

most forms are largely solitary whereas the sheath spines of other members of the *C. aruensis* complex are usually at least partly organised into partial whorls with solitary spines interspersed among the whorls. Rarely, partial whorls of up to six spines may be observed intermixed with solitary spines (see Fig. 18 in Dowe 1989), but it is possible that this feature is accentuated in juvenile sheaths. *Calamus aruensis* bears sheath spines of rather uniform size and, in less heavily armed forms, whorled sheath spines may not be present, but it is immediately distinguished from *C. vitiensis* by its cirrus with irregularly arranged grapnel spines. Unarmed forms occur in both *C. vitiensis* and *C. aruensis*, but again the cirrus morphology can be used to distinguish them. In New Guinea, *Calamus vitiensis* may also be confused with *C. pachypus*, but it lacks the conspicuously swollen spine bases that are so characteristic of *C. pachypus* (Fig. 1D), as well as sheath spines consistently organised into whorls.

Regional entities can be recognised within the variation of *C. vitiensis*. In New Guinea, all forms appear to have leaflets grouped in divaricate pairs and sheaths, when armed, with rather short spines. Even more uniform is the Australian form with similar leaf morphology to the New Guinea form, but with larger and more numerous sheath spines. In the west Pacific, from the Solomon Islands to Vanuatu and Fiji, the species bears regularly arranged leaflets and some specimens display conspicuous brown indumentum on the leaf sheath. A narrower species concept might be advocated by some, but the characters distinguishing these regional forms are so limited and unreliable that formal taxonomic recognition cannot yet be justified. Further study, especially in the west Pacific, is required to clarify further the taxonomy of this species.

The holotype of *C. vitiensis* was destroyed in Berlin and the isotype at Florence consists only of a single pistillate rachilla and a fragment of a fruit. However, we are able to use the name with confidence because of the detailed protologue, which includes a photograph of the holotype, and because no other rattan species is known from Fiji, the country of origin of the type. No appreciable differences can be discerned between *C. vitiensis* and the type of *C. vanuatuensis*, despite assertions to the contrary in the protologue of the latter. Similarly, *C. stipitatus* fits well within the range of variation accepted for *C. vitiensis* here. The distinctive stipitate pistillate flower clusters that are present on the type of *C. stipitatus* are formed by elongation of the axis of the terminal sterile staminate flower, which is otherwise usually condensed, and adnation of the floral bracteole to that axis. This feature is also found in some other specimens of *Calamus vitiensis*.

**3. *Calamus pachypus* W. J. Baker, Bayton, J. Dransf. & Maturb. sp. nov.**, a ceteris speciebus *C. aruensi* affinis, sed spinis vaginarum foliorum flexilibus triangularibus basin valde tumidis, foliolis plerumque geminatis recedit. Typus: Indonesia, Papua, Manokwari Regency, Warmare, Valley of R. Prafi, road to Manyambo (S0°47', E133°58'), *Dransfield et al.* JD 7600 (holotypus K!; isotypi BO, FTG, MAN).

Robust, solitary rattan climbing to 26 m. *Stem* with sheaths 25 – 60 mm diam., without sheaths 13 – 30 mm diam.; internodes 18 – 33 cm. *Leaf* cirrate, to 4 m long including cirrus and petiole; sheath dark green, drying brown, with abundant, caducous indumentum of irregular brown, fibrous scales, spines few to numerous, 1 – 60 × 0.3 – 5 mm, red-brown to black, planar, triangular, flexible, often curving, tapering distinctly at base then attenuate to a narrowly acute apex, margins sometimes

sinuous, spines sometimes united at their margins to form compound spines, spine bases yellow, swollen, often distinctly so in larger spines, spine surface with indumentum as on sheath, spines of various sizes, in irregular partial whorls of up to 14 interspersed with solitary spines, spine impressions on sheath sometimes conspicuous, sheath mouth armed with numerous small spines; knee 60–100 mm long, 24–45 mm wide, unarmed or lightly armed with short spines, colour and indumentum as on sheath; ocrea 2–11 mm, forming a low, woody, brown, lightly armed, persistent collar, base of ocrea extending along petiole to an acute angle; flagellum absent; petiole 5–90 mm, 14–23 mm wide and 7–15 mm thick at base, channelled or flat adaxially, rounded abaxially, indumentum as on sheath, with few to many triangular spines; rachis 1.3–2.2 m, with spines and indumentum as petiole, with grapnel spines abaxially; leaflets 10–17 each side of rachis, usually arranged in widely spaced pairs, rarely regular or subregular, when paired the leaflets in each pair sometimes divergent, broadly lanceolate, cucullate, longest leaflets near middle of leaf, 27–46 × 4.4–6.5 cm, apical leaflets 13–30 × 0.6–4.8 cm, distal leaflets widely spaced, basal leaflets small, leaflet surfaces with very few bristles 0.6–2 mm on adaxial surface of mid-rib and other major veins, leaflet margins unarmed or with very few bristles 0.5–2.5 mm near apex, with indumentum as on sheath sometimes present on both surfaces of leaflet base, transverse veinlets inconspicuous; cirrus 80–160 cm, cirrus grapnel spines arranged regularly. *Staminate inflorescence* limited material seen, similar to pistillate inflorescence, but branched to 3 orders, bracts on primary and secondary branches funnel-shaped; rachillae 3–44 × 0.5–2 mm, sublinear, glabrous; rachilla bracts c. 0.6 × 1.2 mm, distichous, glabrous; floral bracteole 0.6 × 1 mm. *Staminate flowers* not seen. *Pistillate inflorescence*, up to c. 4 m long including 27–72.5 cm peduncle and 25–90 cm sterile tip, branched to 2 orders, usually inserted near to sheath apex, but sometimes emerging from sheath mouth; prophyll 16–33.5 × 1.6–2.3 cm, strictly tubular, with 2 conspicuous keels, prophyll mouth entire, with acute, triangular limb to one side, sometimes subtending primary branch, indumentum as on sheath, lightly to moderately armed with short spines; peduncular bracts absent, rachis bracts 9.5–38 × 0.6–2.1 cm, similar to prophyll, unarmed to moderately armed as prophyll; primary branches 6–9, to 70 cm long, 19–32 cm apart, strongly recurving, with up to 43 rachillae, bracts on primary branch funnel-shaped; rachillae 4–20 × 0.2 cm, sublinear or arcuate; rachilla bracts 1.5 × 1.7–2 mm, subdistichous, with scattered scales as sheath; flower clusters rarely distinctly stalked, stalk to c. 1.5 mm long, proximal floral bracteole obscured by distal bracteole, distal floral bracteole 1.5–1.6 × 1.6–1.7 mm, glabrous, scar from sterile staminate flower c. 0.2 mm diam. *Pistillate flowers* 4–4.5 × 2.5 mm shortly after anthesis; calyx 2.5 mm diam., tubular in basal 1.7–3.5 mm, with 3 lobes to 0.7–0.8 × 1–1.5 mm, glabrous; corolla 2–3.3 × 2 mm, tubular in basal 0.7–1.7 mm, with 3 lobes 1.3–1.6 × 1.5 mm, glabrous; staminodes 6, c. 0.8 mm long, staminodal ring c. 1 mm high; ovary c. 2 × 2 mm, globose, style c. 0.5 mm long, stigmas c. 1 mm long. *Sterile staminate flowers* not seen. *Fruit* globose, 10–15 × 8.5–13.5 mm including beak 1.5–2 mm, with 16–19 longitudinal rows of light green to white, shallowly channelled scales with entire, but uneven margins. *Seed* (sarcotesta removed) 7.3–8 × 7–9.5 × 6–8 mm, globose, with a deep, narrow pit on one side, the surface covered with numerous deep pits and irregular channels; endosperm homogeneous; embryo basal or sub-basal. Fig. 1.

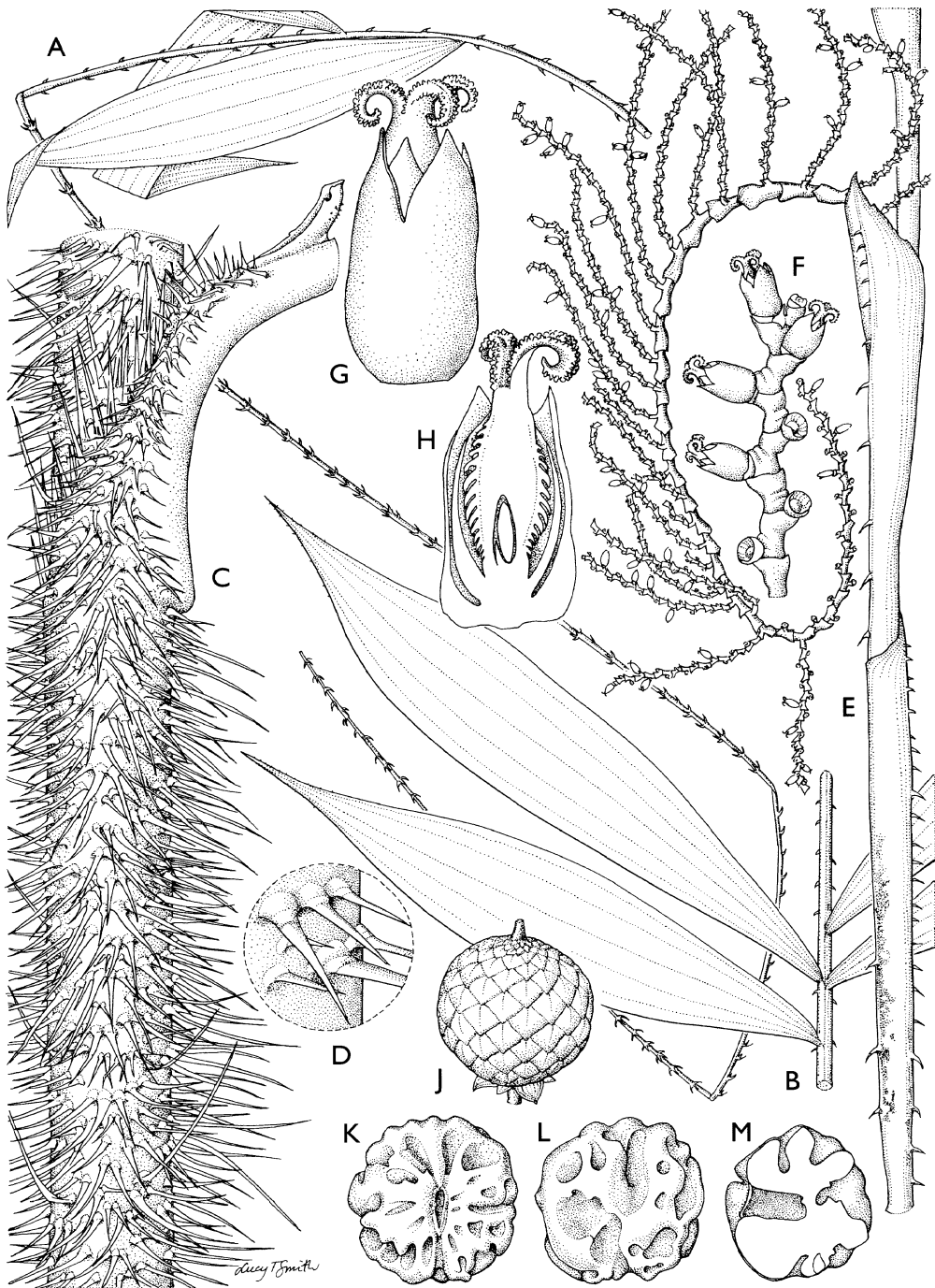


FIG. 1. *Calamus pachyphus*. **A** distal portion of leaf with cirrus  $\times \frac{1}{4}$ ; **B** middle portion of leaf  $\times \frac{1}{4}$ ; **C** leaf sheath  $\times \frac{2}{5}$ ; **D** detail of leaf sheath spines  $\times 1\frac{1}{2}$ ; **E** primary branch of pistillate inflorescence  $\times \frac{1}{3}$ ; **F** pistillate rachilla  $\times 2$ ; **G, H** pistillate flower whole and longitudinal section  $\times 10$ ; **J** fruit  $\times 2$ ; **K, L, M** seed in two views and longitudinal section (sarcotesta removed)  $\times 3$ . **A – H** from Dransfield JD 7600, **J – M** from *Maturbongs* 47. Drawn by Lucy T. Smith.

**DISTRIBUTION.** Known from scattered records throughout mainland New Guinea with one collection from New Ireland.

**HABITAT.** Various types of primary and secondary forest vegetations, 100 – 1500 m with more than half of the records above 600 m.

**LOCAL NAMES.** *hele bu* (Yali), *kour* (Biaru), *kur* (Karkar), *mambile* (Yali), *meya* (Arfak Plains), *tendu mundu* (Berap)

**USES.** Cane used for making bridges and waist hoops, split cane for general cordage, for making arrows and bow strings, and for fire-making.

**CONSERVATION STATUS.** Least concern.

**SPECIMENS SEEN.** INDONESIA, Papua. Jayapura Regency: Jayapura, Berap, May 1994, *Upessy* 7 (K!); Cyclops Mts, Angkasa, Aug. 1998, *Heatubun et al.* 288 (AAU!, BO, K!, MAN, NY!); Papua, Jayapura, N Cyclops Mts, Jan. 2001, *Desianto* 7 (AAU!, K!, MAN). Manokwari Regency: Warmare, valley of R. Prafi, new road to Manyambo, Aug. 1995, *Dransfield et al.* JD 7600 (BO, FTG, K!, MAN, type); Mubri Lama, near Arfak Mts, April 1995, *Maturbongs* 47 (K!, MAN); Manokwari, Mubri, April 1995, *Maturbongs* 46 (K!, MAN); Arfak Plains, Settlement Unit Seven, (satuan Pemukiman Tujuh), April 1994, *Mogea* 6245 (BO, K!, L!, MAN, NY!). Merauke Regency: Between Mindiptanah and Imko, Aug. 1957, *Dijkstra* BW 6630 (L!). Wamena Regency: 6 km SW of Bernhard Camp, Idenburg R., Feb. 1939, *Brass* 12963 (A, L!); Abenaho Subdistr., Jayawijaya, Nov. 1999, *Maturbongs et al.* 644 (AAU!, K!, MAN); Snow Mountains, E of Baliem Valley, vicinity of Panggema, Oct. 1992, *Milliken* 1435 (K!). PAPUA NEW GUINEA. Madang Province; Karkar Island, Mom, Sept. 1970, *Zieck* NGF 36248 (BH, K!, L!, LAE). Milne Bay Province: junction of Ugat and Mayu Rs, near Mayu Island, July 1972, *Streimann & Katik* NGF 28669 (BH, L!, LAE!). Morobe Province: locality unknown, 1989, *Taurereko* 209 (K!); Wau Subdistr., Kanis, between Tori-Korwa, Biaru Valley, June 1969, *Zieck* NGF 36225 (LAE!); Wau Subdistr., Bulolo-Watut, June 1969, *Zieck* NGF 36221 (L!, LAE), March 1964, *Moore & Womersley* 9278 (LAE!). New Ireland Province: Logagon Subdistr., N Schleinitz Range, 5 km S of Logagon, Oct. 1974, *Croft* LAE 65582 (A, BH, BRI, E, K!, L!, LAE). Southern Highlands Province: Moro, Iagifuago, Path along water pipeline from well site down to road, Feb. 1996, *Baker & Kage* 659 (K!, LAE!). Western Province: Yat, June 1967, *Henty et al.* NGF 33042 (BH, CANB!, LAE!).

**NOTES.** This distinctive new species is readily distinguished from its relatives by its leaf sheath armature. The spines on the sheath are flexible, triangular and distinctly swollen at the base (Fig. 1D). While both large and small spines occur on the sheath, very long spines (up to 60 mm) are almost always present. Leaflet arrangement is variable, but the most frequent form bears leaflets grouped in pairs. Although *C. pachypus* is recorded from low elevations, it is more frequently found in submontane and montane vegetations. While the species is known from a relatively limited number of collections, it is apparently widespread in New Guinea and is recorded from both eastern and western extremes of the island. Outside mainland New Guinea, it is known from a single collection from New Ireland.

**4. *Calamus dasyacanthus*** *W. J. Baker, Bayton, J. Dransf. & Maturb. sp. nov.*, *C. aruensi* affinis sed spinis vaginarum foliorum numerosis laceratis fimbriatisque, spinis cirri