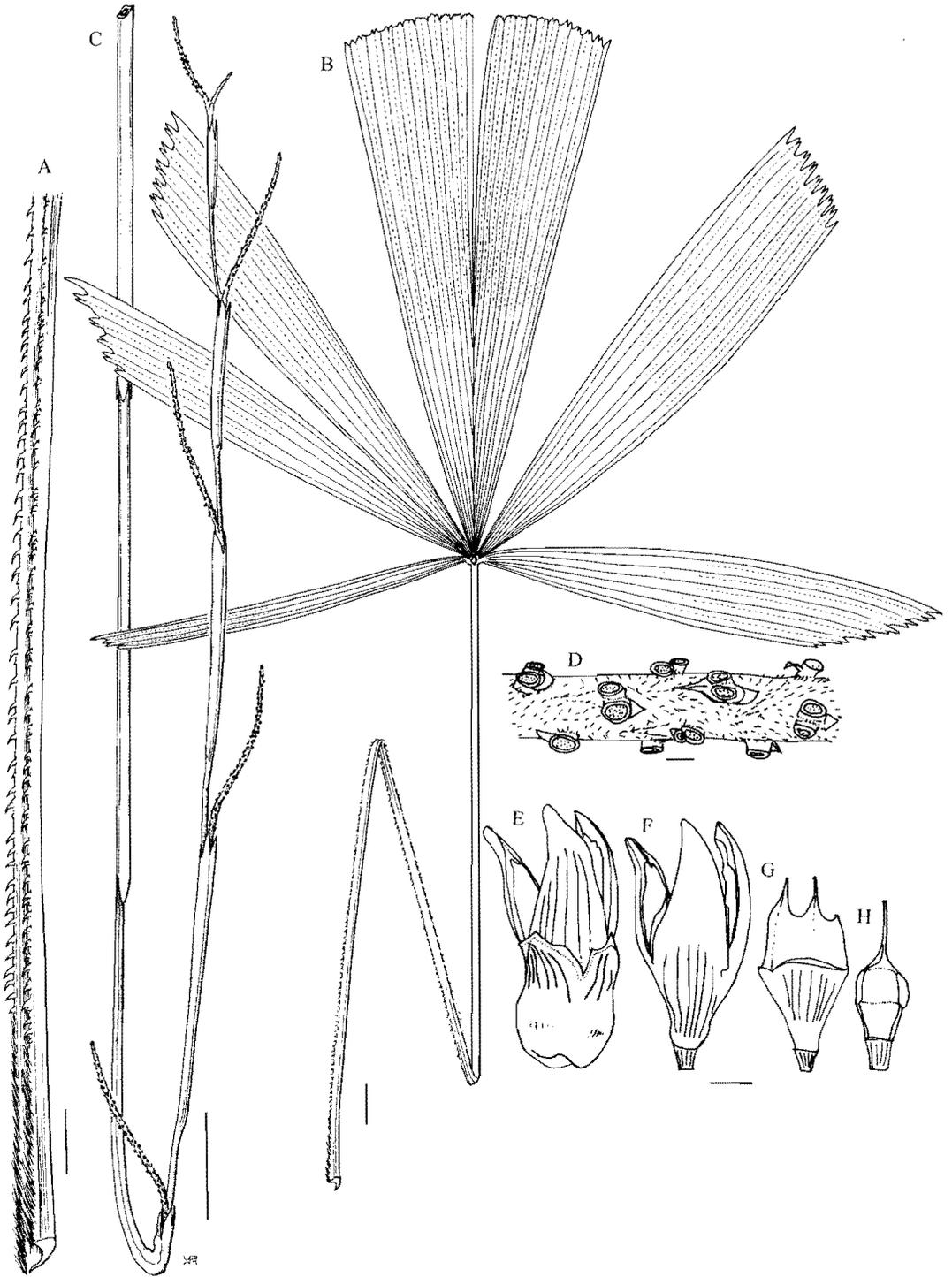
solitary, sessile flowers, but differs from *L. mustapana* in its undivided central leaf segment and glabrous calyx, and from *L. whitmorei* in its longitudinally ridged and fine-hairy rachillae (the ones in *L. whitmorei* corky-cracking and glabrous) and glabrous calyx. Also, *L. pahangensis* resembles *L. terengganuensis* and *L. palas* in its longitudinally ridged and hairy rachillae and glabrous corolla, but differs from both these species in its solitary habit and undivided central leaf segment.

**25. *Licuala palas* L.G. Saw sp. nov.** *L. terengganuensi* similis sed petiolo sicco viride-brunneo, segmentis folii paucioribus (usque ad 6–9), rachilla pilis brevibus dispersis c. 0.3–0.6 m longis tecta, floribus solitariis vel geminatis tuberculis portatis, lobis calycis cuspidatis lobis corollae anguste-triangularibus recedit. Typus: Saw FRI 39889, Peninsular Malaysia, Terengganu, Setiu, Ulu Setiu F.R. (holotypus KEP; isotypi A, K, L, QRS, SAN, SAR). (Fig. 16)

Solitary to clustered. Clusters with c. 1 dominant shoot and suckers at base, stems to 0.5 m tall. Leaves c. 7–14 in crown, sheath disintegrating into coarse fibres; petiole c. 100–240 cm long, c. 14 mm wide near base, c. 7 mm wide towards apex, drying pale greenish brown towards apex to pale reddish brown towards base, spines irregular in shape and size, along lower half of petiole, narrowly triangular and reflexed, black when fresh, brown when dried, no more than 6 mm; frond large, c. 90–220 cm in wide, peltate-orbicular; segments 6–9(–11) with curved lateral margins; lateral segments 4–6-costulate, 44–81 × 10 cm; central segment much larger than laterals, splitting into two equal lobes, joining in lower 12–40 cm, each lobe c. 10–12-costulate, 55–90 × 11–20 cm. Inflorescence patent, shorter than leaves, c. 100–180 cm long, with 4–5 first-order branches only; peduncle c. 59–85 cm long; prophyll c. 20–24 × 0.9 cm; peduncular bract 1; rachis not sinuous, moderately covered with caducous, silky white stellate hairs; rachis bracts at base to 17 × 0.6 cm, tubular, covered with similar hairs to rachis, rachis-bract mouth tightly sheathing, splitting neatly into c. 1–2 apical lobes and on one side; first-order branches close to mouth of rachis bract, c. 21 cm apart; rachillae c. 9–11 × 2 mm, covered with scattered, c. 0.3–0.6-mm-long silky white simple hairs. Flowers in pairs near base, solitary towards apex, densely arranged on short floral stalks c. 0.5 mm long; cincinni c. 12 per cm; bud cylindrical with pointed apex and flat base; calyx cylindrical, c. 3.5 × 3 mm, thick, splitting into 3 lobes with cuspidate apex, glabrous, striate when dry; corolla to c. 5.5 × 3 mm, thick, glabrous, lobes c. 3.5 × 2 mm, elliptic; staminal ring c. 1.2 mm high, filaments subulate, anthers not known; ovary glabrous, ovoid, rounded apically, c. 2 × 1.2 mm, style filiform, c. 1.5 mm long. Young fruits globose, glabrous, smooth, green.

**DISTRIBUTION.** Only known from Ulu Setiu F.R., Terengganu, Peninsular Malaysia.

**HABITAT.** Lowland forest. The population where the type specimen was collected on a ridge, completely dominated the forest floor. In areas near streams where the terrain is flat, the species occurs at lower densities. In these other locations it is found growing sympatrically with *L. triphylla* and *L. tenuissima*.



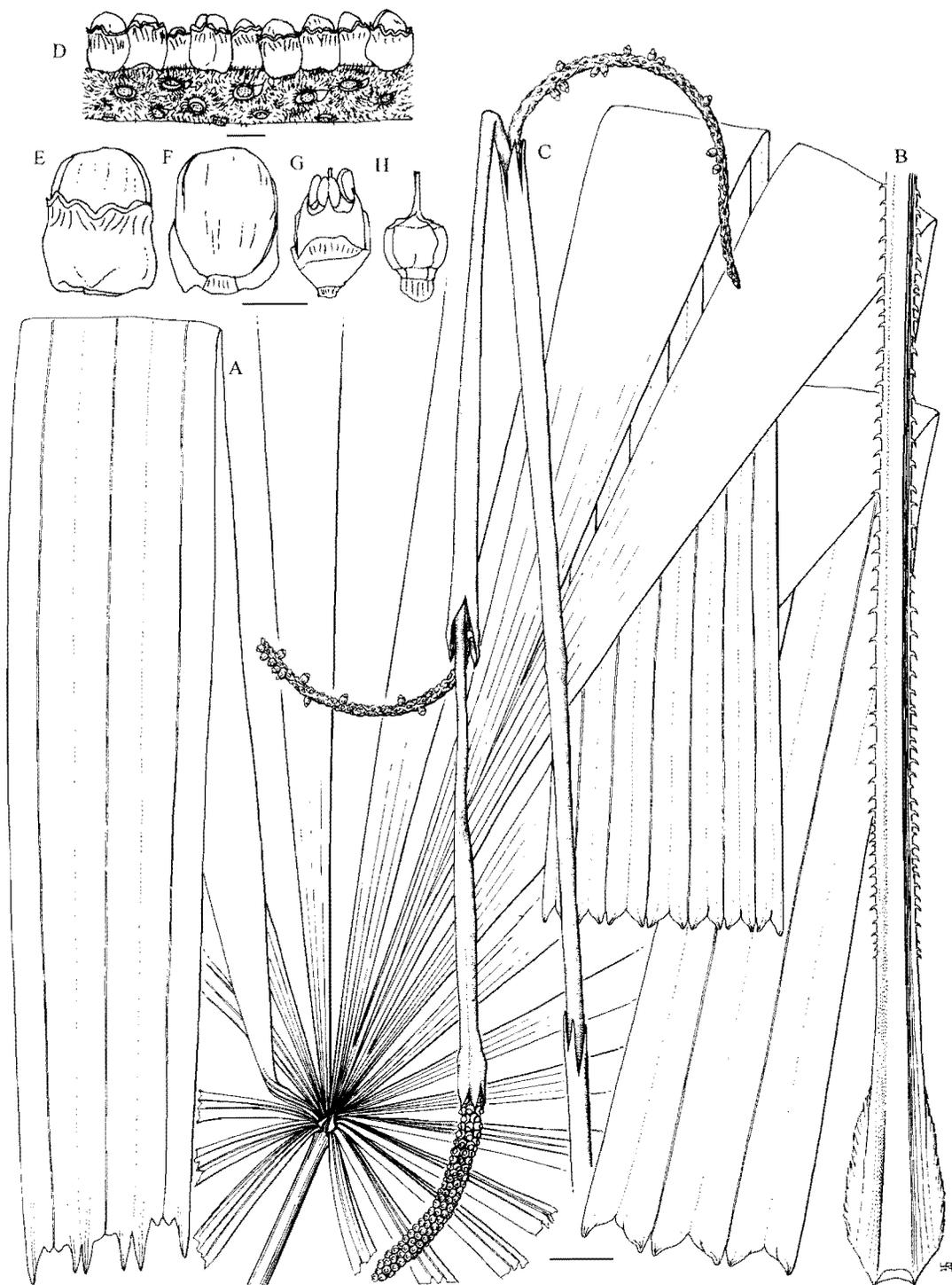
**Fig. 16.** *Licuala palas*. **A.** Details of the petiole base. **B.** Frond. **C.** Inflorescence. **D.** Rachilla only. **E.** Flower after anthesis. **F.** Corolla with calyx removed. **G.** Staminal ring, anthers having dropped off. **H.** Ovary. All from FRI 39889. Scale bar 5 cm for A–C, 2 mm for D–H.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Setiu, Ulu Setiu F.R., Saw FRI 39889 (holotype KEP; isotypes A, K, L, QRS, SAN, SAR).

See discussion under *L. pahangensis* for differences from related species. The species epithet is the local Malay name for the genus, *palas*.

**26. *Licuala terengganuensis* L.G. Saw sp. nov.** *palma caespitosa inflorescentia in 1 rare 2 ordines ramificanti, 3–6 inflorescentiis partialibus, rachide non sinuosa, rachide rachillaque pilis stellatis sericeis 0.5–1 mm longis dense tectis, floribus solitariis sessilibus spiraliter dispositis, calyce cylindraceo, c. 3 × 3.5 mm, crassa, fibrosa, glabra, lobis ellipticis apice acutis, valde reflexis, c. 2 × 2.9 mm, anulo staminale c. 1.5 mm alto 6-lobato, ovario glabro tubinato, apice truncato, 2 × 2 mm, stylo filiforme 0.7 mm longo. Typus: Whitmore FRI 20210, Peninsular Malaysia, Terengganu, Terengganu mountains, Sg. Kerbat near Kuala Kerbat, Jeram Garok (holotypus KEP). (Fig. 17)*

Clusters with *c.* 1 dominant shoot, suckering at base, stems erect, to 2 m tall, 3–7 cm wide. Leaves *c.* 12 in crown, sheaths disintegrating into coarse fibres; petiole to *c.* 2 m long, (6–)10–15 mm wide near base, *c.* (4–)6–10 mm wide towards apex, drying dark reddish brown, spines narrowly triangular, reflexed, irregular in shape and size, no more than 7 mm long along lower *c.* half of petiole; frond *c.* 75–180 cm in wide, peltate-orbicular; segments *c.* 18, about equal in size with straight lateral margins; lateral segments 3–4-costulate, 48–73 × 6–8 cm, central segment splitting into 2(–3) about equal lobes, joined for *c.* lower 4–12 cm, each *c.* 4–8-costulate, 53–81 × 8–10 cm. Inflorescence patent, shorter than leaves, *c.* 70–200 cm long, branched to first, rarely to second order, bearing 3–6 first-order branches; peduncle *c.* 37–120 cm long; prophyll *c.* 20–34 × 0.9–1.2 cm; peduncular bract 1, sometimes absent; rachis not sinuous, densely covered with *c.* 0.7–1-mm-long caducous, silky white stellate hairs with reddish brown bases; rachis bract to 20 × 1.2 cm, tubular, with similar hairs to rachis; rachis-bract mouth tightly sheathing, splitting apically into 1–4 pointed lobes and on one side; first-order branches close to mouth of rachis bract, spicate rarely rebranched to two, *c.* 10–27 cm apart; rachilla 7–20 cm long, *c.* 2–4 mm wide, densely covered with *c.* 0.5–1-mm-long silky white simple hairs. Flowers solitary, sessile, maturing about simultaneously, subtended by 0.5–1-mm-long rounded to broadly elliptic or 1.5–2 mm narrowly triangular rachilla bracts, densely arranged, *c.* 16–20 per cm; bud cylindrical with rounded apex and flat base; calyx cylindrical, *c.* 2.5–3 × 3–3.5 mm, thickly fleshy, truncate, with irregular splits or splits with 3 bifid lobes with distinct lighter-brown apical-margin, glabrous or covered with 0.3–0.7-mm-long scattered hairs, strongly striate when dry; corolla *c.* 4.2–6 × 3.3–4 mm, thick and fibrous, glabrous, lobes elliptic, pointed at apex, but strongly reflexed or not reflexed, *c.* 2 × 2.9 mm; staminal ring *c.* 1.5 mm high, filaments subulate, anthers reniform, *c.* 1–1.2 mm long; ovary glabrous, turbinate, truncate at apex, 2 × 2 mm, style filiform, 0.7 mm long. Fruit ovoid, glabrous, smooth, in an immature specimen *c.* 10 × 8 mm, green; seed globose *c.* 7 mm across.



**Fig. 17.** *Licuala terengganuensis*. **A.** Frond. **B.** Petiole base. **C.** Inflorescence. **D.** Rachilla with flowers. **E.** A mature flower bud. **F.** Corolla with calyx partly removed. **G.** Androecium. **H.** Ovary. A–C from FRI 20210, D from FRI 20272, E–H from *Sinclair* 8258. Scale bar 2 cm for A–C, 2 mm for D–H.

DISTRIBUTION. Endemic to Terengganu in Peninsular Malaysia.

HABITAT. Lowland species on undulating hills, common where it occurs. *Whitmore* FRI 20272 notes its occurrence on sandstone.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Dungun, Bukit Bauk F.R., *Dransfield* JD 5187 (K, KEP), *Saw* FRI 39864 (K, KEP); Terengganu mountains Sg. Kerbat near Kuala Kerbat, Jeram Garok North of river, *Whitmore* FRI 20210 (holotype KEP); Sg. Kerbat at Jeram Ketei FRI 20272 (KEP); Ulu Terengganu, nr. Jeram Galong, *Cockburn* FRI 8348 (KEP); Sungei Petuang F.R., *Husmady et al.* FRI 39104 (KEP); Tersat F.R., *Husmady et al.* FRI 37082 (KEP); Setiu, Chalok Forestry Complex *Saw* FRI 39894 (KEP), Ulu Nerus F.R., *Saw* FRI 39899 (KEP).

*Saw* FRI 39899 has floral bracts that are longer and narrowly triangular, quite different from the rest, which are rounded or broadly elliptic and shorter. However, *Husmady et al.* FRI 39104 has both floral bract types within the inflorescence. *Cockburn* FRI 8348 has its most basal first-order branch rebranching instead of being spicate as in the rest of the specimens.

Outside Bukit Bauk, the calyces of this species are glabrous, but collections made from this place have either hairy or glabrous calyces. In addition, the corolla apices are strongly reflexed in the rest of the collections but in Bukit Bauk, they are pointed and not reflexed. Both field observation and collections also indicate that individuals from the Bukit Bauk population are generally smaller plants with less segmented leaves than plants in other populations. Other than these differences, the plants are very similar in other characters, especially habit, the colour of the petiole, inflorescence type and display, the rachilla type and its hairs, and even the general shape of the calyx.

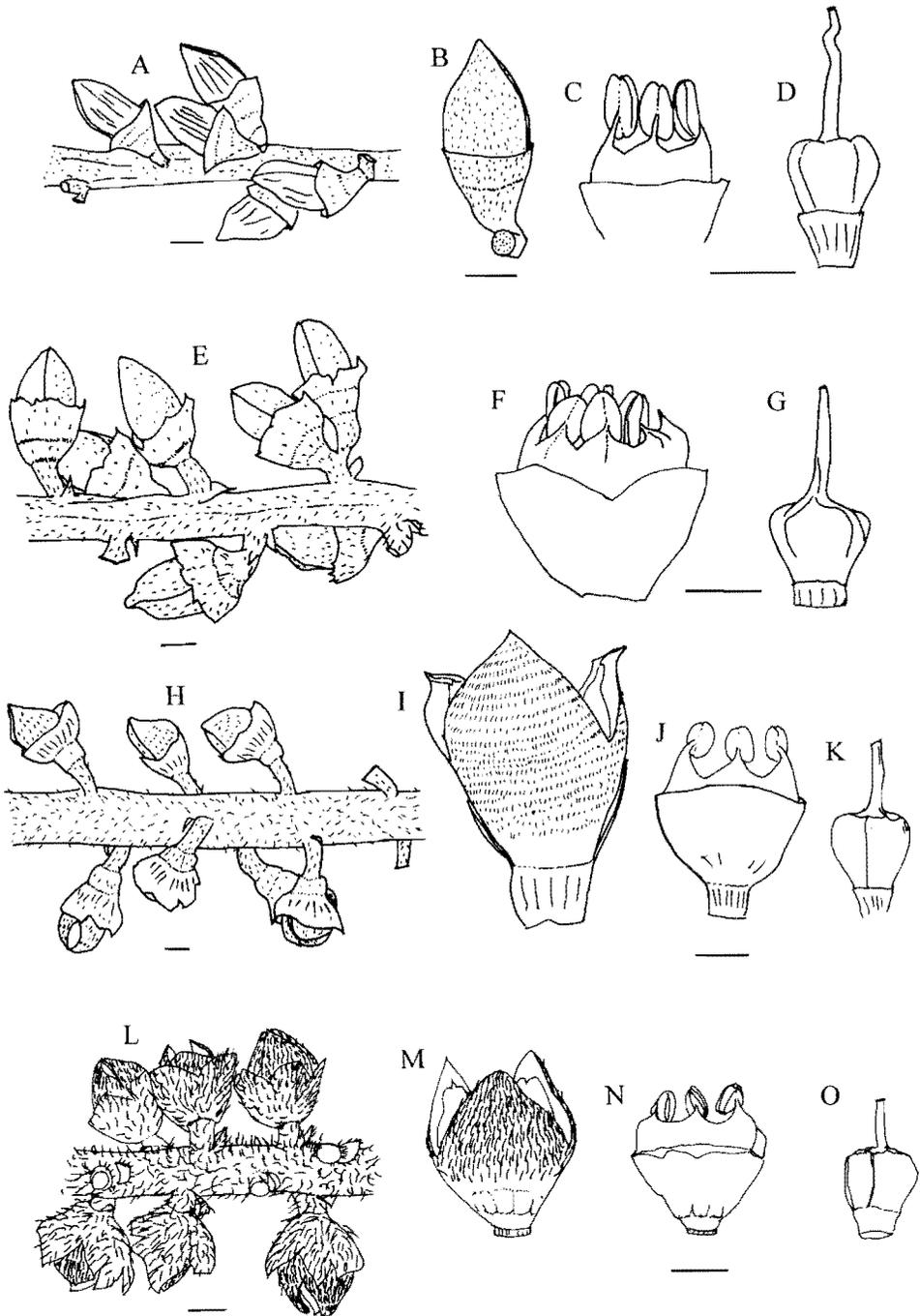
This species has close similarities to *L. pahangensis* and related species, see discussion under that species for differences.

## 27. *Licuala scortechinii* Becc.

Malesia 3: 192 (1889); Becc. & Hook. f., *Fl. Brit. India* 6: 434 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 164 (1907); Becc. in *Webbia* 5: 49 (1921); Ridl., *Fl. Mal. Pen.* 5: 30 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 208 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 67 (1940). Type: *Scortechini s.n.*, Peninsular Malaysia, Perak (holotype Fl).

(Fig. 18 A–D)

Solitary. Stems to 1 m tall, c. 1.7–2 cm wide. Leaves c. 18 in crown, petiole c. 20–30 cm long, 3–5 mm wide at base to c. 2–3 mm towards apex, drying light greenish brown; spines along lower half of petiole, narrowly triangular, reflexed, largest near base c. 1–2 mm long;



**Fig. 18.** A–D *Licuala scortechinii* (from Robinson & Kloss 6016). A. Rachilla with flowers. B. A mature flower bud. C. Androecium. D. Ovary. E–G *Licuala mirabilis* (from Dransfield JD 6785). E. Rachilla with flowers. F. Androecium. G. Ovary. H–K *Licuala kunstleri*. H. Rachilla with flowers. I. Corolla with calyx partly removed. J. Androecium. K. Ovary. (H from FRI 12499, I–K from FRI 37658.) L–O *Licuala acutifida* (from Lobb 280). L. Rachilla with flowers. M. Corolla with calyx removed. N. Androecium. O. Ovary. Scale bar 1 mm for all.

frond small, semi-orbicular, c. 28–39 cm wide; segments c. 9–13, all about the same size with curved lateral margins; lateral segments 2–4-costulate, 14–27 × 2.6–4.5 cm; central segment entire, sessile 3–7-costulate, 15.5–27 × 1.7–7. Inflorescence patent to pendulous, shorter than leaves, c. 15–34 cm long, a spike or with only a single first-order branch; peduncle c. 15–34 cm long; prophyll, to c. 29 × 1.6 cm; peduncular bracts lacking; rachis not sinuous, glabrescent; rachis bract lanceolate with pointed apex, flattened, chartaceous, c. 2 × 0.3 cm, sometimes much reduced in size, sparsely covered with stellate white hairs with reddish brown bases; rachis-bract mouth loosely sheathing, splitting widely on one side; first-order branch near to or away from the mouth of rachis bract, unbranched or with 2–3 secondary branches; rachilla 4–12 cm long, c. 1 mm wide, covered with scattered 0.1–0.2 mm simple golden brown hairs. Flowers solitary to in groups of 2(–3), maturing about simultaneously, on hairy floral-stalks up to 1 mm long, c. 5–8 per cm; bud turbinate, c. 3.5 × 1.5 mm; calyx obconical, loosely enclosing corolla in dried specimens, c. 1.5 × 1.8 mm, sometimes larger, membranous, striate, apex truncate, not lobed, covered with dense to scattered fine golden brown hairs; corolla to 3 × 1.5 mm, thick, striate when dried, covered with scattered fine patent golden brown simple hairs, lobes c. 2 × 1.5 mm, apex acute; staminal ring c. 0.5 mm high, filaments filiform with triangular base, c. 0.5 mm long, anthers reniform, c. 0.8 mm long; ovary glabrous, cylindrical, apex rounded, c. 1 × 1.1 mm, style filiform, 1.5 mm long. Young fruit globose.

**DISTRIBUTION.** Endemic to north-west Peninsular Malaysia.

**HABITAT.** Montane forest on Gunong Jerai and at lower elevations in Perak.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Kedah, Gunong Jerai (Kedah Peak), *Dransfield* JD 5097 (K, KEP), *Haniff s.n.* May 1904, *Ridley* 5201 (BM, FI, SING), *Robinson & Kloss* (K, SING), *Sow* KEP 48628 (KEP); Perak, *Scortechini s.n.* (holotype FI).

A small elegant palm with a much reduced inflorescence, quite similar to that of *L. modesta* from Gunong Pondok, Perak. However, the flowers of *L. scortechinii* have an obconical calyx and striate corolla instead of the cylindrical calyx and non-striate corolla of *L. modesta*. The flowers are similar to those of *L. kunstleri*, *L. mirabilis* and *L. acutifida*. *Licuala scortechinii* can easily be differentiated from these by its much reduced inflorescence. These three species all have well-developed inflorescences consisting of three or more first-order branches whereas *L. scortechinii* has only one.

## 28. *Licuala mirabilis* Furtado

in Gard. Bull. Straits Settlements 11: 58 (1940). Type: *Furtado* SFN 33054, Peninsular Malaysia, Kedah, Baling, Ayer Terjang Valley (holotype SING; isotype BM). (Fig. 18 E–G)

Solitary. Stems to 5 m tall, wide *c.* 4 cm. Leaves *c.* 20 in crown; petiole *c.* 50–100 cm long, 7–10 mm wide at base to *c.* 4–5 mm across towards apex, drying light greenish brown, spines along approximately the lower half of margin, narrowly triangular, irregular in shape and size, reflexed to patent, rather large to *c.* 10 mm long near base; frond orbicular, *c.* 70–90 cm wide; segments *c.* 15–29, with lateral margins slightly curved, *c.* equal in size or mid-segment much larger than laterals; lateral segments 2–4-costulate, 34–42 × 2.6–3 cm; central segment entire, sessile, 4–15-costulate, *c.* 35–53 × 3 cm in equal-segmented specimens to 43 × 28 cm in specimens with wider central segments. Inflorescence erect, shorter than leaves, branched to second order with 3–4 first-order branches, *c.* 35–50 cm long; peduncle *c.* 15–29 cm long; prophyll lanceolate with pointed apex, much flattened, coriaceous, to *c.* 23–28 × 2 cm, covered with scattered to dense appressed white or brown stellate hairs; peduncular bracts absent; rachis sinuous, bending prominently at primary branches, densely covered with 0.2–0.3-mm-long simple golden brown hairs; rachis bracts similar to prophyll to *c.* 13–20 × 2 cm; rachis-bract mouth loosely sheathing, splitting widely on one side to more than half of bract; first-order branches at mouth of rachis bract, with 4–6 secondary branches at base; rachilla to *c.* 16 cm long, 1–3 mm wide, densely covered with fine simple golden brown hairs. Flowers solitary and in groups of 2–3 on prominent 1–2-mm-long floral stalk, maturing almost simultaneously, cincinni *c.* 4–7 per cm; bud turbinate, *c.* 4 × 3.5 mm; calyx *c.* 1.5 × 2.5 mm, obconical, loosely enclosing corolla in dried specimens, covered with scattered golden brown hairs, calyx base thickened, tapered, pedicelliform, *c.* 0.5 × 1 mm, cup membranous and striate, apex truncate, irregularly splitting; corolla *c.* 3.5 × 2.5 mm, thick, densely covered with fine patent golden brown simple hairs, lobes *c.* 2 × 2 mm, apex acute; staminal ring *c.* 0.3 mm high; filaments broadly subulate, *c.* 0.4 mm long, anthers reniform, *c.* 0.7 mm long; ovary glabrous, turbinate, apex rounded, 1 × 1.3 mm, style filiform, 1.5 mm long. Fruit globose, green, ripening red, *c.* 10 mm across, seed globose, *c.* 7 mm across.

**DISTRIBUTION.** Endemic to north-west Peninsular Malaysia.

**HABITAT.** Hill forest species, found up to *c.* 1000 m altitude.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Kedah, 48th mile Jeriang Road, *Kiah* SFN 36169 (SING); Baling, Ayer Terjang Valley, *Furtado* SFN 33054 (holotype SING; isotype BM); Baling Hill, *Corner & Nauen s.n.* 25 October 1941 (SING); Gunung Inas, *Burgess* FRI 9590 (KEP), *Whitmore* FRI 4659 (KEP); Kulim Mahang, Bintang Hijau F.R., *Khairuddin*, FRI 38314 (KEP); Yau, *Ridley s.n.* June 1893 (SING); Perak, Kroh, *Furtado* SFN 33037 (K); Penang, Province Wellesley, Bukit Mertajam, *Burkill* 9021 (SING), *Dransfield & Lim* JD 6785 (KEP).

The species is very similar to *L. kunstleri*; see discussion under that species for differences.

## 29. *Licuala kunstleri* Becc.

in Hook. f., *Fl. Brit. India* 6: 433 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 162 (1907); Becc. in *Webbia* 5: 30 & 44 (1921); Ridl., *Fl. Mal. Pen.* 5: 27 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 167 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 54 (1940). Type: *Kunstler* (*King's collector*) 10205, Peninsular Malaysia, Perak, Ulu Bubu (holotype CAL; isotypes BM, K). (Fig. 18 H–K)

Solitary. Acaulescent to stemmed, stem to *c.* 1 m tall, 4–7 cm wide. Leaves *c.* 10–23 in crown; petiole *c.* 100–200 cm long, *c.* 7–15 mm wide at base to 5–7 mm towards apex, drying light greenish brown, armed with spines along approximately lower half of margin, spines narrowly triangular, reflexed, largest near base *c.* 5 mm long; frond orbicular, *c.* 50–100 cm wide, segments *c.* 10–19 with slightly curved lateral margins; lateral segments 3–7-costulate, 29–55 × 4–12 cm, central leaflet entire, sessile, much larger than laterals, 6–21-costulate, 35–55 × 5–31 cm. Inflorescence erect, shorter than leaves, branched to first and occasionally to second order, with 3–4(–6) first-order branches, *c.* 25–62 cm long; peduncle *c.* 13–26 cm long; prophyll tubular with rounded apex, much flattened, to *c.* 20 × 1.3 cm, densely covered with appressed white and brown stellate hairs; peduncular bracts absent; rachis sinuous, bending slightly near primary branches, covered with scattered simple brown hairs; rachis bract narrowly-funnel shaped to lanceolate, flattened, coriaceous, densely covered with appressed white and brown stellate hairs; rachis-bract mouth loosely sheathing but not inflated, splitting apically into *c.* 1–5 neatly pointed lobes and slightly on one side, *c.* 7–15 × 0.9–2 cm; first-order branches near or away from mouth of rachis bract, mainly simple, occasionally rebranched to 3; rachilla 10–18 cm long and *c.* 2–4 mm wide, covered with scattered fine simple golden brown hairs. Flowers solitary, rarely in pairs, on prominent 1–2-mm-long floral stalks subtended by inconspicuous triangular to rather long lanceolate rachilla bracts, maturing almost simultaneously, cincinni *c.* 5–6 per cm; bud turbinate, *c.* 5 × 3 mm; calyx obconical with cylindrical base, *c.* 2.5 × 3 mm, sometimes larger, loosely enclosing corolla in dried specimens, sparsely covered with *c.* 0.2–0.4-mm-long golden brown hairs, calyx base thickened, pedicelliform, *c.* 0.5 × 1 mm, cup seated on base membranous and striate, apex truncate to irregularly split; corolla thick, *c.* 4.5 × 3 mm, densely covered with *c.* 0.2–0.4-mm-long patent golden brown simple hairs, lobes pointed at apex, *c.* 2.2 × 3 mm; staminal ring *c.* 0.2 mm high, filaments shortly subulate, *c.* 0.5 mm long, anthers reniform, *c.* 0.7 mm long; ovary glabrous, cylindrical, apex rounded, 1.5 × 1.5 mm, style filiform, 1.5 mm long. Fruit globose, green, ripening orange to red, *c.* 9 mm across.

**DISTRIBUTION.** Central Malay Peninsula, with the southernmost records in Negeri Sembilan and northernmost in peninsular Thailand.

**HABITAT.** Lowland and hill forests of the Malay Peninsula, including peninsular Thailand. Lowland forest plants are not as robust or as large as those found in the hills.

**SPECIMENS EXAMINED—PENINSULAR THAILAND.** Betong, Gunong Ina, *Kerr* 7572 (K); Labu Mine near Bannangsta, *Charan et al.* TCW 3125 (K); Narathiwat, Sirinton Waterfalls, *Sumawong* 5 (K); Trang, Khao Chong National Park, *Dransfield & Bhoonab* JD 5433 (K); Muang, *Smith & Sumawong* GC 90 (K). **PENINSULAR MALAYSIA.** Kelantan, Chaning, *Ridley s.n.* 31 January 1917 (K), Gunong Stong, *Whitmore* FRI 12499 (KEP); Sungei Perias *Whitmore* FRI 4176 (KEP); Ulu Sungei Lebir Kechil *Whitmore* FRI 4397 (KEP); Temangan F.R., *Chin & Kusen* 3190 (KLU); Hulu Kelantan, Sungei Nenggiri, *Saw* FRI 37397 (KEP); Tanah Merah, Pergau Dam Site, *Saw* FRI 37617 (KEP); Sungei Mekong, *Saw et. al.* FRI 37662 (KEP); Terengganu, Batu Biwa, *Kiew* RK 2332 (UPM); Hulu Terengganu, Permatang F.R., *Ridzuah & Husmady s.n.* October 1992; Perak, *Scortechini s.n.* (FI); Hulu Perak, Jeram Beruas, *Whitmore* FRI 15728 (KEP); Temenggor, *Ridley* 14709 (BM, SING); Ulu Bubong, *Kunstler (King's collector)* 10205. (holotype CAL; isotypes BM, K); Pahang, Sungai Lepad on Kuantan-Jerantut Rd., *Burkill & Haniff* SFN 17460 (SING); Taman Negara, *Dransfield* 601 (K); Cameron Highlands, *Saw* FRI 37385 (KEP); Selangor, Bukit Kutu, *Casdani s.n.* 1899 (SING); Ulu Gombak F.R., *Saw* FRI 37664 (KEP); Gua Batu Woods, *Ridley s.n.* December 1896 (SING); Negeri Sembilan, Jempul, Pasoh F.R., *Saw & Mustapa* FRI 37506 (KEP); Jelubu, Seriting Ulu F.R., *Saw, Lesmy & Padi* FRI 37312 (KEP).

Occasionally, the first-order branch rebranches into two or three second-order branches. Among the collections listed above, *Chin & Kusen* 3190 has rachillae that are glabrescent, quite unlike the rest; however, there are no other differences.

This species is very similar to *L. mirabilis* and *L. acutifida*, especially those collections with rebranched first-order branches. For the differences from *L. acutifida*, see the discussion under that species. The major differences between *L. kunstleri* and *L. mirabilis* are as follows. The rachis bracts in *L. kunstleri* is loose but not inflated, splitting only slightly on one side; the first-order branch is predominantly simple or with no more than three secondary branches; the rachis axis is slightly sinuous; the flowers are predominantly solitary, rarely in pairs. In contrast, *L. mirabilis* has much inflated rachis bracts, splitting down one side to more than half the length; the first-order branches are never simple, often with four or more secondary branches; the rachis axis is strongly bent at the primary branches and the flowers are predominantly arranged in groups of twos and threes.

### 30. *Licuala acutifida* Mart.

Hist. Nat. Palm. ed. 1: 237 (1838); Griff. in Calcutta J. Nat. Hist. 5: 327 (1844); Mart., loc. cit. ed. 2: 236 (1845); Griff., Palms of British India 122 (1850); Becc. & Hook. f., Fl. Brit. India 6: 433 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 163 (1907); Becc. in Webbia 5: 44 (1921); Ridl., Fl. Mal. Pen. 5: 27 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 168 (1933); Furtado in Gard. Bull. Straits Settlements 11: 44 (1940). Lectotype (selected here): *Porter*

(*Wallich Cat.* 8618B), Peninsular Malaysia, Penang (BR: the two fronds and the inflorescence on right side of the sheet; isoelectotypes BM, C, E, K, P). (Fig. 18 L–O)

Solitary. Stems to 2 m, 2.5–3 cm wide. Petiole *c.* 95 cm long, 4 mm wide at base to 2 mm towards apex, drying with a pale greenish brown colour; spines along approximately the lower quarter to half of length, narrowly triangular, patent to reflexed, 2–4 mm long; frond peltate-orbicular, *c.* 70 cm in wide; segments 13–14, all nearly the same size with slightly curved lateral margins; lateral segments 1–2-costulate, 27–42 × 0.8–3.5 cm; central segment entire, 1–2-costulate, 27–42 × 1–2 cm. Inflorescence patent, shorter than leaves, branched to second order with 3–4 first-order branches, *c.* 35–79 cm long; peduncle *c.* 15–50 cm long; prophyll tubular, densely covered with stellate white hairs with reddish brown bases, to *c.* 19 × 0.5 cm; peduncular bracts absent; rachis not sinuous but occasionally bending at primary branches, densely covered with coarse golden brown stellate hairs; rachis bracts similar to prophyll, to 19 × 0.6 cm; rachis-bract mouth neatly splitting into 1–3 apical lobes and on one side; first-order branches 1–3, near or away from mouth of rachis bract, *c.* 10–19 cm apart; rachillae 6–11 cm long, *c.* 2–2.5 mm wide, densely covered with simple golden brown hairs. Flowers solitary to in groups of 2(–3), on short 0.7 mm high floral stalks; cincinni *c.* 6.8–7.5 per cm; maturing almost simultaneously; bud turbinate; calyx obconical, *c.* 2 × 2.2 mm, membranous, covered with scattered to dense *c.* 0.5–0.8-mm-long tawny golden brown hairs, base not thickened, deeply lobed, lobes obtuse; corolla thick, to 3 × 2.8 mm, densely covered with coarse patent golden brown simple hairs, lobes pointed at apex, *c.* 1.5 × 2.4 mm; staminal ring *c.* 0.5 mm high, filaments subulate, 0.5 mm long, anthers reniform, *c.* 0.5 mm long; ovary glabrous, turbinate but rounded at the edge, 1.2 × 1.2 mm, style filiform, 1 mm long. Young fruit globose, glabrous, surface smooth, green.

**DISTRIBUTION.** Endemic to Penang Hill, Penang in Peninsular Malaysia.

**HABITAT.** Lowland to the upper hill dipterocarp.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Penang, *Griffith* 57 (BM) & 6422 (K), *Lewes s.n.* (BM), *Wallich* 8618AB (K), *Porter (Wallich 8618B)* (lectotype BR, the two fronds and inflorescence on right side of the sheet; isoelectotypes BM, C, E, K, P), *Wallich* 8618C (K), 8618D (K); Government Hill, *Ridley s.n.* March 1915 (K), *Ridley & Curtis* 7906 (K, SING); Penang Hill, SFN 37351 (K), *Ridley s.n.* July 1898 (SING), *Sinclair* SFN 39402 (SING); Belity Rd., *Evans s.n.* 9th July 1970 (KEP); Tiger Hill, *Whitmore* FRI 20527 (KEP); Telok Bahang, *Curtis* 1010 (K, SING); Waterfall, *Curtis s.n.* June 1890 (SING).

The lectotype *Wallich* 8618B (BR) consists of a mixture of *L. acutifida* and *L. spinosa*. The middle inflorescence and the large frond on the left side of the sheet are *L. spinosa*, whilst the rest consisting of two other inflorescences near the left and right margin of the sheet and

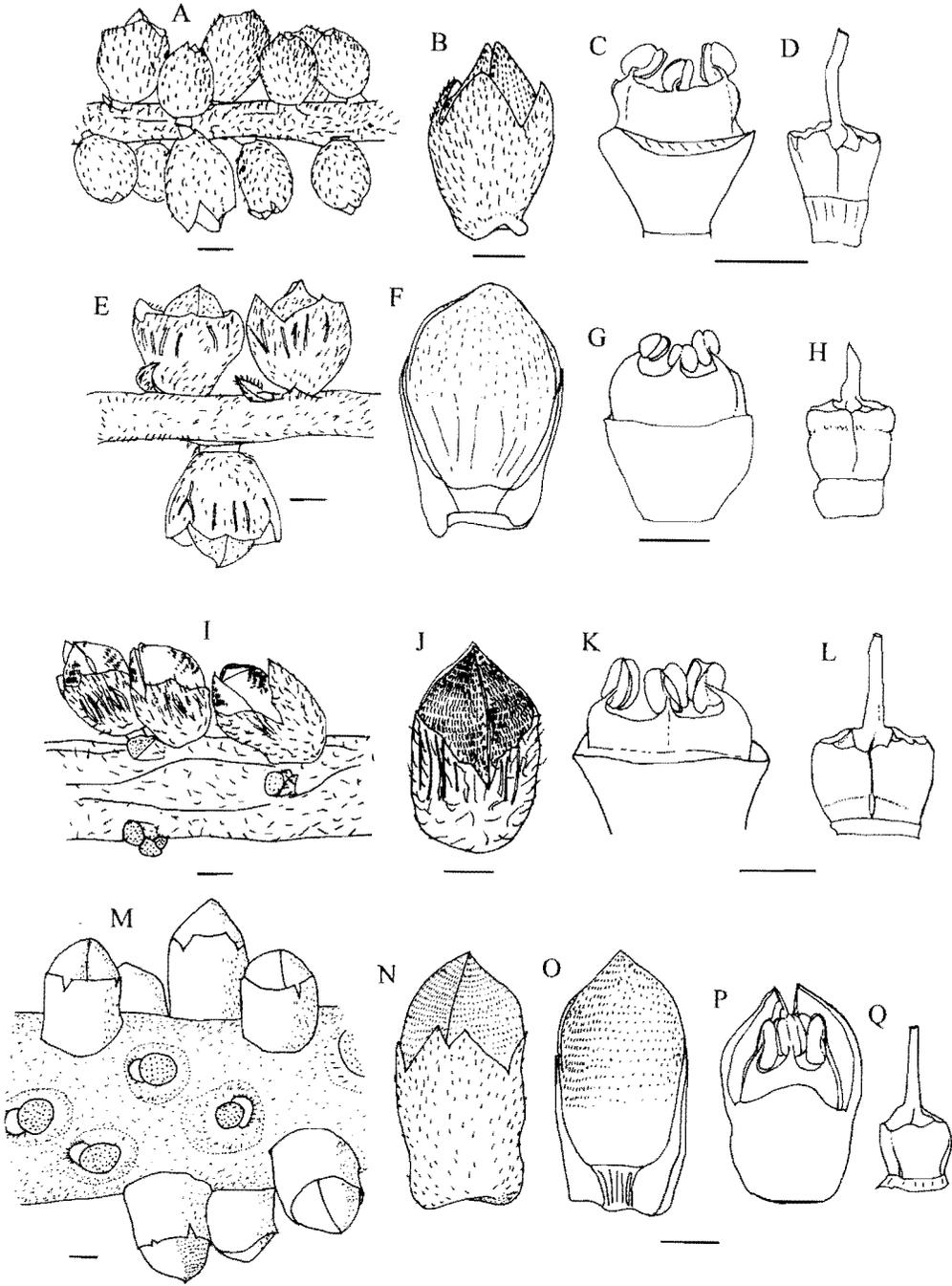
the two fronds on the right represent *L. acutifida*. This species is closely related to *L. kunstleri*, especially in the floral characters. Both species have very similarly shaped flowers and a superficially similar form of hairiness. However, *L. acutifida* has fronds with 1–2-costulate lateral segments, the central segment is approximately the same size as the laterals; the inflorescence is patent and its first-order branches have 1–3 secondary branches; the calyx is covered with hairs of lengths *c.* 0.5–0.8 mm long. In contrast, *L. kunstleri* fronds have 3–7-costulate lateral leaflets, the central segments are much larger than the laterals; the inflorescence is erect and its first-order branches are predominantly spicate, rarely rebranched.

### 31. *Licuala spinosa* Wurm

in Verh. Bat. Genootsch. 2: 474 (1780); Thunb. in Kongl. Vetenskaps Nya Handlingar, 3: 287 (1782); Roxb., Flora Indica 2: 181 (1832); Mart., Hist. Nat. Palm. ed. 1: 235 (1838); Griff., in Calcutta J. Nat. Hist. 5: 321 (1844); Mart., Hist. Nat. Palm. ed. 2: 235 (1849); Griff., Palms of British India 119 (1850); Becc. & Hook. f., Fl. Brit. India 6: 431 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 160 (1907); Becc. in Webbia 5: 24 & 47 (1921); Ridl., in Fl. Mal. Pen. 5: 25 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 186 (1933); Furtado in Gard. Bull. Straits Settlements 11: 67 (1940). Neotype (selected here): *Thunberg s.n.*, Java (UPS, microfiche at K). (Fig. 19 A–D)

*L. acutifida* var. *peninsularis* Becc. in Webbia 5: 44; Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 169 (1933), *pro parte*, **synon. nov.** Lectotype (selected here): *Ridley* 10329, Peninsular Malaysia, Lumut (FI as 10239); isolectotype SING).

Clustering with many subequal basal shoots; stems to 3 m or more tall, to *c.* 5 cm wide. Leaves *c.* 17 in crown, sheath disintegrating into coarse reticulate fibres; petiole *c.* 2–3 m long, *c.* 15–20 mm wide near base, *c.* 6–10 mm wide at apex, drying pale greenish brown; spines along approximately whole length of petiole, narrowly triangular, patent to reflexed, largest near base, to 12 mm long; frond peltate-orbicular, *c.* 100–150 cm wide, segments *c.* 17–23, all about the same size; lateral segments 2–5-costulate, 44–72 × 3.5–8.5 cm; central segment slightly larger than rest, entire, sometimes petiolulate, *c.* 8–10-costulate, 45–76 × 5–14 cm. Inflorescence erect to patent, longer than leaves, extending beyond crown, *c.* 2–3 m long, branched to second order, bearing 7–10 first-order branches; peduncle *c.* 1–1.3 m long, *c.* 10–12 mm across basally; prophyll tubular, *c.* 22 cm or more long, *c.* 2 cm wide, coriaceous, flattened, closely sheathing, densely covered with stellate caducous ferruginous hairs; peduncular bracts present; rachis somewhat rigid, not sinuous; rachis bracts similar to prophyll, *c.* 20–25 × 0.7–1.2 cm; rachis-bract mouth splitting neatly in a few lobes; first-order branches bearing 3–4 rather patent secondary branches, close to or slightly away from mouth of rachis bract; rachilla unornamented, *c.* 20–40 cm long, *c.* 1–2 mm wide, rather wiry, covered with scattered, simple, 0.3–0.7-mm-long brown hairs. Flowers solitary to in



**Fig. 19.** A–D *Licuala spinosa* (from Griffith 54). A. Rachilla with flowers. B. Flower. C. Androecium. D. Ovary. E–H *Licuala patens* (from King's collector 7339). E. Rachilla with flowers. F. Corolla with calyx partly removed. G. Androecium. H. Ovary. I–L *Licuala kingiana* (from Dransfield 874). I. Rachilla with flowers. J. Flower bud. K. Androecium. L. Ovary. M–Q *Licuala ridleyana* (from FRI 37511). M. Rachilla with flowers. N. Flower bud. O. Corolla with calyx partly removed. P. One petal removed revealing androecium. Q. Ovary. Scale bar 1 mm for all.

groups of 2–3, sessile, densely arranged, cincinni *c.* 5–7 per cm, maturing about simultaneously; bud *c.* 4 × 2.5 mm; calyx cylindrical to cyathiform, *c.* 3.1 × 2.2 mm, base thickened, flattened, apex neatly trilobed, acuminate, lobed to about half of calyx length, covered with scattered, 0.3–0.8-mm-long patent hairs; corolla *c.* 3.6 × 2.6 mm, thick, densely covered in upper two-thirds with 0.3–0.7-mm-long simple, patent, translucent hairs, glabrescent towards base, lobes acute, *c.* 1.6 × 2.2 mm; staminal ring truncate, *c.* 0.7–0.8 mm high, filaments subulate, *c.* 0.3 mm long, anthers *c.* 0.5 mm long; ovary glabrous, turbinate, apex truncate, 0.8 × 1.2 mm, style filiform, 1.3 mm long. Fruit globose, glabrous, dark green, ripening orange to red, *c.* 8 mm with smooth surface; seed globose, *c.* 6 mm across.

**DISTRIBUTION.** Andaman and Nicobar Islands, Thailand, Vietnam, Peninsular Malaysia, Borneo, the Philippines, Java and Sumatra.

**HABITAT.** Lowland alluvial forest, fringes of freshwater, peat and mangrove swamp forests, beach forest and open “Melaleuca-savannah” vegetation. It is also the only *Licuala* species known to be able to survive well in the open. In many open areas in the Malay Peninsula where the original forest has been removed, *L. spinosa* continues to persist on abandoned ground and along fences and plot boundaries where secondary forest is left to grow.

**SPECIMENS EXAMINED—VIETNAM.** East of Daklua, *Newman* 119 (K). **PHILIPPINES.** Culion Island, *Merrill* 543 (FI); Palawan, *Bermejos* 39771 (FI); Balabac Island, *Mangubat* BS 448 (FI); Paragua Island, Dumaran (also Luzon), *Com. Seb. Vidal* 3960 (K); Sulu province, Tawitawi, *Ramos & Edano* 44106 (K). **INDIA.** S. Andaman, *Man s.n.* July 1889 (FI); Baratang Island, *Rogers* 32 (FI, K); Nicobar, *King’s collector s.n.* January 1893 (K). **THAILAND.** Bangkok, *Kerr* 4109 (BM, K); Krabi, Khaopra-Bangkraom, *C. Niyomdham et al.* 2031 (K); Ban Keng, *Kerr* 19809 (BM, K); Narathiwat, Sungai Padi, Sala Ton Prone, *Smith & Sumawong* GC 99 (K); Songkla, Tapa, *Kerr* 14711 (BM, K). **PENINSULAR MALAYSIA.** Perlis, Mas Mas F.R., *Kochummen* FRI 2711 (KEP); Kedah, Langkawi Islands, Kuah, *Curtis* 2129 (SING); Gunong Raya F.R., *Whitmore* FRI 12924 (KEP); Penang, South of Bayan Lepas, *Stone* 14482 (K); Perak, Dindings, *Ridley* 3170 (SING); Lumut, *Ridley* 10329 (FI (as 10239), SING); Matang, *Wray, Jr.* 2527 (SING); Terengganu, Dungun, Sungai Paka, *Whitmore* FRI 3968 (KEP); Pahang, Lesong, F.R., *Vethevelu* FRI 29686 (KEP); Tioman Island, Telok Saing, *Nur* SFN 18901 (SING); Pekan, *Ridley s.n.* 20 August 1889 (SING); Tasik Chini, *Saw* FRI 39930 (KEP); Negeri Sembilan, Kuala Pilah to Simpang Pertang Road, *Saw* FRI 37265 (KEP); Malacca, Batu Berendam, Priniggit Road, *Sinclair* SFN 40546 (SING); Pulau Besar, *Ridley* 1667 (SING); Johor, Kuala Rompin, Menchali F.R., *Yap* FRI 30657 (KEP). **SINGAPORE.** Changi, *Ridley s.n.* April 1889 (SING). **BORNEO.** Sabah, Bingkongon, *Balajadia* 3717 (K, SAN); Kudat, *Fraser* 131 (FI, K); Sarawak, Bintulu, Labang, Ulu Stirau, *Ashton* S 18062 (K); Serian, Sabal F.R., *Bujang* 13024 (K); Kalimantan, *Winkler* 3112 (FI); South Kalimantan,

Pleihari, Kec. Jorong, Danau Undang, *Mogea* 775 (K). **SUMATRA**. North Sumatra, Sibolangit Botanical Garden, *Lorzing* 12087 (K). **JAVA**. *Thunberg* s.n. (neotype UPS, microfiche K), *Zollinger* 646 (K); East Java, Blambangan, Pantjur, *Forman* 163 (K); S.W. Java, Udjung Kulon Reserve, near lighthouse, *Kostermans* 21821 (K).

The lectotype of *L. acutifida* var. *peninsularis* should apparently be *Ridley* 10329, but was possibly transposed to 10239 in the duplicate sent to Florence.

In its natural habitat, the species can grow as huge clusters with many sub-equal stems that may dominate the forest understorey. This has been observed in Chini F.R. where *L. spinosa* is very common on the periodically inundated banks of the Chini River. However, it becomes rare or absent on the slopes away from these inundated sites. In coastal strand forest (Langkawi Island, Peninsular Malaysia), it is common along the seaward side and becomes rare then disappears inland.

*Licuala spinosa* is similar to *L. paludosa* in some of its habitat requirements, habit, inflorescence and flowers. However, *L. spinosa* has rather large spines distributed along the whole length of the petiole and its calyx is hairy, whereas *L. paludosa* has very small spines, mainly along the lower half of petiole, and a glabrous calyx.

### 32. *Licuala patens* Ridl.

in J. Royal Asiatic Soc. Straits Branch 82: 202 (1920); Fl. Mal. Pen. 5: 25 (1925). Lectotype (selected here): *Wray, Jr.* 3928, Perak, Gunong Bubu (SING; isolectotypes BM, K).

(Fig. 19 E–H)

*L. paludosa* sensu Furtado in Gard. Bull. Straits Settlements 11: 65 (1940), *pro parte*.

Stems to 2–3 m tall, *c.* 6–10 cm wide, decumbent. Petiole *c.* 1.8–2.5 m long, *c.* 10 mm wide near base, *c.* 7 mm wide at apex, drying pale brown, armed with spines along lower third of petiole, spines narrowly triangular, patent, drying dark brown to black, largest near base, no more than 3 mm long; frond medium-sized, peltate-orbicular, *c.* 100–150 cm wide, segments *c.* 39, all about same size; lateral segments *c.* 2-costulate, 50–75 × 4–5 cm; central segment undivided, *c.* 8-costulate, *c.* 75 × 5 cm. Inflorescence erect to patent, *c.* 1–1.5 m long, branched to second order, bearing more than 4 first-order branches; peduncle *c.* 18 mm wide near base; prophyll tubular, *c.* 30 cm or more long, *c.* 2.2 cm wide, coriaceous, flattened, not inflated, closely sheathing, covered with stellate caducous white hairs with reddish brown bases; peduncular bracts present; rachis somewhat rigid, not sinuous; rachis bracts similar to prophyll, *c.* 22 × 15 cm, rachis-bract spitting apically into a few pointed lobes; first-order branch close to mouth of rachis bract, bearing 13–18 rather patent secondary branches; rachilla unornamented, *c.* 20–35 cm long, *c.* 1–2 mm wide, rather wiry,

covered with scattered, less than 0.1-mm-long simple, brown hairs. Flowers solitary, sessile, *c.* 5–7 per cm, maturing almost simultaneously; bud *c.* 3.5 × 2.5 mm; calyx cyathiform, *c.* 2.5 × 2.5 mm, striate when dry, sparsely covered with simple less than 0.1 mm hairs, neatly 3-lobed, membranous; corolla *c.* 3 × 2.2 mm, thick, covered with scattered simple, fine less than 0.1-mm-long hairs, lobes acute, *c.* 1.2 × 2 mm; staminal ring undulate, *c.* 0.5 mm high, filaments subulate, *c.* 0.4–0.5 mm long, anthers *c.* 0.5 mm long; ovary glabrous, cylindrical, apex truncate, *c.* 1.1–1.5 × 1.2 mm, style filiform, *c.* 0.8 mm long. Young fruit globose.

**DISTRIBUTION.** This species is endemic to the mountain forest of Gunong Bubu, Perak in Peninsular Malaysia.

**HABITAT.** Montane forest.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, Gunong Bubu, *King's collector (Kunstler)* 7339 (FI, K), *Wray, Jr.* 3928 (lectotype SING; isolectotype BM, K), Hulu Kenas, *Scortechini* 799 (FI).

This is a good taxon which Furtado (1940) had reduced to *L. paludosa*. Earlier, Beccari also included the three specimens cited above in *L. paludosa*, accepting the hairiness of the calyx and corolla in *L. patens* as part of the variation of *L. paludosa*. In fact, *L. paludosa* has glabrous calyces and corollas. *Licuala patens* differs from *L. spinosa* and *L. paludosa* in having more (13–18) second-order branches, a corolla covered with hairs less than 0.1 mm long and its occurrence on mountains. *Licuala spinosa* and *L. paludosa* have only 3–8 secondary branches, and *L. spinosa* has 0.3–0.8-mm-long hairs on the calyx, whereas *L. paludosa* has glabrous calyx. Both latter species are plants of the lowlands.

### 33. *Licuala kingiana* Becc.

Malesia 3: 193 (1889); Becc. & Hook. f., *Fl. Brit. India* 6: 435 (1892); Ridl., *Mat. Fl. Mal. Pen.* 2: 165 (1907); Becc. in *Webbia* 5: 38 & 51 (1921); Ridl., *Fl. Mal. Pen.* 5: 30 (1925); Becc. in *Ann. Roy. Bot. Gard. Calcutta* 8: 213 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 54 (1940). Type: *Kunstler (King's collector)* 471, Peninsular Malaysia, Perak, Goping (holotype CAL; isotypes FI, K, BM). (Fig. 19 I–L)

Solitary. Stems to 1 m tall, 1.6 cm wide. Petiole with leaf sheath fibres not breaking into fine individual strands, to *c.* 100 cm, *c.* 5–6 mm across near base, *c.* 2–3 mm wide towards apex, drying greenish brown throughout, armed with spines along approximately lower half of margins, spines narrowly triangular and reflexed, irregular in size, to 6 mm long; frond peltate-orbicular, *c.* 35 cm in wide; segments few, 7–13, almost equal in size with slightly

curved lateral margins; lateral segments 3–5-costulate, 14–24 × 3–3.5 cm; central segment slightly larger than rest, entire, sessile, 10–14-costulate, 19–29 × 8–11 cm. Inflorescence robust and erect, shorter than leaves, c. 15–45 cm long, unbranched or bifurcate; prophyll c. 8–22 × 0.5–1 cm; peduncle c. 6–26 cm long; rachis rigid, erect, densely covered with c. 0.6–1-mm-long velvety, golden brown to white hairs; peduncular bracts absent; rachis bracts tubular, flattened, two-keeled, densely covered with silky, white, velvety hairs, mouth tightly sheathing, splitting neatly into c. 2–3 apical lobes and on one side; rachilla up to 12 cm long, c. 3 mm wide, densely covered with simple, 0.6–1-mm-long golden brown, velvety hairs. Flowers in groups of 2–3 near base, solitary towards apex, on short tubercles; cincinni c. 6–9 per cm; maturing about simultaneously; calyx cylindrical, 3.5 × 2.5 mm, chartaceous, surface striate, covered with scattered 0.6–0.8 mm, patent, golden brown, simple hairs, truncate, splitting irregularly as corolla expands; corolla thick, c. 3–3.5 × 2–2.5 mm, densely covered with coarse, appressed, wavy, golden brown hairs on upper two thirds, glabrescent towards base, lobes c. 2 × 2 mm, pointed at apex; staminal tube c. 0.4–0.5 mm high, filaments thick, filiform with triangular base, anthers reniform, c. 0.5 mm long; ovary glabrous, cylindrical to rather knobby, 0.8–1.3 × 1–1.5 mm, style filiform, 1–1.2 mm long. Fruit not known.

**DISTRIBUTION.** Endemic to central Perak in Peninsular Malaysia.

**HABITAT.** Lowland to hill dipterocarp forest and occasionally on lower slopes of limestone hills.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, Bujong Malacca, Curtis 3162 (SING); Ridley *s.n.* July 1904 (SING); Gunong Bubu, near Bruas, Kiew RK 2581 (UPM); Gopong, Kunstler (*King's collector*) 471 (holotype CAL; isotypes FI, K, BM); Gunong Keledang, Ridley 9804 (SING); Gunong Kerbau, Robinson *s.n.* June 1913 (K); Ipoh, Bukit Layang-Layang, Saw FRI 34279 (KEP), Kinta Hills F.R., Dransfield & Manokaran JD 4473 (KEP); Keledang Saiong F.R., Dransfield 874 (K), Whitmore FRI 20461 (KEP), Saw FRI 40044 (KEP); Kinta valley, Ridley *s.n.* 18. (SING); Sungei Siput, Haniff & Nur SFN 6962 (SING).

A very distinctive species with a very much reduced inflorescence, spicate to bifurcate, and glabrous ovary. No other Malay Peninsula species has such a combination of characters. *Licuala mattanensis* Becc. from Borneo has a very similar inflorescence but its flowers are glabrous and its fruits are narrowly fusiform. The flowers of *L. kingiana* approach those of *L. ridleyana* and *L. malajana*, all having rather hairy flowers, i.e., hairy calyces and corollas but glabrous ovaries. The strongly appressed hairs on the corolla are also very distinctive of this group. *Licuala kingiana* is different from the other two species in its coarser hairs and the very reduced inflorescences. Both *L. ridleyana* and *L. malajana* have rather well-developed inflorescences with three or more first-order branches.

**34. *Licuala cameronensis* L.G. Saw sp. nov.** palma parva solitaria inflorescentia patenti vel pendula, folius brevior in 1 ordinem ramificanti 2 inflorescentii partialibus spicatis rachide rachillisque lanuginosis pilis albis ad 1–2 mm longis, floribus solitariis, calyce urceolato 2 × 3 mm, irregulariter spissa, dense lanuginoso pilis simplicibus, corolla c. 3.3 × 3 mm, pilis albis vel translucentibus adpressis undulatis tecta, annulo staminale, c. 0.7 mm alta regulariter 6-lobato, ovario glabro distinctissima. Typus: Saw FRI 37383, Peninsular Malaysia, Pahang, Cameron Highlands, Boh Tea Estate forest area (holotypus KEP). (Fig. 20)

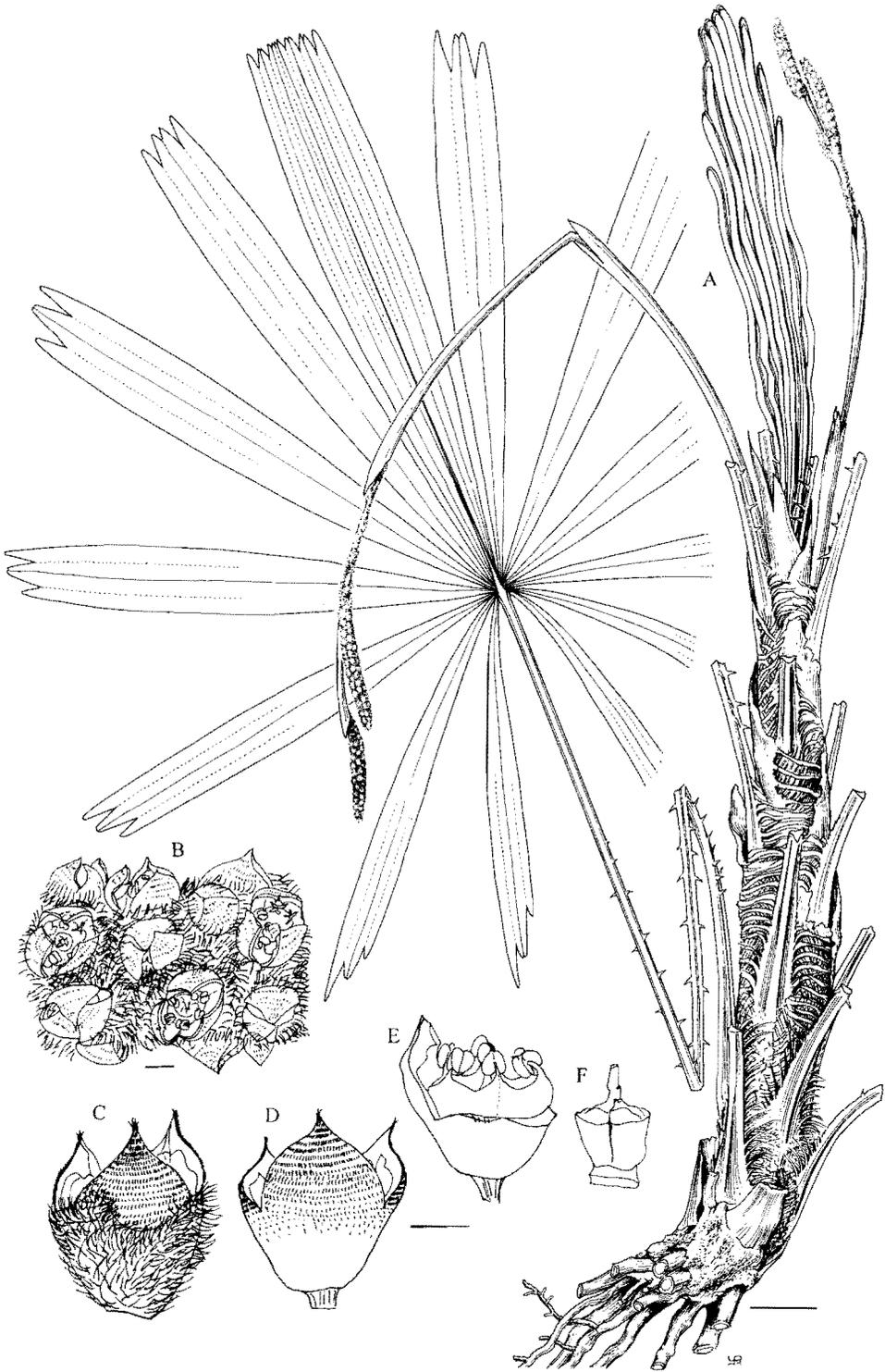
Solitary, small sized palm. Stem erect to 30 cm tall, c. 2.5 cm wide. Leaves c. 16 in crown, sheath ligule papery, marcescent, leaf sheath fibres breaking into coarse fibres; petiole c. 56 cm, 5 mm across near base, c. 3 mm wide towards apex, drying reddish brown near base to pale brown towards apex, armed with spines along approximately lower three quarters of petiole, spines narrowly triangular to sickle-shaped irregularly directed, spaced and sized, largest c. 5 mm long; frond small, c. 30 cm in wide, peltate-orbicular; segments many, 13–15, about equal in size with curved lateral margins; lateral segments 1–2-costulate, 14–18 × 1–2 cm; central segment entire, sessile, 4–5-costulate, 16–18 × 3–3.5. Inflorescence patent to pendulous, shorter than leaves, to c. 30 cm long with only 2 first-order branches; peduncle c. 19 cm long; prophyll 8–15 × 0.5 cm; peduncular bract absent; rachis not sinuous, very lanuginose with 1–2-mm-long woolly, white hairs; rachis bracts at base 12 × 0.4 cm, at apex much reduced to no longer than 1.5 cm, tubular, flattened, two-keeled, glabrescent, mouth loosely sheathing, splitting down one side and apically neatly into 1–2 lobes; first-order branches originating away from mouth of rachis bract, c. 3–8 cm apart; rachillae 2–7 cm long and c. 5 mm wide, densely covered with coarse, woolly, white, simple hairs, unornamented. Flowers solitary, sessile, light brown, densely arranged, c. 18 per cm, maturing together about same time; calyx urceolate, 2 × 3 mm, chartaceous, splitting irregularly, densely covered with 1–2-mm-long shaggy woolly, white, simple hairs; corolla c. 3.3 × 3 mm, thick, covered with white or translucent appressed and coarse wavy hairs, lobes c. 1.7 × 2.3 mm, apex pointed; staminal ring c. 0.7 mm high, filaments thick, filiform with triangular bases, anthers reniform, c. 0.5 mm long; ovary glabrous, subturbinate, distinctly truncate at apex, 1 mm long, style filiform, c. 1 mm long; fruit globose, glabrous, smooth, c. 10 mm across, green, ripening orange, seed globose, 5–6 mm across.

**DISTRIBUTION.** Endemic to the Cameron Highlands, Pahang in Peninsular Malaysia.

**HABITAT.** Lower montane forest, mainly on slopes.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Pahang, Cameron Highlands, *Damanhuri* FRI 37358 (KEP), *Saw* FRI 37383 (holotype KEP).

This species, a most distinctive *Licuala* with very short patent to pendulous inflorescence, is only known from the type locality in a forest beside a tea estate. Its rachilla and rachis are



**Fig. 20.** *Licuala camerounensis*. **A.** Habit with inflorescences. **B.** Rachilla with flowers. **C.** Flower. **D.** Corolla. **E.** Androecium. **F.** Ovary. All from FRI 37383. Scale bar 2 cm for A, 2 mm for B–F.

very lanuginose, similar to *L. lanuginosa* but its simple pendulous first-order branches and a glabrous ovary are quite different. *Licuala lanuginosa* has an erect inflorescence with second-order branches and hairy ovary.

**35. *Licuala whitmorei* L.G. Saw sp. nov.** *palma acaulescens solitaria, inflorescentia in 1 ordinem ramificantis 4 inflorescentiis partialibus, rachilla c. 5–9 × 0.2 mm, crasso, pilis tenuis simplicibus minus quam 0.1 mm longis sparse tecta apice truncato 3 lobis brevissimis acutis, corolla usque ad c. 5 × 2.5 mm, crassa fibrosa, pilis simplicibus albis patentibus dispersis minus quam 2 mm longis tecta, annulo stamine regulariter 6 labato, ovario glabro tubrinato versus medium distincte notato, c. 1.3 × 1.4 mm, stylo filiforme, 0.9 mm longo.*  
*Typus: Whitmore FRI 15610, Peninsular Malaysia, Johor, Mersing F.R. (holotypus KEP).*

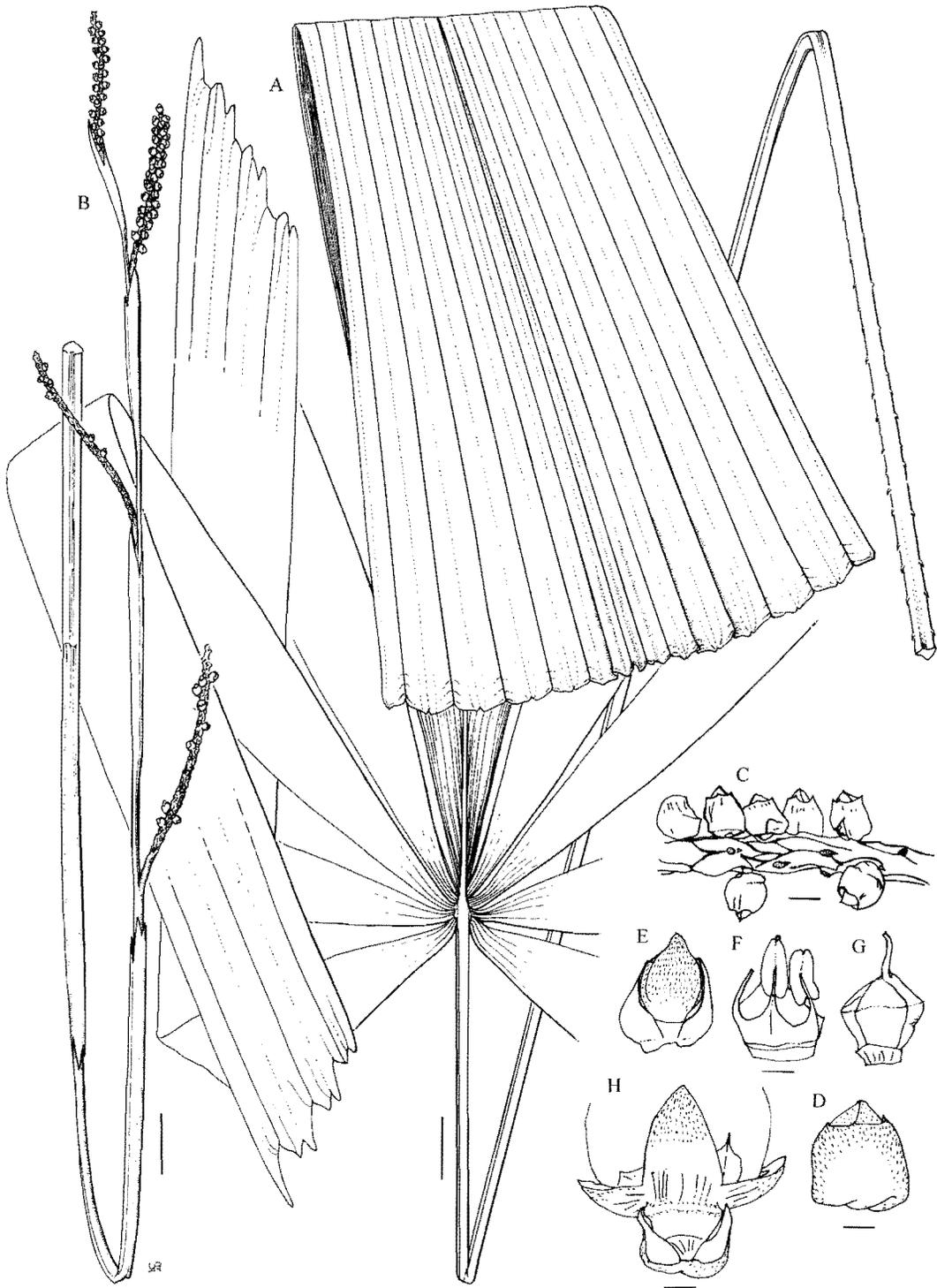
(Fig. 21)

Solitary. Petiole *c.* 73 cm, *c.* 7 mm wide near base, *c.* 4 mm towards apex, drying pale greenish brown, armed with narrowly triangular and reflexed spines no more than 2 mm long along approximately lower third of petiole; frond peltate-orbicular, *c.* 70 cm in wide, segments 7–9, with slightly curved lateral margins; lateral segments 3–4-costulate, 34–45 × 4.5–5 cm, central segment much larger than laterals, entire, 14–16-costulate, 36–50 × 16–19 cm. Inflorescence shorter than leaves, *c.* 70–76 cm long, branched to first order with 4 first-order branches; peduncle *c.* 46–51 cm long; prophyll not known; peduncular bract 1; rachis not sinuous, sparsely covered with caducous white stellate hairs; rachis bract to *c.* 10 × 0.6 cm, tubular, flattened, with similar indumentum to rachis, rachis-bract mouth splitting apically into *c.* 1–2 lobes and on one side; first-order branches close to mouth of rachis bract, *c.* 7–11.5 cm apart; rachilla *c.* 5–9 × 0.2 mm, glabrous, corky, cracking into angular plates in dried herbarium specimens. Flowers solitary, sessile, cream, in shallow pits, densely arranged, *c.* 14.8 per cm, maturing almost simultaneously, bud cylindrical with pointed apex and flat base; calyx cylindrical, *c.* 2 × 3 mm, thickly fleshy with broad base, sparsely covered with less than 0.1-mm-long white, simple hairs, slightly striate when dry, truncate at apex with 3 very short pointed lobes; corolla to *c.* 5 × 2.5 mm, thick and fibrous, covered with scattered, less than 0.2-mm-long patent, white, simple hairs, corolla lobes elliptic, pointed at apex, *c.* 3.3 × 2.5 mm; staminal ring *c.* 0.5 mm high in immature flower, filaments filiform with triangular base, 1 mm long, anthers reniform, *c.* 0.9 mm long; ovary glabrous, turbinate, distinctly ridged around middle, *c.* 1.3 × 1.4 mm, style filiform, 0.9 mm long. Young fruits globose, glabrous, smooth, green.

**DISTRIBUTION.** Endemic to east Johor, Peninsular Malaysia.

**HABITAT.** Lowland dipterocarp forests (in *kapur* (*Dryobalanops aromatica*) forest).

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Johor, Mersing F.R., *Whitmore* FRI 15610 (holotype KEP), FRI 15605 (KEP).



**Fig. 21.** *Licuala whitmorei*. **A.** Frond. **B.** Inflorescence. **C.** Rachilla with flowers. **D.** An immature flower. **E.** Corolla with calyx partly removed. **F.** Androecium. **G.** Ovary. **H.** Corolla from a fruiting specimen with calyx partly removed. A–G from FRI 15610, H from FRI 15605. Scale bar 2 cm for A–B, 1 mm for C–H.

Only known from two collections from the Mersing F.R., Johor. No other species has the unique corky cracked rachilla found in this species. See discussion under *L. pahangensis* for its affinity with that species and other similar taxa. The species epithet is named in honour of the collector, Dr. T.C. Whitmore.

### 36. *Licuala ridleyana* Becc.

in *Webbia* 5: 31 (1921) and *Ann. Roy. Bot. Gard. Calcutta* 13: 170 (1933); Furtado in *Gard. Bull. Straits Settlements* 11: 66 (1940). Lectotype (selected here): *Ridley* 14112, Peninsular Malaysia, Perak, Tapah (SING; isolectotypes FI, K) (holotype B–destroyed).

(Fig. 19 M–Q)

*L. acutifida* Mart. var. *peninsularis* Becc. in *Webbia* 5: 31 (1921) and *Ann. Roy. Bot. Gard. Calcutta* 13: 170 (1933), *pro parte*. Lectotype (selected here): *Ridley* 9806, Peninsular Malaysia, Perak, Bujong Malacca (SING).

*L. confusa* Furtado in *Gard. Bull. Straits Settlements* 11: 44 (1940), **synon. nov.** Type: *Furtado* A, Peninsular Malaysia, Perak, Tapah Hill F.R. (holotype SING; isotype BM).

*L. dransfieldii* Kiew in *Malayan Nature J.* 42: 263 (1989), **synon. nov.** Type: *Kiew* RK 2748, Peninsular Malaysia, Johor, Ulu Endau, Sungei Marong (holotype UPM; isotypes K, SING).

Clustering with 1–3 erect, dominant shoots, suckering at base, to 3 m tall, *c.* 2.5 cm wide, internodes *c.* 1.4–1.8 cm long. Leaves *c.* 10–20 in crown, sheath with rather fragile ligule and disintegrating into coarse fibres; petiole *c.* 70–120 cm, *c.* 8–10 mm wide at base, *c.* 3–5 mm wide towards apex, drying pale greenish brown; spines no more than 6 mm long, along approximately lower half of petiole, narrowly triangular and reflexed; frond peltate-orbicular, *c.* 45–90 cm wide, segments very variable in number, *c.* 5–20; in many-segmented specimens, size about equal, lateral segments 2–3-costulate, 23–47 × 2–3.5 cm, central segment entire, 3–4-costulate, 34–48 × 3.5–5 cm; in few-segmented specimens, lateral segments 4–7-costulate, 26–44 × 7–9 cm, central segment larger than rest, entire, 11–15-costulate, 37–51 × 13–22 cm. Inflorescence erect, within crown, shorter than leaves *c.* 10–80 cm long, branched to first order only bearing 2–5 branches; peduncle *c.* 5–18 cm; prophyll to *c.* 10–15 × 1.5 cm; peduncular bracts sometimes lacking; rachis sinuous, bending at primary branches, covered with caducous, white to gray, stellate hairs with reddish brown bases; rachis bract to *c.* 10 × 1.5 cm, tubular to funnel-shaped, covered with similar hairs to rachis, rachis-bract mouth loosely sheathing, splitting neatly into *c.* 3–6 apical lobes and slightly on one side; first-order branches at or close to mouth of rachis bract, *c.* 4–17 cm apart; rachillae 8–21 × 0.1–0.5 cm, thin to swollen, covered with less than 0.2-mm-long scattered, brown, simple hairs. Flowers solitary, sessile, creamy yellow,

maturing approximately simultaneously, densely arranged in shallow pits to slightly raised tubercles, *c.* 8–12 per cm; bud cylindrical with pointed apex and flat base; calyx cylindrical, rarely urceolate, *c.* 2–3 × 2–2.5 mm, thick and fleshy at base, chartaceous towards apex, apex truncate to sometimes trilobed with bifid or rounded apex, or with irregular splits, covered with less than 0.2-mm-long scattered to sparse, simple hairs, striate in immature flowers but not in mature; corolla to *c.* 4 × 2.5 mm, thick and fibrous, covered densely with fine, appressed, golden brown hairs, lobes elliptic, *c.* 2.5 × 2 mm, apex acute; staminal ring *c.* 0.5 mm high, filaments short, less than 0.4 mm long, subulate, anthers reniform, *c.* 0.7 mm long; ovary glabrous, turbinate to urceolate, distinctly truncate, *c.* 1.2 × 1.2 mm, style filiform, *c.* 1.5 mm long. Fruit globose, glabrous, smooth, *c.* 10 mm across, green, ripening orange; seed globose 7 mm across.

**DISTRIBUTION.** Endemic to south Peninsular Malaysia.

**HABITAT.** Lowland to hill dipterocarp forest. In Johor, it is common in lowland forest with undulating terrain, and slopes and ridges of hill forest. Farther north, e.g., in Negeri Sembilan and Selangor, the species is restricted mainly to hill slopes and ridges; it is rather uncommon on flat terrain.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, Bujong Malacca, *Ridley* 9806 (SING); Dindings, Telok Kopia F.R., *Whitmore* FRI 3102 (KEP); Lumut F.R., *Whitmore* FRI 990 (KEP); Tapah, *Ridley* 14112 (lectotype SING; isolectotypes FI, K); Tapah Hill F.R., *Furtado* A; Pahang, Krau Game Reserve, North of Teris River, *R. Gianni* E 276 (K); Bukit Rengit, *Saw* FRI 37370 (KEP); Maran, Cehabu, near Gua Tunkat, *R. Gianni* E 124 (K); Rompin, Lesong F.R., *Saw* FRI 37530 (KEP); Selangor, Semenyih, *Hume* 7962 (SING); Ulu Langat, Sungei Lalang F.R., *Dransfield* 917 (K), *Saw* FRI 37321 (KEP); Negeri Sembilan, Jempol, Serting Tengah F.R., *Saw* FRI 37697 (KEP); Malacca, Ophir, *Palmer* 14/4 (SING); Johor, Ulu Endau, Labis F.R., RK 2748 (UPM, K, SING); Kluang, Gunung Belumat, *Dransfield* 848 (K, KEP), *Saw* FRI 37428 (KEP); Muar, Ma'Okil F.R., *Dransfield & Fong* JD 5023 (KEP); Segamat, Gunung Ledang F.R., *Saw* FRI 37725 (KEP).

The inflorescence length is extremely variable but very consistent within populations. Specimens from the south, i.e., in Johor, south Pahang and Malacca, have shorter inflorescences, up to 20 cm long. Farther north, in Negeri Sembilan and central Pahang, the inflorescences tend to be more robust and longer, up to 45 cm. In Sungai Lalang, Selangor, the inflorescence lengths are between 45 and 80 cm long (the latter in *Dransfield* 917). Specimens collected from Perak have inflorescences ranging from 60 to 80 cm long. There is a general cline in inflorescence length, shorter inflorescences in more southerly populations and longer inflorescences further north. Other than this, there are no major differences in the inflorescence type, rachis bract type, rachilla characters and floral characters between the southern and northern populations. It is with this range of variation

in mind that *L. dransfieldii* is reduced into this species. I have also included *L. confusa* with this species. Although Furtado (1940) considered that *L. confusa* has a deeply lobed calyx whereas *L. ridleyana* has the calyx apex almost truncate at first, then irregularly split, these character states are not very consistent. Furtado (1940) pointed out that the flowers in the attached envelope on the sheet of the lectotype (*Ridley* 14112 at SING) were mixed and belonged to two taxa, namely *L. ridleyana* and *L. confusa*. Having examined this sheet in SING, I am of the opinion that they represent the same taxon, and I do not agree that this is a mixed collection as Furtado alleged. This was further confirmed by the duplicates seen in Kew and Florence.

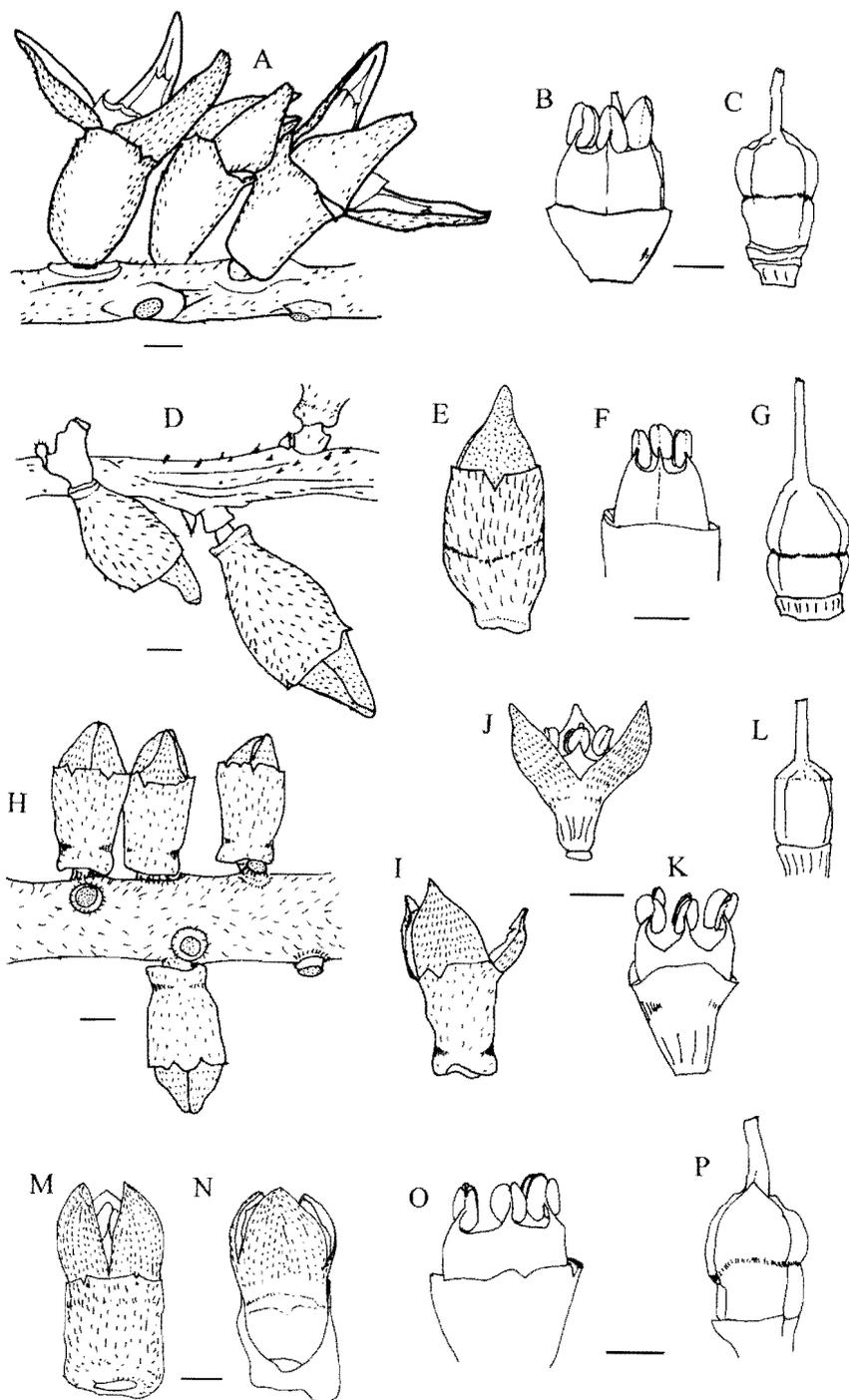
The species is similar in its inflorescence to *L. pahangensis* and its affiliated species. It can be easily differentiated from them by the following features: *L. ridleyana* has a sinuous inflorescence and its corolla lobe is densely covered with appressed golden brown hairs, whereas *L. pahangensis* and its affiliated species all have non-sinuous inflorescences and glabrous corollas. Note that the hairs on the corolla of *L. ridleyana* consist of dense and very appressed hairs, and has been mistaken as being glabrous by both Beccari (1920 & 1933) and Kiew (1989). As was noted by Beccari, its flowers are very similar to *L. malajana*, which has, however, inflorescences branched beyond the first order.

*Whitmore* FRI 990 and FRI 3102 from Perak have rachillae with rather swollen tubercles, quite different from the other collections. The calyx is urceolate instead of cylindrical as seen in the other collections.

### 37. *Licuala tiomanensis* Furtado

in Gard. Bull. Straits Settlements 11: 68 (1940). Type: *Nur* 18611, Peninsular Malaysia, Pahang, Tioman Island, Bukit Kajang (holotype SING; isotype K). (Fig. 22 A–C)

Solitary. Stems erect, to *c.* 6 m tall. Petiole *c.* 20–120 cm long, 6 mm wide near base, *c.* 3.5 mm wide towards apex, drying dark reddish brown, spines along lower half of petiole, narrowly triangular and reflexed to sickle-shaped, irregularly sized, to 4 mm long; frond peltate-orbicular, *c.* 30–60 cm in wide, leaflets 13–17, approximately the same size with straight lateral margins, lateral segments 2–3-costulate, 15–35 × 3–5 cm, central segment slightly larger than rest, entire, sessile, *c.* 8-costulate, 25–35 × 6–9 cm. Inflorescence *c.* 30–70 cm long, branched to first order only with 3–4 branches; peduncle 15–30 cm long; prophyll *c.* 20 × 1.2 cm; peduncular bracts absent; rachis not sinuous, covered with caducous brown indumentum; rachis bract at base *c.* 27 × 1 cm, tubular, flattened, covered with brown indumentum, splitting apically with 1–2 lobes and on one side, mouth tightly sheathing; first-order branches close to mouth of rachis bract, *c.* 18–22 cm apart; rachillae up to *c.* 22 × 2.5 mm, covered with scattered less than 0.3-mm-long white simple hairs.



**Fig. 22.** A–C *Licuala tiomanensis* (from Nur 18611). A. Rachilla with flowers. B. Androecium. C. Ovary. D–G *Licuala longicalycata* (from SFN 32401). D. Rachilla with flowers. E. Flower bud. F. Androecium. G. Ovary. H–L *Licuala modesta* (from King's collector 1983). H. Rachilla with flowers. I. Flower. J. Corolla. K. Androecium. L. Ovary. M–P *Licuala malajana* var. *malajana* (from Dransfield JD 6786). M. Flower. N. Corolla with calyx partly removed. O. Androecium. P. Ovary. Scale bar 2 mm for A–G, 1 mm for H–P.

Flowers solitary on very short tubercles, *c.* 5.6 per cm, maturing simultaneously; buds ellipsoid, with slightly tapered base and pointed apex; calyx cyathiform, *c.* 5 × 2–2.5 mm, not striate, covered with scattered golden brown, simple hairs of *c.* 0.2–0.5 mm long, apex truncate, splits irregular, shallow; corolla to *c.* 6.5 × 2.5 mm, thick, densely covered with *c.* 0.3–0.5-mm-long appressed, golden brown hairs, lobes narrowly deltoid, pointed at apex, *c.* 5 × 2.5 mm; staminal ring *c.* 1 mm high, filaments subulate, short to *c.* 0.3 mm long, anthers *c.* 0.8 mm long; ovary ovoid, constricted in middle, glabrous, rounded apically, *c.* 2 × 1.5 mm high, style filiform, 1 mm long. Fruits unknown.

**DISTRIBUTION.** Endemic to Tioman Island, Pahang in Peninsular Malaysia.

**HABITAT.** Lower montane forest where it completely dominates the forest understorey.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Pahang, Tioman Island, Bukit Kajang, *Nur* 18611 (holotype SING; isotype K), 18910 (K, SING), *Saw et al.* FRI 40085 (A, K, L, KEP, QRS, SAN, SAR); Gunong Lalang, *Kadim & Noor* K 608 (C, K, L, SING).

It is a distinctive species with rather large flowers. It is similar to *L. ridleyana*; both species have spicate first-order branches and similar rachilla, and similar hair type on the calyx and corolla. They differ from each other in the following characters: the mature flower buds of *L. ridleyana* are less than 5 mm long while those of *L. tiomanensis* are 7 mm or more. Moreover, the calyx of *L. tiomanensis* is cyathiform but cylindrical in *L. ridleyana*.

### 38. *Licuala longicalycata* Furtado

in Gard. Bull. Straits Settlements 11: 54 (1940). Type: *Kiah* SFN 32401, Peninsular Malaysia, Johor, Sungai Kayu (holotype SING; isotype K). (Fig. 22 D–G)

Clustered with usually one main and 2–5 or more subdominant stems of varying shoot sizes, to *c.* 2 m tall. Leaves *c.* 6–20 per shoot, leaf sheath with rather fragile ligule and disintegrating into coarse fibres; petiole *c.* 1.2–2.5 m long, *c.* 6–10 mm wide near base, *c.* 5–7 mm wide at apex, drying light greenish brown, spines rather regularly spaced, no more than 5 mm long along lower half or more of petiole; frond orbicular, *c.* 60–120 cm wide; segments *c.* 11–19, approximately equal in size, lateral margins straight; lateral segment 2–3-costulate, *c.* 50–68 × 3–5 cm; central segment entire, slightly larger than rest, sessile sometimes petiolulate, 9–12-costulate, *c.* 52–77 × 10–12 cm. Inflorescence erect, shorter than leaves, *c.* 75–90 cm long, bearing 5–8 first-order branches; peduncle *c.* 25–40 cm long, *c.* 7–9 mm wide at base; prophyll tubular, *c.* 15 × 1.5 cm, flattened, not inflated with closely sheathing, irregularly-split mouth; peduncular bracts absent; rachis somewhat rigid, not sinuous; rachis bracts similar to prophyll, to *c.* 10–19 × 1–1.3 cm, coriaceous with

irregularly split, non-fibrous mouth, densely covered with caducous stellate hairs, hairs silvery, appressed, wavy, coarse to *c.* 1 mm or more long; first-order branches close to mouth of rachis bract, bearing 5–8 secondary branches; rachilla to *c.* 15 cm long, *c.* 1–1.5 mm diameter, flexuous, covered with sparse to scattered less than 0.2-mm-long simple hairs. Flowers solitary or in pairs, on swollen tubercles with short floral stalks of 1–2 mm long, cincinni *c.* 2–3 per cm, maturing about simultaneously, bud ellipsoid, *c.* 7–8 × 2.5–3 mm; calyx cyathiform, *c.* 4.5 × 2.5 mm, base tapered, thickened, apex truncate and shallowly splitting into 3 cuspidate or sometimes bifid lobes, covered with scattered less than *c.* 0.2-mm-long silvery simple hairs; corolla *c.* 5.5–6.5 × 2.5 mm, thick, densely covered with less than *c.* 0.2-mm-long appressed golden simple hairs towards upper half, glabrescent towards base, lobes with acute apex, *c.* 3.5–4 × 2.5 mm; staminal ring undulate, *c.* 2 mm high, filaments subulate, *c.* 0.5 mm long, anthers *c.* 0.9 mm long; ovary glabrous, fusiform, apex tapered, 2.2 × 1.5 mm, style filiform, 1.8 mm long. Fruit ovoid, glabrous, green, ripening orange to red, *c.* 12–13 × 10 mm with smooth, seed globose *c.* 9 mm across.

**DISTRIBUTION.** Endemic to south Peninsular Malaysia.

**HABITAT.** Lowland species, occasionally found in edges of seasonal and freshwater swamp. In Endau Rompin Park, *L. longicalycata* is also found in heath forest over sandstone on better-drained terrain.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Pahang, Chini F.R., Cockburn FRI 11068 (KEP); Lesong F.R., Saw FRI 38532 (KEP); Pekan, Ulu Jeram, *R. Gianni* E96 (K); Palong F.R., Whitmore FRI 3989 (KEP); Rompin Iron Mine, Whitmore FRI 3608 (KEP); Tasek Bera, *R. Gianni* 42 (L); Tasek Chini, Saw FRI 39927 (KEP); Termerloh, Poore 1213 (SING); Negeri Sembilan, Ayer Kuning, near Bahau, Symington FMS 24379 (KEP, SING); Fort Iskander, Stone 7159 (KLU); Johor, Gemas, Palmer 1/2 (SING); Gunong Arong F.R., Dransfield & Fong JD 5063; Kluang F.R., Dransfield 823 (K, KEP); Kuala Palong F.R., Everett FRI 14262 (KEP); Gunong Lambak F.R., Saw FRI 37440 (KEP); Labis, Symington FMS 47068 (KEP); Lenggong F.R. Saw *et al.* FRI 37434 (KEP); Pulau Sibul, Tow 112 (SINU); Rengam F.R., Kochummen FRI 2180 (KEP); Sungai Kayu, Kiah SFN 32401 (holotype SING; isotype K); Sungai Linggui Dam, Saw *et al.* FRI 37420 (KEP); Ulu Endau, Sungai Jawang, Kiew RK 2044 (UPM).

The inflorescence of this species is similar to that of *L. paludosa* and *L. spinosa*. The flowers of *L. longicalycata*, however, are larger and with a truncate calyx. *Licuala paludosa* and *L. spinosa* have smaller flowers and a tri-lobed acute calyx. The flowers of *L. longicalycata* are more similar to those of *L. tiomanensis* than any other species; both species have rather large flowers, a cyathiform calyx, similar appressed hairy corollas and glabrous ovaries. These species differ in the spicate first-order branches of *L. tiomanensis* against the much-branched first-order branches of *L. longicalycata*.

### 39. *Licuala modesta* Becc.

Malesia 3: 195 (1889); Becc. & Hook. f., Fl. Brit. India 6: 433 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 163 (1907); Becc. in Webbia 5: 48 (1921); Ridl., Fl. Mal. Pen. 5: 28 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 198 (1933); Furtado in Gard. Bull. Straits Settlements 11: 60 (1940). Lectotype (selected here): *King's collector* 3243, Peninsular Malaysia, Perak, Larut (FI; isoelectotypes CAL, K, L). (Fig. 22 H-L)

*L. wrayi* Becc. ex Ridl. in J. Roy. Asiatic Soc. Straits Br. 82: 201 (1920); Becc. in Webbia 5: 50 (1921); Ridl., Fl. Mal. Pen. 5: 28 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 210 (1933). Type: *Wray, Jr.* 3918, Peninsular Malaysia, Perak, Gunong Bubu (holotype K; isotype FI).

Solitary to clustered, clusters with 1-3 dominant stems with numerous suckers at base, stems to 3 m tall, 2-3 cm wide. Leaves *c.* 8-16 in crowns of clustered populations and *c.* 14-35 in solitary-stemmed populations, petiole *c.* 80-120 cm long, *c.* 5-7 mm wide at base to *c.* 2-4 mm towards apex, drying light reddish brown, spines along lower quarter to half of length, narrowly triangular, patent to reflexed, largest near base *c.* 2-5 mm long, frond medium-sized, peltate-orbicular, *c.* 45-55 cm in wide; segments variable in number in different populations *c.* 7-22, all nearly same size in many-segmented leaves to central segment largest in fewer-segmented leaves, lateral margins slightly curved; lateral segments of both types 2-3-costulate, 20-32 × 2-4 cm, central segment entire sessile; in many-segmented-leaf type, central segment 3-5-costulate, 25-32 × 3-4 cm, in fewer-segmented-leaf type central segment 8-18-costulate, 27-30 × 11-15 cm. Inflorescence erect to patent, shorter than leaves, *c.* 22-57 cm long, branched to first and second orders with 1-5 first-order branches; peduncle *c.* 21-41 cm long; prophyll lanceolate, flattened, to *c.* 25 × 1.2 cm; peduncular bracts absent; rachis not sinuous, densely covered with golden to dark brown stellate hairs; rachis bracts lanceolate, flattened, chartaceous, covered with scattered white stellate hairs with reddish brown bases, rachis-bract mouth loosely sheathing, splitting widely on one side with a pointed apex, to *c.* 17 × 0.7 cm; first-order branches near to or away from mouth of rachis bract, rebranches 1-4 secondary branches, *c.* 4-14 cm apart in inflorescences with more than 2 first-order branches; rachilla 7-14 cm long *c.* 1-2 mm wide, densely covered with simple golden brown hairs. Flowers solitary or in groups of 2(-3), on *c.* 0.5-mm-high floral stalks subtended by broadly triangular rachilla bracts, cincinni *c.* 5.2-8 per cm, maturing about simultaneously; bud cylindrical with pointed apex, *c.* 4-6 × 2-2.5 mm; calyx cylindrical with a slight constriction just above base, *c.* 2.5-3 × 2-2.5 mm, sometimes larger, thick, base flattened and thickened, apex truncate to irregularly lobed, covered with scattered to dense coarse tawny golden brown hairs; corolla *c.* 4.5-5 × 2 mm, thick, densely covered with 0.2-0.3-mm-long appressed golden brown simple hairs, lobes, *c.* 2.5-3.5 × 2-2.5 mm, apex acute; staminal ring *c.* 0.5 mm high; filaments filiform with triangular base, 0.5-1 mm long, anthers reniform, *c.* 0.8 mm long; ovary glabrous, cylindrical with rounded apex, *c.* 2 × 1 mm, style filiform, 1.2 mm long.

Fruit globose, *c.* 9 mm across, glabrous, surface, green, ripening orange; seed globose, *c.* 7 mm across.

**DISTRIBUTION.** Endemic to north-west–central Peninsular Malaysia.

**HABITAT.** This species is found in a rather wide range of habitats, from lowland forest right up to montane forest. There are also two specimens collected from a limestone hill, Gunong Pondok. On Bukit Larut and Gunong Bubu, the species ranges from the foot of the mountain to the summit.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Perak, Bay Hill, *Fox* 163 (SING); Bukit Larut (Larut Hills, Maxwell's Hill, Gunong Hijau or Taiping Hills), *Furtado* SFN 37103 (SING), *King's collector* 1951 (CAL, BM, K, L), 1983 (CAL, BM, K), 2309 (CAL, FI, K), 2420 (CAL, FI, K), 3243 (lectotype FI; isolectotypes CAL, K, L), *Saw* FRI 37668 (KEP); Gunong Bubu, *Saw* FRI 37678 (KEP), *Whitmore* FRI 619 (KEP, SING), *Wray, Jr.* 3918 (K); Matang, *Wray, Jr.* 2527 (SING); Padang Rengas, Gunong Pondok, *Chin* 884 (KLU), *Henderson* SFN 23804 (KEP, SING); Kelantan, West, Sungai Perias near Kuala May, *Whitmore* FRI 4104 (KEP).

The species is particularly variable in its morphology. The more typical ones have equally segmented leaflets and compound first-order branches and are found on the foothill of mountains to about 1000 m elevation. The population from which Beccari described *L. wrayi* is found at and around the summit of Gunong Hijau and Gunong Bubu. The inflorescence in this is more robust and is frequently reduced to a single compound first-order branch; flowers tend to be larger than those at lower elevations. I have seen both populations in Bukit Larut (Gunong Hijau is one of the summits on this hill) and am certain that they are the same species, as the basic characters in the inflorescence and flower are the same. The main differences are in the reduction of the inflorescence to a single first-order branch, the degree of robustness and size. I agree with Furtado in reducing *L. wrayi* to *L. modesta*. Further, there are also distinct lowland and montane populations. The population in the montane forest of Bukit Larut typically has individuals that are strongly clustered with a few dominant stems and strong suckering basally. Among these clumps, individual stems have smaller crowns, *i.e.* *c.* 8–18 leaves per stem. At lower elevations, *e.g.*, at the foot of the mountain, the populations are predominantly solitary but each stem has a larger number of leaves, *i.e.*, *c.* 14–35.

There are another three collections which differ from the rest in having less-segmented fronds and an inflorescence that is reduced to a single first-order branch with 2–4 rebranches. The inflorescence is much less robust than in the type *Wray* 3918. These specimens were collected from Gunong Pondok, Perak (*Chin* 884 and *Henderson* SFN 23804), in close proximity to Gunong Bubu and Bukit Larut, and from Sungei Perias, west Kelantan (*Whitmore* FRI 4104). The flowers of these are, however, similar to the rest of the collections and clearly represent *L. modesta*.

The species is similar to *L. acutifida* in the inflorescence branching and the indumentum on the inflorescence and flowers. *Licuala modesta* is distinguished from *L. acutifida* mainly by the obconical and trilobed calyx, and corolla with rather patent hairs of the latter. Specimens with much reduced inflorescences, such as those collected from the limestone hills and from Kelantan, resemble *L. scortechinii*; however, the flowers of *L. scortechinii* have a truncate unlobed calyx, which loosely encloses the corolla and, as in *L. acutifida*, is obconical.

#### 40. *Licuala malajana* Becc.

Malesia 3: 197 (1889); Becc. & Hook. f., Fl. Brit. India 6: 431 (1892); Ridl., Mat. Fl. Mal. Pen. 2: 161 (1907); Becc. in Webbia 5: 35 & 48 (1921); Ridl., Fl. Mal. Pen. 5: 26 (1925); Becc. in Ann. Roy. Bot. Gard. Calcutta 8: 196 (1933); Furtado in Gard. Bull. Straits Settlements 11: 58 (1940). Lectotype (selected by Beccari 1933): *Scortechini* 52b, Peninsular Malaysia, Perak, Salak Hills (FI). (Fig. 22 M-P, 23)

Solitary and acaulescent, to clustered and stemmed. When clustered, with 1–2 dominant shoots, suckering at base to 3 m or more tall, *c.* 2–3 cm wide, 3–5 cm with leaf sheath bases. Leaves *c.* 11–25 in crown, sheath with rather fragile ligule and disintegrating into coarse fibres; petiole *c.* 70–240 cm, *c.* 8–15 mm across near base to *c.* 3–7 mm towards apex, drying pale greenish brown, spines, less than 6 mm long along approximately lower half or more of petiole, narrowly triangular and reflexed; frond waxy shining when fresh, peltate-orbicular, *c.* 50–110 cm in wide, segments variable in number in 2 ranges 5–9 and 13–33, in few-segmented specimens, lateral segments *c.* 3–9-costulate, 57–65 × 8–21 cm; central segment much larger than laterals, undivided, to rarely divided in 2, 14–28-costulate, *c.* 59–69 × 32–51 cm; in individuals with many segments, segments about equal in size, lateral segments 2–3-costulate, 26–54 × 5–5.5 cm; central segment undivided, sometime petiolulate, 4–5-costulate, 28–59 × 6 cm. Inflorescence patent, shorter than leaves, *c.* 54–105 cm long, branched to second order, bearing 5–8 first-order branches; peduncle *c.* 15–37 cm long, *c.* 7–10 mm wide near base; prophyll *c.* 12–15 × 1.3–1.5 cm; peduncular bracts absent; rachis somewhat rigid, sinuous, bending slightly at primary branches; rachis bracts tubular, suddenly constricted obliquely towards base, slightly flattened, not inflated, *c.* 8–11 × 0.8–2 cm, coriaceous with apex irregularly splitted and non-fibrous, covered with caducous stellate hairs, hairs translucent to brown with reddish brown bases, appressed to patent, coarse to *c.* 1 mm or more long; first-order branches close to mouth of rachis bracts, bearing 3–5 secondary branches; rachillae to *c.* 23 cm long, 2–4 mm wide, rather swollen, subulate, flexuous, covered with scattered less than 0.2-mm long, simple hairs. Flowers strictly solitary, sessile, densely arranged in shallow pits, *c.* 6–8.5 per cm, maturing about simultaneously, bud *c.* 4.5–5.5 × 2.3–3 mm; calyx cylindrical, *c.* 2.2–3 × 2–2.5 mm, base flattened, thickened basally, covered with scattered, less than 0.2-mm long, translucent to brown simple hairs, apex truncate with shallow-irregular splits or with 3 bifid lobes; corolla *c.* 4–5 × 2–3 mm, thick, densely covered with *c.* 0.1 mm or less appressed golden brown

simple hairs on apical half, glabrescent towards base, lobes *c.* 2–2.5 × 2.5 mm, apex acute; staminal ring *c.* 0.5 mm high, apex undulate, filaments subulate, *c.* 0.5 mm long, anthers *c.* 0.6–0.7 mm long; ovary glabrous, fusiform, 1.5–2.2 × 1–1.5 mm, sometimes constricted in middle, apex tapered, style filiform, 1.2–1.5 mm long; fruit globose, glabrous, pale green, ripening dull orange, *c.* 10 mm with smooth surface, seed globose *c.* 8 mm across.

#### KEY TO VARIETIES

Segments large, mid-segment more than 40 cm long, lateral margin straight; clustering and stemmed plant.....var. **malajana**  
 Segments small, mid-segment less than 30 cm long, lateral margin curved; solitary and acaulescent plant.....var. **humilis**

#### var. **malajana**

(Fig. 22 M–P)

Clustering and stemmed habit with leaves rather large; segments greater than 40 cm long, lateral margin straight.

DISTRIBUTION. Peninsular Thailand into north Peninsular Malaysia.

HABITAT. A rather widespread species, found in well-drained terrain on hill slopes and ridges, lowland to hill forest; *L. malajana* has been recorded in elevations above 800 m in hill dipterocarp forest.

**SPECIMENS EXAMINED—PENINSULAR THAILAND.** Kao Keo, Songlala, *Kerr* 15936 (K); Pattani, Bukit, *Kerr* 7123 (K); Narathiwat, Sungai Padi, *Smith & Sumawong*, GC 102 (K); Sungai Kolok, Nikom Waeng, *Larsen & Larsen* 32821 (K); Surat Thani, Ban Ta Khun, Bang Chang, Klong Saeng, *Smith & Sumawong*, GC 64 (K); Waeng (near Malaysian-Thai border), *Smitinand & Phengkhlai* 1200 (K, L). **PENINSULAR MALAYSIA.** Kelantan, Sungai Kerteh, Batu Papan, *Nur & Foxworthy* 12077 (K, SING); Sungai Lebir, *Whitmore* FRI 4341 (KEP); Ulu Kelantan, Relai F.R., *Cockburn* FRI 7219 (KEP); Ulu Sungai Aring, *Whitmore* FRI 4433 (KEP); Penang, Province Wellesley, Bukit Mertajam, *Dransfield et al.* JD 6786 (K, KEP); Perak, Gopeng district, *King's collector* 8127 (BM, FI, K); Gunong Ijok, *Scortechini s.n.* September 1884 (FI); Salak Hills, *Scortechini* 52b (lectotype FI); Ulu Perak, ridge at Kuala Temengor, *Whitmore* FRI 15822 (KEP); Terengganu, Besut, Ulu Brang, *Whitmore* FRI 12634 (KEP), FRI 12695 (KEP); Ulu Nerus F.R., *Saw* FRI 39901 (KEP); Ulu Setiu F.R., *Dransfield* JD 5140 (KEP); Mandi Angin Expedition, *Whitmore* FRI 8935 (KEP); Ulu Terengganu, Gunong Kerbat, *Whitmore* FRI 20317 (KEP); Sungai Terengganu near Kuala Panchor, *Whitmore* FRI 20557 (KEP); Pahang, Bukit Senai, Chegar Perah, *Henderson* SFN 19434 (SING); Krau Game Reserve, Bukit Rengit, *Saw* FRI 37369 (KEP); Kuala Lipis, Merapoh, *Yap* FRI 28467 (KEP); Ulu

Terenggun F.R., *Saw & Kamarudin* FRI 37592 (KEP); Selangor, Genting Simpah, *Whitmore* FRI 4627 (KEP); Ulu Gombak F.R., *Kochummen* FRI 16728 (KEP); Hulu Selangor, Semangkok Pass, *Ridley s.n.* July 1897 (SING).

On the whole, this species is rather constant in its inflorescence morphology, although there is some variation in size. All specimens examined have similarly rebranched first-order branches with rather swollen rachillae. Typically, flowers have calyces with patent hairs, appressed hairy corolla and glabrous ovary. *Licuala ridleyana* has similar rachillae and flowers but differs in its spicate first-order branches.

Most of the collections consist of specimens with many segments, *c.* 17–33 segments per frond, with similar-sized segments. However, included in the variation are specimens with a smaller number of segments, and with mid segments wider than the laterals, from the northeast corner of Taman Negara, Pahang and the Terengganu mountains in the Ulu Brang area (*Whitmore* FRI 12634 and FRI 20557). The collection notes made by Whitmore (FRI 12634) indicated that there is much variation in the degree of segmentation. The variation in fact ranges from individuals with entire fronds to others with up to 15 segments. The other collection (FRI 20557) has its mid-segment divided in two. Until a better understanding of this variation is known, this is also included as part of the variation in this variety.

***Licuala malajana* var. *humilis* L.G. Saw var. nov.** *a varietate typica habitu acaulescenti solitario segmentis minoribus marginibus vurvatis segmento mediono minus quam 30 cm longo differt. Typus: Whitmore FRI 20554, Peninsular Malaysia, Terengganu, Sungai Terengganu near Rantau Panchor (holotypus KEP).* (Fig. 23)

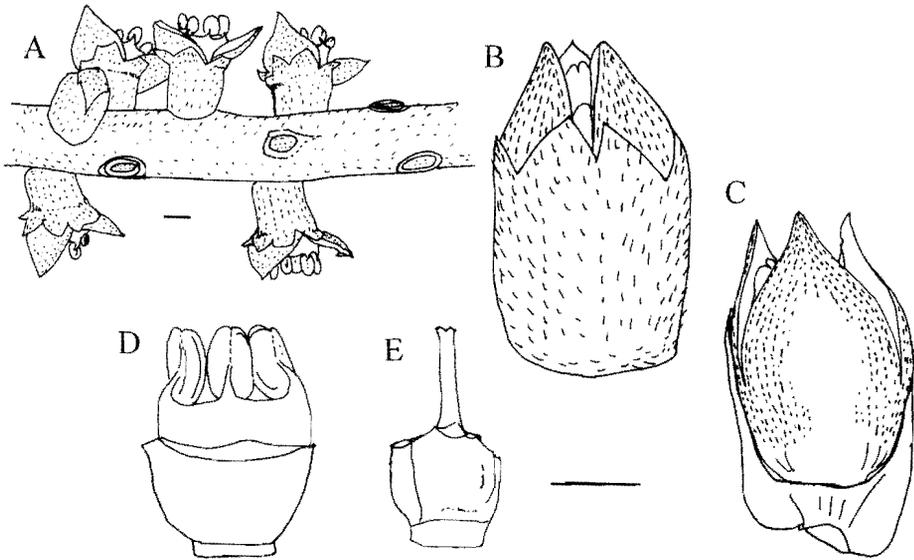
Differing from the typical variety in its smaller segments with mid-segment less than 30 cm long, segments with curved lateral margins, acaulescent and solitary habit.

DISTRIBUTION. Endemic to Terengganu in Peninsular Malaysia.

**SPECIMENS EXAMINED—PENINSULAR MALAYSIA.** Terengganu, Sungai Terengganu near Rantau Panchor, *Whitmore* FRI 20554 (KEP); Sungai Kerbat near Kuala Kerbat, *Whitmore* FRI 20224 (KEP) and FRI 20306 (KEP).

**41. *Licuala stongensis* L.G. Saw sp. nov.** *L. malajanae similis sed rachillis glabris et calyce glabro differt. Typus: Whitmore FRI 12469, Peninsular Malaysia, Kelantan, Gunong Stong (holotypus KEP).* (Fig. 24)

Solitary. Stems to *c.* 1.3 m tall. Petiole drying reddish brown, spines of rather irregular



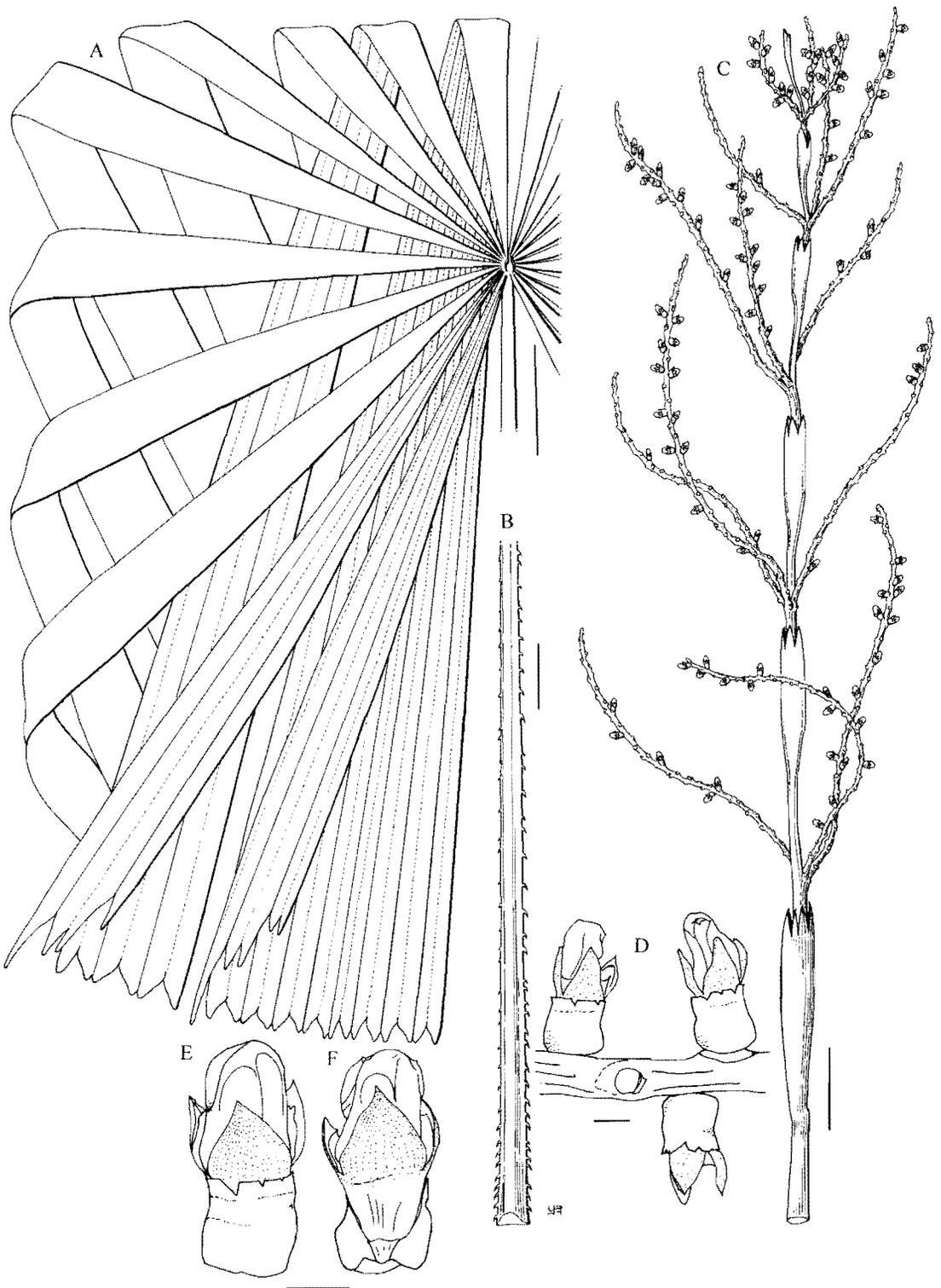
**Fig. 23.** *Licuala malajana* var. *humilis*. **A.** Rachilla with flowers. **B.** Flower. **C.** Corolla with calyx partly removed. **D.** Androecium. **E.** Ovary. All from FRI 20554. Scale bar 1 mm.

spacing and sizes, reflexed, no more than 4 mm long; frond peltate orbicular, *c.* 100 cm wide, coriaceous, segments *c.* 25, lateral margins straight; lateral segments 2–3-costulate, *c.* 44–56 × 4–5.5 cm; central segment larger than rest, entire, sessile, 8-costulate, *c.* 57 × 10 cm. Inflorescence erect, shorter than leaves, *c.* 68 cm long, bearing 4 first-order branches; peduncle *c.* 20 cm long, *c.* 11 mm wide at base; prophyll not available; peduncular bract absent; rachis somewhat robust, not sinuous; rachis bract at base *c.* 14 × 0.7 cm, tubular with tapered base, flattened, coriaceous, covered with scattered caducous stellate hairs, hairs reddish brown, appressed, rachis-bract mouth loosely sheathing, with 2–4 irregularly-split-pointed-apical lobes only; first-order branch close to mouth of rachis bract, at base bearing 3 rather flexuous secondary branches, *c.* 16 cm apart; rachillae to *c.* 24 cm long, *c.* 2 mm diameter, glabrous, unornamented. Flowers solitary or in pairs, sessile, rather laxly arranged, cincinni *c.* 2 per cm, maturing about simultaneously; calyx glabrous, cylindrical, *c.* 3.5 × 3.5 mm, base flattened, much thickened, apex truncate, with irregular shallow splits; corolla *c.* 5.5 × 4 mm, thick, lobes *c.* 3 × 3 mm, apex acute, densely covered with less than 0.1 mm appressed golden brown simple hairs on upper two-thirds, glabrescent towards base; staminal ring undulate, *c.* 1 mm high; stamens and ovary not available in specimen; young fruits ellipsoid.

**DISTRIBUTION.** Endemic to Gunong Stong, Kelantan in Peninsular Malaysia.

**HABITAT.** A mountain species found at 1300 m above sea level on a granitic hillside.

This is a rather distinctive species, known only from the type collection. It is similar to *L.*



**Fig. 24.** *Licuala stongensis*. **A.** Frond. **B.** Petiole base. **C.** Young infructescence. **D.** Rachilla with immature fruits. **E.** Immature fruit. **F.** Corolla with calyx partly removed. All from FRI 12469. Scale bar 5 cm for A & C, 2 cm for B, 2 mm for D-F.

*malajana* in its inflorescence type and floral shape, and similar appressed hairs on the corolla. It differs, however, in its glabrous rachilla and calyx (*L. malajana* has a hairy rachilla and calyx).

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