

Revision of the Genus *Pandanus* Stickman, Part 10

New *Pandanus* Species from Vietnam

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DURING THE YEAR 1959–60 the writer has actively collected and studied *Pandanus* in Vietnam. The following novelties are here reported.

Pandanus hueensis sp. nov. (sect. *Pandanus*)
Figs. 60–63

NOM. VERN.: "dua."

DIAGNOSIS HOLOTYPI: Arbor 7 m. alta 15 cm. diametro, cortice brunneo cum radicillis 1–2.5 cm. longis paucis adscendentibus, radicibus fulturosis 30–40 cm. longis 2.5 cm. diametro paucis, foliis 1.45–1.58 m. longis 4.7–5.5 cm. latis coriaceis ligulatis supra intense viridibus infra pallidioribus et glaucis in sectio sinuatis in apice trigono subulato sensim longiter diminuentibus eo 10 cm. ex apice 2.2 mm. lato basi clausa integra et amplexicaule sed ex 8–10 cm. marginibus cum spinis 2–4 mm. longis 3–10 mm. distantibus toto albis vel cum apicibus brunneis subulatis arcuatis adscendentibus, midnervo infra cum spinis 2–2.5 mm. longis 12–30 mm. distantibus subulatis in basi incrassatis valde reflexis, in regione medialis marginibus cum spinis 3–4 mm. longis 3–13 mm. distantibus subulatis adpresse adscendentibus, midnervo infra cum spinis 1.5–2.5 mm. longis 12–18 mm. distantibus adpresse adscendentibus, circa apice marginibus et midnervo infra cum serris mucronatis 0.5–0.7 mm. longis 2–4 mm. distantibus, syncarpiis solitariis terminalibus, pedunculo 30 cm. longo folioso obtuse triangularibus, syncarpio 28 cm. longo 20 cm. diametro late elliptico-ovoideo sed triangularibus, centro 5 cm. diametro ellipsoideo 143 phalangibus ferrento eis 7.4–8 cm. longis 3–4.6 cm. latis 2.8–3.6 cm. crassis anguste oblongo-oblancoideo quando submaturis in apice aurantiascentibus lateribus laevibus lucidis planatis vel subcurvatis 4–7-angulatis parte supera $\frac{1}{3}$ libera apice sub-

convexo suturis lateralibus nullis, sinibus centralibus apicalibus 3.5–5 mm. profundis dimidia infera V-formatis, carpelis 4–9 plerumque 6–7 apicibus pyramidalibus sed in phalangiis parvis et minoribus apicibus anguste pyramidalibus et apice subrostratis sed in eis majoribus apicibus oblato-pyramidalibus, stigmatibus 2.5–3.5 mm. longis suborbicularibus ad reniformibus obscure brunneis sulcatis apicalibus contripetalibus inclinatibus, sutura proxima lata et $\frac{1}{2}$ – $\frac{2}{3}$ ad fundam extenta, endocarpio in tertia supera 2 cm. longo osseoso brunneo pagina interiori lucida marginibus lateralibus 2 mm. crassis, seminibus 14–15 mm. longis 5 mm. diametro ellipsoideis, mesocarpio apicali in carpella quoque cavernoso 10–18 mm. longo cum fibris paucis et membranibus medullosis albis multis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree 7 m. tall, 15 cm. in diameter; bark brown, with a few appressed ascending rootlets 1–2.5 cm. long; prop roots few, 30–40 cm. long, 2.5 cm. in diameter; leaves 1.45–1.58 m. long, 4.7–5.5 cm. wide, coriaceous, ligulate, bright green above, below slightly paler and glaucous, in section sinuate, gradually long tapering to the subulate, trigonous apex, this 10 cm. down only 2.2 mm. wide, the enclosed base amplexicaul and entire, but beginning 8–10 cm. up the margin with spines 2–4 mm. long, 3–10 mm. apart, wholly white or with brown tips, subulate, arcuate, ascending; the midrib below, beginning 8 cm. up, with spines 2–2.5 mm. long, 12–30 mm. apart, broad based subulate, sharply reflexed; at midsection the margin with spines 3–4 mm. long, 3–13 mm. apart, subulate, appressed ascending; the midrib below with spines 1.5–2.5 mm. long, 12–18 mm. apart, appressed ascending; near the tip the margins and midrib below with mucronate serrations 0.5–0.7 mm. long, 2–4 mm. apart; syncarp single, terminal; peduncle 30 cm. long, leafy bracted, obtusely 3-angled; syncarp

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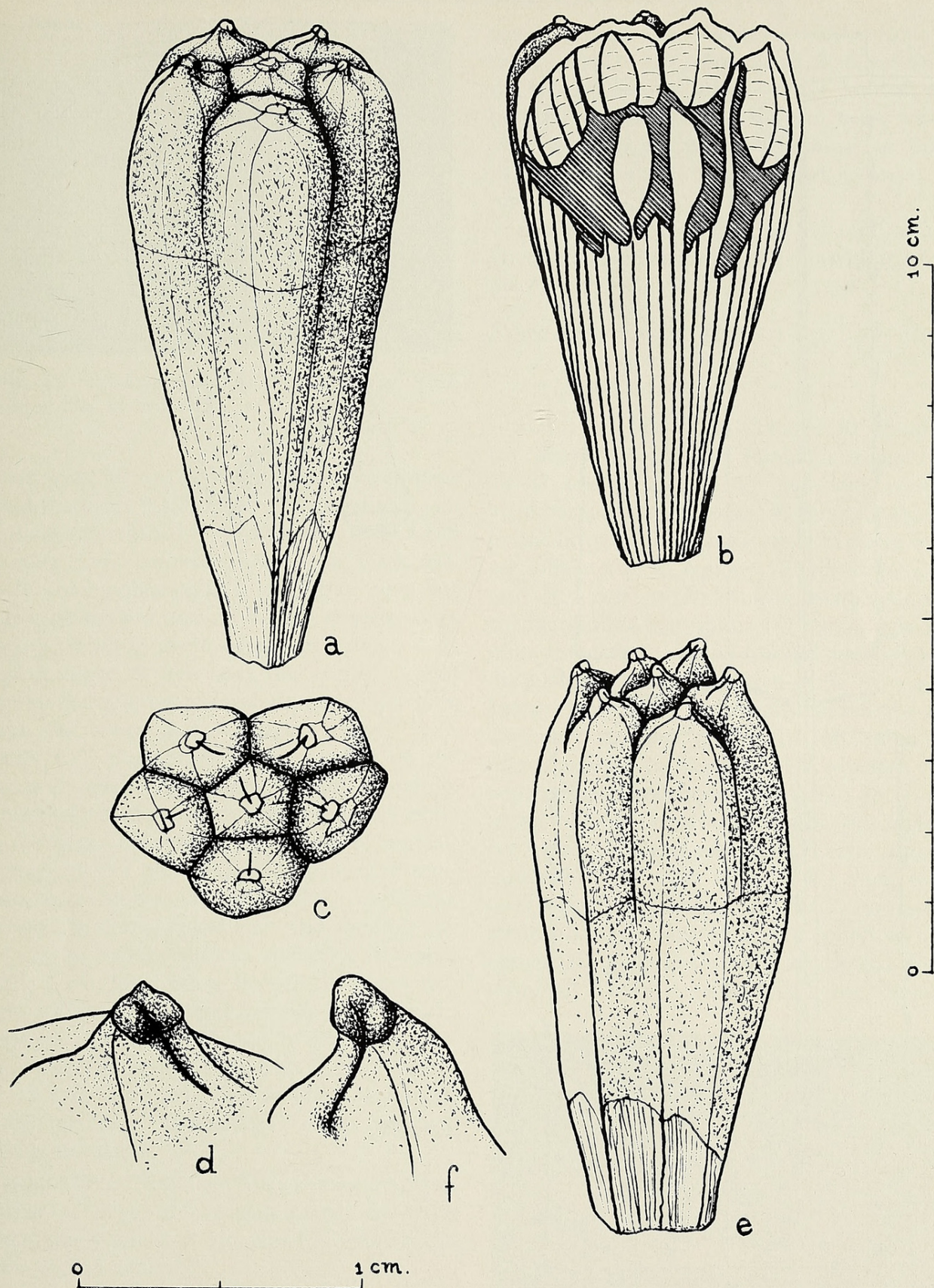


FIG. 60. *Pandanus hueensis*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, stigma and carpel apex of broader phalange, oblique view, $\times 4$; *e*, narrower phalange, lateral view, $\times 1$; *f*, stigma and carpel apex of narrower phalange, oblique view, $\times 1$.

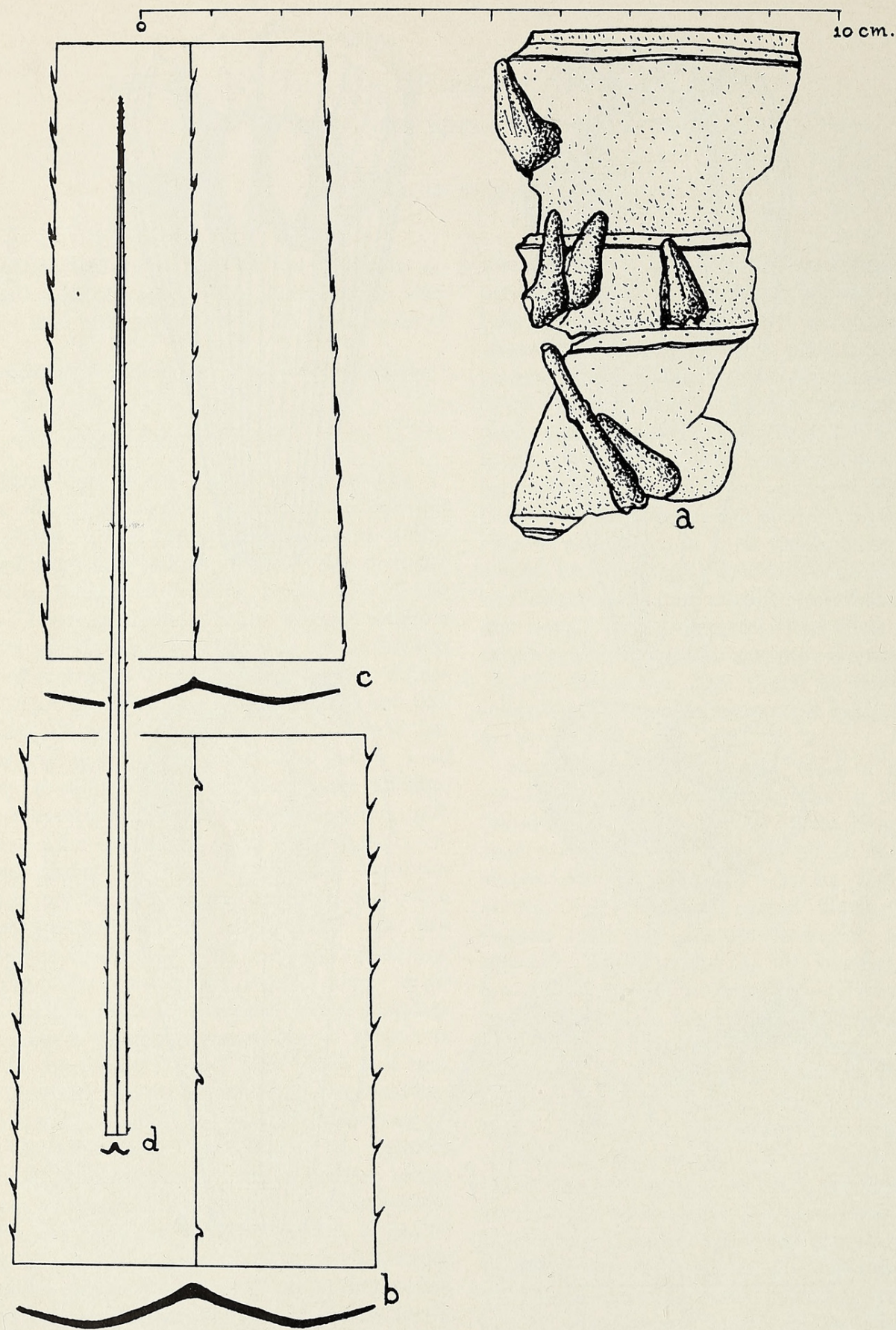


FIG. 61. *Pandanus bueensis*, from holotype. *a*, Bark with ascending rootlets, $\times 1$; *b*, leaf base, lower side, $\times 1$; *c*, leaf middle, lower side, $\times 1$; *d*, leaf apex, lower side, $\times 1$.



FIG. 62. *Pandanus hueensis*, from holotype. With figure of Mrs. H. St. John.

28 cm. long, 20 cm. in diameter, broadly elliptic-ovoid, distinctly 3-sided, the core ellipsoid, 5 cm. in diameter, with 143 phalanges, these 7.4–8 cm. long, 3–4.6 cm. wide, 2.8–3.6 cm. thick, narrowly oblong-oblancoeloid, not quite ripe, but yellow below and turning orange at apex, sides smooth, shining, plane or gently curved, 4–7-angled, upper $\frac{1}{3}$ free, apex low convex, lateral sutures none; apical central sinuses 3.5–5 mm. deep, the lower half V-shaped; carpels 4–9, mostly 6–7, the apices pyramidal, but on the narrower, smaller phalanges the apices narrow pyramidal and the summit almost rostrate, while on the larger ones the apices oblate pyramidal; stigmas 2.5–3.5 mm. long, suborbicular to reniform, dark brown, creased, apical, centripetal, inclined; proximal crease wide and running $\frac{1}{2}$ – $\frac{2}{3}$ way to valley bottom; endocarp in upper third, 2 cm. long, bony, brown, the inner surfaces polished, the lateral margins 2 mm. thick; seeds 14–15 mm. long, 5 mm. in diameter, ellipsoid; apical mesocarp cavernous in each carpel, 10–18 mm. long, with a few fibers and many white medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Vietnam, Thai Duong Ha, Hue, thicket at edge of brackish marsh by inner beach, sandy soil, 2 m. alt., April 3, 1960, H. St. John 26,343 (BISH).

DISCUSSION: *P. hueensis* is a member of the section *Pandanus* and finds its closest relationship in *P. tutuilaensis* Martelli of Samoa, which has the syncarp oblong; phalanges 7 cm. long, 3.5 cm. wide, 2.5–3 cm. thick; carpel apices

conic; central apical sinuses 3–9, mostly 5–7 mm. deep. On the other hand, *P. hueensis* has the syncarp broadly elliptic-ovoid, 3-sided; phalanges 7.4–8 cm. long, 3–4.6 cm. wide, 2.8–3.6 cm. thick; carpel apices pyramidal to oblate pyramidal; and the central apical sinuses 3.5–5 mm. deep.

The new epithet refers to the type locality, Hue, to which is added *-ensis*, making it a Latin place adjective.

Pandanus integriapicis sp. nov. (sect. *Pandanus*)

Figs. 64, 66

DIAGNOSIS HOLOTYPE: Trunco 50 cm. alto 7 cm. diametro, radicibus fulturosis nullis, foliis 78–87 cm. longis 4.2–4.5 cm. latis coriaceis viridibus glaucis in sectio M-formatis ligulatis ex medio sensim diminuentibus in apice longiter subulato eo in regione 10 cm. ex puncto 3 mm. lato, basi amplexicauli et integra sed ex 2 cm. marginibus cum spinis 4–7 mm. longis 5–15 mm. distantibus curvatis fortiter subulatis pallidis adscendentibus, midnervo ex 8–9 cm. supra basem cum spinis simulantibus sed reflexis, circa sectionem mediam marginibus cum spinis 3–4 mm. longis 7–12 mm. distantibus subulatis valde adpressis adscendentibus midnervo infra cum spinis 2–3 mm. longis simulantibus adscendentibus, circa apicem marginibus totis integris, midnervo infra cum spinis 0.5–1 mm. longis 6–11 mm. distantibus subulatis adpressi-adscendentibus, pedunculo 13 cm. longo vel ultra obtuse triangularibus foliosis, syncarpio solitario terminali 17 cm. longo 10–11 cm. diametro



FIG. 63. *Pandanus hueensis*, from holotype. Showing branch, foliage, and syncarp, lateral view.

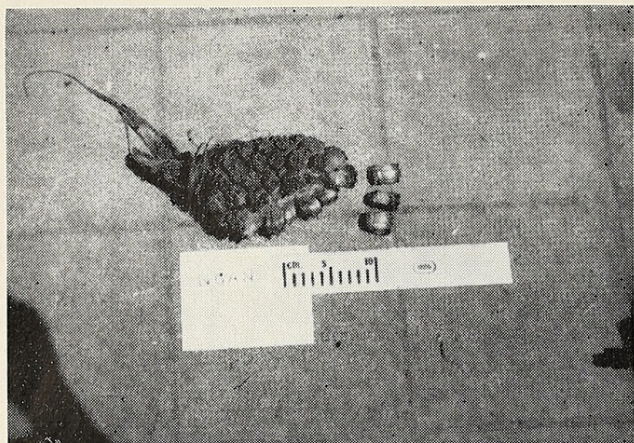


FIG. 64. *Pandanus integrapiensis*, from holotype. Showing syncarp and phalanges, lateral view.

ellipsoideo minime trigono centro molliter carnosus et in post maturitate in fibris paucis siccato, cum circa 74 phalangibus eis 2.7–3.1 cm. longis parte supera principali 2.1–3 cm. latis 1.8–2.6 cm. crassis oblongis viridibus sed pallide aurantescentibus, lateribus laevibus planis vel paene convexis sublucidis 4–7-angulosis parte $\frac{2}{3}$ supera libera, apice depresso-convexo, suturis lateralibus nullis, sinibus centralibus apicalibus 2–4 mm. profundis, parte $\frac{1}{3}$ infera carnosa distenta 2–4 mm. projecta lucida aurantiaca (Seguy, Code Univ. Couleurs pl. XIII no. 182), carpellis 7–9, apicibus centralibus conicis sed marginalibus oblique pyramidalibus et paene divergentibus, stigmatibus 2.5–3 mm. longis cordatis vel suborbicularibus vel oblatis sulcatis nigris terminalibus et prominentibus subhorizontalibus vel valde obliquis centripetalibus, sutura proxima profunda et lata ad fundam plerumque extentam, endocarpio submediali osseoso brunneo marginibus lateralibus 1 mm. latis, seminibus 7–8 mm. longis 2.5 mm. diametro fusiformibus, mesocarpio apicali cavernoso 8–13 mm. longo cum fibris longitudinalibus et membranis albis medullosis, mesocarpio basali luteo carnosus et fibroso.

DIAGNOSIS OF HOLOTYPE: Trunk 50 cm. tall, 7 cm. in diameter, prop roots none; leaves 78–87 cm. long, 4.2–4.5 cm. wide, coriaceous, green and glaucous, ligulate, in section M-shaped, gradually long tapering from the middle to a long subulate apex, this 10 cm. down only 3 mm. wide, the base amplexicaul and entire, but beginning 2 cm. up the margins with spines 4–7 mm. long, 5–15 mm. apart, curved, stout sub-

ulate, pale, ascending, the nearby midrib beginning 8–9 cm. up, with similar but reflexed spines; near the midsection the margins with spines 3–4 mm. long, 7–12 mm. apart, subulate, closely appressed ascending; the midrib below with similar ascending spines 2–3 mm. long; near the apex the margins entire, but the midrib below with appressed ascending, subulate spines 0.5–1 mm. long, 6–11 mm. apart; peduncle 13 or more cm. long, obtusely triangular, leafy bracted; syncarp solitary, terminal, 17 cm. long, 10–11 cm. in diameter, ellipsoid, slightly 3-sided, the core becoming soft fleshy and disintegrating to only a few fibers at maturity, bearing about 74 phalanges, these 2.7–3.1 cm. long, the main upper part 2.1–3 cm. wide (3.8 cm. in a double), 1.8–2.6 cm. thick, oblong, green, turning pale orange, the sides smooth, plane to gently convex, slightly shining, 4–7-angled, upper $\frac{2}{3}$ free, apex low convex, lateral sutures none, apical central sinuses 2–4 mm. deep, lower $\frac{1}{3}$ of phalange inflated fleshy at maturity, projecting 2–4 mm., shining, brilliantly colored, orange (Seguy, Code Universel Couleurs pl. XIII, no. 182); carpels 7–9, the apices conical on the central, but obliquely pyramidal and slightly divergent on the marginal ones; stigmas 2.5–3 mm. long, cordate or suborbicular or oblate, creased, black, prominent, terminal, subhorizontal to sharply oblique, centripetal; proximal crease deep and wide, extending to or nearly to the valley bottom; endocarp submedian, bony, brown, the lateral margins 1 mm. thick; seeds 7–8 mm. long, 2.5 mm. in diameter, fusiform; apical mesocarp in each carpel apex cavernous,



FIG. 65. *Pandanus Phamboangii*, from holotype. Showing foliage and syncarp, lateral view.

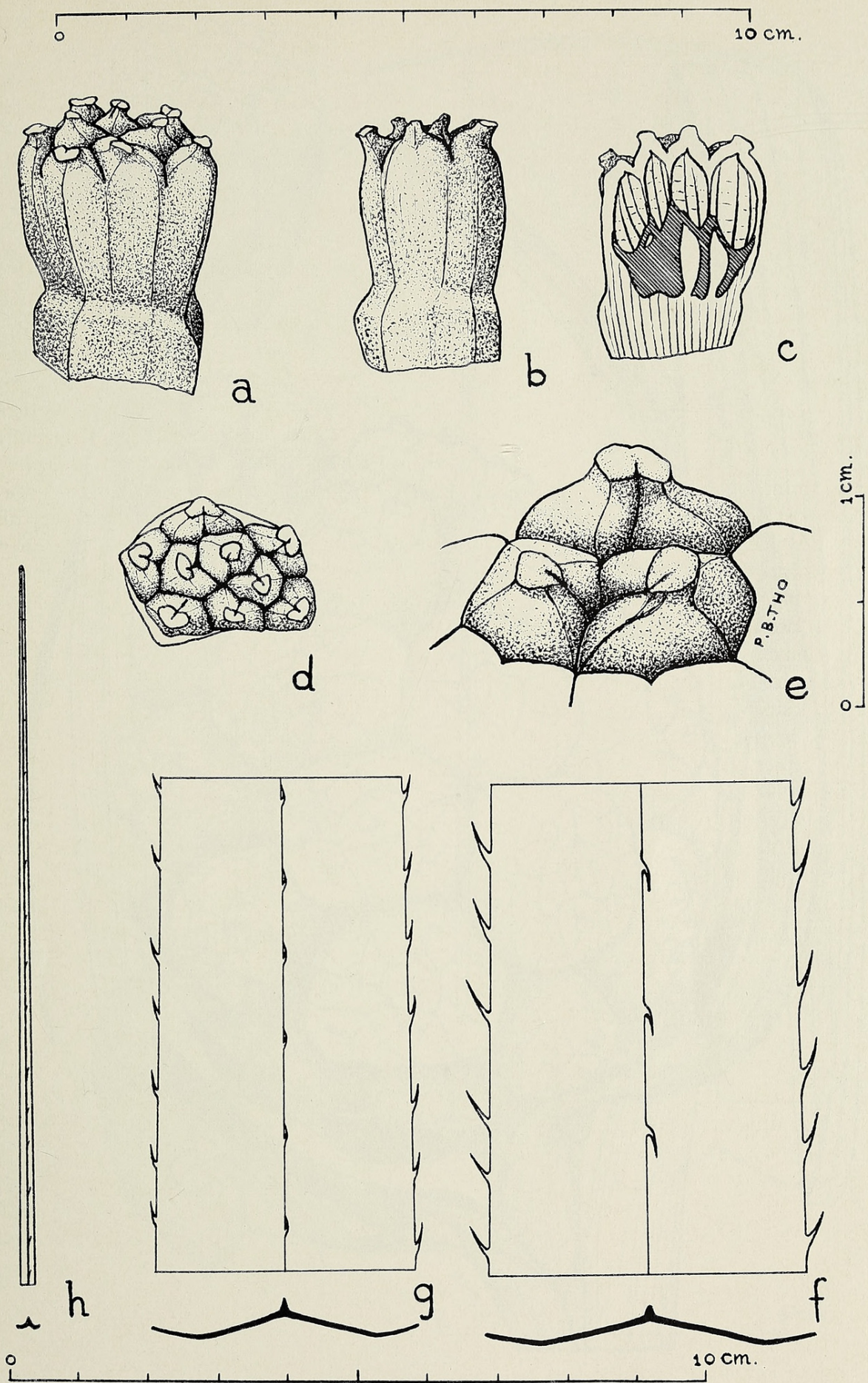


FIG. 66. *Pandanus integrilapicis*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, smaller phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, carpel apices, oblique view, $\times 3$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

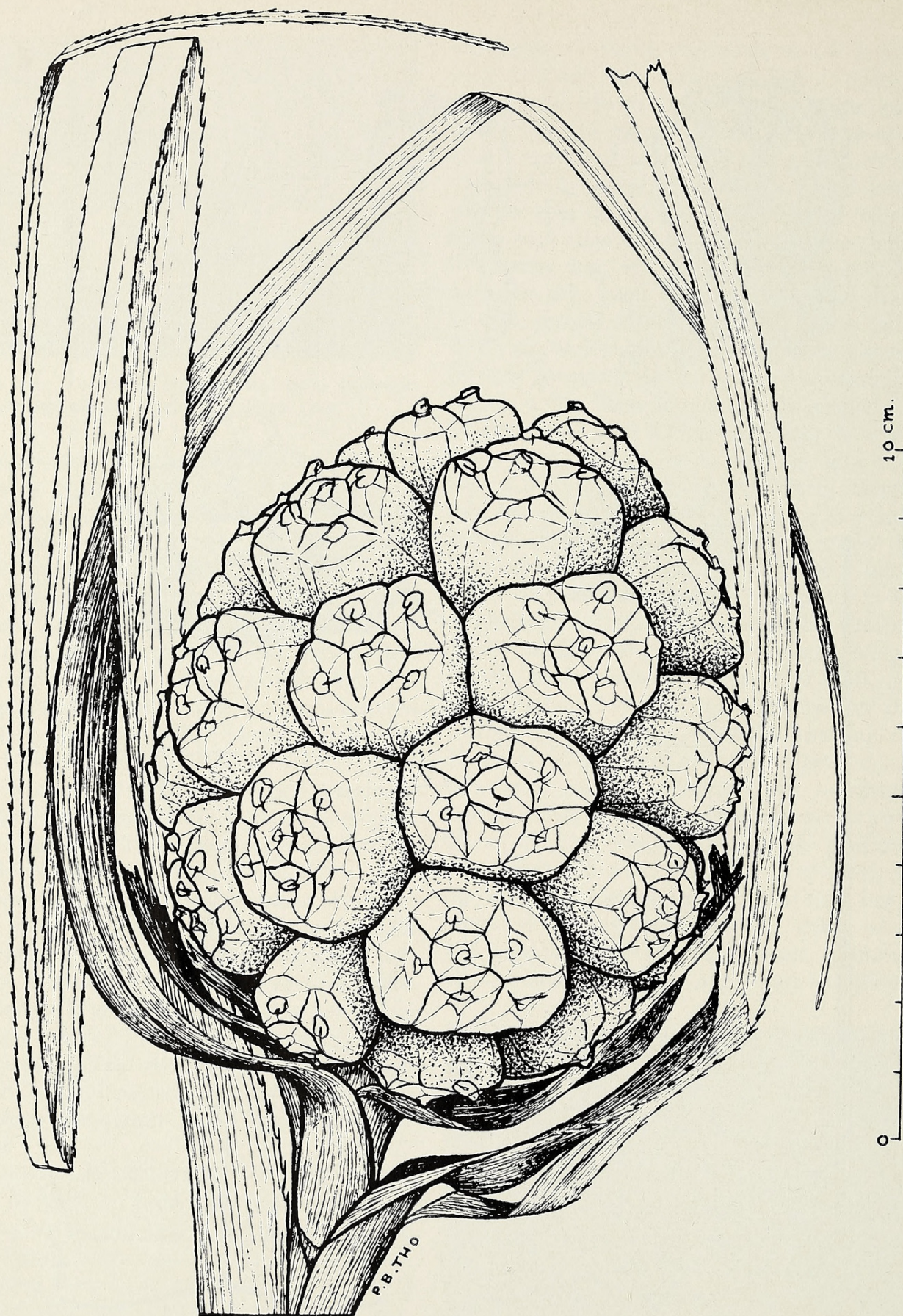


FIG. 67. *Pandanus Phamhoangii*, from holotype. Syncarp, lateral view, $\times 1$.

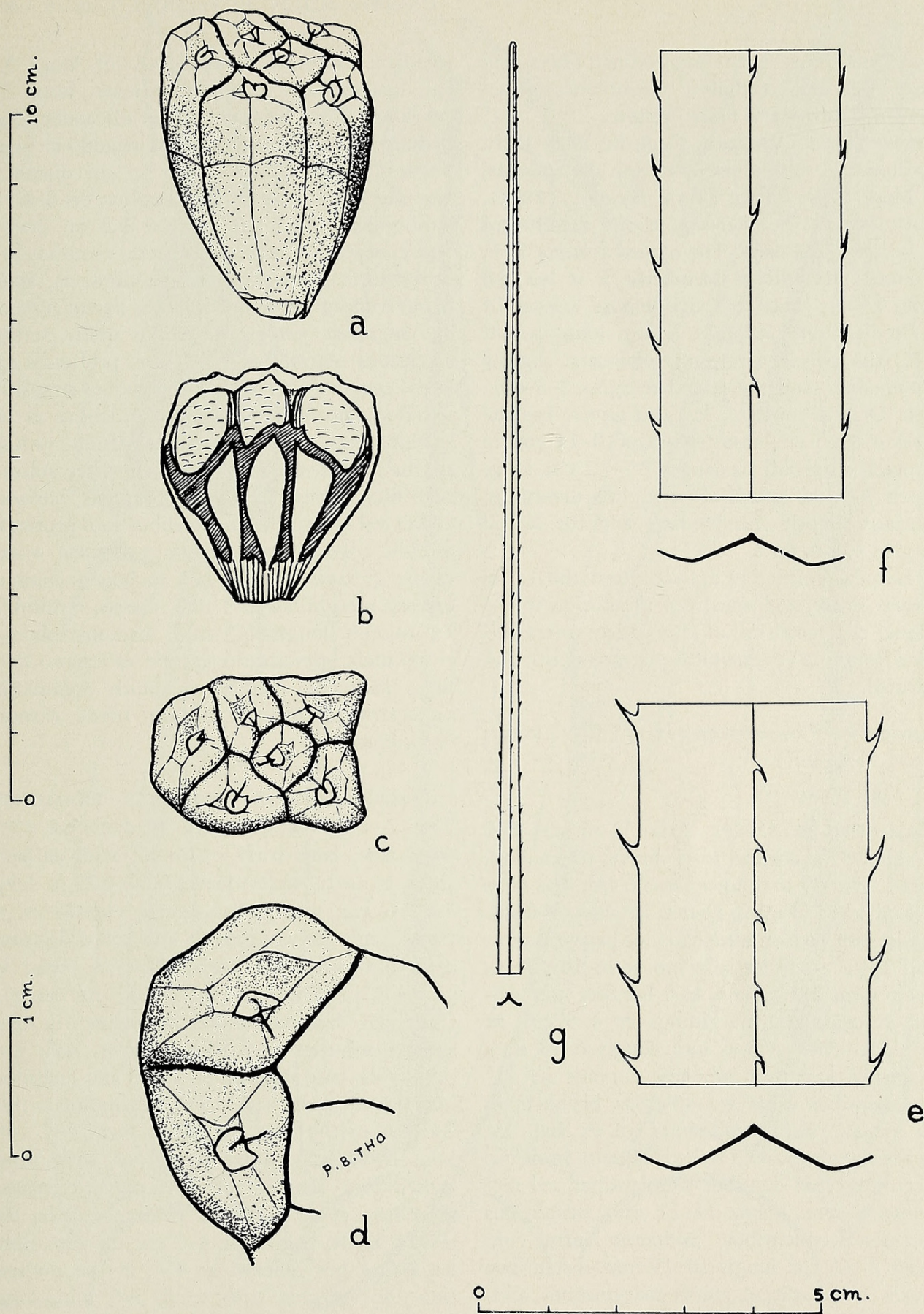


FIG. 68. *Pandanus Phamboangii*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, apical view, $\times 2$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

8–13 mm. long, with longitudinal fibers and white, delicate, medullary membranes; basal mesocarp fibrous and fleshy, yellow.

HOLOTYPE: Vietnam, plage de Phan thiêt, sur dunes de sable nues, avec peu de *Spinifex*, 19 Mars 1960, *Phung Trung Ngan* 1 (BISH).

DISCUSSION: *P. integriapicis* is a member of the section *Pandanus*. The closest relative is *P. coronatus* Martelli of Mindanao I. It has the leaves 14 cm. wide; syncarp globose, almost 14 cm. in diameter; phalanges 3.5 cm. long; carpels 9–12, the apices diverging; endocarp slightly supramedian, and the lateral margins 2–3 mm. thick. On the contrary, *P. integriapicis* has the leaves 4.2–4.5 cm. wide; syncarp 10–11 cm. in diameter, ellipsoid; phalanges 2.7–3.1 cm. long; carpels 7–9, the apices often slightly diverging; endocarp slightly inframedian, and the lateral margins 1 mm. thick.

The new epithet is derived from the Latin, *integer*, entire, and *apex*, tip, in allusion to the unique characteristic of the spiny margined leaves which have the apical margins entire and unarmed.

Pandanus Phamhoangii sp. nov. (sect. *Pandanus*)

Figs. 65, 67–69

DIAGNOSIS HOLOTYPE: Arbor 2 m. alta 8–9 cm. diametro, cortice fusci breve tuberculosi, foliis 1.23–1.29 m. longis 3.4–3.6 cm. latis coriaceis olivaceis in initio glaucis in sectio V-formati ligulatis sensim attenuatis midnervo prominenti apice graciliter subulato et in 10 cm. ex puncto olim 2 mm. lato, basi breviter amplexicauli et exarmata, marginibus ex 4–5 cm. ex basi cum dentibus 3–6 mm. longis 6–18 mm. distantibus graciliter subulatis curvatis in 45° adscendentibus albis vel apicibus brunneis in basi crassatis, midnervo infra 7 cm. ex basi cum spinis simulantibus sed reflexis armato, in medio marginibus cum dentibus simulantibus sed rectioribus 3 mm. longis 12–21 mm. distantibus adpressi-adscendentibus, midnervo infra cum aculeis 2–4.5 cm. longis 10–19 mm. distantibus reflexis, circa apicem spinis marginorum midnervique 0.3–0.5 mm. longis 3–9 mm. distantibus fortiter subulatis adpresse adscendentibus, quoque serie foliarum prima cum bractea 7 cm. longa 3 cm. lata naviculare cum duo carenis

cucullata exarmata, secunda 9.5 cm. longa 3.5 cm. lata cuneata integra excarinata, tertia 20 cm. longa 3 cm. lata cum spinis adscendentibus, pedunculo 15 cm. longo obtuse trigono et bracteato, syncarpio 11 cm. longo 9.3 cm. diametro late ellipsoideo cum 34 phalangibus, eis 3.4–3.6 cm. longis 2.6–3.2 cm. latis 2.2–2.8 cm. crassis late cuneatis tertia supera libera viridibus sed probabiliter in maturitate aurantiacis, apice plano-truncato, lateribus laevibus paene curvatis 4–7-angulosis, suturis lateralibus nullis, suturis apicalibus centralibus 0.5–1 mm. profundis angustis tessellatis, carpellis 5–7, apicibus subplanis sed frequente minime subpyramidalibus et eis marginalibus cum depressione distali vadosa, stigmatibus 2–4.5 mm. longis breviter sulcatis suborbicularibus vel ovatis brunneis horizontalibus vel obliquis centripetalibus sinu profundo dimidia distantia ad fundum valliculae, endocarpio 2/5 distantia ex basi mahogani-colorato osseoso marginibus 2–3 mm. crassis, seminibus 11–14 mm. longis 4–5 mm. diametro oblique ellipsoideis, mesocarpio apicale cavernoso cum fibris paucis et membranis multis medullosis, mesocarpio basali aurantiaco-luteo carnosio fibrosoque.

DESCRIPTION OF SPECIMENS EXAMINED: Tree 2–4 m. tall, 8–10 cm. in diameter; prop roots few; bark buff-colored, with axillary, short, blunt tubercles; leaves 0.66–1.29 m. long, 3.4–4.6 cm. wide, olive green, coriaceous, at first slightly glaucous above and below, ligulate, gradually long attenuate, in section broad V-shaped but the sides arcuate, the midrib thickened, sharp and projecting below; the apex slender subulate and 10 cm. down only 2–3 mm. wide, base short amplexicaul and unarmed, but the margins with teeth beginning within 2–5 cm. of the base, the lowest teeth 3–7 mm. long 6–18 mm. apart, white or with small brown tips, slender subulate, upward curved, ascending at 45° from a thickened base, the midrib below beginning 3–7 cm. up with similar spines but reflexed at 45°, at the midsection the margins with teeth 3–6 mm. long, 12–21 mm. apart, similar but straighter and appressed ascending; the midrib below with spines 2–4.5 mm. long, 10–19 mm. apart, reflexed; near the apex the spines of margins and lower

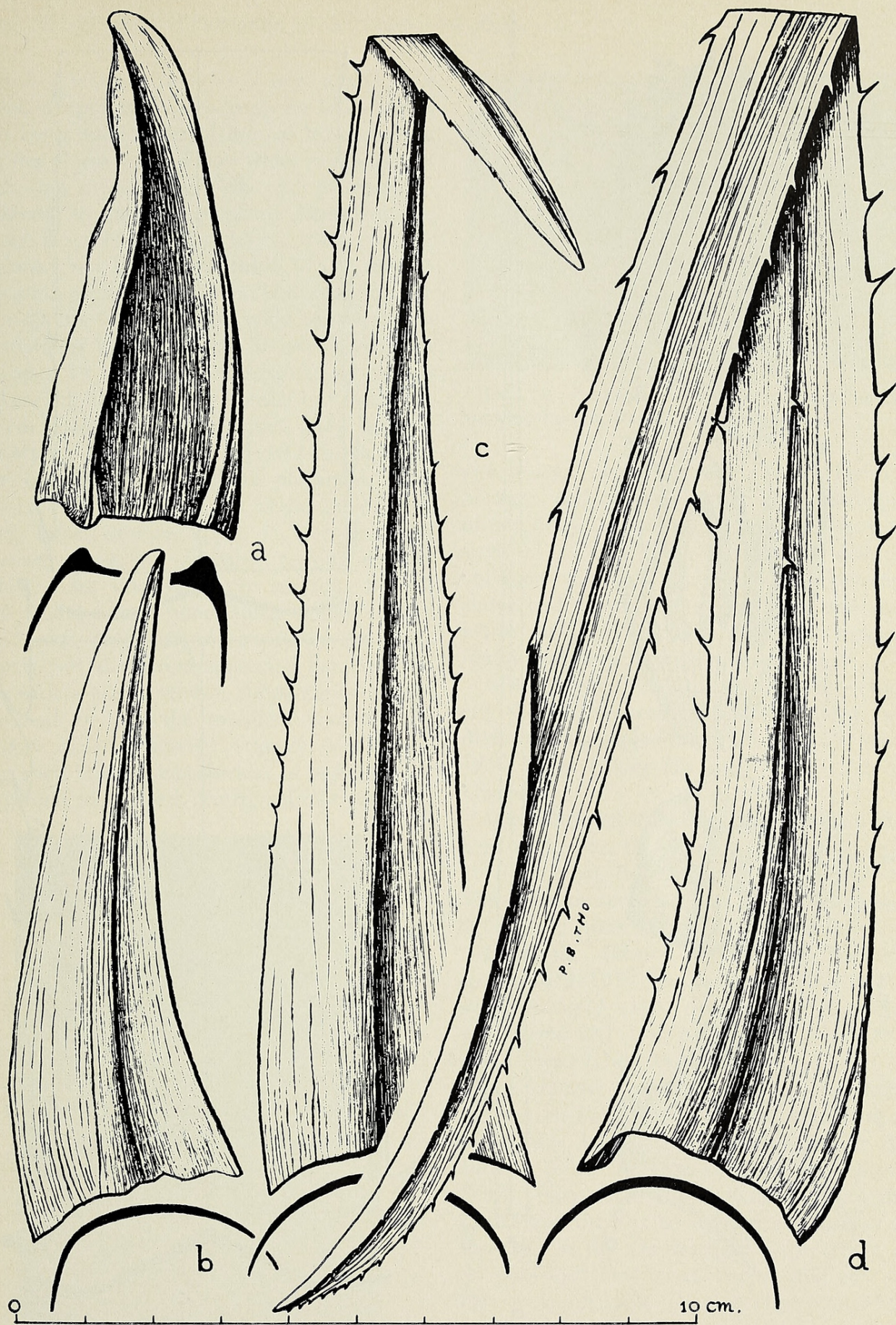


FIG. 69. *Pandanus Phamhoangii*, from holotype. Leaf series, beginning with, *a*, boat-shaped bract; *b*, lanceolate bract; *c*, foliaceous bract; *d*, larger foliaceous bract, all $\times 1$.

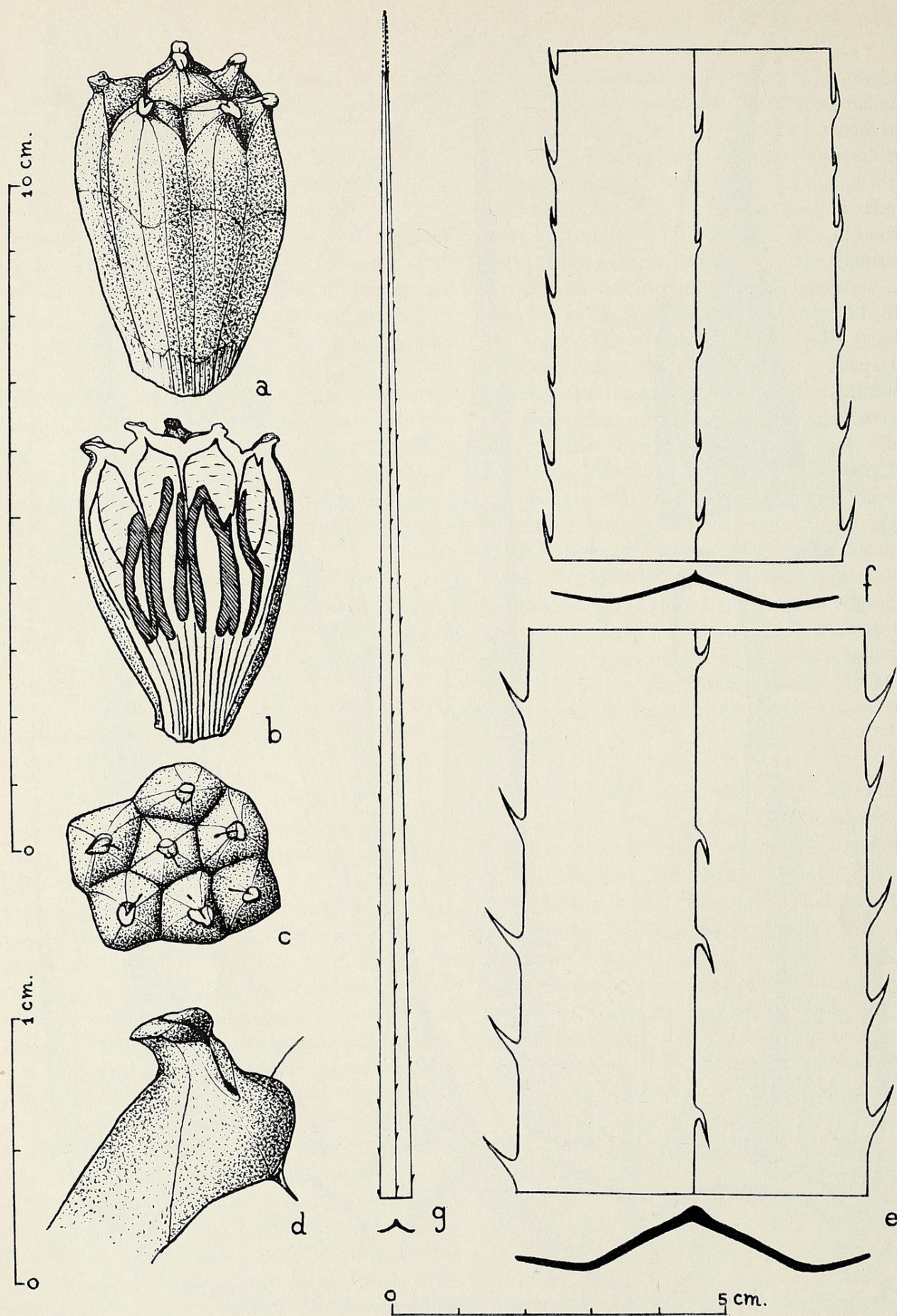


FIG. 70. *Pandanus projectens*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apex, oblique view, $\times 4$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

midrib 0.3–1 mm. long, 3–9 mm. apart, stout subulate, appressed ascending; the foliar bracts that begin each series of normal leaves having the first 7 cm. long, 3 cm. wide, navicular but with only two strong keels and hence semi-quadrangle in section, cucullate, unarmed; the second bract 9.5 cm. long, 3.5 cm. wide, cuneate, unarmed, not keeled; the third 20 cm. long, 3 cm. wide, ascending spiny on both margins; the fifth 49 cm. long, 3–5 cm. wide, shaped like a normal leaf but acute and 10 cm. down from the apex 14 mm. wide, with spines of margin and midrib like those of a normal leaf; peduncle 15 cm. long, obtusely trigonous, leafy bracted; syncarp 11–12.5 cm. long, 9.3–10.5 cm. in diameter, broadly ellipsoid, of 34 phalanges, these 3.4–3.8 cm. long, 2.6–4 cm. wide, 2.2–3.1 cm. thick, broad cuneate, upper $\frac{1}{3}$ free, apex flat truncate, green but probably turning orange-yellow, sides smooth, gently curving, 4–7-angled, lateral sutures none; apical central sinuses 0.5–2 mm. deep, narrow, impressed tessellate; carpels 5–8, the apices appearing flat, but usually with a slight central, subpyramidal elevation and at least the marginal ones with a shallow distal concavity; stigmas 2–4.5 mm. long, short creased, suborbicular to ovate, brown, horizontal or inclined, centripetal; the proximal



FIG. 71. *Pandanus reversispiralis*, from holotype. Habit, with figure of Prof. Pham Hoang Ho.

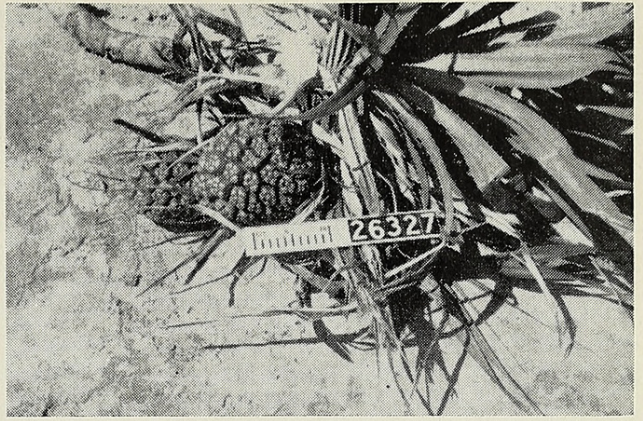


FIG. 72. *Pandanus reversispiralis*, from holotype. Showing branch, foliage, and syncarps.

crease deep, extending half way to the valley bottom; endocarp in lower $\frac{2}{5}$, mahogany brown, bony, the lateral margins 2–3 mm. thick; seeds 11–14 mm. long, 4–5 mm. in diameter, obliquely ellipsoid; apical mesocarp cavernous above each seed, with a few fibers and many white medullary membranes; basal mesocarp fibrous and fleshy, orange yellow.

HOLOTYPE: Vietnam, Phu' ó' ctuy (formerly Baria), sources chauds de Cu-my, avec *Melaleuca leucadendron*, 2 m. alt., 15 janvier 1960, Pham Hoang Ho 2,462 (BISH); isotype (Saigon).

SPECIMENS EXAMINED: Vietnam: Phan thiét, bord de la mer, sur sable fin légèrement rouge, 19 mars 1960, Phung Trung Ngan 2 (BISH). The collector recorded that the phalange bases are slightly sweet and are eaten by children.

Indonesia: Riouw Archipel, P. Toekoelai, strand, 16/9/1919, "pandan laoet," H. A. B. Bun-nemeijer 6,311 (BO). Anambas Is., 3/4/1928, van Steemis 983 (BO); Notoena Eil., 13/4/1928, van Steemis 1,309 (BO).

DISCUSSION: *P. Phamhoangii* is a member of the section *Pandanus*. Somewhat similar specimens have been determined by certain later authors as *P. tectorius* Soland. var. *sinensis* Warb. They came from countries other than China, and there is no indication that they are the same as the var. *sinensis* Warb. There are no published taxa so similar to this new one that it is of value to give comparative differences.

The new species is named in compliment to its collector, Pham Hoang Ho, Professeur de Botanique, Université de Saigon.

Pandanus projectens sp. nov. (sect. *Pandanus*)
Fig. 70, 91A

DIAGNOSIS HOLOTYPI: Arboriforma, trunco 1.5 m. alto 6–7 cm. diametro, foliis 1.26 m. longis 5 cm. latis ligulatis coriaceis in sectio M-formatis ex basi sensim in apice longo subulato diminuentibus eo in puncto 10 cm. ex apice 3 mm. lato, in regione basali marginibus cum aculeis 6–9 mm. longis 10–20 mm. distantibus arcuato-subulatis adscendentibus in tota stramineis vel apicibus brunneis, midnervo infra cum aculeis simulantibus 4–6 mm. longis 13–27 mm. distantibus reflexis, in sectio medialis marginibus et midnervo infra cum aculeis 4–5 mm. longis 7–15 mm. distantibus subulatis adpresse adscendentibus, circa apicem marginibus et midnervo infra cum subulato-serris 0.5–0.7 mm. longis 3–10 mm. distantibus, pedunculo 10 cm. vel ultra longo 12 mm. diametro deltoideo bracteoso, syncarpio solitario terminali 18.5 cm. longo 14.5 cm. diametro elliptico-ovoideo cum 82 phalangibus eis 4.2–4.6 cm. longis 2.2–4 cm. latis 2.3–3.5 cm. crassis cuneato-obovoideis 5–6-angulosis lateribus subconvexis sublucidis verisimiliter luteis parte $\frac{1}{3}$ supra libera apice convexo, suturis lateralibus nullis, sinibus apicalibus centralibus 3–5 mm. profundis, carpellis 6–9 apicibus pyramidalibus sed quibusdam marginalibus divergentibus, stigmatibus 3–4 mm. longis obliquis projectentibus ovatis vel ellipticis brunneis papillois sulcatis centripetalibus, sutura proximali $\frac{1}{2}$ ad fondam extenta, endocarpio mediali brunneo osseoso marginibus lateralibus 1.5–2 mm. crassis, seminibus



FIG. 73. *Pandanus semiorbicularis*, from paratype. Staminate inflorescence.



FIG. 74. *Pandanus semiorbicularis*, from holotype. Showing lower trunk and prop roots.

8–11 mm. longis 3–4 mm. diametro fusiformibus, mesocarpio terminali in apice quaque carpella cavernam cum medulla alba formanti, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Treelike; trunk 1.5 m. tall, 6–7 cm. in diameter; leaves 1.26 m. long, 5 cm. wide, ligulate, coriaceous, in section M-shaped, gradually tapering from the base to the long subulate apex which about 10 cm. down is 3 mm. wide, near the base the margins with prickles 6–9 mm. long, 10–20 mm. apart, arcuate-subulate, ascending stramineous throughout or with the tip brownish; the nearby midrib below with similar prickles 4–6 mm. long 13–27 mm. apart but reflexed; at midsection the margins and midrib below with prickles 4–5 mm. long, 7–15 mm. apart, subulate, appressed ascending; near the tip the margins and midrib below subulate-serrate, the teeth 0.5–0.7 mm. long, 3–10 mm. apart; peduncle 10 or more cm. long, 12 mm. in diameter, triangular, leafy bracted; syncarp solitary, terminal, 18.5 cm. long, 14.5 cm. in diameter, elliptic-ovoid, with 82 phalanges, these 4.2–4.6 cm. long, 2.2–4 cm. wide, 2.3–3.5 cm. thick, cuneate-obovoid, 5–6-angled, the sides gently curved, almost smooth, somewhat shining, apparently becoming yellowish, upper $\frac{1}{3}$ free, apex convex, lateral sutures none, apical central sinuses 3–5 mm. deep; carpels 6–9, the apices pyramidal but some of the marginal ones divergent; stigmas 3–4 mm. long, oblique, projecting and prominent, ovate or elliptic, brown, papillose, centripetal, creased; proximal crease mostly extending about $\frac{1}{2}$ way to valley bottom; endo-

carp median, brown, bony, the lateral margins 1.5–2 mm. thick; seeds 8–11 mm. long, 3–4 mm. in diameter, fusiform; apical mesocarp forming in each carpel an apical cavern filled with white membranous pith; basal mesocarp fibrous and fleshy.

SPECIMEN EXAMINED: Vietnam: Phan Thiét, à mi-chemin de la route allant vers Mui-Né, bord de la mer, 14 août 1960, *Pham Hoang Ho* 5,345 (BISH).

DISCUSSION: *P. projectens* is a member of the section *Pandanus*, and there it seems most closely related to *P. odoratissimus* L. f. which has the phalange with the upper half free; the carpel apices conic-semiorbicular and with the peak erect. In contrast, *P. projectens* has the phalange with the upper third free; carpel apices pyramidal, with the peak slender, projecting and mostly diverging.

The new epithet is the Latin participle, *projectens*, projecting, in allusion to the projecting or diverging apices of the carpels.

Pandanus reversispiralis, sp. nov. (sect. *Pandanus*)

Figs. 71–72, 79–80A

DIAGNOSIS HOLOTYPI: Arbor 7 m. alta 13 cm. diametro pauciter ramosa, cortice griseo sparse verrucoso ex alabastris axillaribus adventitiis in spiris tribus quibus post ascensionem gradorum 360° reversis sunt, radicibus fulturosis 30 cm. longis 2.5 cm. diametro muriculatis, foliis 70–88 cm. longis 4.8–5.2 cm. latis coriaceis viridibus in ambis lateribus sed subglaucis

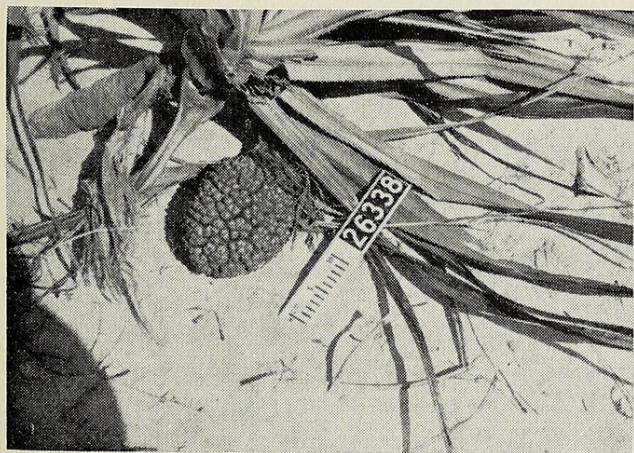


FIG. 75. *Pandanus semiorbicularis*, from holotype. Showing branch, foliage, and syncarp, lateral view.

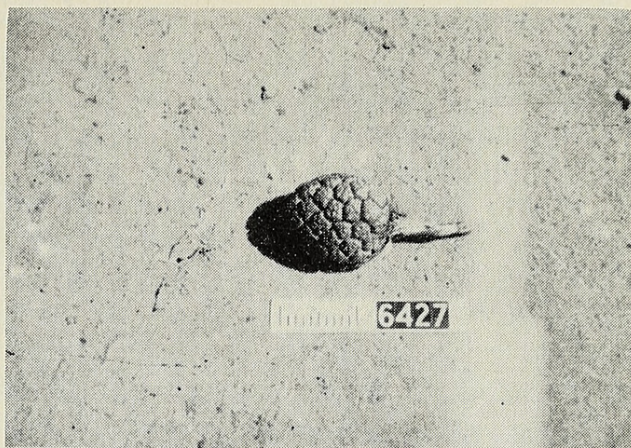


FIG. 76. *Pandanus Smitinandii*, from holotype. Showing syncarp, lateral view.

in sectio late U-formati in basi amplexicaulibus apice gradatim longe attenuato et deltoideo-subulato, proxima basi marginibus cum dentibus 4–6.5 mm. longis 5–15 mm. distantibus albis sed apicibus brunneo-tinctis subulatis adscendentibus, midnervo cum aculeis 3–4 mm. longis 10–25 mm. distantibus fortibus subulatis reflexis, in sectio medialis marginibus cum aculeis 3–4 mm. longis 5–17 mm. distantibus subulatis subadpressi-adscendentibus, midnervo cum aculeis simulantibus sed 15–18 mm. distantibus in 45° adscendentibus, circa apicem marginibus midnervoque cum dentibus 1 mm. longis 3–5 mm. distantibus subulatis adscendentibus, pedunculis 20–25 cm. longis recurvatis minime triangularibus foliosis, syncarpiis 12–16 cm. longis 11–14 cm. diametro ovali-subglobosis cum 52–94 phalangibus eis immaturis viridibus et dense congregatis sed in maturitate separatis namque amplificatio basorum carnosorum, centro albo molle carnosum, phalangibus 4.3–4.6 cm. longis 2.5–3.8 cm. latis 2.3–3.2 cm. crassis oblongis et paene cuneatis parte supera 3/5 libera, apice oblato-convexo vel in phalangibus paucicarpellatis truncatis, suturis lateralibus nullis, lateribus planis vel minime curvatis 5–8-angulatis, parte 2/5 infera carnosam incrassatam aurantiacam, sinibus centralibus apicalibus 3.5–5 mm. profundis angustis, carpellis 5–7, apicibus eis marginalibus depresso-pyramidalis-semiorbicularibus et cum concavitate parva distali obliqua, stigmatibus 2–3 mm. longis sulcatis ellipticis vel transverse ellipticis obliquis centripetalibus nigris, sinu proximali forti et ad fundam vallis extensam, endocarpio centrali 2 cm. longo osse-

oso brunneo lateribus 2–3 mm. crassis, seminibus 10–15 mm. longis 3 mm. diametro obliquiter ellipsoideis, mesocarpio apicali meduloso, mesocarpio basali fibroso et carnosio luteo.

DESCRIPTION OF ALL SPECIMENS: Tree 7 m. tall, 13–18 cm. in diameter, loosely branched; bark gray, sparsely warty from axillary adventitious buds in three ascending spirals which reverse direction after each circuit of 360° ; prop roots 30 cm. long, 2.5 cm. in diameter, muriculate; leaves 70–130 cm. long, 4.8–6 cm. wide, coriaceous, green but slightly glaucous on both sides, broad M-shaped in cross section, clasping at base, the apex gradually long attenuate and triangular subulate, and 5 mm. wide 10 cm. down from the apex; near the base the margins with stout white, but brown-tipped, subulate, ascending teeth 4–6.5 mm. long, 5–15 mm. apart, the midrib with strong subulate reflexed prickles 3–4 mm. long, 10–25 mm. apart; at the middle the margins with the teeth 3–4 mm. long, 5–17 mm. apart, subulate, subappressed ascending; the midrib below with similar teeth 15–18 mm. apart, ascending at 45° ; near the tip the margins and midrib below with ascending subulate teeth 1 mm. long, 3–5 mm. apart;



FIG. 77. *Pandanus subcarnosus*, from holotype. Habit view.



FIG. 78. *Pandanus subcarnosus*, from holotype. Showing foliage and syncarp.

peduncles 20–25 cm. long, recurving, perceptibly 3-sided, leafy bracted; syncarps 12–16 cm. long, 11–14 cm. in diameter, oval-subglobose, of 52–94 phalanges, these when green well crowded but when ripe becoming distant due to the swelling of the fleshy bases; the axis of the syncarp white, soft, fleshy, doubtless shrinking to a very small remnant; phalanges 4.3–4.6 cm. long, 2.5–3.8 cm. wide, 2.3–3.2 cm. thick, in outline oblong, but slightly cuneate, upper 3/5 free, apex low convex or in those with fewer carpels truncate, lateral sutures none, sides plane or gently curving, 5–8-angled, distinctly fleshy and swollen up to 2/5 way from base, this swelling orange (orange, planche XIV, no. 196, Seguy, E., Code Universel des Couleurs, 1936, Paris, P. Lechevalier), while the upper 3/5 are orange no. 181, pl. XIII; central apical sinuses 3.5–5 mm. deep, narrow; carpels 5–7, the apices of the marginal ones depressed pyramidal-semiorbicular and just distal of the apex with a small oblique concavity; stigmas 2–3 mm. long, creased, elliptic or transversely so, oblique, centripetal, black; the proximal crease strong and extending fully to the bottom of the valley; endocarp central, 2 cm. long, bony, brown, the lateral walls 2–3 mm. thick; seeds 10–15 mm. long, 3 mm. in diameter, oblique ellipsoid; apical mesocarp with a section in each carpel tip, filled solid with white pith; basal mesocarp with fibers and a yellow flesh of bland taste at first, but after a minute irritating. Staminate plant (from Ho 2,532): staminate inflorescence 50 cm. long, terminal, pendent, bearing numerous white bracts; lowest

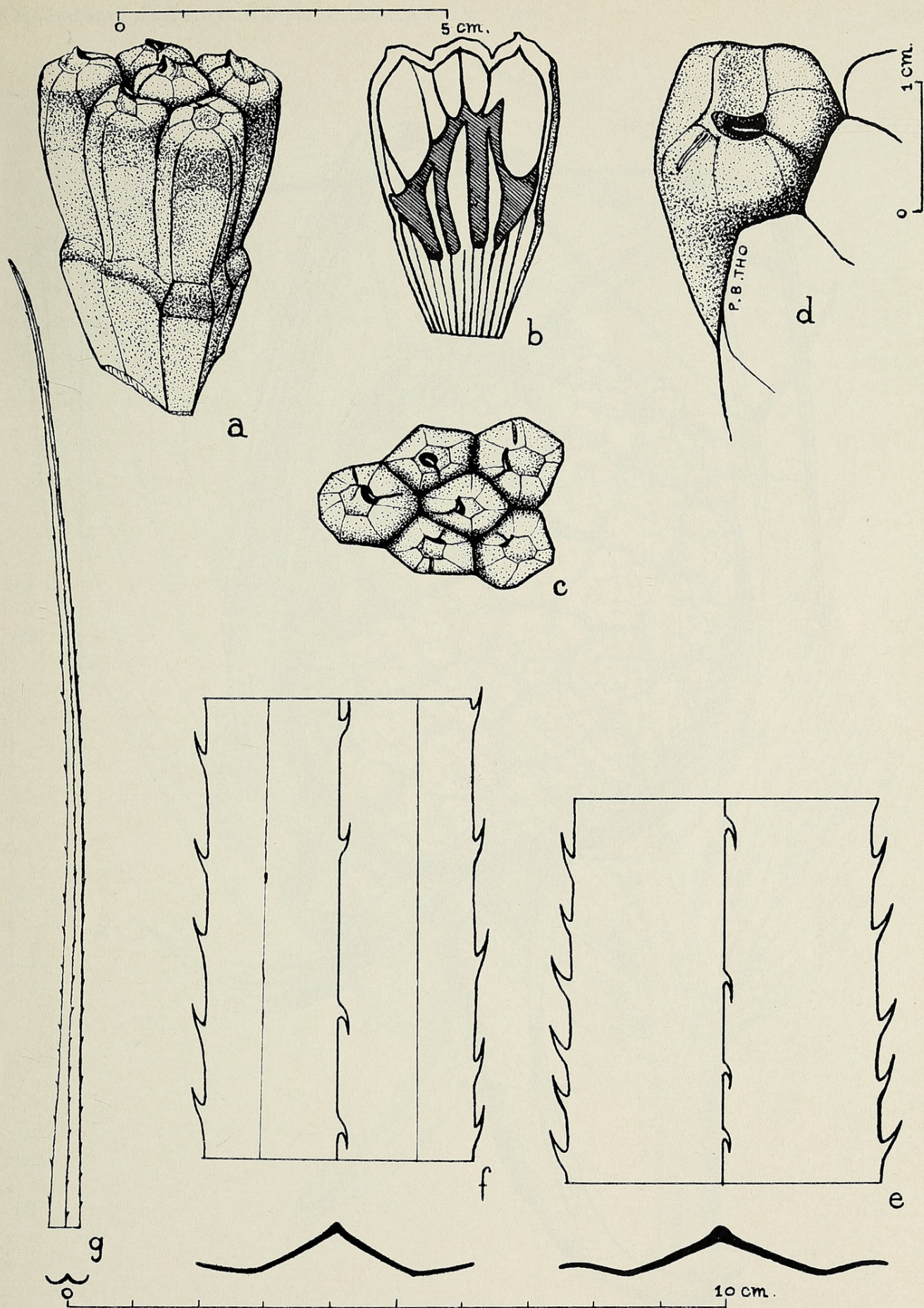


FIG. 79. *Pandanus reversispiralis*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apex, oblique view, $\times 2$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

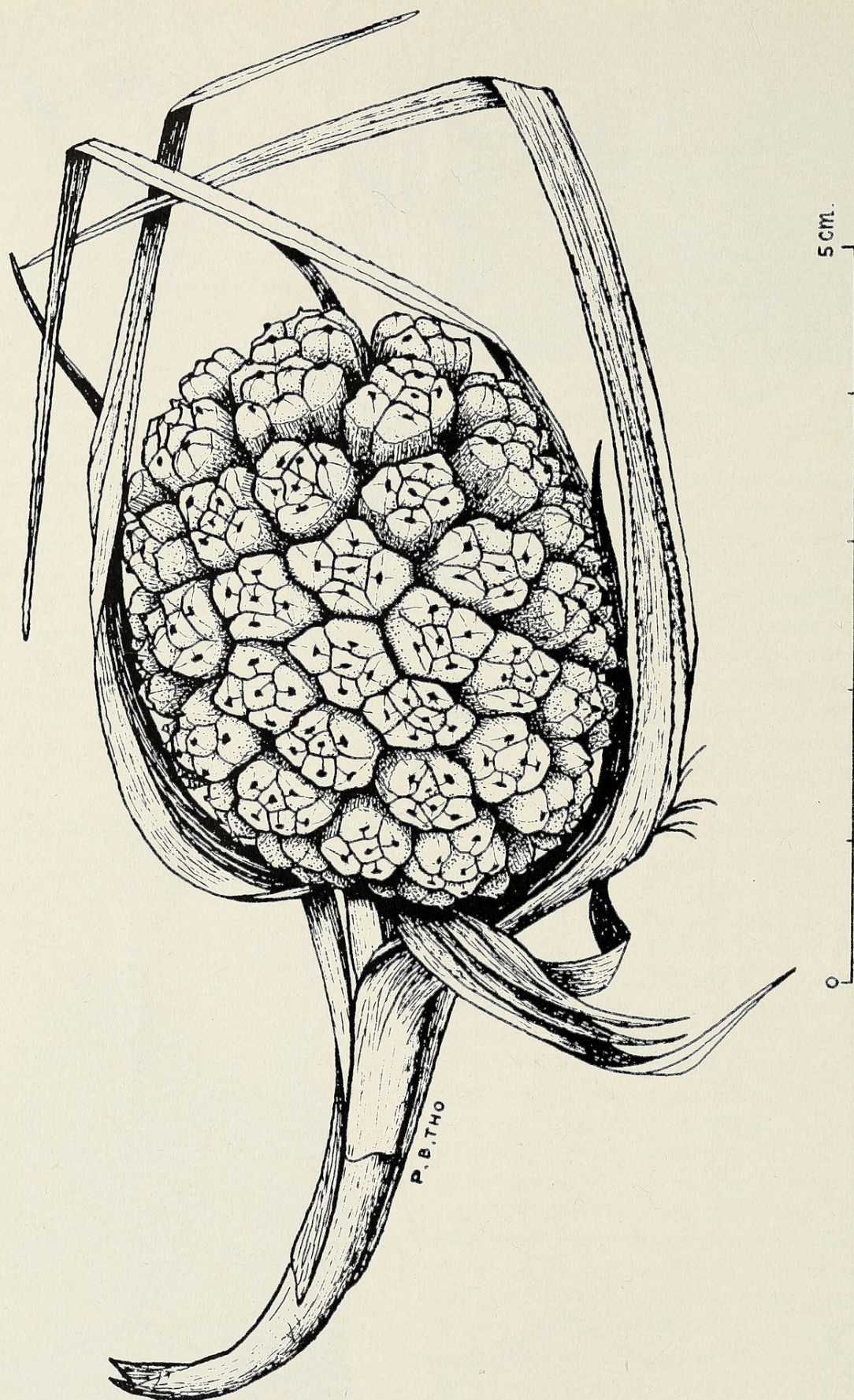


FIG. 80. *Pandanus reversispiralis*, from holotype. Syncarp, lateral view, $\times \frac{1}{2}$.

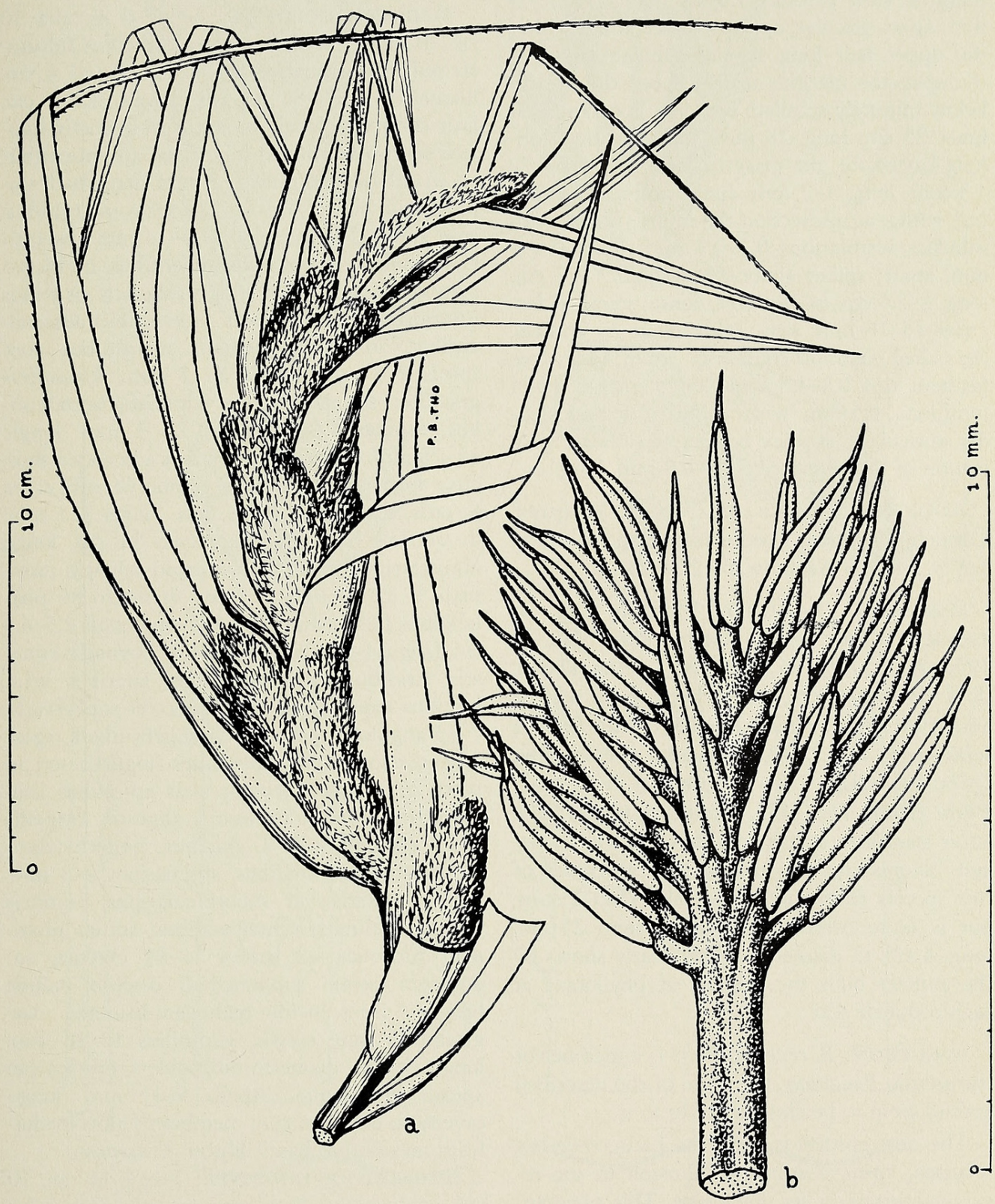


FIG. 80A. *Pandanus reversispiralis*, staminate, from Ho 2,532. *a*, Inflorescence, $\times \frac{1}{2}$; *b*, stamens, $\times 10$.

floral bract 50 cm. long, 4.2 cm. wide, the lower half narrowly elliptic, of this its lower half narrowly elliptic, unarmed, its upper half with the margins with prickles 1.5–1.8 mm. long, 3–6 mm. apart, acicular, appressed ascending, white; the upper half long slender subulate, towards the apex the margins unarmed but the midrib below minutely subulate serrulate; median floral bract 25 cm. long, 28 mm. wide, narrowly oblong-lanceolate, the margins with prickles 0.7–1.3 mm. long, 1–2 mm. apart, acicular, ascending, white; at midsection the midrib below with subulate serrulations 0.2–0.3 mm. long, 0.3–1 mm. apart; spikes about 15, fragrant, 5–7 cm. long, 2–2.5 cm. in diameter, dense; staminal fascicles 14–16 mm. long, with about 25 anthers, the naked common column 6–7 mm. long; free filament tips 0.8–1.5 mm. long; anthers 2.5–4 mm. long, 0.5 mm. wide, subulate, at base slender auriculate, at apex bearing a subulate projection of the connective 0.7–0.9 mm. long.

HOLOTYPE: Vietnam, Cap St. Jacques, Corniche d'Oguân, granite ledges above beach, Jan. 3, 1960, *H. St. John* 26,327 (BISH).

SPECIMENS EXAMINED: Vietnam, Cap St. Jacques, Báisau, moist dune hollow, Jan. 3, 1960, *H. St. John* 26,326 (BISH); Hòn Tho'm, ile s. de Phu Qu'ôc, plage, bord de la mer, 7 avril 1961, *Pham Hoang Ho* 2,531, fruit (BISH); same data, *Ho* 2,532, staminate, (BISH); Phu Qu'ôc Ile, village Du'ông dtông, 6 avril 1961, *Pham Hoang Ho* 2,533, staminate, (BISH). The latter staminate specimen shows branch, leaves, and inflorescence. It matches the specimen of this species from the nearby islet Hòn Tho'm, but is more complete, having a stem 25 cm. long, 4 cm. in diameter which clearly shows by the axillary buds the reversal of phyllotaxy at each peduncle scar.

DISCUSSION: *P. reversispiralis* is a member of the section *Pandanus*, but none of the described species seem to be close relatives to it.

The new epithet is from the Latin, *reversus*, reversed; *spira*, a spiral, in allusion to the reversing spirals in its phyllotaxy. This phenomenon has recently been described and illustrated by the author (Univ. de Saigon, Fac. de Sci., Ann. 1960: 279, figs. 1–2, 1961).

Pandanus semiorbicularis sp. nov. (sect. *Pandanus*)

Figs. 73–75, 81–82

DIAGNOSIS HOLOTYPE: Arbor 6 m. alta 10 cm. diametro, cortice laeviore, radicibus fulturosis nullis vel paucis et ad 40 cm. longis 4 cm. diametro, foliis 85–94 cm. longis 4.5–5 cm. latis coriaceis glaucis in sectio M-formatis ligulatis sensim ad apicem subulatum diminuentibus eo in 10 cm. ex puncto 8 mm. lato, basi amplexicauli inermi sed ex 2.5–3 cm. marginibus cum spinis 2–4 mm. longis 5–14 mm. distantibus subulatis pallidis adscendentibus, midnervo cum spinis 2–2.5 mm. longis subulatis eis tribus inferioribus valde reflexis superioribus adscendentibus, in sectio medialis marginibus cum spinis 2–3 mm. longis 8–12 mm. distantibus graciliter subulatis valde adpressi-adscendentibus, midnervo cum spinis 2.5–3 mm. longis 12–18 mm. distantibus subulatis adscendentibus, circa apicem marginibus et midnervo infra acute serratis, dentibus 0.2–0.3 mm. longis 3–5 mm. distantibus brunneis, pedunculo 31 cm. longo obtuse trigono folioso, syncarpio solitario terminali 17 cm. longo 14.5 cm. diametro 86 phalangibus ferrentibus eis 4.5–5 cm. longis 2.5–4.3 cm. latis 2.4–3.5 cm. crassis late obovoideo-cuneatis viridibus aurantescentibus, lateribus infra laevibus supra rugulosis planis vel subcurvatis, 7–13-angulosis, parte tertia supera libera, apice subconvexo, suturis lateralibus angustis sed in parte $\frac{2}{3}$ supera distinctis sinis apicalibus centralibus 5–9 mm. profundis angustis, carpellis 5–10, plerumque 7–8, apicibus semiorbiculari-vel oblato-pyramidalibus, stigmatibus 2–3 mm. longis cordatis vel suborbicularibus brunneis sulcatis inclinatis centripetalibus, sutura proximali profunda ad basem $\frac{1}{4}$ – $\frac{1}{2}$ extenta, endocarpio paene supramediali osseoso pallide brunneo intra lucido mahogani-brunneo marginibus 3 mm. crassis, seminibus 12–16 mm. longis 5 mm. diametro ellipsoideis, mesocarpio apicali in quaque carpella 8–17 mm. longo cavernoso et solum cum membranis albis medullosis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree 6 m. tall, 10 cm. in diameter; bark very smooth; prop roots none or few up to 40 cm. long, and 4 cm. in diameter; leaves 85–94 cm. long, 4.5–5 cm. wide, coriaceous, glaucous, ligulate, in section

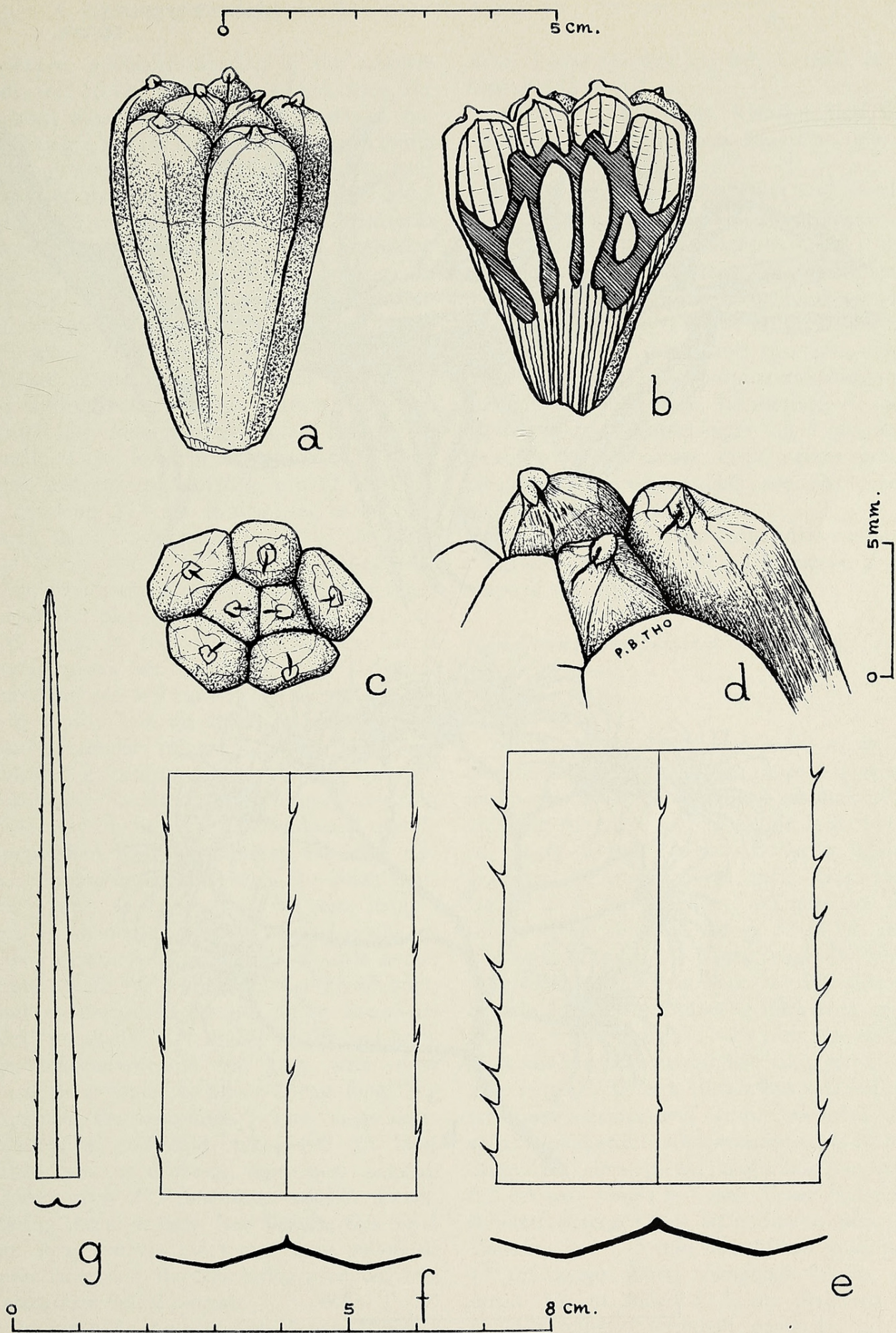


FIG. 81. *Pandanus semiorbicularis*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, oblique view, $\times 2$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

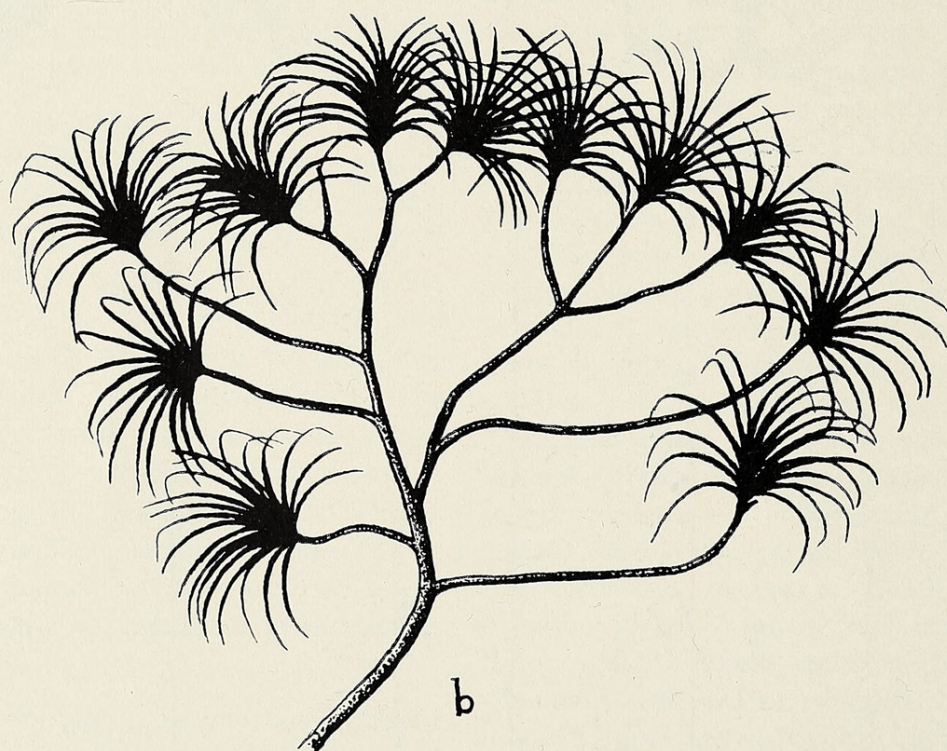
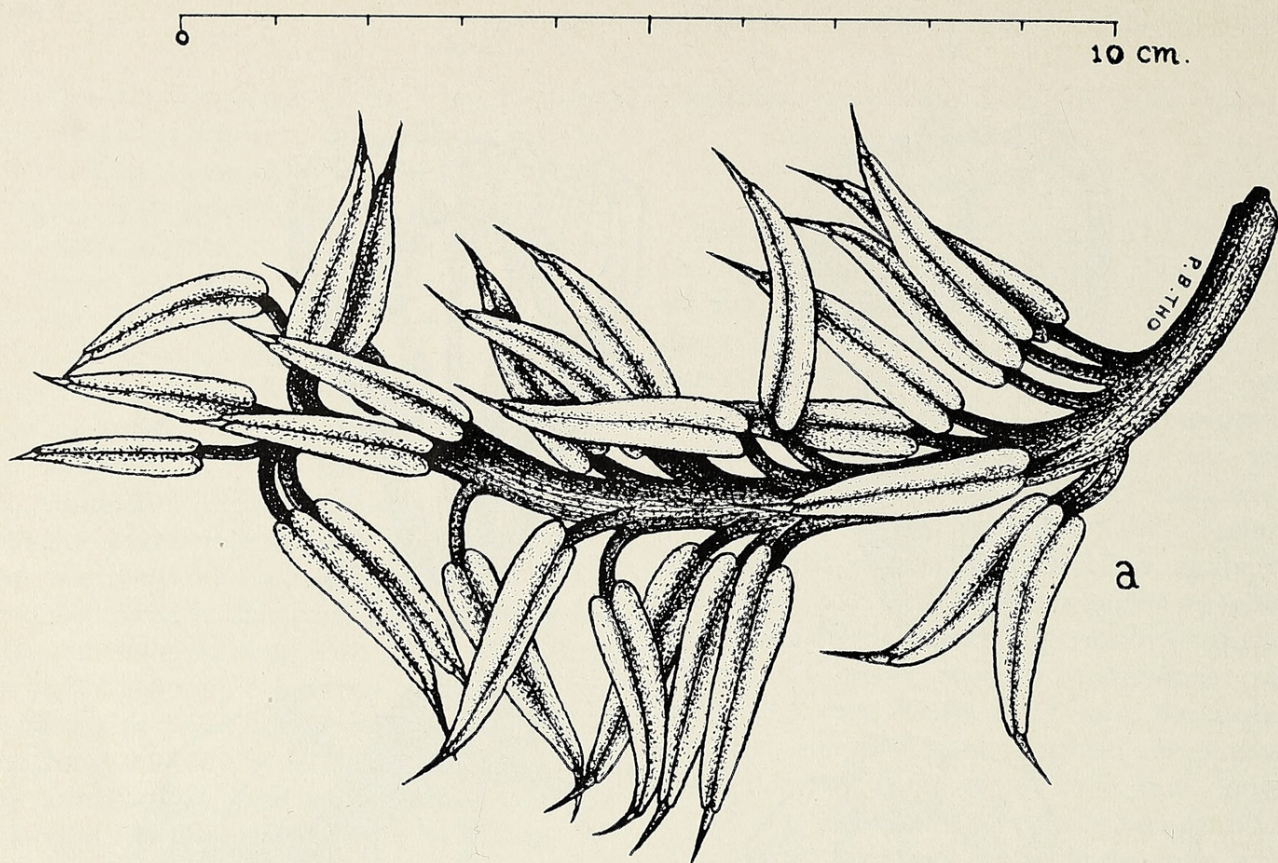


FIG. 82. *Pandanus semiorbicularis*, from paratype. *a*, Staminal column, $\times 10$; *b*, profile of tree, $\times \frac{1}{10}$.

M-shaped, gradually tapering to the subulate apex, this 10 cm. down only 8 mm. wide, the enclosed base amplexicaul and unarmed, but beginning 2.5–3 cm. up the margins with spines 2–4 mm. long, 5–14 mm. apart, subulate, pale, ascending, the nearby midrib with spines 2–2.5 mm. long, subulate, broader based, the three lowest sharply reflexed, the upper ascending; near the midsection the margins with spines 2–3 mm. long, 8–12 mm. apart, slender subulate, closely appressed ascending; the midrib with spines 2.5–3 mm. long, 12–18 mm. apart, subulate, ascending; near the apex the margins and midrib below sharply serrate, the teeth 0.2–0.3 mm. long, 3–5 mm. apart, brown; peduncle 31 cm. long, in section obtusely triangular, leafy bracted; syncarps solitary, terminal, 17 cm. long, 14.5 cm. in diameter, of 86 phalanges, these 4.5–5 cm. long, 2.5–4.3 cm. wide, 2.4–3.5 cm. thick, broadly obovoid-cuneate, green, turning orange, sides smooth below, rugulose above, plane or gently curving, 7–13-angled, upper $\frac{1}{3}$ free, apex low convex, lateral sutures narrow but distinct in upper $\frac{2}{3}$; apical central sinuses 5–9 mm. deep, narrow; carpels 5–10, mostly 7–8, the apices semiorbicular- or oblate-pyramidal; stigmas 2–3 mm. long, suborbicular or cordate, brown, creased, inclined, centripetal; proximal crease deep, extending $\frac{1}{4}$ – $\frac{1}{2}$ way to valley bottom; endocarp slightly suprmedian, bony, light brown, the inner surfaces shining mahogany brown, the lateral margins 3 mm. thick; seeds 12–16 mm. long, 5 mm. in diameter, ellipsoid; apical mesocarp with a cavern 8–17 mm. long in each carpel, empty except for white medullar membranes; basal mesocarp fibrous and fleshy. Staminate trees (no. 26,337) of similar stature and herb-age; inflorescence 30 cm. long, with many bracts, these white, the lowest 26 cm. long, long acuminate, the upper ones 5–9 cm. long, lanceolate, acute; staminate spikes 4–6 cm. long, 15–20 mm. in diameter, numerous; staminal columns many, 8–10 mm. long, tree-like, anther-bearing except at base; free filament tips 0.8–1 mm. long; anthers 2–3.3 mm. long, yellowish, linear lanceolate, the connective produced into a prominent apical acumen.

HOLOTYPE: Vietnam, Cap Varella, Province of Khanh Hoa, coastal sand dunes, top of beach, with *Scaevola Taccada*, *Euphorbia* sp., *Thuarea*

involuta, and *Spinifex* sp., Feb. 7, 1960, H. St. John 26,338 (BISH).

SPECIMENS EXAMINED: Vietnam, Cap Varella, same locality and data, staminate tree, H. St. John 26,337 (BISH).

DISCUSSION: *P. semiorbicularis* is a member of the section *Pandanus*. Its closest relative is *P. tectorius* Soland. var. *Loureiri* (Gaud.) Martelli, from Tourane, Vietnam, but this is incompletely known only on the basis of a single phalange collected by Gaudichaud. It has the phalange 3.7 cm. long, short pyriform; carpel apices low convex, the central apical sinuses apparently 2–3 mm. deep. In contrast, *P. semiorbicularis* has the phalanges 4.5–5 cm. long, broadly obovoid-cuneate; carpel apices semiorbicular or oblate-pyramidal; and the central apical sinuses 5–9 mm. deep.

The new epithet is the Latin adjective, *semiorbicularis*, half orbicular, in reference to the shape of the carpel apices.

Pandanus Smitinandii sp. nov. (sect. *Pandanus*)

Figs. 76, 83

DIAGNOSIS HOLOTYPE: Arbor 2–3 m. alta 10 cm. diametro, trunco furcato distorto cum aculeis paucis quibusdam adpressi-adscendentibus, radicibus fulturosis ad 1 m. longis, foliis 1–1.15 m. longis 4.3–4.8 cm. latis coriaceis ligulatis gradatim diminuentibus in apice longe subulato eo in 10 cm. ex apice 2–2.5 mm. lato, basi inermi et amplexicauli sed ex 3.5–7 cm. marginibus cum spinis 3–4.5 mm. longis 5–15 mm. distantibus crassiter subulatis arcuatis adscendentibus stramineis, midnervo infra cum spinis reflexis 3 mm. longis 11–25 mm. distantibus, in sectio medialis marginibus cum spinis 2–3 mm. longis 3–12 mm. distantibus subulatis adscendenti-subadpressis, midnervo infra cum spinis simulantibus adscendentibus 14–20 mm. distantibus, circa apicem marginibus cum spinis 0.2–0.3 mm. longis 3–5 mm. distantibus valide subulatis divergentibus, eis midnervo infra simulantibus sed 2–5 mm. distantibus, pedunculo 17 cm. longo obtuse triangulari folioso, syncarpio 14 cm. longo 11.5 cm. diametro late ovoideo solitario terminali pendenti cum 72 phalangibus, eis adhuc viridibus sed amplitudinibus plenis et basi lutescenti 4–4.3 cm. longis

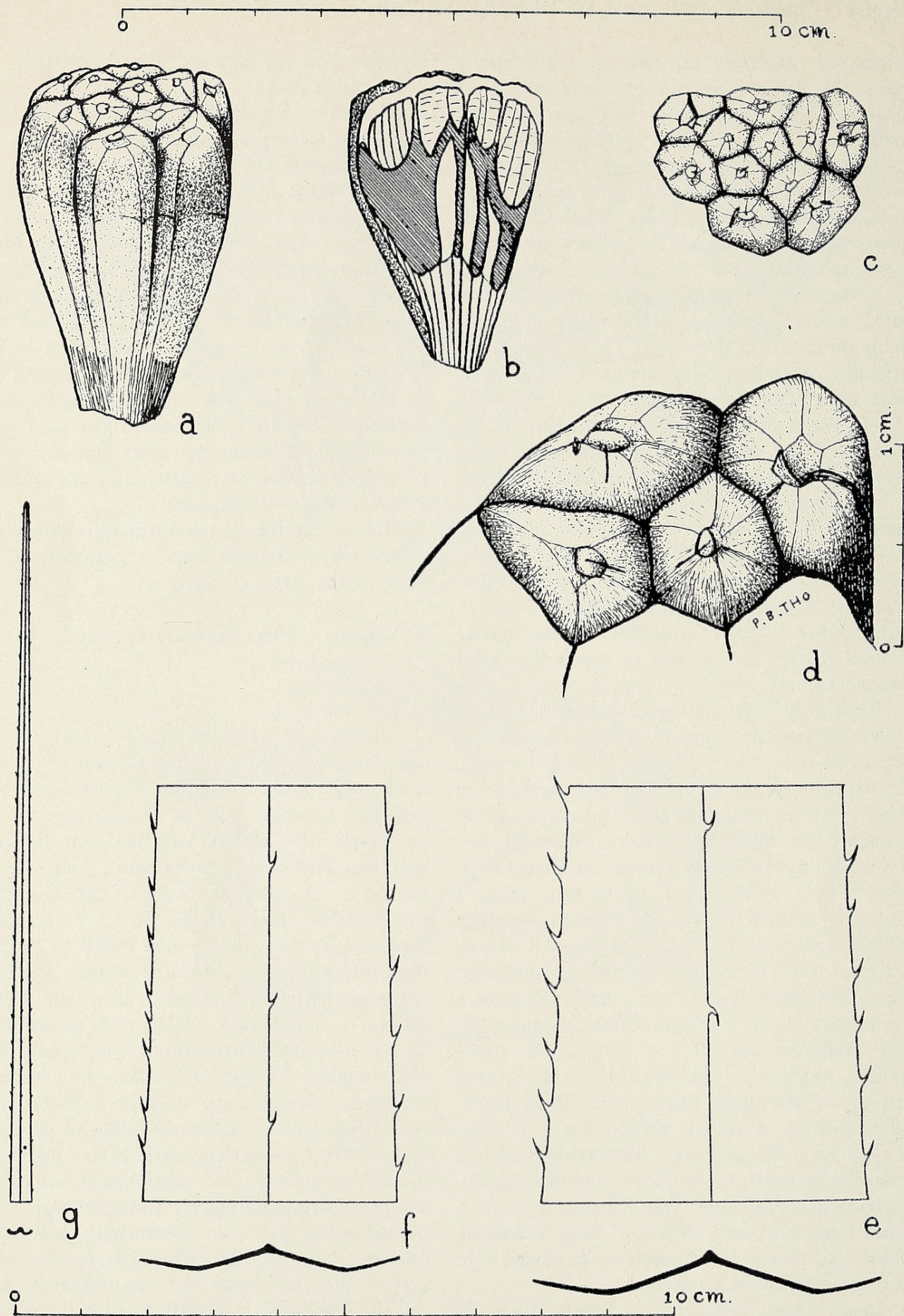


FIG. 83. *Pandanus Smitinandii*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, oblique view, $\times 3$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

2.5–3 cm. latis 2.1–3.1 cm. crassis late cuneatis parte $\frac{1}{4}$ supera libera apice depresso convexo lateribus laevibus sublucidis planatis vel subcurvatis 7–10-angulatis suturis lateralibus nullis vel paucis in media supera, sinibus centralibus apicalibus 2–3 mm. profundis V-formatis, carpelibus 6–12, plerumque 8–9, apicibus depresso-pyramidalibus, stigmatibus 1–2 mm. longis suborbicularibus ad cordatis obliquis centripetalibus, sutura proxima profunda dimidia distantiae ad fondam extenta, endocarpio paene supramediali osseoso pallide brunneo pagina interiori lucida brunnea marginibus lateralibus 2–3 mm. crassis, seminibus 14–16 mm. longis 2–3 mm. diametro anguste ellipsoideis, mesocarpio apicali in carpella quaque cavernoso 10–15 mm. longo cum fibris longitudinalibus paucis sed cum membranis medullosis albis multis, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Tree 2–3 m. tall, 10 cm. in diameter; trunk forked, crooked, with sparse prickles, some of them appressed ascending; prop roots up to 1 m. long; leaves 1–1.15 m. long, 4.3–4.8 cm. wide, coriaceous, ligulate, gradually tapering to a long subulate apex which 10 cm. back from the tip is 2–2.5 mm. wide, the base unarmed and amplexicaul, but from a point 3.5–7 cm. up, the margins with spines 3–4.5 mm. long, 5–15 mm. apart, stout subulate, arcuate ascending, stramineous, the nearby midrib below with reflexed spines 3 mm. long, 11–25 mm. apart; at the midsection the margins with spines 2–3 mm. long, 3–12 mm. apart, subulate ascending-subappressed; the midrib below with similar, ascending spines 14–20 mm. apart; near the apex the margins with spines 0.2–0.3 mm. long, 3–5 mm. apart, stout subulate, divergent; those of the midrib below similar but 2–5 mm. apart; peduncles 17 cm. long, obtusely triangular in cross section, leafy bracted; syncarp 14 cm. long, 11.5 cm. in diameter, broadly ovoid, solitary, terminal, pendent, of 72 phalanges, these still green, but apparently full sized and the lower part turning yellowish, 4–4.3 cm. long, 2.5–3.3 cm. wide, 2.1–3.1 cm. thick, broad cuneate, upper $\frac{1}{4}$ free, apex low convex, sides smooth, somewhat shiny, plane or gently curved, 7–10-angled, lateral sutures none or few in upper half; apical central sinuses 2–3 mm. deep, V-shaped; carpels 6–12,

mostly 8–9, the apices much flattened pyramidal; stigmas 1–2 mm. long, suborbicular to cordate, oblique, centripetal; the proximal crease deep, extending $\frac{1}{2}$ way to the valley bottom; endocarp slightly supramedian, bony, light brown, but the inner surface shining brown, the lateral margins 2–3 mm. thick; seeds 14–16 mm. long, 2–3 mm. in diameter, narrowly ellipsoid; apical mesocarp cavernous in each carpel, 10–15 mm. long, with a few longitudinal fibers but many white medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Vietnam, near Qua'ng Ngäi, 94 km. s. of Touranne (Da Nang), common on dunes and sandy soil along the road, 2 m. alt., 12 Feb. 1960, *Tem Smitinand* 6,427 (BISH).

DISCUSSION: *P. Smitinandii* is a member of the section *Pandanus* and finds there as its closest relative *P. subulatus* St. John of Vietnam, which species has the bark with a few appressed ascending adventitious rootlets; leaves 70–74 cm. long, 4 cm. wide and with the marginal spines near the base 5–6 mm. long; phalanges 3.5–4.1 cm. long, the sides 5–7-angled; carpels 5–6; and the seeds 8–11 mm. long, 4.5 mm. in diameter. In contrast *P. Smitinandii* has the bark only with sparse prickles; leaves 100–115 cm. long, 4.3–4.8 cm. wide, the marginal spines near the base 3–4.5 mm. long; phalanges 4–4.3 cm. long, the sides 7–10-angled; carpels 6–12; and the seeds 14–16 mm. long, 2–3 mm. in diameter.

The new epithet is given in honor of Mr. Tem Smitinand, chief of the section of Botany and Zoology, Royal Forest Department, Thailand.

Pandanus subcarnosus sp. nov. (sect. *Pandanus*)

Figs. 77–78, 84

NOM. VERN.: "dua".

DIAGNOSIS HOLOTYPI: Arbor 2–3 m. alta 15 cm. diametro, cortice laeve, radicibus futuriosis nullis, foliis 99–113 cm. longis 3.7–4 cm. latis subcoriaceis ligulatis sed sensim ad apicem longam subulatam diminuentibus eo 10 cm. ex puncto 3 mm. lato, 3–6 cm. ex basi marginibus armatis spinis 2–3.5 mm. longis 4–10 mm. distantibus albis subulatis adscendentibus, midnervo infra cum spinis 2–3 mm. longis 15–20 mm. distantibus subulatis, eis tribus reflexis alteris adscendentibus, circa mediam marginibus cum spinis 2–3 mm. longis 6–12 mm. distantibus

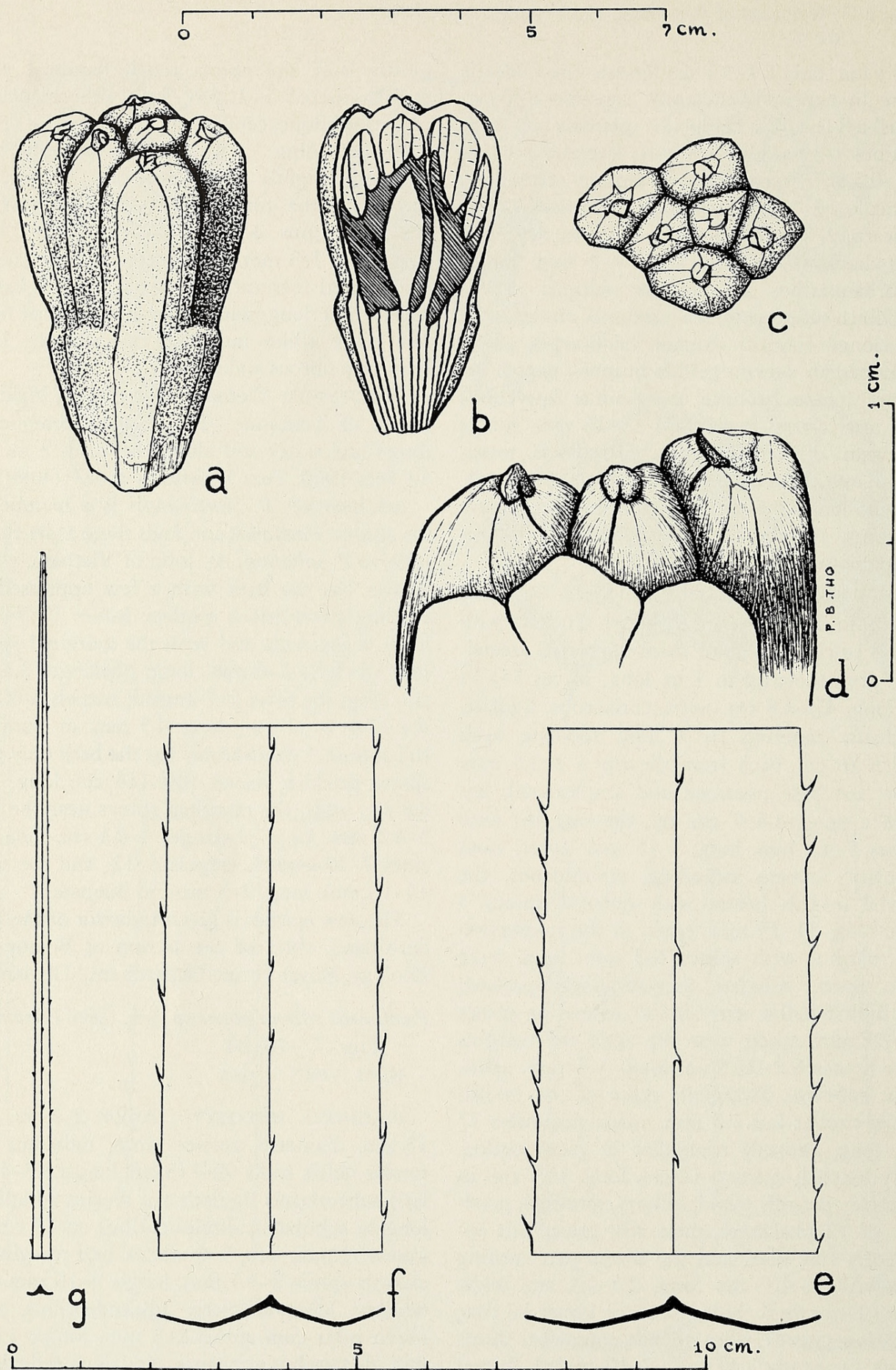


FIG. 84. *Pandanus subcarnosus*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, oblique view, $\times 3$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

subulatis adpressi-adscendentibus, midnervo infra cum spinis 2 mm. longis gracilibus subulatis albis adpressi-adscendentibus, ad apicem marginibus midnervoque infra cum subulato-serris 0.3–0.5 mm. longis 5–15 mm. distantibus, pedunculo 20 cm. longo obtuse deltoideo folioso, syncarpio terminale solitario 16 cm. longo 14 cm. diametro late ovoideo aurantiaco (colore 196, tab. XIV, Seguy, E., Code Univ. Couleurs, 1936) 84 phalangibus ferrentibus, eis 4.5–4.9 cm. longis 2.6–4.2 cm. latis 2.2–2.9 cm. crassis, oblongis vel ad formam cuneato-oblongam variantibus, parte supera 3/5 libera, parte 2/5 infera carnosae incrassatae, apice plerumque paene convexo sed rariter truncato, lateribus laevibus lucidis planis sed ad apicem subcurvatis 5–9-angulosis, suturis lateralibus nullis, sinibus apicalibus centralibus 3–5.5 mm. profundis angustis, carpellis 6–10, plerumque 7–8, apicibus oblato-pyramidalibus exterioribus plerumque cum concavito parvo obliquo subterminali distali, stigmatibus 1.5–2.5 mm. longis obliquis centripetalibus brevis sulcatis suborbicularibus, eis marginalibus cum galea cartilaginea inflexa semitectis, sinu proximo profundo $\frac{1}{2}$ – $\frac{3}{4}$ distancia ad fondam extento, endocarpio paene supramediale osseoso lucido mahogani-brunneo lateribus 2–3 mm. latis, seminibus 16 mm. longis 5–6 mm. diametro ellipsoideo, mesocarpio apicali cavernoso pauca fibroso et cum membranis albis medullosis repleto, endocarpio basali fibroso et carnosio luteo.

DIAGNOSIS OF HOLOTYPE: Tree 2–3 m. tall, 15 cm. in diameter, but the clumps apparently repeatedly cut back by the people of the vicinity; bark smooth; prop roots none; leaves 99–



FIG. 85. *Pandanus subulatus*. Habit of holotype.



FIG. 86. *Pandanus vietnamensis*, from holotype. Foliage and branches with syncarps.

113 cm. long, 3.7–4 cm. wide, subcoriaceous, ligulate, but tapering gradually to the long subulate tip, this at 10 cm. back from the apex 3 mm. wide, near the base the margins spiny beginning 3–6 cm. from the base, the spines 2–3.5 mm. long, 4–10 mm. apart, white, stout subulate, ascending, the nearby midrib below with spines 2–3 mm. long, 15–20 mm. apart, subulate, the first three reflexed, the others ascending; near the middle the margins with spines 2–3 mm. long, 6–12 mm. apart, subulate, appressed ascending, the midrib below with spines 2 mm. long, slender subulate, white, appressed ascending, near the apex the margins and midrib below with subulate serrations 0.3–0.5 mm. long, 5–15 mm. apart; peduncle 20 cm. long, obtusely triangular in cross section, leafy bracted; syncarps terminal, solitary, 16 cm. long, 14 cm. in diameter, broadly ovoid, orange (color no. 196, pl. XIV, Seguy, E., Code Universel de Couleurs, 1936, Paris, Paul Lechevalier), of 84 phalanges, these 4.5–4.9 cm. long, 2.6–4.2 cm. wide, 2.2–2.9 cm. thick, oblong to cuneate-oblong, upper 3/5 free due to the fleshy enlargement of the lower 2/5, the apex mostly slightly convex but on a few truncate, the sides smooth, shining,

plane except where gently curved near the apex, 5–9-angled, lateral sutures none; apical central sinuses 3–5.5 mm. deep, narrow; carpels 6–10, mostly 7–8, the apices oblate pyramidal, the outer mostly with a small, oblique, distal, subterminal concavity; stigmas 1.5–2.5 mm. long, oblique, centripetal, short creased, suborbicular, the marginal ones partly covered by a cartilaginous inflexed visor; the proximal crease deep and extending $\frac{1}{2}$ – $\frac{3}{4}$ way to the valley bottom; endocarp placed slightly above the middle, bony, shining mahogany brown, the lateral margins 2–3 mm. thick; seeds 16 mm. long, 5–6 mm. in diameter, ellipsoid; apical mesocarp cavernous in each carpel, traversed by a few strong, longitudinal fibers and filled with white medullary, membranous partitions; basal mesocarp fibrous and fleshy, yellowish.

HOLOTYPE: Vietnam, Nha Trang, on sand dunes back of the beach, common, forming clumps, growing with *Calotropis gigantea*, *Randia prostrata*, *Dodonaea viscosa*, and *Zoisia pungens*, Feb. 8, 1960, H. St. John 26,341 (BISH).

DISCUSSION: This new *P. subcarnosus* is a member of the section *Pandanus*, and there its closest relative is the Philippine *P. coronatus* Merr. which is characterized by having the leaves 14 cm. wide (juvenile); syncarps globose, of about 50 phalanges; phalanges 3.5 cm. long, 2.5–3 cm. wide, the base with a fleshy enlargement 5 mm. or more wide on each side; carpels 9–12, the apices conic; and the stigmas erect or some of them oblique, 0.5 mm. long. In contrast, *P. subcarnosus* has the leaves 3.7–4 cm. wide; syncarps broadly ovoid, of 84 phalanges, pha-

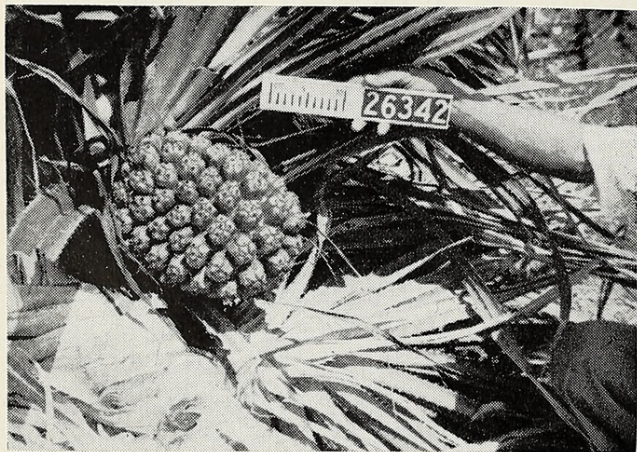


FIG. 87. *Pandanus vietnamensis*, from holotype. Foliage and syncarp, lateral view.

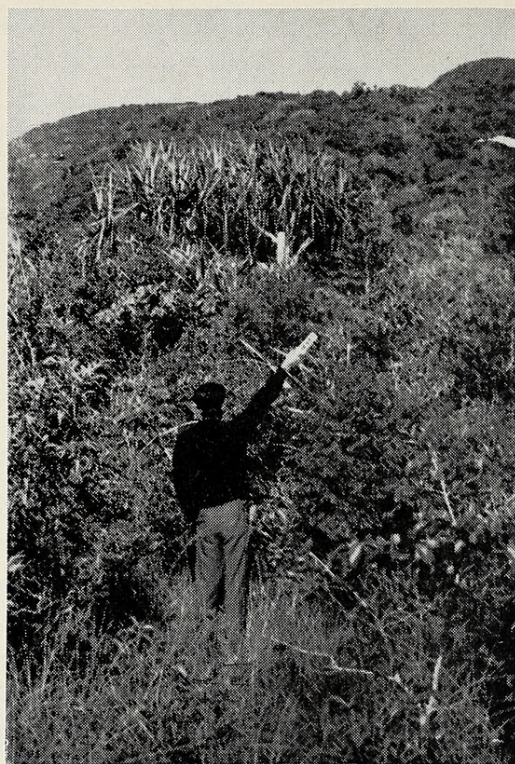


FIG. 88. *Pandanus corniferus*, from holotype. Habit view of tree.

langes 4.5–4.9 cm. long, 2.6–4.2 cm. wide, the basal fleshy enlargement only 1–2 mm. wide on each side; carpels 6–10, mostly 7–8, the apices oblate-pyramidal; and the stigmas oblique, 1.5–2.5 mm. long.

Pandanus subulatus sp. nov. (sect. *Pandanus*)
Figs. 85, 92

DIAGNOSIS HOLOTYPI: Arbor 2–4 m. alta 12–15 cm. diametro, cortice cum radicibus paucis adventiviis adpressi-adscendentibus, radicibus fulturosis 30–50 cm. longis 15–20 cm. diametro, series foliarum supra quidque pedunculam cum serie bractearum, bractea prima 9 cm. longa 5 cm. lata, bracteis in foliis mergentibus, foliis 70–74 cm. longis 4 cm. latis coriaceis minime glaucis olivaceis V-formatis ligulatis sed ex tertia parte infera ad apicem longe subulatam diminuentibus in puncto 10 cm. ex apice 3.5 mm. latis, marginibus ad basem cum spinis 5–6 mm. longis 6–12 mm. distantibus subulatis albis in 45° adscendentibus, midnervo infra cum spinis 3–4 mm. longis 12–20 mm. distantibus albis crassiter subulatis reflexis, circa mediam marginibus cum spinis omnibus longis vel in uno latere longis brevibusque alternatis 2–5 mm.

longis 6–10 mm. distantibus subulatis adpressi-
adscendentibus, spinis in midnervo 2–3.5 mm.
longis 7–15 mm. distantibus adscendentibus,
circa apicem marginibus et midnervo infra cum
spinis 0.5–0.8 mm. longis 3–5 mm. distantibus
subulato-serratis, pedunculo foemineo 15–20
cm. longo obtuse triangularibus bracteatis, syn-
carpiis 10–12 cm. longis 10–10.5 cm. diametro
solitariis terminalibus pendentibus aurantescenti-
bus suborbiculari-ellipticis cum 47–73 phalan-
gibus eis 3.5–4.1 cm. longis 2.2–3.3 cm. latis
1.8–2.3 cm. crassis obovoideo-cuneatis vel an-
guste ita, lateribus laevibus planis vel minime
curvatis parte supera pauce rugulosa et cum
fissuris longitudinalibus brevibus brunneis mul-
tis, 5–7-angulatis, suturis lateralibus nullis, apice
truncato, sinibus apicalibus centralibus 2–3.5
mm. profundis V-formatis, carpellis 5–6, ple-
rumque 5, apicibus pyramidalibus vel oblato-
pyramidalibus quando marginalibus et cum an-
gulo forte tum stigmate terminale cum concavo
distali minimo, sed carpella marginali cum latere
plano grandi stigmate marginali, stigmatibus
1.5–2 mm. longis nigris suborbicularibus vel
cordatis sulcatis obliquis et centripetalibus, sinu
proximali profundo et $\frac{1}{3}$ – $\frac{2}{3}$ distancia ad fun-
dam extenso, endocarpio paene supramediale
13–15 mm. longo osseoso brunneo marginibus
1.5–2 mm. latis, seminibus 8–11 mm. longis 4–5
mm. diametro obliquiter ellipsoideis, mesocarpio
apicale cavernoso 8–13 mm. longo exfibroso sed
cum membranis albis medullosis multis, meso-
carpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree 2–4 m. tall,
12–15 cm. in diameter; bark with a few, ap-

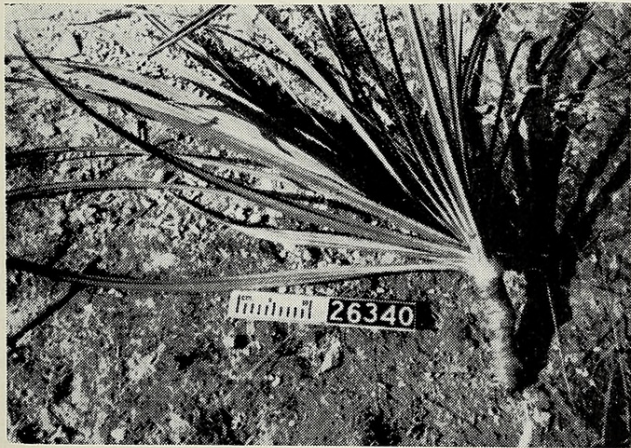


FIG. 89. *Pandanus corniferus*, from holotype. Lat-
eral view of branch and foliage.



FIG. 90. *Pandanus corniferus*, from holotype. Young
vigorous shoot showing foliage.

pressed-ascending, adventitious roots; prop roots
30–50 cm. long, 15–20 mm. in diameter; leaf
series beginning above each peduncle with an
entire deltoid bract 9 cm. long, 5 cm. wide, the
successive several bracts each larger and the later
ones spiny, merging in series to the foliage
leaves, these 70–74 cm. long, 4 cm. wide, cori-
aceous, somewhat glaucous on both sides, espe-
cially towards the base, olive green, at base wide
V-shaped in section, ligulate, but gradually nar-
rowing from the lower third to a long subulate
apex which 10 cm. back from the tip is 3.5 mm.
wide, the margins spiny beginning 4 cm. from
the base, the spines near the base 5–6 mm. long,
6–12 mm. apart, white, subulate, ascending at
45°, the midrib below with spines 3–4 mm.
long, 12–20 mm. apart, white, stout subulate,
reflexed; at the middle the marginal spines all
long, or on one margin alternately long and
short, 2–5 mm. long, 6–10 mm. apart, subulate,
appressed ascending, those of the midrib 2–3.5
mm. long, 7–15 mm. apart, ascending; near the
apex the margins and midrib below with spines
0.5–0.8 mm. long, 3–5 mm. apart, subulate-
serrate; pistillate peduncle 15–20 cm. long, in
cross section obtusely triangular, leafy bracted;

syncarps solitary, terminal, pendent, becoming orange, 10–12 cm. long, 10–10.5 cm. in diameter, suborbicular-elliptic, of 47–73 phalanges, these 3.5–4.1 cm. long, 2.2–3.3 cm. wide, 1.8–2.3 cm. thick, obovoid-cuneate or narrowly so, turning orange, sides smooth, plane or gently curving, upper part slightly rugulose, and with numerous short, brown, longitudinal cracks, 5–7-angled; lateral sutures none, apex truncate; apical central sinuses 2–3.5 mm. deep, the valley V-shaped; carpels 5–6, usually 5; the apices pyramidal or oblate-pyramidal, if the carpel is marginal and including a strong lateral angle, then the stigma is terminal and central and outside it is a tiny concavity, but if the carpel centers by a flat side, the stigma is marginal and there is no concavity; stigmas 1.5–2 mm. long, black, suborbicular to widely cordate, creased, oblique and centripetal; the proximal crease deep, extending $\frac{1}{3}$ – $\frac{2}{3}$ way to the valley bottom; endocarp slightly supramedian 13–15 mm. long, bony, brown, the lateral margins 1.5–2 mm. thick; seeds 8–11 mm. long, 4–5 mm. in diameter, obliquely ellipsoid; apical mesocarp with a cavern in each carpel, 8–13 mm. long, free of fibers but with numerous white medullary mem-

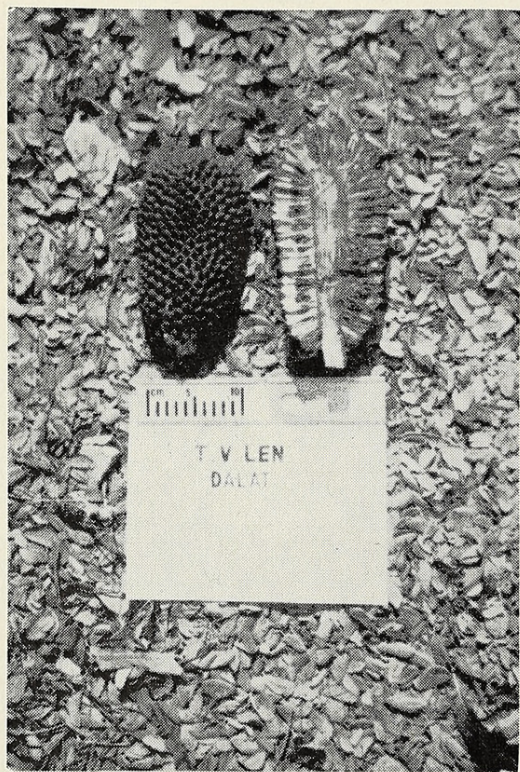


FIG. 91. *Pandanus multirupaceus*, from holotype. Lateral view of syncarp.

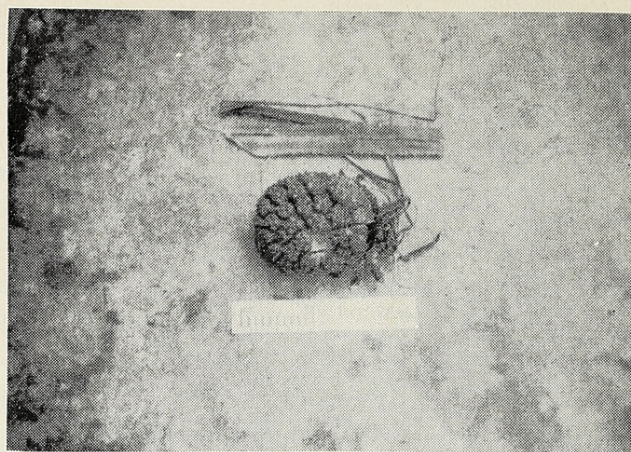


FIG. 91A. *Pandanus projectens*, from holotype. Lateral view of syncarp and leaf.

branous partitions; basal mesocarp fibrous and fleshy.

HOLOTYPE: Vietnam, n. side of Hon Mieu I., Baie de Nha Trang, top of rocky beach, growing with *Scaevola Taccada*, and *Thespesia populnea*, Feb. 6, 1960, H. St. John 26,331 (BISH).

DISCUSSION: *P. subulatus* is a member of the section *Pandanus*. Its closest relative seems to be *P. odoratissimus* L. f. var. *savaiiensis* (Martelli) Martelli of Samoa which has the leaves 60 cm. long, 1.5 cm. wide (juvenile?), the midrib below near the base with one or two or no spines; carpels 5–8, the apices pyramidal-subrotund; and the endocarp convex below. *P. subulatus* has, in contrast, the leaves 70–74 cm. long, 4 cm. wide, the midrib below near the base with spines 3–4 mm. long, 12–20 mm. apart, white, stout subulate, reflexed; carpels 5–6, usually 5, the apices pyramidal or oblate-pyramidal; and the endocarp concave below.

The new epithet is the Latin adjective, *subulatus*, awl-shaped, in allusion to the shape of the leaf apex.

Pandanus vietnamensis sp. nov. (sect. *Pandanus*)

Figs. 86, 87, 93

DIAGNOSIS HOLOTYPE: Arbor 3–5 m. alta 15 cm. diametro, radicibus fulurosus nullis, foliis 99.5–149 cm. longis 5–6 cm. latis olivaceis infra minime glaucis coriaceis ligulatis ex medio sensim ad apicem deltoideum longe subulatum diminuentibus eo in 10 cm. ex apice 1.5 mm. lato, basi amplexicaule inerme sed marginibus ex 5–11 cm. cum spinis 4–11 mm. longis 7–22

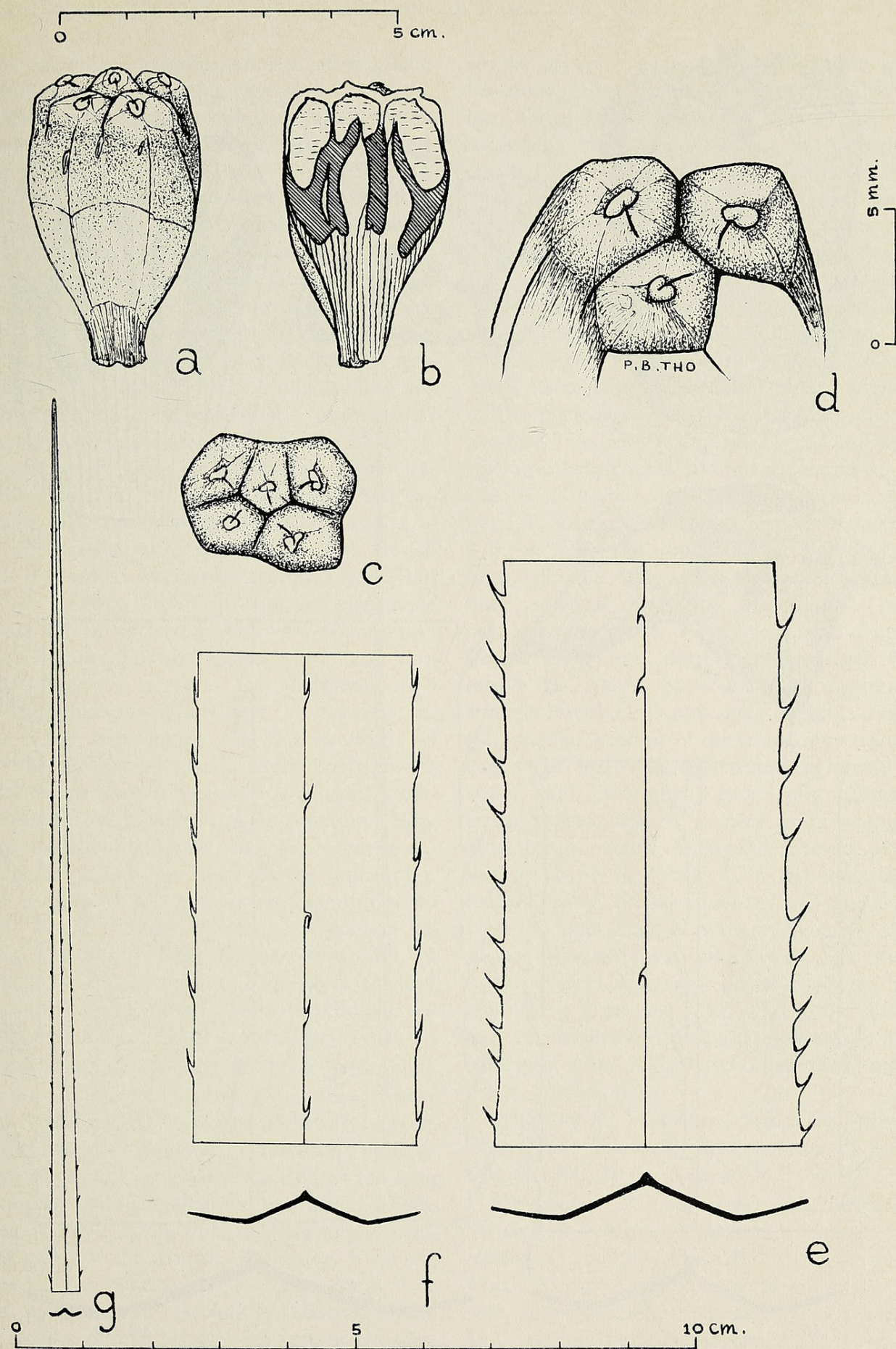


FIG. 92. *Pandanus subulatus*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, oblique view, $\times 2$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

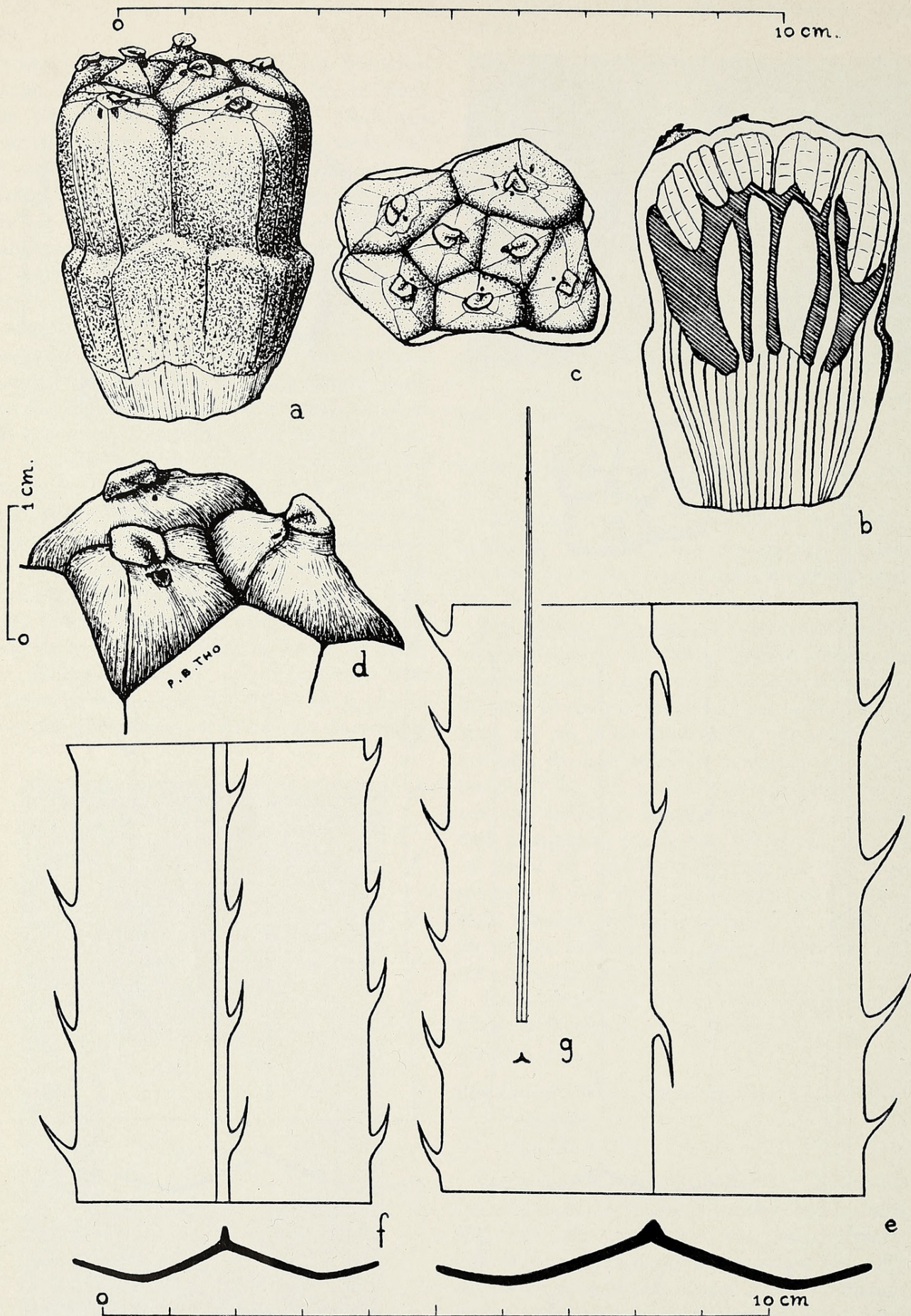


FIG. 93. *Pandanus vietnamensis*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apices, oblique view, $\times 2$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

mm. distantibus arcuatis subulatis albis adscendentibus, midnervo infra cum spinis 6–8 mm. longis 20–42 mm. distantibus subulatis reflexis basibus fortioribus, circa mediam marginibus sum spinis 6–8 mm. longis 12–25 mm. distantibus, midnervo infra cum spinis 6–8 mm. longis 12–25 mm. distantibus subulatis curvatis adscendentibus in nervo angusto elevato affixis, circa apicem marginibus cum spinis 0.5–0.9 mm. longis 5–11 mm. distantibus subulatis valde adpressis adscendentibus, midnervo subulato-serratis dentibus 0.3–0.5 mm. longis 5–8 mm. distantibus, pedunculo 30 cm. longo obtuse deltoideo folioso, syncarpio solitario terminali 27 cm. longo 19 cm. diametro coccineo (rouge no. 152, Seguy, E., Code Univ. Couleurs 1936) late ellipsoideo cum 106 phalangibus, eis 5.8–6 cm. longis, parte supera libera 3–4.2 cm. latis, 2.5–3.7 cm. crassis, parte infera 4–10 mm. latioribus et carnosa incrassata, suturis lateralibus nullis, lateribus dimidia superae plerumque planis vel in parte subconcavis 7–9-angulosis, suturis centralibus apicalibus 1.5–3 mm. profundis angustis, carpelis 5–9 plerumque 6–7 apicibus plano-pyramidalibus, stigmatibus nigris 3.5–5 mm. longis vel latis ovalibus vel suborbicularibus vel ceteris lateralibus truncatis et latioribus quam longis sulcatis obliquis prominentibus centripetalibus, sinu proximo solum punctato vicino stigmati, endocarpio paene supramediali 2.7–3 cm. longo osseoso rubro-brunneo lateribus 1.5–2 mm. crassis, seminibus 20 mm. longis 6 mm. diametro ellipsoideis vel obliquiter ellipsoideis, mesocarpio apicali in carpela quaque cavernoso cum fibris fortibus paucis et cum membranis albis medullosis completis, mesocarpio basali fibroso carnosoque.

DIAGNOSIS OF HOLOTYPE: Trees 3–5 m. tall, 15 cm. in diameter; prop roots none; leaves 99.5–149 cm. long, 5–6 cm. wide, olive green, below slightly glaucous, coriaceous, ligulate, from the middle gradually tapering to the long acuminate, subulate, deltoid apex which 10 cm. down is only 1.5 mm. wide, the base amplexicaul, unarmed, but the margins beginning 5–11 cm. from the base with spines 4–11 mm. long, 7–22 mm. apart, arcuate, ascending, subulate, white; the nearby midrib below with spines 6–8 mm. long, 20–42 mm. apart, subulate, reflexed, heavier based; near the midsection the margins with

similar spines 6–8 mm. long, 12–25 mm. apart, the sharp, raised midrib below with spines 6–8 mm. long, 12–25 mm. apart, subulate, curved, ascending; near the apex the margins with spines 0.5–0.9 mm. long, 5–11 mm. apart, subulate, ascending, closely appressed; the midrib subulate-serrate, the teeth 0.3–0.5 mm. long, 5–8 mm. apart; peduncle 30 cm. long, obtusely triangular in section, leafy bracted; syncarps terminal, solitary, 27 cm. long, 19 cm. in diameter, scarlet (or more exactly Rouge no. 152, pl. XI, Seguy, E., Code Universel des Couleurs, 1936, Paris, Paul Lechevalier), broad ellipsoid, of 106 phalanges, these 5.8–6 cm. long, the upper half 3–4.2 cm. wide, and 2.5–3.7 cm. thick, the lower half from 4–10 mm. wider and thicker due to its fleshy enlargement (which is color no. 152, shading down to yellow, or orange, no. 213, pl. XV), the upper half, or slightly more than half, free, apex low convex; lateral sutures none; sides of upper half mostly plane or in part gently concave, 7–9-angled, central apical sinuses 1.5–3 mm. deep, narrow; carpels 5–9, mostly 6–7, the apices flattened pyramidal; stigmas black, 3.5–5 mm. long or wide, oval to suborbicular, or some of the lateral ones truncate and wider than long, all creased, obliquely inclined and centripetal, prominent; proximal crease represented by a mere point or cut a short distance below the stigma; endocarp placed slightly above the center, 2.7–3 cm. long, bony, reddish brown, the lateral walls 1.5–2 mm. thick; seeds 20 mm. long, 6 mm. in diameter, ellipsoid or obliquely so; apical mesocarp of a cavern in the apex of each carpel, these traversed by a few strong fibers and filled with white medullary membranes forming an aerenchyma; basal mesocarp with many longitudian fibers and a white, tasteless flesh.

HOLOTYPE: Vietnam, 6 km. e. of Mũi Nê, Phan Thiết Province, clumps at top of beach, Feb. 9, 1960, *H. St. John* 26,342 (BISH).

DISCUSSION: *P. vietnamensis* is a member of the section *Pandanus* and there finds its closest relative, *P. coronatus* Martelli of the Philippines, which species has its leaves 14 cm. wide and near midsection the marginal teeth 0.5–1 mm. long; syncarp globose, almost 14 cm. in diameter, with about 50 phalanges; phalanges 3.5 cm. long, 2.5–3 cm. wide; carpels 9–12 and

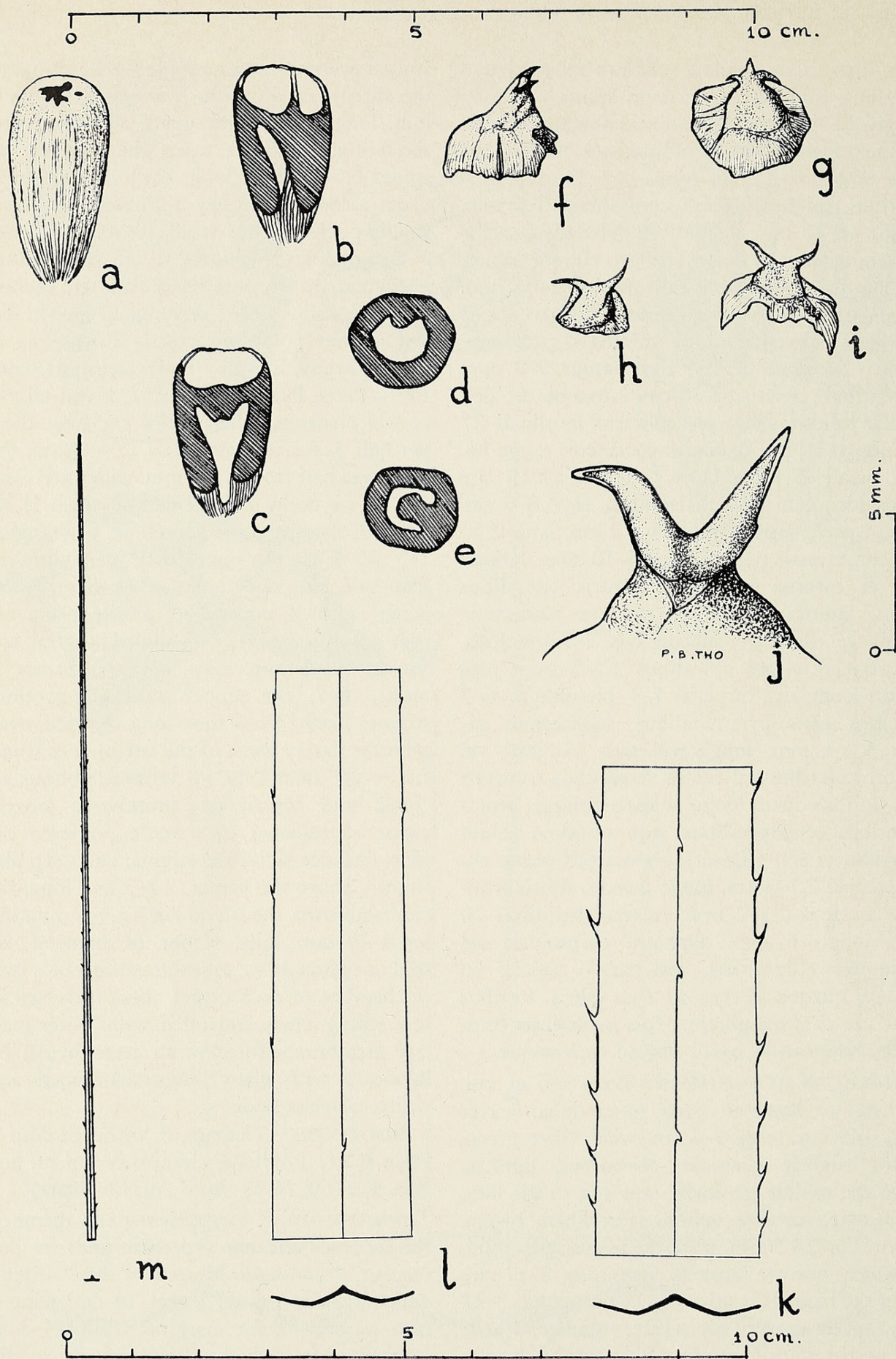


FIG. 94. *Pandanus corniferus*, from holotype. *a*, Drupe, minus the pileus, lateral view, $\times 1$; *b*, *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, median transverse section, $\times 1$; *e*, supramedian transverse section of drupe, $\times 1$; *f*, *g*, *h*, *i*, pileus with stigma, oblique view, $\times 1$; *j*, stigma, lateral view, $\times 4$; *k*, leaf base, lower side, $\times 1$; *l*, leaf middle, lower side, $\times 1$; *m*, leaf apex, lower side, $\times 1$.

their apices obliquely conic; and the stigmas 2 mm. long. In contrast, *P. vietnamensis* has its leaves 5–6 cm. wide and near the midsection the marginal teeth 6–8 mm. long; syncarp broad ellipsoid, 27 cm. long, 19 cm. in diameter, of 106 phalanges; phalanges 5.8–6 cm. long, 3–4.2 cm. wide; carpels 5–9 and their apices flattened pyramidal; and the stigmas 3.5–5 mm. long.

The new epithet is formed of the name of the native country, Vietnam, plus *-ensis*, the Latin, adjectival, place ending.

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

Figs. 88–90, 94

DIAGNOSIS HOLOTYPE: Arbor 5–8 m. alta 15 cm. diametro, cortice brunneo laevi, radicibus fulturosis multis ad 3 m. longis 1–2 cm. diametro pallide griseis laevibus sed cum radicibus spinis simulantibus verticillatis, foliis 1.81–1.87 m. longis 2.4–2.7 cm. latis obscure olivaceis crassis sed fragilibus supra late sulcatis ligulatis sed longiter diminuentibus in apice subulato deltoideo ad 10 cm. solum 0.9 mm. lato, marginibus cum spinis ex 45 mm. ex basi incipientibus eis 3–4 mm. longis 7–15 mm. distantibus subulatis adscendentibus pallidis, midnervo infra ex 9.5 cm. spinoso spinis 3.5–4 mm. longis 25–35 mm. distantibus subulatis basi distenta subiter reflexis, circa mediam marginibus subintegris, midnervo infra cum spinis paucis remotis 1.3 mm. longis subulatis adscendentibus apice brunneo, circa apicem marginibus et midnervo infra cum serris 0.2–0.3 mm. longis adpressis, foliis plantae juvenalis 1.81–1.87 m. longis 4 cm. latis cum apice longiori et spinis pauciter majori, syncarpiis quam dicunt "solitariis 20 cm. diametro (?) globoso rubro, drupis saccharosis edulibus sed celeriter irritantibus," drupis manifesto 32–35 mm. longis teretibus 14–16 mm. diametro ellipsoideis vel cuneato-ellipsoideis, pileo 15–20 mm. alto 15–19 mm. diametro semiorbiculari in apice ferrenti instrumentum stigmatalis 13–17 mm. longum in 45° obliquum parte libera 7–9 mm. longa dimidia bipartita, stylis 3–6 mm. longis subulatis divergentibus recurvatis, corpore druparum in sicco 20–29 mm. longo 12–17 mm. diametro stramineo vel pallide brunneo, endocarpio 14–16 mm. longo solido osseoso brunneo pauciter inframediali in media supera invaginata

lateribus 3–4 mm. latis, seminibus 7–10 mm. longis 7 mm. diametro subteretibus, mesocarpio apicali unico cavernoso 6–7 mm. longo fibrillis nullis, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Trees 5–8 m. tall, 15 cm. in diameter; bark brown, smooth; prop roots numerous, as much as 3 m. long from the trunk, 1–2 cm. in diameter, the bark light gray, smooth except for small, spine-like rootlets in remote whorls; leaves 1.8–1.87 m. long, 2.4–2.7 cm. wide, dark olive green, thick but the tissue weak and easily torn across, above with a wide central furrow, the margins reflexing, ligulate but long tapering to a slender subulate tip, deltoid in cross section and 10 cm. back from the tip only 0.9 mm. wide, the margins with spines commencing 45 mm. from the base, these 3–4 mm. long, 7–15 mm. apart, subulate, ascending, pale, the adjacent midrib below spiny beginning at 9.5 cm. from the base, the spines 3.5–4 mm. long, 25–35 mm. apart, subulate, broad based, sharply reflexed; near the middle the margins subentire, the midrib with a few remote spines 1.3 mm. long, subulate, ascending, brown-tipped; near the apex the margins and midrib below with appressed serrulations 0.2–0.3 mm. long; leaves of juvenile plants 1.81–1.87 m. long, 4 cm. wide, the subulate apex much longer and the spines a little larger; syncarps reported to be "solitary, 20 cm. in diameter (which size I doubt and think much too large), globose, red, the drupes sweet, with the flesh edible but soon irritating"; no attached or complete fruits were found on the scores of trees, only fallen drupe bodies and many detached, dried examples of the pileus; drupes apparently 32–35 mm. long, terete and 14–16 mm. in diameter, or slightly compressed and 12–15 mm. thick, ellipsoid or cuneate-ellipsoid; pileus 15–20 mm. high, 15–19 mm. in diameter, semiorbicular, bearing on the apex a dark brown, shining, stigmatic apparatus, the whole 13–17 mm. long, oblique at 45°, but the free part 7–9 mm. long, this parted about ½ way into two styles 3–6 mm. long, subulate, widely diverging and recurving; body of the drupes when dried 20–29 mm. long, 12–17 mm. in diameter, stramineous or pale brown; endocarp 14–16 mm. long, massive, placed slightly below the middle, bony, brown, the upper half of the

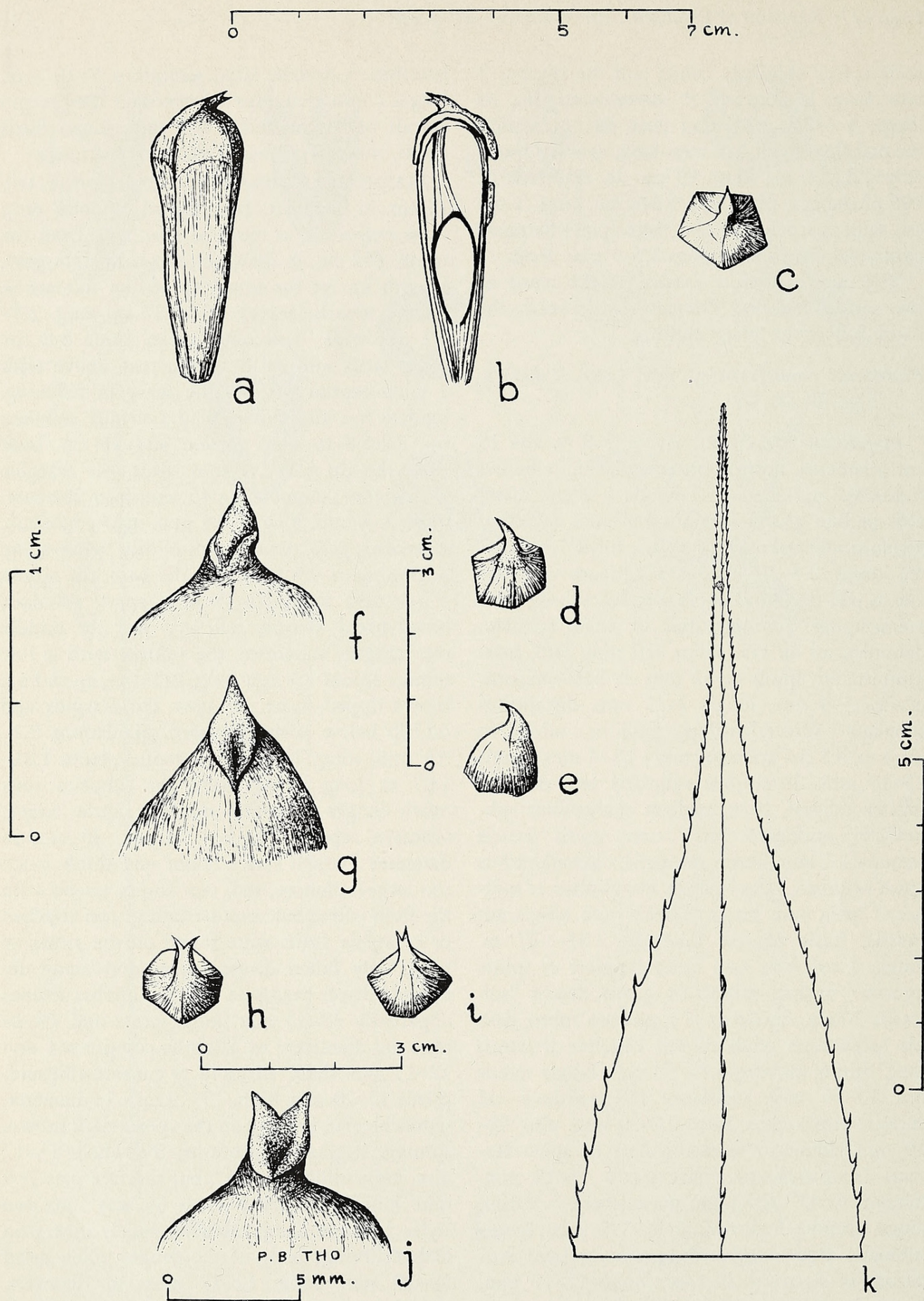


FIG. 95. *Pandanus multidrupaceus*, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, drupe, apical view, $\times 1$; *d*, pileus, lateral view, $\times 1$; *e*, pileus, lateral view, $\times 1$; *f*, *g*, stigma, lateral view, $\times 4$, this and *a*–*f* from median drupes; *h*, *i*, apical view of pileus of subbasal drupes, $\times 1$; *j*, lateral view of stigma of subbasal drupe, $\times 4$; *k*, apex of floral bract, lower side, $\times 1$.

cavity partly filled by a broad invagination from one side, the lateral walls 3–4 mm. thick; seed cavity 7–10 mm. long, 7 mm. in diameter, terete except for the invagination; apical mesocarp a single cavern 6–7 mm. long, free of fibers except for those making a central shaft; basal mesocarp fibrous and fleshy.

HOLOTYPE: Vietnam, Ile Tre (Hon-Mieu), Baie de Nha Trang, lower wooded slopes on s. side, common at 30–200 m. alt., in brush and forest of *Randia* and other spiny or thorny species, Feb. 7, 1960, *H. St. John* 26,340 (BISH).

DISCUSSION: The new *P. corniferus* is a member of the section *Rykia*. Its closest relative there is *P. furcatus* Roxb., described from northeast India and later found growing also in Burma and in Vietnam. It is distinguished by its drupes 3–4 cm. long, 8–9 mm. in diameter; pileus 1 cm. long, 12–13 mm. in diameter, broad cylindrical; style 3–4 mm. long, bifurcate less than $\frac{1}{2}$ way, slightly curved; and the apical mesocarp 1 cm. long. *P. corniferus* differs in having the drupes 32–35 mm. long, 13–18 mm. in diameter; pileus and stigma 15–20 mm. long, 15–19 mm. in diameter; styles 2–3-forked, 3–6 mm. long, cleft $\frac{1}{2}$ way, the subulate forks widely diverging and recurving.

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

Figs. 91, 95, 96

DIAGNOSIS HOLOTYPE: Arbor 3.5–5 m. alta 8 cm. diametro, radicibus fulturosis 1.5–2.5 cm. diametro laevibus excepta tuberculis paucis remotis, foliis 2–2.95 m. longis 6.3–6.8 cm. latis coriaceis ligulatis apice longe acuminato subulato in puncto 10 cm. ex apice 3.5 mm. latis basi inerme vix majore sed in uno latere ex 14 cm. dum in alter ex 29 cm. marginibus cum spinis 6–8 mm. longis 14–33 mm. distantibus subrectis subulatis adscendentibus basi in-crassata, midnervo cum spinis 7–9 mm. longis simulantibus sed crassioribus reflexisque, in regione mediali marginibus cum spinis 3–4 mm. longis 28–40 mm. distantibus crassiter subulatis adscendentibus, midnervo infra cum spinis crassissimis 4–5 mm. longis reflexis, proxima apice subulato-serrato dentibus 1–1.5 mm. longis 6–27 mm. distantibus, midnervo inerme, pedunculo 15 cm. et ultra longo obtuse deltoideis folioso,

bracteis inferis 11 cm. latis superioribus 60 cm. longis 10 cm. latis lanceolatis acuminatis marginibus medialis inferique cum spinis 1–1.5 mm. longis sed ad apicem in marginibus midnervo-que majoribus 2–2.5 mm. longis 4–11 mm. distantibus valde subulatis curvatis, syncarpio 22 cm. longo 12 cm. diametro anguste ovoideo-cylindraco cum 752 drupis luteis, nucleo 2.5–3 cm. diametro albido molle carnosum et fibroso, drupis immaturis rubrescenti-viridibus apice glauco, eis medialis et superis 4.2–4.5 cm. longis 10–13 mm. latis 9–13 mm. crassis illis inferis et subbasalibus 3.3–4.2 cm. longis 9–12 mm. latis 12–15 mm. crassis cuneatis 5–6-angulosis lateribus planatis parte $\frac{1}{5}$ supera libera, pileo glauco conico-pyramidalis sed parte proxima obliqua et supra curvata decidua, stylo 5–7 mm. longo osseoso lucido ad basem obscure brunneo ad apicem pallide brunneo irregulariter bifido (vel paucis apicalibus integris), stigmatibus brunneis papillosis infra confluentis sed in ramis separatis, endocarpio in tertia infera 14–16 mm. longo 4–6 mm. diametro osseoso marginibus lateralibus 0.5 mm. crassis, superficie interiori straminea lucida in stylo cum fibris connectis, seminibus late ellipsoideis, mesocarpio apicali quam parte tertia grandiori albo molle exfibroso, mesocarpio basali fibroso et carnosum.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree 3.5–5 m. tall, 8 cm. in diameter; prop roots 1.5–2.5 cm. in diameter, smooth except for a few remote tubercles; leaves 1.58–2.95 m. long, 6.3–6.8 cm. wide, coriaceous, ligulate, the apex long acuminate, the tip subulate, and 10 cm. down only 3.5 mm. wide, the very base unarmed, scarcely widened, beginning at 14 cm. on one side, at 29 cm. on the other the margins with spines 6–8 mm. long, 14–33 mm. apart, nearly straight subulate, heavy based, and ascending, the midrib below with spines 7–9 mm. long, similar but even thicker and reflexed; at the middle the margins with spines 3–4 mm. long, 28–40 mm. apart, stout subulate, ascending, the midrib below with very stout ones 4–5 mm. long, reflexed; near the apex the margins subulate serrate, the teeth 1–1.5 mm. long, 6–27 mm. apart, the midrib unarmed; peduncle 15 or more cm. long, bluntly triangular in cross section, leafy bracted, the lower bracts 11 cm.

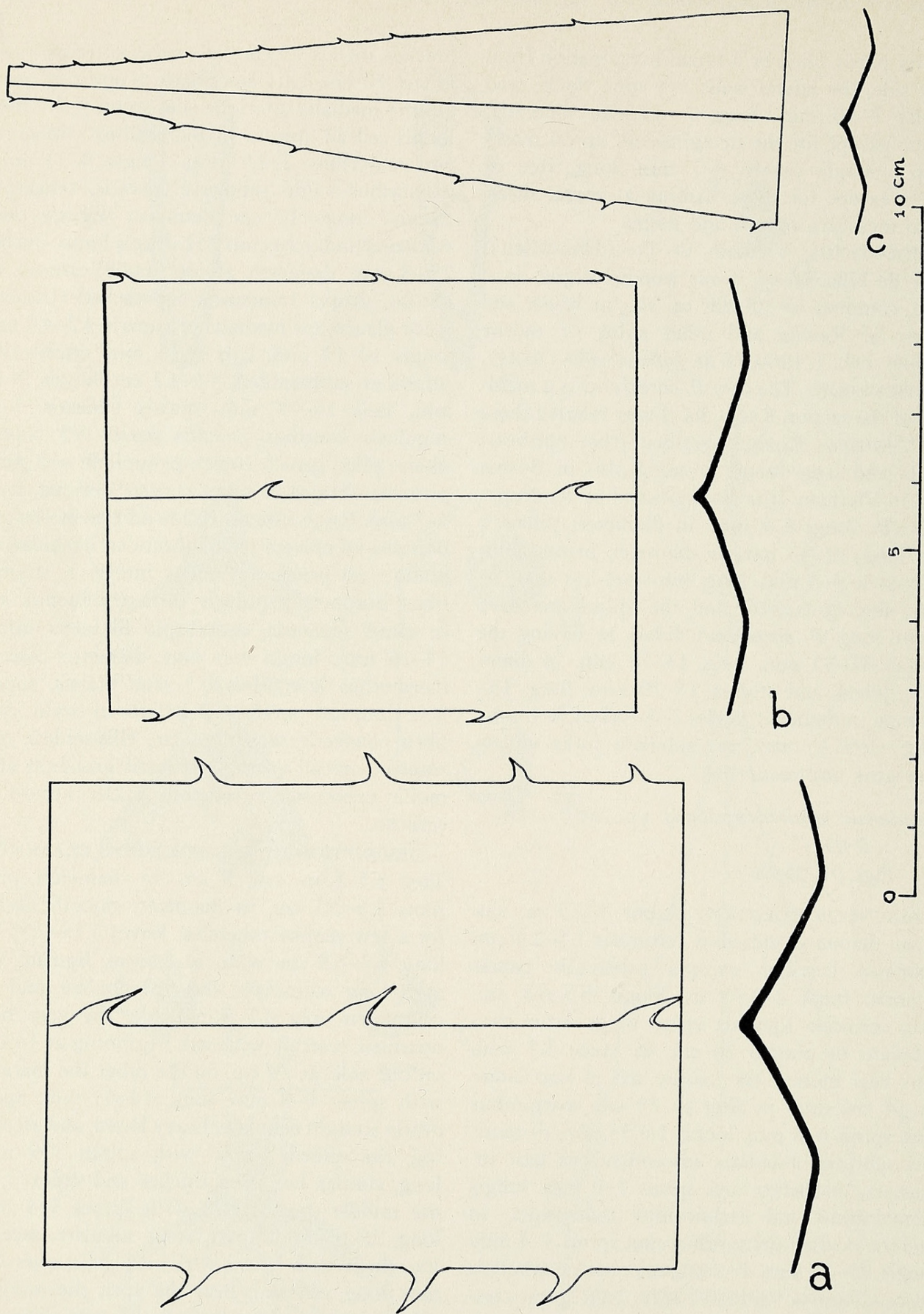


FIG. 96. *Pandanus multirupaceus*, from holotype. *a*, Leaf base, lower side, $\times 1$; *b*, leaf middle, lower side, $\times 1$; *c*, leaf apex, lower side, $\times 1$.

wide, the upper bracts 60 cm. long, 10 cm. wide, lanceolate, acuminate, the middle and lower margins with spines 1–1.5 mm. long but increasing upwards, and near the tip on margins and midrib below the spines 2–2.5 mm. long, 4–11 mm. apart, stout subulate, upcurved; syncarp 22 cm. long, 12 cm. in diameter, narrowly obovoid-cylindric, of 752 drupes; the core 2.5–3 cm. in diameter, white, soft fleshy and fibrous; drupes reddish green, but still unripe and the apex glaucous, the middle and upper drupes 4.2–4.5 cm. long, 10–13 mm. wide, 9–13 mm. thick, the lower and subbasal ones 3.3–4.2 cm. long, 9–12 mm. wide, 12–15 mm. thick, cuneate, 5–6 angled, the sides plane, upper 1/5 free; pileus glaucous, conic-pyramidal, but the upper part oblique and curved towards the apex of the syncarp, deciduous; style 5–7 mm. long, bony, shining, towards the base dark brown, towards the apex pale brown, irregularly bifid (or on a few apical drupes entire); stigmas brown, papillose, confluent below but separating on the forks; endocarp in lower 1/3, 14–16 mm. long, 4–6 mm. in diameter, bony, the lateral walls 0.5 mm. thick, the inner surface stramineous, shining, produced upwards by a broad subulate, fibrous, oblique connection to the style; seeds

broadly ellipsoid; apical mesocarp extensive, filling more than the upper 1/3 with a white, soft, continuous, non-fibrous tissue; basal mesocarp fibrous and fleshy.

HOLOTYPE: Vietnam, 8 km s. w. de Pampei, Teurnoum, Dalat, frequent, le long des ruisseaux, forêt dense, 9 Feb. 1960, Trung Van Lén (BISH).

SPECIMENS EXAMINED: Vietnam, forest of Manglinh, near Dalat, 25 mars, 1960, Trung Van Lén.

DISCUSSION: *P. multidrupaceus* is in the section *Rykia* and is most closely related to *P. tonkinensis* Martelli, of Tonkin and Annam, which species has the plant 1–2 m. tall; leaves 70–80 cm. long, 4 cm. wide, the basal marginal prickles 8–15 mm. long; pistillate inflorescence bracts 7 cm. long, 2.5 cm. wide; syncarp broadly ellipsoid (very young); drupes about 80. *P. multidrupaceus* has the tree 3.5–5 m. tall; leaves 2–2.95 m. long, 6.3–6.8 cm. wide, the basal marginal prickles 6–8 mm. long; pistillate inflorescence bracts 55 cm. long, 9.5 cm. wide; syncarp cylindric-obovoid; and the drupes 752.

The new epithet is composed from the Latin *multus*, many; *drupaceus*, bearing drupes, in reference to the 752 drupes of the syncarp.



St. John, Harold. 1962. "Revision of the Genus *Pandanus* Stickman, Part 10. New *Pandanus* Species from Vietnam." *Pacific science* 16(1), 88–125.

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