

Revision of the Genus *Pandanus* Stickman, Part 5
Pandanus of the Maldive Islands and the Seychelles Islands, Indian Ocean

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THE MALDIVE ISLANDS form a western fringe of atolls off the coast of India and Ceylon. Their flora was summarized by J. C. Willis and J. S. Gardiner (1901), but *Pandanus* has not received particular attention. They recorded *Pandanus* on many of the atolls, and described their utilization for mats, pillows, sails, and for food. Three species were listed: *P. odoratissimus* L. f., *P. Leram* Jones ex Fontana with the doubtful synonym (? *P. Hornei* Balf. f.), and *P. sp.* indet. The present writer considers the first to be a misidentification with the Ceylonese species; the second, *P. Leram*, is confined to the Andaman and Nicobar Islands, and the Maldive plant is doubtless the new *P. Fosbergii* St. John, and the third remains undetermined. Four additional species of the affinity of *P. odoratissimus* are here described.

Dr. F. R. Fosberg in 1956 observed and collected *Pandanus* on several of the islands. He identified (1957: 11) them as *P. odoratissimus*. His no. 36,916 is here described as *P. maldivicus* St. John; and his no. 36,899 as *P. Fosbergii* St. John.

Dr. W. D. Hartman was a member of the Yale University 1957 Expedition to the Indian Ocean. From his excellent collections there are here described several new species.

Hartman also visited the Chagos Archipelago, but on his brief land excursions he found no *Pandanus*.

SEYCHELLES ISLANDS

The flora of these islands is well known and was well presented by Baker (1877). From the islands we know *P. Balfourii* Martelli, *P. Hornei* Bory, *P. multispicatus* Balf. f., and *P. sechel-*

larum Balf. f. Of these, Hartman in 1957 collected all but the third, and his complete specimens allowed supplements to the previously published descriptions.

For Aldabra Atoll, J. C. F. Fryer (1912: 402) recorded *P. Vandermeeschii* Balf. f. in Baker, a species now considered endemic to Mauritius. The Aldabra specimens are in need of further revision, and the writer has not seen them as yet.

Pandanus OF THE MALDIVE ISLANDS

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

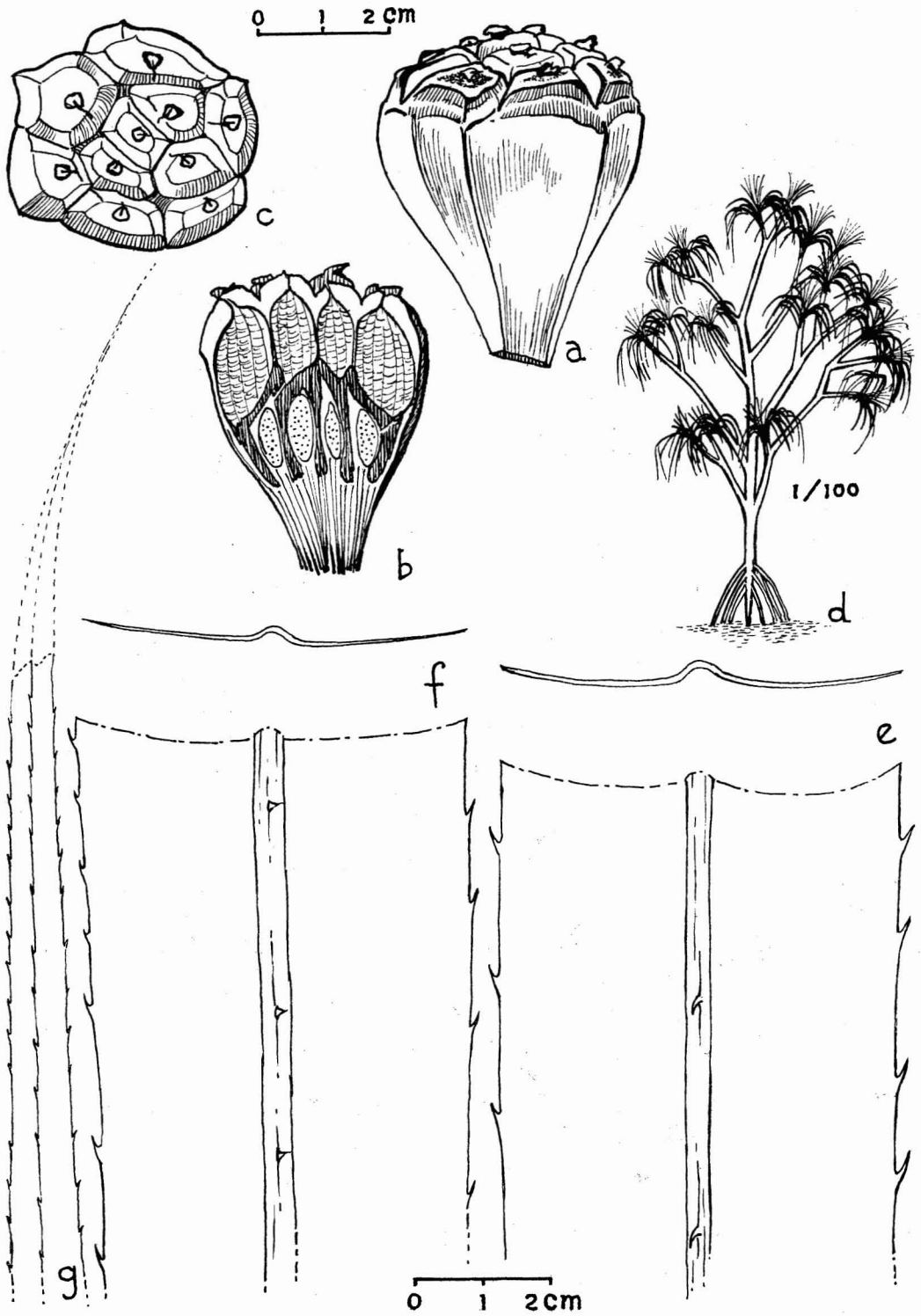
Fig. 12

NOM. VERN.: "karikayo."

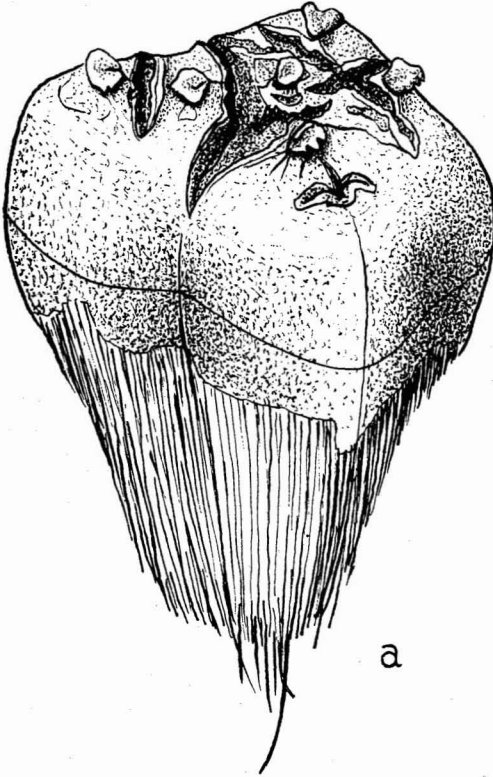
DIAGNOSIS HOLOTYPI: Arbor 6-7 m. alta, corona late ovoidea, radicibus fulturosis evidentibus, foliis 150 cm. longis 6.3 cm. latis firme subcoriaceis ligulatis apice gradatim longe acuminatis apice ultimo non viso ad basem M-formatis, marginibus in regione basali cum aculeis 3-4 mm. longis 12-22 mm. distantibus adscendentibus forte subulatis cum basibus incrassatis et apicibus obscure brunneis midnervio proximo infra cum aculeis 2.5-3 mm. longis 11-30 mm. distantibus reflexis crasse subulatis cum basibus incrassatis, in regione mediali marginibus cum aculeis 2-3 mm. longis 8-22 mm. distantibus subulatis in 30° adscendentibus, midnervio proximo infra inermi; in regione apicali aculeis 0.4-0.6 mm. longis crasse subulatis in 45° adscendentibus eis marginalium 3-5 mm. distantibus illis midnervi 5-10 mm. distantibus adscendentibus, phalangibus 4.5-4.9 cm. longis 3.4-4.1 cm. latis 3-3.7 cm. crassis obovoideis basi cuneata apice valde convexo, parte ¼ supra libera lateribus laevibus lucidis in sicco brunneis fere planatis anguste

¹B. P. Bishop Museum, Honolulu 17, Hawaii, U.S.A. Manuscript received May 20, 1960.

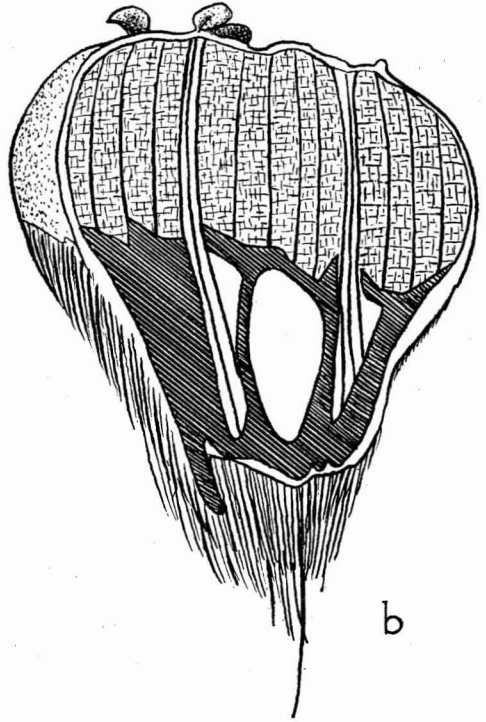
FIG. 12. *Pandanus adduensis*, from the holotype. a, Phalange, lateral view, × 1; b, phalange, longitudinal section, × 1; c, phalange, apical view, × 1; d, tree, × 1/100; e, leaf base, lower side, × 1; f, leaf middle, lower side, × 1; g, leaf apex, lower side, × 1.



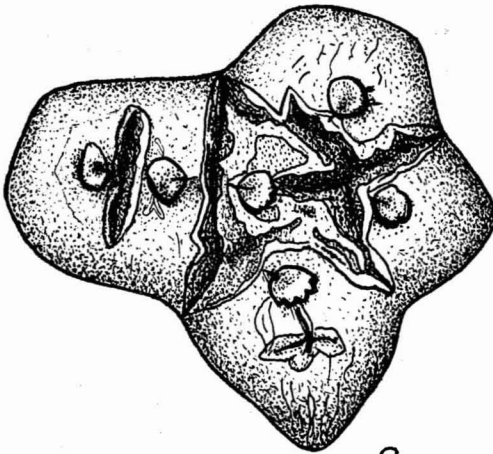
0 1 2cm



a

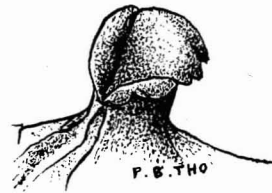


b

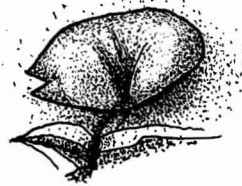


c

0 1 2cm



d



e

0 5mm

6–7-angulosis, suturis lateralibus nullis, sinibus apicalibus centralibus 3–4 mm. profundis V-formatis (phalangiis geminatis 5–5.5 cm. latis et carpellis 18–22), carpellis 9–13, apicibus humiliter pyramidalibus eis centralibus valde oblati illis marginalibus late distali truncatis et etiam concavis, stigmatibus 2.5–4 mm. longis cordatis vel irregulariter ellipticis oblique inclinatis centripetalibus, sutura proximali $\frac{1}{3}$ – $\frac{1}{2}$ distancia ad fundum extenta, endocarpio paene submediali osseoso obscure brunneo marginibus lateralibus 2 mm. crassis, seminibus 8–10 mm. longis 3.5–5 mm. diametro oblique ellipsoideis, mesocarpio apicali in quaque carpella cavernoso cum fibris longitudinalibus et membranis medullois, mesocarpio basali fibroso.

DIAGNOSIS OF HOLOTYPE: Tree 6–7 m. tall; crown broad ovoid; prop roots present; leaves 150 cm. long, 6.3 cm. wide, firm subcoriaceous, M-shaped in cross-section, ligulate, the apex gradually long acuminate, but the tip not seen, the margins near the base with prickles 3–4 mm. long, 12–22 mm. apart, stout subulate, broad based, ascending, dark brown tipped; the nearby midrib below with prickles 2.5–3 mm. long, 11–30 mm. apart, reflexed, stout subulate from an enlarged base; at the midsection the margins with prickles 2–3 mm. long, 8–22 mm. apart, subulate, ascending at 30°; the midrib unarmed; near the apex the margins and midrib below with ascending prickles 0.4–0.6 mm. long, stout subulate, ascending at 45°, those of the margin 3–5 mm. apart, but those of the midrib 5–10 mm. apart; phalanges 4.5–4.9 cm. long, 3.4–4.1 cm. wide, 3–3.7 cm. thick, obovoid with the base cuneate and the apex convex, upper $\frac{1}{4}$ free, the sides smooth, shining, brown when dry, almost plane, sharply 6–7-angled, lateral sutures none; central apical sinuses 3–4 mm. deep, V-shaped; (phalange twins 5–5.5 cm. wide and with 18–22 carpels); carpels 9–13; carpel apices low pyramidal, the central ones strongly oblate, the marginal ones broad truncate and even concave distally from the stigma; stigmas 2.5–4 mm. long, cordate or irregularly elliptic, oblique, centripetal; proximal suture running $\frac{1}{3}$ – $\frac{1}{2}$ way to valley bottom;

endocarp slightly submedian, bony, dark brown, the lateral margins 2 mm. thick; seeds 8–10 mm. long, 3.5–5 mm. in diameter, obliquely ellipsoid; apical mesocarp in each carpel a cavity with longitudinal fibers and pithy partitions; basal mesocarp fibrous.

HOLOTYPE: Maldiv Islands: Addu Atoll, Hitadu Islet, near shore, common, Oct. 13, 1957, W. D. Hartman 4 (Arn. Arb.).

DISCUSSION: *P. adduensis* is a member of the section *Pandanus*. In that section its close relative is an undescribed species from Papua, *St. John* 26,234, which has the phalange upper third free, the apex low convex; carpel apices rounded pyramidal, the outer ones with an oblique outer plane surface reaching only to the stigma; stigmas 1–2 mm. long, ellipsoid; bark with papillae developing ascending rootlets. *P. adduensis* has the phalange with the upper quarter free, its apex convex; carpel apices low pyramidal, the marginal ones broad truncate and even concave distally from the stigma; stigmas 2.5–4 mm. long, cordate or irregularly elliptic; and the bark lacking ascending rootlets.

The new epithet is made of *Addu*, the type locality; and *-ensis*, the Latin adjectival place ending.

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

Figs. 13–14

NOM. VERN.: "karikio."

DIAGNOSIS HOLOTYPE: Arbor 6–8 m. alta, foliis 3–4 ("ad saltem 4") m. longis 11–13 cm. latis firmis spongioso-coriaceis minime M-formatis in sectio ligulatis sed ad apicem constrictis in apice (acuto?), basi amplexicaule exarmatis per 10 cm. deinde marginibus grosse subulato-serratis serris 3.5–5 mm. longis 10–25 mm. distantibus in apice brunneis, midnervio infra cum serris simulantibus 3 mm. longis 15–30 mm. distantibus reflexis, in regione mediali marginibus cum serris 3–4 mm. longis 7–17 mm. distantibus grosse subulatis adpresse adscendentibus, midnervio infra salienti et cum dentis sumulantibus adscendentibus 4–8 cm. distantibus, proxima apice marginibus subulato-

FIG. 13. *Pandanus Fosbergii*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, *e*, stigmas, oblique view, $\times 4$.

serratis dentibus 1 mm. longis 1.5–3 mm. distantibus adscendentibus, midnervio cum serris simulantibus sed 3–13 mm. distantibus, pedunculo circa 30 cm. longo trigono folioso, bracteis longe subulato-acuminatis et cum spinis simulantibus, syncarpio "oblongo scilicet 3 dm. longo 1.5 dm. diametro," phalangibus 8.7 cm. longis 6.2 cm. latis 5.2 cm. crassis late cuneiformibus sed in sectio transversali trigono, apice subconvexo, parte $\frac{1}{3}$ supera libera, suturis lateralibus nullis, lateribus laevibus gradatim convexis in sicco pallide brunneis obtuse 3–4-angulosis, sinibus centralibus apicalibus nullis suturis tantum lineis superficialibus tessellatis sed in post maturite cum rima lata, carpellis 6, apicibus subconvexis non protensis, stigmatibus 4–5 mm. longis suborbicularibus vel obreniformibus centripetalibus tota elevatis obliquis, sutura proximali plerumque ad suturam extenta, endocarpio mediali 3–4 cm. longo osseoso obscure brunneo superficie interiori lucida, marginibus lateralibus 2–3 mm. crassis, seminibus 2.2–2.4 cm. longis 11 mm. diametro anguste obovoideis, mesocarpio cum cavernis subdistinctis cum fibris et medulla firma persistenti, mesocarpio basali fibroso et carnosio et dicit esculenti.

DIAGNOSIS OF HOLOTYPE: Tree, up to 6–8 m. tall, large stemmed; leaves 3.4 "to at least 4" m. long, 11–13 cm. wide, firm, spongy coriaceous, slightly M-shaped in cross-section, ligulate, but near the apex narrowed to the (acute?) tip, the base amplexicaul, unarmed for about 10 cm., then the margins coarsely subulate serrate, the teeth 3.5–5 mm. long, 10–25 mm. apart, brown-tipped, the midrib below with similar teeth 3 mm. long, 15–30 mm. apart, reflexed; at the midsection the margins with the teeth 3–4 mm. long, 7–17 mm. apart, heavy subulate, appressed ascending, the midrib below salient and with similar, ascending teeth 4–8 cm. apart, near the apex the margin with teeth 1 mm. long, 1.5–3 mm. apart, subulate-serrations, the midrib below with similar teeth but these 3–13 mm. apart; peduncle about 30 cm. long, trigonous, leafy bracted, the bracts similarly spiny, and long subulate acuminate; syncarp "oblong, at least 3 dm. \times 1.5 dm., but none seen mature"; phalange 8.7 cm. long, 6.2 cm. wide, 5.2 cm. thick, broad cuneiform, but trigonous

in cross section, the apex low convex, upper $\frac{1}{3}$ free, lateral sutures none, the sides smooth, gently convex, pale brown when dried, with 3–4 obtuse angles; apical central sinuses none, the suture lines merely superficial and tessellate; in post maturity a broad crack develops near each sutural region; carpels 6, their apices low convex, not projecting; stigmas 4–5 mm. long, suborbicular to obreniform, centripetal, wholly elevated and oblique; proximal crease running quite or nearly to the sinus line; endocarp median, 3–4 cm. long, bony, dark brown, the inner walls polished and shining, the lateral walls 2–3 mm. thick; seeds 2.2–2.4 cm. long, 11 mm. in diameter, narrowly obovoid; apical mesocarp of scarcely distinct caverns, with longitudinal fibers and a firm, persistent medullary tissue; basal mesocarp fibrous and fleshy, reported to be edible.

HOLOTYPE: Maldive Islands: Malé Atoll, Kuda Bados Islet, occasional in coconut plantation, 1 m. alt., key picked up on ground nearby, April 1, 1956, *F. R. Fosberg* 36,899 (US).

DISCUSSION: *P. Fosbergii* is a member of the section *Pandanus*, but the structure of the apex of the phalange is bizarre for that section, and at a glance more closely resembles the section *Vinsonia*. This is due to the broad and obtuse apex of the phalange which is not lobed. The intercarpellary apical sinuses are superficial and are mere tessellate lines, though in postmaturity wide cracks appear at or near the sinus lines. Diagnostic of the section *Vinsonia* are the flush, horizontal stigmas. In *P. Fosbergii* the stigmas are of another sort. They are large (4–5 mm. long), strongly elevated, oblique and centripetal. Hence, under the present classification of the genus, the new species must be placed in the section *Pandanus*.

Though not a close relative, the most similar appearing species is *P. spiralis* R. Br. of Australia. This species has the phalanges 6 cm. long, the apex convex; carpels 9–20; stigmas 2–3 mm. long, hippocrepiform; seeds 4 mm. in diameter, very narrowly elliptic; and the apical mesocarp of separate caverns. *P. Fosbergii* has the phalanges 8.7 cm. long, the apex low convex; carpels 6; stigmas 4–5 mm. long, suborbicular; seeds 10 mm. in diameter, obovoid; and the apical mesocarp of confluent caverns.

This new species is named for its collector, Dr. F. Raymond Fosberg, of the U. S. Geological Survey.

This species seems to be the one recorded (and doubtless misdetermined) by J. C. Willis and J. S. Gardiner (1901: 104) as *P. Leram* Jones *ex* Fontana. That is a native of the distant Nicobar and Andaman Islands. It has massive phalanges roughly similar to those of the species here described, but the carpels are arranged in transverse, parallel lines, the stigmas are laterally directed, and the species belongs to a different section of the genus, *Hombromia*. They observed the plant, "a very large green stemmed *Pandanus*... reaching a height of over 50 feet, found in the Hulule, Turadu, Goifurfehendu, Limbo Kandu, &c. (Gardiner), and known as Karikeo (Keeva in Addu Atoll);..."

The tentative record of *P. Hornei* Balf. *f.* in Baker, by Willis and Gardiner (1901: 104), also seems to belong here.

Pandanus Hartmanii sp. nov. (sect. *Pandanus*)
Fig. 15

DIAGNOSIS HOLOTYPEI: Arbor 5–6 m. alta circa 12 cm. diametro, ramis horizontalibus deinde adscendentibus griseis laevibus, radicibus futurosis multis sublaevibus 1–2 m. longis circa 4 cm. diametro et frequenter in 6–10 dm. ex terra divisus in radicellis pluribus, foliis 120 cm. longis 5.7 cm. latis firme subcoriaceis ligulatis in sectio late M-formatis longe attenuatis et in 10 cm. ex apice 2.5 mm. latis proxima basi marginibus cum spinis 3.5–5 mm. longis 8–18 mm. distantibus crassiter subulatis in 45° adscendentibus, midnervio cum spinis reflexis 2–3 mm. longis 10–12 mm. distantibus crassiter subulatis, in sectio mediali marginibus cum spinis 3.5–4.5 mm. longis 5–15 mm. distantibus adpressis crassiter subulatis, midnervio infra cum spinis 2–3 mm. longis 13–23 mm. distantibus adpressis et plerumque adscendentibus, proxima apice marginibus et midnervio infra cum spinis 0.6–0.8 mm. longis 7–14 mm. distantibus, aculeis omnibus cum apicibus nigris, syncarpio solitario terminali scilicet (ex photo) late ellipsoideo et 20 cm. long, 14 cm. diametro, phalangibus 4–4.3 cm. longis 3.2–4 cm. latis 2.8–3.1 cm. crassis in sicco pallide brunneis infra subluteis, lateribus planis vel cum sulcis vadosis

paucis 4–6-angulosis, parte supera 1/8 libera, apice convexo, suturis lateralibus nullis, sinibus centralibus apicalibus 3–5 mm. profundis angustis, carpellis 12–14, plerumque 12, apicibus conicis sed valde oblati et eis centralibus gradatim minoribus interioribus plerumque 1/2–2/3 tam grandis quam exterioribus, stigmatibus grandis prominentibusque centralibus elevatis sed subhorizontalibus interioribus 3–4 mm. longis 2–2.5 mm. latis ellipticis exterioribus 2–3 mm. longis 3–4 mm. latis irregulariter cordatis, endocarpio centrali 1.7–2 cm. longo osseoso brunneo lateribus 1–3 mm. crassis, seminibus 11–14 mm. longis 4 mm. diametro late ellipsoideis, mesocarpio apicali in quaque carpella cavernoso cum membranibus albis medullois paucis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree 5–6 m. tall, about 12 cm. in diameter; branches horizontal, then ascending; trunk gray, smooth; prop roots 1–2 m. long, about 4 cm. in diameter, smooth, many of them at 6–10 dm. from ground dividing into a cluster of smaller rootlets; leaves 1.2 m. long, 5.7 cm. wide, firm subcoriaceous, ligulate, broad M-shaped in section, long attenuate and at 10 cm. from the tip only 2.5 mm. wide, near the base the margins with very stout subulate teeth 3.5–5 mm. long, 8–18 mm. apart, ascending at 45°, the midrib below with mostly reflexed prickles 2–3 mm. long, 10–25 mm. apart, stout subulate; at the midsection the marginal teeth 3.5–4.5 mm. long, 5–15 mm. apart, appressed, stout subulate and heavy-based; the midrib below with prickles 2–3 mm. long, 13–23 mm. apart, appressed, mostly ascending; near the apex the margins and midrib below with prickles 0.6–0.8 mm. long, 7–14 mm. apart; all prickles with darkish tips; syncarp solitary, terminal, apparently broad ellipsoid and 20 cm. long, 14 cm. in diameter; phalanges 4–4.3 cm. long, 3.2–4 cm. wide, 2.8–3.1 cm. thick, quadrate-cuneate, apex convex, upper 1/8 free, sides smooth, shining, light brown, 4–6-angled, the sides flat or with a few shallow furrows, the lower half when dry still yellowish; central apical sinuses 3–5 mm. deep; carpels 12–14, mostly 12; carpel apices conic but the apex much depressed, those towards the center gradually smaller, the central ones 1/2–2/3 as large as the outer ones; stigmas centripetal, large and

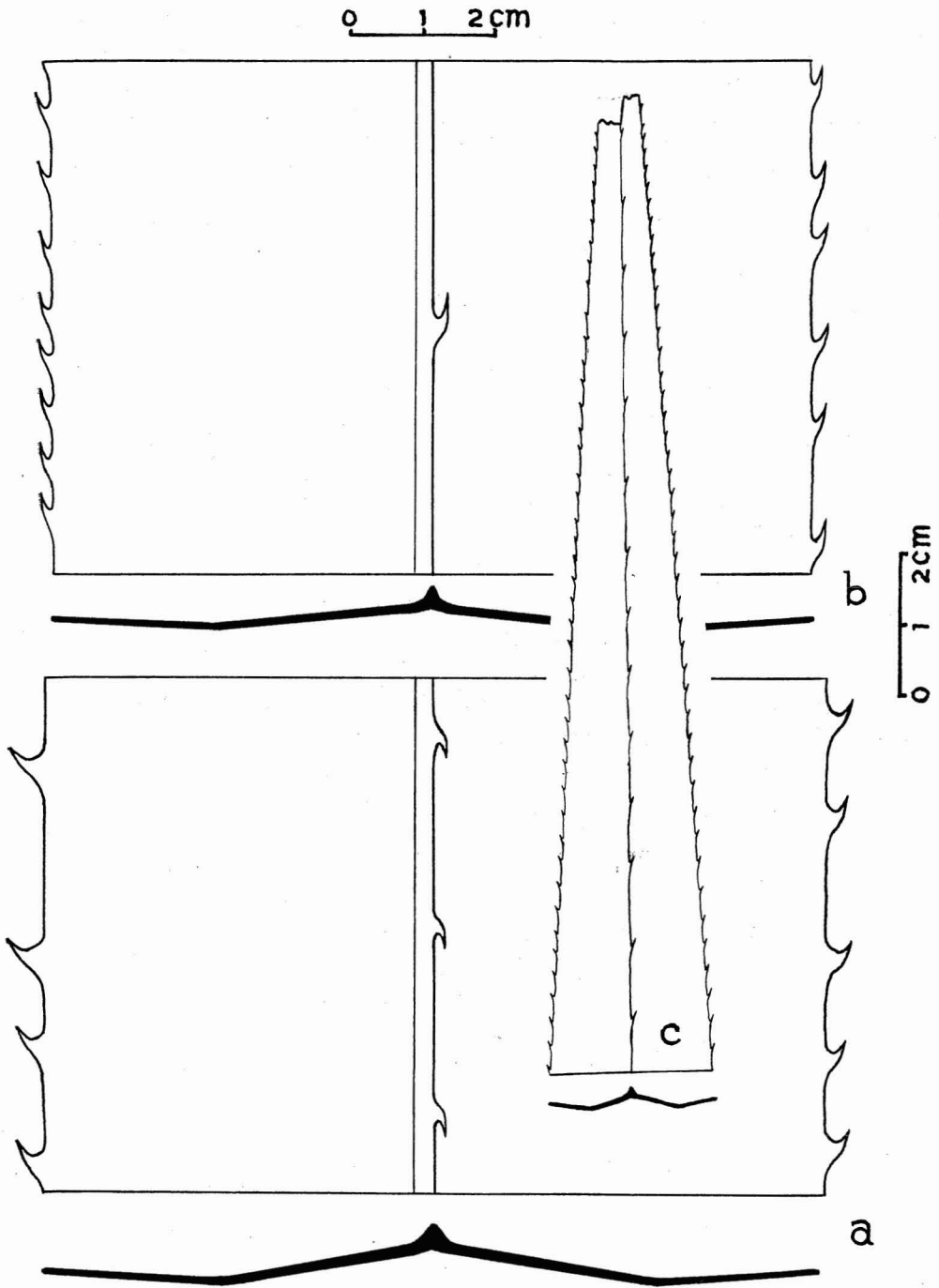


FIG. 14. *Pandanus Fosbergii*, from holotype. *a*, Leaf base, lower side, $\times 1$; *b*, leaf middle, lower side, $\times 1$; *c*, leaf tip, lower side, $\times 1$.

prominent, the inner ones 3–4 mm. long, 2–2.5 mm. wide, elliptic, the outer ones 2–3 mm. long, 3–4 mm. wide, irregularly cordate, elevated, but more or less horizontal; endocarp central, 1.7–2 cm. long, bony, brown, the lateral walls 1–3 mm. thick; seeds 12–13 mm. long, broad ellipsoid; apical mesocarp with ellipsoid caverns mostly empty but with a few transverse white membranes; basal mesocarp fibrous.

HOLOTYPE: Maldiv Islands, Haddumati Atoll, Hitadu Islet, common near shore, Oct. 10, 1957, *W. D. Hartman* 3 (Arn., Arb.).

DISCUSSION: *P. Hartmanii* is a member of the section *Pandanus*. The closest relative seems to be *P. tectorius* Soland. var. *spiralis* (Blanco) Martelli, of the Philippines. It has the carpels 6–9, and their apices low pyramidal-convex; and the leaves 5 cm. wide. *P. Hartmanii* has the carpels 12–14, and their apices conic but the apex much depressed; and the leaves 5.7 cm. wide.

This species is named for the anthropologist Dr. W. D. Hartman, member of the recent Yale University Expedition to the Indian Ocean. He collected all but one of the species of *Pandanus* known on the Seychelles Islands, and he collected excellent material of three new species on the Maldiv Islands. His notes indicate the presence of others there which were either not in fruit or the fruits of which were not attainable. Because of his excellent collections of these difficult plants it is a pleasure to name this species for him.

Pandanus Karikayo sp. nov. (sect. *Pandanus*)
Figs. 16–17

NOM. VERN. "karikayo."

DIAGNOSIS HOLOTYPI: Arbor 4–5 m. alta scilicet 15 cm. diametro, corona ovoidea, cortice sublaevi, radicibus fulturosus evidentibus, foliis 100–125 (–300?) cm. longis 5.2 cm. latis ligulatis subcoriaceis longe attenuatis ad basem V-formatis sed ultra planis in regione basali marginibus cum aculeis 0.5–1 mm. longis 3–5 mm. distantibus salientibus, in regione 15 cm. ex basi cum aculeis 5–7 mm. longis 13–26 mm. distantibus subulatis in 45° adscendentibus, midnervio infra cum aculeis 4–4.5 mm. longis 15–30 mm. distantibus crassiter subulatis recurvatis, in sec-

tio mediale marginibus cum aculeis 5–7 mm. longis 13–26 mm. distantibus adscendentibus, midnervio cum aculeis infra 3.5–4 mm. longis 15–30 mm. distantibus recurvatis, circa apice marginibus midnervioque cum aculeis 0.6–1 mm. longis 3–8 mm. distantibus crassiter subulatis adpresse adscendentibus, aculeis paene totis pallidis, syncarpio unico terminali scilicet 18 cm. longis et 13 cm. diametro rubro late ellipsoideo, phalangibus multis 3.8–4.4 cm. longis 2.1–3.4 cm. latis 2–2.6 cm. crassis obovoideo-cuneatis apice subconvexo parte $\frac{1}{4}$ supera libera lateribus laevibus lucidis in sicco pallide brunneis curvatis vel minime sulcatis 4–5-angulosis, suturis lateralibus nullis, sinibus apicalibus centralibus 4–8 mm. profundis omnibus angustis vel paucis cum fundam latam, carpellis 10–14 et rare cum carpella laterali abortiva, apicibus conicis adscendentibus depresso subrotundatis omnibus aequalibus vel centralibus minoribus $\frac{2}{3}$ tam grandibus quam marginalibus eis saepe conicis asymmetricalibus et clare divergentibus, stigmatibus 1.5–2.5 mm. longis ellipsoideis obliquis elevatis prominentibus centripetalibus breve sulcatis, sutura proximali $\frac{1}{3}$ distancia ad fundam extenta, endocarpio centrali osseoso mahogani-colorato marginibus lateralibus 1.5–2 mm. crassis, seminibus 10–11 mm. longis ellipsoideis, mesocarpio apicali in quaque carpella cavernoso fibroso et cum membranibus subalbis medullosis, mesocarpio basali cum fibris fortibus.

DIAGNOSIS OF HOLOTYPE: Trees 4–5 m. tall, about 15 cm. in diameter; trunk rather smooth; crown ovoid; prop roots diverging at about 40°; leaves 100–125 (–300?) cm. long, 5.2 cm. wide, subcoriaceous, ligulate, long attenuate, towards the base V-shaped, beyond it plane, near the base the margins with salient prickles 0.5–1 mm. long, 3–5 mm. apart, but at 15 cm. up from the base the prickles 5–7 mm. long, 13–26 mm. apart, subulate, ascending at 45°, the nearby midrib below with prickles 4–4.5 mm. long, 15–30 mm. apart, stout subulate, recurving; at the middle the margins with prickles similar to those near the base but ascending at 25°–40°, the midrib below with prickles 4–4.5 mm. long, 15–30 mm. apart, stout subulate, recurving; near the apex the margins and midrib below with prickles 0.6–1 mm. long, 3–8

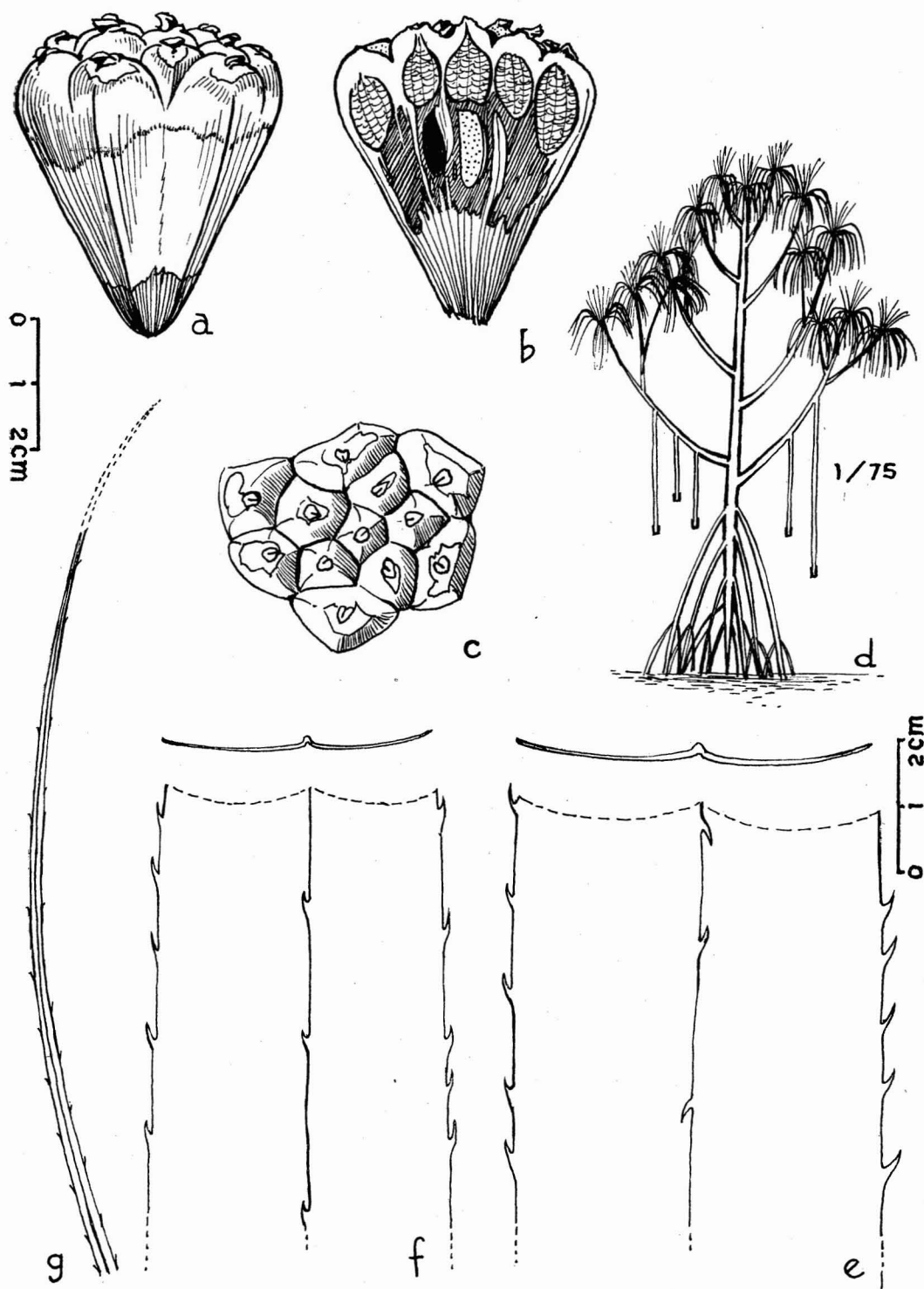


FIG. 15. *Pandanus Hartmannii*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, tree, $\times 1/75$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf tip, lower side, $\times 1$.

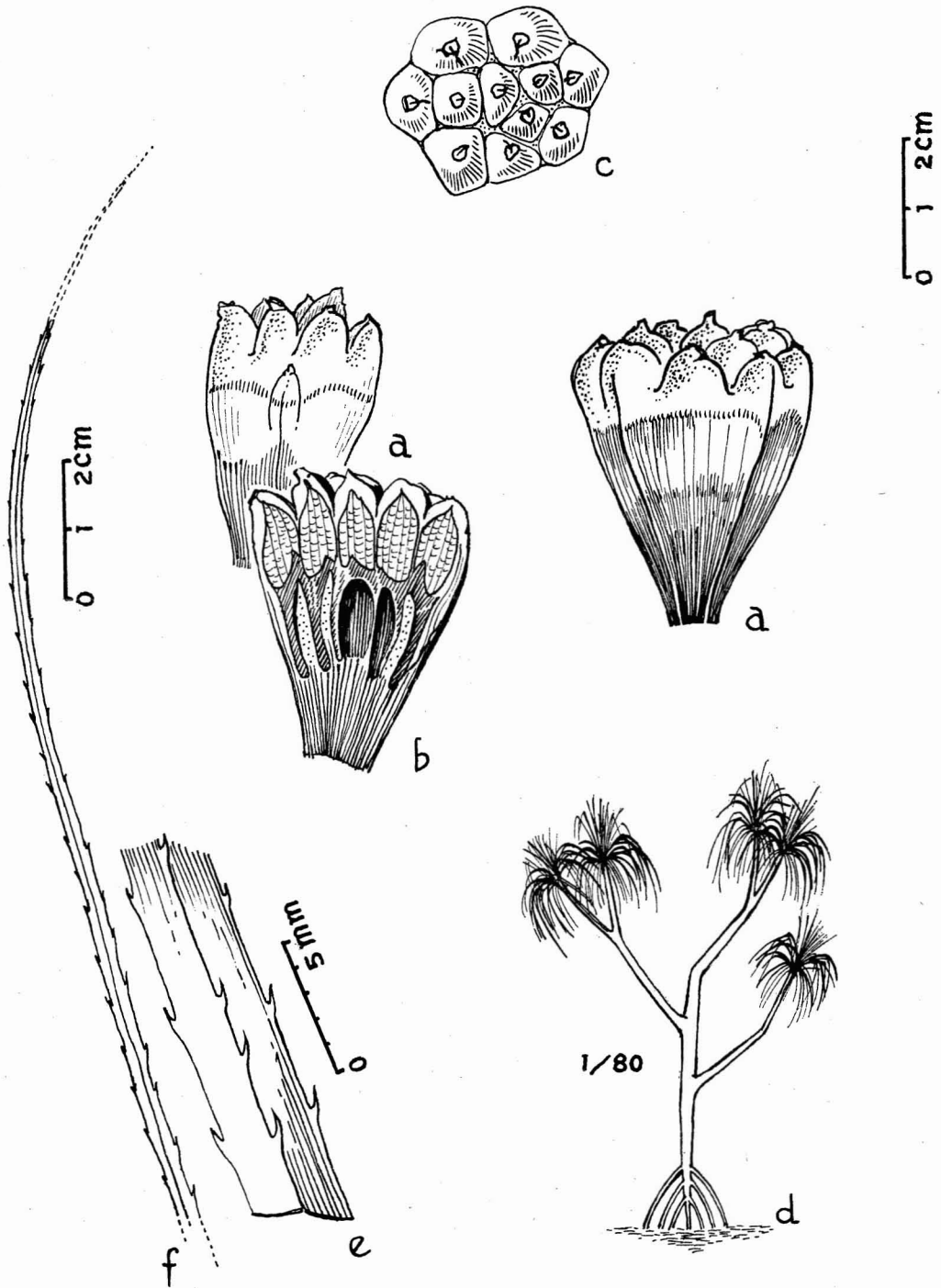


FIG. 16. *Pandanus Karikayo*, from holotype. *a*, Phalanges, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, tree, $\times 1/80$; *e*, leaf apex, lower side, $\times 4$; *f*, leaf apex, upper side, $\times 1$.

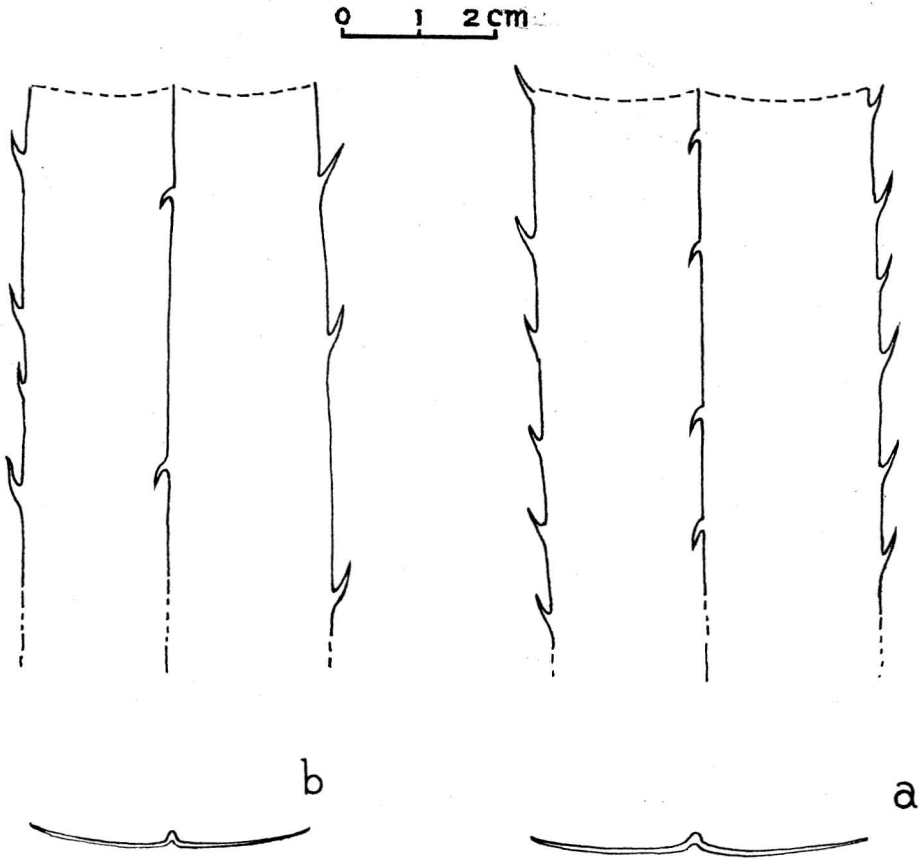


FIG. 17. *Pandanus Karikayo*, from holotype. *a*, Leaf base, lower side, $\times 1$; *b*, leaf middle, lower side, $\times 1$.

mm. apart, stout subulate, closely ascending; prickles all pale; syncarp single, terminal, broad ellipsoid, apparently 18 cm. long, 13 cm. in diameter, "bright red"; phalanges numerous, 3.8–4.4 cm. long, 2.1–3.4 cm. wide, 2–2.6 cm. thick, obovoid-cuneate, apex slightly convex, upper $\frac{1}{4}$ free, sides smooth, shining, when dry light brown, curving or slightly channeled, 4–5-angled; lateral sutures none; apical central sinuses 4–8 mm. deep, all narrow or a few broad based; carpels 10–14, rarely with a tiny, lateral, splintlike one also; carpel apices ascending, depressed, somewhat rounded conic, but the marginal ones often conic, asymmetric and distinctly divergent, all subequal or the ones toward the center somewhat smaller, these about $\frac{2}{3}$ as large as the marginal ones; stigmas 1.5–2.5 mm. long, ellipsoid, short creased, prominent, raised,

oblique, centripetal; proximal suture extending $\frac{1}{3}$ way to the valley bottom; endocarp central, bony, mahogany-colored, the lateral margins 1.5–2 mm. thick; seeds 10–11 mm. long, ellipsoid; apical mesocarp in each carpel forming a large cavern with strong longitudinal fibers and whitish pithy partitions; basal mesocarp with strong fibers.

HOLOTYPUS: Maldives Islands, Fadiffolu Atoll, Kuredu Islet, common on shore and middle, Sept. 25, 1957, *W. D. Hartman 1* (Arn. Arb.).

DISCUSSION: *P. Karikayo* is a member of the section *Pandanus*. Its closest relative appears to be *P. odoratissimus* L. f., of the island of Ceylon, which has the phalanges with the upper $\frac{1}{3}$ free; the central apical sinuses 4 mm. deep; and the stigmas of the outer carpels horizontal. In *P. Karikayo* the phalanges have the upper $\frac{1}{4}$

free; the central apical sinuses 4–8 mm. deep; and the stigmas of the outer carpels divergent.

The new specific epithet is the vernacular name of the species on Fadiffolu Atoll.

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

Fig. 18

NOM. VERN.: "karikayo."

DIAGNOSIS HOLOTYPI: Arbor 2–6 m. alta, trunco scilicet 12 cm. diametro cum foliis subpersistentibus, radicibus futurosos scilicet 3–6 dm. longis et laevibus, foliis 117 cm. longis 4 cm. latis ligulatis subcoriaceis longiter attenuatis in sectio ad basem W-formatis ad mediam planatis, apice longe acuminato et in 10 cm. ex apice 2.5 mm. lato, ad basem marginibus cum aculeis 2–4.5 mm. longis 9–22 mm. distantibus crassiter subulatis adscendentibus, midnervio ad basem infra cum aculeis 2–3 mm. longis 1–3 cm. distantibus subulatis valde reflexis, in regione mediali marginibus cum aculeis 1.5–2.5 mm. longis 8–17 mm. distantibus, midnervio infra cum aculeis 1.5–2 mm. longis 15–22 mm. distantibus subulatis adscendentibus, proxima apice marginibus cum dentibus 0.3–0.5 mm. longis 3–7 mm. distantibus, aculeis omnibus cum apice nigro, syncarpio solitario terminali 14 cm. longo 11 cm. diametro late ellipsoideo cum circa 60 phalangibus eis 4.8–5.2 cm. longis 2.5–3.4 cm. latis 2.2–2.9 cm. crassis obovoideis cuneatis scilicet luteis in sicco pallide brunneis laevibus lucidis lateribus planatis vel rare vadoso-sulcatis 4–6-angulosis parte $\frac{1}{4}$ supera libera, apice convexo sinibus apicalibus centralibus 2–3 mm. profundis angustis vel latis, carpellis 5–9 plerumque 6, apicibus valde depresso-pyramidalibus eis marginalibus clariter cum apice et stigmate divergenti, apicibus interioribus minoribus, centralibus $\frac{2}{3}$ tam grandis quam marginalibus, stigmatibus 2.5–3.5 mm. longis ovatis vel rhombicis prominentibus elevatis centripetalibus, sutura proximali $\frac{1}{4}$ distancia ad fundum extenta, endocarpio paene submediali osseoso obscure mahogani-colorato marginibus lateralibus 1.5–2 mm. crassis, seminibus 11–13 mm. longis 4 mm. diametro asymmetriciter ellipsoideis, mesocarpio apicali cum cavernis cum membranis firmis albis completis, mesocarpio basali fibroso et carnoso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree 2–6 m. tall, and about 12 cm. in diameter, the bark and roots appearing smooth; trunk usually more or less clothed with persistent, dead leaves; leaves 117 cm. long, 4–5 cm. wide, ligulate, subcoriaceous, towards the base W-shaped, further out plane, then long attenuate, the apex 10 cm. back only 2.5 mm. wide; near the base the margins with prickles 2–4.5 mm. long, 9–22 mm. apart, stout subulate, ascending; the midrib the only prominent nerve, and near the base with prickles below 2–3 mm. long, 1–3 cm. apart, strong subulate, reflexed; near the middle the margins with prickles 1.5–2.5 mm. long, 8–17 mm. apart; the midnerve below with prickles 1.5–2 mm. long, 15–22 mm. apart, reflexed; near the tip the margins and midrib below with prickles 0.3–0.5 mm. long, 3–7 mm. apart; all the prickles dark-tipped; syncarp solitary, terminal, 14 cm. long, 11 cm. in diameter, broad ellipsoid, with about 60 phalanges, these 4.8–5.2 cm. long, 2.5–3.4 cm. wide, 2.2–2.9 cm. thick, obovoid, cuneate, apparently yellow, when dry pale brown, shining, the sides smooth, shining, plane or a few of them shallow furrowed, 4–6-angled, upper $\frac{1}{4}$ free, the apex convex; central apical sinuses 2–3 mm. deep, narrow or broad; carpels 5–9, mostly 6; carpel apices much depressed pyramidal, the marginal ones with apex and stigmas distinctly diverging, the others decreasing in size towards the center, the central ones being about $\frac{2}{3}$ size of the marginal ones; stigmas 2.5–3.5 mm. long, ovate to rhombic, short creased, prominent, raised, centripetal; the proximal suture running $\frac{1}{4}$ way to valley bottom; endocarp slightly submedian, bony, dark mahogany-colored, the lateral margins 1.5–2 mm. thick; seeds 11–13 mm. long, 4 mm. in diameter, asymmetric ellipsoid; apical mesocarp with a cavern in each carpel, these filled with white, firm, cross membranes; basal mesocarp fibrous and fleshy.

HOLOTYPI: Maldives Islands, South Malosmadulu Atoll, Dunikolu Islet, common, chiefly on the shore, Oct. 2, 1957, *W. D. Hartman* 2 (Arn. Arb.).

SPECIMENS EXAMINED: Maldives Islands, Malé Atoll, Malé Islet, forming thicket back of seaward beach, 1–2 m. alt., nom. vern "bokio," fruits red on ripening, not eaten or used for

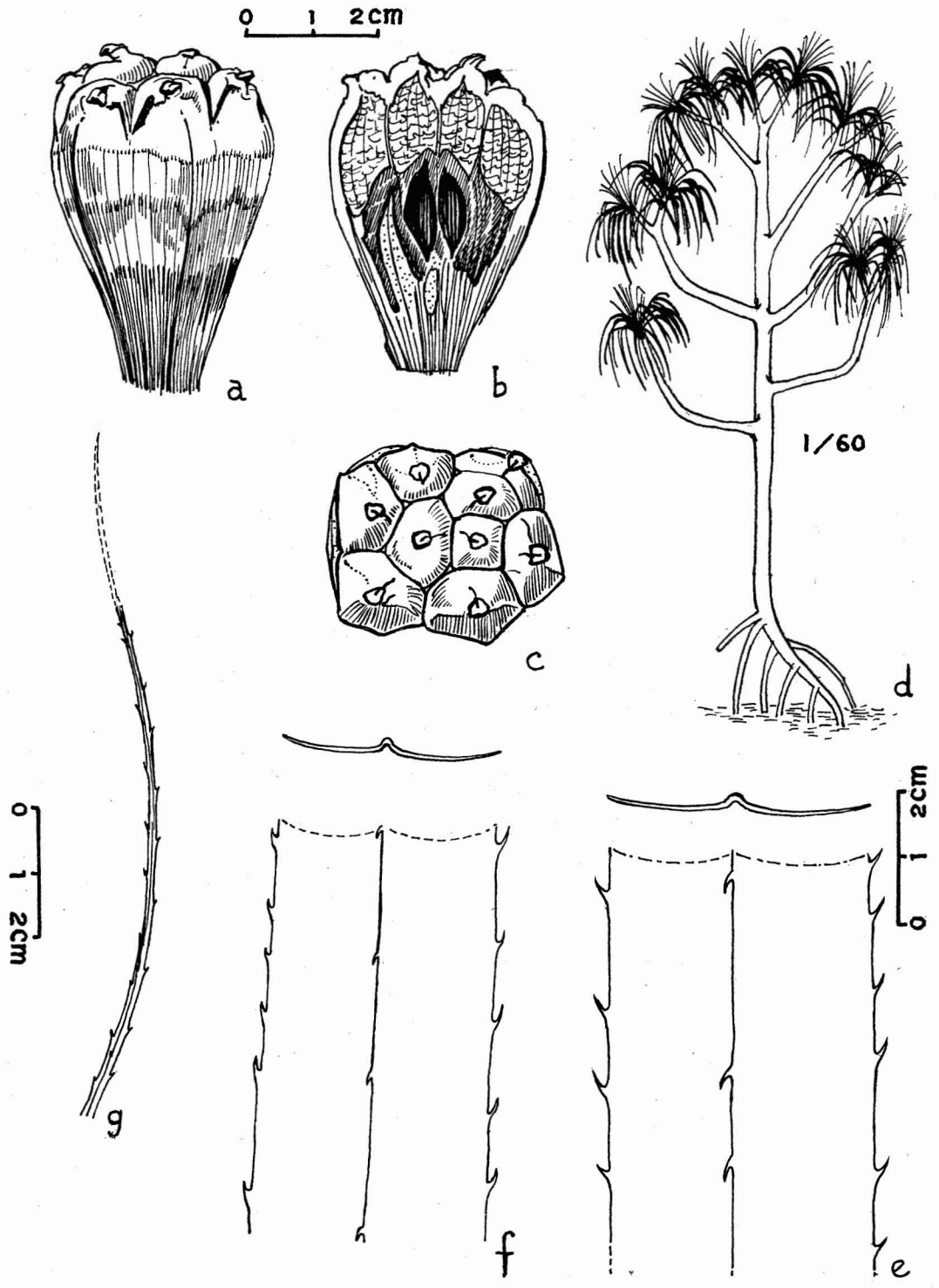


FIG. 18. *Pandanus maldivicus*, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, tree, $\times 1/60$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

anything, April 12, 1956, *F. R. Fosberg* 36,916 (US).

DISCUSSION: *P. maldivicus* is a member of the section *Pandanus*. Its closest relative seems to be *P. tectorius* Sol. var. *sarawakensis* Martelli of Borneo. This has the phalanges 6–6.5 cm. long, the upper 1/2 free, the sides flat or more or less concave; central apical sinuses apparently 4–5 mm. deep; and the stigmas 2–2.8 mm. long, inflexed even on the marginal carpels. In contrast, *P. maldivicus* has the phalanges 4.8–5.2 cm. long, upper 1/4 free, the sides plane and curved or shallowly furrowed; central apical sinuses 2–3 mm. deep; and the stigmas of the marginal carpels distinctly diverging.

The new specific epithet is taken from the geographic name Maldives, to which is added a Latin adjectival suffix.

Pandanus OF THE SEYCHELLES ISLANDS

Pandanus Balfourii Martelli, *Webbia* 1: 361–362, 1905; 4(1): 7, t. 4, figs. 4–7, 1913 (sect. *Pandanus*)
Fig. 19

This species was briefly described, then later illustrated by Martelli, from collections from the Seychelles made by Horne and by Dupont. It is a well-marked species, and its status is not in question. However, the collection, data, and photos by Dr. W. D. Hartman, made in 1957, make possible an expanded and more complete description, including stems, leaves, etc. The supplementary descriptive details are as follows:

Tree 5–6 m. tall, and at a point just above the roots 15–17.5 cm. in diameter, but below the first branches 20–23 cm. in diameter, appearing smooth; crown semiorbicular; prop roots borne up to 6 dm. from the ground; leaves 125–145 cm. long, 4.6–4.8 cm. wide, firm, strong, subcoriaceous, ligulate, M-shaped in cross-section, the tip long, slender acuminate to a subulate tip, this at 10 cm. down only 2 mm. wide, at 20 cm. only 8 mm. wide, near the base the margins with prickles 3–3.5 mm. long, 3–10 mm. apart, stout, broad-based subulate, salient ascending, the nearby midrib below beginning 12 cm. up with prickles 2.5–3 mm. long, 10–25 mm. apart, stout subulate, reflexed;

at the midsection the margins with prickles 2–2.5 mm. long, 2–5 mm. apart, appressed ascending and more slenderly subulate, tipped with dark brown; the midrib below with prickles 1.5–2 mm. long, 7–15 mm. apart, slender subulate, ascending-subappressed; near the apex the margins and midrib below with prickles 0.3–0.5 mm. long, 2–3 mm. apart, stout subulate, broad based, appressed-ascending, brown tipped; phalanges 102; these 3.7–4 cm. long, 2–4.3 cm. wide, 1.6–2.5 cm. thick, upper 1/5–1/4 free, apex low convex, sides gently convex or plane, shining, pale brown when dry; lateral sinuses none; lateral furrows none or slight, 4–6-angled, lower half fibrous and fleshy and orange; central apical sinuses 1–2 mm. deep, shallow, broad V-shaped; carpels 5–10, their apices low, rounded pyramidal, green when ripe; stigmas 1–2 mm. long, suborbicular to cordate; endocarp dark brown, slightly suprmedian, the lateral margins 1–2 mm. thick.

SEYCHELLES ISLANDS: Mahé Island, opposite Souris Island, group on granite cliffs near shore, Nov. 9, 1957, *W. D. Hartman* 6 (Arn. Arb.).

Pandanus Hornei Balf. f., in Baker, Fl. Mauritius and Seychelles 397, 1877; Martelli, *Webbia* 4(1): 17, t. 16, figs. 1–3, 1913 (sect. *Dauphinensia*), new sectional placement
Figs. 20–21

NOM. VERN.: "vacoa parasol."

This very distinct species has been known for nearly a century. The phalanges were later illustrated by Martelli, but his figures did not clarify the remarkable stigmatic apparatus. Now, the recent collection and data by Dr. W. D. Hartman allow the furnishing of a supplementary description and more adequate illustrations, as follows:

Trees 15–20 m. tall, and the trunk at 3 m. from the ground 15–17.5 cm. in diameter, at 7–10 m. up 20–22.5 cm. in diameter, tall straight, twice trichotomous, then dichotomous; prop roots 2.4–3 m. long, nearly vertical and seeming to hug the trunk; leaf (1 seen) 2.25 m. long, 10 cm. wide, subcoriaceous, gradually tapering to the elongate apex (but the tip lost), at base 1-furrowed, further out M-plicate, at base the margin entire for 11 cm., then in-

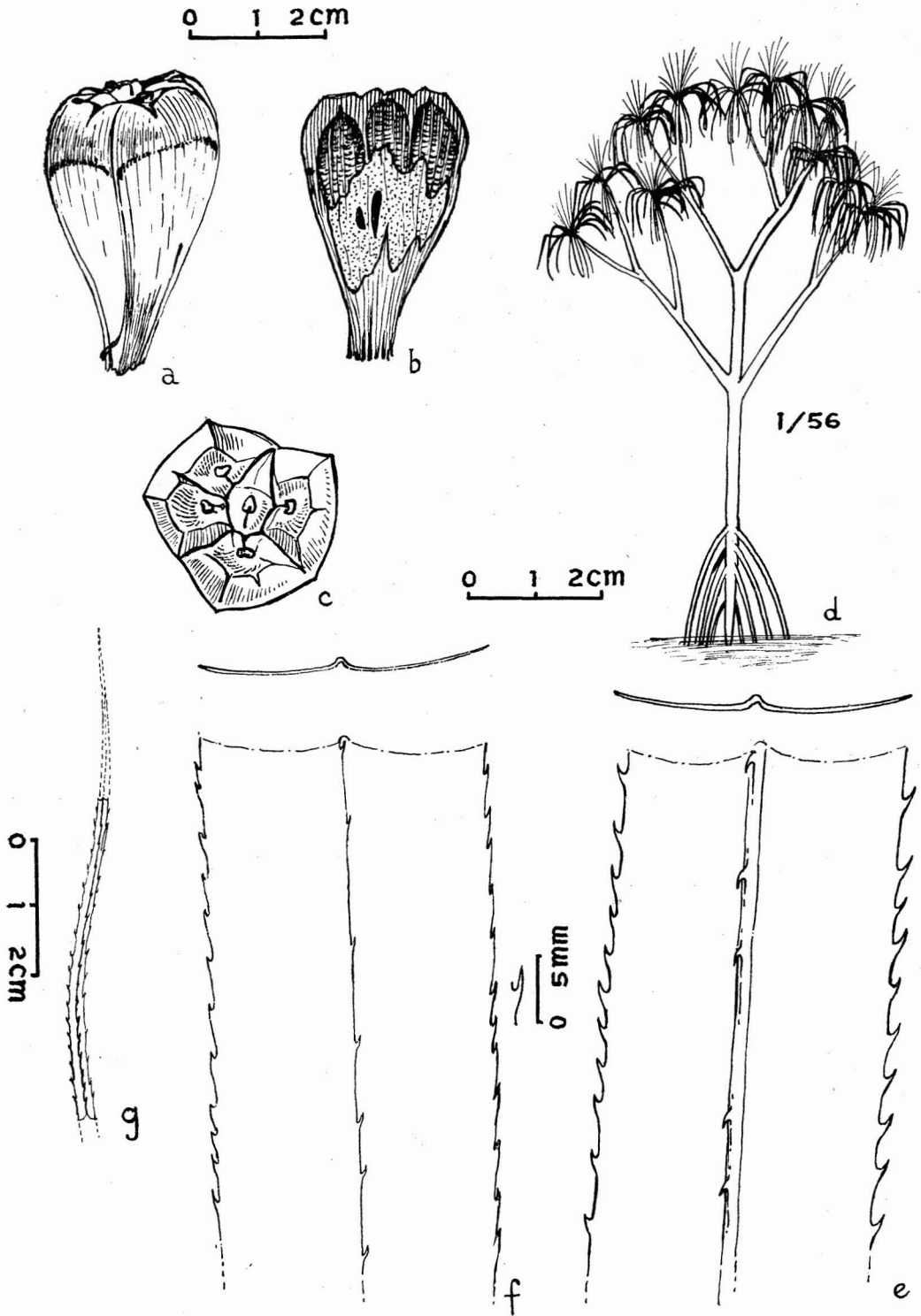


FIG. 19. *Pandanus Balfourii*, from Mahé I., Hartman 6. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, tree, $\times 1/56$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$, and one prickle $\times 2$; *g*, leaf apex, lower side, $\times 1$.

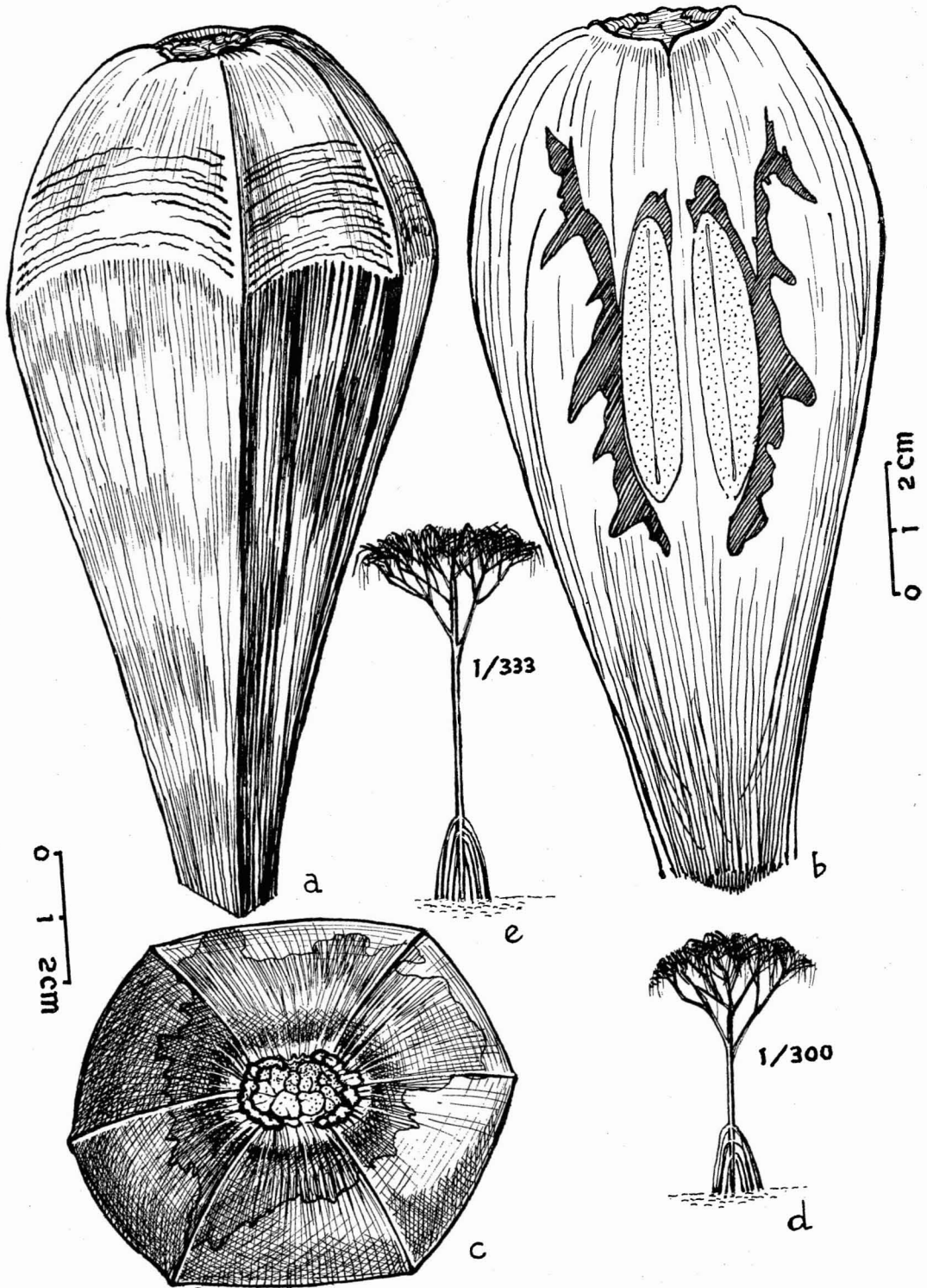


FIG. 20. *Pandanus Hornei*, from Praslin I., Hartman 7. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, medium-size tree, $\times 1/300$; *e*, large tree, $\times 1/333$.

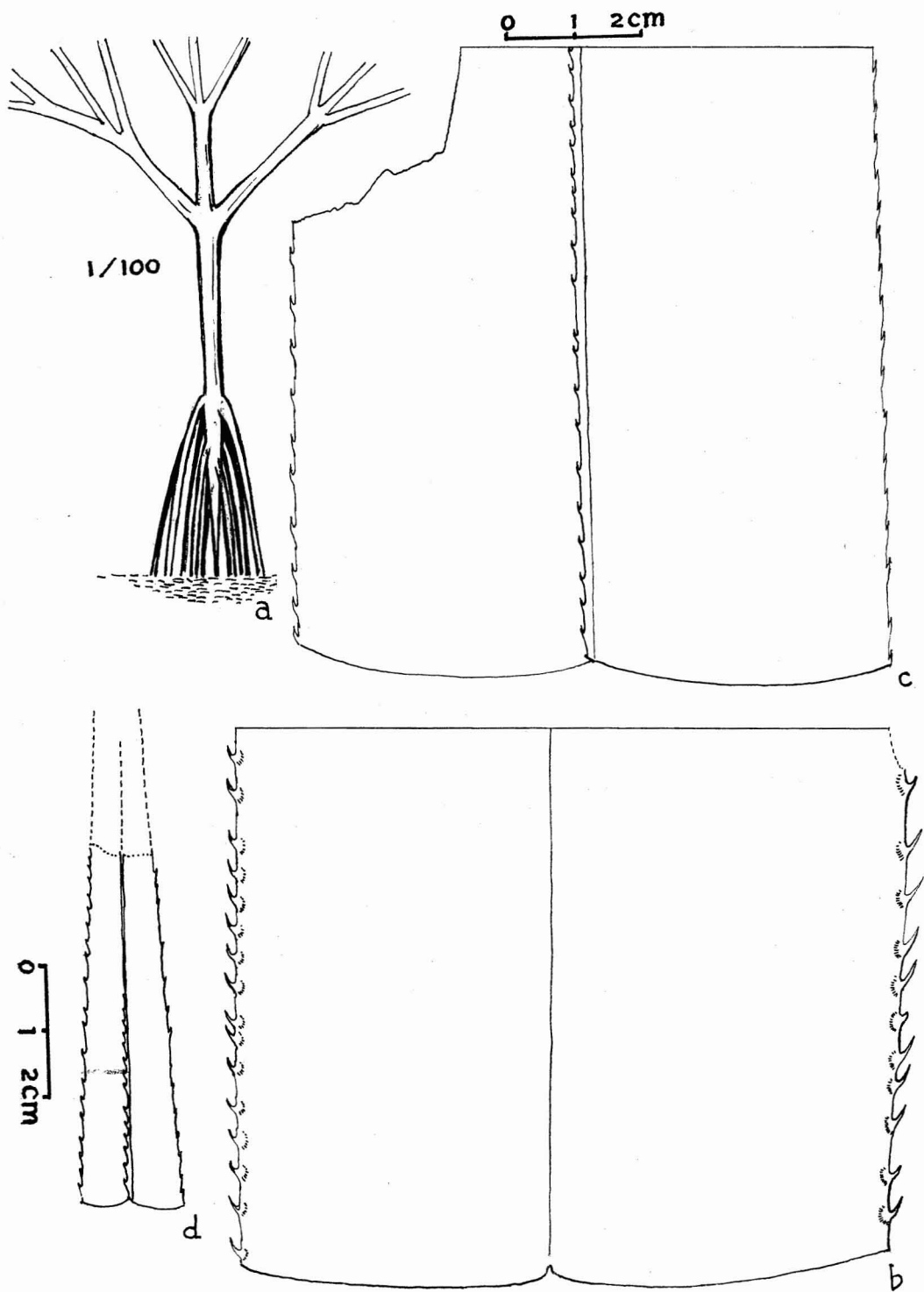


FIG. 21. *Pandanus Hornei*, from Praslin I., *Hariman* 7. *a*, Trunk, branches, and prop roots, $\times 1/100$; *b*, leaf base, lower side, $\times 1$; *c*, leaf middle, lower side, $\times 1$; *d*, leaf apex, lower side, $\times 1$.

creasingly coarsely aculeate, the prickles 3–4.5 mm. long, 3–10 mm. apart, stout subulate, upward curved, blackish; the nearby midrib unarmed; at midsection the marginal prickles 2 mm. long, 3–5 mm. apart, dark brown, subulate, upward curved; the midrib below with prickles 1 mm. long, 4–6 mm. apart, subulate, appressed ascending; near the tip the margins and midrib below with aculeate-serrations 0.2–0.4 mm. long, 1–2 mm. apart, brown, appressed ascending; pistillate inflorescences single, terminal; phalanges (4 seen) 12.2–13.2 cm. long, 5.3–6.8 cm. wide, 5–6.3 cm. thick, cuneate oblanceolate, the apex rounded, upper $\frac{1}{4}$ free and green, glaucous, the lower $\frac{3}{4}$ fleshy, reddish orange, the sides smooth, above slightly convex, below plane; apex with a central rounded rim and within a concavity 2 mm. deep, the surface of which is covered by several irregular, unequal, cordate elevations which at first glance would seem to be stigmas, but are not these; and in some there is an apical central crack 1 mm. deep; along the apical rim are two arcuate or parenthesis-like, wavy ridges which are the two centripetal stigmas which along the perimeter are 20–22 mm. long; indocarp in upper $\frac{2}{5}$, bony, dark brown, the lateral margins at the thinnest parts 3–4 mm. thick; seeds 45–46 mm. long, 10–11 mm. in diameter; mesocarp continuous, of solid pith and few longitudinal fibers.

SEYCHELLES ISLANDS: Praslin Island, Vallée de Mai, near stream, 500–600 ft. elev., Nov. 11, 1957, *W. D. Hartman* 7.

He also recorded, "Another stand of these trees was later seen (and photographed) growing along a stream near Newcombe Forest, Praslin Island. They were not quite as tall as the trees in the Vallée de Mai."

DISCUSSION: The crowded, cordate elevations in the apical concavity of the phalange are deceptively like stigmas. Only after careful study of the apex and of cut sections was it demonstrated that the actual stigmas were the two arcuate or parenthesis-like projections on the central apical rim. It would have been a pleasure to publish Hartman's excellent color photos of this species, but the cost forbids.

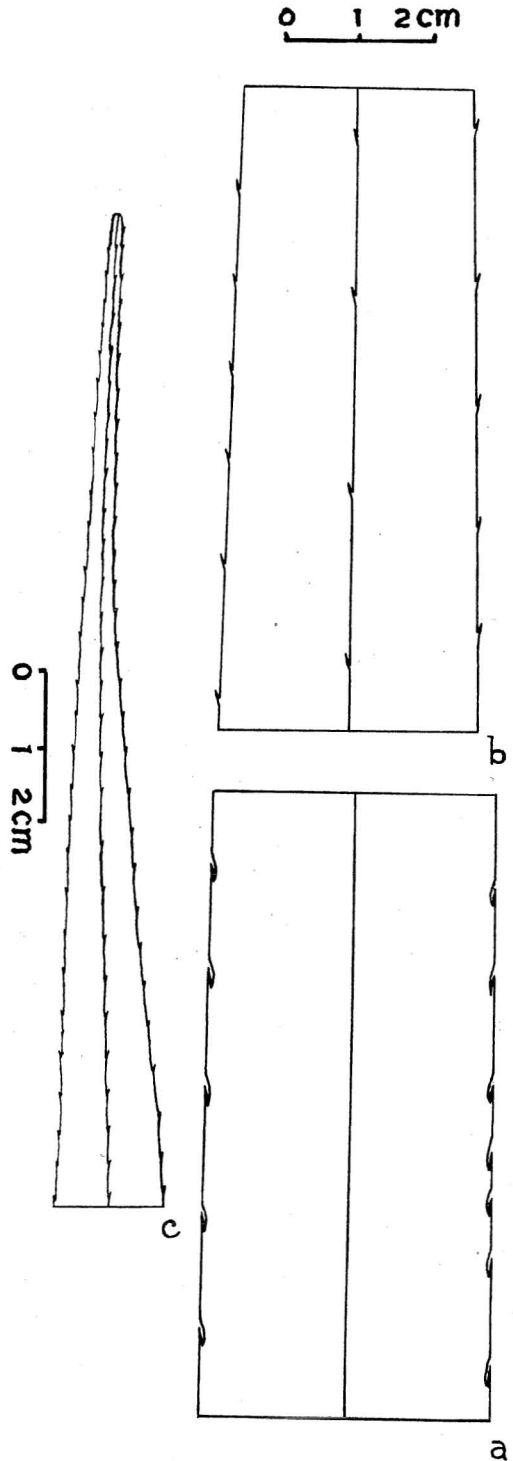


FIG. 22. *Pandanus sechellarum*, from Mahé I., *Hartman* 5. a, Leaf base, lower side, $\times 1$; b, leaf middle, lower side, $\times 1$; c, leaf apex, lower side, $\times 1$.

Pandanus multispicatus Balf. f., in Baker, Fl. Mauritius and Seychelles 403, 1877; Warburg, Engler's Pflanzenreich IV, 9: 67-68, 1900; Martelli, Webbia 4(1): 24, 1913 (sect. *Microstigma*)

SEYCHELLES ISLANDS: endemic.

Martelli's record of this species for Reunion Island was not confirmed by Vaughan and Wiehe (1953: 31). This species has never been illustrated.

Pandanus sechellarum Balf. f., in Baker, Fl. Mauritius and Seychelles 402, 1877; Martelli, Webbia 4(1): 30, t. 7, figs. 6-8, 1913 Fig. 22

NOM. VERN.: "vacoa marron."

This was collected by Hartman in 1957, but since he found only half-grown fruits, his collection furnished only vegetative characters to supplement the known ones, as follows:

Prop roots present up to 6 dm. from ground; leaves 88-90 cm. long, 4-4.2 cm. wide, subcoriaceous, dark green above, paler below, ligulate, tapering gradually to the acute apex, this at the point 10 cm. down 11 mm. wide, M-shaped in section, the enlarged base entire, but beginning 10 cm. up the margins with prickles 1.5-2 mm. long, 7-16 mm. apart, acicular, appressed and seeming like a continuation of the margin since located above a concavity; the nearby midrib unarmed; at the midsection the teeth of the margins 1-1.5 mm. long, 11-26 mm. apart, acicular, appressed ascending; the

midrib below with prickles 0.5-1 mm. long, 10-20 mm. apart, acicular, appressed ascending; near the tip the margins and midrib below with teeth 0.2 mm. long, 3-6 mm. apart, subulate, broad based, appressed ascending.

SEYCHELLES ISLANDS: Mahé Island, opposite Souris Island, group of 6-8 trees among granite boulders near shore, shaded by coconut palms, Nov. 9, 1957, *W. D. Hartman* 5.

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