

Revision of the Genus *Pandanus* Stickman, Part 20 New Species from India and Thailand

HAROLD ST. JOHN¹

THE FOLLOWING NEW SPECIES of *Pandanus* from India and Thailand are, all except one, based upon collections made by botanists other than the writer.

SPECIES FROM INDIA Section *Rykia*

Pandanus assamensis sp. nov. (sect. *Rykia*).

Fig. 225

DIAGNOSIS HOLOTYPE: Caule 6–7 mm diametro brunneo lucido laevi, internodis 10–11 mm longis, foliis 28–30 cm longis 22–27 mm latis chartaceis supra viridibus infra pallidioribus 1-sulcatis 2-plicatis in sectione mediali cum 15–16 nervis parallelis secundariis ubique conspicuis in quaque media, nervis tertiis nullis, laminis infra cuneatis proxima basem 15–16 mm latis ligulatis ad apicem subiter in apice subulato 3 cm longo 0.5–0.7 mm lato contractis basi amplexicauli inermi sed ex 2.5–3 cm marginibus cum aculeis 1–2 mm longis 1.5–3 mm separatis rectis subulatis adscendentibus apicibus subrubris, midnervo infra ex 5–5.5 cm cum aculeis 2–2.5 mm longis 14–26 mm separatis subulatis reflexis basibus incrassatis, in sectione mediali marginibus cum aculeis 0.3–0.5 mm longis 1–8 mm separatis acicularibus adpresse adscendentibus, midnervo cum aculeis paucis 0.7–0.8 mm longis 20–25 mm separatis crassiter subulatis reflexis basibus latis, in apice caudato marginibus et midnervo infra cum aculeis 0.3–0.5 mm longis 0.2–1 mm separatis validis arcuatis subulatis adscendentibus; inflorescentia foeminea cum syncarpio terminali erecto solitario, pedunculo 8 cm longo 3 mm diametro 3-laterato supra crassiori et in apice 4 mm diametro cum bracteis paucis, syncarpio 3.5 cm longo 2.5 cm diametro

oblongo-ellipsoideo cum circa 720 drupis eis 11–12 mm longis 2 mm latis et crassis 5–6-angulatis corpore 7–8 mm longo oblongo-oblanceoloideo, pileo cum basi 1.5–2 mm alto semiellipsoideo laevi vel minime papilloso, stylo 5–6 mm longo graciliter subulato in basi valde reflexo, drupis superis cum stylis terminalibus illis latioribus cum stylis lateralibus, stigmatibus 4–5 mm longo lineari proximo brunneo papilloso fere ad apicem extento, endocarpio supra-mediali lateribus 0.07 mm crassis cartilagineis stramineis, mesocarpio apicali parvo meduloso, mesocarpio basali in lateribus fibroso intra carnosum.

DIAGNOSIS OF HOLOTYPE: Stem 6–7 mm in diameter, brown, shining, smooth, the internodes 10–11 mm long; leaves 28–30 cm long, 22–27 mm wide, chartaceous, green above, pale green below, 1-ribbed, but 2-pleated, at midsection with 15–16 parallel secondary veins in each half, these conspicuous on both sides throughout, no tertiary cross veins, cuneate below and just above the base only 15–16 mm wide, ligulate, near the apex abruptly contracted to a subulate tip 3 cm long, this 0.5–0.7 mm wide, the base amplexicaul and unarmed, but starting 2.5–3 cm up the margins with prickles 1–2 mm long 1.5–3 mm apart, straight subulate, ascending, reddish tipped; the midrib below beginning at 5–5.5 cm with prickles 2–2.5 mm long, 14–26 mm apart, subulate, reflexed, heavy based; at midsection the margins with prickles 0.3–0.5 mm long, 1–8 mm apart, acicular, appressed ascending; the midrib below with a few prickles 0.7–0.8 mm long, 20–25 mm apart, stout subulate, broad based, reflexed; on the caudate apex the margins and midrib below with prickles 0.3–0.5 mm long, 0.2–1 mm apart, stout, arcuate subulate, ascending; pistillate inflorescence with one terminal, erect, solitary syncarp; peduncle 8 cm long, 3 mm in diameter, 3-sided, few bracted,

¹B. P. Bishop Museum, Honolulu, Hawaii 96819, U.S.A. Manuscript received August 13, 1962.

thickening upwards and near the apex 4 mm in diameter; syncarp 3.5 cm long, 2.5 cm in diameter, oblong-ellipsoid, bearing about 720 drupes, these 11–12 mm long, 2 mm wide and thick, 5–6-angled, the body 7–8 mm long, oblong-oblancooid; pileus with its base 1.5–2 mm high, semiellipsoid, the surface smooth or slightly papillose; style 5–6 mm long, slender subulate, bent at base and sharply reflexed, the upper drupes with nearly terminal styles, the lower ones with styles lateral in attachment; stigma 4–5 mm long, linear, proximal, brown, papillose, running almost to the stigma tip; endocarp in lower $\frac{1}{3}$, the walls 0.07 mm thick, cartilaginous, stramineous; seed 2.5 mm long, ellipsoid; apical mesocarp sparse, pithy; basal mesocarp fibrous up the margins, fleshy within.

HOLOTYPE: India, Assam, Kambang, plains, May 1888, *L. Wray, Jr. 1,939* (SING). Isotype (CAL).

DISCUSSION: *P. assamensis* is a member of section *Rykia*, as is the most closely related species, *P. Scortechinii* Martelli, of Perak, Malaya. The new holotype was included among the specimens cited by Martelli when he published the latter species. Later, he typified his species by a collection from Perak, Malaya, and omitted the collection from Assam. One of these is made the basis of the species here described as new. *P. Scortechinii* has the style 4–5 mm long, subulate from a broad, compressed base, terminal and ascending; stigma 2.5–3 mm long; endocarp in lower $\frac{1}{3}$; stem near the apex 13 mm in diameter; leaf with the caudate tip 1.3 mm wide, the marginal prickles near the base 3–6 mm apart, the nearby midrib below with prickles 0.5–1 mm long, and at midsection the midrib unarmed. *P. assamensis* has the style 5–6 mm long, slender subulate, the apical drupes with terminal styles, the middle and lower ones with lateral styles; stigma 4–5 mm long; endocarp in lower $\frac{1}{3}$; stem near the apex 6–7 mm in diameter; leaf with the caudate tip 0.5–0.7 mm wide, the marginal prickles near the base 14–26 mm apart,

the nearby midrib below with prickles 2–2.5 mm long, and at midsection the midrib below with prickles 0.7–0.8 mm long.

SPECIES FROM THAILAND

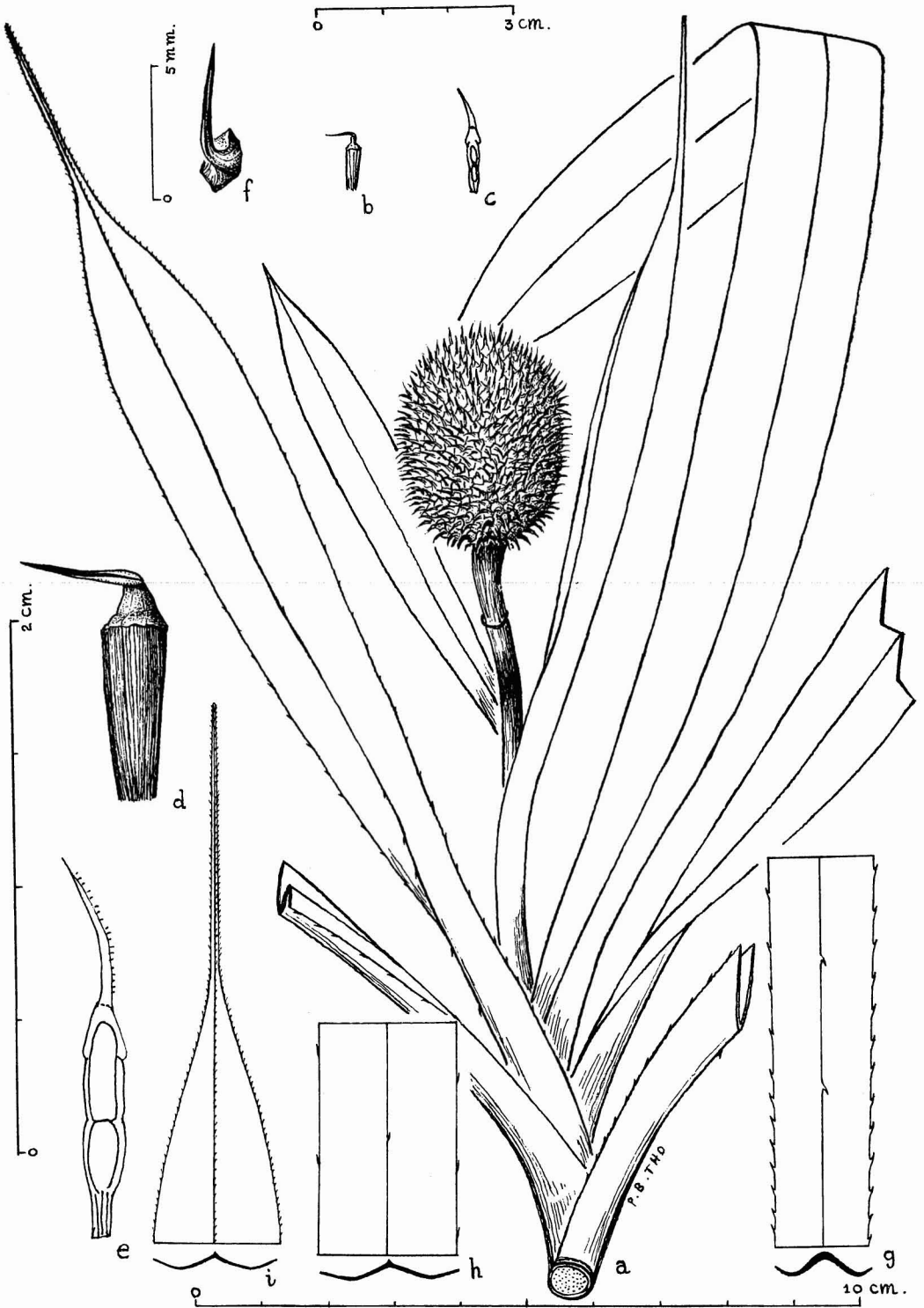
Section *Acrostigma*

Pandanus retroaculeatus sp. nov. (sect. *Acrostigma*).

Fig. 226

DIAGNOSIS HOLOTYPI: Planta 2 m alta, foliis circa 64 cm longis 2 cm latis supra viridibus infra pallide viridibus chartaceis excepta in basi subcoriacea supra midnervum sulcatis 2-plicatis ligulatis sed in dm ultimo in apice subulato diminuentibus (apex deest) in sectione mediali cum 28 nervis parallelis secundariis in quoque latere ubique prominentibus ad apicem nervis tertiis obliquis remotis evidentis basi amplexicauli et inermi conspicue nervosa ex 6 cm marginibus cum aculeis 1.5–2 mm longis 2–5 mm separatis subulatis luteis inferis divergentibus, midnervo infra ex 9 cm cum aculeis 3.5–5 mm longis 5–12 mm separatis crassiter subulatis valde reflexis basi incrassata, in sectione mediali marginibus cum aculeis 0.8–1 mm longis 2–5 mm separatis subulatis adscendentibus, midnervo angusto et elevato cum aculeis 0.5–0.8 mm longis 3–5 mm separatis subulatis adscendentibus, proxima apicem marginibus cum serrulis 0.2–0.4 mm longis 0.5–1.5 mm separatis, midnervo infra cum serrulis 0.6–0.8 mm longis 2–3 mm separatis, in pagina supera ex medio ad apicem plicis binis cum aculeis 0.3–0.5 mm longis 1–3 mm separatis subulatis adscendentibus, inflorescentia foeminea erecta folioso-bracteata cum syncarpio solitario, pedunculo 13 cm longo 3–4 mm diametro 3-laterato, bracteis floraceis circa 9 luteis inferiore 7.5 cm longa 1 cm lata lineari-lanceolata marginibus mediae ultimae cum aculeis pallidis congestis 0.1–0.2 mm longis, syncarpio (immature) 2 cm longo 18 mm diametro ovoideo cum circa 288 drupis eis cum pileo 6–8 mm longo basi 3 mm alta 5-angulosa lanceoloidea laevi et cum sulca pro-

FIG. 225. *Pandanus assamensis* St. John, from holotype. *a*, fruiting branch, lateral view, $\times 1$; *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, $\times 1$.



fundo ex stigmatate descendenti, stylo 3–5 mm longo subulato subarcuato vel recto osseoso subulato, stigmatate 3.5–5 mm longo lineari distali obscure brunneo papilloso, corpore 2.5–3 mm longo immaturo.

DIAGNOSIS OF HOLOTYPE: Plant 2 m tall; leaves about 64 cm long, 2 cm wide, green above, pale green below, towards the base subcoriaceous, the rest chartaceous, sulcate above the midrib, 2-pleated, ligulate but in the last dm tapering to a subulate apex (the tip lacking in ours), at midsection with 28 parallel secondary veins, these prominent throughout, towards the apex the remote oblique tertiary cross veins visible, the base amplexicaul and unarmed, prominently veiny, beginning at 6 cm the margins with prickles 1.5–2 mm long, 2–5 mm apart, subulate, yellowish, the lowest ones divergent, the midrib below beginning at 9 cm with prickles 3.5–5 mm long, 5–12 mm apart, stout subulate, sharply reflexed, the base thickened; at midsection the margins with prickles 0.8–1 mm long, 2–5 mm apart, subulate, ascending; the midrib below narrow and raised, with prickles 0.5–0.8 mm long, 3–5 mm apart, subulate, ascending; near the tip the margins with serrulations 0.2–0.4 mm long, 0.5–1.5 mm apart; the midrib below with serrulations 0.6–0.8 mm long, 2–3 mm apart; on the upper surface from the middle to the tip the pleats with prickles 0.3–0.5 mm long, 1–3 mm apart, subulate, ascending; pistillate inflorescence erect, leafy bracted, bearing one syncarp; peduncle 13 cm long, 3–4 mm in diameter, 3-sided; floral bracts about 9, yellow, the lowest 7.5 cm long, 1 cm wide, linear-lanceolate, the margins of the outer half with pale, crowded prickles 0.1–0.2 mm long; syncarp (young) 2 cm long, 18 mm in diameter, ovoid, bearing about 288 drupes, these with pileus 6–8 mm long, its base 3 mm high, 5-angled, lanceoloid, smooth, with a deep furrow continuing down from the stigma; style 3–5 mm long, subulate, slightly arcuate or straight, bony, yellowish; stigma 3.5–5 mm long, linear, distal, dark brown, papillose; body 2.5–3 mm

long, too immature to reveal its structure.

HOLOTYPE: Thailand, Ronpibun Hill, Nakawon Srithamrat, jungle, 2,000 ft alt, *Eryl Smith* 485 (BK).

DISCUSSION: *P. retroaculeatus* is a member of the section *Acrostigma*, as is its closest relative, *P. Toinu* St. John, also of Thailand, a species with the pileus 5 mm long; stigma 2–2.5 mm long; stems 15 cm tall; leaves 14 mm wide, firm chartaceous, at midsection with 19–20 parallel secondary veins in each half, the tertiary cross veins visible nearly throughout, beginning at 5 cm from the base the margins with prickles 1–1.5 mm long, 2–5 mm apart, lance-deltoid, and flat. *P. retroaculeatus* has the pileus 6–8 mm long; stigma 3.5–5 mm long; stems 1.5 m tall; leaves 20 mm wide, chartaceous except for the subcoriaceous base, at midsection with 28 parallel secondary veins in each half, the tertiary cross veins oblique, remote, visible towards the apex, beginning at 6 cm from the base the margins with prickles 1.5–2 mm long, 2–5 mm apart, and stout.

The new epithet is from the Latin *retorsus*, backward, and *aculeatus*, with prickles, and it is given with allusion to the strong, retrorse prickles of the midrib.

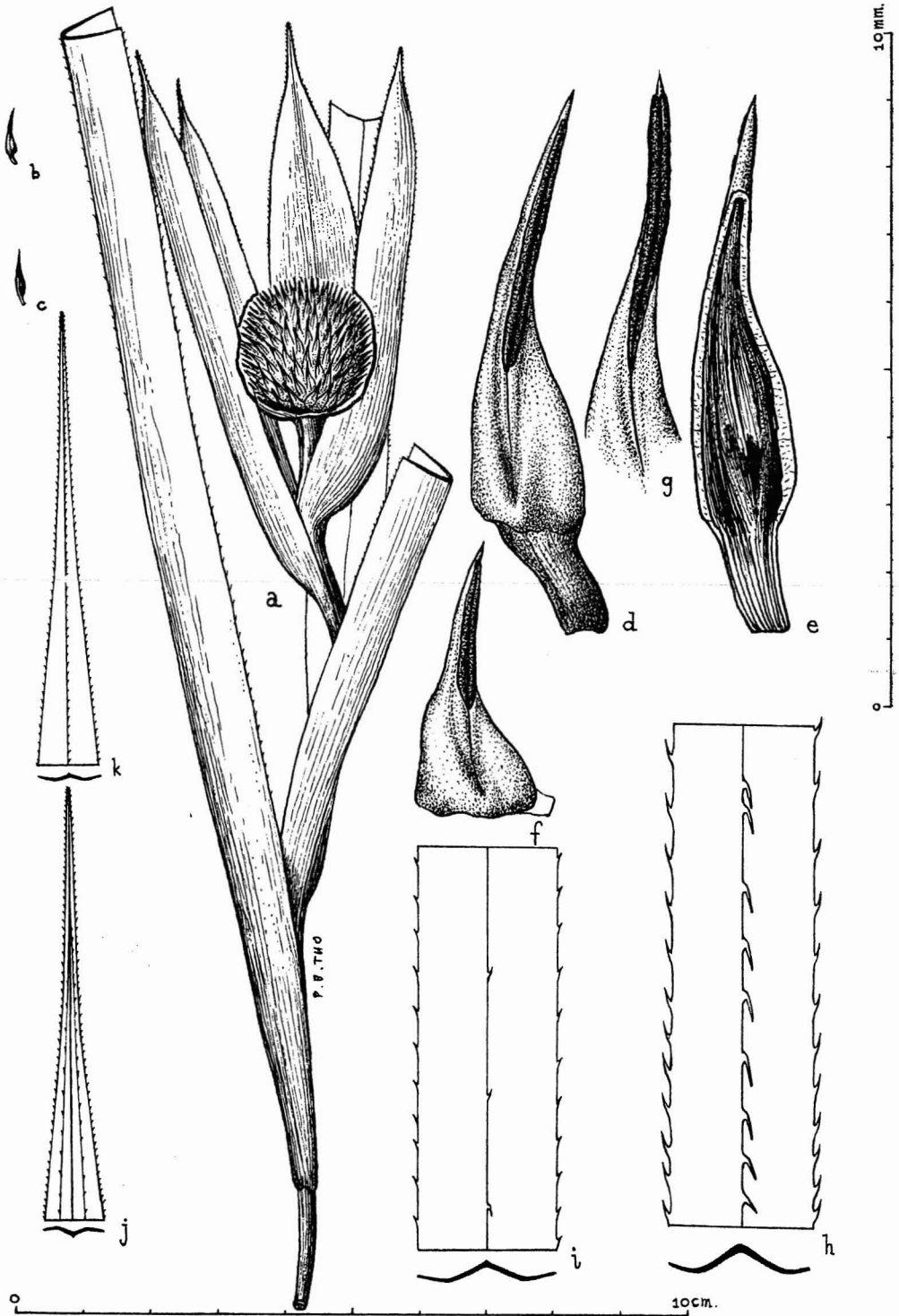
Pandanus Toinu sp. nov. (sect. *Acrostigma*).

Fig. 227

NOM. VERN.: "tôi nu."

DIAGNOSIS HOLOTYPE: Planta erecta aggregata, caulibus 15 cm altis 8 mm diametro, foliis 72 cm longis 14 mm latis firme chartaceis supra viridibus infra pallide viridibus 1-sulcatis 2-plicatis in sectione M-formatis ligulatis in apice in 8 cm ultimis sensim diminuentibus in apice subulato 1 cm longo in sectione mediali cum 19–20 nervis parallelis secundariis in quaque media eis ubique evidentis et reticulis oblongis elongatis formantibus in media ultima plicis supra cum subulato-serrulis 0.5–0.9 mm longis 2–4 mm separatis basi amplexicauli inermi sed nervis longitudinalibus prominentissimis ex 5

FIG. 226. *Pandanus retroaculeatus* St. John, from holotype. *a*, fruiting branch, lateral view, $\times 1$; *b*, *c*, drupe, lateral view, $\times 1$; *d*, drupe, lateral view $\times 10$; *e*, drupe, longitudinal median section, $\times 10$; *f*, *g*, pileus, 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, $\times 1$.



cm marginibus cum aculeis 1–1.5 mm longis 2–5 mm separatis lanceo-deltae complanatis luteis adscendentibus, midnervo infra ex 5.5 cm cum aculeis 0.7–1.5 mm longis 2–8 mm separatis subulato-conicis infimis erectis alteris reflexis, in sectione mediali marginibus cum subulato-serrulis 0.7–0.9 mm longis 2–3 mm separatis, midnervo infra cum serrulis 0.5 mm longis 4–8 mm separatis vel nullis, ad apicem marginibus et midnervo infra cum serrulis 0.1 mm longis 1–2 mm separatis, inflorescentia foemina erecta foliosa cum syncarpio solitario, pedunculo 8 cm longo 4 mm diametro trigono, syncarpio (immature) 2 cm longo 18 mm diametro ovoideo-subglobose cum circa 240 drupis eis immaturis 7–8 mm longis, pileo 5 mm longo obliquiter lanceoloideo proxime curvato osseoso luteo basi 2 mm alta 1.7–2 mm lata obliquiter pyramidalis prominente 5-angulosa glauca, stylo 3 mm longo crassiter subulato arcuato lucido subtereto, stigmatate 2–2.5 mm longo late lineari cinnamomum-brunneo papilloso subterminali, corpore 2.5–3 mm longo oblanceoloideo immaturo contracto.

DIAGNOSIS OF HOLOTYPE: Plant erect, forming tufts; stems about 15 cm tall, 8 mm in diameter; leaves 72 cm long, 14 mm wide, firm, chartaceous, green above, pale green below, with one central furrow, 2-pleated, in section M-shaped, ligulate, at tip gradually narrowed in the last 8 cm to a 1 cm subulate apex, at midsection with 19–20 parallel secondary veins in each half, these prominent throughout, the tertiary cross veins visible nearly throughout, forming a network with the meshes elongate oblong, on the outer half the pleats on the upper surface with subulate-serrulations 0.5–0.9 mm long, 2–4 mm apart, the base amplexicaul, unarmed, but the longitudinal veins very prominent, beginning at 5 cm the margins with prickles 1–1.5 mm long, 2–5 mm apart, lance-deltoid, flat, yellow, ascending; the midrib below beginning at 5.5 cm with prickles 0.7–1.5 mm long, 2–8 mm apart, subulate conic, the lowest erect, the others

becoming reflexed; at midsection the margins with subulate-serrulations 0.7–0.9 mm long, 2–3 mm apart; the midrib below with serrulations 0.5 mm long, 4–8 mm apart, or none; near the tip the margins and midrib below with serrulations 0.1 mm long, 1–2 mm apart; pistillate inflorescence erect, leafy, bearing a single syncarp; peduncle 8 cm long, 4 mm in diameter, trigonous; syncarp (immature) 2 cm long, 18 mm in diameter, ovoid-subglobose, bearing about 240 drupes, these (immature and the body little developed) 7–8 mm long; pileus 5 mm long, obliquely lanceoloid, proximally curved, bony, yellow, the base 2 mm high, 1.7–2 mm wide, obliquely pyramidal, prominently 5-angled, glaucous; style 3 mm long, thick subulate, arcuate, shining, subterete; stigma 2–2.5 mm long, broad linear, cinnamon-brown, papillose, reaching quite to the tip; body 2.5–3 mm long, oblanceoloid, shrunken, immature.

HOLOTYPE: Thailand, Padang Besar, 50 m alt, light evergreen forest, Dec. 25, 1927, *A. F. G. Kerr* 13,639 (BK).

DISCUSSION: *P. Toinu* is a member of the section *Acrostigma*, as is its closest relative, *P. similis* Craib, of Thailand, a species with the pileus 5 mm wide, the base hemispheric; style flat; leaves 1 m long, 14–19 mm wide, near the base the midrib with prickles 1.5–2 mm long, 15–20 mm apart, reflexed, at midsection the margins with white serrations 0.4–0.5 mm long, and 3–6 mm apart. *P. Toinu* has the pileus 1.7–2 mm wide, the base obliquely pyramidal; style subterete; leaves 72 cm long, 14 mm wide, near the base the midrib with prickles 0.7–1.5 mm long, 2–8 mm apart; at midsection the margins with yellow subulate-serrulations 0.7–0.9 mm long, and 2–3 mm apart.

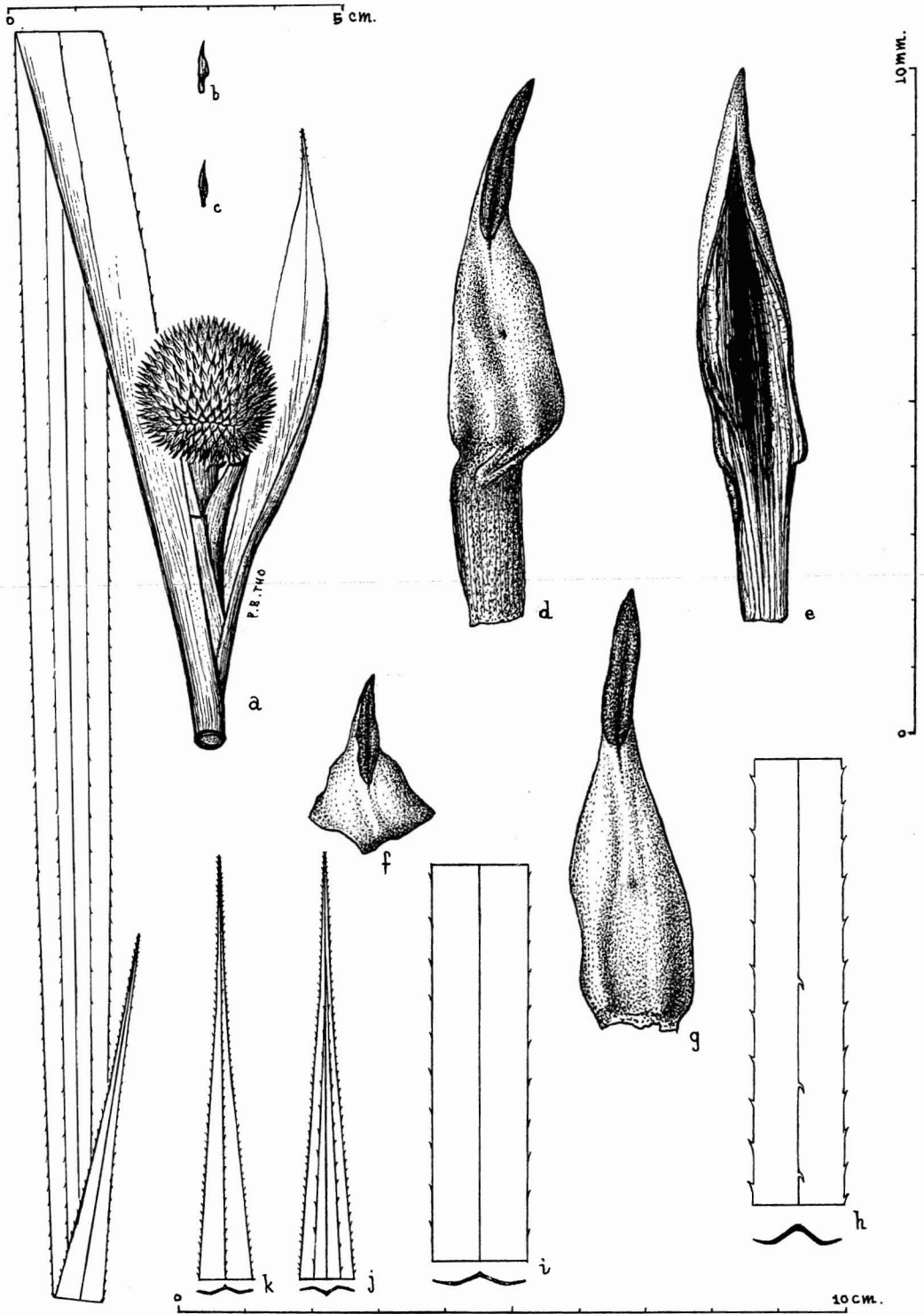
The specific epithet is the vernacular name of the species, used as a noun in apposition.

Section *Rykia*

Pandanus acaulescens sp. nov. (sect. *Rykia*).

Fig. 228

FIG. 227. *Pandanus Toinu* St. John, from holotype. *a*, fruiting branch, lateral view, $\times 1$; *b*, *c*, drupe, lateral view, $\times 1$; *d*, drupe, lateral view, $\times 10$; *e*, drupe, longitudinal median section, $\times 10$; *f*, *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, $\times 1$.

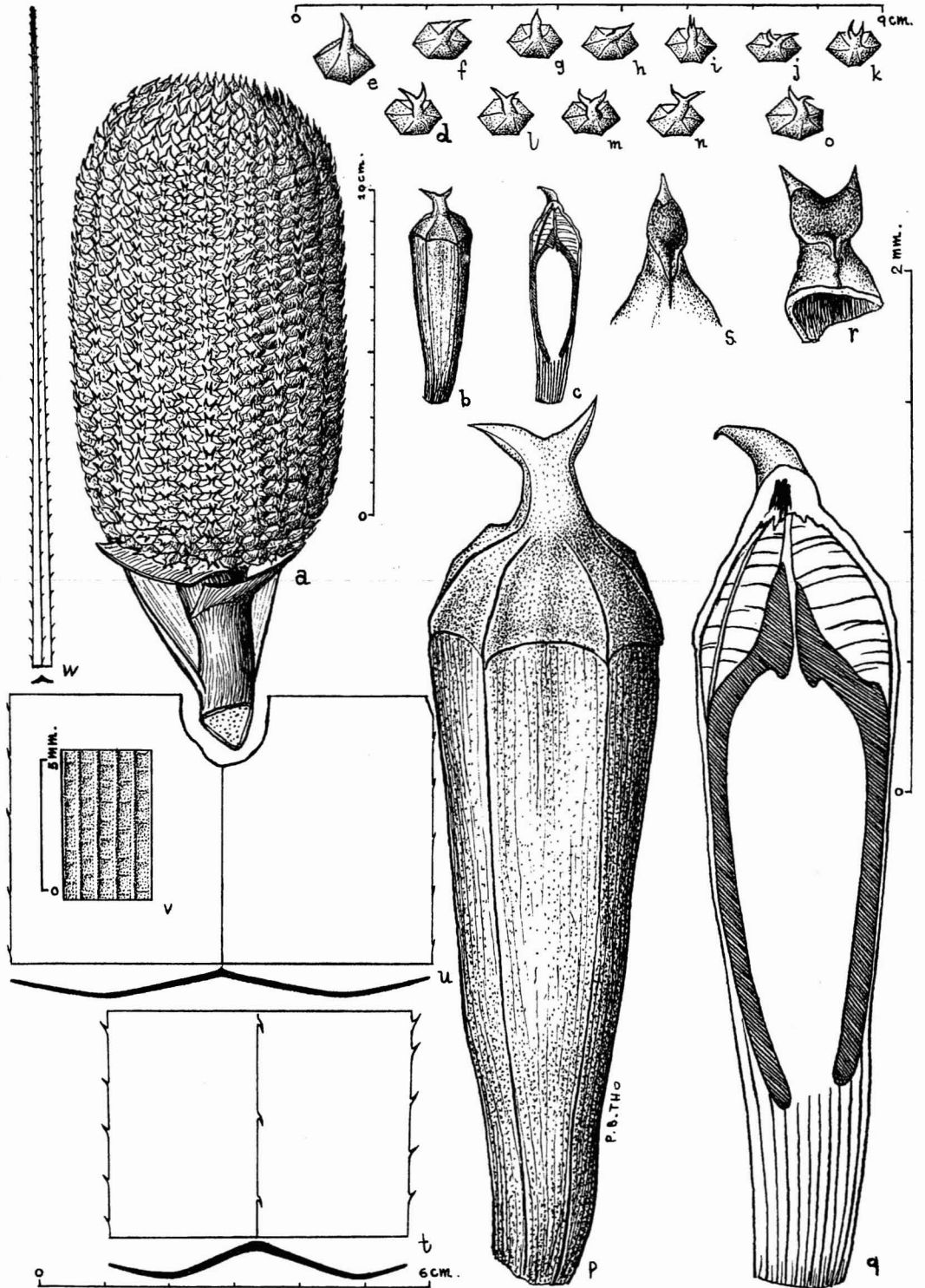


DIAGNOSIS HOLOTYPE: Planta acaulescens aggregata, foliis 2.54–3.5 m longis circa mediam 6.1 cm latis proxima basem 4 cm latis subtiliter coriaceis supra midnervum late sulcatis 2-plicatis in sectione mediali cum 49 nervis parallelis secundariis in quaque media nervis tertiis in media ultima conspicuis et reticulis quadratis formantibus lamina ligulata in apice trigono subulato 15 cm longo diminuentibus eo in puncto 10 cm ex apice 1.5 mm lato basi amplexicauli inermi crassa lucida rubro-brunnea, marginibus ex 16 cm cum aculeis 1.5–2.5 mm longis 5–10 mm separatis subulatis pallidis adscendentibus, midnervo infra ex 14 cm cum aculeis 2–3 mm longis 11–18 mm separatis arcuatis subulatis recurvatis per 16 cm extentis deinde ad $\frac{1}{4}$ ultima inermi, in sectione mediali marginibus cum serrulis 0.7–1 mm longis 4–11 mm separatis, in apice subulato marginibus et midnervo infra cum serrulis 0.6–1 mm longis 1–4 mm separatis, inflorescentia foeminea erecta cum syncarpio solitario, pedunculo 56 cm longo trigono subclavato in apice 15 mm diametro media ultima folioso-bracteato, bracteis syncarpium includentibus interioribus marcescentibus et in stigmatibus affixis, bracteis superis 17 cm longis 6 cm latis marginibus superis et midnervo infra serrulatis, syncarpio 14.5 cm longis 9.3 cm diametro ellipsoideo 3-laterato cum circa 696 drupis in lineis verticalibus, drupis 32–33 mm longis 7–10 mm latis 6–10 mm crassis obscure viridibus crassiter cuneatis 6-angulis parte $\frac{1}{5}$ supera libera corpore 25–26 mm longo lateribus planis, pileo cum basi 4–5 mm alta subrotundata-pyramidalis exlucida, stylo 4–6 mm longo longiter cornuformi osseoso mahogani-brunneo lucido infra terete supra complanato valde proxime curvato plerumque $\frac{1}{3}$ – $\frac{2}{5}$ bifido ramis plerumque divergentibus (stylo druparum terminalium subulato integro), stigmate 3–3.5 mm longo lanceolato proximo brunneo papilloso, endocarpio mediali elliptico-oblancoideo osseoso brunneo lateribus lateralibus 1 mm cras-

sis intra laevi et lucido apice in projectione lanceo-subulato extenso, semine 13 mm longo oblanceo-ellipsoideo, mesocarpio apicali cavernoso cum membranis medullosis transversis albis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Acaulescent, tufted plant; leaves 2.54–3.5 m long, 6.1 cm wide a little beyond the middle, near the base 4 cm wide, thin coriaceous, broadly furrowed above the midrib, 2-pleated, at midsection with 49 parallel secondary veins in each half, the tertiary cross veins conspicuous in the outer half, making a reticulum of squarish meshes, blade ligulate, tapering to a 15 cm trigonous, subulate tip, this 10 cm down 1.5 mm wide, the base amplexicaul, unarmed, thick, shining, reddish brown, the margins beginning at 16 cm with prickles 1.5–2.5 mm long, 5–10 mm apart, subulate, pale, ascending; the nearby midrib below beginning at 14 cm with prickles 2–3 mm long, 11–18 mm apart, arcuate, subulate, recurved, these extending for only 16 cm, then the midrib unarmed till the last quarter; at midsection the margins with serrulations 0.7–1 mm long, 4–11 mm apart, on the subulate apex the margins and midrib below with serrulations 0.6–1 mm long, 1–4 mm apart; pistillate inflorescence erect, with 1 syncarp; peduncle 56 cm long, trigonous, subclavate, at apex 15 mm in diameter, the upper half leafy bracted, the bracts enclosing the syncarp and the inner ones becoming marcescent and impaled on the sharp stigmas; upper bracts 17 cm long, 6 cm wide, their upper margins and midrib serrulate; syncarp 14.5 cm long, 9.3 cm in diameter, ellipsoid, 3-sided, bearing in vertical rows about 696 drupes, these dark green, 32–33 mm long, 7–10 mm wide, 6–10 mm thick, cuneate, 6-angled, upper $\frac{1}{5}$ free, the body 25–26 mm long, its sides flat; pileus with the base 4–5 mm high, slightly rounded pyramidal, dull; style 4–6 mm long, hornlike, bony, mahogany-brown, shining, terete below, flattened above, sharply proximally curved, mostly

FIG. 228. *Pandanus acaulescens* St. John, from holotype. *a*, syncarp, lateral view, $\times \frac{1}{2}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, *i*, *j*, *k*, *l*, *m*, *n*, *o*, lateral drupes, apical view, $\times 1$; *e*, *f*, *g*, *h*, apical drupes, apical view, $\times 1$; *p*, drupe, lateral view, $\times 4$; *q*, drupe, longitudinal median section, $\times 4$; *r*, style and stigma of lateral drupe, lateral view, $\times 4$; *s*, style and stigma of apical drupe, lateral view, $\times 4$; *t*, leaf base, lower side, $\times 1$; *u*, leaf middle, lower side, $\times 1$; *v*, secondary and tertiary venation of leaf middle, lower side, $\times 4$; *w*, leaf apex, lower side, $\times 1$.



bifid $\frac{1}{3}$ – $\frac{2}{5}$ way, the forks mostly divergent (the apical drupes with the style simple, subulate); stigma 3–3.5 mm long, lanceolate, on the proximal face of the lobes, united below, brown, papillose; endocarp median, elliptic-oblongoid, bony, brown, the lateral walls 1 mm thick, the inner surface smooth, shining, the apex prolonged upwards into a lance-subulate projection; seed 13 mm long, oblong-ellipsoid; apical mesocarp cavernous, with transverse, white, medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand, Chiangmai, Tat Noi, common in dry waterway, 900 m alt, tufted plant, no stems, 19 April 1960, *Tem Smitinand* 6,746 (BKF).

DISCUSSION: *P. acaulescens* is a member of the section *Rykia*, as is its closest relative, *P. penetrans* St. John, a species found in the same general locality, and one which has the infructescence pendent; syncarp 12 cm in diameter; drupes 33–35 mm long, 9–11 mm wide, upper $\frac{1}{4}$ free; pileus 12–15 mm high, the base oblong-pyramidal; style 7–8 mm long; endocarp submedian; leaves 5–5.6 cm wide near the base, at midsection with 43 parallel secondary veins in each half, at midsection the margins with prickles 1.5–2.5 mm long, 13–22 mm apart, subulate, the nearby midrib below with prickles 3.5–5 mm long, 38–70 mm apart, stout subulate, reflexed; tree up to 9 m tall, 8 cm in diameter, the bark with ascending adventitious rootlets. *P. acaulescens* has the infructescence erect; syncarp 9.3 cm in diameter; drupes 32–33 mm long, 7–10 mm wide, upper $\frac{1}{5}$ free; pileus 8–11 mm high, the base slightly rounded pyramidal; style 4–6 mm long; endocarp median; leaves 4 cm wide near the base, at midsection with 49 parallel secondary veins in each half, at midsection the margins with serrulations 0.7–1 mm long, 4–11 mm apart, the nearby midrib

below unarmed; and the plant acaulescent.

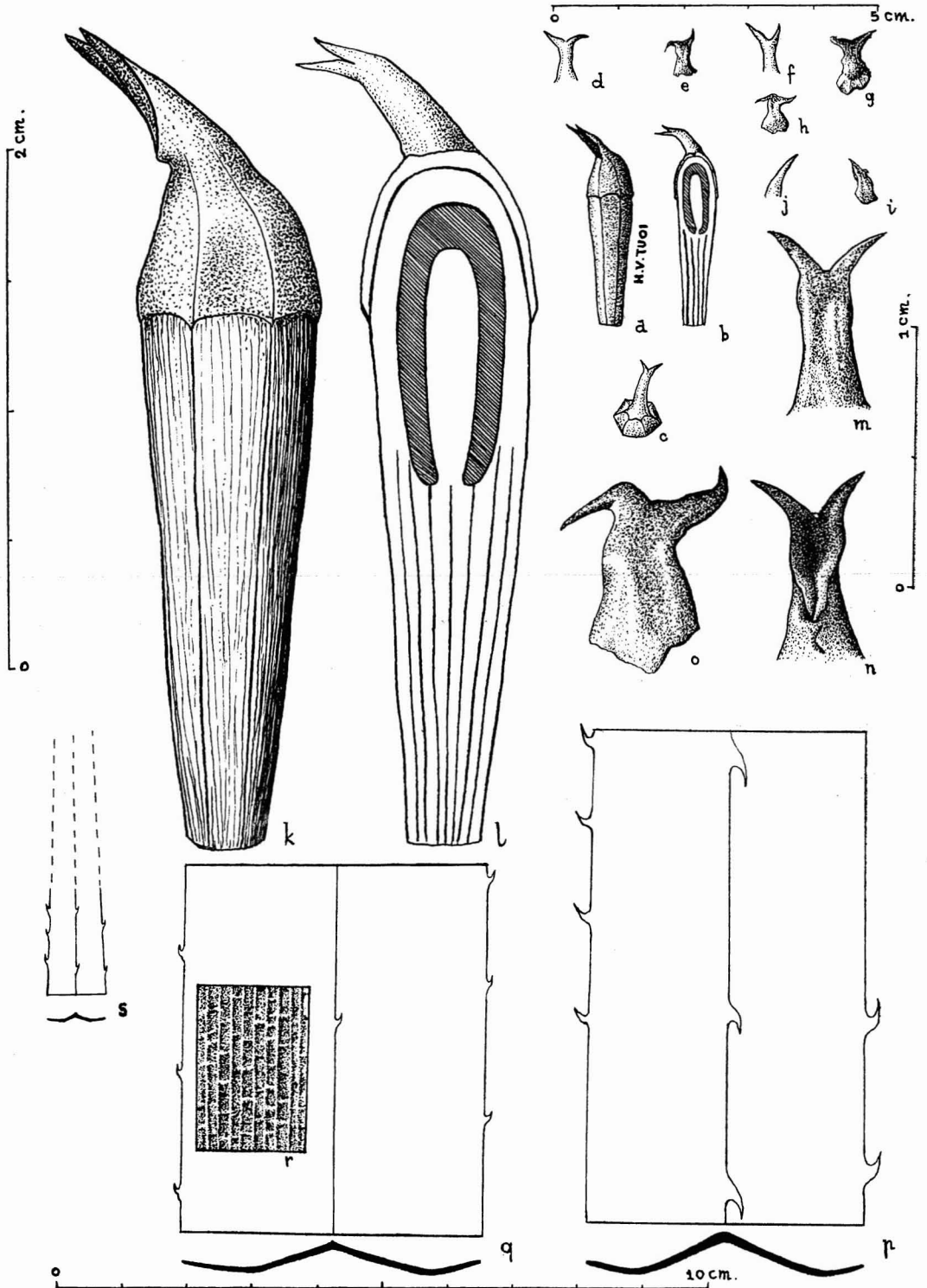
The new epithet is the Latin *acaulescens*, without a stem, and is here given as a descriptive name.

Pandanus ligulatus sp. nov. (sect. *Rykia*).

Fig. 229

DIAGNOSIS HOLOTYPI: Truncus 3 m altus, foliis 3.95 m et plus longis 4 cm latis subcoriaceis apparente pallide viridibus supra midnervum late sulcatis 2-plicatis ligulatis apice perditis, in sectione mediali cum 46 nervis parallelis secundariis in quoque dimidio ad apicem praecipue infra nervis tertiis conspicuis et oblongos angustos formantibus basi alexicauli et inermi cupraceo sed ex 13–18 cm marginibus cum spinis 4–4.5 mm longis 25–45 mm separatis crasse arcuato-subulatis adscendentibus brunneis, midnervo infra cum spinis simulantibus sed crassioribus et reflexis, in sectione mediali marginibus cum aculeis 2–2.5 mm longis 15–21 mm separatis subulatis adscendentibus apicibus brunneis, midnervo infra cum aculeis simulantibus adscendentibus sed 30–33 mm separatis, in apice marginibus cum subulato-serrulis 1–1.5 mm longis 3–5 mm separatis, midnervo infra cum serrulis simulantibus 8–12 mm separatis, infructescentia pendentis cum syncarpio solitario, pedunculo 70 cm longo 1.3 cm diametro trigono folioso-bracteato, bracteis superis 20 cm longis 5 cm latis foliaceis marginibus cum subulato-serrulis 0.5 mm longis 3–5 mm separatis, syncarpio 11 cm longo 7.5 cm diametro late ellipsoideo viridi, drupis 27–32 mm longis 6–8 mm latis 5–7 mm crassis oblongo-oblongoideis eis lateralibus et subbasalibus minime compressis (illis apicalibus parve majoribus et paucis cum stylo subulato integri arcuato), pileo 10–13 mm longo basi 4–7 mm alto anguste pyramidaliconico 5–6-anguloso minute papilloso, stylo 6–7 mm longo osseoso brunneo lucido supra mediam compresso prox-

FIG. 229. *Pandanus ligulatus* St. John, from holotype. *a*, drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, drupe apex, apical view, $\times 1$; *d*, *e*, *f*, *g*, *h*, style and stigma of lateral drupes, lateral view, $\times 1$; *i*, *j*, style and stigma of apical drupes, lateral view, $\times 1$; *k*, drupe, lateral view, $\times 4$; *l*, drupe, longitudinal median section, $\times 4$; *m*, style, distal view, $\times 4$; *n*, style and stigma, proximal view, $\times 4$; *o*, style, distal view, $\times 4$; *p*, leaf base, lower side, $\times 1$; *q*, leaf middle, lower side, $\times 1$; *r*, secondary and tertiary venation at middle, lower side, $\times 4$; *s*, leaf apex, lower side, $\times 1$.



ime subarcuato $\frac{1}{4}$ – $\frac{1}{3}$ bifido, furcis inaequalibus divergentibus, stigmatibus 4–5 mm longo in basi lanceolato bifido brunneo papilloso ad apices non extento, endocarpio in parte $\frac{2}{5}$ supera 11 mm longo cylindrico osseoso lateribus 1 mm crassis, semine 7 mm longo sublineari, mesocarpio apicali parvo fibroso et medullosa, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Stem 3 m tall; leaves more than 3.95 m long, 4 cm wide, subcoriaceous, apparently pale green, broad channeled above the midrib, 2-pleated, ligulate, the apex lost but apparently acuminate, at midsection with 46 parallel secondary veins in each half, towards the tip especially below the tertiary cross veins conspicuous and forming narrowly oblong meshes, the base amplexicaul, unarmed, copper-colored, but beginning at 13–18 cm the margins with thorns 4–4.5 mm long, 25–45 mm apart, stout arcuate subulate, ascending, brown; the midrib below with thorns similar but stouter and reflexed; at midsection the margins with prickles 2–2.5 mm long, 15–21 mm apart, subulate, appressed ascending, brown-tipped; the midrib below with similar ascending prickles but 30–33 mm apart; near the apex the margins with subulate-tipped serrations 1–1.5 mm long, 3–5 mm apart; the midrib below with similar serrations 8–12 mm apart; infructescence pendulous, bearing a single syncarp; peduncle 70 cm long, 1.3 cm in diameter, trigonous, leafy bracted, the upper bracts 20 cm long, 5 cm wide, foliaceous, the marginal teeth 0.5 mm long, 3–5 mm apart, subulate-serrulate; syncarp 11 cm long, 7.5 cm in diameter, broadly ellipsoid, green; drupes 27–32 mm long, 6–8 mm wide, 5–7 mm thick, oblong-ob-lanceoloid, the lateral and subbasal ones little or not at all compressed, 5–6-angled (the apical ones slightly the larger and a few of them with an unbranched, arcuate, subulate style); pileus 10–13 mm long, its base 4–7 mm high, narrowly

pyramidal-conic, 5–6-angled, minutely papillose; the style 6–7 mm long, bony, brown, shining, compressed above the middle, gently arcuate proximally, bifid $\frac{1}{4}$ – $\frac{1}{3}$ way, the forks subequal, divergent, often unequally so; stigma 4–5 mm long, lanceolate at base, bifid, not reaching the tips, brown papillose; endocarp in upper $\frac{2}{5}$, 11 mm long, cylindrical, bony, pale, the lateral walls 1 mm thick; seed 7 mm long, almost linear; apical mesocarp sparse, fibrous and pithy; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand, northeastern part, Loei, Phu Krading, common in evergreen forest by stream, 1,300 m alt, 24 Nov. 1958, *Tem Smitinand* 4,950 (BKF).

DISCUSSION: *P. ligulatus* is a member of the section *Rykia*, as is its closest relative the Thailand species *P. penetrans* St. John, which species has the syncarp 14 cm long, 12 cm in diameter; drupes 33–35 mm long, 9–11 mm wide, 7–10 mm thick; base of the pileus 7–10 mm high; endocarp submedian; seed 13 mm long; leaves 2.7–2.9 m long, 5–5.6 cm wide, near the base the margins with prickles 3.5–4 mm long, 11–18 mm apart. *P. ligulatus* has the syncarp 11 cm long, 7.5 cm in diameter; drupes 27–32 mm long, 6–8 mm wide, 5–7 mm thick; base of the pileus 4–7 mm high; endocarp in the upper $\frac{2}{5}$; seed 7 mm long; leaves 3.9 or more m long, 4 cm wide; and near the base the margins of the leaves with thorns 4–4.5 mm long, 25–45 mm apart.

The new epithet is the Latin adjective, *ligulatus*, strap-shaped, in reference to the ligulate leaf blades.

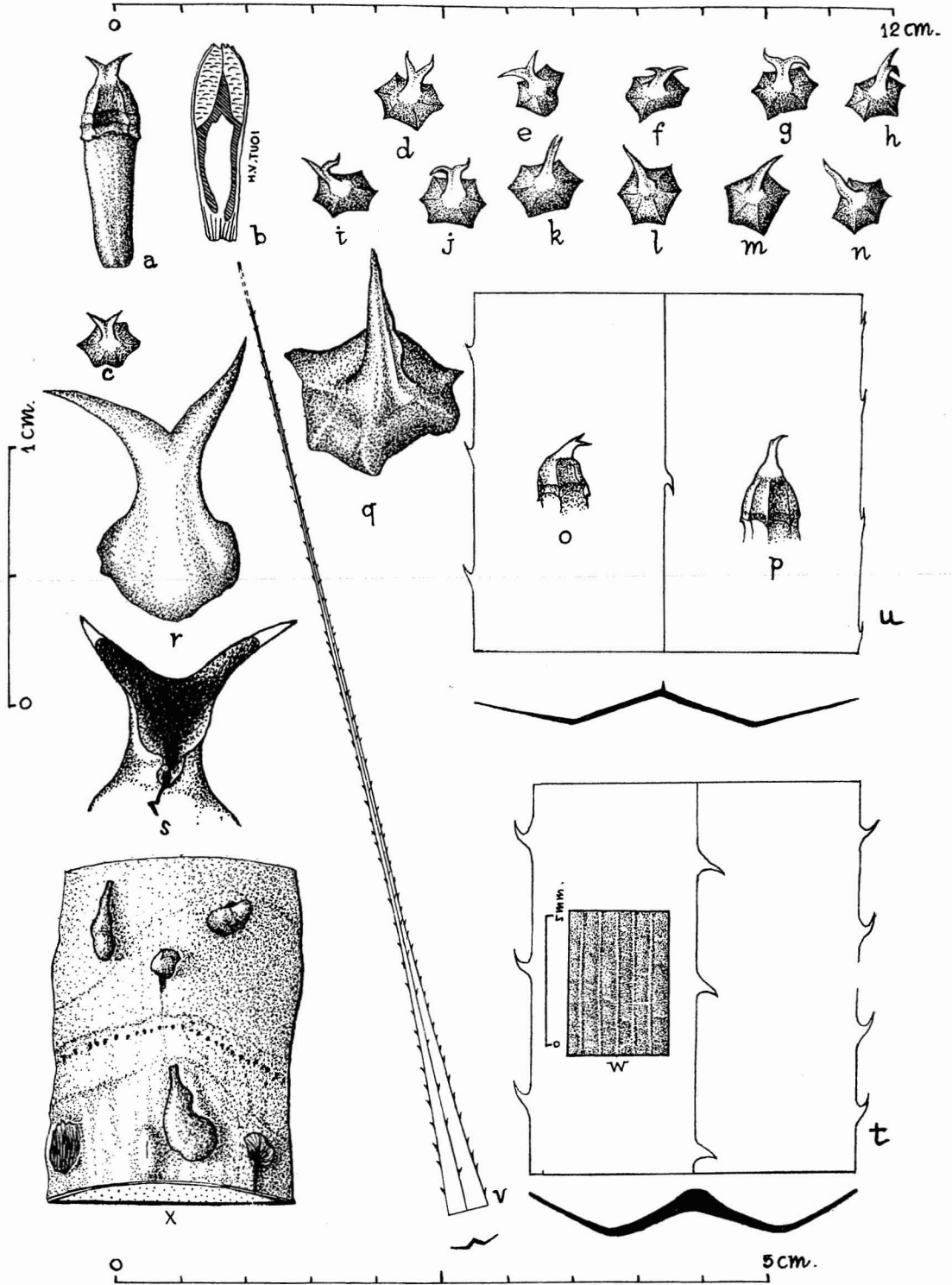
Pandanus penetrans sp. nov. (sect. *Rykia*).

Figs. 230, 231

NOM. VERN.: "toei."

DIAGNOSIS HOLOTYPE: Arbor 9 m alta 8 cm diametro, cortice brunneo cum radicillis 1 cm

FIG. 230. *Pandanus penetrans* St. John, from holotype. *a*, drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, lateral drupe and style, apical view, $\times 1$; *l*, *m*, *n*, apical drupe and style, apical view, $\times 1$; *o*, *p*, pileus, and style, lateral view, $\times 1$; *q*, apex and style of apical drupe, apical view, $\times 4$; *r*, pileus and style of lateral drupe, distal view, $\times 4$; *s*, style and stigma of lateral drupe, proximal view, $\times 4$; *t*, leaf base, lower side, $\times 1$; *u*, leaf middle, lower side, $\times 1$; *v*, leaf apex, lower side, $\times 1$; *w*, secondary and tertiary veins, lower side, rather near apex, $\times 4$.

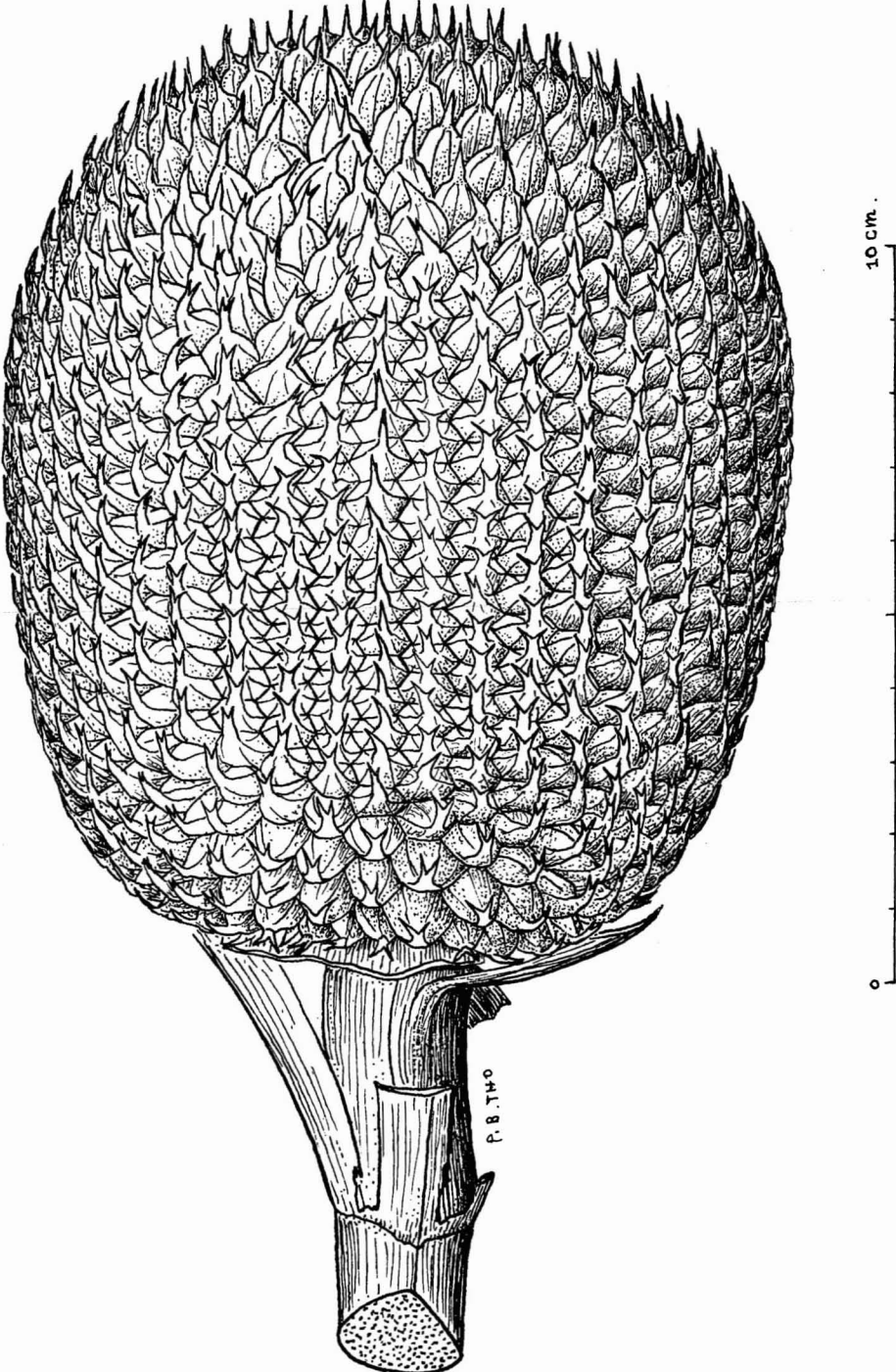


longis adventivis paucis spiniformatis adpresse adscendentibus, radicibus futurosis nullis vel in truncis prostratis 3–5 dm longis 1 cm diametro paucis laevibus vel parve spinosis, foliis 2.73–2.9 m longis 6–6.3 cm latis in media sed proxima basem 5–5.6 cm latis subcoriaceis supra obscure olivaceo-viridibus infra pallide viridibus in basi clausa cupracea supra midnervo late 1-sulcatis 2-plicatis in sectione mediali cum 43 nervis parallelis secundariis in quoque medio in dimidia ultima nervis tertiis conspicuis in lateribus ambis laminis ligulatis sed in basi subcuneatis et in apice subulato trigono gracili breviter diminuentibus eo 10 cm ex apice 1 mm lato basi amplexicauli et inermi sed marginibus ex 10–11 cm cum aculeis 3.5–4 mm longis 11–18 mm separatis subulatis validibus subadscendentibus subviridibus vel albis apicibus brunneis, midnervo infra ex 18 cm cum aculeis 4–5 mm longis 15–25 mm separatis crasse subulatis subreflexis in sectione mediali marginibus cum aculeis 1.5–2.5 mm longis 13–22 mm separatis subulatis adpresse adscendentibus, midnervo infra cum aculeis 3.5–5 mm longis 38–70 mm separatis crasse subulatis reflexis, in apice subulato marginibus et midnervo infra cum serrulis 0.3–0.5 mm longis 1–6 mm separatis, inflorescentia foeminea terminali pendenti cum syncarpio solitario, pedunculo 65 cm longo subclavato in apice 2 cm diametro trigono folioso-bracteato bracteis superis 80 cm longis 7 cm latis, bractea supera 17 cm longa 5.5 cm lata marginibus superis serrulatis, syncarpio cum bracteis marcescentibus subclausis, syncarpio 14 cm longo 12 cm diametro late ellipsoideo valde 3-laterato cum circa 576 drupis eis 33–35 mm longis 9–11 mm latis 7–10 mm crassis oblongo-lanceoloideis 5–7-angulosis (drupis terminalibus parve majoribus et cum stylo subulato arcuato integro) eis lateralibus viridibus subglaucis lateribus planis laevibus parte $\frac{1}{4}$ supera libera, pileo 12–15 mm alto cum basi 7–10 mm alta 5–7-angulosa oblanceo-pyramidalis lateribus laevibus, stylo 7–8 mm longo cornoso obscure brunneo lucido compresso adscendenti tum valde proxime curvato $\frac{1}{3}$ – $\frac{2}{5}$ furcato furcis spinosiformibus plerumque divergentibus et subaequalibus, stigmatibus

4–5 mm longo lanceolato bifurcato brunneo papilloso paene ad apices extento, drupis apicalibus cum stylo 5–6 mm longo subulato erecto recto vel subarcuato, endocarpio submediali corpore 14 mm longo osseoso brunneo in apice cum extensione subulato 8 mm longo lateribus lateralibus 1–1.5 mm crassis intra lucidis, semine 13 mm longo ellipsoideo, mesocarpio apicali cavernoso cum membranis albis medullosis multis, mesocarpio basali parvo fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree, up to 9 m tall, 8 cm in diameter; bark brown, with a few, well spaced, adventive rootlets, up to 1 cm long, appressed ascending, almost spine-like; prop roots none on erect trunks, but on fallen trunks rare and 3–5 dm long, 1 cm in diameter, smooth or with a few remote, small spines; leaves 2.73–2.9 m long, 6–6.3 cm wide at the middle, 5–5.6 cm wide near the base, subcoriaceous, above dark olive green, below pale green, the covered auriculate base copper-colored, broadly furrowed above the midrib, 2-pleated, at midsection with 43 parallel secondary veins in each half, in the outer half the tertiary cross veins conspicuous on both sides, a little sinuous, making a pattern of squares or short oblongs, blade ligulate, though slightly tapering to the base and short tapering to the 10–15 cm, trigonous, slender subulate apex, this 10 cm down 1 mm wide, the base amplexicaul and unarmed, but the margins beginning at 10–11 cm with prickles 3.5–4 mm long, 11–18 mm apart, stout subulate, slightly ascending, greenish to whitish and brown-tipped; the midrib below beginning at 18 cm with prickles 4–5 mm long, 15–25 mm apart, stout subulate, slightly reflexed; at midsection the margins with prickles 1.5–2.5 mm long, 13–22 mm apart, subulate, appressed ascending; the midrib below with prickles 3.5–5 mm long, 38–70 mm apart, stout subulate, reflexed; on the subulate apex the margins and midrib below with serrulations 0.3–0.5 mm long, 1–6 mm apart; pistillate inflorescence terminal, pendent, bearing one syncarp; peduncle 65 cm long, slightly clavate, at apex 2 cm in diameter, trigonous, leafy bracted; upper bracts 80 cm long, 7 cm wide, the innermost 17 cm long, 5.5 cm

FIG. 231. *Pandanus penetrans* St. John, from holotype, syncarp, lateral view, $\times 1$.



wide, the upper margins serrulate; syncarp enveloped and nearly concealed by the marcescent bracts; syncarp 14 cm long, 12 cm in diameter, broad ellipsoid, markedly 3-sided, bearing about 576 drupes, these 33–35 mm long, 9–11 mm wide, 7–10 mm thick, oblong-lanceoid, 5–7-angled (the apical ones averaging slightly the larger and with a simple, arcuate, subulate style), the normal lateral ones still green, but full sized, a little glaucous, the sides plane and smooth, upper $\frac{1}{4}$ free; pileus 12–15 mm high, the base oblong-pyramidal, 7–10 mm high, 5–7-angled, the sides smooth; style of lateral and basal drupes 7–8 mm long, horn-like, dark brown, shining, flattened, ascending, then sharply proximally curved almost at right angle, bifurcate $\frac{1}{3}$ – $\frac{2}{5}$ way, the forks spine-like, mostly divergent and subequal; stigma 4–5 mm long, lanceolate, bifurcate, brown, papillose, extending almost to the tips; apical drupes with simple, subulate style 5–6 mm long, erect, straight or slightly arcuate; endocarp submedian, the body 14 mm long, bony, brown, the apex bearing a subulate prolongation 8 mm long, the lateral walls 1–1.5 mm thick, the inner surface shining; seed 13 mm long, ellipsoid; apical mesocarp a cavern with many white medullary membranes; basal mesocarp scant, fibrous and fleshy.

HOLOTYPUS: Thailand, Doi Suthet, Chiang Mai, moist forest of *Manglieta Garrattiana* and *Podocarpus nereifolia*, moist stream bank on granite, 1,200 m alt, June 7, 1960, H. St. John 26,352 (BISH).

DISCUSSION: *P. penetrans* is a member of the section *Rykia*, as is its closest relative, the Malayan species *P. longicaudatus* Holtum & St. John, a species which has the syncarp 16–17 cm long; drupes 41–44 mm long, 8–14 mm wide, cuneate oblong; pileus base 4–6 mm high, pyramidal-hemispheric; stigma 3–3.5 mm long; leaves 4.7–6 cm wide, at midsection with 48 parallel secondary veins in each half, the covered base olive-ochre, and at midsection the midrib unarmed. *P. penetrans* has the syncarp 14 cm long; drupes 33–35 mm long, 9–11 mm wide, oblong-lanceoid; pileus base 7–10 mm high, oblong-pyramidal; stigma 4–5 mm long; leaves 6–6.3 cm wide, at midsection with 43 parallel secondary veins in each half, the covered base copper-colored, at midsection the midrib below with prickles 3.5–5 mm long, 38–70 mm apart.

The new epithet is the Latin word *penetrans*, penetrating, and is given in reference to the sharp, rigid style forks that easily penetrate one's flesh.