

Revision of the Genus *Pandanus* Stickman. Part 38  
*Pandanus* in Fiji, First Group (except Section *Pandanus*)<sup>1</sup>

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THE FIJIAN ISLANDS are partly oceanic islands, partly continental islands with igneous rocks. From this habitat diversity one would expect a larger and more varied flora than that of isolated oceanic islands. This is so in the genus *Pandanus*. Besides the section *Pandanus* which contains most of the littoral and oceanic species, there are found in Fiji four other sections of the genus.

KEY TO SECTIONS

- A. Fruits all (or mostly) 1-celled,
  - B. Stigmas longer than broad, linear, distal, on a subulate style; stamens radiating from the expanded apex of the filament column ..... *Digitati*.
  - B. Stigmas broader than long,
    - C. Stigmas on the concave apex of the drupe, filling all spaces between several hard cordate pseudostigmas, and extending down the outer sides as radiating lines or ellipses ..... *Radiatistigma*.
    - C. Stigma a ligulate tranverse band under the horizontal flabellate 5-9-dentate style which projects from the margin of the apical concavity of the drupe ..... *Galeatistigma*.
- A. Fruits several-celled,
  - D. Stigmas on the distal surface of the phalange (only 1. *P. Whitmeeanus*)..... *Coronata*.
  - D. Stigmas apical on carpel summits (this will appear in the second group)... *Pandanus*.

KEY TO *Digitati*

- Syncarps 20×10 cm; endocarp median; pileus 5-7 mm high, hemispheric, scaberulous; leaf near the base 15 cm wide, and with 74 secondary parallel veins in each half ..... 2. *P. Thurstoni*.
- Syncarps 11-12×9.5-10 cm; endocarp in the lower  $\frac{1}{3}$ ; pileus 7-9 mm high, smooth, its upper part narrowly pyramidal; leaf near the base 8 cm wide, and with 87 secondary parallel veins in each half ..... 3. *P. Varawa*.

KEY TO *Galeatistigma*

- Drupes 6-6.8 cm long; style with 5-9 deltoid teeth; bracts of syncarp 15 cm long; leaf middle with 62 parallel secondary veins in each half, and there the marginal prickles 2-2.8 mm long ..... 4. *P. Joskei*.
- Drupes 3.1-3.8 cm long; style with 4-6 rounded lobes; bracts of syncarp 9 cm long; leaf middle with 48 parallel secondary veins in each half, and there the marginal prickles 0.1-0.2 mm long ..... 5. *P. taveuniensis*.

<sup>1</sup> Manuscript received 6 July 1974.  
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KEY TO *Radiatistigma*

- A. Drupes 5.5–6 cm long; seed cavity central and surrounded by an endocarp 5–9 mm thick; leaf middle 7–7.5 cm wide, and there with 73–74 parallel secondary veins in each half, and beginning at 8 cm the margins with prickles 1.7–2.5 mm long, 2.5–6 mm apart, arcuate lance subulate, strongly ascending, pale with red tips ..... 8. *P. vitiensis*.
- A. Drupes 3.3–4.5 cm long,
- B. Seed cavity central; endocarp 4–8 mm thick; leaves 3.3 cm wide at the middle, and there with 37 parallel secondary veins in each half ..... 7. *P. levuensis*.
- B. Seed cavity at the lower  $\frac{1}{6}$ , surrounded by the thin endocarp; leaves 9.6 cm wide at the middle, and there with 74 parallel secondary veins in each half ..... 6. *P. Gillespiei*.

SECTION *Coronata*

1. *Pandanus Whitmeeanus* Martelli, Webbia 1: 364, 1905; 4(1): 36, 68, 94, 1913; 4(2): tab. 22, figs. 4–6, 1914; Univ. Calif. Publ. Bot. 12: 359, pl. 45, figs. 8–9, 1930; B. P. Bishop Mus., Occas. Papers 10(13): 23, 1934; Setchell, Carnegie Inst. Wash., Publ. 341, Dept. Marine Biol. 20: 16, 116–118, 201, 224, 1924; St John & A. C. Smith, Pacif. Sci. 25: 345, 1971; Stone, Biol. Soc. Wash., Proc. 80: 50–51, fig. 1, 1967.
- P. corallinus* Martelli, Univ. Calif. Publ. Bot. 12: 359, pl. 45, figs. 10–12, 1930; lectotype of section *Coronata*, by St. John, Pacif. Sci. 14: 228, 1960; Stone, Biol. Soc. Wash., Proc. 80: 53, 1967.

(Section *Coronata*)

Figures 337, 338

NOM. VERN.: “na parou” (Nguna I., New Hebrides); “ndraundreka” (Fijian); “paono” (Samoan); “paogo” (Tongan); “ara amoa” (Aitutaki).

ORIGINAL DIAGNOSIS: “Drupae 7 cent. longae, fere  $3\frac{1}{2}$  cent. latae,  $2\frac{1}{2}$  cent. crassae, plus minusve compressae, oblongae, basi sensim attenuatae, acute exagonae, apice explanatae. Stigmata plurima (6–8) circum et infra marginem areolae terminalis lateraliter radiatim disposita, sessilia, plana, elliptica, 5 mill. longa, 2 mill. lata. Pars mesocarpica superseminalis plena medullosa-fibrosa, 3 cent. lata,  $2\frac{1}{2}$  cent. longa; endocarpum lapidium subcentrale totam latitudinem drupae tenens.”

EXPANDED DIAGNOSIS OF HOLOTYPE: Vegetative parts not preserved; drupes 6.7–7 cm long,

3–3.5 cm wide, 2–2.5 cm thick, narrowly oblanceoloid, compressed, 5–6-angled, the apex with a truncate rim, then within this concave, lower sides flat, lateral sinuses none, upper  $\frac{2}{3}$  free, the surface shining, smoothish but warty, the elliptic rim of the apex less than half as wide as the phalange, within the rim the apex concave, with irregular brown cracks and one suborbicular stigma; the 6–8 regular stigmas 4–5 mm long, 1.5–2 mm wide, narrowly elliptic, sulcate, brown, papillose, flush, vertical on the outer sides just below the apical rim; endocarp in the lower  $\frac{3}{4}$  and 25–26 mm long, bony, dark brown, broadly semiellipsoid, the apex concave, the lateral walls 3–4 mm thick, within smooth, shining; seed 10–12 mm long, ellipsoid; apical mesocarp 24–29 mm long, undivided, a solid tissue of parenchyma traversed by longitudinal fibers; basal mesocarp 17–21 mm long, fibrous and fleshy.

EXPANDED DESCRIPTION: Tree to 15 m tall; leaves 1–3 m long, 8–10 cm wide near the base, 7.5–10 cm wide at the middle, coriaceous, above green and shiny, below pale and glaucous; at midsection with 72–88 parallel secondary veins in each half, the tertiary crossveins seen in the outer  $\frac{2}{3}$  on both sides, forming short oblong meshes, the blade broadly ligulate, but in the outer  $\frac{1}{6}$  narrowing to a 5–10 cm trigonous thick subulate apex, this at the point 10 cm down 6–26 mm wide, the base unarmed, stramineous to pinkish; beginning at about 19 cm the margins with prickles mostly broken and lost, but some 0.8–1 mm long, 1–4 mm apart, arcuate subulate, subappressed ascending, weak, stramineous; beginning at about 20 cm the midrib below with prickles 1 mm long, 3–8 mm apart, arcuate subulate, weak, strongly

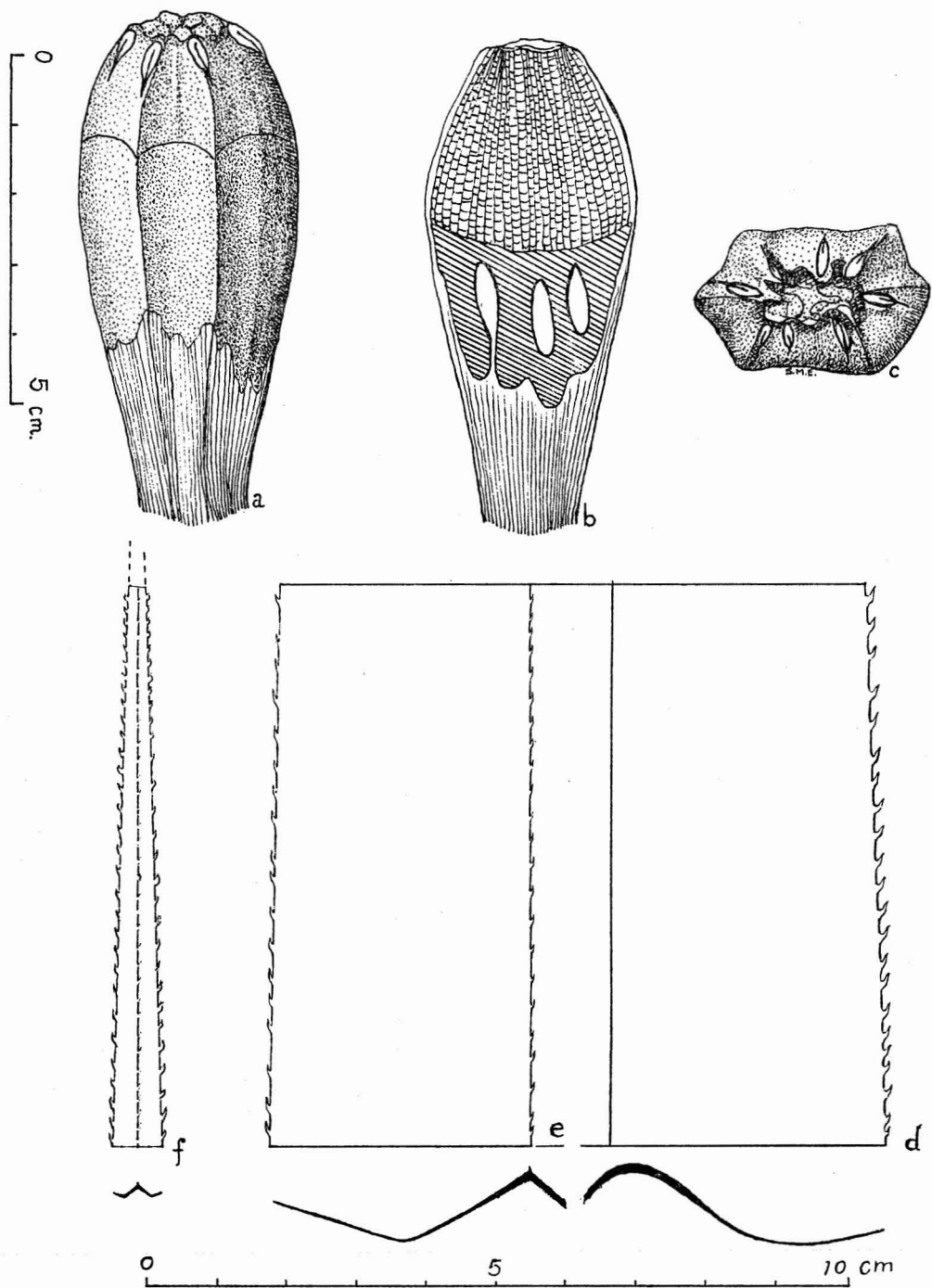


FIGURE 337. *Pandanus Whitmeeanus* Martelli, from holotype. *a*, phalange, lateral view,  $\times 1$ ; *b*, phalange, longitudinal median section,  $\times 1$ ; *c*, phalange, apical view,  $\times 1$ . From Christophersen 3,580, Samoa, *d*, half of leaf base, lower side,  $\times 1$ ; *e*, half of leaf middle, lower side,  $\times 1$ ; *f*, leaf apex, lower side,  $\times 1$ .

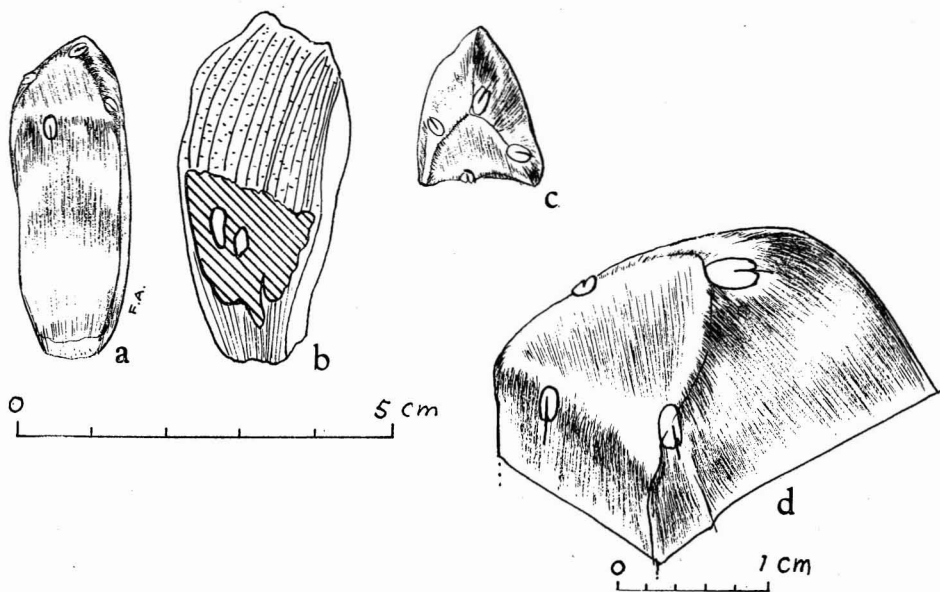


FIGURE 338. *Pandanus corallinus* Martelli, from holotype. *a*, phalanges, lateral view,  $\times 1$ ; *b*, phalange, longitudinal median section,  $\times 1$ ; *c*, phalange, apical view,  $\times 1$ ; *d*, phalange apex, oblique view,  $\times 2$ .

ascending; at midsection the margins with prickles 1.5–2.5 mm long, 3–5 mm apart, arcuate thick subulate, ascending, brown tipped, perceptibly alternately large and small; the nearby midrib below with prickles 0.8–1 mm long, 3–6 mm apart, arcuate subulate, compressed, strongly ascending, stramineous with slight brown tips; on the subulate apex the margins and midrib below with prickles 0.5–1 mm long, 1–3 mm apart, arcuate subulate, strongly ascending, pale with brown tips; the pleats above unarmed; infructescence terminal, with a solitary syncarp; peduncle 27 cm long, 3 cm in diameter, straight, clavate, 3-sided, with rounded angles, bearing several foliaceous bracts; syncarp up to 25 cm long, 22 cm in diameter, subglobose, bearing the numerous phalanges in vertical rows; dried core 10.5 cm long, 6 cm in diameter, ellipsoid, fibrous, rigid, with well-marked fruit scars; phalanges 5.3–8.5 cm long, 2–3.5 cm wide, 1.8–2.5 cm thick, oblance ellipsoid, compressed, 4–6-angled, the apex bright green, the rest orange, the sides plane but gently curved, the upper  $\frac{1}{3}$  free, the apex 8–12 mm wide, concave; stigmas 5–8 and 3–5 mm long, 2 mm wide, elliptic, flush, brown, papillose, radiate, running from the apical rim down the outer sides of the phalange; endocarp

in the lower  $\frac{2}{3}$  and 17–21 mm long, bony, dark brown, semiellipsoid, lateral walls 2–4 mm thick, within smooth and shining; seeds 10–12 mm long, ellipsoid; apical mesocarp 22–30 mm long, an undivided tissue of parenchyma traversed by numerous longitudinal fibers; basal mesocarp 10–17 mm long, fibrous and fleshy.

HOLOTYPE: (Samoa), Feb. 1878, Rev. *Whitmee* (K)!

SPECIMENS EXAMINED: Fiji, Suva, coast road, Dec. 1939, *A. Meebold* 26,529 (BISH); Queens Road, 8 miles from Suva, Rewa, hillside near road, 28.3.56, *J. W. Parham* 10,092 (BISH, SUVA); Viti Levu, Serua, flat coastal strip in vicinity of Ngaloa, in swampy grass-flats, and on edge of forest, near sea level, Nov. 26–Dec. 26, 1953, *A. C. Smith* 9,436 (BISH, US).

Samoa: Tutuila, top of Pioa, scrub forest, 500 m alt., Jan. 2, 1932, *E. Christophersen* 3,580 (BISH); Savaii, Safobu, cult., Sept. 1931, *Christophersen & E. Steblin* 3,597 (BISH); Tutuila, Pago Pago, July 6, 1920, *W. A. Setchell* 300 (BISH, UC).

Tonga: Tongatabu, from necklace worn by a Tongan woman, June 1926, *Setchell & H. E. Parks* 15,420 (FI, UC), the type of *P. corallinus*



Martelli; Aug. 23, 1926, *Setchell & Parks* 15,650 (BISH, FI, G, K, UC).

Cook Islands: Aitutaki, June 1966, *H. F. Clay* 1 (BISH); one tree in village, Aug. 1955, *R. C. Cooper* 36,743 (AK, BISH).

Horne Islands, Futuna Island, only cult. around houses, Oct. 1, 1969, *D. E. Yen* X78 (BISH).

New Hebrides: Nguna Island, just n. of Ile Vaté, Mt. Mawasi, in small wet gully near summit, 2,000 ft. alt., 4 Sept. 1957, *B. C. Stone* 2,209 (BISH); and 2,210 (BISH).

*P. corallinus* Martelli is here reduced to synonymy. It was based wholly on nine phalanges taken from a necklace worn by a Tongan woman. The phalanges are small, 3.6–4.5 cm long, and all are curved and very asymmetric. They have a well-formed endocarp, but poorly formed seed cavities. The stigmas are like those of *P. Whitmeeanus*. It is certain that these phalanges are merely the basal, poorly formed ones from a syncarp of that species. Being smaller and curved, they were favored for necklace making over the larger, heavier, straight ones that are the abundant, lateral, well-developed ones. B. C. Stone independently arrived at this same conclusion (Biol. Soc. Wash., Proc. 80: 53, 1967).

*P. Whitmeeanus* is an economic species, now growing on several island groups, but its true home is in doubt. However, there is some evidence recorded by collectors.

In Fiji it grows only in the lowlands near villages, and A. C. Smith recorded, "considered the best *Pandanus* for mats, for which leaves of young plants are used."

In Samoa Christophersen recorded his no. 3,597 as cultivated; but his 3,580 as from forest on top of a 500-m mountain; and Setchell stated that it was cultivated by villages.

In Tonga the only collection was made by Bouli, a chief who brought the specimen to Setchell and Parks. Its leaves were used to make fine mats.

In Aitutaki H. F. Clay, and also R. C. Copper, found only a single tree cultivated in a village.

On Futuna it grew only in cultivation by the houses.

On Nguna Island in the New Hebrides B. C. Stone found it growing in a wet gully near the

summit of Mt. Mawasi, at 2,000 ft alt. That sounds like a natural habitat.

On all the islands where it is present its leaves are used for making mats and plaiting handicraft articles, and for these uses it is a favorite. In Tonga the bright-colored, fragrant phalanges are strung into garlands for personal adornment. This custom is common with *Pandanus* fruits throughout Polynesia. Only a week before the time of this writing, in June 1973, the author in Honolulu was decorated with a *Pandanus* lei.

On Futuna the leaves were not used, but the fruits were strung into garlands with other fruits, leaves, and flowers. Also, oil from the fruits was used to perfume coconut oil to be used as a cosmetic.

It is quite clear that the tree is an economic plant, treasured by the native Pacific islanders. On their voyages they have doubtless carried seeds or cuttings of the tree, and planted them on their home island. Where then is it native? The evidence suggests that it is native to the New Hebrides.

#### SECTION *Digitati* SECT. NOV.

Arbores, infructescencia spicata cum syncarpiis compluribus, drupis 1-loculatis oblanceoloidis rostratis, stylo subulato rigido, stigmatibus lineari distali; plantis masculis cum inflorescentia cum bracteis multis imbricatis, spica mascula solitaria, staminibus 5–8 in fasciculo, columna erecta tum proxime abrupte curvata et expansa et in margine antheras salientas ferrenti.

Trees; infructescence spicate with several syncarps; drupes 1-celled, oblanceoloid, beaked; style subulate, rigid; stigma linear, distal. Male plants with inflorescence with many imbricate bracts at base; staminate spike solitary; stamens 5–8 in a fascicle; column erect, then sharply proximally bent and expanded, and bearing the anthers salient from its margin.

HOLOTYPE: *Pandanus Varawa* St. John, here described, from Fiji!

The new epithet is the Latin adjective *digitatus*, with fingers, and it is given with

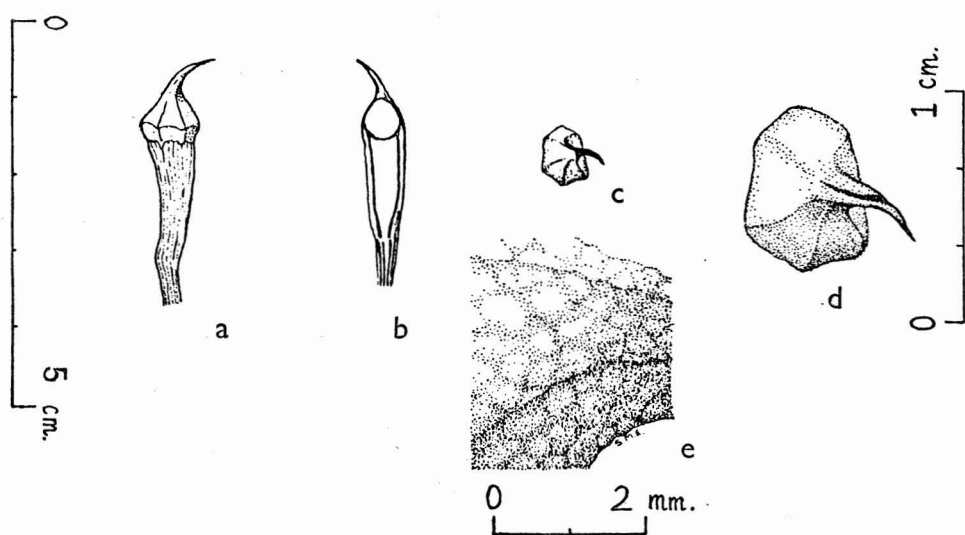


FIGURE 339. *Pandanus Thurstoni* Wright, from holotype. *a*, drupe, lateral view,  $\times 1$ ; *b*, drupe, longitudinal median section,  $\times 1$ ; *c*, drupe, apical view,  $\times 1$ ; *d*, drupe, apical view,  $\times 3$ ; *e*, apex of pileus, oblique view,  $\times 10$ ; *f*, half of leaf base, lower side,  $\times 1$ ; *g*, half of leaf middle, lower side,  $\times 1$ .

reference to the digitate arrangement of the anthers.

The pistillate plants seem inseparable from those of the section *Acrostigma*, but in that group the numerous staminate spikes have separate anthers attached directly to the rhachis, while in section *Digitati* the solitary staminate spike bears stamens in fascicles with the anthers borne on the margin of the divergent, expanded apex of the column. *Acrostigma* occurs in the Solomons and from there west to India.

Although its male plants are unknown, it is likely that the other Fijian species, *P. Thurstoni* Wright, also belongs in the new section.

2. *Pandanus Thurstoni* Wright, Kew Bull. Misc. Inf. 348, 1894 (as *P. Thurstonii*), Martelli, Webbia 4(1): 9, 35, 92, 96, 1913; Stone, Biol. Soc. Wash., Proc. 80: 49–50, 1967.

(Section *Digitati*)

Figure 339

ORIGINAL DIAGNOSIS: “fruticosus foliis linearibus acuminatis marginibus minute denticulatis costis integris, druparum capitibus circa 8 racemose dispositis, drupis sejunctis 5–6-angulatis, stigmate spinoso secedente, semine solitario.”

EXPANDED DIAGNOSIS OF HOLOTYPE: Shrub; leaves “3.3–4 m long,” massive, near the base 15 cm wide, apparently near the middle 12.3 cm wide, thick coriaceous, U-sulcate, 2-pleated, above shiny green, below paler green, somewhere near the middle with 74 parallel secondary veins in each half, the tertiary crossveins raised and conspicuous on both sides, forming short oblong meshes, the blade apparently broad ligulate (the apex and outer part missing), the base unarmed, pale; beginning at 36 cm the margins with prickles mostly broken, but seemingly similar to those of the midsection (near the base the midrib below not observed); near the midsection the margins with prickles 0.3–0.7 mm long, 1–3 mm apart, arcuate subulate, ascending, brown, larger and smaller intermingled; the nearby midrib below apparently unarmed; syncarp 20 cm long, 10 cm in diameter; drupes 35–37 mm long, 7–7.5 mm wide, 5–6 mm thick, narrowly oblanceoloid,

6-angled, the lower sides flat, the upper  $\frac{1}{3}$  free; pileus 5–7 mm high, 6-angled, the lower part hemispheric, smooth, the upper part minutely roughened; style 5–7 mm long, subulate, curved; stigma nearly as long, linear, extending almost to the tip, brown, papillose; endocarp median, 12 mm long, firm, cylindric, the margin prolonged upwards as a rim, the lateral walls 0.2 mm thick, stramineous, within transversely striate; apical mesocarp 5 mm long, a semiglobose cavern with a few marginal black membranes; basal mesocarp 10 mm long, fibrous and fleshy.

HOLOTYPE: Fiji, comm. 6/94, Sir J. B. Thurston (K)! It consists of 23 drupes, a basal, and a median piece of a leaf. Isotype, of 15 drupes (F).

### 3. *Pandanus Varawa* sp. nov.

(Section *Digitati*)

Figures 340, 341

NOM. VERN.: “varawa” (Fijian).

DIAGNOSIS HOLOTYPE: “Arbor ad 7 m alta est, cauli brevi erecto, foliis crebre congregatis suberectis vel demum pendentibus,” foliis 2–3 m longis proxima basem et in 70 cm ex apice 8 cm latis coriaceis lamina ligulata sensim in apice acuminato diminuenti supra obscure viridi et sublucido infra pallide viridi U-sulcato 2-plicato in sectione mediali cum 84 nervis parallelis secundariis in dimidio quoque nervis tertiis in paginis ambis prominentibus et reticula breviter oblonga formantibus (basi non visi), proxima basem marginibus cum aculeis 1.5–1.7 mm longis 9–21 mm separatis obliquo ovato-deltoides acutis compressis adscendentibus stramineis, ex basi per sectionem longam inermi, in regione 63 cm ex apice marginibus cum aculeis 0.5–1.3 mm longis 2–5 mm separatis crasse subulatis suberectis valde adscendentibus pallidis, ad apicem marginibus et midnervo infra cum aculeis 0.2–0.3 mm longis 1–2 mm separatis subulatis adscendentibus pallidis, ad apicem supra plicis cum aculeis crassis adscendentibus; infructescencia terminali spicata cum 5–13 syncarpiis, pedunculo ultra 12 cm longo fere 1 cm diametro, syncarpiis 11–12 cm longis 9.5–10 cm diametro late

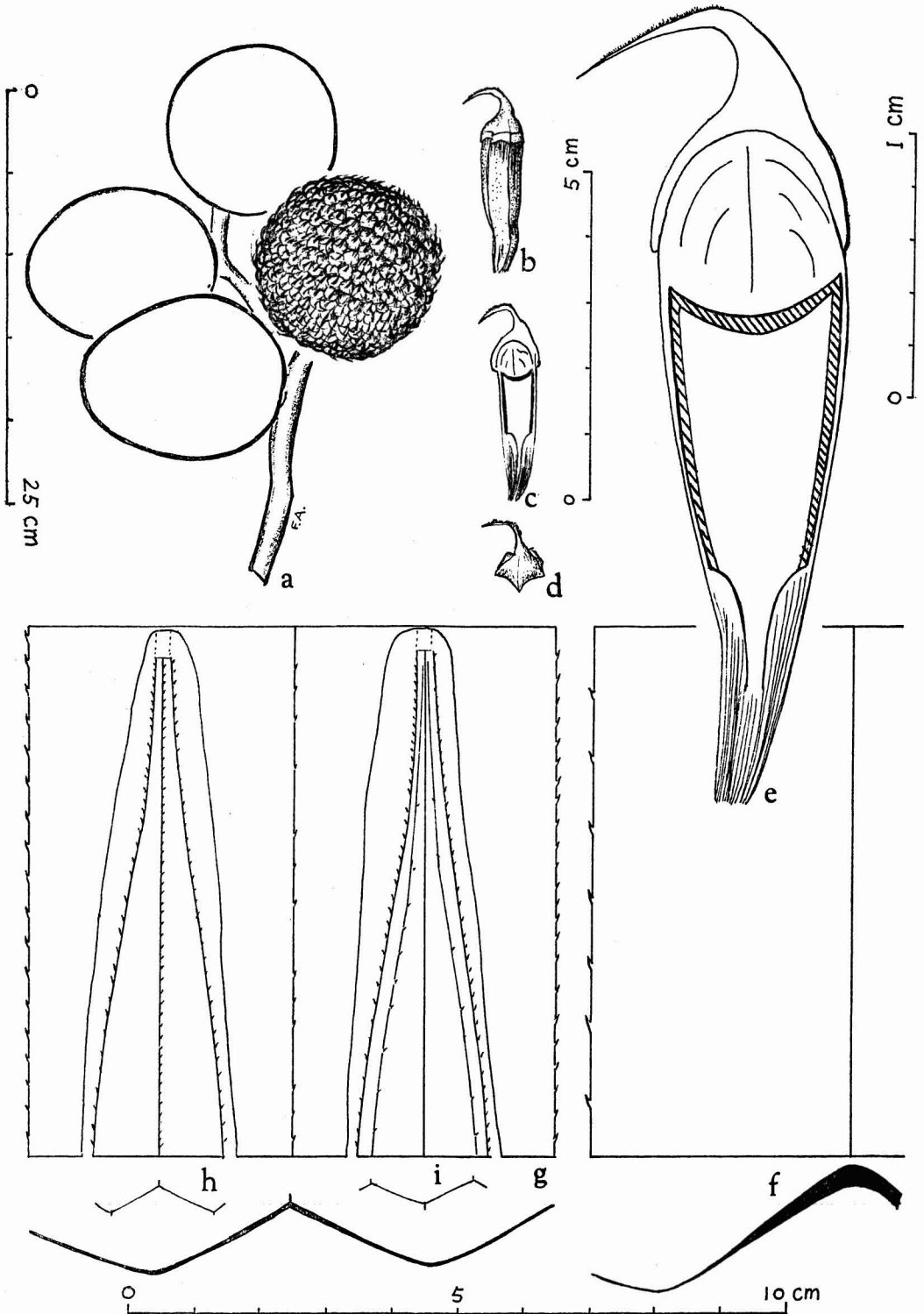
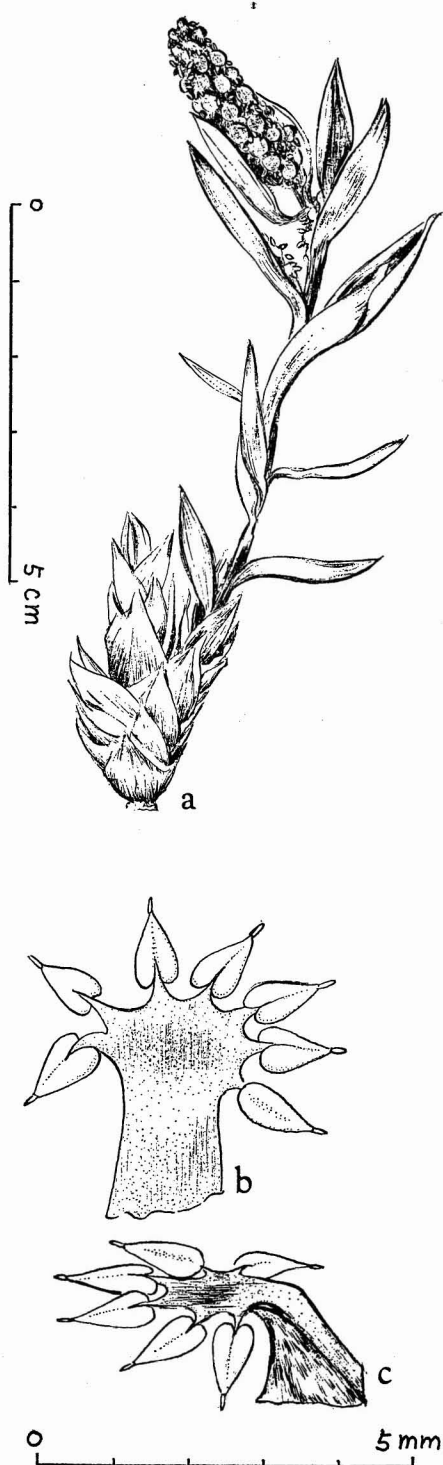


FIGURE 340. *Pandanus Varawa* St. John, from holotype. *a*, infructescence,  $\times \frac{1}{4}$ ; *b*, drupe, lateral view,  $\times 1$ ; *c*, drupe, longitudinal median section,  $\times 1$ ; *d*, drupe, apical view,  $\times 1$ ; *e*, drupe, longitudinal median section,  $\times 4$ ; *f*, half of leaf base, lower side,  $\times 1$ ; *g*, leaf middle, lower side,  $\times 1$ ; *h*, leaf apex, lower side,  $\times 1$ ; *i*, leaf apex, upper side,  $\times 1$ .



ellipsoideo ad subgloboso, drupis 30–35 mm longis 6–9 mm latis 5–6.5 mm crassis cuneatis oblanceoloideis 5–6-angulis lateribus inferis subplanis parte  $\frac{1}{3}$  supera libera, pileo 7–9 mm alto parte infera hemisphaerica angulosa parte supera anguste pyramidalis 5–6-angulosa laevi lucida, stylo 6–7 mm longo aciculari curvato luteo lucido, stigmate 5–6 mm longo lineari badio papilloso, endocarpio in parte  $\frac{1}{3}$  infera et 11–12 mm longo cuneati-cylindrico firme cartilagineo stramineo apice concavo lateribus lateralibus 0.2 mm crassis intra laevibus lucidis, semine 9 mm longo, mesocarpio apicali 7 mm longo cavernoso subgloboso, mesocarpio basali 7 mm longo in lateribus sursum deorsum fibroso intra carnosio.

DIAGNOSIS OF HOLOTYPE: "Tree up to 7 m tall, the stem short and erect; the leaves densely aggregated, suberect or at length drooping"; leaves 2–3 m long, 8 cm wide near the base and at 70 cm from the tip, strap-shaped, gradually tapering to an acuminate apex, coriaceous, above dark green and somewhat shiny, below pale green, U-sulcate, 2-pleated, at midsection with about 84 parallel secondary veins in each half, tertiary veins prominent on both sides, forming short oblong meshes (the base not seen), near the base the margins with prickles 1.5–1.7 mm long, 9–21 mm apart, oblique ovate deltoid, acute, compressed, ascending, stramineous; the midrib from near the base unarmed for a long distance; at the point 63 cm down from the apex the margins with prickles 0.5–1.3 mm long, 2–5 mm apart, heavy subulate, nearly straight, strongly ascending, pale; near the apex the margins and midrib beneath with prickles 0.2–0.3 mm long, 1–2 mm apart, subulate, ascending, pale; infructescence terminal spicate, with 5–13 syncarps; peduncle more than 12 cm long, about 1 cm in diameter; syncarps 11–12 cm long, 9.5–10 cm in diameter, broadly ellipsoid to subglobose; drupes 30–35 mm long, 6–9 mm wide, 5–6.5 mm thick, cuneate oblanceoloid, 5–6-angled, lower sides flattish, upper  $\frac{1}{3}$  free; pileus 7–9 mm high, the

FIGURE 341. *Pandanus Varawa* St. John, from Smith 992a. a, staminate inflorescence,  $\times 1$ ; b, staminate fascicle, proximal view,  $\times 10$ ; c, staminal fascicle, lateral view,  $\times 10$ .

lower part hemispheric, angled, the upper part narrowly pyramidal, 5–6-angled, the surface smooth, shining; style 6–7 mm long, acicular, curved, yellow, shining; stigma 5–6 mm long, linear, brown, papillose; endocarp in lower  $\frac{1}{3}$  and 11–12 mm long, cuneate-cylindric, firm cartilaginous, stramineous, the apex concave, the lateral walls 0.2 mm thick, within smooth, shining; seed 9 mm long; apical mesocarp a cavern 7 mm long, subglobose; basal mesocarp 7 mm long, fibrous up the sides, fleshy within.

**Staminate Plant (Smith 992a):** Staminate inflorescence a lateral bracteate shoot 8.5 cm long, the lower 2 cm covered by 3 tiers of ovate coriaceous bracts 1 cm long, the middle 2.5 cm with the peduncle 2 mm thick, and with 6 remote bracts 17–20 mm long, 5–6 mm wide, oblong, folded, acute, coriaceous, green; upper floral bracts 20–25 mm long, 7–8 mm wide, elliptic, navicular; flowering part 4.5 cm long, bearing 5 spikes, the lateral ones 10–15 mm long, 4 mm thick, the terminal ones 3 cm long, 7–8 mm thick, the thick axis bearing fascicles 2.5–3.5 mm long; column 1–1.5 mm long and thick, abruptly bent proximally, then expanded into a flat, oval, or polygonal tip which is 2–2.5 mm long, 1.5–2 mm wide, and bears 5–8 anthers diverging from its lateral and apical margins, free filament tip 0.2–0.3 mm long, deltoid; anthers 0.6–0.7 mm long, broadly ovate-deltoid, with 2 rounded lobes at base, bearing at the apex a subulate prolongation of the connective 0.2–0.3 mm long.

**HOLOTYPE:** Fiji, Koro Island, eastern slope of main ridge, shady swampy forest, interior of island, 300–500 m. alt., Jan. 29–Feb. 5, 1934, A. C. Smith 992 (BISH). Isotypes (A, FI, P, S, UC, US)!

**SPECIMENS EXAMINED:** Fiji, ditto, staminate, A. C. Smith 992a (BISH).

**DISCUSSION:** *P. Varawa* is the type species of the new section *Digitati*.

If *P. Thurstoni* is properly placed in the section *Acrostigma*, its male inflorescences would have the stamens all distinct and each attached directly to the axis of the spike. As yet the staminate plants of this species are unknown, and, in fact, it is known only from the type specimen sent to Kew by Sir J. B. Thurston,

Governor of Fiji. The holotype consists of a basal and a median (?) piece of one leaf and 23 loose drupes. Because the stigmas are unattached, one cannot determine their direction, whether distal or proximal, and hence establish the species as a member of the section *Acrostigma* or of *Lonchostigma*. In any case *P. Thurstoni* is very similar to and resembles *P. Varawa* more closely than it does any known member of the section *Lonchostigma*, hence, a contrast between the two given is here. Geographically the new species is remote, as the nearest locality for another species of the section *Lonchostigma* is on the island of Morotai in the Moluccas. The type collection of *P. Varawa*, Smith 992, was recently listed as being *P. Thurstonii* by B. C. Stone (Biol. Soc. Wash., Proc. 80: 49–50, 1967).

*P. Thurstoni* Wright of Fiji has the syncarps  $20 \times 10$  cm; drupes with pileus 5–7 mm high, hemispheric, its upper  $\frac{1}{2}$  scabrous; endocarp median, its sides prolonged upwards beyond the concave tip; leaves 15 cm wide near the base. *P. Varawa* of Koro Island, Fiji, has the syncarps  $11\text{--}12 \times 9.5\text{--}10$  cm; drupes with pileus 7–9 mm high, the lower part hemispheric, the upper part pyramidal, smooth throughout; endocarp in lower  $\frac{1}{3}$ , the top merely concave; leaves 8 cm wide near the base.

#### SECTION *Galeatistigma*

4. *Pandanus Joskei* Balf. f., Linn. Soc. Bot., Jour. 20: 416, 1882; Warb. in Engler's Pflanzenreich, IV, 9: 73, 1900; Martelli, Webbia 4(1): 18, 88, 95, 1913; 4(2): tab. 24, figs. 1–3, 1914; Univ. Calif. Publ. Bot. 12(9): 334, 1930; Stone, Biol. Soc. Wash., Proc. 80: 50, 1967.
- P. Joskei* J. Horne, A Year in Fiji 265, 1881 (nom. nud.).

(Section *Galeatistigma*)

#### Figure 342

**ORIGINAL DIAGNOSIS:** "Arborescens erecta, foliis acuminatis reduplicatis basi grosse apice tenuiter aculeatis, syncarpiis ovoideis v. conoideis magnis solitariis axillaribus ad truncos infrafoliaceis longe pedunculatis, bracteis plurimis acuminatis, drupis anguste obcuneatis 4–6-angulatis apice planis v. concavis stigmatate auriculato, 1-spermis."

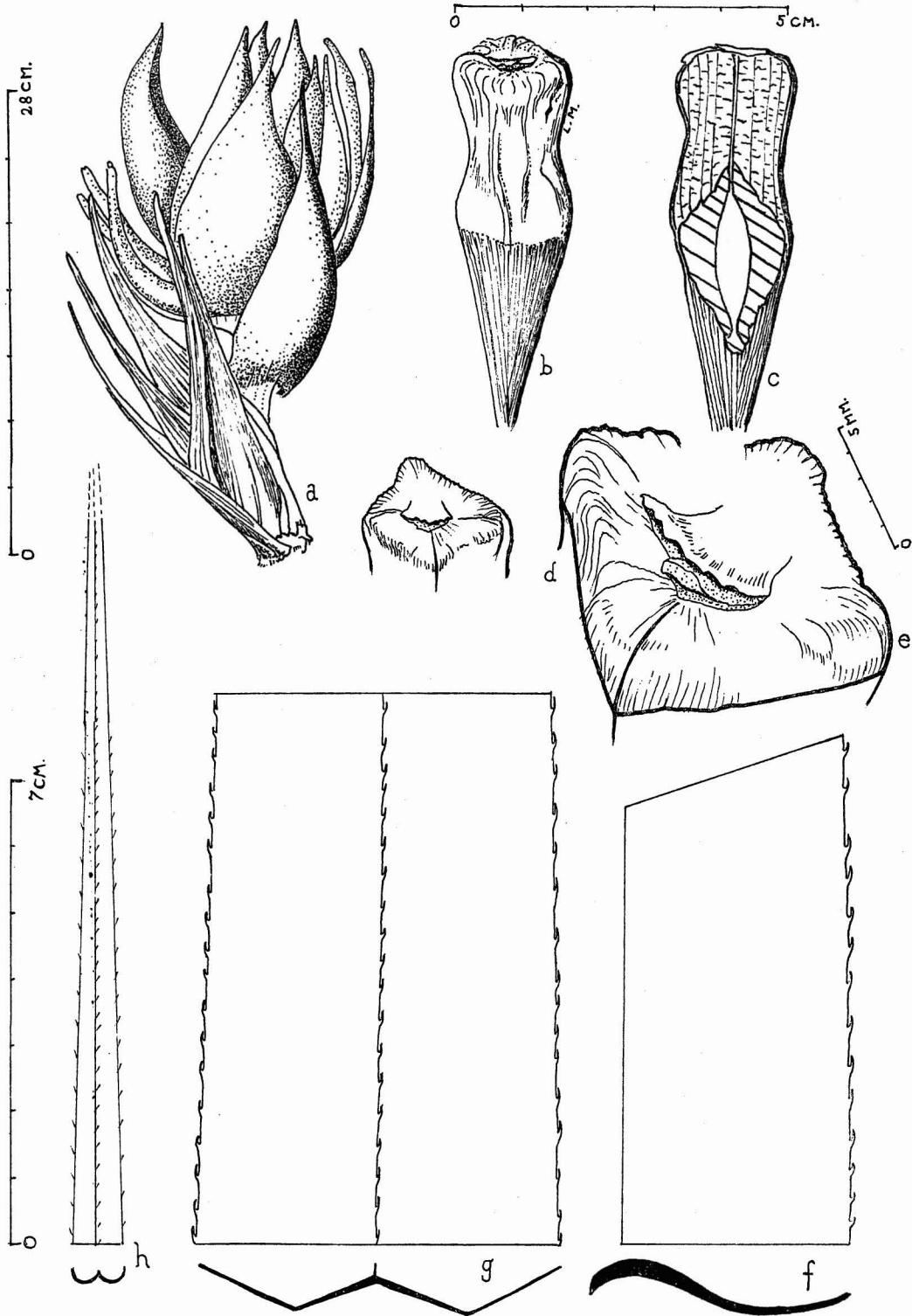


FIGURE 342. *Pandanus Joskei* Balf. f., from neotype. *a*, infructescence,  $\times \frac{1}{4}$ ; *b*, drupe, lateral view,  $\times 1$ ; *c*, drupe, longitudinal median section,  $\times 1$ ; *d*, drupe, apical view,  $\times 1$ ; *e*, drupe apex, style, and stigma, oblique view,  $\times 4$ ; *f*, half of leaf base, lower side,  $\times 1$ ; *g*, leaf middle, lower side,  $\times 1$ ; *h*, leaf apex, lower side,  $\times 1$ .



**DIAGNOSIS OF NEOTYPE:** Tree 3–10 m tall, unbranched; leaves 1.13 (+0.07?) m long, 7 cm wide near the base, 5.3 cm wide at the middle, coriaceous, above shiny green, below pale green and apparently glaucous, U-sulcate, with 2 rounded pleats, at midsection with 62 parallel secondary veins in each half, but no tertiary crossveins evident, the blade sword-shaped, tapering from the base to the trigonous subulate apex (the tip lost), the base unarmed, pale, beginning at 10 cm the margins with prickles 2–3 mm long, 4–13 mm apart, arcuate subulate, compressed, strongly ascending, pale but the tips red; beginning at 15 cm the midrib below with prickles 1.7 mm long, 9–26 mm apart, stout subulate, strongly ascending, wholly stramineous or the tips turning brown; at midsection the margins with prickles 2–2.8 mm long, 3–8 mm apart, subulate, compressed, appressed ascending, the base pale, the rest brownish red; the nearby midrib below with prickles 1.3–1.7 mm long, 3–5 mm apart, subarcuate subulate, compressed, appressed ascending, the base stramineous, the rest brownish red, perceptibly of two kinds, large and small alternating; near the apex the margins and midrib below with crenate-serrulations 0.2–0.3 mm long, 3–7 mm apart, dark red; infructescence lateral from the naked trunk below the terminal plume of leaves; peduncle more than 14 cm long, 3 cm in diameter, densely clothed with imbricate bracts ascending in several (doubtless 3) spiral ranks, the cauline ones 16–19 cm long, 4–5 cm wide, decreasing slightly in size to the uppermost ones, linear lanceolate, concave, green, very thick coriaceous and rigid, shining, punctate towards the base, the outer half longitudinally striate veiny, almost unarmed, but the outer margins minutely denticulate; the syncarp enclosed by numerous bracts about 15 cm long, 7 cm wide, lanceolate to ovate-lanceolate (but tips broken), navicular, thin but rigid coriaceous, when dried chocolate brown, apparently unarmed and the margins membranous for at least the lower  $\frac{2}{3}$ ; the core fragment (when dried) fibrous; drupes 6–6.8 cm long, 1.6–2.5 cm wide, 1.7–1.9 cm thick, cuneate, 4–5-angled, truncate and retuse, the upper  $\frac{1}{6}$ – $\frac{1}{5}$  free, the sides longitudinally pebbly rugose; apical depression 5–10 mm in diameter, and from its margin projecting dis-

tally is the style 5–8 mm wide, 1–3 mm long, bony, shining, the base straight, the margin rounded but with 5–9 deltoid teeth; stigma 6–10 mm wide, brown, papillose, a ligulate band under the overhanging style; endocarp 2.5–3 cm long, bony, blackish brown, thick fusiform, the apex bearing bristles to the stigma, the lateral walls 3–3.5 mm thick, within papillose; seed 12–13 mm long, narrowly ellipsoid; apical mesocarp 15–23 mm long, of strong longitudinal fibers and transverse brown membranes; basal mesocarp 25–27 mm long, fibrous and fleshy.

**NEOTYPE:** Fiji, Viti Levu, Mt. Korobamba, in canyon below summit, June 11, 1927, *H. E. Parks 20,344* (F!) Isotypes (A, B, BISH, BM, BR, C, CAS, F, G, K, MO, NY, UC, US, Z)!

**SPECIMENS EXAMINED:** Fiji, Viti Levu, 10 miles s. of Suva, Oct. 2, 1893, *D. Yeoward* (K, F!). Fiji, without locality, comm. 6/94, Sir *J. B. Thurston* (K).

**DISCUSSION:** A neotype is here designated for *P. Joskei*, because of its dubious origin. Mr. J. Horne discovered it on Viti Levu in 1879, drew a rough sketch of it, and wrote some descriptive notes. He selected the binomial *P. Joskei* and printed the name (as a nomen nudum) in his narrative in 1881. On returning to England he gave his notes and sketch to Prof. Balfour who agreed that it was a new species and published it, deriving the diagnosis from Horne's notes, but without any actual specimen—without a type. Such a method of publishing a species is reprehensible. Horne's observation and notes were good, hence, it is possible definitely to recognize the species and positively to identify recent collections with it. Since it was published without any type or known specimen, a neotype for it is here selected, described, and illustrated.

Balfour in publishing *P. Joskei* (1882) assigned it to the section *Vinsonia*. Warburg (1900) placed it near section *Lophostigma*, but considered it uncertain. Martelli (1913) assigned it to the section *Lophostigma* and later (1930) reaffirmed this placement. B. C. Stone (1967) placed it in section *Maysops*. The writer now includes it in the new section *Galeatistigma*.

*Pandanus taveuniensis* sp. nov.(Section *Galeatistigma*)

Figure 343

DIAGNOSIS HOLOTYPE: Arbor 1.3–3.3 m alta est, caule simplici, foliis 1.62–1.77 m longis proxima basem 6.4 cm latis in medio 5 cm latis coriaceis U-sulcatis 2-plicatis supra obscure viridibus lucidis infra albi-viridibus et glaucis in sectione mediali cum 48 nervis parallelis secundariis in dimidio quoque nervis tertiis transversis in paginis ambis fere omnino evidenti et reticula breviter oblonga formantibus lamina fere ligulata sed in parte  $\frac{1}{8}$  apicali in apice trigono brevi crasse subulato deminuenti eo in puncto 10 cm ex apice 34 mm lato basi inermi pallida, ex 1 cm marginibus cum aculeis 0.3–1 mm separatis biformatis eis majoribus 0.3–0.4 mm longis subarcuatis subulatis adscendentibus pallidis cum apicibus subbrunneis et cum illis minoribus 3–4-plo numerosis simulantibus 0.1–0.2 mm longis intermixtis, midnervo infra per partem  $\frac{1}{8}$  inferam inermi, in sectione mediali marginibus cum serrulis 0.5–1.5 mm separatis biformatis eis majoribus 0.2 mm longis subbadiis et cum illis minoribus 0.1 mm longis vel etiam minoribus et 3–4-plo numerosis intermixtis, ad apicem marginibus cum aculeis inaequalibus 0.3–0.4 mm longis 0.3–1 mm separatis arcuatis subulatis adscendentibus subbrunneis, midnervo cum aculeis 0.3–0.5 mm longis 0.3–1.5 mm separatis arcuatis graciliter subulatis adscendentibus infra stramineis cum apicibus rubris, infructescencia axillari cum syncarpio solitario et a quiescentibus fere clausis, pedunculo 12–14 cm longo 22–24 mm in basi diametro cum bracteis multis in spiris tribus imbricatis coriaceis foliaceis eis inferis 4 cm longis 2 cm latis ovati-lanceolatis concavis integris inermibus illis superis 10 cm longis 3.5 cm latis simulantibus sed lanceolatis, bracteis circum syncarpium fere 12 in 2–3 circulis 9 cm longis 5 cm latis ovatis acutis coriaceis coloratis (in sicco brunneis), syncarpio 10 cm longo 8 cm diametro ovoideo, drupis 31–38 mm longis 11–17 mm latis 6–13 mm crassis cuneiformatis 4–6-angulosis apice truncato et concavo lateribus inferis planis parte  $\frac{1}{11}$  supera libera, pileo 4–6 mm alto crebre papilloso et scabro bordini rotundato concavo apicali 4–7 mm lato, stylo

horizontali et proximali in fugo mediali transverso 3.5–5 mm longo 2–4 mm lato papilloso bordini expanso hemisphaerico subtili et cum 4–6 lobis rotundatis et infra cum labia secunda plus minusve diviso et clauso, stigmate 3.5–5 mm longo lineari badio papilloso, endocarpio in parte  $\frac{4}{5}$  supera et 13–16 mm longo osseoso obscure brunneo adamantiformi sed tertia supera minori acuta et cum seta ad stigmatem humeris in parte  $\frac{1}{3}$  supera fere horizontalibus sed concavis lateribus lateralibus 2.3–3 mm crassis intra rubri-brunneis laevibus lucidis, semine 4–5 mm longo ellipsoideo, mesocarpio apicali 7–9 mm longo cum fibris longitudinalibus rigidis paucis et membranis transversis brunneis, mesocarpio basali 14–16 mm longo fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree 1.3–3.3 m tall; stem simple, unbranched; leaves 1.62–1.77 m long, 6.4 cm wide near the base, 5 cm wide at the middle, coriaceous, U-sulcate, 2-pleated, dark shiny green above, whitish green and glaucous beneath, at midsection with 48 parallel secondary veins in each half, the tertiary crossveins visible on both sides nearly throughout, forming short oblong meshes, blade nearly ligulate, but in outer  $\frac{1}{8}$  narrowing to the trigonous short stout subulate apex, this at the point 10 cm down 34 mm wide, the base unarmed, pale; beginning at 1 cm from the base the margins with prickles 0.3–1 mm apart, of 2 kinds, large ones 0.3–0.4 mm long, subarcuate subulate, ascending, pale with brownish tips, mingled with 3–4-times as many small similar ones 0.1–0.2 mm long; the midrib below unarmed for the lower  $\frac{4}{5}$ ; at midsection the margins with serrulations 0.5–1.5 mm apart, of 2 kinds, large ones 0.2 mm long, brownish, mingled with similar small ones 3–4-times more numerous, 0.1 mm long or even smaller; near the apex the margins with unequal prickles 0.3–0.4 mm long, 0.3–1 mm apart, arcuate subulate, ascending, brownish; the midrib below with prickles 0.3–0.5 mm long, 0.3–1.5 mm apart, arcuate slender subulate, ascending, stramineous below, red-tipped; infructescence axillary, bearing a solitary syncarp, more or less concealed by debris; peduncle 12–14 cm long, 22–24 mm in diameter at base, the upper part concealed; peduncular bracts numerous, in

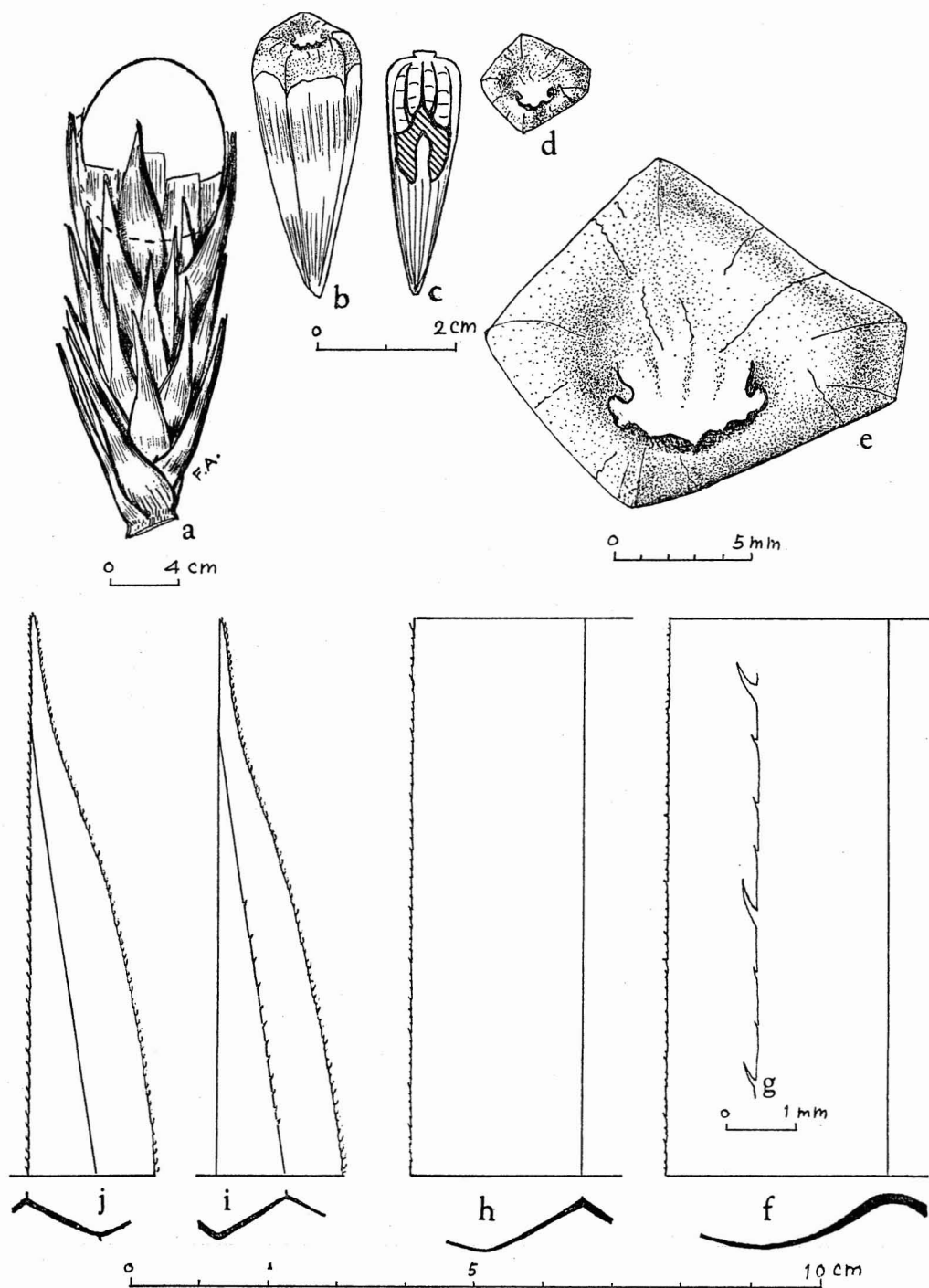


FIGURE 343. *Pandanus taveuniensis* St. John, from holotype. *a*, infructescence,  $\times \frac{1}{4}$ ; *b*, drupe, lateral view,  $\times 1$ ; *c*, drupe, longitudinal median section,  $\times 1$ ; *d*, drupe, apical view,  $\times 1$ ; *e*, drupe apex, style, and stigma, apical view,  $\times 4$ ; *f*, half of leaf base, lower side,  $\times 1$ ; *g*, prickles of near basal margin,  $\times 10$ ; *h*, half of leaf middle, lower side,  $\times 1$ ; *i*, leaf apex, upper side,  $\times 1$ ; *j*, leaf apex, lower side,  $\times 1$ .

3 spiral ranks, imbricate, coriaceous, foliaceous, the lowest ones 4 cm long, 2 cm wide, ovate-lanceolate, concave, entire, unarmed, the upper progressively larger; the upper ones 10 cm long, 3.5 cm wide, similar but lanceolate; bracts enclosing the syncarp about 12, in 2–3 circles, 9 cm long, 5 cm wide, ovate, acute, coriaceous, colored (when dried chocolate brown); syncarp 10 cm long, 8 cm in diameter, ovoid; drupes 31–38 mm long, 11–17 mm wide, 6–13 mm thick, cuneiform, 4–6-angled, the apex truncate and concave, lower sides flat, upper  $\frac{1}{11}$  free; pileus 4–6 mm high, densely papillose, and rough, the rim rounded, the apical concavity 4–7 mm wide; style borne from the median transverse ridge, proximally directed, almost parallel to the drupe apex, 3.5–5 mm wide, 2–4 mm long, the base and stalk oblong, papillose, the expanded rim hemispheric, thin, with 4–6 low rounded lobes, and beneath is a lower lip once or more divided, and more or less concealed; stigma 3.5–5 mm long, linear, brown, papillose; endocarp in upper  $\frac{4}{9}$  and 13–16 mm long, bony, dark brown, diamond-shaped, but the upper  $\frac{1}{3}$  small, acute, bearing a bristle to the stigma, the shoulders at the upper  $\frac{1}{3}$ , nearly horizontal, but the upper surface concave, lateral walls 2.3–3 mm thick, within reddish brown, smooth, shining; seed 4–5 mm long, ellipsoid; apical mesocarp 7–9 mm long, of a few stiff longitudinal fibers and transverse brown membranes; basal mesocarp 14–16 mm long, fibrous and fleshy.

HOLOTYPE: Fiji, Taveuni Island, above Qacavulo Estate, forest, 2,750 ft. alt., 2.5.69, A. C. Smith, J. W. Parham et al. 16,932 (BISH)!

DISCUSSION: *P. taveuniensis* is a member of the section *Galeatistigma*, as is its closest relative, *P. Joskei* Balf. f., of Viti Levu, Fiji, a species with the infructescence cauliflorous; syncarp 15–30 cm long, 10–24 cm in diameter; drupes 6–6.8 cm long, 1.6–2.5 cm wide; endocarp median, 25–30 mm long, without shoulders; style 5–8 mm wide, with 5–9 deltoid teeth; bracts of syncarp 15 cm long, 7 cm wide; leaves 1.1 m long, 7 cm wide near the base, at the middle with 62 parallel secondary veins in each half, and there the margins with prickles 2–2.8 mm long, 3–8 mm apart, subulate, compressed, appressed ascending, the base pale, the

rest brownish red. *P. taveuniensis* has the infructescence axillary; syncarp 10 cm long, 8 cm in diameter; drupes 3.1–3.8 cm long, 1.1–1.7 cm wide; endocarp in upper  $\frac{4}{9}$  and 13–16 mm long, with nearly horizontal shoulders; style 3.5–5 mm wide, with 4–6 rounded lobes; bracts of syncarp 9 cm long, 5 cm wide; leaves 1.6–1.7 m long, 6.4 cm wide near the base, and at the middle with 48 parallel secondary veins in each half, and there the margins with serrulations 0.5–1.5 mm apart, of 2 kinds, large ones 0.2 mm long, brownish, mingled with similar small ones 3–4-times more numerous, 0.1 mm long or even smaller.

### *Radiatistigma* sect. nov. (subgenus *Lophostigma*)

Drupis 1-carpelatis oblanceoloideis, apice concavo cum pseudostigmatibus pluribus subcordatis osseosos prostratis, et in intervallis stigmatibus discoideo et in lateribus exterioribus in lineis vel ellipticis descendenti, syncarpio solitario, arbore cum trunco indiviso. Planta mascula incognita.

Drupes 1-celled, oblanceoloid, the apex concave, with several more or less cordate pseudostigmas, and filling the intervals between them is the subdiscooid stigma and this extends down the outer sides as radiating lines or ellipses; syncarp solitary; tree with an undivided trunk. Staminate plant unknown.

HOLOTYPE: *Pandanus vitiensis* Martelli, Univ. Calif. Publ. Bot. 12(9): 333, pl. 42, 1930, Fiji!

Also in this new section are *P. Gillespiei* St. John and *P. levuensis* Martelli.

The new name is derived from the Latin *radiatus*, radiating, and *stigma*, a mark, but in botany a stigma, and it is given with reference to the radiating lobes of the discooid stigma.

### 6. *Pandanus Gillespiei* sp. nov.

(Section *Radiatistigma*)

Figure 344

DIAGNOSIS HOLOTYPI: Licet arbor est (habitus radices truncus ramulique incogniti sunt), foliis 2.56 (+0.05–0.08?) m longis proxima

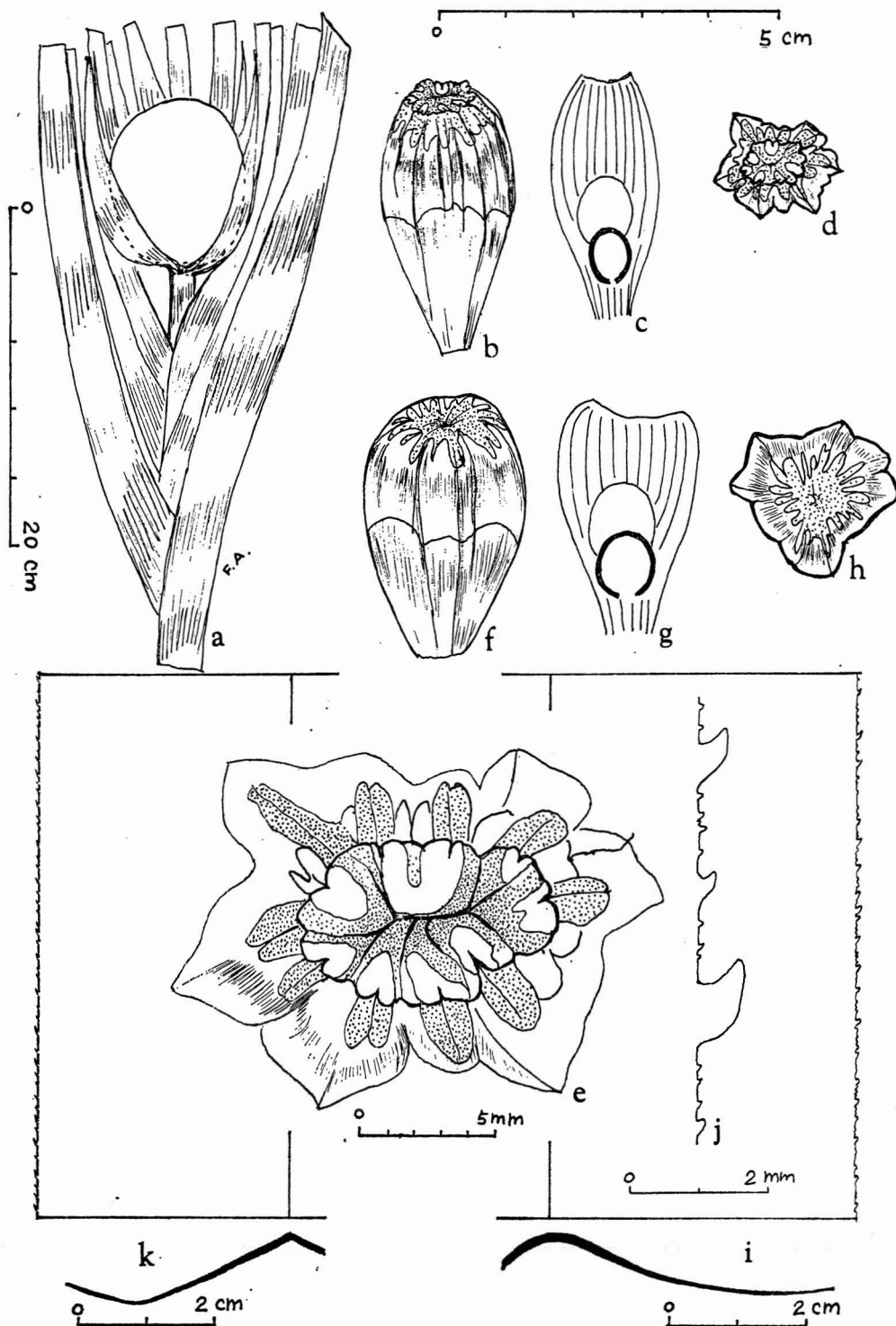


FIGURE 344. *Pandanus Gillespiei* St. John, from holotype. *a*, infructescence,  $\times \frac{1}{4}$ ; *b*, drupe, lateral view,  $\times 1$ ; *c*, drupe, longitudinal median section,  $\times 1$ ; *d*, drupe, apical view,  $\times 1$ ; *e*, drupe apex, apical view,  $\times 4$ ; *f*, larger drupe, lateral view,  $\times 1$ ; *g*, larger drupe, longitudinal median section,  $\times 1$ ; *h*, larger drupe, apical view,  $\times 1$ ; *i*, half of leaf base, lower side,  $\times 1$ ; *j*, prickles of near basal margin,  $\times 10$ ; *k*, half of leaf middle, lower side,  $\times 1$ .

basem 9 cm latis in medio 9.6 cm latis crasse coriaceis U-sulcatis 2-plicatis supra lucidis viridibus infra pallidioribus in sectione mediali cum 74 nervis parallelis secundariis in dimidio quoque nervis tertiis transversis supra ad basim evidentis et reticula breve oblonga formantibus, lamina ligulata sed in parte  $\frac{1}{10}$  apicali in apice (acuto?) deminuenti (apice interito), ex 8.5 cm marginibus cum aculeis 0.3–1 mm separatis biformatis eis majoribus 0.7–1 mm longis digitatis curvatis adscendentibus stramineis et intra jugum quodque illis 7–15 minoribus 0.1–0.3 mm longis conicis divergentibus stramineis inaequalibus, midnervo fere ad apicem inermi, in sectione mediali aculeis 0.7–3 mm separatis biformatis eis majoribus 0.5–0.7 mm longis subulatis compressis fere adpresse adscendentibus stramineis et intra jugum quodque cum illis 1–3 minoribus 0.1–0.2 mm longis, infructescentia cum syncarpio solitario, pedunculo ultra 34 cm longo recto 20 mm diametro trigono clavato et a bracteis foliosis multis quam syncarpium longioribus parte infera 6–7 cm lata marginibus minute aculeatis, syncarpio 9.5 cm longo 8 cm diametro (immature), ellipsoideo, drupis lateralibus 3.6–3.8 cm longis 1.5–2.1 cm latis 1–1.5 cm crassis oblancei-ellipsoideis cum 5–6 angulis majoribus parte  $\frac{3}{7}$  supera libera laevi pallida glauca et cum 7–10 angulis secundariis vel fugis rotundatis, apice 6–9 mm lato concavo polygono et cum 6–9 pseudo-stigmatibus duris pallidis cordatis vel ellipticis, intervallis cum stigmate discoideo badio papilloso et in lateribus cum radiis ligulatis multis 3–6 mm longis descendentibus, endocarpio (immature) in parte  $\frac{1}{8}$  infera et fere 7 mm longo ellipsoideo subtili cartilagineo et infra cavo majori, mesocarpio apicali 26 mm longo indiviso cum fibris longitudinalibus multis et parenchyma denso, mesocarpio basali 3 mm longo fibroso et carnosio, drupis apicalibus 2.8–3.1 cm longis 2.3–2.4 cm latis 1.8–2 cm crassis, apice concavo 13–16 mm lato.

DIAGNOSIS OF HOLOTYPE: Doubtless a tree (habit, roots, trunk, and branches unknown); leaves 2.56 (+0.05–0.08?) m long, 9 cm wide near the base, 9.6 cm wide at the middle, thick coriaceous, U-sulcate, 2-pleated, above shiny green, below paler green and dull, at midsection with 74 parallel secondary veins in each half,

the tertiary crossveins seen above near the base, forming short oblong meshes, the blade ligulate, but in the outer  $\frac{1}{10}$  narrowing to the (acute?) apex (the tip lost); beginning at 8.5 cm up the margins with prickles 0.3–1 mm apart, of 2 kinds, large ones 0.7–1 mm long, fingerlike, curved, ascending, stramineous, each pair separated by 7–15 small ones 0.1–0.3 mm long, conic, divergent, stramineous, unequal; the midrib below unarmed almost to the tip; at midsection the margins with prickles 0.7–3 mm apart, of 2 kinds, large ones 0.5–0.7 mm long, subulate, compressed, almost appressed ascending, stramineous, each pair separated by 1–3 similar small ones 0.1–0.2 mm long; infructescence with a solitary syncarp; peduncle more than 34 cm long, straight, 20 mm in diameter, trigonous, clavate, concealed by numerous leafy bracts much exceeding the syncarp, their lower part 6–7 cm wide, their margins with minute prickles like those of the leaves; syncarp 9.5 cm long, 8 cm in diameter (immature), ellipsoid; lateral drupes 3.6–3.8 cm long, 1.5–2.1 cm wide, 1–1.5 cm thick, oblance ellipsoid, with 5–6 major angles, upper  $\frac{3}{7}$  free, smooth, pale, glaucous, and with 7–10 secondary angles or rounded ridges; the apex 6–9 mm wide, concave, polygonal, bearing 6–9 hard, pale, cordate or elliptic pseudostigmas, and the intervening space filled by the discoid brown papillose stigma which also extends down the outer sides as numerous 3–6 mm long ligulate rays; endocarp (immature) in lower  $\frac{1}{8}$  and about 7 mm long, ellipsoid, thin, cartilaginous, and above it is a slightly larger cavity; apical mesocarp 26 mm long, undivided, of numerous longitudinal fibers and solid parenchyma; basal mesocarp 3 mm long, fibrous and fleshy; apical drupes 2.8–3.1 cm long, 2.3–2.4 cm wide, 1.8–2 cm thick, the concave apex 13–16 mm wide.

HOLOTYPE: Fiji, Viti Levu Island, Tholo North Prov., vic. of Nandarivatu, 900 m. alt., Nov. 14, 1927, J. W. Gillespie 3,734 (UC)! Isotype (FI).

DISCUSSION: *P. Gillespiei* is a member of the section *Radiatistigma*, as is its closest relative, *P. levuensis* Martelli, of the east side of Viti Levu, at low altitude, a species with the drupes 3.3–



4.5 cm long, the upper  $\frac{1}{2}$  free, with smooth, flattish sides between the 5–6 angles; seed cavity at the middle and only its upper half covered by a thick hemispheric endocarp; leaves 1.62 m long, 3.3 cm wide at the middle, and there with 37 parallel secondary veins in each half and there the margins with appressed serrulations 0.2 mm long, 2–9 mm apart, greenish with brown tips. *P. Gillespiei* has the drupes 3.6–3.8 cm long, the upper  $\frac{3}{4}$  free, with 5–6 major angles and 7–10 secondary angles and valleys; seed cavity at the lower  $\frac{1}{6}$ , surrounded by the endocarp; leaves 2.56 (+0.05–0.08?) m long, 9.6 cm wide at the middle, and there with 74 parallel secondary veins in each half, and there the margins with prickles 0.7–3 mm apart, of two kinds, large ones 0.5–0.7 mm long, subulate, compressed, almost appressed ascending, stramineous, each pair separated by 1–3 similar small ones 0.1–0.2 mm long.

The new epithet is chosen to honor the collector, John Wynn Gillespie (1901–1932), explorer and writer on the flora of Fiji.

7. *Pandanus levuensis* Martelli, Univ. Calif. Publ. Bot. 12: 334–335, pl. 44, 1930 (excluding pl. 43); Stone, Biol. Soc. Wash., Proc. 80: 53, 1967.

(Section *Radiatistigma*)

Figure 345

ORIGINAL DIAGNOSIS: "Arbor parva, 3 m. alta, pluriramosa. Syncarpium solitarium, erectum cum pedunculo ultra 40 cent. longo, plurimis spathis subdistantibus, foliaceis, coriaceis, omnino induto suffultum. Pedunculum 1.5–2 cent. crassum trigonum, creberrime sagrinatum et longitudinaliter valide et crebre rugosum. Spathae decrescentes, inferiores verisimiliter foliis simillimae, coriaceae, ultra 0.5 m. longae, lineari-lanceolatae, attenuatae, acutae, 7 cent. circiter, latae, ima basi subdecurentes et pedunculum cum parte inferiore involventes, profunde et acute caliculatae, dorso acutissimo, in pagina inferiore leves, basin versus crebre punctulato-sagrinatae; parti apicali laminae subexplanata, utrinque venatae; marginibus in parte basilari conduplicatis, crebre et acute denticulatis, dentibus irregularibus, rectis, acutis in parte intermedia, brevi spatio, inermi-

bus, in reliqua parte, minute et creberrime serratis; dentibus rectis; costa media acuta prominente in dimidia superiore parte tantum irregulariter crebre, brevissime denticulato-serrata. Spathae superiore plurimae, confertae, syncarpium paullum superantes, interiores breviores sublineari lanceolatae, omnes, involucrantes, coriaceae, spathis foliaceis simillimae, late-lanceolatae, acutae, concavo-convexae, dorso acutissimo quasi carinato et marginibus, parte basilari excepta, dense, validiuscule et brevissime denticulato-serratis. Syncarpium erectum, solitarium, 7.5–11 cent. longum, 6–10 cent. diam. oblongum, numerosis phalangibus instructum. Phalanges compactae, variables, maturae circiter 28 mill. longae, 14–20 mill. circiter latae, acute-penta hexagonae, lateribus subaequalibus e medio ad basim connatae et attenuato-cuneatae vel contractae, e medio ad apicem liberae, pyramidatae vel convexo-pyramidatae, truncatae, lateribus longitudinaliter breviter costulatis, vertice lato-truncato-plano, disciforme, ambitu irregulariter rotundato vel subconcavo. Stigmata plurima coronam formantia subito infra marginem disci, verticaliter disposita et in disco plus minusve irregulariter radiatis, radiis linearibus; in sectione longitudinali endocarpium osseum in medio phalangis situm, 12 mill. spissum, totam latitudinem occupans, utrinque truncatum vel superne vix convexum et ad centrum in mucronem brevissimum productum; locus semifer unus, magnus; mesocarpium inferum et superum fibrosum. Phalanges immaturae quas tantum vidi, prismaticae 3 cent. longae 1.5–2 cent. latae vel cuneatae, apicem versus convexae vel convexo brevissime pyramidatae, latissime truncatae in dimidia superiore parte liberae, inferiore connatae, vertice lato plano; stigmata illis phalangibus jam descriptis simillima. In sectione longitudinali endocarpium incompletum apparet, angustum et in medio dimidia partis inferioris situm; locus semifer unicus basilaris; mesocarpium crasse fibrosum endocarpium involvens. Cetera ut in phalangibus maturis."

EXPANDED DIAGNOSIS OF LECTOTYPE: Inflorescence with a solitary syncarp; peduncle more than 18 cm long, 15 mm in diameter, trigonous, covered by numerous ascending



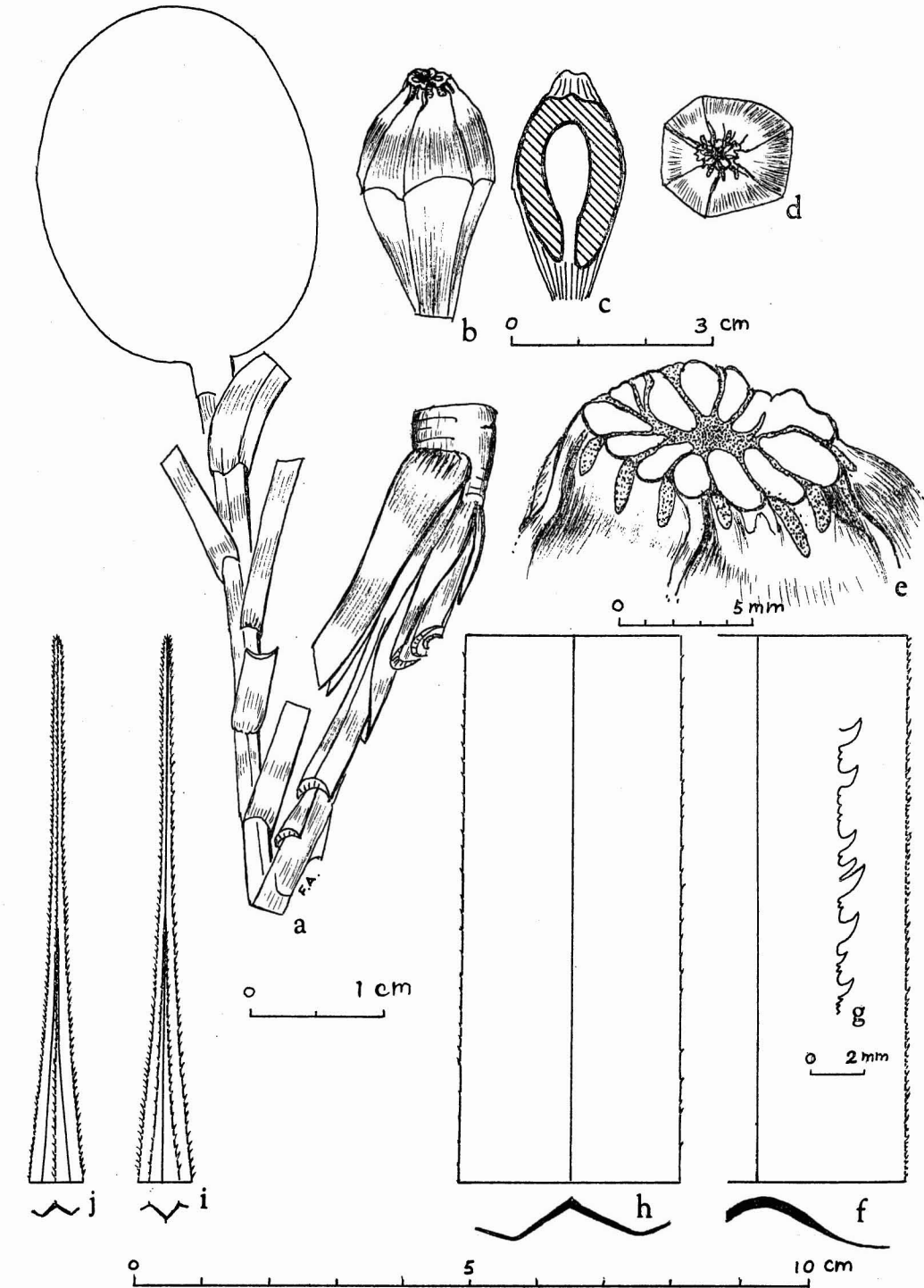


FIGURE 345. *Pandanus levuensis* Martelli, from Smith & Parham 16,549. *a*, infructescence,  $\times \frac{1}{2}$ ; *b*, drupe, lateral view,  $\times 1$ ; *c*, drupe, longitudinal median section,  $\times 1$ ; *d*, drupe, apical view,  $\times 1$ ; *e*, drupe apex, with pseudostigmas and stigma, oblique view,  $\times 4$ ; *f*, half of leaf base, lower side,  $\times 1$ ; *g*, prickles of near basal margin,  $\times 4$ ; *h*, leaf middle, lower side,  $\times 1$ ; *i*, leaf apex, lower side,  $\times 1$ ; *j*, leaf apex, upper side,  $\times 1$ .

leafy green bracts; lower bracts 5 cm wide, probably 60 cm long, linear lanceolate, attenuate, at midsection with 56 parallel secondary veins in each half, but no visible tertiary veins, at midsection the margins with heterogeneous subulate-serrulations, the large ones 0.5–2 mm apart and 0.3–0.4 mm long, stramineous, and between each pair of large teeth are 2–6 similar but much smaller and very unequal ones; the nearby midrib below with stramineous umbos 0.2 mm long, 0.3–2 mm apart, salient; syncarp 7.5 cm long, 6 cm in diameter, ellipsoid, bearing 68 drupes, these 2.6–3 cm long, 1.5–1.8 cm wide, 1.4–1.7 cm thick, oblanceoloid, 5–6-angled, the upper  $\frac{2}{3}$  free, the apex 4–6 mm wide, shallowly concave, the sides smooth, glaucous, gently convex, but near the apex with several secondary ridges on each side, the apex with 4–8 cordate pseudostigmas, these flush, irregular but mostly with their broad end touching the outer rim, and between them the intervals occupied by the brown papillose stigma which forms a disk on the concave apex and extends down the outer sides as numerous radial lobes 1–2.5 mm long, elliptic, mostly on the secondary ridges; endocarp in upper  $\frac{1}{3}$  and 9 mm long, bony, stramineous, transversely ellipsoid, the apex truncate, the base rounded, but extending only  $\frac{2}{3}$  way down over the seed cavity, lateral walls 4.5–5 mm thick, within smooth, shining; seed 7 mm in diameter, globose; apical mesocarp 5–7 mm long, pyramidal, concave truncate, with numerous strong longitudinal fibers and the upper part with parenchyma, the lower part with brown transverse membranes; basal mesocarp 16–18 mm long, soft fleshy, shrinking and drying black, the fibers delicate and scarcely discernible.

DESCRIPTION FROM (*Smith & Parham 16,549*): Slender tree 5 m tall; stem branched once or twice; leaves 1.62 m long, 4.4 cm wide near the base, 3.3 cm wide at the middle, thin coriaceous, U-sulcate, 2-pleated, above olive green, dull below and slightly paler green, at midsection with 37 parallel secondary veins in each half, the tertiary veins slightly oblique, seen above, forming narrow rhombic meshes, blade ligulate, but tapering in the outer  $\frac{1}{3}$  to a trigonous slender subulate apex, this at the point 10 cm down 11 mm wide, the base unarmed, pale; begin-

ning at 5 cm the margins with prickles 0.2–1 mm apart, diverse, large ones 0.5–1 mm long, arcuate ovate acute, ascending, stramineous, separated by 3–6-times as many irregular small ones 0.1–0.3 mm long, these conic or serrulate, divergent or slightly ascending; the midrib below unarmed for the lower  $\frac{4}{5}$ ; at midsection the margins with appressed serrulations 0.2 mm long, 2–9 mm apart, greenish with brown tips; on the subulate apex the margins and midrib with major serrulations 0.2 mm long, 0.5–1 mm apart, stramineous, and alternating with them smaller irregular ones; near the apex the pleats above with prickles 0.2–0.3 mm long, 0.5–2 mm apart, arcuate conic subulate, ascending, stramineous; infructescence axillary, bearing a solitary syncarp; peduncle 30 cm long, 14 mm in diameter, trigonous, bearing numerous leafy bracts; syncarp 10.5 cm long, 8.5 cm in diameter, ellipsoid; drupes 3.3–3.8 cm long, 1.6–2.1 cm wide, 1.3–1.7 cm thick, ellipsoid or narrowly so, 5–6-angled, the apex truncate concave, lower sides flat, upper  $\frac{1}{2}$  free, its sides gently convex, sloping upwards to the broad beak 2–3 mm high, its apex 4–8 mm wide, concave, containing 4–11 pseudostigmas, bony, cordate, some wholly in the concavity, some reaching the margin and extending as two ridges down the side of the beak; stigma single but filling the intervals between the pseudostigmas and with fingerlike lobes down the sides of the rostrum between the descending lobes of the pseudostigmas; endocarp slightly supramedian, bony, dull reddish brown, ellipsoid, filling most of the drupe interior, the apex subtruncate, with a convex central projection, lateral walls 3.5–5 mm thick, within tan colored, smooth, shining; seed 12 mm long, ellipsoid; apical mesocarp 5 mm long, solid with longitudinal fibers and parenchyma; basal mesocarp 6–7 mm long, fibrous and fleshy.

LECTOTYPE: Fiji Islands, Viti Levu, Mt. Korobamba, May, June, July, 1927, *H. E. Parks 20,345* (UC)! Isotypes (A, B, BISH, BM, C, CAS, F, G, K, MO, NY, P, US, W).

SPECIMENS EXAMINED: Fiji, Viti Levu, Rewa Dist., Mt. Korobaba, forest, 1,000 ft. alt., 21.4.69, *A. C. Smith, J. W. Parham et al. 16,549* (BISH).

DISCUSSION: Martelli accurately described the stigma which forms an interrupted disc on the concave apex and continues down the outer sides as numerous narrow rays. Then, inconsistently, he placed the species in the section *Lophostigma* which was characterized by Warburg (Engler's Pflanzenreich IV, 9: 44, 1900), as having a cristate or dentiform stigma projecting laterally. Brongniart's original sense of this section was preserved when it was recently typified (St. John, Pacif. Sci. 14: 226, 1960). *P. levuensis* cannot be left in this section. It is here transferred to the new section *Radiatistigma* which also contains *P. vitiensis* Martelli, of Fiji.

Martelli did not designate a holotype or follow the type method. He cited for his new species, *P. levuensis*, two collections from the island of Viti Levu. They are not conspecific. Consequently, one of them, Parks 20,345, is chosen, and here designated as the lectotype.

Stone (1967: 53) reduced *P. levuensis* to the synonymy of *P. vitiensis*.

8. *Pandanus vitiensis* Martelli, Univ. Calif. Publ. Bot. 12: 333, pl. 42, 1930; Stone, Biol. Soc. Wash., Proc. 80: 53–54, 1967.

(Section *Radiatistigma*)

Figure 346

NOM. VERN.: "ndraundreka" (Fijian lang.).

ORIGINAL DIAGNOSIS: "Arbor 10–15 m. alta, stipite non ramoso; (fide Parks). Folia non vidi. Syncarpium terminale, solitarium, erectum, pedunculo elongato, in sicco longitudinaliter rugoso, angustis spathis foliaceis subdistantibus vestito. Spathae decrescentes, crasse coriaceae, inferiores foliaceae; 40 cent. et ultra longae, 7 cent. latae, sublancoolato-attenuatae, acutae; spathae superiores breviores, late lanceolatae, acutae, concavo-subnaviculares, omnes utrinque crebre minute longitudinaliter venatae, basin versus leves; costa media, in pagina inferiore valida, angusta, acuta, prominens in parte basilaris levis et inermis, in parte superiore creberrime et minutissime serrata; marginibus basilaribus corneis et acute conduplicatis, inermibus, dein a denticulis creberrimis brevissimis acutis munitis in reliqua parte creberrime minutissime serratis. Syncarpium (11×15 cent.?) compactum latum et

conicum (fide Parks) vel potius globoso-conicum, fere ex 40 drupis constant. Drupae 5.5–6 cent. longae, 3–3.5 cent. crassae, acute hexagonae, faciebus latis, subaequalibus, in parte inferiore 4.5 cent. longa inter se connatae, cuneatae, acutae, fibrosae, in parte superiore liberae inter se divaricatae, leves pyramidatae, vix rotundatae, superne truncatae, vertice plus minusve lato, disciformi suborbiculari, subconcavo, et umbilicato; stigmata plurima verticalia et applicata subito infra marginem disci coronam formantia et in disco polyradiata. Endocarpium osseum 4 cent. longum, in parte media situm et totam latitudinem drupae explens, superne truncatum, inferne vix angustatum; cavitate seminifera in medio endocarpi posita, lata, circulari. Mesocarpium superum 1 cent. spissum, dense medullosa-fibrosum, inferum 1.5 cent. fibrosum."

EXPANDED DIAGNOSIS OF HOLOTYPE: Tree 10–15 m tall, unbranched; leaves 1.05–1.2 (+?) m long, 7–7.5 cm wide near the base and at the middle, coriaceous, above green and shiny, below pale green and apparently glaucous, U-sulcate, 2-pleated, at midsection with 73–74 parallel secondary veins in each half, the tertiary veins obscure, blade ligulate or sword-shaped, narrowing towards the tip (but the tip lost), the base unarmed, pale; beginning at 8 cm the margins with prickles 2–2.5 mm long, 2.5–6 mm apart, obliquely lance-subulate, compressed, strongly ascending, pale with red tips; the midrib below unarmed for the lower  $\frac{1}{4}$ ; at midsection the margins with prickles 1.5 mm long, 3–8 mm apart, subulate, closely appressed ascending, the base pale, the tip reddish brown; midrib below with prickles 1.3–1.5 mm long, 8–17 mm apart, subsigmoid lance-subulate, compressed, almost appressed ascending, stramineous with red tips; the apex missing; infructescence terminal, bearing a solitary syncarp; peduncle 36–40 cm long, 25 mm wide, clavate, trigonous, concealed by leafy green bracts, these becoming smaller upwards; lowest bract much more than 40 cm long, 7 cm wide, ligulate-lanceolate, attenuate, acute, uppermost bract 13 cm long, 7 cm wide, lanceolate, the margins and midrib below minutely subulate-serrulate; syncarp 16.5 cm long, 14 cm in diameter, ellipsoid-subglobose, bearing 52

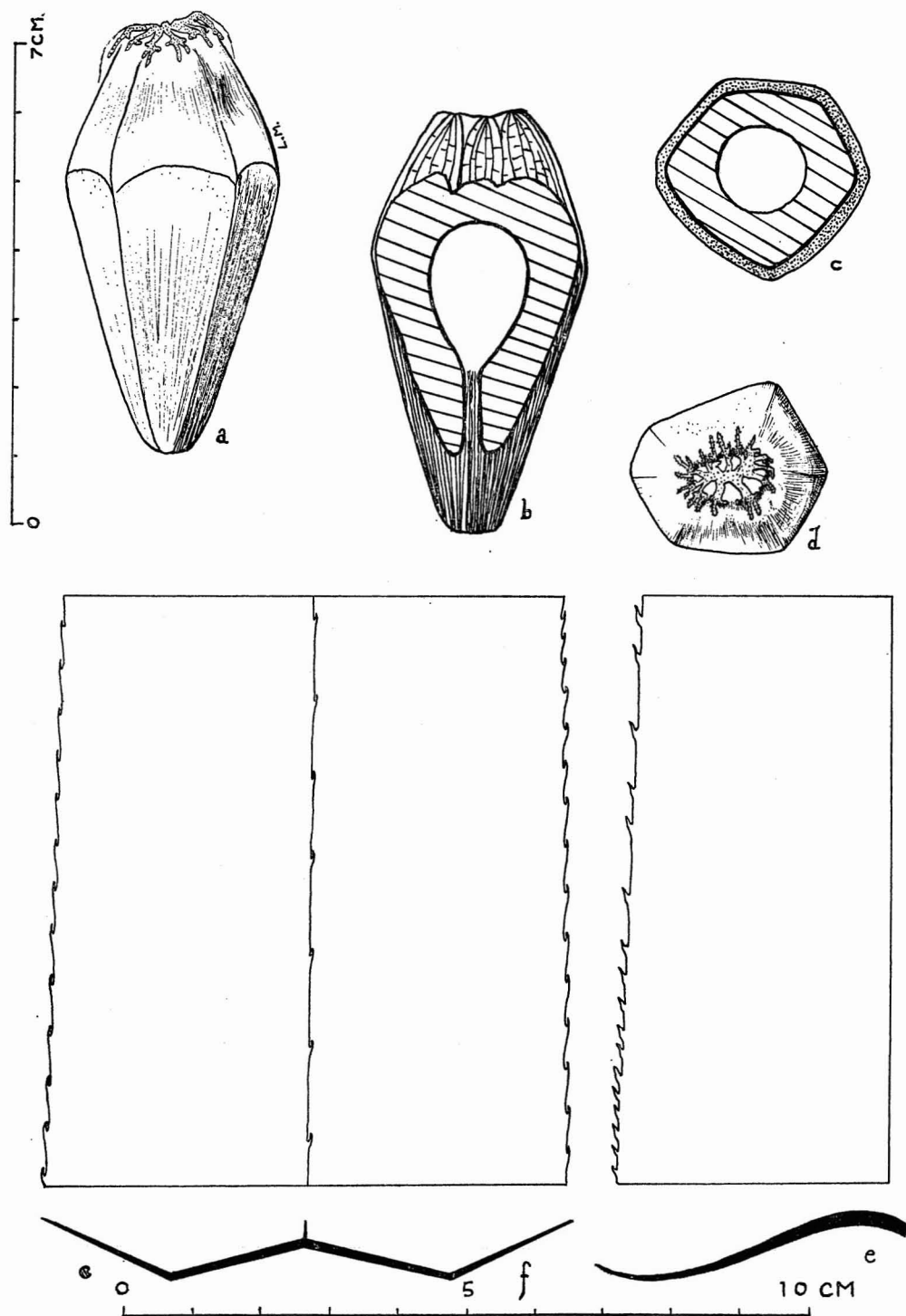


FIGURE 346. *Pandanus vitiensis* Martelli, from holotype. *a*, drupe, lateral view,  $\times 1$ ; *b*, drupe, longitudinal median section,  $\times 1$ ; *c*, drupe, transverse median section,  $\times 1$ ; *d*, drupe, with pseudostigmas and stigma, apical view,  $\times 1$ ; *e*, half of leaf base, lower side,  $\times 1$ ; *f*, leaf middle, lower side,  $\times 1$ .

drupes; dried core 6.3 cm long, 3.3 cm in diameter, the drupe scars 9–11 mm across, shallow hexagons; drupes 5.5–6 cm long, 2.7–3.5 cm wide, 2.6–3.2 cm thick, oblanceoloid, 5–6-angled, the base truncate, the apex 8–17 mm wide, concave, its hollow 1–2 mm deep, upper  $\frac{2}{3}$  free, smooth, glaucous and its sides from plane to gently convex, often with wavy brown longitudinal cracks near the summit, the angles sharp but not salient, from the rim of the concavity radiating inward are 5–10 pseudo-stigmas, all touching the rim or rarely some only interior, these 1–4 mm long, more or less cordate, bony, flush, yellowish brown, minutely papillose, and filling the intervals between these is the stigma, 14–25 mm in diameter, brown, papillose, the inner part polygonal to sub-discoid and filling the intersites of the apical concavity, and also extending as numerous narrow, mostly elliptic, lobes from 1–3 mm down the outer sides of the phalange, the whole resembling a radiating sunburst; endocarp slightly supramedian 30–35 mm long, bony, chestnut brown, turbinate, lateral walls 5–9 mm thick, within smooth, shining; carpel 1; the single seed 17 mm long, 13 mm in diameter, obovoid; apical mesocarp 10–12 mm long, undivided, a tissue of many longitudinal fibers and solid parenchyma; basal mesocarp 13–25 mm long, fibrous and fleshy.

EXPANDED DESCRIPTION FROM ALL SPECIMENS EXAMINED: Tree 5–15 m tall, 10–15 cm in diameter, without prop roots; leaves 1.8–3.3 m long, 7–8 cm wide at middle and base, the prickles as described on the type or (on *Setchell & Parks 15,054*) the margins beginning 5 cm from the base with polymorphic prickles, the large ones 0.8–1.5 mm long, 4–15 mm apart, oblique lanceolate, compressed, ascending, stramineous, and between them are numerous smaller prickles of several sizes, some similar in shape, some conic, and the smallest ones very minute; at midsection the marginal prickles similar to the basal ones but larger, and the large ones 1.8–2.2 mm long.

HOLOTYPE: Fiji Islands, Viti Levu, at Colo-i-Suva, at 300 m. alt., May, June, July 1927, *H. E. Parks 20,980* (uc)! Specimen examined.

Isotypes (A, B, BISH, BM, F, FI, G, K, MO, NY, S, US, W, Z)!

SPECIMENS EXAMINED: Fiji, Viti Levu, 1927, *J. W. Gillespie 3,734.5* (BISH, UC); Suva, febr. 1930, *A. Meebold 8,192* (M); along Prince's Road, near Colo-i-Suva, May 25, 1926, *W. A. Setchell & Parks 15,054* (A, BISH, C, G, NY, UC, US, W); Mba, s. slopes of Mt. Ndelainathovu, on the escarpment west of Nadarivatu, dense forest, 870–970 m. alt., June 26, 1947, *A. C. Smith 4,917* (A, BISH, K, US).

DISCUSSION: Apparently Martelli who described this very distinct species did not understand its structure. He did not mention its carpels or seeds, but he stated that it had many vertical stigmas, apical and extending like rays down the outer sides of the fruit. His plate 42 shows a longitudinal median section of a drupe and in it are clearly visible the solitary seed and the massive endocarp. He placed the species in his new section *Coronata*. This has the phalanges several-celled, and the stigmas placed like rays on the outer sides. He put three species in the section. Later the section was typified by one of the other two species, *P. corallinus* Martelli (St. John, Rev. *Pandanus* 5, in *Pacif. Sci.* 14: 228, 1960). In *Pandanus* the carpels are always 1-seeded, so the number of stigmas and the number of seeds or seed cavities is always identical. If the stigmatic lobes running down the outer sides of the fruit were separate stigmas, as Martelli thought, there should be within the fruit the same number of seeds as these numerous stigmatic lobes.

The 1-celled drupes of *P. vitiensis* with their apical, sunburstlike stigma are so very different from the others in section *Coronata* that it is here made the basis of a separate section. Martelli did not designate a holotype for this species, as he did not follow the type method. In this case he cited only the single collection, *Parks 20,980*, so it is automatically the type number. The whole series of this number was sent to Martelli by Setchell, then returned to the University of California. The collection there (uc) is a full, excellent specimen. Beside it are the original photographs and Martelli's handwritten manuscript. It seems proper to select the specimens at Berkeley, California (uc) as the holotype.