

Revision of the Genus *Pandanus* Stickman, Part 15 Malayan Species Described by H. N. Ridley

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AS IN MANY OTHER GENERA Henry N. Ridley, director of the Botanic Garden, Singapore, made noteworthy contributions to the knowledge of the Malayan species of *Pandanus*. His species were validly published in local journals or in his books. He described them briefly, usually giving some details of the stem, leaves, appearance of the syncarp, length of style, and width of the exposed tip of the drupes. He cited specimens but did not adopt the type method. None of his species were illustrated. The writer has investigated Ridley's species, sought the holotypes or has chosen lectotypes in the Singapore herbarium. These specimens were kindly made available by the present director, Dr. H. M. Burkill.

Ridley's species of *Pandanus* are nearly all good, and these are to be maintained. He placed most of his species in either the section *Rykia* or in *Acrostigma*. As will be noted in the treatment that follows, additional sections are to be found among his species. The large majority of Ridley's species are treated in this article; and the few remaining ones will be illustrated and described in subsequent parts when their type specimens have been located and studied.

SECTION *Acrostigma*

Pandanus aurantiacus Ridl., Roy. Asiat. Soc., Straits Branch, Jour. 41: 49 (1904) = 1903; Fl. Malay Penin. 5: 81, 1925; Martelli, Webbia 4(2): t. 30, figs. 10-13, 1914; (sect. *Acrostigma*)

Fig. 172

DIAGNOSIS OF LECTOTYPE: "Large branching shrub with stems 3.6 m. tall, 5-7.5 cm. through"; leaves "glaucous green"; the lower bracteal leaf 1.26 m long, 4.2 cm wide, coriaceous, 1-ribbed

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but 2-pleated and in section M-shaped, the blade sword-shaped, from the base gradually tapering to the approximately 20 cm long subulate apex which about 10 cm down is 1.5 mm wide, at midsection each side with 42 parallel secondary nerves, the base amplexicaul and unarmed but beginning 7-8 cm up the margins with serrations 0.6-0.9 mm long, 1-2.5 mm apart, pale; the midrib below from 21 cm up with serrations 0.3-0.5 mm long, 2-10 mm apart, subulate-tipped; at midsection the margins and midrib below with serrae 1-1.5 mm long, 1-3 mm apart; near the apex the margins and midrib below with rigid serrulations 0.4-0.6 mm long, 2-4 mm apart; pistillate inflorescence 43 cm long, 12-13 mm in diameter, trigonous, bracted, spicate, bearing in the terminal 20 cm 5 syncarps which are orange and subequal; syncarps 6-7 cm long, 5-5.5 cm in diameter, ovoid to broadly ellipsoid, bearing about 160 drupes, these 21-22 mm long, 3.5-5 mm wide, 3-4 mm thick, lower $\frac{2}{3}$ oblanceoloid, upper $\frac{1}{3}$ subulate, 4-6-angled, the body sides smooth, later with exposed fibers; pileus 10-11 mm long, of a lower half narrowly conic-pyramidal, the surface smooth, sharply angled, the angles continuing along the stout subulate style forming the upper half, arcuate proximally; stigma 3 mm long, linear, in a distal cleft running almost to the apex; endocarp centering in lower $\frac{1}{3}$, and 7-8 mm long, the walls pale, 0.3 mm thick; apical mesocarp a broad cavern 2 mm long; basal mesocarp fibrous up the sides, fleshy within.

EXPANDED DESCRIPTION: Shrub to 5 m tall; stem with the leaf scars inconspicuous; prop roots 60 cm long; leaves to 2 m long, 4-5 cm wide, above clear green, below paler and glaucous; foliage leaves little broadened at base, the margins beginning at 4 cm up with prickles 1.6-2 mm long, 2-5 mm apart, stout subulate, ascending; the midrib below beginning at 9

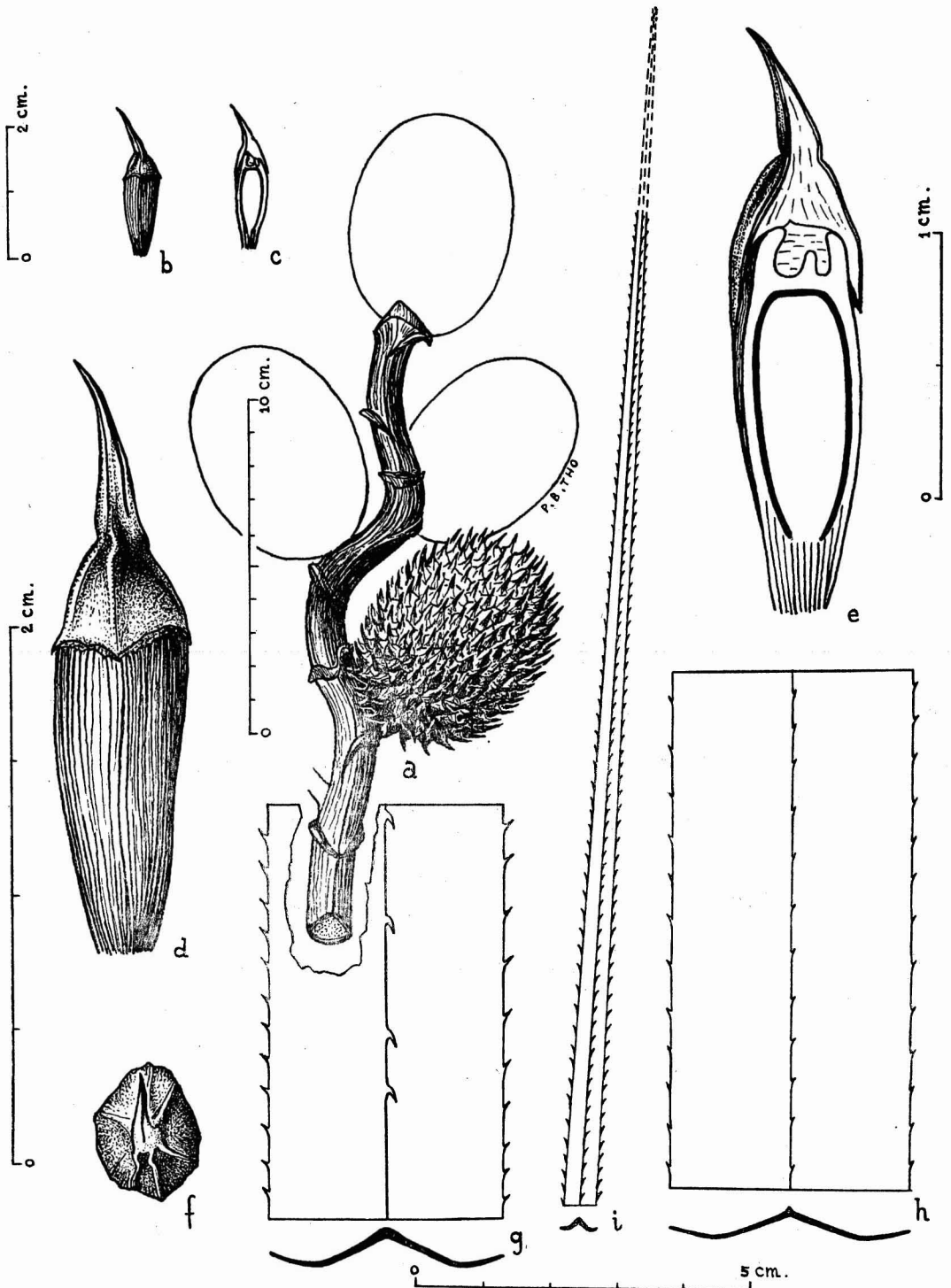


FIG. 172. *Pandanus aurantiacus* Ridl., from lectotype. *a*, Inflorescence, $\times \frac{1}{2}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.

cm with prickles 3–3.5 mm long, 8–20 mm apart, very stout subulate, strongly reflexed; pistillate scape 15–40 cm long, bearing 3–9 syncarps, these 5–7 cm long; drupes very hard until ripe when they become bright reddish orange and soft.

LECTOTYPE: Singapore, Bukit Timah [Bukit Mandai Road], 1894, *H. N. Ridley*, (SING). Specimen examined and herein designated as lectotype.

SPECIMENS EXAMINED: Singapore, Pasir Panjang, 17 Oct. 1912, *I. H. Burkill & M. R. Henderson* 6,802 (BO, SING). Malaya: Johore, Pulau Kukub, 1904, *H. N. Ridley* (paratype), (SING).

Ridley, when publishing this species, cited three collections and mentioned Sarawak, but did not designate a holotype. The most complete of his original specimens is here chosen as the lectotype.

Pandanus collinus Ridl., Mater. Fl. Malay Penin. 2: 228, 1907; Fl. Malay Penin. 5: 79, 1925; Martelli, Webbia 4(1): 10, 1913; (sect. *Acrostigma*)

Fig. 173

DIAGNOSIS OF LECTOTYPE: Shrub 1.2–2.1 m tall; stem at summit 6 mm in diameter, brownish, smooth; leaves 25–45 cm long, 8–11 mm wide, firm chartaceous, apparently pale green on both sides and flat except near the base where 2-pleated, 1-ribbed, above unarmed, at the middle with 10–11 secondary parallel veins in each half, below the tertiary cross veins barely visible, gradually narrowed in the last 10 cm to a subulate tip 15–20 mm long and 0.6–0.8 mm wide, the base amplexicaul, unarmed, blackish purple, beginning at 2 cm from the base the margins with prickles 0.7–1 mm long, 3–7 mm apart, subulate, ascending, yellowish but red-tipped; the midrib below unarmed to well beyond the middle; at mid-section the margins with subulate tipped serrulations 0.2–0.3 mm long, 1.5–3 mm apart, appressed ascending, red-tipped; near the apex the margins with serrulations 0.1–0.2 mm long, 0.3–0.5 mm apart; the midrib below with serrulations 0.2–0.3 mm long, 0.5–1.5 mm apart; pistillate inflorescence terminal, erect, bearing 1 head; peduncle 8 cm long, 3 mm in diameter,

bracted; syncarp 3 cm long, 2.5 cm in diameter, subglobose, bearing about 88 drupes, these 14–15 mm long, 4–5 mm wide, 3–4 mm thick, the body ellipsoid to obovoid, 5–6-angled, 10 mm long; pileus with the base 3.5–4 mm high, semiorbicular or slightly narrower, rather smooth, but with longitudinal ridges and lines; style 4–5 mm long, abruptly subulate, angled, sharply proximally curved, bony; stigma 3–4 mm long, elliptic-linear, brown, papillose, extending to the tip; endocarp centering in lower $\frac{1}{3}$ but extending to the base, the walls 0.1 mm thick, cartilaginous, stramineous; seed 7.5–8 mm long, lance-obovoid; upper mesocarp an oblate hemisphere, filled with white medullary membranes; basal mesocarp fibrous up the sides, fleshy within, sparse.

LECTOTYPE: Malaya, Kedah, Kedah Peak, woods, 1893, *H. N. Ridley*, (SING). Specimen examined and here designated as lectotype!

DISCUSSION: *P. collinus* belongs in the section *Acrostigma*. It was described by Ridley from three collections from Malaya. The best of these and the one labeled *P. collinus!* by Ridley is here chosen as the lectotype. Contrasting differences are given for this in our treatment of *P. alticola*.

Pandanus glaucophyllus Ridl., Roy. Asiat. Soc., Straits Branch, Jour. 41: 50, (1904) = 1903; (sect. *Acrostigma*)

Fig. 174

DIAGNOSIS OF HOLOTYPE: "Stems 3–4 m. tall, 12–25 mm. in diameter," the internodes brown to yellowish, smooth, mostly higher than the nodes; leaves 52–60 "or more" cm long, near the base about 4 cm wide, near the apex 5.7–6.5 cm wide, appearing narrowly oblong, rather flaccid and when dry chartaceous, glaucous, 1-ribbed but 2-pleated and in section low M-shaped, the secondary parallel veins conspicuous and 34 of them in each half, the apex abruptly contracted to a 6–7 cm trigonus subulate caudate prolongation which near its base is 1 mm wide, the base of the blade amplexicaul and unarmed, but beginning at 4 cm up the margins with prickles 0.5–0.8 mm long, 1–3 mm apart, slender subulate, pale, ascending or diverging and some of them doubles or triples; the midrib

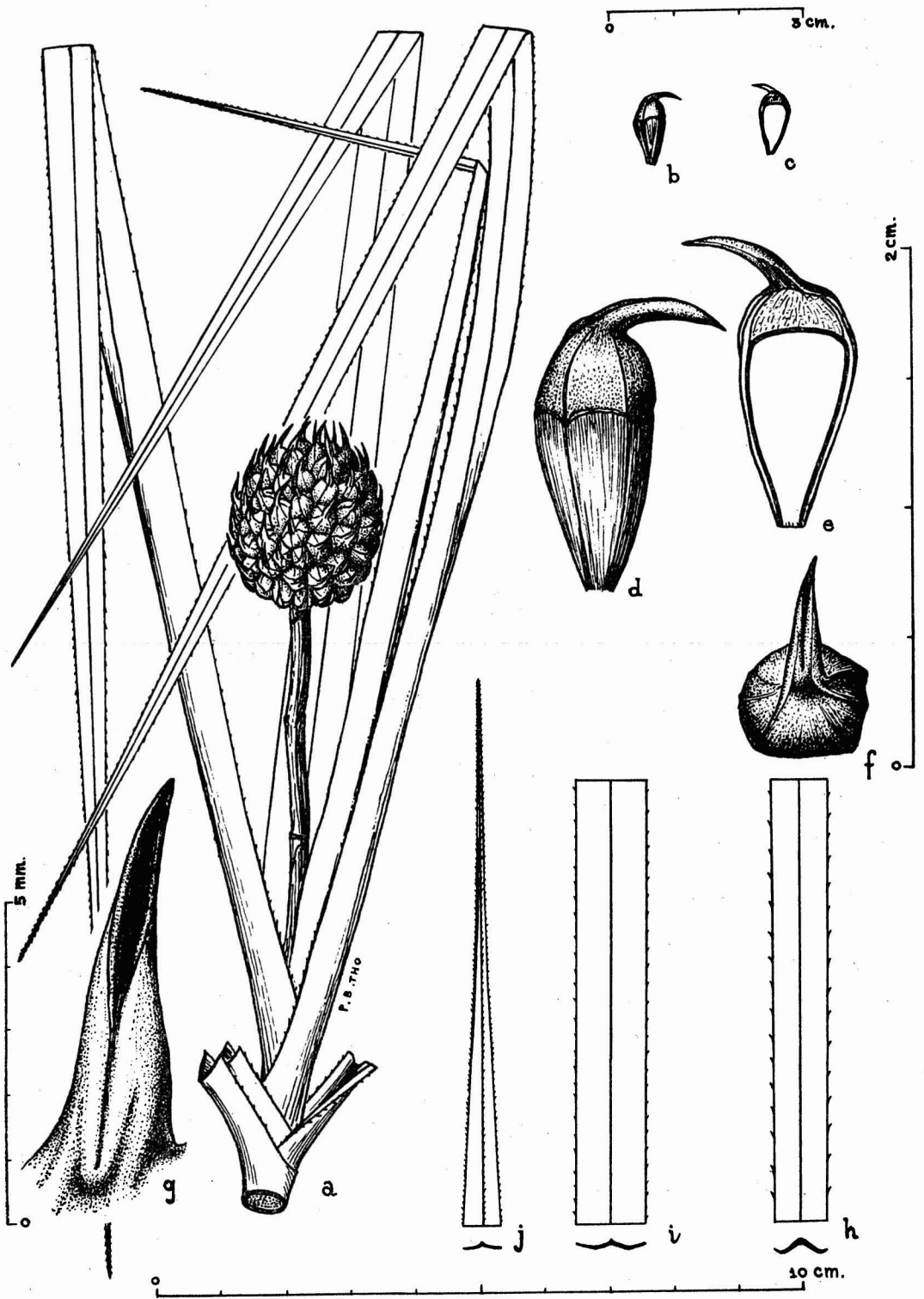


FIG. 173. *Pandanus collinus* Ridl., from lectotype. *a*, Habit and syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, style and stigma, distal view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

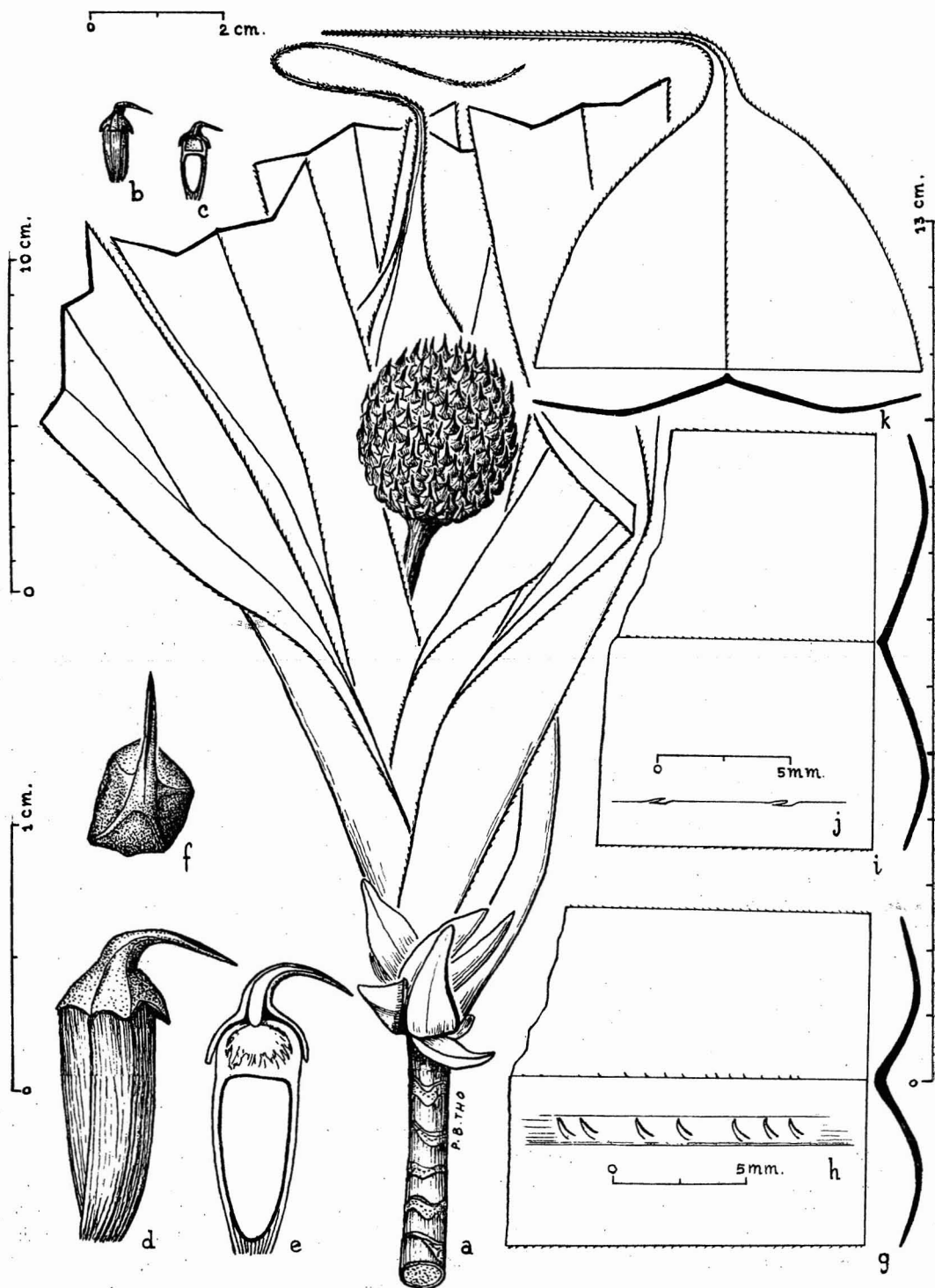


FIG. 174. *Pandanus glaucophyllus* Ridl., from holotype. *a*, Habit and syncarp, $\times \frac{1}{2}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, leaf base, lower side, $\times 1$; *h*, midrib, lower side, near base, $\times 4$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf margin, near middle, $\times 4$; *k*, leaf apex, lower side, $\times 1$.

below beginning at 4–9 cm with prickles 0.8–1 mm long, 0.5–6 mm apart, slender subulate, brownish, ascending, oblique, closely appressed; at midsection the margins with prickles 0.5–0.7 mm long, 1–3 mm apart, slender subulate, ascending flat appressed and occupying recesses in the margin; the midrib below glabrous or with a few prickles like those lower down; at the bend of the apical contraction the margins with prickles 0.6–0.8 mm long, 0.6–1.5 mm apart, slender subulate, somewhat ascending or divergent; the midrib with prickles 0.6–1 mm long, 1–2 mm apart, arcuate subulate, ascending; on the caudate tip the margins and midrib below with prickles 0.3–0.7 mm long, 0.3–1.5 mm apart, stout arcuate subulate, ascending; pistillate peduncle 8 cm long, 7 mm in diameter, erect, bearing a single syncarp 5.7 cm long, 4.5 cm in diameter, broadly ellipsoid, bearing about 320 drupes, these 12–13 mm long (or 16–18 mm following the curve of the stigma), 5–6 mm wide, 3.5–4.5 mm thick, the body narrowly oblong ellipsoid, 5–6-angled, the sides smooth; pileus smooth, the base 3–3.5 mm long, conical or broadly so, bearing the terminal style 5–6.5 mm long, stout subulate, strongly curved proximally, having a distal cleft nearly its whole length in which is the stigma 3–4 mm long, linear, brown, papillose, running to the tip; endocarp pale brownish, centering in the lower $\frac{1}{3}$, its walls 0.1 mm thick; seeds 7–8 mm long, oblance-oblong; apical mesocarp a cavern 2–2.5 mm long, invaded by trichomes and hairs; basal mesocarp with fibers up the sides and the center fleshy.

HOLOTYPE: Malaya, "Perak, Thaiping Hills, in dense forest about 2500 feet altitude," above tea border, Dec. 1898, *H. N. Ridley* (SING). Holotype examined!

Pandanus parvus Ridl., Roy. Asiat. Soc., Straits Branch, Jour. 33: 71, Jan. 1900; Fl. Malay Penin. 5: 78, 1925; *P. flagellifer* Warb., in Engler's Pflanzenreich IV, 9: 80, Dec. 21, 1900; Martelli, Webbia 4(1): 14, 1913; 4(2): t. 33, f. 7, 1914; (sect. *Acrostigma*)

Figs. 175, 176

DIAGNOSIS OF HOLOTYPE: "Stem 2.92 cm. tall, 12 mm. in diameter, slender, branched

above," rooting throughout; leaves 27–37 cm long, near the tip 32–36 mm broad, near the base 16–20 mm broad, appearing ligulate, but actually tapering downwards, thin subcoriaceous, dark green above, pale and glaucous beneath, 2-pleated and in section low M-shaped but only 1-ribbed, the midrib below narrow and raised, the secondary parallel veins prominent throughout, and at midsection 18–21 on a side, the tertiary cross veins faintly visible below near the tip, making small squarish meshes, near the apex abruptly rounded contracted to a 3–6 cm caudate deltoid subulate tip 0.8 mm wide, the base amplexicaul, unarmed for 4–5 cm, then the margins with prickles 0.7–1.3 mm long, 2–7 mm apart, slender subulate, straight or slightly curved, brownish, ascending; the midrib below unarmed to near the apex; at midsection the margins with similar prickles 0.5–1 mm long, 4–12 mm apart; on the rounded apical contraction the margins with prickles 0.5–0.8 mm long, 0.5–2 mm apart, stouter subulate, slightly ascending; the midrib below with prickles 0.8–1.4 mm long, 1–7 mm apart, arcuate subulate, slightly ascending; on the caudate tip the margins and midrib below with stout prickles 0.3–0.8 mm long, 0.5–1.5 mm apart, subulate, arcuate, ascending; in the series of bracteal leaves the first several 2–4 cm long, lance-navicular, entire; pistillate inflorescence 1-headed; peduncle 5 cm long, 4–5 mm in diameter, 3-angled, few bracted; syncarp erect, 3.5 cm long, 3.3 cm in diameter, ovoid-globose, bearing about 150 drupes, these 11–12 mm long or following the curve 14–15 mm long, 3.5–5.5 mm wide, 2.5–3.5 mm thick, fusiform, the body 7–8 mm long, oblanceoloid, the surface smooth, later fibrous; pileus smooth, apparently glaucous, 9–10 mm long, the base oblong-pyramidal and with the apex oblique and proximally curved, tapering into a hornlike style which is 5–6 mm long, all (except the apical ones) sharply proximally curved, stigma 4–5 mm long, lance-linear, dark brown, papillose, extending to the tip; endocarp in lower $\frac{1}{4}$, stramineous, bony, the walls 0.3 mm thick, and the lateral walls extending upwards to bound the apical cavity; seed 5 mm long, oblanceoloid, truncate at tip; apical mesocarp a cavern filled with white medullary ascending hairs; basal mesocarp sparse, fibrous and fleshy.

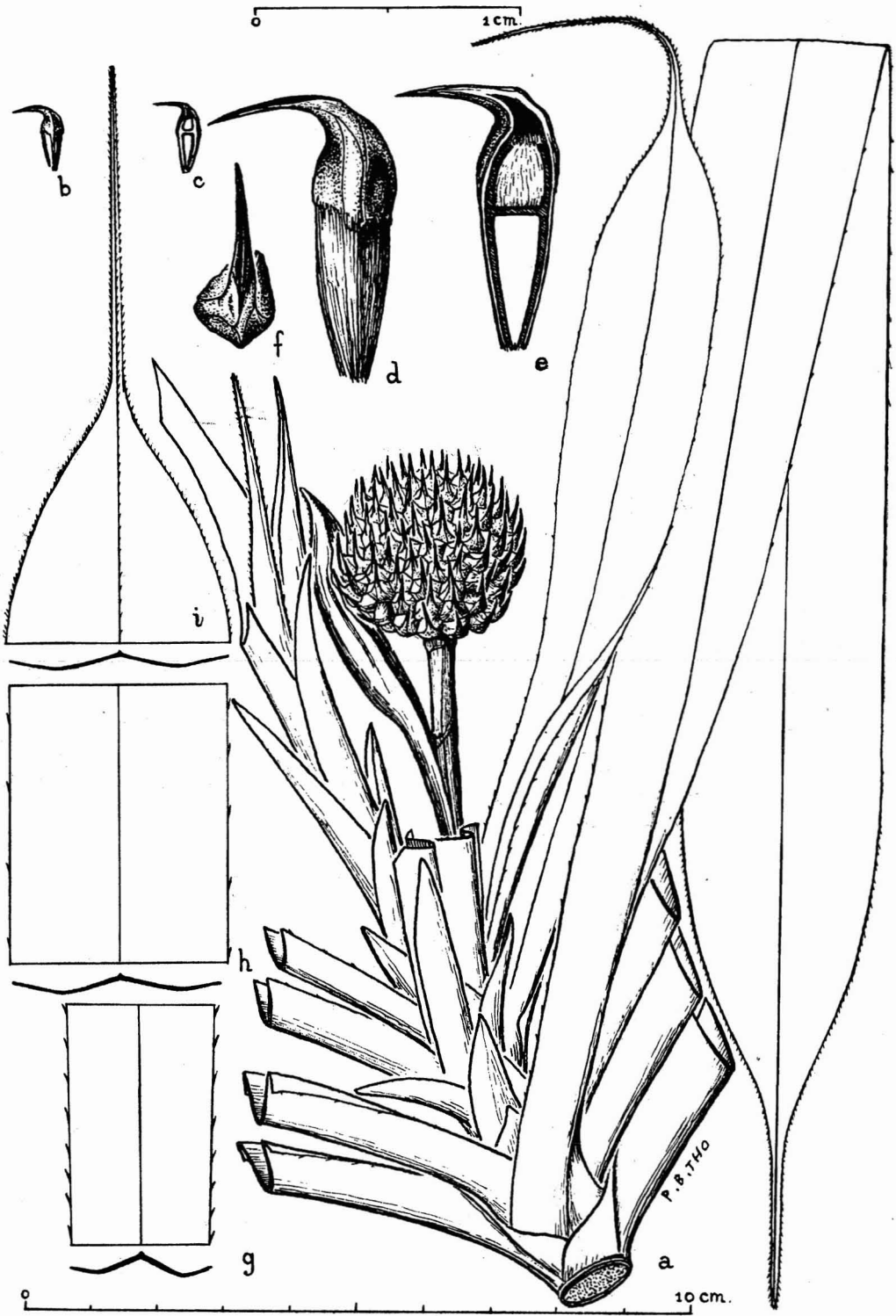


FIG. 175. *Pandanus parvus* Ridl., from holotype. *a*, Habit and syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe and stigma, apical view, $\times 4$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.

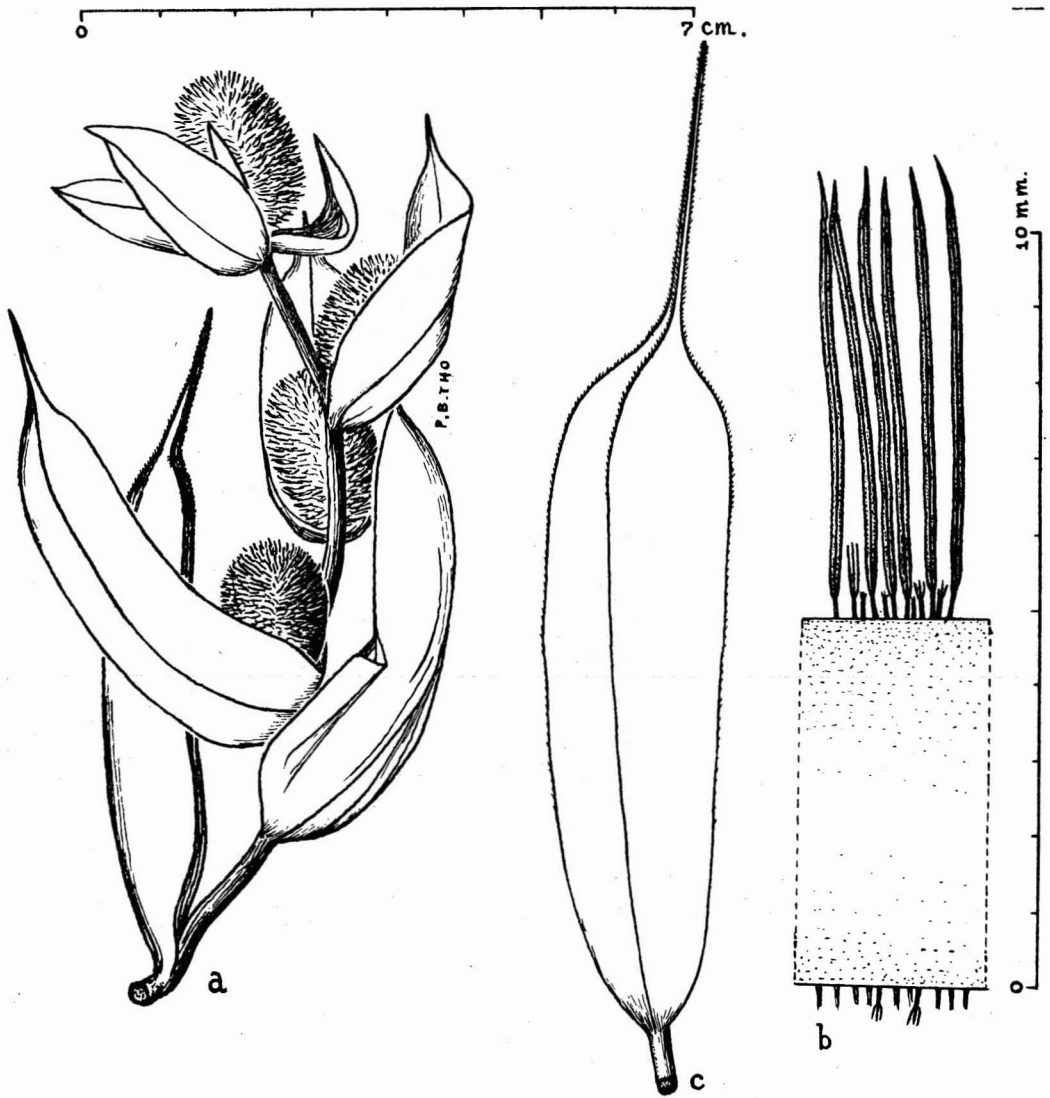


FIG. 176. *Pandanus parvus* Ridl., from Singapore, cult., 1895, H. N. Ridley. *a*, Staminate inflorescence, $\times 1$; *b*, stamens, lateral view, $\times 10$; *c*, floral bract, lateral view, $\times 1$.

EXPANDED DESCRIPTION: Pistillate stems 0.8–2.92 m tall, 6–12 mm in diameter; prop roots up to 50 cm long, 4–5 mm in diameter, smooth, green to brown, nearly vertical; leaves 27–50 cm long, 21–48 mm wide, the caudate apex 3–9 cm long; peduncle 5–12 cm long; syncarp 2.5–4 cm long, 2.5–3.3 cm in diameter, globose or ovoid-globose.

DESCRIPTION OF STAMINATE PLANT: Staminate inflorescence 15–18 cm long, bracts white and somewhat fleshy; peduncle 3–4 mm in diameter, fleshy, soon withering and caducous; lowest bracts 8–13 cm long, 26–30 mm wide, sterile, the body 6–9 cm long, navicular, with prominent parallel veins, the lower half with margins unarmed; near the apex the margins

with prickles 0.5–1 mm long, 0.3–1 mm apart, subulate, diverging or subascending; the midrib with stouter prickles 0.7–1 mm long, 0.5–1 mm apart, slightly ascending; on the caudate tip the margins and midrib below with prickles 0.5–0.9 mm long, 0.5–1 mm apart, arcuate subulate, ascending; median bracts 3–4.5 cm long, 1.6–2.4 cm wide, lanceolate, the margins and the midrib below towards apex minutely prickly; spikes 5–8 and 1.5–2.5 cm long, 0.8–1.3 cm in diameter, ellipsoid, dense; stamens very numerous, attached singly and directly to the axis; filament 0.2 mm long; anther 4.5–5 mm long, 0.2 mm wide, bearing an apical subulate prolongation of the connective 0.4–0.7 mm long.

HOLOTYPE: Singapore, Kranji, 1892, *H. N. R[idley]*, (SING). Holotype examined!

SPECIMENS EXAMINED: Singapore, Hinterindien, Dec. 16, 1905, *A. Engler* 3,862 (B); Singapore, Bidadari, 1898, *H. N. R[idley]* 9, 171 (FI); Singapore, cult., first male flowers seen, 1895, *H. N. R[idley]*, (FI, SING); without collector, ex Hb. (SING), Forest Iurong, low growing plant, Jan. 10, 1889, *Flora of Singapore* 92 (B), the holotype of *P. flagellifer*.

Malaya: Johore, Sungei Pelepah Kiri, 26 June 1928, *E. J. H. Corner* 35,556 (SING).

Pandanus perakensis Ridl., Mat. Fl. Malay Penin. 2: 231, 1907; Fl. Malay Penin. 5: 81, 1925; (sect. *Acrostigma*)

Fig. 177

DIAGNOSIS OF LECTOTYPE: (Probably acaulescent); leaves 1.5–1.8 m long, 2–3.6 cm wide, subcoriaceous, light green, linear, rather abruptly narrowed to the 9 cm subulate, trigonous apex, this 10 cm down 6 mm wide, in section the blade M-shaped, at midsection with 39–41 secondary veins in each half; near the base the margins with spines 2–3 mm long, 5–13 mm apart, stout subulate, arcuate, pale, broad based, ascending; the nearby midrib below with spines 2.5–3 mm long, 6–13 mm apart, similar but even thicker subulate and reflexed; at midsection the margins with subulate-tipped serrae 0.5–1.5 mm long, 4–8 mm apart, the midrib below with prickles 0.5–1 mm long, 8–15 mm apart, subulate; near the apex the margins with

serrulations 0.3–0.5 mm long, 2–3 mm apart; the midrib below with similar ones but 2–4 mm apart; peduncle 15 cm long, 8–9 mm in diameter, straight, bracted; syncarps 3–4, spicate, crowded, 4.5–6.5 cm long, 3.5–4.5 cm in diameter, elliptic-cylindric (rarely subglobose), appearing spiny from the numerous curved ascending styles (but a few at the very base reflexed), bearing about 430 drupes; drupes 20–22 mm long, 5–6 mm wide, 4–5 mm thick, oblong-fusiform, compressed, apparently green, upper ½ free, the body 13–14 mm long, oblongoid, the apex truncate, pileus at last shedding, the base semiorbicular, bearing a style 6–7 mm long, stout subulate, ridge angled, gently arcuate towards apex of syncarp; stigma 4–5 mm long, linear, distal, running to the very apex; endocarp 6–7 mm long, centering in lower ⅓, ellipsoid, truncate, stramineous, cartilaginous, the sides 0.15 mm thick; apical mesocarp 3–3.5 mm long, a fat discoid cavern with a few white membranes; basal mesocarp fibrous along the margins, fleshy within.

EXPANDED DESCRIPTION: Pistillate plants with peduncle 13–15 cm long; syncarps 2–3 and 4.5–7 cm long, 3.5–5.5 cm in diameter.

LECTOTYPE: Malaya, "Perak, Maxwell's Hill"; June 1893, *H. N. R[idley]*, (SING). Lectotype examined!

SPECIMENS EXAMINED: Malaya, Pahang, Kuala Lipis, 1892, *A. S. Machado* 11,633 (SING); Kedah, Baling Hill, 21 Nov. 1941, *E. J. H. Corner* & *J. C. Nauen* (SING).

Pandanus spinulosus (Ridl.) comb. nov. (sect. *Acrostigma*); *P. collinus* Ridl. var. *spinulosus* Ridl., Fl. Malay Penin. 5: 79, 1925.

Fig. 178

DIAGNOSIS OF HOLOTYPE: Stem slender, just below the leaves 4 mm in diameter; leaves 67–68 cm long, 16 mm wide, subcoriaceous, green above, below paler and apparently somewhat glaucous, with a central furrow over the midrib, 2-pleated, and towards the tip the 2 pleats spinulose above, at midsection with 16–18 parallel secondary veins in each half, these prominent throughout, below the tertiary cross veins visible, remote and forming elongate meshes, the blade ligulate, in outer ⅓ tapering

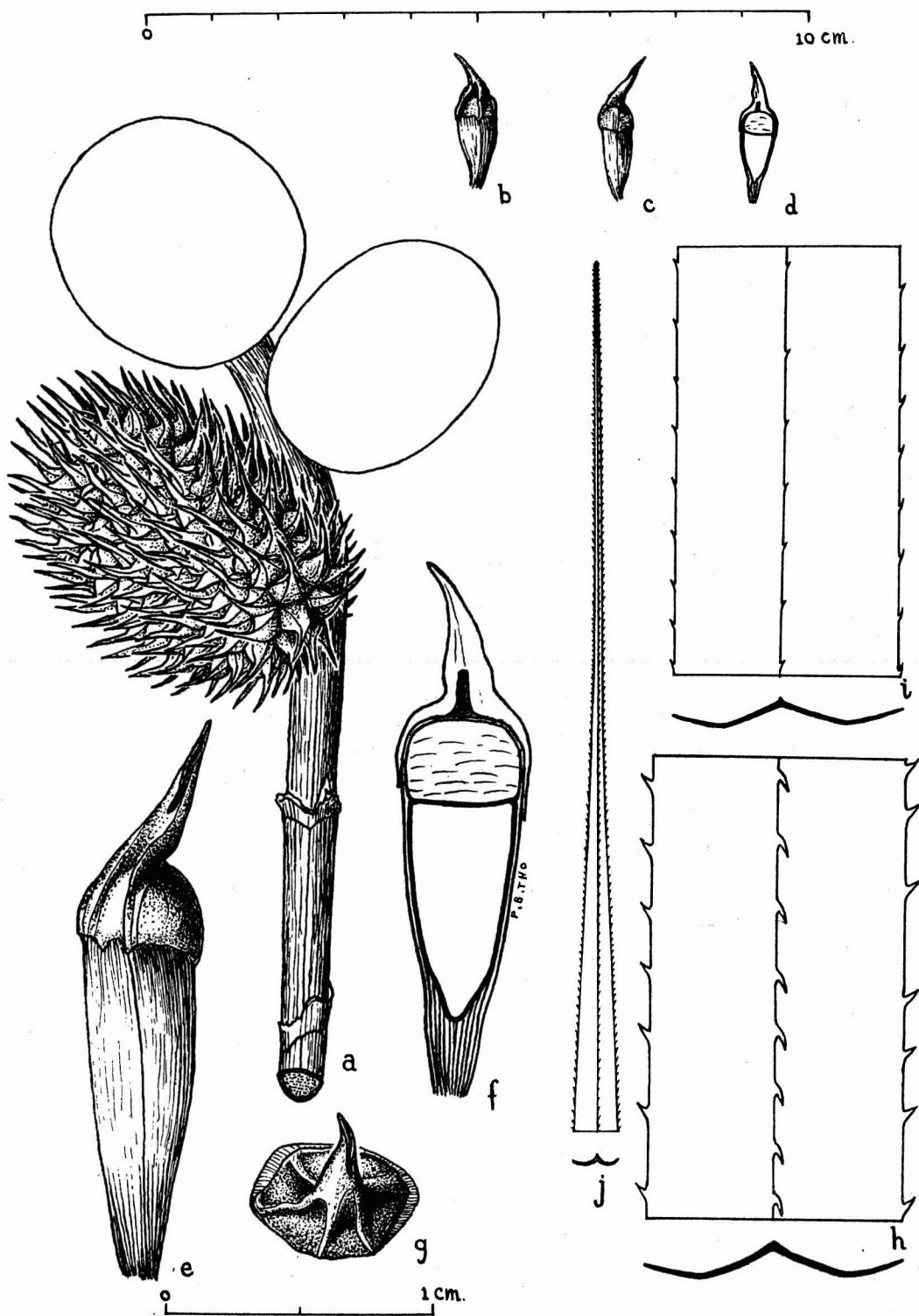


FIG. 177. *Pandanus perakensis* Ridl., from lectotype. *a*, Infructescence, $\times 1$; *b*, *c*, drupe, lateral view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e*, drupe, lateral view, $\times 4$; *f*, drupe, longitudinal median section, $\times 4$; *g*, drupe, style, and stigma, apical view, $\times 4$; *b*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

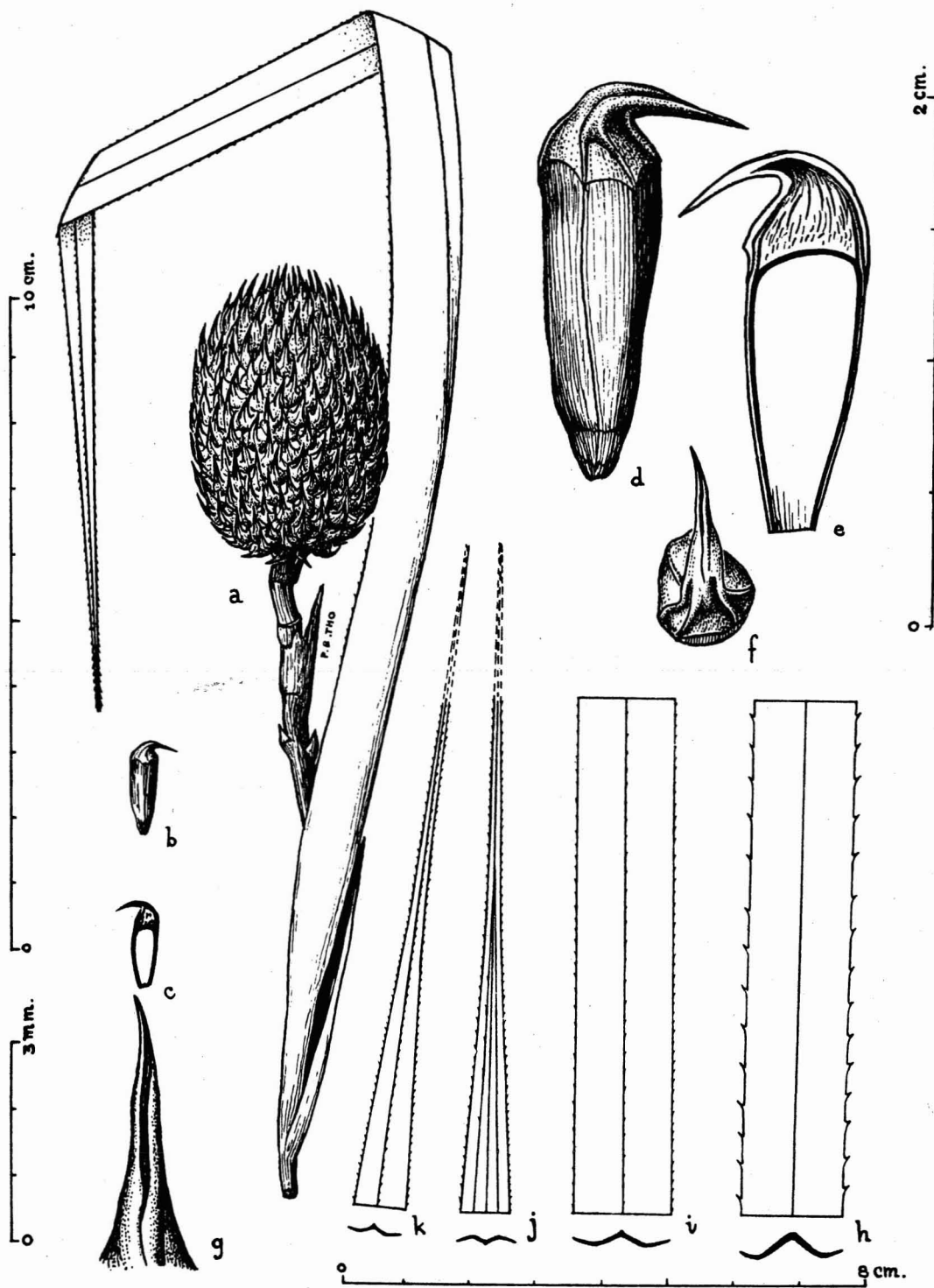


FIG. 178. *Pandanus spinulosus* (Ridl.) St. John, from holotype. *a*, Inflorescence, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, style and stigma, lateral view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, upper side, $\times 1$; *k*, leaf apex, lower side, $\times 1$.

0 3 cm.

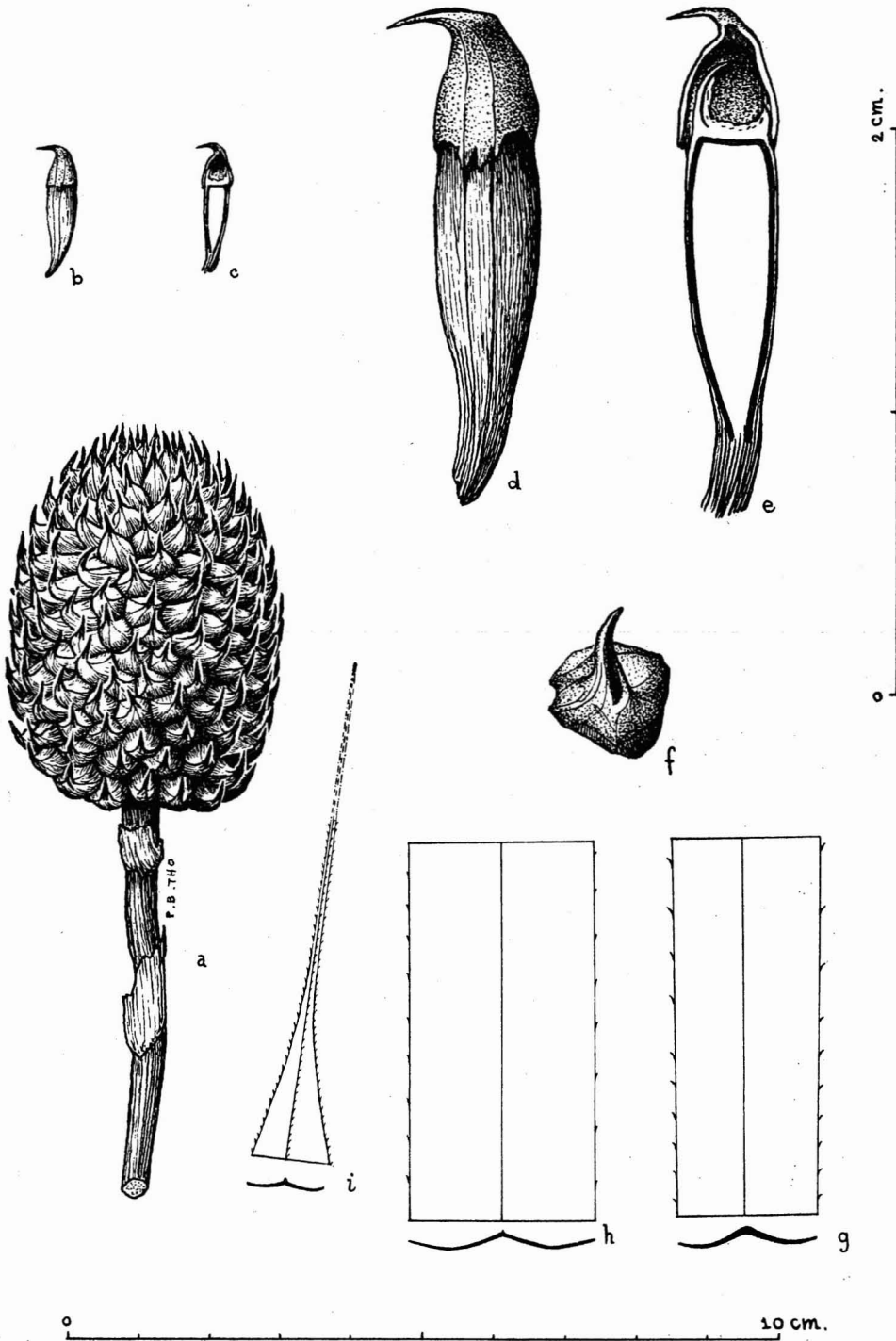


FIG. 179. *Pandanus unguiculatus* Ridl., from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.

gradually to the subulate, deltoid apex about 3 cm long and 1.5 mm wide, the base amplexicaul, unarmed, partly dark purple, beginning at 4 cm up the margins with prickles 0.7–1.5 mm long, 3–5 mm apart, subulate, ascending at 45°, the base thickened, pale; the midrib below unarmed to beyond the middle; at midsection the margins with prickles 0.7–0.9 mm long, 2–4 mm apart, subulate, ascending; near the tip the margins and midrib below with subulate serrations 0.4–0.6 mm long, 0.7–1 mm apart; pistillate inflorescence erect, bearing a single syncarp; peduncle 10 cm long, 4–5 mm in diameter, 3-sided, bracteate; syncarp 4.5 cm long, 3.1 cm in diameter, oblong-ellipsoid, bearing about 120 drupes, these 15–17 mm long, 3–4.5 mm wide and thick, pale green, fusiform but the upper end contracted and more slender, 5–6-angled, the body 11–12 mm long; pileus 8–9 mm long, the base 2.5–3 mm high, narrowly semiorbicular, with 5–6 sharp angles, these mostly single; style 5–5.5 mm long, sharply curved proximally, flattened and ridged below, pale, bony; stigma 3–4 mm long, distal, linear, running to the apex, brown, papillose; endocarp centering in lower $\frac{1}{3}$, but extending to the base, the walls 0.1 mm thick, cartilaginous, pale; seed 8–9 mm long, extending to the base; apical mesocarp spherical, filled with white, medullary membranes; basal mesocarp sparse, fibrous.

HOLOTYPE: Malaya, Kelantan, along the ridge of Gunong Sitong, 2,500 ft. alt., 6 March 1924, *Mohamed Nur & Foxworthy 12,252* (SING).

DISCUSSION: *P. spinulosus* is a member of the section *Acrostigma*, and in that section is found its closest relative, *P. collinus* Ridl., which species has the leaves 25–45 cm long, 8–11 mm wide, unarmed above, each half at midsection with 10–11 secondary parallel veins, at midsection the margins with subulate-serrations 0.2–0.3 mm long; syncarp 3 cm long; drupes 14–15 mm long, the pileus base hemispheric, abruptly contracted to the subulate style which is 4–5 mm long. *P. spinulosus* has the leaves 67–68 cm long, 16 mm wide, above towards the tip the two pleats spinulose, at midsection with 16–18 secondary parallel veins in each half, at midsection the margins with subulate prickles 0.7–0.9 mm long; syncarp 4.5 cm long; drupes

15–17 mm long, the pileus base narrowly hemispheric, gradually tapering into the thick subulate style which is 5–5.5 mm long.

Pandanus unguiculatus Ridl., Mat. Fl. Malay Penin. 2: 229, 1907; Fl. Malay Penin. 5: 78, 1925; (sect. *Acrostigma*)

Fig. 179

DIAGNOSIS OF HOLOTYPE: "Plant small"; leaves 26–48.5 cm long, near the base 2–2.3 cm wide, near the middle 2.4–2.7 cm wide, ligulate, but perceptibly tapering both ways from the middle, dark green above, pale green below, thick chartaceous, only the midrib thickened, but the blade pleated and M-shaped in section, the secondary parallel veins conspicuous, at midsection 17–19 in each side, the tertiary cross veins visible in upper third below, oblique, forming short, rather oblong meshes; near the apex abruptly contracted to a subulate tip more than 20–25 mm long, 0.9 mm wide, the base amplexicaul and entire but beginning at 4–5 cm the margins with prickles 0.7–1 mm long, 2–6 mm apart, subulate, ascending, pale; the midrib unarmed for lower $\frac{2}{3}$'s; at the midsection the margins with prickles 0.5–0.7 mm long, 2–5 mm apart, subulate, appressed ascending, "red-tipped" but when dried brownish; near the apex the margins and midrib below with subulate-tipped serrations 0.2–0.3 mm long, 0.5–2 mm apart; peduncle 5 cm or more long, 4 mm in diameter, bracted; syncarp single, 5.5 cm long, 4 cm in diameter, broad ellipsoid, bearing about 220 drupes, these 16–18 mm long (or 18–20 mm, following the curve), 4–5 mm wide, 3.5–4 mm thick, oblance-fusiform, the body 14–15 mm long, narrowly ellipsoid; the pileus smooth, pyramidal-ovoid, 5–7 mm high, tapering into the hornlike style which is 2.5–3 mm long, mostly upwards curved to about right angles; stigma 2.5–3.5 mm long, distal, linear, papillose, brown; endocarp slightly submedian, 9–11 mm long, oblanceoloid, the apex truncate, but with ascending shoulders partly surrounding the apical cavity, stramineous, cartilaginous, the lateral walls 0.15 mm thick; seed 7–8 mm long; apical mesocarp forming a broadly ovoid cavern with a few white medullary membranes; basal mesocarp scant, fibrous and fleshy.

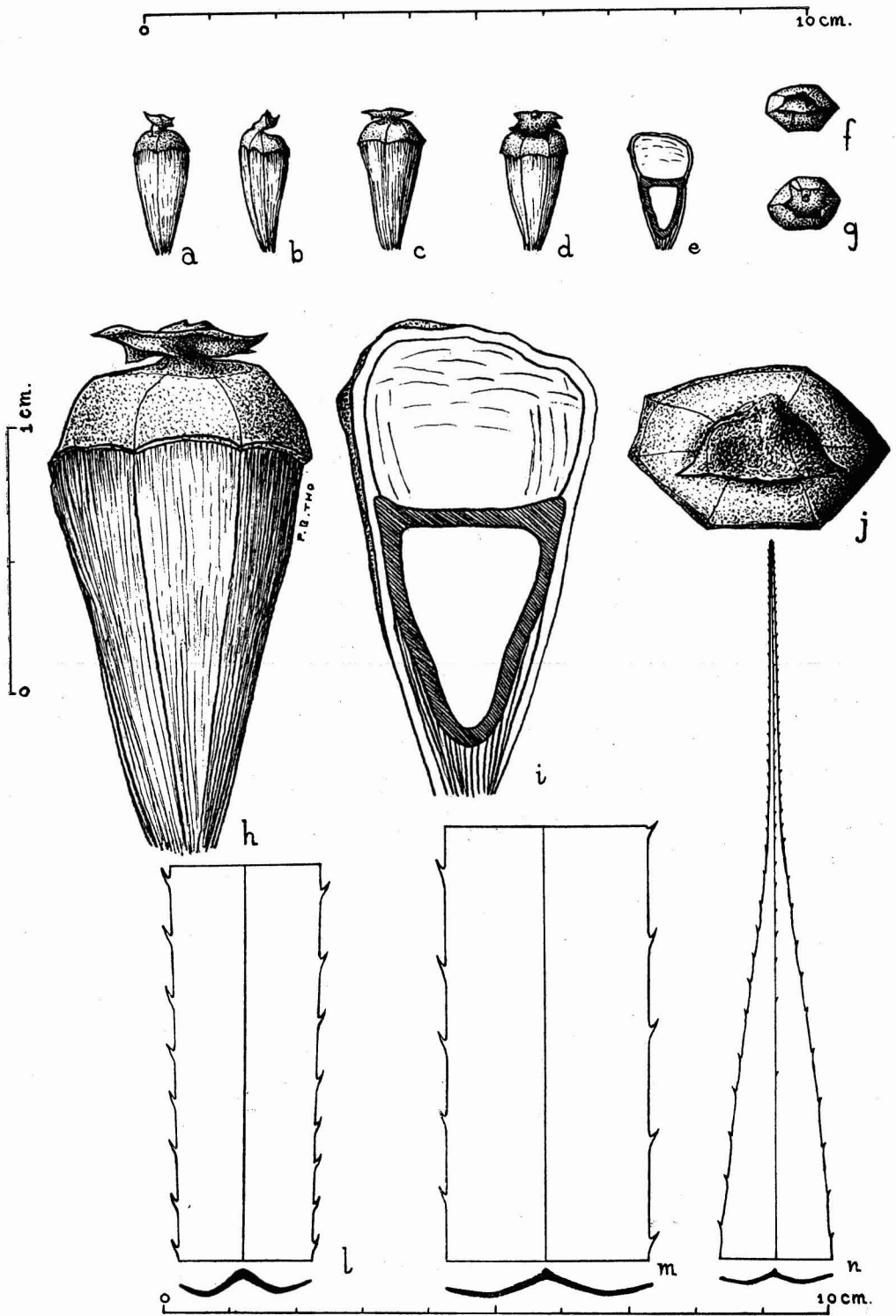


FIG. 180. *Pandanus stelliger* Ridl., from lectotype. *a-d*, Drupe, lateral view, $\times 1$; *e*, drupe, longitudinal median section, $\times 1$; *f*, *g*, drupe and stigma, apical view, $\times 1$; *h*, drupe, lateral view, $\times 4$; *i*, drupe, longitudinal median section, $\times 4$; *j*, drupe and stigma, apical view, $\times 4$; *l*, leaf base, lower side, $\times 1$; *m*, leaf middle, lower side, $\times 1$; *n*, leaf apex, lower side, $\times 1$.

EXPANDED DESCRIPTION FROM ALL SPECIMENS EXAMINED: Stems up to 1.8 m tall, 9–13 mm in diameter, smooth, yellowish, erect or ascending, with aerial roots; leaves arching outward and the tips pendent, glaucous below, the subulate tip 20–46 mm long; inflorescence erect; peduncle 5–6 cm long.

HOLOTYPE: Malaya, Selangor, Bukit Kutu, May 1896, *H. N. R[idley]* 7,659 (SING). Holotype examined!

SPECIMENS EXAMINED: Malaya, Pahang, Fraser's Hill, 19 Aug. 1937, *E. J. H. Corner* 33,233 (SING).

SECTION *Asterostigma*

Pandanus stelliger Ridl., Roy. Asiat. Soc., Straits Branch, Jour. 41: 49–50, (1904) = 1903; Fl. Malay Penin. 5: 76, 1925; Martelli, *Webbia* 4(2): t. 26, f. 1–2a, 1914; (sect. *Asterostigma*)

Figs. 180, 181

DESCRIPTION OF LECTOTYPE: Shrub 1.5–3.3 m tall, the slender stems pale brown, 2.5 cm in diameter, branched, bearing a few mucros; leaves dark green, 55–60 cm long, near the base



FIG. 181. *Pandanus stelliger* Ridl., from lectotype, habit and infructescence, $\times \frac{1}{2}$.

1.8 cm wide, near the middle 2.8–3.8 cm wide, in section with a broad, central channel, and hence M-shaped, the secondary parallel veins at midsection 19–20 in each half, prominent, the tertiary cross veins visible below, transverse or oblique, forming short, somewhat oblong meshes, the actual base amplexicaul and unarmed, but beginning at 2–2.5 cm the margins with prickles 1.5–2.5 mm long, 4–9 mm apart, broad subulate, ascending, pale; the midrib unarmed except near the tip; at midsection the margins with prickles 2.1–2.5 mm long, 7–23 mm apart, similar; near the 3–8 cm apex the margins and midrib below with serrulations 0.2–0.3 mm long, 2–6 mm apart, brown; peduncle terminal, 5 cm long, leafy bracted, bearing 4 syncarps in a dense spike about 10 cm long; syncarps subequal, 5–6 cm long, 3.5–4.5 cm in diameter, ovoid to broadly ellipsoid, bearing 64–88 drupes, these 19–21 mm long (including the stigma), 7–10.5 mm wide, 6–8 mm thick, oblanceoloid with an obtusely convex apex, the sides 5–6-angled, smooth, when dried brown, the body 15–17 mm long, cuneiform; pileus 6–7 mm long, oblate semiorbicular; style subterminal, 0.5–1 mm long, vertical except on the basal drupes where sharply reflexed distally; stigmas on the expanded apical surface, 4–7 mm in diameter, 4–7-pointed, horizontal or mushroom-shaped, papillose, brown; drupe body 14–17 mm long; endocarp centering in lower $\frac{1}{3}$, bony, light brown, the inner surface shining, the lateral walls 0.5 mm thick, the apical plug 1–1.3 mm thick; seeds 6–7 mm long, obdeltoid; apical mesocarp with a cavity 6–7 mm long, with a few white membranes near the margins; basal mesocarp sparse, fibrous and fleshy.

EXPANDED DESCRIPTION OF ALL PISTILLATE PLANTS EXAMINED: Plants 1.5–4 m tall; leaves 55–113 cm long, at midsection with 19–29 secondary parallel veins in each half; peduncle 5–7 cm long, bearing 2–5 syncarps, these 4–6 cm long; drupes 7–13 mm wide, 6–10 mm thick, bright yellow.

DESCRIPTION OF STAMINATE PLANTS: Leaves 63–70 cm long, near the base 20–21 mm wide, near the middle 26–29 mm wide, at midsection the parallel secondary veins 22–24 in each half, and at midsection the margins with appressed ascending serrulations 0.3–0.4 mm long, 7–12

mm apart; staminate inflorescence 47 cm long, leafy bracted; lowest bract 47 cm long, 2.2 cm wide, for the lower 10 cm slightly distended, sheathing and paler, the rest foliaceous; floral bracts thin, apparently white, the median one 15 cm long, 4.6 cm wide, lanceolate, on the outer $\frac{1}{3}$ the margins and midrib below with serrulations 0.1 mm long, 0.2–1 mm apart; the 7 spikes 3–6 cm long, 12–15 mm in diameter, cylindrical, dense; fascicle 5–8 mm long, with 19–22 stamens, the naked common column 3–4 mm long, rhachis 2–2.5 mm long, clavate; free filament tips 1–2 mm long, divergent; anthers 1.5–2 mm long, linear-oblong, bearing a pale subulate projection of the connective 0.2–0.3 mm long.

LECTOTYPE: Malaya, "Selangor, on the Tras Route at the 20th mile (8775)," 2,000 ft. elev., July 1897, *H. N. Ridley* (SING). Lectotype here designated; specimen examined! Isotype (FI)!

SPECIMENS EXAMINED: Malaya: Perak, Larut, top of mountains, open jun[gle], 2,000 to 3,000 ft. alt., April 1883, *H. Kunstler* 4,166 (CAL); Haram Parak, June 1884, *Scortechini* (CAL).

Pahang: Gunong Tahan, 7 Sept. 1937, *E. J. H. Corner* (SING); Sungei Chelia, Chegar Perah, 14 Oct. 1927, *M. R. Henderson* 19,370 (SING).

Penang: Government Hill, Dec. 1895, *C. Curtis* (SING); Waterfall Hill, 500 ft. alt., June '88, *L. Wray Jr.* 2,227 (CAL).

SECTION *Hombronia*

Pandanus irregularis Ridl., Fl. Malay Penin. 5: 76–77, 1925; Henderson, M. R., Roy. Asiat. Soc., Malay Branch, Jour. 17: 82, 1939; (sect. *Hombronia*)

Figs. 182, 183

DIAGNOSIS OF HOLOTYPE: "Leaves long, very broad," 9.3 cm wide, thick and leathery, 1-ribbed, 2-pleated, in section depressed, M-shaped, the secondary parallel veins visible below, scarcely so above and at midsection 83–92 in each half, the base amplexicaul and unarmed, but beginning at 12 cm up the margins with thorns 4.5 mm long, 1–2 cm apart, heavy deltoid subulate, black-tipped, ascending; the midrib below with similar reflexed thorns 2–3 cm apart;

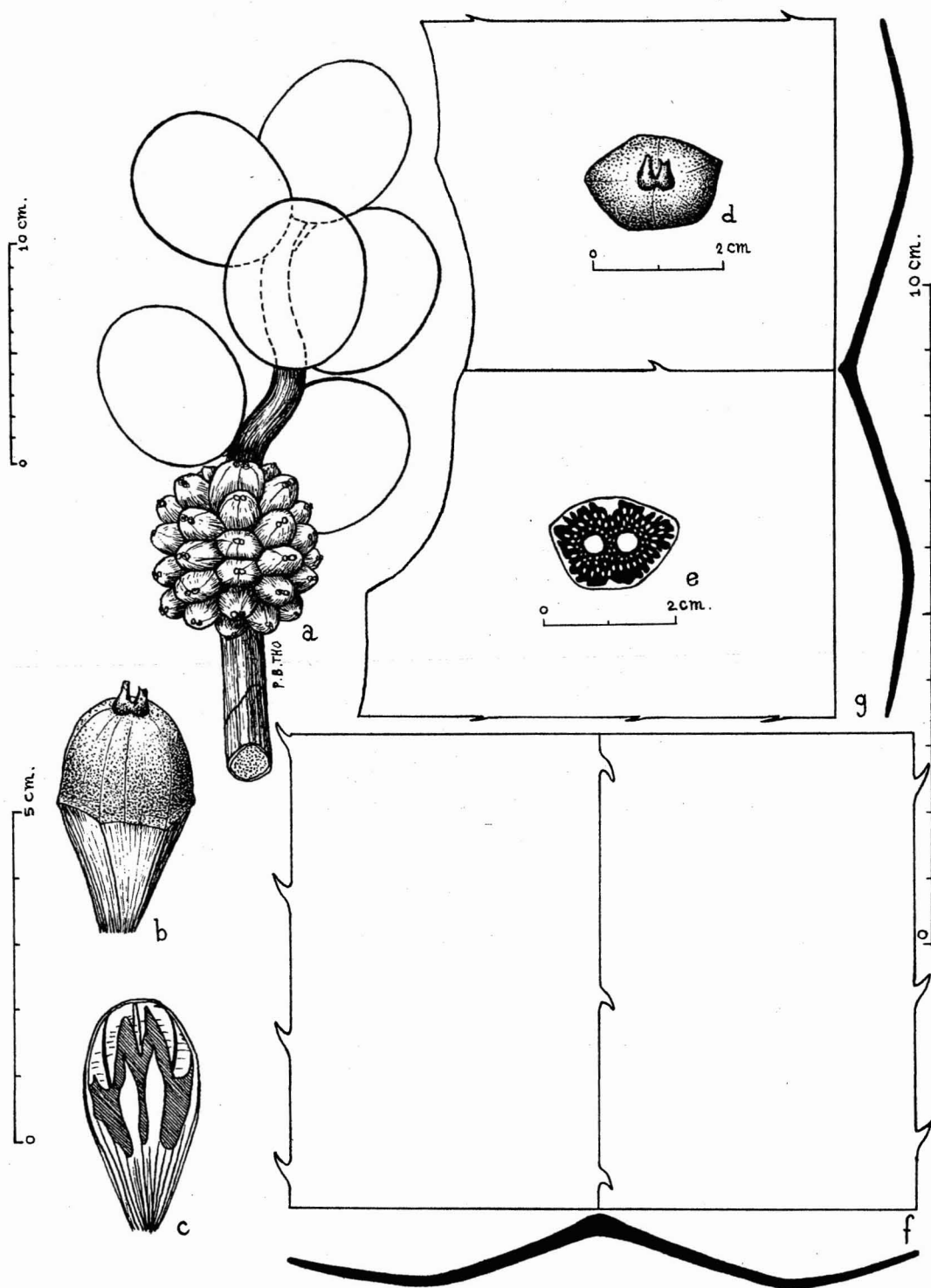


FIG. 182. *Pandanus irregularis* Ridl., from holotype. *a*, Inflorescence, $\times \frac{1}{3}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe and stigmas, apical view, $\times 1$; *e*, drupe, transverse median section, $\times 1$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$.

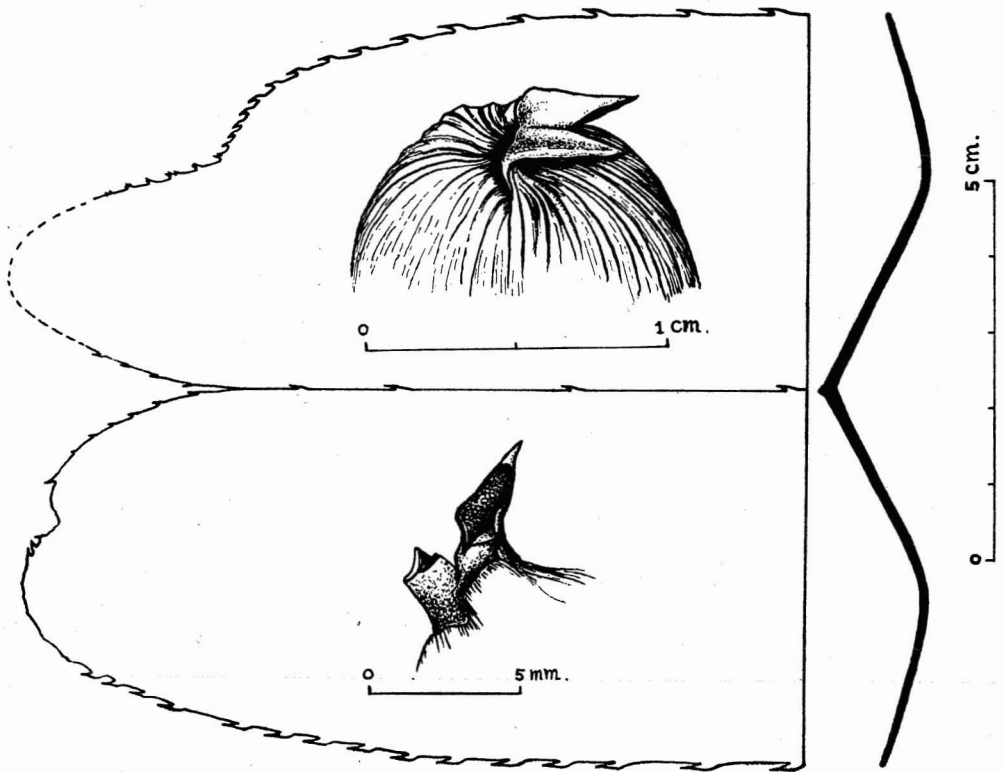


FIG. 183. *Pandanus irregularis* Ridl., from holotype, leaf apex, lower side, $\times 1$.

on a leaf section cut higher up (exact place unknown) the margins with spines 3–3.5 mm long, 25–36 mm apart, heavy subulate, ascending; the midrib below with scars of fallen spines 3–6 cm apart; pistillate inflorescence 30 cm long, with about 7 syncarps; peduncle 15 mm in diameter, obtusely trigonous, bracted; syncarps 6.5–7.5 cm long, subglobose, bearing about 36–44 drupes, these 1–3- but mostly 2-celled, 3–3.5 cm long, 1.8–2.4 cm wide, 1.2–1.5 cm thick, "dark green," narrowly obovoid to oblanceoloid, compressed, the apex entire, obtuse, the sides smooth, convex, lateral sutures none; stigmas almost all eroded but 1 basal drupe bears a single stigma 5 mm long, lanceolate, sharply bent to the horizontal, the receptive surface distal; endocarp 22 mm long, centering in upper $\frac{2}{5}$, at midsection filling the drupe, bony, massive, dark brown but including pale fibers, the lateral walls 4–5 mm thick; seeds

8–9 mm long, 3 mm in diameter, ellipsoid; apical mesocarp cavernous, with strong, longitudinal fibers and soft pith; basal-mesocarp fibrous and fleshy.

EXPANDED DESCRIPTION OF ALL SPECIMENS EXAMINED: Leaf more than 1.4 m long, near the base 9 cm wide, near the middle 12 cm wide, near the apex 10.5 cm wide, broad ligulate; margins near the base with thorns 3.5–4.5 mm long, 1–2.5 cm apart; midrib below with thorns 3–3.5 mm long, 2–5 cm apart, subulate, reflexed; at midsection the margins with spines 4–4.5 mm long, 20–25 mm apart, sharply ascending, subulate but the base much thickened; the midrib below concealed; the apex apparently damaged in growth and without a caudate apex, rather contracted to 2 broadly obtuse lobes and deeply emarginate, and even prickly on the margins of the cleft, all this, however, apparently an abnormality; peduncle 30 cm long;

spike 14 cm long, bearing 4 syncarps; stigmas 4 mm long, sharply proximally bent, the receptive surface usually proximal.

HOLOTYPE: Malaya, Kelantan, Sungei Ketah, Batu Bau (Bow), 15 Feb. 1924, *Mohamed Nur & Foxworthy* 12,104 (SING). Holotype examined!

SPECIMENS EXAMINED: Malaya, Pahang, Gua Tipus, the common pandan on the limestone, 17 Oct. 1927, *M. R. Henderson* 19,468 (SING).

DISCUSSION: *P. irregularis* was placed by Dr. Ridley in the section *Rykia*. It has, however, the drupes 1–3-celled, and usually 2-celled, with the cells in linear arrangement, and the large stigmas terminal, but distal and laterally directed. There is no question but that it must now be placed in the section *Hombroonia*.

It is one of the numerous plant species known to occur only on limestone knobs. These precipitous pinnacles or narrow ridges rise spectacularly from the rolling uplands of Thailand and Malaya. Their sides are often precipices of shining, white limestone, sparsely vegetated, but their crests have a dark evergreen, virgin forest cover. To a botanist they are very attractive. Four species of *Pandanus* in Malaya are restricted to these calcareous habitats. Besides this species published by Ridley, two more are now being described, and one more has yet to be found in fruit. A good account of this localized flora is given by Dr. M. R. Henderson (*Roy. Asiat. Soc., Malay Branch, Jour.* 17: 13–87, pl. III–XI, 1939).

Malaya, SECT. NOV.

Phalangibus pluricarpellatis, stylis terminalibus adscendentibus vel arcuatis corniformatis integris vel bifidis, stigmatibus centripetalibus ellipsoideis vel lanceolatis; plantis masculis incognitis.

Phalanges of several united carpels; styles terminal, ascending or arching, stout, hornlike with

a subulate apex or compressed and more or less oblong, with the apex sharply bifurcate; stigmas centripetal, ellipsoid or lanceolate; staminate plants unknown.

HOLOTYPE: *Pandanus Klossii* Ridl., Fed. Malay States Mus., Jour. 6: 190–191, 1915.

DISCUSSION: The single known species occurs on the mountains of Pahang in Malaya. It combines the characteristics of the section *Rykia* in its hornlike, simple or bifurcate styles, and of the section *Pandanus*, in its many-carpellate, large phalanges. Since these two sections are very distinct and are only remotely related, it is best to make the very bizarre *P. Klossii* the basis of a new section.²

Pandanus Klossii Ridl., Fed. Malay States Mus., Jour. 6: 190–191, 1915; Fl. Malay Penin. 5: 74, 1925; (sect. *Malaya*)

Figs. 184, 185

DIAGNOSIS OF HOLOTYPE: Shrub 2–7 m tall; stems usually solitary, 7.5 cm in diameter, gray, erect or arcuate; leaves 1.3–1.8 m long, 6.8–7.2 cm wide, thick coriaceous, above dark green, below pale green, 1-ribbed, but 2-pleated and in section low M-shaped, the longitudinal parallel secondary veins 0.5–0.8 mm apart, 49–52 in each half, evident on both sides as are the tertiary cross veins that form a network of meshes, oblong or rhombic, longer than broad, the blade ligulate, and only near the tip rather abruptly narrowing to a 5 cm stout subulate tip, trigonous and 2–3 mm wide, the very base not collected, near the base the margins with stout thorns 5–8 mm long, 8–30 mm apart, arcuate ascending, black; the midrib below with similar but reflexed thorns; at midsection the margins with prickles 3 mm long, 15–50 mm apart, subulate, ascending, flat appressed; the midrib below with prickles 2 mm long, 35–50 mm apart, heavy, arcuate, ascending; near the tip

² The new section can be inserted in the author's key in this Revision of the Genus *Pandanus* (p. 2) by replacing the 11th line from the bottom by:

L. Stigmas elongate, acerose, or stout hornlike, simple or bifurcate,

a. Stigmas stout hornlike, simple or bifurcate.....*Malaya*

a. Stigmas elongate, acerose,

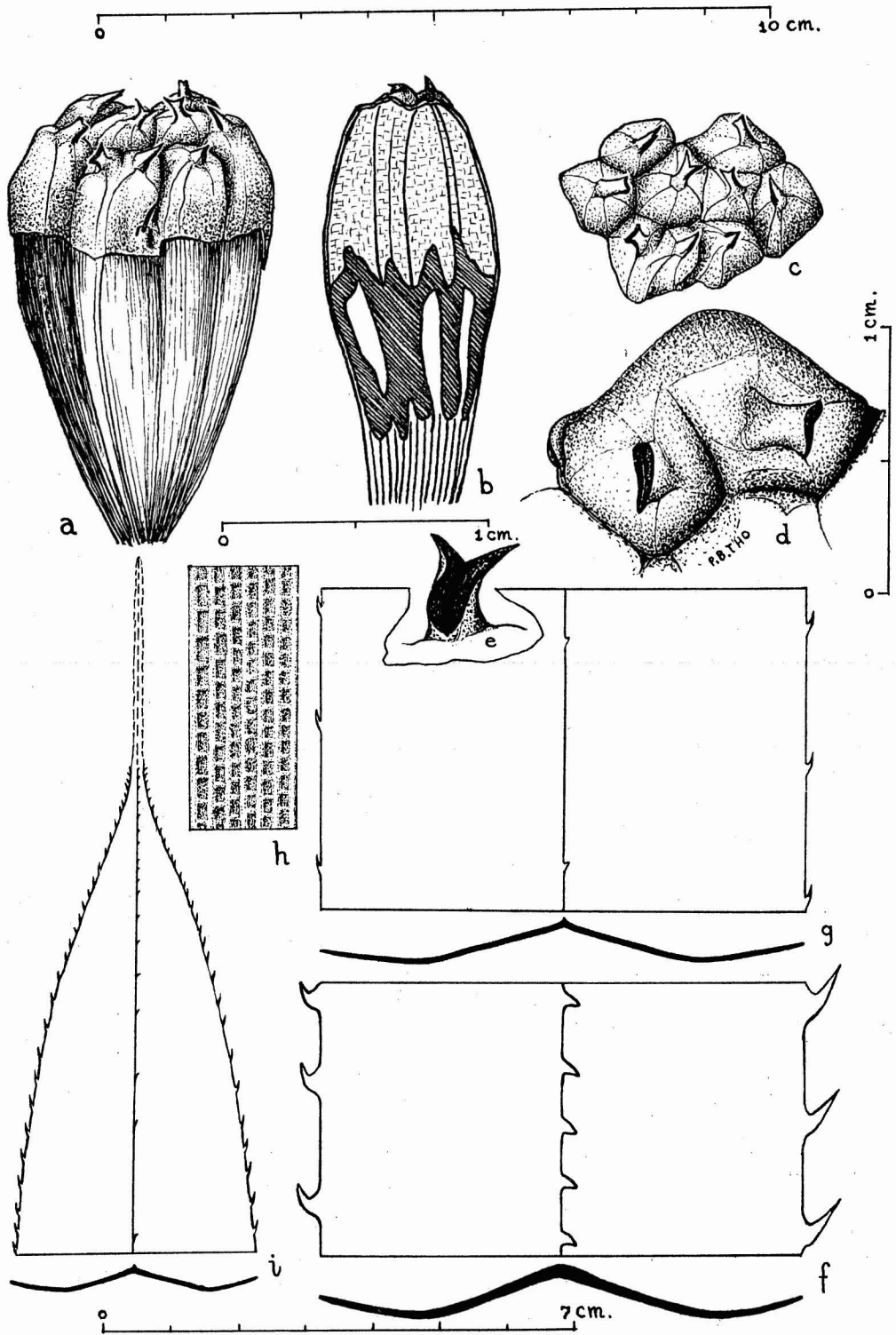


FIG. 184. *Pandanus Klossii* Ridl., from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, and stigmas, apical view, $\times 1$; *d*, carpel apices and stigmas, apical view, $\times 4$; *e*, style and stigma, oblique view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, venation in outer third, lower side, $\times 4$; *i*, leaf apex, lower side, $\times 1$.

the margins and midrib below with serrations 0.3–0.5 mm long, those of the margin 1–1.5 mm apart, those of the midrib below 2–5 mm apart; pistillate peduncle 15–30 cm long, 12–18 mm in diameter, 3-sided, leafy bracted; syncarp single, globose or ellipsoid, about 15 cm in diameter; phalanges numerous and 6–6.5 cm long, 3.6–3.9 cm wide, 2–2.7 cm thick, cuneiform, 4–6-angled, "showing signs of turning red or orange," the sides smooth, gently convex, free in upper $\frac{1}{3}$, the apex low convex, lateral sutures visible only in upper $\frac{1}{3}$; central apical sinuses 1–4 mm deep, straight or arcuate, narrow; carpels 9–10 (in a double 16–17 and the phalanges 5.7–6 cm wide), the apices semiorbicular, faintly angled; styles 4–6 mm long, dark, bony, either simple and hornlike or flattened and sharply bifid, mostly centripetal; stigmas as long as the styles, ellipsoid or lanceolate, brown, papillose, covering the proximal face; proximal sinus none; endocarp in lower $\frac{1}{3}$ and 2.7 cm long, bony, massive, dark brown, the lateral walls 2 mm thick, the inner surfaces shining and rugulose; seeds 14–16 mm long, 2–3 mm in diameter, oblong-ellipsoid; upper mesocarp 2–2.5 cm long, of dense pith and a few fibers; basal mesocarp fibrous and fleshy.

ADDED DESCRIPTION FROM ALL SPECIMENS EXAMINED: Phalanges about 96; carpels 5–10; syncarp 9–15 cm in diameter.

HOLOTYPE: Malaya, Pahang, Gunong Tahan, July 1911, *H. N. Ridley* 16,037 (SING). Iso-type (BO). Ridley stated, "Common all over the Padang. In the more open exposed spots the stem is short and erect, about 6 to 8 feet tall; in the woods the stems are long and weaker, often falling about at all angles, 20 feet or more long. No trace of male flowers could be seen anywhere. The plant is very abundant, almost filling up the woods in some places." The collection, *Ridley* 16,037, was made by Ridley previous to his publication of the species in 1915, was labeled *P. Klossii* by him, and seems to have been the only collection in the Singapore herbarium up to that time. In his *Flora of the Malay Peninsula* (1925) he accepted the species and cited only his collection from Gunong Tahan, so this one seems acceptable as his holotype.

SPECIMENS EXAMINED: Malaya, Pahang,

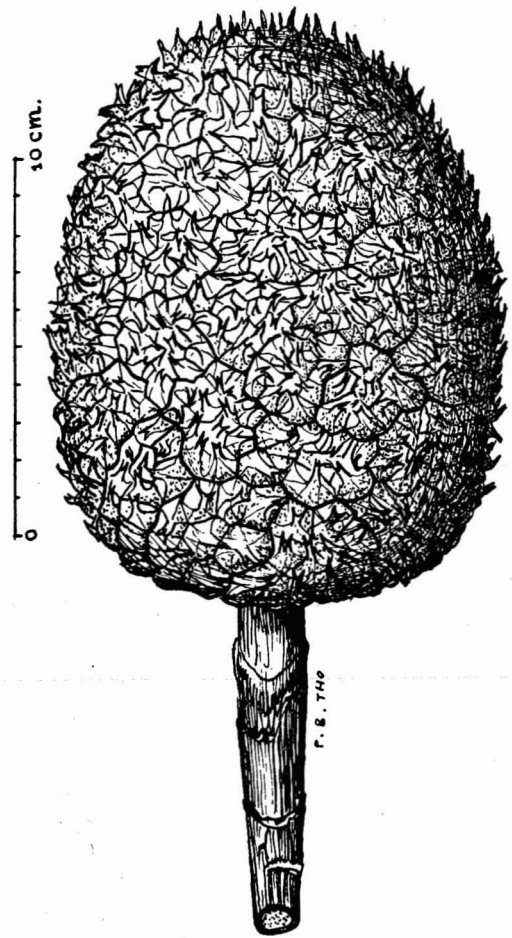


FIG. 185. *Pandanus Klossii* Ridl., from holotype, syncarp, $\times \frac{1}{2}$.

Gunong Tahan, 14 Sept. 1937, *E. J. H. Corner* (SING); Pahang, Gunong Tapis, Kuantan, 4,600 ft. alt., 14 June 1934, *C. F. Symington & Kiah* 28,843 (SING).

DISCUSSION: *P. Klossii* Ridl., a very unique species, is here made the holotype for the new section *Malaya*. This combines the characters of the two sections *Pandanus* and *Rykia*. When Ridley described the species in 1915 he did not place it in a section, but later in 1925 in his *Flora of the Malay Peninsula* he put it in the section *Keura*, which is now called *Pandanus*. As usual he had a good eye for species, but his description seems to have been hastily drawn. He stated (1915: 191) "the drupes are separate

till the fruit is nearly ripe, when from 6 to 7 become adnate and remain so as the whole fruit breaks up." The holotypic collection consists of two sheets, one with overripe fruit, the other with a small, immature syncarp. In both the phalanges are of several fused carpels. The carpels are fused from the base to within 4 mm of the apex, and the sides lack sutures. The writer sees no evidence on these specimens to confirm Ridley's statement that the drupes are separate and only tardily connate; on the contrary, all the structural evidence indicates that the phalanges are of several carpels united from the beginning.

Though Ridley did not explain the source of his specific epithet, it was obviously given in honor of Cecil Boden Kloss, an English zoologist and to a lesser degree a botanist. In 1903 and 1907 he was employed by the Singapore Botanic Garden. He was later director of the Raffles Museum.

Multidens, SECT. NOV.

Frutices, foliis angustis, syncarpio solitario ellipsoideo, stylo singulo terminali osseoso proxime curvato basi cylindrico margine (2-) 3-6-lobato lobis deltoideis, drupis 1-loculatis. Plantis masculis cum inflorescentia bracteata 1-spicata, staminibus distinctis in axili affixis, filamentis 4-plo tam longis quam antheris.

Bushes; leaves narrow; syncarp solitary, ellipsoid; style single, terminal, proximally curved, bony, shining, the base cylindrical, the margin (2-) 3-6-lobed, the lobes deltoid; drupes 1-celled. Staminate plants with inflorescence bracteate, bearing a solitary terminal spike; stamens separate, attached directly to the axis; filament 4 times as long as the anthers.

HOLOTYPE: *P. pentodon* Ridl., Fl. Malay Penin. 5: 75, 1925. Also in the section is *P. tetradon* Ridl. of Singapore.

Pandanus pentodon Ridl., Fl. Malay Penin. 5: 75, 1925; (sect. *Multidens*)

Fig. 186

DIAGNOSIS OF LECTOTYPE: Stem short, branched, up to 2 cm in diameter; leaves said to attain more than 100 cm in length, 11-12 mm wide, coriaceous, dark glossy green, pale green beneath, channeled above the midrib and with 2 lateral pleats, in section low M-shaped, narrowly ligulate, outer halves of leaves missing, at midsection with 17-22 secondary parallel veins in each half, the tertiary cross veins barely visible below near the base, the base amplexicaul and unarmed, apparently copper-colored, beginning at 3-5 cm up the margins with pale serrulations 0.5-0.8 mm long, 1-6 mm apart; the midrib unarmed to at least beyond the middle; at midsection the margins with slender serrulations 0.3-0.6 mm long, 4-8 mm apart, the upper surface unarmed; the apex tapering to a 10 cm trigonous subulate tip which 10 cm down is 4 mm wide, the margins and midrib below with serrations 0.2-0.3 mm long, 0.7-3 mm apart; pistillate peduncle 13 cm long, 8 mm in diameter, bracted, bearing a single, erect syncarp; the highest peduncular bract 30 or more cm long, at base 2.2 cm wide, narrowly lanceolate and tapering noticeably right from the base, the margins with serrulations similar to those of the leaves, but on the upper surface beginning 10 cm up the 2 lateral pleats with similar serrulations, the lower ones 5-13 mm apart, the upper ones 2-5 mm apart; partly hiding the fruit are 3 series of floral bracts, 3 deep, and subequal, 5 cm long, 2 cm wide, lance-elliptic, fleshy, cream-colored; syncarp 5 cm long, 3 cm in diameter, bearing about 400 drupes (when young these are cream-colored), 12-13 mm long, 2-3.5 mm wide and thick, linear-oblongoid, 5-6-angled, the body 10-11 mm long, the summit rounded; pileus 2.5-3

Insertion in Key

On p. 225 (p. 2 of reprint) for the second J, read

- J. Styles 1 (-2), often cartilaginous or bony,
 z. Styles toothlike to broad subulate, entire or bifid; staminate spikes bearing stamens fascicled at apex of column.....*Rykia*
 z. Style with cylindrical base, then curving proximally and the margin (2-) 3-6-lobed with deltoid lobes; staminate spike solitary, bearing separate stamens attached directly to the axis.....*Multidens*

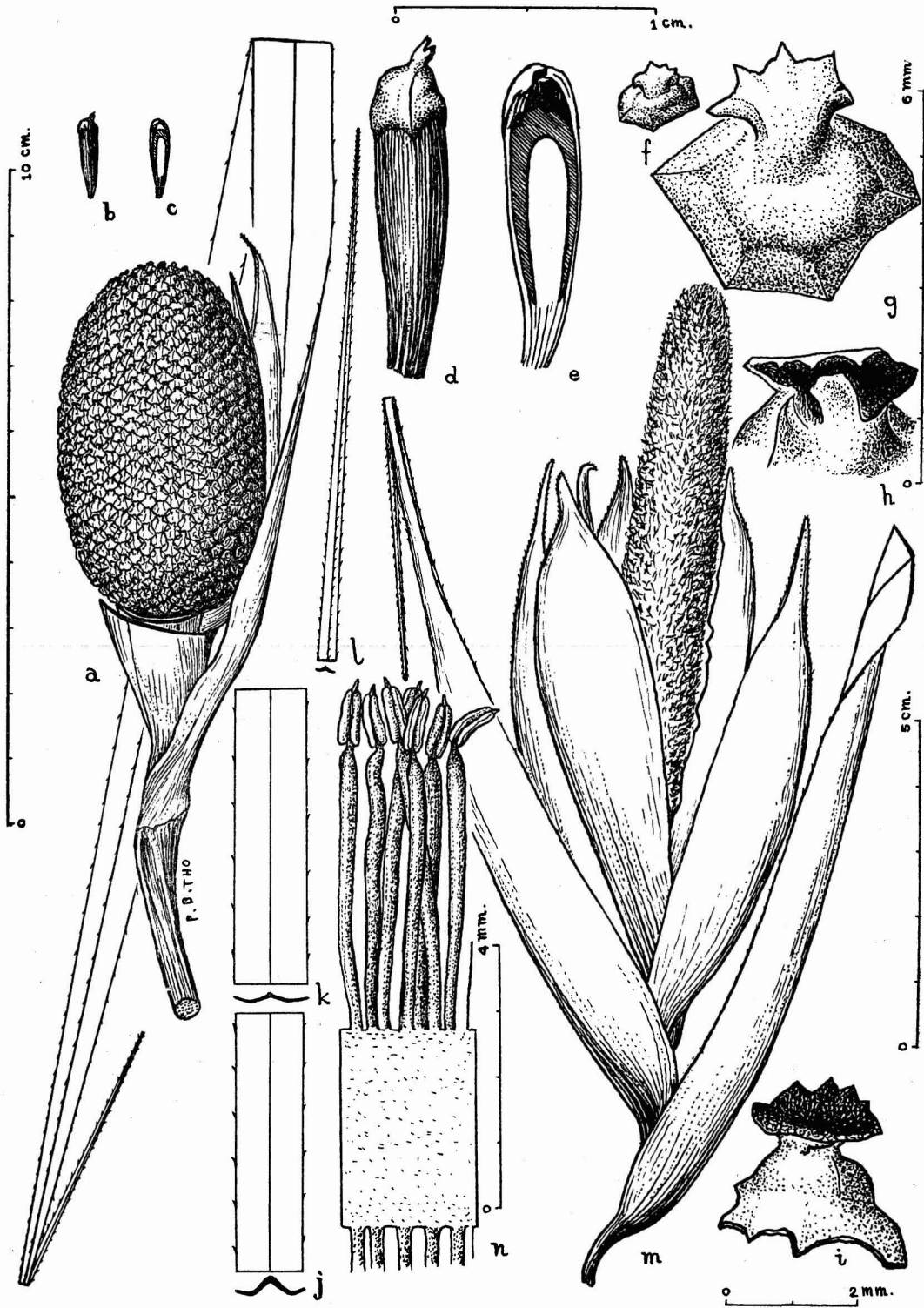


FIG. 186. *Pandanus pentodon* Ridl., from lectotype. *a*, Infructescence, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe and style, apical view, $\times 1$; *g*, drupe apex and style, apical view, $\times 10$; *h*, stigma, oblique view, $\times 10$; *i*, drupe apex, style, and stigma, lateral view, $\times 10$; *j*, leaf base, lower side, $\times 1$; *k*, leaf middle, lower side, $\times 1$; *l*, leaf apex, lower side, $\times 1$; *m*, staminate inflorescence, $\times 1$; *n*, stamens and axis, $\times 10$.

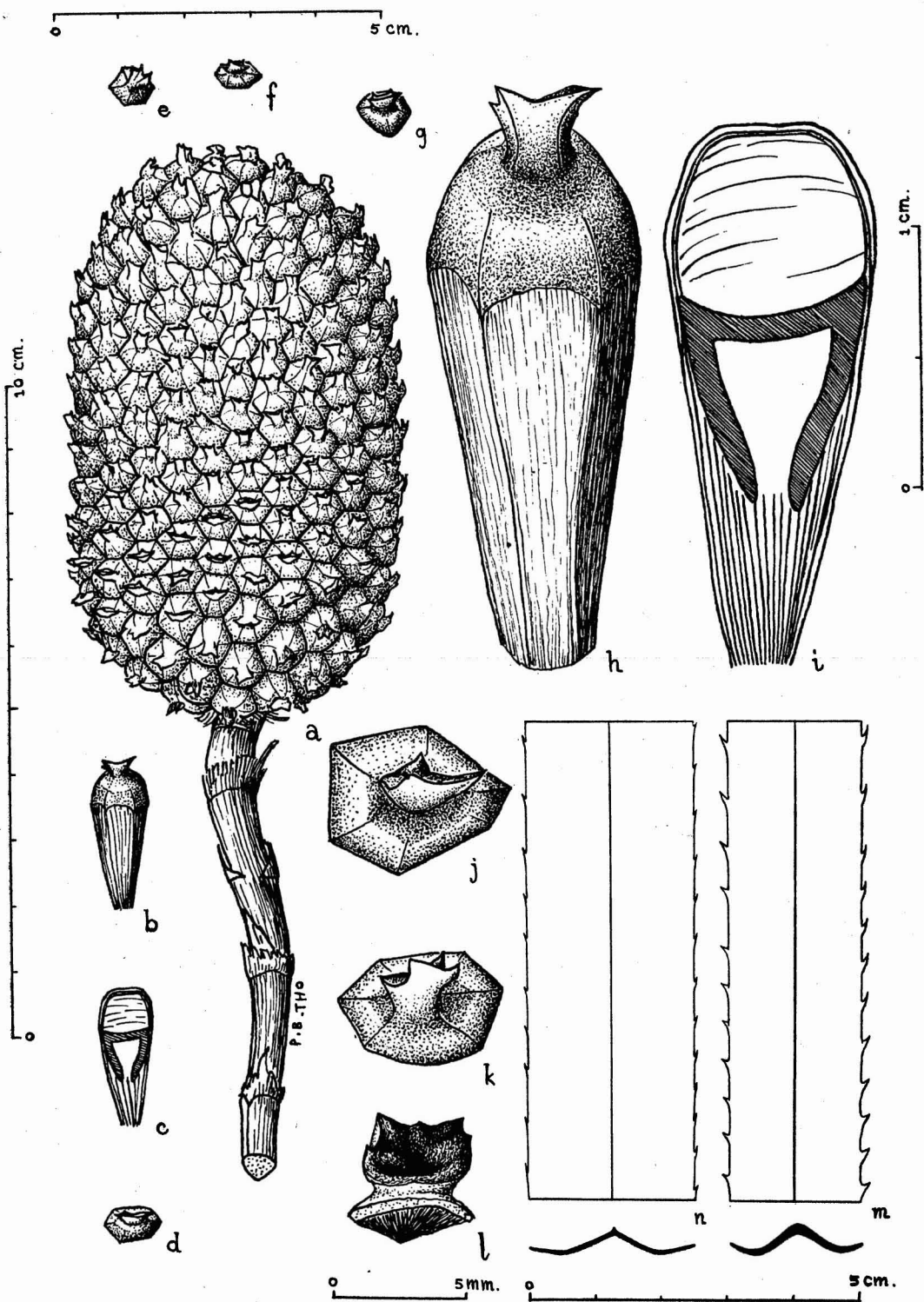


FIG. 187. *Pandanus tetradon* Ridl., from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d-g*, drupe, style, and stigma, apical view, $\times 4$; *i*, drupe, longitudinal median section, $\times 4$; *j, k*, drupe, style, and stigma, apical view, $\times 4$; *l*, stigma, proximal view, $\times 4$; *m*, leaf base, lower side, $\times 1$; *n*, leaf middle, lower side, $\times 1$.

mm long, the base pyramidal-semiorbicular, smooth, when dried somewhat yellowish; style 1–1.5 mm long, apical, bony, yellowish, shining, its base short cylindrical, then the rest sharply curved proximally and flabellate with the margins (3–) 4–5 (–6) dentate; stigma 0.5–1 mm long, obdeltoid to flabellate, papillose, brown, on the distal side of the style; endocarp central, bony, pale brown, the upper lateral walls 1 mm thick; seed 5–5.5 mm long; apical mesocarp an empty cavern; basal mesocarp fibrous up the sides, fleshy within.

STAMINATE PLANT: Herbage not seen; staminate inflorescence dense, leafy bracted, the main part 14 cm long; lowest floral bract about 30 cm long, the upper part green, foliaceous, 10 mm wide, with serrulations 0.2 mm long, 2–5 mm apart, the 10 cm basal part 19–20 mm wide, folded, firm, apparently pale, with similar or smaller serrulations; median floral bract 7 cm long, 3 cm wide, navicular, elliptic, acute, serrulate near the apex on margins and midrib below, firm, apparently pale; spike single, terminal, 7.5 cm long, 13 mm in diameter, cylindrical, dense; stamens distinct, attached directly to the axis; filaments 4.2–4.4 mm long, anthers 0.8 mm long, narrowly oblong, bearing at tips a 0.15–0.2 mm subulate prolongation of the connective.

LECTOTYPE: Malaya, Johore, Ulu Kahang, abundant along edges of Kahang river, 250 ft. alt., 1 June 1923, *R. E. Holttum 10,861* (SING) —the pistillate plant here designated as lectotype. Mingled on the same sheet is a staminate plant.

Pandanus tetradon Ridl., Roy. Asiat. Soc., Jour. 68: 13–14, 1915; *P. singaporensis* Kanehira, Jour. Jap. Bot. 14: 173–177, figs. 6–8, 10, 1938, a superfluous name; non *Barrotia tetradon* Gaud., Bot. Voy La Bonite, t. 13, figs. 1–8, 1841, an invalid name; non *P. tetradon* Balf. f., Linn. Soc. Bot. Jour. 17: 63, 1878, a name not accepted by its author; non *P. tetradon* Balf. f. ex Kanehira, Bot. Mag. Tokyo 52: 236–239, fig. 70, 1938, a later synonym of *P. compressus* Martelli (1905); (sect. *Multidens*)

Fig. 187

DIAGNOSIS OF HOLOTYPE: "Large bushy plant; branches at apex 2.5 cm in diameter"; leaves well over 97 cm long, 2.6 cm wide at the middle, 2 cm wide near the base, coriaceous, 1-ribbed, 2-pleated, in section low M-shaped, about at the midsection with 25–26 secondary parallel veins in each half, these visible at least below throughout, tertiary cross veins visible in outer half, transverse, forming oblong meshes, mostly short, the blade ligulate, the apex not preserved, the base amplexicaul, unarmed, beginning at 5 cm up the margins with prickles 1.5–2.5 mm long, 5–10 mm apart, subulate-tipped serrae, pale, with reddish tips; the midrib below unarmed for at least lower $\frac{2}{3}$'s; near the midsection the margins with similar serrae, 1.3–1.5 mm long, 6–13 mm apart; leaf apex "acuminate," but not preserved; pistillate inflorescence terminal, more or less concealed; peduncle 19 cm long, 7 mm in diameter, 3-sided, sinuous, leafy bracted, bearing 1 syncarp, this 8.8 cm long, 5 cm in diameter, cylindrical with obtuse ends, bearing about 176 drupes, these 22–24 mm long, 6–10 mm wide, 5–10 mm thick, increasing upwards in size and the apical ones definitely the largest, cuneate-oblong, obtuse, 5–6-angled, upper $\frac{1}{3}$ free, the sides nearly smooth; style 3–4 mm long, bony, dark shining brown, at base cylindrical, then quadrate and curved proximally, and all the lateral ones with an oblique plane to the 2–3–4-dentate margins; stigma 1–2 mm wide or long, rugose, of various shapes, filling the cavity proximal of the style apex, with 2–4 (–5) deltoid lobes; endocarp centering in lower $\frac{3}{8}$, bony, dark brown; seed 6 mm long, obdeltoid; apical mesocarp 6–7 mm long, a rounded cavity with a few pale membranes; basal mesocarp fibrous and fleshy.

EXPANDED DESCRIPTION OF PISTILLATE PLANTS: Stems at apex 1.5–2.5 cm in diameter, brown, striate, covered with ascending adventitious rootlets 1–2 cm long; leaves 78 to more than 97 cm long, the tip gradually diminishing to a trigonous subulate apex about 10 cm long, and at base 4 mm wide, on the subulate apex the margins and midrib below with serrations 0.3–0.5 mm long, 2–5 mm apart; syncarp single or with a secondary one below and 4.5 cm long, ovoid.

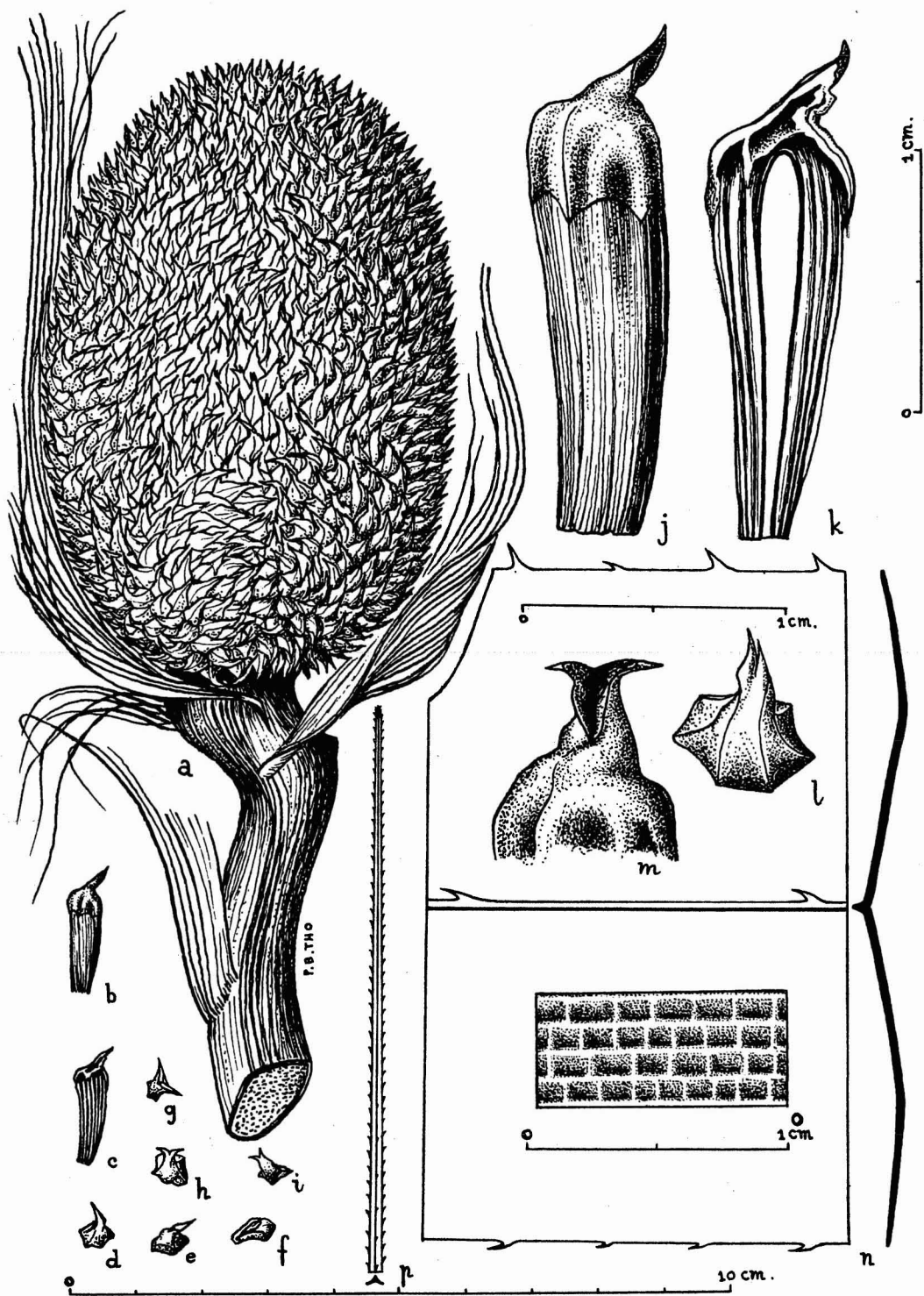


FIG. 188. *Pandanus immersus* Ridl., from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d-i*, drupe, style, and stigma, apical view, $\times 4$; *j*, drupe, lateral view, $\times 4$; *k*, drupe, longitudinal median section, $\times 4$; *l*, drupe apex and style, apical view, $\times 4$; *m*, drupe apex, style, and stigma, proximal view, $\times 4$; *n*, leaf middle, lower side, $\times 1$; *o*, venation of leaf middle, lower side, $\times 4$; *p*, leaf apex, lower side, $\times 1$.

HOLOTYPE: Singapore, on the west coast road near Pasir Panjang, Dec. 11, 1911, *H. N. Ridley* 15,465 (SING). Holotype examined!

SPECIMENS EXAMINED: Singapore, Botanic Gardens, Aroid Rockery, cult., 20 April 1936, *E. J. H. Corner* 30,993 (KEP, SING).

SECTION *Rykia*

Pandanus immersus Ridl., *Asiat. Soc.*, Straits Branch, Jour. 41: 48–49, 1903; *Mater. Fl. Malay Penin.* 2: 224, 1907; *Fl. Malay Penin.* 5: 76, 1925; Martelli, *Webbia* 4(1): 18, 1913; (sect. *Rykia*)

Fig. 188

NOM. VERN.: "mengkuang ayer."

DIAGNOSIS OF HOLOTYPE: Aquatic, "the stem rising but little above" the surface of the river; leaves "many feet long," 10.2 cm wide, coriaceous, green above, pale and glaucous beneath, the longitudinal veins strong, visible above and conspicuous below, about 1 mm apart, at midsection with 70 secondary parallel veins in each side, the venation also consisting of tertiary cross veins 1–3 mm apart, these easily visible above and conspicuous below, the base not preserved but the blade 1-ribbed, 2-pleated, in section M-shaped, ligulate, narrowing upwards and in the upper quarter tapering to a subulate deltoid apex about 30 cm long, and at a point about 10 cm down from the tip only 1.3 mm wide; at about the midsection the margins with thorns 2.5–4 mm long, 9–18 mm apart, subulate but the base thickened, nearly straight, ascending, pale except for the very tip which may be reddish; near the tip the margins with serrae 0.8–0.9 mm long, 1.5–3 mm apart, stout; the midrib below nearly unarmed; pistillate inflorescence apparently emersed; peduncle more than 8 cm long, 15 mm in diameter, 3-sided, bracteate; syncarp perhaps a third mature, 9.5 cm long, 6 cm in diameter, ellipsoid, 3-sided, bearing about 1,440 drupes, these 17–19 mm long, 5–6 mm wide, 3–4 thick, the body 12–13 mm long, arcuate spatulate, upper $\frac{1}{3}$ free, cuneate to the base; the pileus 7–8 mm long, the base subsemiorbicular, minutely papillose; the style 4–6 mm long, hornlike, mostly gently curved proximally, the apical ones unbranched, of the

median and lower ones about half are entire with a single horn but the other half are bifurcate and the 0.5–2 mm lobes often are wide-spreading; stigma 3.5–5 mm long; endocarp (immature) oblanceoloid, nearly as long as the body; mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, "Selangor, in the Labu River, forming dense thickets," May 1891, *H. N. Ridley*, (SING). Holotype examined!

Pandanus johorensis Martelli, *Soc. Bot. Ital.*, Bul. 302, 1904; *P. muarensis* Ridl., *Mater. Fl. Malay Penin.* 2: 226–227, 1907, and *Fl. Malay Penin.* 5: 77, 1925; (sect. *Rykia*)

Figs. 189, 190

NOM. VERN.: "rassau."

DIAGNOSIS OF ISOTYPE: Leaves 1.3–1.45 m long, 4.2 cm wide, coriaceous, paler beneath, 1-ribbed, 2-pleated, at midsection with 43 secondary parallel veins in each half, no visible cross veins, ligulate, gradually tapering to a 27 cm subulate deltoid apex, this 10 cm down 0.7 mm wide, the base amplexicaul, unarmed, but beginning at 10–11 cm on one side, and at 18 cm on the other the margins with prickles 1.5–2 mm long, 4–11 mm apart, subulate, ascending, dark reddish; the midrib below beginning at 8 cm with prickles 3–3.5 mm long, 12–22 mm apart, stout subulate, arcuate, reflexed; at midsection the margins with prickles 1–1.5 mm long, 4–14 mm apart, stout subulate, arcuate, closely ascending; the midrib below with prickles 1.5–1.8 mm long, 5–45 mm apart, stout subulate, arcuate, reflexed or ascending; on the subulate apex the margins with serrae 0.5 mm long, 1–3 mm apart; those of the midrib below similar but 3–7 mm apart; peduncle 29 mm long, 8 mm in diameter, 3-sided, slightly sinuous, leafy bracted; syncarp single, 6 cm long, 3 cm in diameter, narrowly ellipsoid (very young), bearing about 4,096 drupes, these (immature) 11–12 mm long, 1.5–2.5 mm wide and thick, 5–6-angled, upper $\frac{2}{3}$ free, the body 4.5–5 mm long, oblong-ellipsoid, papillose, with thick longitudinal fibers; style 7 mm long, setiform, hard, shining and yellow; stigma linear, proximal, brown, as long as the style; endocarp and seed not yet formed, but inside the ovary wall

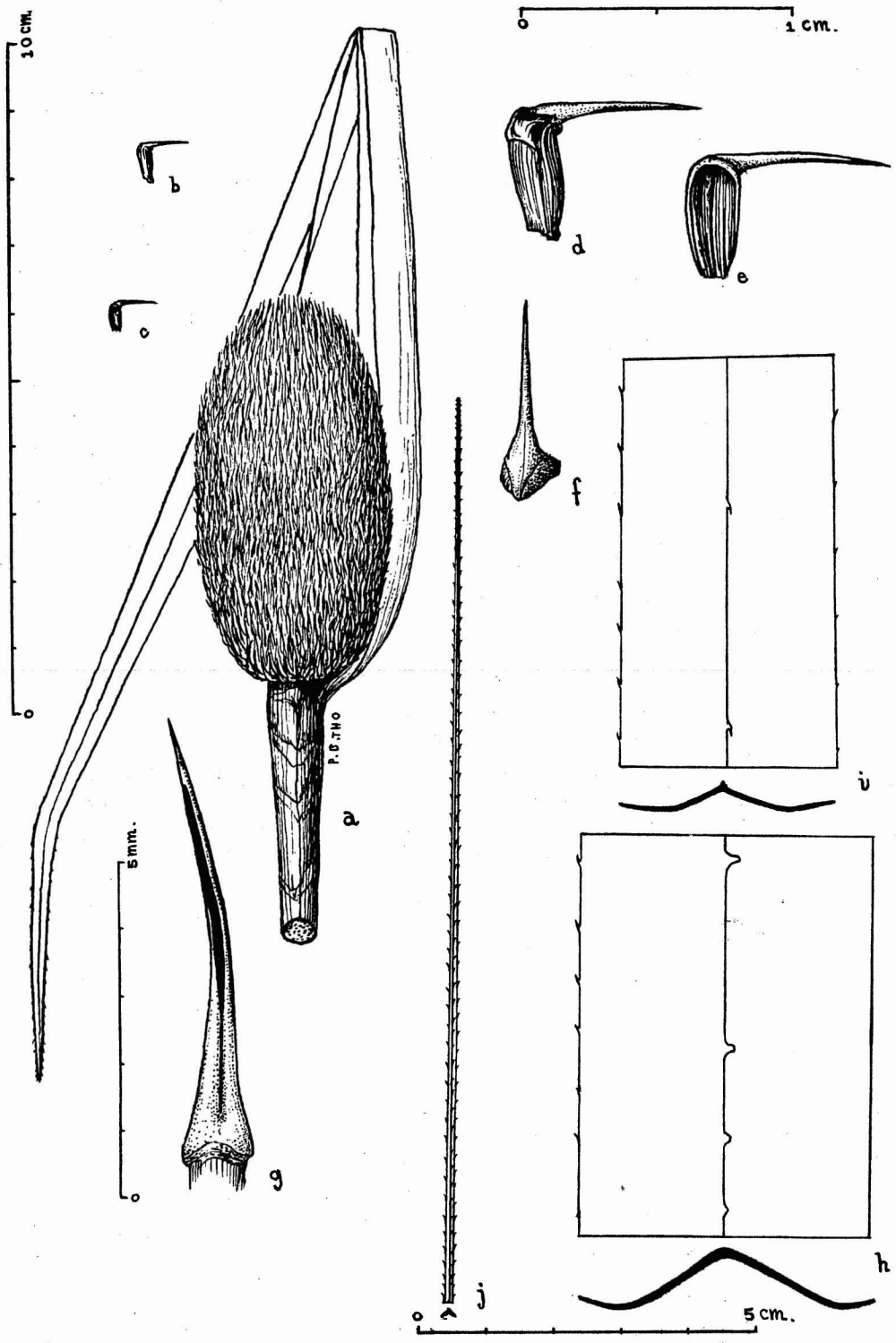


FIG. 189. *Pandanus joborensis* Martelli, from isotype. *a*, Syncarp, $\times 1$; *b*, *c*, drupe, lateral view, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe apex and style, apical view, $\times 4$; *g*, style and stigma, proximal view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

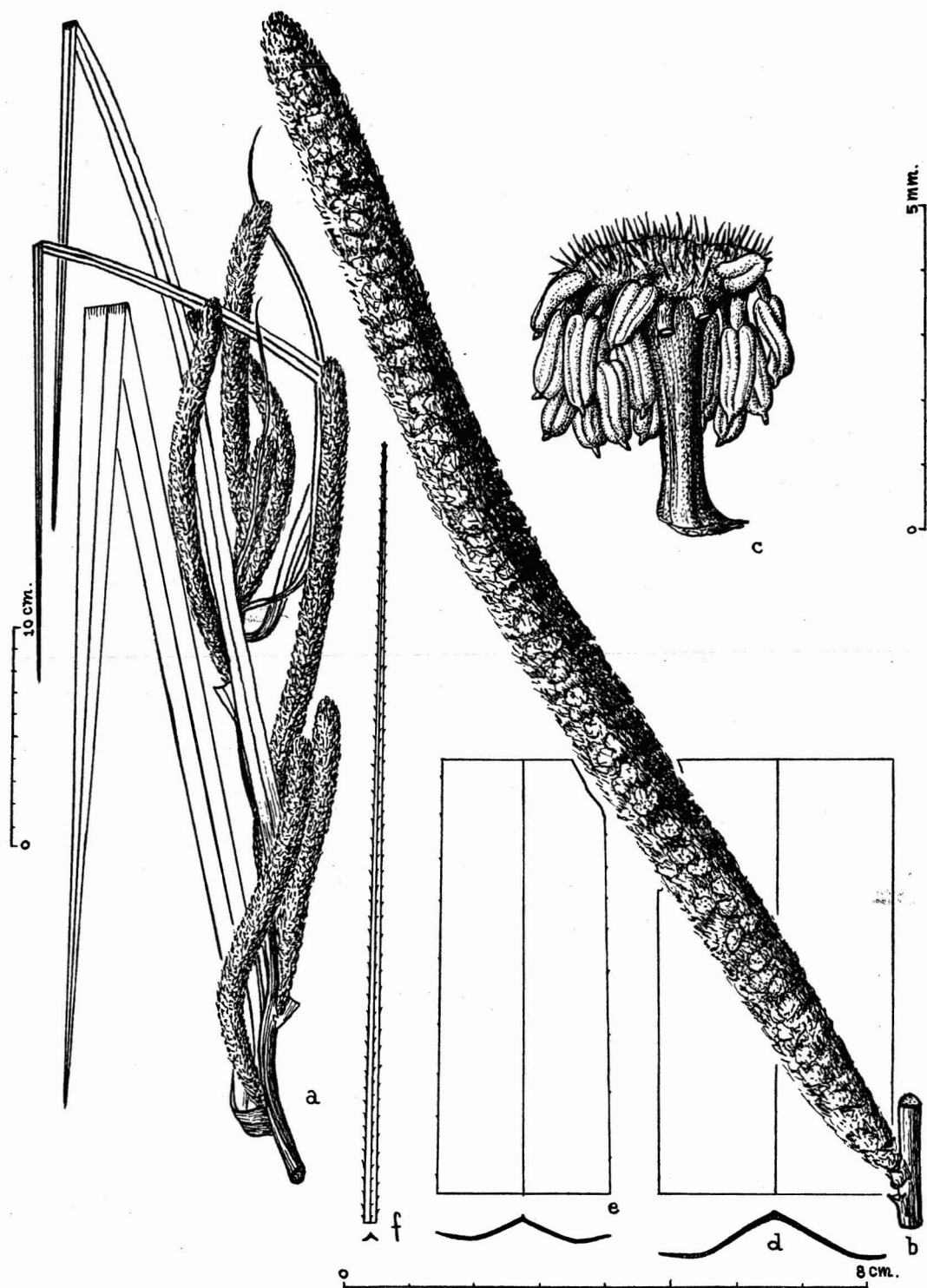


FIG. 190. *Pandanus johorensis* Martelli, from Corner 28,161. *a*, Staminate inflorescence, $\times \frac{1}{3}$; *b*, spike, $\times 1$; *c*, staminate column, scale, and stamens, $\times 10$; *d*, leaf base, lower side, $\times 1$; *e*, leaf middle, lower side, $\times 1$; *f*, leaf apex, lower side, $\times 1$.

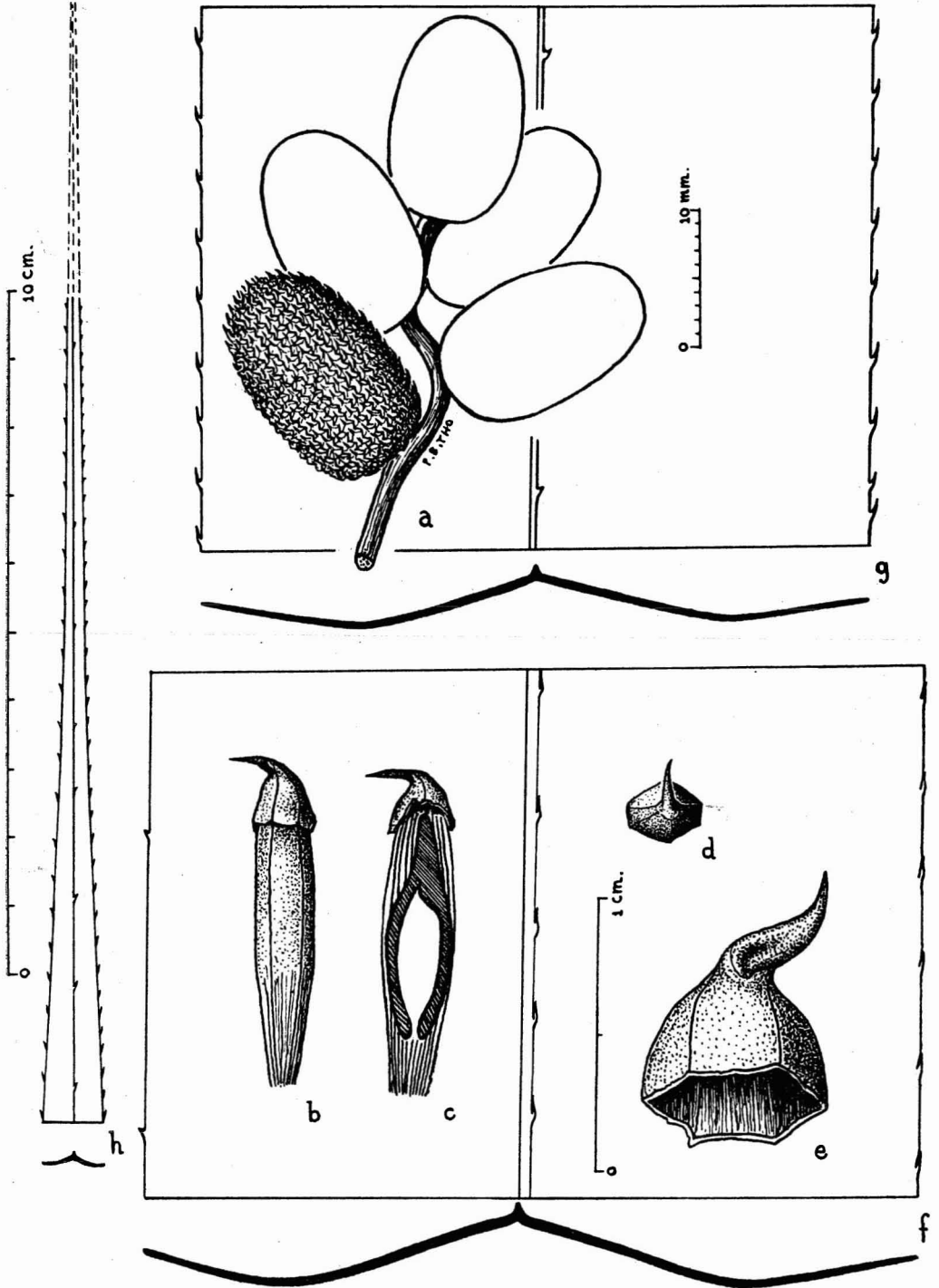


FIG. 191. *Pandanus penangensis* Ridl., from holotype. *a*, Inflorescence, $\times 1/5$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe apex and style, $\times 1$; *e*, drupe apex and stigma, proximal view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

of tissue and heavy longitudinal fibers there is a single large cavity, with indefinite traces of inner tissue.

EXPANDED DESCRIPTION FROM ALL PISTILLATE PLANTS EXAMINED: Shrub, to 6 m tall, upper branches 3–4 cm in diameter, dark brown, forming dense thickets, with a few thornlike axillary rootlets 4–6 mm long, divergent; leaves 1–1.8 m long, 2.9–4.1 cm wide; syncarp solitary, pendulous, 12–16 cm long, 6–10 cm in diameter, ellipsoid.

DESCRIPTION OF STAMINATE PLANTS: Bracteal leaves up to 80 cm long, 3.5 cm wide, coriaceous, apparently pale, ligulate, the upper $\frac{1}{3}$ long tapering to a trigonous subulate apex, this 10 cm down 2 mm wide, the lower $\frac{1}{3}$ wholly unarmed, at midsection with 51 secondary veins in each half, no visible tertiary veins; near the apex the margins and midrib below with subulate serrulations 0.5–0.7 mm long, 2–6 mm apart; staminate inflorescence 45 cm long, with 8 spikes, these 15–25 cm long, 12–15 mm in diameter, densely flowered but somewhat interrupted; flowers sweet and sickly scented; filament column 4 mm long, stout, clavate, bearing an apical parasol-like scale 3–5 mm in diameter, the apex hispidulous with hairs 0.3–0.4 mm long; free filament tips 0.5–2 mm long, pendent from the lower surface, glabrous or sparsely hispidulous; anthers 10–16, and 0.8–1.3 mm long, mostly cylindric, bearing an apical mucro 0.2 mm long, formed of a projection of the connective (description from *Corner* 28,161).

ISOTYPE: Malaya, Johor, Muar, Bukit Wiligu, Sungei Pauh, 1902, *Fox* 11,326 (SING). Isotype examined!

SPECIMENS EXAMINED: Malaya, Johore, Mawai, generally flowering of staminate and pistillate on riverside, flowers visited by bees and beetles, May 13, 1934, *E. J. H. Corner* 28,161 (SING).

DISTRIBUTION: Malaya and Sumatra, forming dense thickets in estuaries, forming a zone beginning where *Nipa* stops, in tidal fresh water. Plants with similar leaves have been seen from Borneo.

DISCUSSION: *P. johorensis* Martelli is a member of the section *Rykia*. It was briefly published in 1904 by Martelli as only a few phrases in a key to certain species. His holotype was:

"Stato di Johor. Penis. Malese, no. 11326 Ridl. (H. Becc.)." The specimen above cited is an isotype in the herbarium in Singapore. It bears the data: "Malay Peninsula, Johor, Bukit Wilgu, Sungei Pau, 1902, *Fox* 11,326." In his *Materials for a Flora of the Malayan Peninsula* 2: 226, 1907, Ridley accepted Martelli's species, and cited the single collection, "Muar: Bukit Wilgu, Sungei Pauh (W. Fox) 11326." Later, Ridley in his *Flora of the Malay Peninsula* 5: 77, 1925, treated this plant as *P. johorensis* sensu Ridl., not of Martelli, and redescribed it as the new species *P. muarensis* Ridl. For this he had the holotype: "Muar, Sungei Pauh (Fox)." Whatever misconception Ridley thought there was, he had no right to rename the species using the same holotype. Certainly the collection *Fox* 11326 from Bukit Wilgu, Sungei Pauh, Johor, is the same as [Ridley] 11,326 with the same locality data. The number is a Singapore Herbarium number, as the staff members were required to use this single series of numbers, not their own personal collection numbers. The holotypic specimen in the herbarium at Firenze was not a duplicate distributed from Singapore. Rather, it is a fragment consisting of about two score of the drupes placed in a paper pocket on which in Martelli's hand is written the data. These fragments were taken from the syncarp of the isotypic specimen, then in Calcutta, now in Firenze. It lacks stem, leaves, inflorescence, and syncarp. Nevertheless, the actual holotype is this fragmentary specimen, *Fox* (or *Ridley*), once in Calcutta, and now in Firenze. However, there seems no doubt but that *P. muarensis* Ridl. is a typonym and must be placed in the synonymy of *P. johorensis* Martelli. The isotype in Singapore has a syncarp with immature drupes that have not matured their endocarp and seed.

Pandanus penangensis Ridl., *Asiat. Soc., Straits Branch, Jour.* 41: 50, (1904) = 1903; *Fl. Malay Penin.* 5: 81, 1925; (sect. *Rykia*)

Fig. 191

DIAGNOSIS OF HOLOTYPE: "Tree 7 m. tall, 10 cm. in diameter"; leaves 2 m or more long, near the base 12 cm wide, when young marbled light and dark green, beginning at 15–16 cm

the margins with prickles 1.3–1.5 mm long, 4–7 mm apart, pale, subulate, flat appressed ascending; the midrib below sharp salient and with similar ascending prickles, the secondary parallel veins conspicuous and in lower part 69 in each half, and except at base the tertiary cross veins prominent on both sides, transverse or oblique and forming short, rather oblong meshes, mid-section not seen; at 45 cm down from the apex the blade 11.5 cm wide, the apex abruptly narrowed to a subulate tip about 5(?) cm long, the margins with subulate serrae 1.5–2.5 cm long, 3–10 mm apart; the midrib below with serrae 0.8–1 mm long, 7–20 mm apart; drupes 42–47 mm long, 7–9 mm wide, 6–7 mm thick, 5–6-angled, the sides smooth, gently curved, probably only the pileus free, the body 37–40 mm long, drupes and pilei shedding separately; pileus 9–11 mm long (or if measured along the curve of the style 13–16 mm long), 10–13 mm wide, 8–10 mm thick, 6-angled, broad ovoid-pyramidal, the tip proximally curved; style 5–7 mm long, heavy subulate, curved

proximally almost to a right angle; stigma 4–5 mm long, lanceoloid, papillose, brown; endocarp 32–33 mm long, narrow ellipsoid, bony, ebony-colored, the inner surface shining, the lateral wall 1–1.5 mm thick; seed 15–17 mm long, 4–6 mm in diameter, ellipsoid; apical and basal mesocarp fibrous and fleshy.

EXPANDED DESCRIPTION FROM ALL SPECIMENS EXAMINED: Leaves to 4 m long, the mid-section 10 cm wide, the margin with prickles 2.8–3 mm long, 5–14 mm apart, stout, heavy based, arcuate subulate, appressed ascending, brown; pistillate inflorescence of 4–5 syncarps, each with numerous drupes; syncarps 15–20 cm long, 9.5–10 cm in diameter, ellipsoid.

HOLOTYPE: "Malaya, Penang Hill from base to the top, in woods." The specimen is labeled: Malaya, Pulau Penang, Fort Hill, 1900, *H. N. Ridley* (SING). Holotype examined!

SPECIMENS EXAMINED: Malaya, Pulau Penang, Government Hill, common on the hill top, but not often in fruit, 29 July 1907, *I. H. Burkill* 2,666 (SING).