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NEW TAXA OF PANDANUS (PANDANACEAE) FROM MALESIA AND PAPUASIA

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INTRODUCTION

Monographic studies in Pandanaceae continue to yield previously unrecognized taxa both at specific and higher ranks. In *Pandanus*, with the increase of knowledge of staminate structures becoming available through better collections and more critical observations, use of staminate characters integrated with previously known data is providing important new insights into infrageneric taxa and their affinities, as well as completing the fundamental descriptions at species rank important for both systematic and ecological studies. In the results reported here two new species, *Pandanus calvus* and *P. kosteri*, and two new sections, *Hastatistigma* (based on *P. vinaceus*) and *Macrokurzia* (based on *P. daymanensis*) are proposed. Two species previously known only from pistillate materials, *P. cernuifolius* and *P. irregularis*, are clarified by description of staminate specimens, while in the case of *P. copelandii*, a previously unrecognized staminate feature is described. Field data for the inadequately known species *P. leptocarpus* are provided, and the first illustrations of the type specimen (staminate) of *P. houlletii* are provided. These taxa are discussed under the subgenera to which they are referred in the synopsis (Stone, 1974).

Subgenus Rykia

Section Rykia (De Vriese) Kurz

Pandanus calvus Stone, *spec. nov.* – **Fig. 1.**

Frutex humilis caespitosus decumbens. *Folia* loriformia vulgo 90–180 cm longa, 4–7 cm lata, basi sensim modice angustata, apice abrupte acuminato-caudata, caudo gracillimo usque ad 12 cm longo pro majore parte vix 1 mm lato; vagina amplectentia, marginibus anguste membranaceis, pallida vel viridia. Foliorum marginibus in basi dentatis, dentibus patentibus vel subadscendentibus, usque ad 2 mm longis et

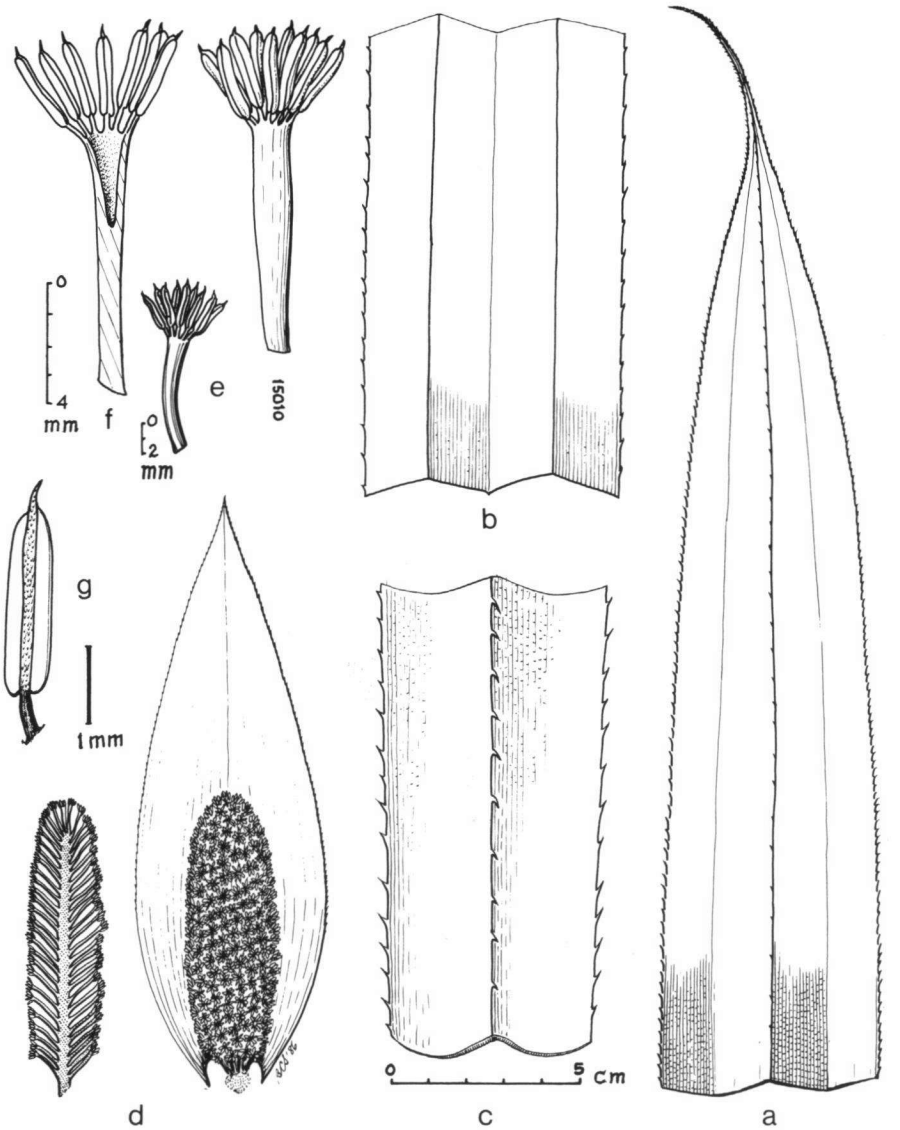


Fig. 1. *Pandanus calvus* Stone. — Details of leaf: a. apex, dorsal surface; b. middle segment, ventral surface; c. basal segment, dorsal surface (note retrorse prickles of midrib). Details of staminate inflorescence: d. bract and spike, and longisection view of spike; e. staminate flower in profile (at two magnifications), and f. in longisection view (note obconic cavity at apex of column). Detail of anther: g. connective (dorsally) with abundant crystal-cells. All from the type collection.

3–11 mm sese separatis; in medio, cum dentibus reductis c. 1 mm longis et 5–18 mm sese separatis; apicem versus, cum denticulis c. 0,5–0,6 mm longis et 1,5–2 mm sese separatis; et in caudo cum denticulis c. 0,3–0,4 mm longis et 0,6–1,4 mm sese separatis. Costa media in basi dorso dentato, dentibus retrorsis 2–3 mm longis et 0,6–2,5 cm sese separatis; costa in medio, longe tractu, carinato inermeque; apicem versus cum denticulis antrorsis c. 1 mm longis et 2–10 mm sese separatis; in caudo cum denticulis ad eos marginorum simillimis. Pagina supra viridia, infra leviter pallidiora subnitentia, in foliis juvenilibus roseato- vel rubropurpurato-tincta, in foliis adultis leviter lineato-venosa, venis longitudinalibus ad 64 per foliam, venulis transversis reticulationes formantibus c. 1–3 mm longis. *Inflorescentia* erecta terminalis, mascula (solum nota) c. 20–25 cm longa, bracteis c. 9–11 pallide junceis fertilibus 7–9, maxime c. 35 cm longis, minimis c. 4–5 cm longis, naviculari-ovatis, caudatis vel acutis, marginibus parvissime denticulatis. Spicae masculae albae oblongae vulgo 5–7 cm longae. Phalanges staminorum umbelliformes 9–10 mm longi, columno nudo 6–7 mm longo, apice infundibulato, filamentis brevibus c. 0,4–0,5 mm longis, antheris c. 2,3–2,5 mm longis, breviter apiculatis, apiculo laeve acuto 0,2–0,3 mm longo. Pollinae granis laevis (psilatis). Cetera ignota.

Type: Malaysia: Selangor: Ulu Gombak forest reserve N. of Kuala Lumpur, stream valley c. 500 m S. of Karak Highway Tunnel, under 200 m alt., *Saraca*-stream in lowland dipterocarp forest; rosette-forming shrubs near rocky stream-bank in shade; bracts pale yellowish; 6 Nov. 1983, *B.C. Stone & S.H. Sohmer 15615* (KLU, holo; BISH, K, KEP, L, PH, iso).

Additional specimens. MALAYSIA. Selangor: Kuala Lumpur, University of Malaya, garden adjacent to Botany Dept., 10 Oct. 1981, *B.C. Stone 15010* (KLU, PH); Ulu Gombak, Genting Sempah road 22nd mile, beside stream, 20 Dec. 1965, *B.C. Stone 6113* (KLU, PH).

The paucity of staminate specimens of *Pandanus* and the difficulties that exist in correlating staminate and pistillate specimens militate, in general, against basing new taxa on staminate specimens alone. However, in the context of a recent revision of the peninsular Malaysian species, the result of a prolonged study of *Pandanus* in the region, it has become evident that the plants here named *P. calvus* represent a new species of section *Rykia*. Among the peninsular Malaysian species of this section that are similar (*P. unguifer* J.D. Hook., *P. crinifolius* Martelli), *P. calvus* stands out because of its vegetative characteristics; it differs from *P. unguifer* in its less fiercely dentate leaves (the marginal teeth shorter and more crowded) and paler yellowish (not apricot-salmon-colored) bracts; and from *P. crinifolius* in its straighter, less arched, proportionally narrower and somewhat smaller leaves and lack of an erect tall trunk. In its staminate flowers, *P. calvus* is much more similar to *P. unguifer* than to *P. crinifolius*, the latter differing by its very long anther apiculi (see fig. 6 in Stone, Fedn Mus. J. n.s. 28: 18. 1982). In Ridley's Flora (Fl. Malay Penins. 5: 75. 1925), *Pandanus bidens* Ridley is listed; this is an obligate synonym of *Pandanus crinifolius*. Similarly, *P. bicornis* Ridley is a synonym of *P. unguifer*. Staminate collections of *P. unguifer* in Malaysia are still lacking, so the comparison of *P. calvus* must be with the staminate specimen of Buchanan-Hamilton from India, illustrated by Martelli (in Webbia 4: t. 33, fig. 4. 1914). This specimen is called *P. minor*

Fig. 2. *Pandanus houlletii* Carrière. – Details of staminate inflorescence. Type specimen (P).

Buch.-Ham. by Martelli, but as I have previously explained, this name is a synonym of *P. unguifer* (see Stone, Fedn Mus. J. n.s. 28: 60–61. 1982). The illustration in Martelli shows that in Hamilton's plant the column is shorter and the anthers are slightly shorter than is the case in *P. calvus*.

Among the more remarkable characters of this new species is the smooth or psilate exine of the pollen grains. This is apparently the first record of smooth exine in species of section *Rykia*, although such grains are already known in species of section *Acrostigma*. It is perhaps significant that smooth-grain species, so far known, are all rather small, low plants of forest understorey. All other species of section *Rykia* so far known as to pollen show the more familiar spinulose exine. The possibility of an ecological correlation here deserves investigation. The species epithet *calvus*, meaning 'bald' refers to the smooth pollen grains.

Pandanus calvus is known so far only from the Ulu Gombak valley in Selangor. (Some specimens numbered *15010* were distributed with the locality 'Cameron Highlands' but this is erroneous. Also, any label with the number *16015* should be corrected to *15615*.)

Pandanus houlletii Carrière – Figs 2, 3.

Pandanus houlletii Carrière, Rev. Hort. 40 (1868) 210, f. 23; Warb. in Engl., Pflanzenr. 3, IV.9 (1900) 87; Ridley, Fl. Malay Penins. 5 (1925) 74; Stone, Fedn Mus. J. n.s. 28 (1983) 26.

In 1983 this species was lectotypified and a discussion was presented concerning the justification for this step. The name *houlletii*, it was suggested, might commemorate the English school teacher in Singapore named Hullett. This was a mistake; it appears Hullett was active at a slightly later date, and also it has been learned that the superintendent of the Jardin des Plantes, Paris, at the time this plant was described, was a Monsieur Houllet. Carrière most probably dedicated the species to him.

The question of the origin of the species is still in doubt; the label on the lectotype (almost certainly the only specimen preserved) states 'Philippines' while Carrière's text gives 'Singapour'. The latter seems correct, as previously pointed out.

The type is here illustrated (Fig. 2) and an analysis of the staminate flowers is provided (Fig. 3).

Section Mydiophylla Stone

Pandanus irregularis Ridley – Fig. 4.

Pandanus irregularis Ridley, Fl. Malay Penins. 5 (1925) 76; M.R. Henderson, Malayan Branch J. Roy. Asiat. Soc. 17 (1939) 82; St. John, Pacific Sci. 17 (1963) 344, f. 182, 183; Stone, Malayan Nat. J. 21 (1968) 6, f. 2, 14; Fedn Mus. J. n.s. 23 (1983) 84, f. 27, 28.

This Peninsular Malaysian endemic, known only from some limestone hills ('gua') in the area east of the main range (Kelantan, Pahang) has hitherto been

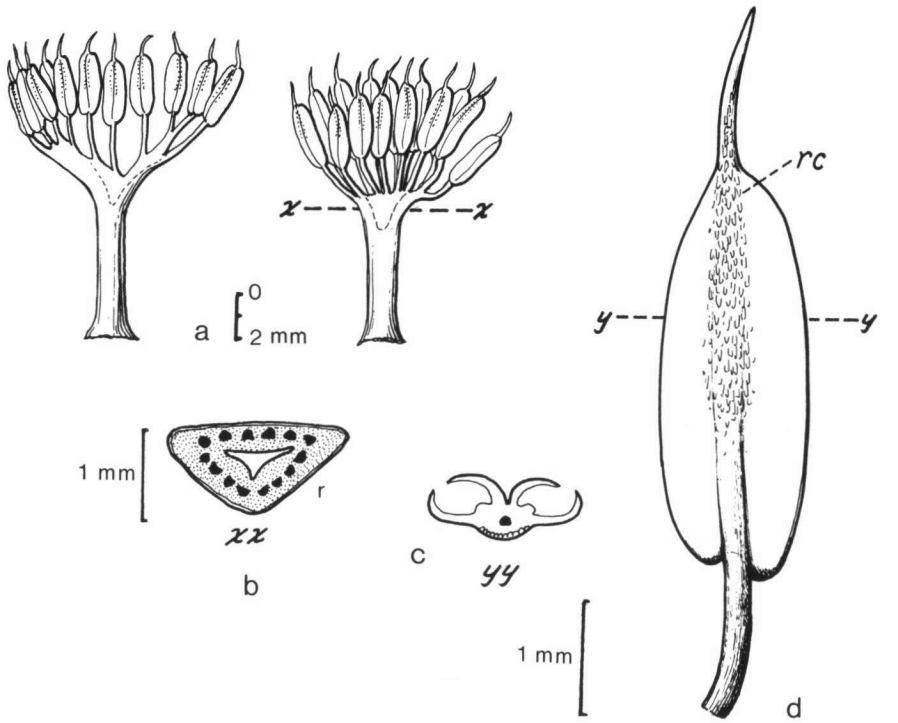
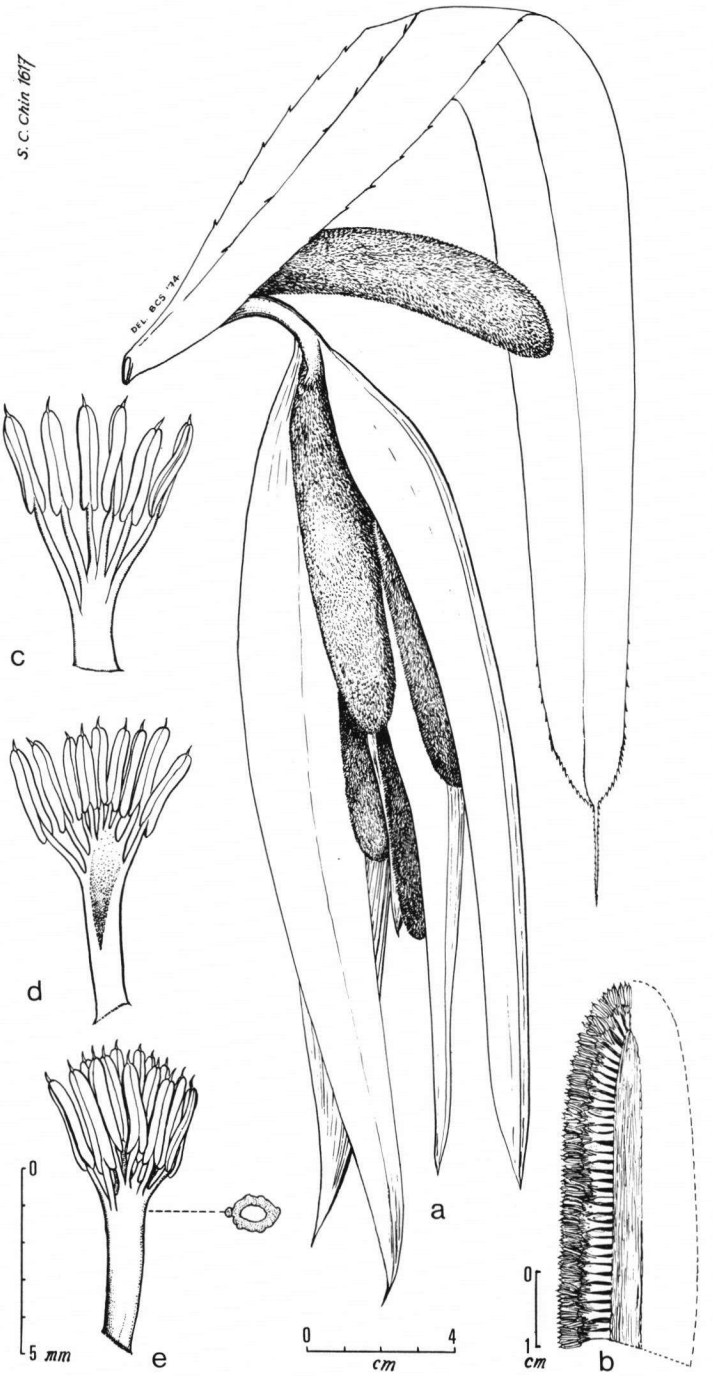


Fig. 3. *Pandanus houlletii* Carrière. – Details of staminate inflorescence and flowers: a. staminate flower in profile; b. transverse section of column (x–x); c. transverse section of anther (y–y), dorsal face at bottom; d. enlarged view of one stamen; note concentration of crystal-cells in connective along distal part and on apiculus. From the type specimen (P).

known only by the pistillate collections (cited in Stone, 1983). New collections by S.C. Chin have provided good material of the staminate flowers which are here illustrated (Fig. 4).

The inflorescences are pendulous, multibracteate, and bear about 7 spikes. Each spike is cylindric, consisting of tightly packed staminal flowers. These display the subumbellate configuration typical of subgenus *Rykia*, with a well-developed column (stemonophore) bearing about 6–15 stamens at the apex. The stamens have distinct filaments somewhat shorter than the anthers. Each anther is elongate, and there is a short, distinct, acute apiculus or mucro at the tip. The upper part of the column is hollow, with a cone-shaped interior descending about halfway down. The

Fig. 4. *Pandanus irregularis* Ridley. – a. Staminate inflorescence; b. partial longisection view of a spike; c. details of individual staminate flower; d. *ibid.* in longisection to show obconic cavity at apex of column; e. *ibid.* with transverse section of column at position indicated. From *Chin 1617* (KLU).


S. C. Chin 1617
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entire structure is compatible with staminal floral arrangements in subgenus *Rykia* in general, and confirms the allocation of this species (and thus of section *Mydiophylla*) to subgenus *Rykia*.

Specimens examined. MALAYSIA. Kelantan; Batu Tapah limestone hill, flowering Aug. 1971, *S.C. Chin 1617* (KLU!).

Subgenus Lophostigma

Section Hastatistigma Stone, *sect. nov.*

Inflorescentia terminalis pedunculatis solitaria, cephalio oblongo vinaceo-purpureo plurimis drupis composito; drupa minima stylo cum stigmate hastato breve ventraliter situato; inflorescentia mascula ignota. Folia linearia plicis binis lateralibus apicem versus ventraliter subremote denticulatis. Frutices, habitu caespitosi.

Type species: *Pandanus vinaceus* Stone.

Distribution. Monotypic. Endemic to Borneo.

Pandanus vinaceus Stone

Pandanus vinaceus Stone, Fedn Mus. J. n.s. 11 (1967) 118, f. 1; Bot. Jahrb. Syst. 94 (1974) 500; Huynh, Bot. Jahrb. Syst. 97 (1976) 96, 113. – Type: *Stone & Anderson 6774* (KLU, holotype) from Sarawak, Stepok swamp forest near Kuching.

This species was at first placed under section *Multidens* St. John which is a synonym of section *Asterostigma* Martelli. It differs from the other species of that section (such as *P. discostigma* Martelli, *P. dorystigma* Martelli, *P. pentodon* Ridley, and *P. matthewsii* Merr.) in a number of ways. All the true members of section *Asterostigma* are rheophytes, limited to lowland, humic acid streams, while *P. vinaceus* is a rather large rosette shrub of peat forest. More significantly, it lacks the discoid-denticulate stigma characteristic of section *Asterostigma* and has a more cylindric-oblong fruit head. The leaves are considerably longer and proportionally wider. There are also anatomical differences as described by Huynh, *l.c.*, who stated that *P. vinaceus* constitutes a group of its own among the species assigned to section *Asterostigma*. The staminate inflorescence of *P. vinaceus* is still unknown. However, it seems reasonably sure that it should be regarded as representing a distinct section. This is assigned to subgenus *Lophostigma*, which is meagerly represented in Western Malesia, being best developed in New Guinea and New Caledonia.

Section Maysops St. John

Pandanus cernuifolius Merr. & Perry

Pandanus cernuifolius Merr. & Perry, J. Arnold Arbor. 20 (1939) 180, pl. I, f. 20.

This species has scarcely been mentioned again since its original description, and has for long been known only from the type collection, *Brass 3916*, from the Central

Division of New Guinea. Two further collections are cited here, one being in fruit, the other including for the first time the staminate inflorescence.

Specimens examined. WEST IRIAN: Idenburg River, Bernhard Camp, 6 km SW, oak forest undergrowth; 1200 m alt. Fruit ovoid- cylindric, 21 × 9 cm, red; stem 3 m tall, proproots none, Feb. 1939, *L.J. Brass 12875* (A, L!). Nassau Mountains, 900 m alt., Oct. 1926, *W. Docters van Leeuwen 10572* (L! staminate).

Additional descriptive notes: *Leaves* 125 × 5.1 cm (*10572*) to 212 × 4.8 cm (*12875*), the apex acute-acuminate, not prolonged. Sheath unarmed, 5–6 cm long. Margins of blade near base with antrorse, deltoid, slender prickles 1–2 mm long, 3–12 mm apart; at the middle with appressed prickles scarcely 0.5 mm long and often remote, sometimes 3–6 mm apart or much more, leaving long unarmed tracts; near the apex with prickles 0.7–0.9 mm long, 1–3 mm apart. Midrib at base rounded, entire, unarmed; near the middle keeled, but unarmed; near apex keeled and with antrorse prickles scarcely 0.5 mm long, 3–8 mm apart. Longitudinal nerves about 90 per leaf. Leaf apex ventrally with pleats prickly with antrorse, rather widely spaced, short prickles, extending along distal 15 cm of apex. *Staminate inflorescence* c. 40 cm long; bracts 10–25 cm long, narrowly ovate-navicular, acute-acuminate, the margins and keel (especially distally) minutely ciliolate-spinulose. Spikes 7 or 9, about 7 cm long or less, 15 mm wide (when dry), the axis trigonal-cylindric, 2.5–3 mm thick. *Stamens* seemingly free, individual bulbil-like filaments 1.75 mm long, set with a few raphidophorous cells; abruptly rounded and continuing as a short, flexible, basal prolongation of the connective, 0.25–0.30 mm long; anther 2.75 mm long, 0.5 mm wide, with subulate terminal apiculus 0.25–0.30 mm long.

The disposition of the stamens is such that their association into flowers is (because of the nature of the specimen) indiscernible. They are, most probably, grouped into floral units of about 6 (possibly fewer, or up to 9), but the filaments are so nearly free that the grouping is obscured. In form and size, however, they are almost identical to flowers of *Pandanus croceus* Stone (Contr. Herb. Austr. 4: 24, f. 9. 1974), but the filaments are only 2/3 as long (the anthers are exactly the same length).

Pandanus kosteri Stone, *spec. nov.* – **Fig. 5.**

Frutex c. 1,7 m altus, stipite erecto. *Folia* 60–100 cm longae, (2–)3–5 cm latae, sublinearia, apicem versus acuto-acuminatae, in basi leniter angustati (ad 2,5 cm), pagina supra laeve, infra pallido sublaeve nervis indistinctis, nervis longitudinalibus c. 48–68 per foliam, c. 0,5–0,8 mm sese separatis; vagino anguste breviterque marginato auriculis stramineis integris c. 2 cm longis, 2 mm latis, subtruncatis; marginibus basem versus denticulatis, denticulis angustis c. 1–2 mm longis, patentibus, vulgo 1–5 mm sese separatis; in medio, denticulis appressiter antrorsis c. 0,6–0,7 mm longis, vulgo 3–7(–15) mm sese separatis; apicem versus, denticulis c. 0,2–0,6 mm longis, 1–2,5 mm sese separatis; costa medio dorso basem versus inerme vel perpauce denticulatis denticulis reductis; in medio carinato inerme vel sparse et irregulariter parvidenticulatis, denticulis c. 0,1 mm longis; apicem versus (in parte

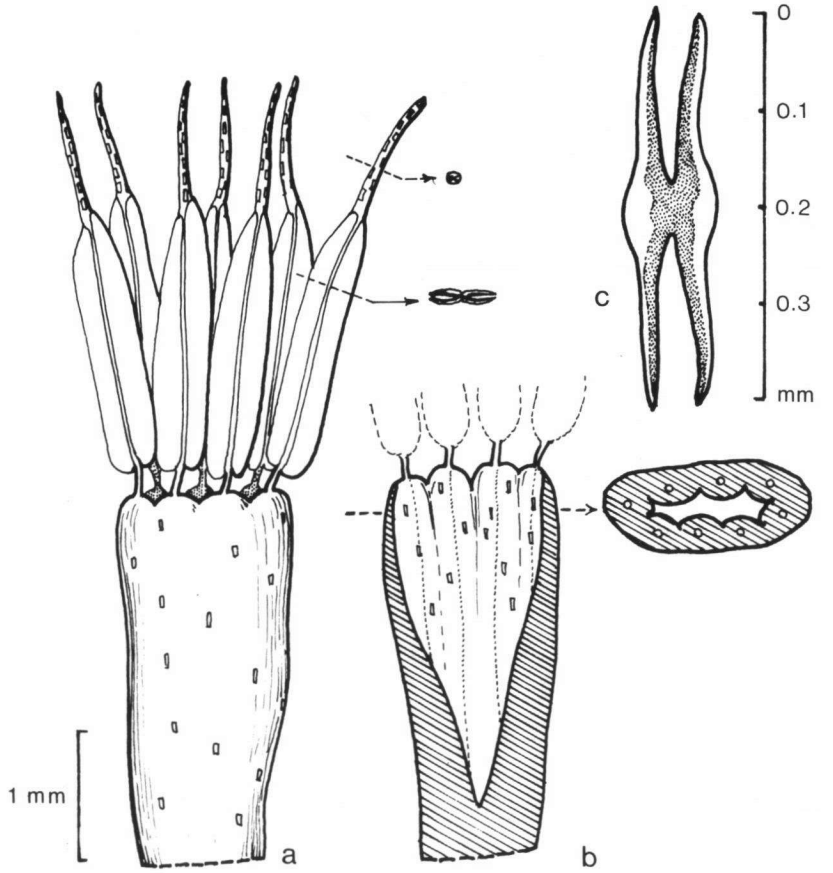

Fig. 5. *Pandanus kosteri* Stone. – Details of staminate flower: a. one flower in profile; b. longisection of filament-tube, and transverse section at position indicated; c. transverse section of one anther, greatly magnified, the thecal walls fully expanded; the apparent thecal chambers are the 'false pockets' (sensu Huynh). From *Koster BW 13646*.

distali quaternali) denticulis parvibus c. 0,2–0,33 mm longis, 1–5 (rariter ad 15) mm sese separatis; plicis lateralibus supra denticulatis in parte distali c. 20 cm longi, denticulis c. 0,3–0,4 mm longis, vulgo 3–15 mm sese separatis, rare reduplicatis. *Inflorescentia* terminalis; spadix mascula c. 50–55 cm longa, pendula, pedunculo gracile 5 mm diametro, bracteis basalibus foliaceis, eis intermediis navicularibus, concavis, ad 30 cm longis et 5–6 cm latis, caudiculatis, marginibus crebre serrulatis; eis fertilibus parvioribus ad 6 cm longis, 1 cm latis (vel minoribus) simillimis; spicibus oblongis 5–7, e plurimas phalangibus compositis, 3–8 cm longis, 9–13 mm crassis. Phalanges staminorum infra tubulosi compressi columno c. 3 mm longo, extus laeve sparsiter cum cellulis raphidophoris ornato, intus obconice concavo, filamentis connatis 5–9, distaliter ad oram tubulam leniter manifestis, deinde abrupte liberis et 0,2 mm longis albidis perangustis flexibilis distinctis, antheris oblongis 3

mm longis, base rotundati, apice acuminato-apiculati, thecis c. 2 mm longis, apiculo c. 1 mm longo cum cellulis raphidophoris ornato. *Inflorescentia foemina* pendula bracteata, pedunculo c. 12 cm longo, 6 mm crasso; spathis interioribus ovato-naviculariformibus acutis 7–13 cm longis, 6 cm latis, marginibus, costa et plicibus lateralibus distaliter denticulatis. Cephalium solitarium parvum breviter oblongo-ellipsoideum 6,5 cm longum, 3,5 cm latum, e pluribus drupis compositum. *Drupa* 15 × 4–5 mm cuneiformia truncata, pileo 2–3 mm alto, 5–6-angulato, apice depresso-subconcavo, stylo turritiforme, stigmate transverse reniforme 1–1,5 mm lato, laterale infra stylam. Endocarpium 6 mm longum subcentralium ellipsoideum pariete 0,5–0,7 mm crasso. Mesocarpium superum fibrosum fibris subclaviformibus; inferum fibrosum.

Type: West Irian: Kebar (Sanopi), oak forest on plateau, clay soil, 1300 m alt., rather common, 1.5 m high, fruits red, 17 Feb. 1958, *Ch. Koster BW 6852* (L!).

Additional specimens. WEST IRIAN. Wondiwoi Mountains, Wandammen Peninsula, 950 m alt., primary forest, rather common, 1.7 m high, bracts red, flowers brown, 27 Feb.1962, *Ch. Koster BW 13646* (L! standard staminate specimen).

This new species, known so far unfortunately only from the two collections cited, shows well the value of knowing the staminate as well as the pistillate characteristics.

The formation of the staminate flower in *P. kosteri* should be compared to that of *P. croceus*. In the former, there is a definite filament-tube, with only the brief rounded tips of the filaments serving to distinguish them; in the latter, the filaments are separated all the way to the base, making it difficult to observe the number of stamens in each floral unit. Yet the appearance, size, and anatomical detail (the occurrence of raphidophorous cells), as well as the otherwise almost identical anthers with their basal and apical prolongations of the connective, all afford clues to the affinity of these species. However, the latter staminal formation has been considered the norm for species of section *Maysops*, while the former (tubular) structure has been considered as representative of sections *Kurzia, Microstigma,* and perhaps of subgenus *Kurzia* as a whole. The significance of *P. kosteri* is that it focusses attention on the character of the basal prolongations of the connective while indicating that the fusion of the filaments, *i.e.* the tubular or non-tubular nature of the flower, is of lesser importance. Thus in assigning *P. kosteri* to section *Maysops* we see one extreme of a possible trend. If we examine some other species which are certainly members of section *Maysops*, such as *P. zea* St. John, we note that the tubular portion of the staminate flower is in effect intermediate, the filaments being fused along two-thirds to three-quarters of their length. The same trend, moreover, can be observed in undoubted members of section *Kurzia* (by undoubted is meant that their fruits show unambiguous agreement with the definition of the section). In *P. cominsii* Hemsl. and *P. hollrungii* K.Schum., the filaments are completely fused; while in *P. minusculus* Stone, they are free to the base.

Anatomical data further strengthens the assignment of *P. kosteri* to section *Maysops*. Thanks to an examination of leaf micromorphology and anatomy by K.-L. Huynh (*in litt.*) the affinity of *P. kosteri* to some other species of section *Maysops* is confirmed. In the medullary tissue between the veins and between the adaxial and abaxial chlorenchyma of the leaves there are abundant fiber bundles, a feature

characteristic of section *Maysops* (and unknown in species of section *Kurzia*, which may have staminate flowers quite similar to those of *P. kosteri*). In addition it is noted that the anther apiculi of *P. kosteri* are well provided with crystal cells, as is usually the case in species of section *Maysops*.

Subgenus Kurzia

Section Leptocarpa Huynh & Stone

Section *Leptocarpa* Huynh & Stone, Bot. Jahrb. Syst. 98 (1977) 219.

Inflorescentia terminalis, solitaria, pedunculatis; cephalio oblonge-cylindrico (ad 35 cm longo), e plurimis drupis composito. Drupa perangusta elongata 45–64 mm longa, pileo breve pyramidato truncato stigmate 1,5–2 mm lato, velutino-pulvinato. Endocarpium submedianum.

Type species: *Pandanus leptocarpus* Martelli.

Distribution. Monotypic. Endemic to Papua New Guinea.

Pandanus leptocarpus Martelli

Pandanus leptocarpus Martelli, Webbia 4 [(1913) 21, *nomen*;] (1914) t. 33, f. 8 (illust.); J. Arnold Arbor. 10 (1929) 140; Huynh, Bot. Jahrb. Syst. 98 (1977) 219.

The leaf-anatomical characters, as previously described by Huynh, and the characteristic fruit morphology, as described above, appear to distinguish this species from those of any other section.

During field work in Papua New Guinea in 1971 (see Stone, Contr. Herb. Austr. 4: 7–40. 1974) several days of exploration were spent around Ihu near the mouth of the Vailala River in the Gulf District in an attempt to obtain new collections of pandans, especially those discovered there much earlier by L.J. Brass. Among the results of this exploration were specimens of *Pandanus leptocarpus* (cited below). The extensive field notes obtained at the time are quoted here in order to record data from the living plants. Two other recent collections are also cited.

Notes on the living plants (from *Stone 10124 = LAE 53424*): Trees forming dense thickets, upcurved then erect trunks with proproots to 3 m long and 7 cm diam., with blunt nub-like prickles; trunks to 14 m tall, sometimes partly decumbent, bluntly prickly; growing in seasonally flooded mud along riverbanks, with *Pandanus lauterbachii, Scirpodendron ghaeri* , a cauliflorous *Ficus, etc.* Stems emitting sucker shoots from low down, these becoming ascendent and erect, and emitting proproots; leaves on sucker shoots green, not glaucous, the midrib at base with a few short prickles; but leaves of adult plants glaucous beneath, the midrib at base quite unarmed; blades to c. 150–240 cm long, 5.3–9.4 cm wide, at apex with prickly ventral pleats (prickles few). Pistillate heads at anthesis pale straw-yellow slightly tinged with salmon; head 13 × 7.8 cm, yellowish with white stigmas, sweet-fragrant

(with numerous *Nitidulid* beetles and earwigs). Ripe fruit heads to 35 × 18.5 cm; drupes 45–64 mm long, the pileus dark green, below this the drupe apex bright orange, slightly greenish around the endocarp, the base yellow-orange; receptacle pale yellow. Upper mesocarp pithy white, endocarp brown, c. 12.5 mm long, fusiform; lower mesocarp whitish fibrous; no germination noted. Small crabs were found in leaf axils of adult trees.

Specimens examined. PAPUA NEW GUINEA. Gulf District; E. Purari River delta channel c. 15 miles inland, tidal freshwater forest ecotone, 0 m alt.; trunk 10 m high, proproots with spines; stem pustular; leaves grey-green, 150–200 cm long; infructescence solitary, fruitlets scarlet on inner faces, dull-grey-green on exposed faces; peduncle 30–60 cm long, with 6–8 bracts, 16 Feb. 1966, *Schodde & Craven 4493* (A, L); Vailala River, 5 km inland up from Ihu, eastern banks, 0 m alt., 27 April 1971, *Stone & Galore 10124 = LAE 53424* (K, KLU, L, LAE, PH); Baimuru Subdistrict, Era River tributary, 5 m alt., tidal zone swamp forest, 6 April 1974, *Croft & Vinas LAE 61301* (A).

Two other collections of this species are known, both female (like those cited above); the type collection, *Versteeg 1101* (U), the only collection from West Irian (Noord Rivier); and *Brass 1164* from the Vailala River.

Discovery of the staminate flowers of this species remains an important desideratum and should serve to check the soundness of the sectional status afforded to the species.

Section Macrokurzia Stone, *sect. nov.*

Inflorescentia terminalis, pedunculata, solitaria; cephalio subgloboso; drupae obovoideae, pileo pyramidato; stigma verticale adaxiale, obdeltoideo, 2,5 mm lato. Mesocarpium superum cavernosum. Endocarpium submedianum obconicum, pariete tenue, semen unicum.

Type species: *Pandanus daymanensis* St. John.

Distribution. Monotypic. Endemic to Papua New Guinea.

Pandanus daymanensis St. John

Pandanus daymanensis St. John, Pacific Sci. 27 (1973) 79–81, f. 321; Huynh, Bot. Jahrb. Syst. 98 (1977) 222.

This species was originally assigned to sect. *Microstigma* and retained therein by Huynh. It differs rather clearly from *P. conoideus* Lam., type of that section, and other species currently placed there such as *P. ruber* St. John, *P. erythros* St. John, and *P. magnificus* Martelli, in its subglobose cephalia (not long-cylindric), its much larger drupes and larger stigmas, and the large cavern or chamber of the apical mesocarp. In these features, *P. daymanensis* approaches more closely to sect. *Karuka*. The nature of the pericarp, unfortunately, cannot be compared, but it is unlikely to be identical to the thin oil-rich tissue that occurs in the true members of sect. *Microstigma* (which has found a use in the comestible 'Marita' forms cultivated in Papua New Guinea). These characters exclude *P. daymanensis* from the immediate alliance of *P. conoideus*, and justify the erection of a distinct section. Again in

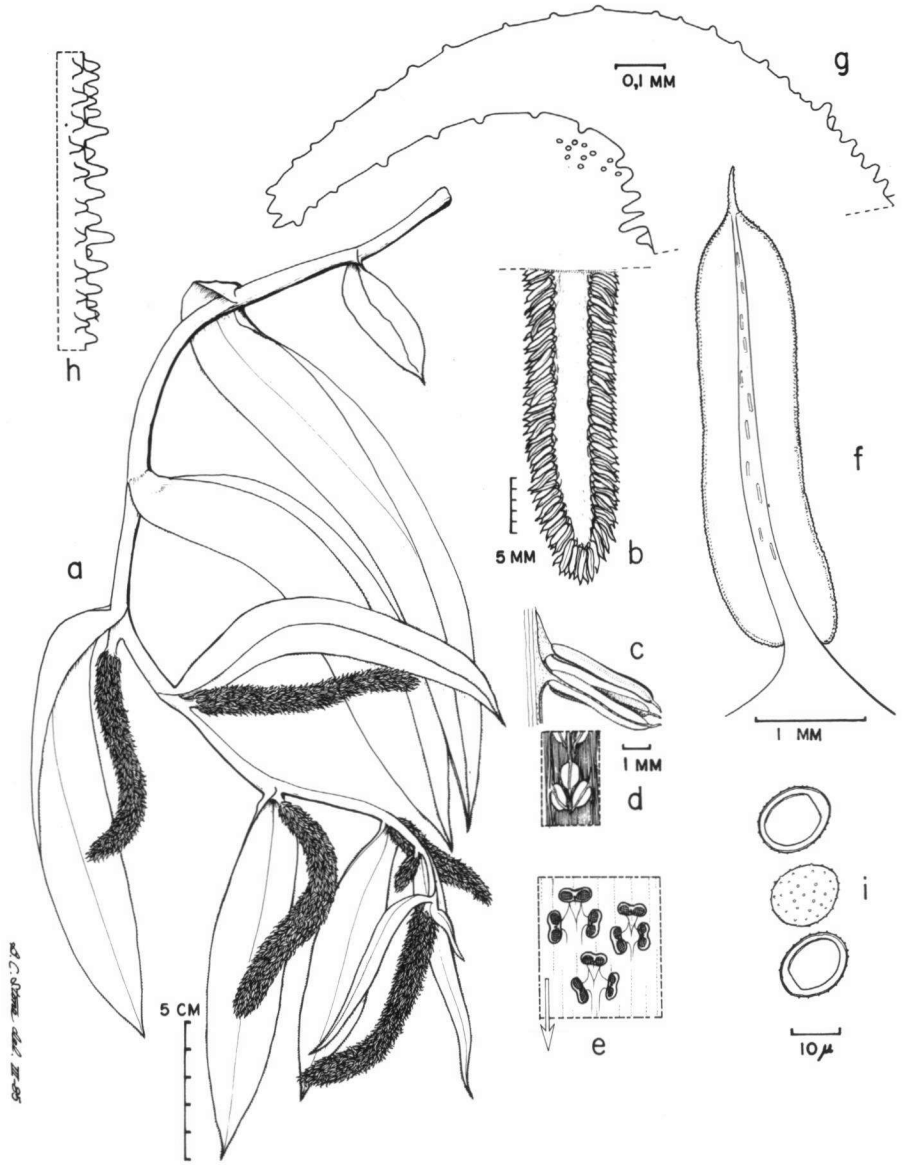

Fig. 6. *Pandanus copelandii* Merr. – Details of staminate inflorescence and flowers: a. inflorescence; b. apex of a spike in longisection; c. details of one flower (a triad of stamens), shown also in two plan views (d, e); f. one stamen enlarged; g. with camera-lucida outline of the apiculus; i. pollen.

this case the eventual discovery of the staminate flowers should be a test of this taxonomic disposition.

The name *Macrokurzia* suggests the larger drupes and the position of the section in subgenus *Kurzia*.

Of the anatomical characters noted by Huynh, *P. daymanensis* is notable for its larger abaxial stomata (in contrast to *P. conoideus* and its immediate allies) and the partly vertical orientation of the crystals; also, the medullary tissue includes fibre fascicles in the vicinity of the chlorenchyma. Horizontal orientation of crystals is normal. These characteristics lend weight to a separate status for *P. daymanensis*. (See also Huynh, Bot. Jahrb. Syst. 94: 217, f. 47. 1974; and 98: 207. 1977.)

Subgenus Acrostigma

Section Acrostigma

Pandanus copelandii Merr. – Fig. 6.

Pandanus copelandii Merr., Bur. Govt. Lab. Publ. 17 (1904) 7; Martelli, Philipp. J. Sci. 3 (1908) Bot. 71; Webbia 4 (1914) t. 31, f. 5, 7; Merr., Enum. Philipp. Fl. Pl. 1 (1923) 15; St. John, Pacific Sci. 23 (1969) 355, f. 295–296; Stone, Bot. Jahrb. Syst. 94 (1974) 524; Fedn Mus. J. n.s. 23 (1983) 24.

Recently fully described and illustrated by St. John, this species is fairly well known and characterized. However, a new collection from Luzon by M.S. Allen (*PNH 150369*) has disclosed a further character not previously mentioned. This consists in the microscopically papillate epidermis of the anther thecae (just noticeable at hand-lens magnification). The papillae extend on to the short apiculus. Papillate apiculi are now documented in several species of *Pandanus* but this seems to be the first mention of the extension of papillae to the anther all along the length of the thecae. An important additional feature displayed in this specimen is the clear grouping of anthers into triads, reflecting the basic floral construction. Previously, most descriptions of species of sect. *Acrostigma* omitted this feature or described staminal arrangement as 'solitary' due to poor preservation of the rapidly decaying spikes and the destructive predation of *Nitidulid* larvae. Fresh material of several species (*P. elostigma* Martelli may also be mentioned) in recent studies clearly shows that the tristaminate condition is common, probably basic, in this section.

Specimens examined. PHILIPPINES: Luzon, Cagayan Province, Nanadukan, coastal strands, *M.S. Allen field no. 289–81 = PNH 150369* (PH! PNH).