Pacific Science (1974), Vol. 28, No. 3, p. 339–355
Printed in Great Britain

The Vascular Flora of Fanning Island, Line Islands, Pacific Ocean[1]

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THE FLORA of Fanning Island has been reported upon before. When Capt. E. Fanning discovered the island in 1798, he noted that a grove of old coconut trees was present, which was an indication of previous visitation and settlement (Fanning 1833).

In the report on the botany of the Challenger Expedition, Hemsley (1885: 1(4): 116) printed a list of 15 species that had been collected on Fanning by J. T. Arundel, 2 of them cultivated, 4 of them adventive, and 9 indigenous plants.

The basic report on the botany of Fanning is that by Erling Christophersen (1927: 37–44), with the botanical results of the Whippoorwill Expedition. He gives a good account of the geography, climate, soils, vegetation, and the higher flora. He lists a total of 46 vascular plants. This total includes 7 ornamental, 6 food plants, 14 adventives, and 19 indigenous species.

C. R. Long, botanist of the Pacific Ocean Biological Survey Program, visited Fanning in July 1965, and made a good collection of plants.

A new summary of the flora is desirable due to these collections and the ones made in July 1972 by Dennis J. Russell and Roy T. Tsuda. Their collections have added to the floristic list 3 indigenous species, 15 adventives, and numerous cultivated ornamentals.

Also the collections made in 1934 by H. St. John and F. R. Fosberg have not previously been reported upon.

In the present summary of the flora of Fanning, there are listed 39 ornamentals, 13 food plants, 28 adventives, 20 indigenous plants, and 2 endemics, making a total flora of 102 species and varieties.

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[3] The names of the indigenous and the endemic plants are printed in boldface type.

NATIVE AND ADVENTIVE PLANTS[3]

PSILOTACEAE

Psilotum nudum (L.) Griseb. S. of airstrip, July 1972, *D. J. Russell & R. T. Tsuda 10.*

POLYPODIACEAE

Phymatodes Scolopendrium (Burm. f.) Ching. *Ball 6*; *Christophersen 19*; *C. R. Long 3,523*; *3,549*; *Russell & Tsida 38.*

PANDANACEAE

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

Figs. 1–3

DIAGNOSIS HOLOTYPI: Arbor fere 6 m alta cum ramulis multis in coronam ellipsoideam est, radicibus fere 1 m longis multis, trunco laevi, ramulis inter cicatrices brunneis lucidis et in apice fere 5.5 cm diametro, foliis 1.5 m longis proxima basem 7.5 cm latis in medio 5.6 cm latis coriaceis supra viridibus lucidis infra pallide viridibus et glaucis in sectione mediali cum 56 nervis parallelis secundariis in dimidio quoque sed nervis tertiis non evidentibus lamina gladiata ex basi in apice trigono gracile subulato deminuenti (apice interito) basi inermi pallida, ex 9–10 cm marginibus cum aculeis 2.2–2.5 mm longis 7–15 mm separatis subulatis compressis adpresse adscendentibus stramineis, ex 34 cm midnervo infra cum aculeis 2–2.5 mm longis 18–24 mm separatis subulatis adpresse adscendentibus stramineis cum apicibus rubris, in sectione mediali marginibus cum aculeis 1.8–2 mm longis 3–7 mm separatis subulatis adpresse adscendentibus stramineis, proxima apicem marginibus et midnervo infra cum aculeis 0.3 mm longis 3–7 mm separatis arcuatis subulatis adscendentibus stramineis, plicis inermibus, infructescentia cum syncarpio solitario, pedun-

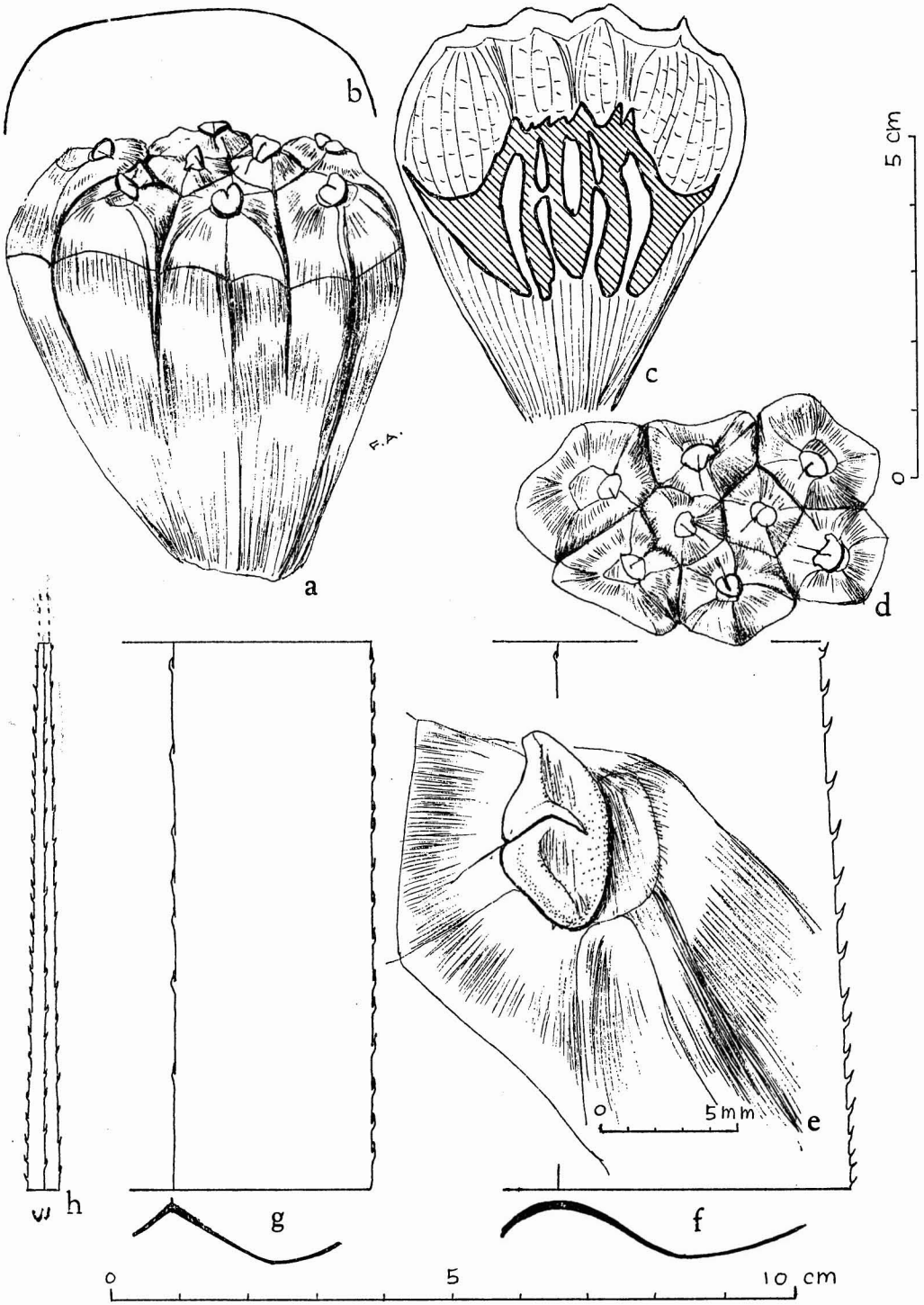

FIG. 1. *Pandanus fanningensis* St. John, from holotype. *a*, phalange, lateral view, ×1; *b*, profile of phalange apex; *c*, phalange, longitudinal median section, ×1; *d*, phalange, apical view, ×1; *e*, carpel apex and stigma, ×4; *f*, half of leaf base, lower side, ×1; *g*, half of leaf middle, lower side, ×1; *h*, leaf apex, lower side, ×1.

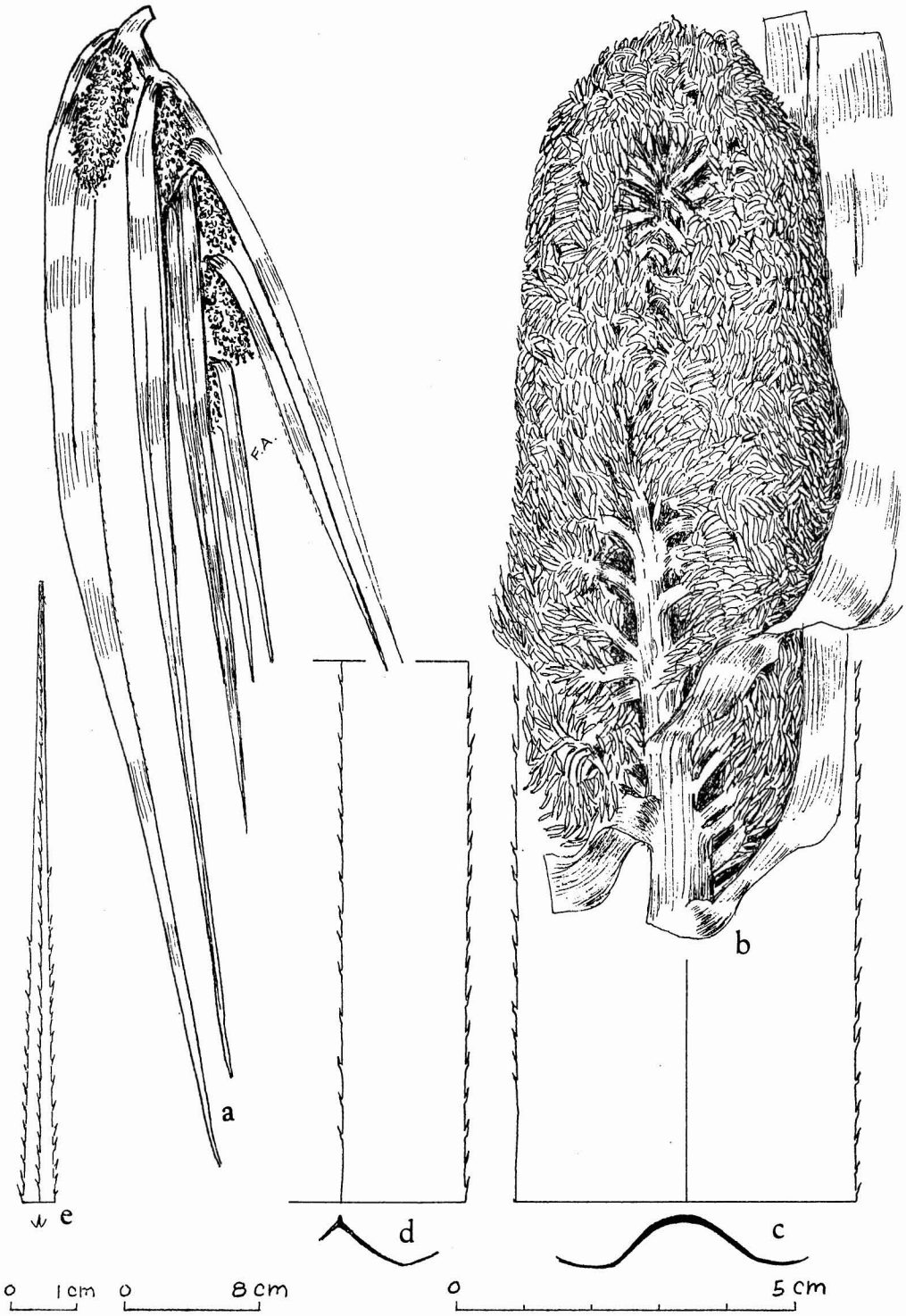

Fig. 2. *Pandanus fanningensis* St. John, from *Russell & Tsuda 31*. *a*, staminate inflorescence, ×1/4; *b*, staminate spike, ×1; *c*, leaf base, lower side, ×1; *d*, half of leaf middle, lower side, ×1; *e*, leaf apex, lower side, ×1.

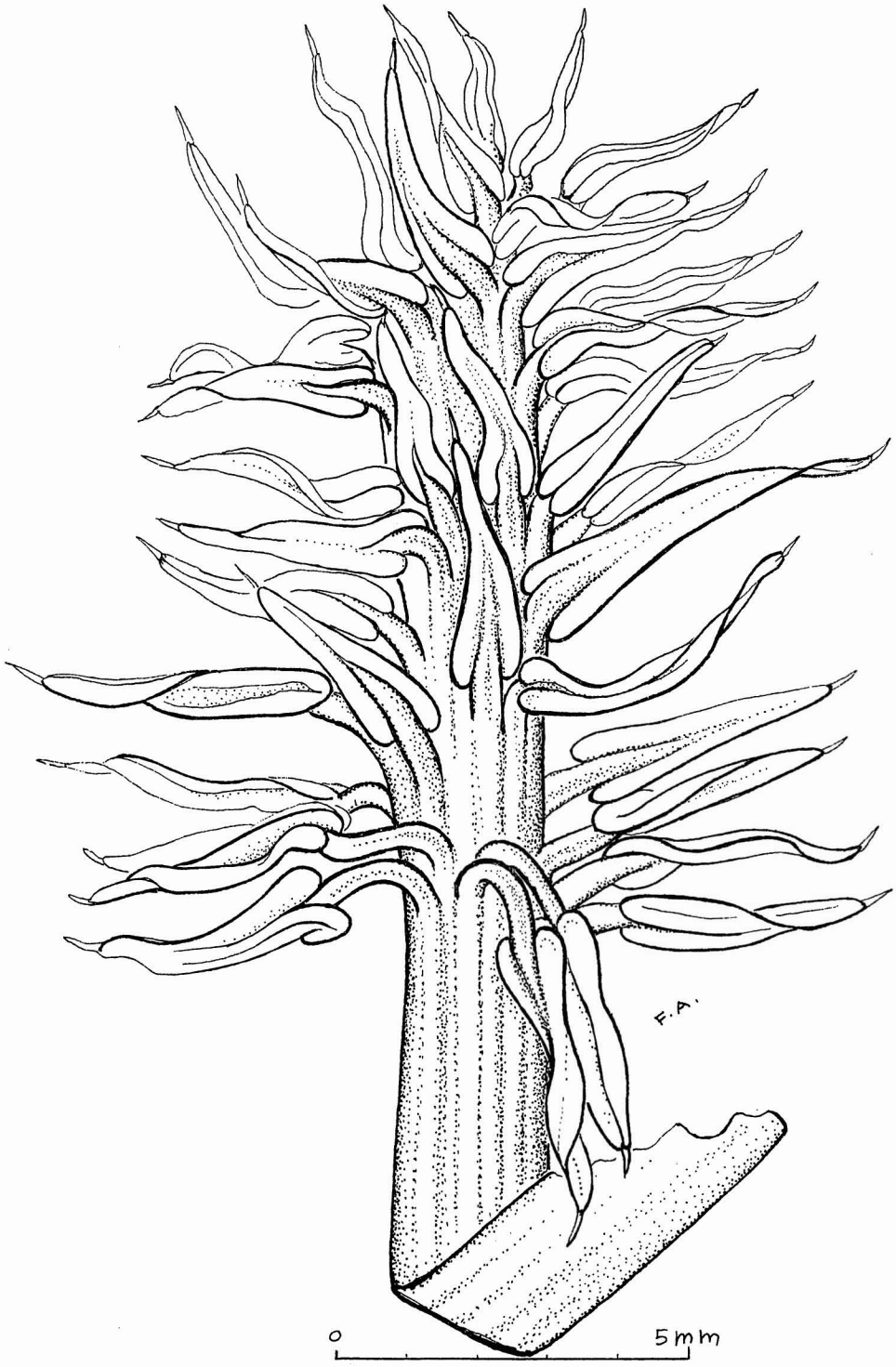

FIG. 3. *Pandanus fanningensis* St. John, from *Russell & Tsuda 31*. Staminate fascicle, ×10.

culo 17 cm longo 15 mm diametro trilaterato foliosi-bracteato, syncarpio 21 cm longo 14.5 cm diametro ellipsoideo trilaterato, phalangibus 5.7–6.3 cm longis 3.5–5.2 cm latis (6.1–6.5 cm latis in geminibus cum 12–13 carpelis) 3–4.2 cm crassis cuneatis obovoideis vel late obovoideis 5–6-angulosis lateribus inferis planis parte $\frac{1}{3}$ supera libera cum lateribus laevibus lucidis lateribus carpelarum marginalium cum 0–2 angulis secundariis et cum planis sursum curvatis, carpelis 5–8 radiatis, apicibus marginalibus oblate pyramidali-hemisphaericis et rare 1–2 cum areola concava distali 2–3 mm lata, stigmatibus 3–4 mm latis suborbicularibus vel reniformibus prostratis horizontalibus vel subelevatis, sinibus proximalibus fissura $\frac{1}{2}$–$\frac{2}{3}$ ad fondam extensis, endocarpio minime supramediali 3 cm longo osseoso subbrunneo late ellipsoideo cum humeris medialibus late curvatis adscendentibus apice obtuso, seminibus 15–18 mm longis anguste ellipsoideis, mesocarpio in apice carpelae cuiusque cavernam 10–22 mm longam cum aerenchyma fibris longitudinalibus fortibus et membranis pallidis, mesocarpio basali 18–20 mm longo fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree about 6 m tall, many branched into a compact ellipsoid crown; prop roots about 1 m long, numerous, brown; trunk smooth; branches brown and shiny between the pale annular leaf scars; branchlets at apex 5.5 cm in diameter; leaves 1.5 m long, 7.5 cm wide near the base, 5.6 cm wide at the middle, coriaceous, above shiny green, below paler green and glaucous, at midsection with 56 parallel secondary veins in each half, but no visible tertiary veins, the blades sword-shaped, tapering from base to the trigonous slender subulate apex (the tip lost), the base unarmed, pale; beginning at 9–10 cm the margins with prickles 2–2.5 mm long, 3–7 mm apart, nearly straight subulate, ascending, stramineous; beginning at 34 cm the midrib below with prickles 2–2.5 mm long, 18–24 mm apart, subulate, appressed ascending, stramineous with red tips; at midsection the margins with prickles 1.8–2 mm long, 3–7 mm apart, subulate, appressed ascending, stramineous; the nearby midrib below with prickles 2.2–2.5 mm long, 7–15 mm apart, subulate, compressed, appressed ascending, stramineous; near the apex the margins and midrib below with prickles 0.3 mm long, 3–7 mm apart, arcuate subulate, ascending, stramineous; infructescence of a solitary syncarp; peduncle 17 cm long, 15 mm in diameter, 3-sided, leafy bracted; syncarp 21 cm long, 14.5 cm in diameter, ellipsoid, 3-sided; phalanges 5.7–6.3 cm long, 3.5–5.2 cm wide (6.1–6.5 cm wide in doubles with 12–13 carpels), 3–4.2 cm thick, cuneate obovoid or broadly so, 5–6-angled, the lower sides flat, the upper 1/3 free, its sides smooth, shining, the lateral carpel sides with 0–2 secondary angles and the intervening planes gently upcurved; carpels 5–8, radial, the marginal apices oblate pyramidal hemispheric and rarely 1–2 with a concave distal platform 2–3 mm wide; stigmas 3–4 mm wide, suborbicular to reniform, flush and horizontal, or partly elevated; proximal sinuses a crack running $\frac{1}{2}$–2/3 way to valley bottom; endocarp slightly supramedian, 3 cm long, bony, brownish, broadly ellipsoid, with median shoulders, widely curved ascending, the apex obtuse; seeds 15–18 mm long, narrowly ellipsoid; mesocarp forming in the apex of each carpel a cavern 10–22 mm long, with aerenchyma of strong longitudinal fibers and pale membranes; basal mesocarp 18–20 mm long, fibrous, and fleshy.

STAMINATE PLANT (*Russell & Tsuda 31*): Tree about 5 m tall, freely branched into a dense, hemispheric crown; staminate inflorescence about 80 cm long, cernuous; floral bracts foliaceous but white, the lower one 68 cm long, 5 cm wide, the upper ones 18 cm long; staminate spikes several, 6–13.5 cm long, 3.5–4.5 cm in diameter; staminate fascicles with about 37 stamens; column 11 mm long, stout; free filament tips 0.5–1.7 mm long; anthers 2.4–4 mm long, narrowly lanceoloid, the 2 basal lobes rounded, the apex bearing a subulate prolongation of the connective 0.35–1.5 mm long.

HOLOTYPUS: Line Islands, Fanning Island, near Cable Station, July 1972, *D. J. Russell & R. T. Tsuda 32* (BISH).

SPECIMENS EXAMINED: Line Islands, Fanning Island, near Cable Station, staminate, July 1972, *Russell & Tsuda 31* (BISH).

DISCUSSION: *P. fanningensis* is a member of the section *Pandanus*, as is its nearest relative,

P. pukapukaensis St. John, of the Danger Islands, Pukapuka Island, a species with the phalange 6.8 cm long; endocarp apex ovoid, the shoulders inframedian and long ascending; basal mesocarp 22–26 mm long; stigmas 2–2.7 mm long, suborbicular (or broadly elliptic); staminate spikes 2–2.5 cm in diameter; staminal column 5 mm long, the fascicles of about 16 stamens; anthers 1.7–2.7 mm long. *P. fanningensis* has the phalanges 5.7–6.3 cm long; endocarp apex low convex, the shoulders median, shortly ascending; basal mesocarp 18–20 mm long; stigmas 3–4 mm wide, suborbicular to reniform; staminate spikes 3.5–4.5 cm in diameter; staminal column 11 mm long, the fascicles with about 37 stamens; anthers 2.4–4 mm long.

The new epithet is formed from the name of the type locality, Fanning; and *-ensis*, the Latin adjectival geographic suffix.

Pandanus Hermsianus Martelli (sect. *Pandanus*), Univ. Calif. Publ. Bot. 13(7): 145, pl. 12, 1926
Figs. 4–5

ORIGINAL DIAGNOSIS: "Phalanges druparum magnae, ambitu subglobosae, compressae, supra plano-convexiusculae, 6 cm. spissae, 4.5 cm. crassae, et 9 cm. latae, in tertiam inferiorem partem fibrosae, rotundatae, vix attenuatae, ima basi latae; drupis vel loculis numerosissimis (circiter 17), transverse triseriatis, subprofunde et latiuscule separatis, rotundato-pyramidatis, pentagonis, a sulco longitudinali percursis, loculis exterioribus satis majoribus, lateraliter acute prominentibus, pentagonis, faciebus latis, subplanis et secus suturas druparum sulco longitudinali profundo excavatis; stigma hippocrepiforme planum ad verticem loculorum situm, in loculis exterioribus latissimum (5 mm.), crassum; endocarpium osseum, plus quam tertiam inferiorem partem et totam latitudinem phalangis occupans, fere 3.5 cm. spissum, superne rimosum, ambitu convexiusculum, inferne truncatum, rimulosum; mesocarpium superum fere 2 cm. spissum, fibroso-medullosum, cavernis extensioribus amplis, ovatis, inferum brevissimum fibrosum."

EXPANDED DIAGNOSIS OF HOLOTYPE (a single phalange, half of it in Berkeley, half in Firenze): phalange 6–6.2 cm long, 10 cm wide, 4.5 cm thick, transversely ellipsoid, 6–8-angled, the apex convex, lower sides not seen, the lateral sinuses deep V-shaped valleys running far down, the upper 2.5–3 cm free, the surface rather smooth, shining; carpels 17, each lateral one with its outer side rounded, elevated, running far down as a projection, and their apices semiorbicular, but the tip laterally turned and salient; the inner carpel apices slightly oblate hemispheric, with several low angles, the platform lacking on all; stigmas 4–5 mm long, broadly elliptic to cordate, flush, brown, papillose; proximal sinuses narrow but deep, extending half to all the way to the valley bottom; central apical sinuses 4–6 mm deep, curving, V-shaped; endocarp 13–20 mm distant from the apex, 35–37 mm long, bony, dark reddish brown, transversely ellipsoid, the apex convex, but with a few short lanceoloid projections, the margins with prominent winglike curved ascending shoulders, lateral walls 4–8 mm thick, within smooth, shining; seeds 15–18 mm long, ellipsoid; mesocarp forming in the apex of each carpel a cavern 15–27 mm long, with aerenchyma of longitudinal fibers and pale membranes, the part of the basal mesocarp which remains is 2–7 mm long.

SUPPLEMENTARY DESCRIPTION: Upright tree 5 m tall; bark gray, rough; leaves 1.85–2 m long, 8.6 cm wide near the base, 6.2 cm wide at the middle, coriaceous, U-sulcate, 2-pleated, shiny olive green above, pale green and apparently glaucous below, at midsection with 58 parallel secondary veins in each half, the tertiary veins obscure, the blade sword-shaped, tapering from base to the trigonous slender subulate apex, this at the point 10 cm down 1.5 mm wide, the base unarmed, pale; beginning at 12 cm the margins with prickles 2–3 mm long, 3–8 mm apart, arcuate subulate, compressed, geniculate near the base, ascending, stramineous with dark brown tips; the midrib below unarmed for 24 cm; at midsection the margins with prickles 1.2–1.8 mm long, 6–11 mm apart, arcuate stout subulate, compressed, strongly ascending, dark maroon; the nearby midrib below with prickles 1–1.4 mm long, 12–22 mm apart, subarcuate subulate, compressed, appressed ascending, dark maroon; on the subulate apex the margins

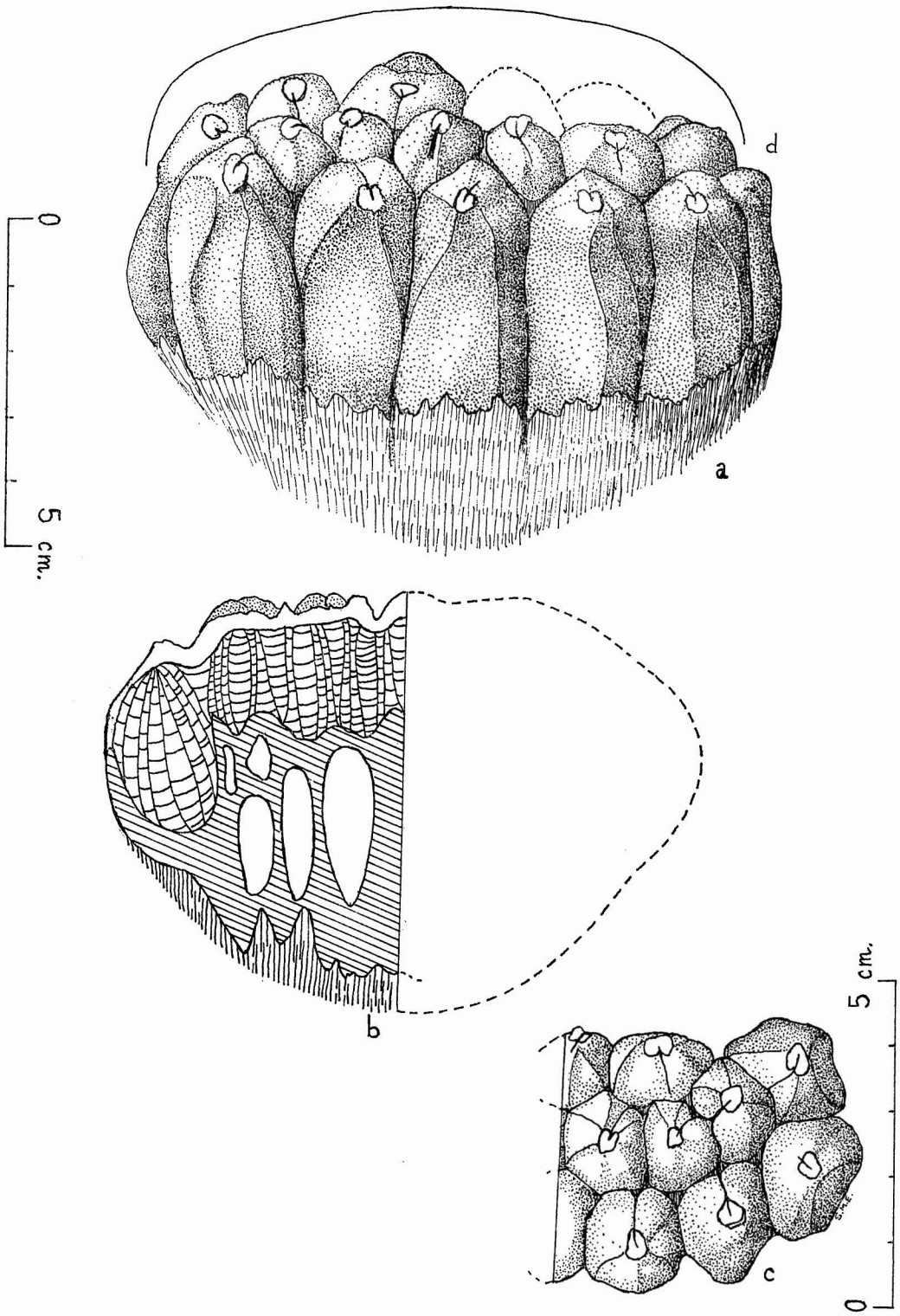

Fig. 4. *Pandanus Hermsianus* Martelli, from holotype and isotype. *a*, phalange, lateral view, ×1; *b*, phalange, half of longitudinal median section, ×1; *c*, phalange, half of apical view, ×1; *d*, profile of phalange apex.

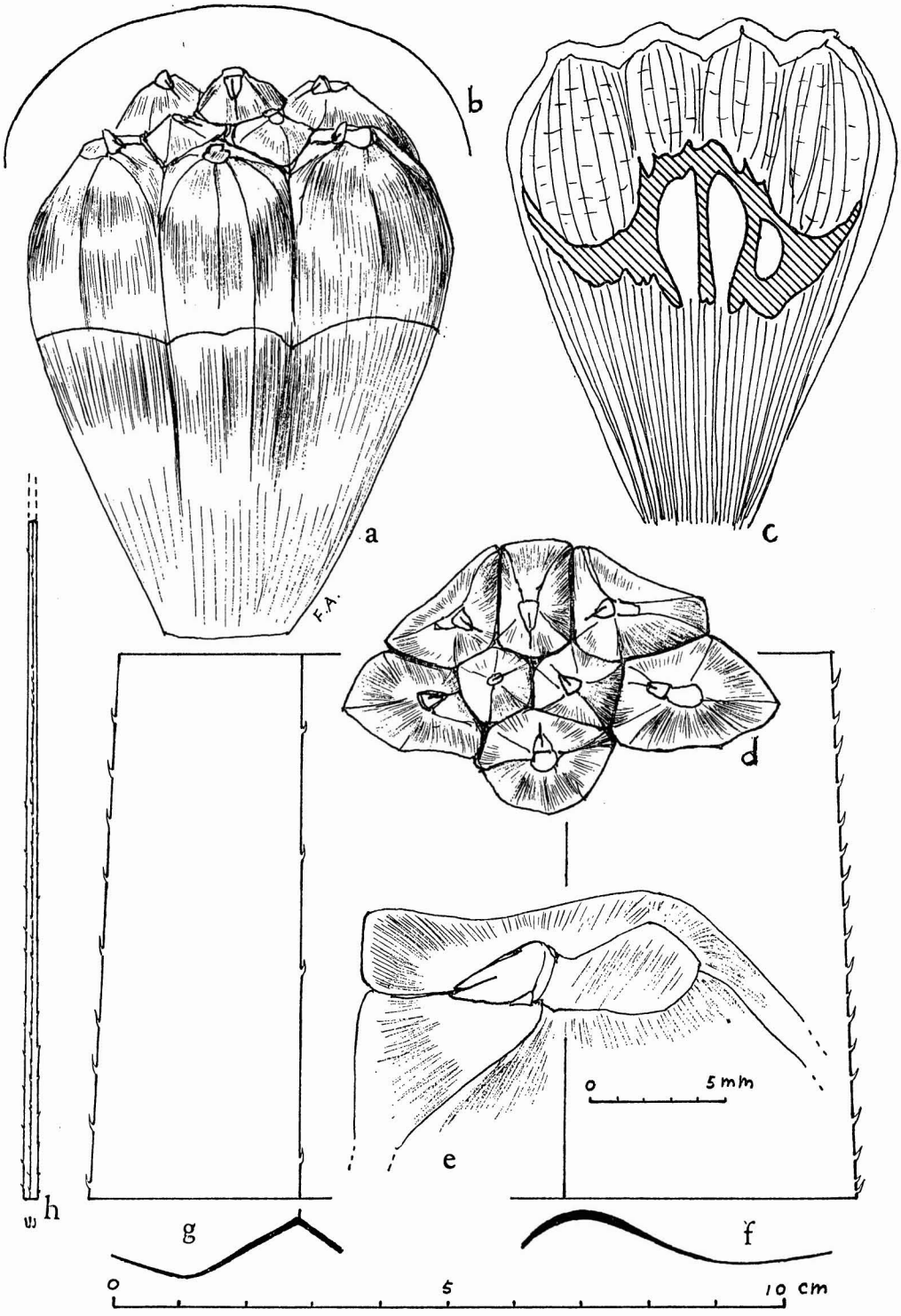

FIG. 5. *Pandanus Hermsianus* Martelli, from *St. John & Fosberg 14,106*. *a*, phalange, lateral view, ×1; *b*, profile of phalange apex; *c*, phalange, longitudinal median section, ×1; *d*, phalange, apical view, ×1; *e*, carpel apex and stigma, ×4; *f*, half of leaf base, lower side, ×1; *g*, half of leaf middle, lower side, ×1; *h*, leaf apex, lower side, ×1.

and midrib below with prickles 0.2–0.3 mm long, 2–7 mm apart, thick subulate ascending, maroon; infructescence with a solitary syncarp; phalanges 7.3–7.8 cm long, 5.3–7.4 cm wide, 3.8–4.3 cm thick, broadly cuneiform, widest near the top, 5–6-angled, the apex rather low convex, lower sides flat, lateral sinuses narrow but extending down to beyond the middle, the upper 1/3 free, its sides smooth, shining, each lateral carpel with 1–3 angles and gently curving plane surfaces; carpels 6–11, radial, the marginal ones with apices hemispheric or oblately so, angled, and many of those on the phalange sides with a nearly vertical outer plane side rising to the stigma, and all with a concave platform 2–3 mm wide, distal of the stigma and more or less level; inner carpel apices from $\frac{1}{2}$ as large to as large as the outer ones; stigmas 2.5–4 mm long, obdeltoid, elevated, oblique, running down the steep inner carpel face; proximal sinuses a deep crack running $\frac{1}{2}$–$\frac{3}{4}$ way to valley bottom; central apical sinuses 4–6 mm deep, wide V-shaped, straight; endocarp in the upper 3/7 and 25–26 mm long, bony, dark brown mahogany colored, the central body ellipsoid, the apex with short lanceoloid projections over the seeds, the shoulders inframedian, wide sweeping upcurving and winglike, the upper surface with a semicircular profile, lateral walls above the shoulders 2–3 mm thick, within smooth, shining, dark red mahogany colored; seeds 12–13 mm long, ellipsoid; mesocarp forming in the apex of each carpel a cavern 15–28 mm long, with aerenchyma of strong longitudinal fibers and pale membranes; basal mesocarp 30–35 mm long, fibrous and fleshy.

HOLOTYPE: Eastern Polynesia, Fanning Island, on beach, Aug. 1924, *W. B. Herms* (FI). Type examined. Isotype (UC).

SPECIMENS EXAMINED: Pacific Equatorial Islands, Fanning Island, coral and islet, 1 m alt, 21 April 1934, *H. St. John & F. R. Fosberg 14,106* (BISH).

DISCUSSION: Martelli did not state the location of the type and there is no implication in his publication to help one decide the question. Only a single phalange was collected. Later, this phalange was cut in two, and one half rests in Firenze, the other in Berkeley.

Martelli (p. 145) speculated on the origin of this drift fruit, saying, "It is highly probable that this characteristic *Pandanus* is not a native of Fanning Island, or of any of the neighboring small islands, and that the single drupe picked up on the beach originated on some larger island, and reached Fanning Island through the medium of ocean currents."

In an article on Australian *Pandanus*, Martelli (1933: 23) later evidently mentioned *P. Hermsianus*, inadvertently calling it *P. fanningensis* Martelli. He stated that he considered the species a waif that had drifted to Fanning; that it belonged in the group of *P. spiralis* R. Br. of Australia. On rapid reading, it would seem that Martelli was reducing his own species to synonymy, but on careful reading it is clear that he said that he considered the Fanning Island plant not native there, and to be of the same group of species as *P. spiralis*.

P. spiralis is known only by the type collection from Allen Island, of the Wellesley Group, Gulf of Carpentaria, northern Australia. Drift from there to Fanning Island in a direct line would be some 1,120 miles, and in a more probable circular route would be perhaps 2,000 miles. Such a voyage for a bit of flotsam would take years, and the prolonged soaking by seawater and the battering by stormy waves would cause much erosion on such a fruit as a *Pandanus* phalange. Logs of *Pseudotsuga* that drift the 2,000 miles from the Strait of Juan de Fuca, northwest America, to Hawaii take 4.5 years for the voyage with a direct sea current, and arrive cleaned of the 15–30 cm of bark and with the wood of the trunk washed and polished till it looks and feels like satin.

Having been found only on the beach of Fanning Island, this single known phalange of *P. Hermsianus* may have arrived there by sea drift after a short or a long voyage. No such species is known on any of the adjacent Line Islands. If the phalange arrived after a long voyage, it should exhibit an extreme degree of weathering. On the contrary, the free upper part of the phalange of the holotype (except where damaged or destroyed by clumsy sawing) is clean, fresh looking, and not weathered. The stigmas are well preserved, only the brown papillose surface being mostly gone. The surface of the carpel apices is waxy and shiny,

and unweathered, not at all eroded. This part could not have been in seawater for several years. The basal mesocarp is represented only by the bases of its fibers, the flesh and the rest of the fibers having completely vanished. When ripe this tissue between the fibers is soft and juicy. In a few days in the water it would all float away. If undisturbed on the land surface, it would soon dry and largely fall away. However, the phalange has not been undisturbed. The fibers of the basal mesocarp which once attached it to the syncarp core were of equal length, and the phalange base was originally truncate, now the fibers have been trimmed to a length of 2–7 mm, close to the base of the bony endocarp and conforming exactly to its rounded basal profile. Weathering or erosion would not trim off the fibers in this manner. The writer's long field experience and that with hundreds of species of the section *Pandanus* has taught him that the basal fibers are long enduring, and that under nearly all circumstances all (or most of them) are of equal length and persist, and show the position of the flat base and the original length of the phalange.

On the coral atolls, if ripe phalanges fall to the ground and escape man, they are quickly eaten by animals. On the Line Islands, such as Fanning, they are usually eaten by the swarms of hermit crabs. Less commonly they could be eaten by other crabs, or rats, or birds, or ants, etc. Such animals bite or chew the flesh from the base, but do not leave the basal fibers in a spiral twist, as do humans. It is clear that this phalange grew on Fanning Island, ripened, and fell to the ground, where its soft flesh and the fiber tips were eaten or chewed off by some animal.

Fanning Island was uninhabited when discovered in 1798, but there are archaeological stone structures indicating occupation for some period by early Pacific native voyagers, and coconuts had been introduced and established. Its present status is different. In the 19th century it was settled and developed as a large copra plantation. Laborers are brought in under short-term contract from the Gilbert Islands, and they live in a permanent Gilbertese village. The fact that the Gilbert Islanders have brought some of their crop plants with them and successfully cultivated them is evidenced by the growth by their village of *Cyrtosperma Chamissonis*, and one, large-fruited, edible cultivar of *Pandanus*, called "kaina."

It is known that the Gilbert Islands are one of the two areas with a large number of edible cultivars of *Pandanus*. The many scores of such cultivars in the adjacent Marshall Islands are now quite well known, due to the investigations of Kanehira, St. John, and especially by B. C. Stone. The knowledge of the cultivars in the Gilbert Islands is still rudimentary, resting mostly upon the recording by anthropologists of the vernacular names of the varieties. The estimates of the total of varieties vary from 160 to 194. All of the varietal names are different from those in use by the Marshallese. Of all these, only one has been described (as a species by Martelli). There are but few collections available even yet. The writer (in 1966) knew only nine of these cultivars. One of them, the cultivar "kaina," was collected in the Gilbertese village on Fanning and from the islets with copra plantations. Cable Islet, however, had a natural stand of brush and trees. The *Pandanus* here formed a small, dense grove, close to the lagoon beach, and was in undisturbed natural growth. The phalanges that the writer gathered here in 1934 were not quite ripe, as the apex was green, but the contiguous lower sides were yellow and soft. Drawings and measurements were made of this fresh material. The phalanges were from 7–7.8 cm long, 5–7.4 cm wide, 3.8–4.4 cm thick. The specimen illustrated in Fig. 5 is one of average size. It differs from the type of *P. Hermsianus* in being longer and narrower, 7 × 6.3 cm, but the apex has the same big, rounded carpel apices, wide valleys 4–6 mm deep. The basal mesocarp is longer, being complete and undamaged. There are two larger phalanges in this collection, 7.1 and 7.3 cm wide, and they even more closely resemble the single phalange of *P. Hermsianus* which was 10 cm wide, and of 17 carpels. So close is the resemblance that the author sees no reason to keep them apart. He now gives a supplementary description, based upon adequate material, and establishes *P. Hermsianus* in the status of a well-known, valid species, evidently endemic to Fanning Island.

A later discussion of this species by B. C. Stone appeared (1968 [= 1969]: 92) under a heading, "Disposition of *Pandanus Hermsianus* Martelli." He deplores the publication of a

species based upon a single damaged phalange; agrees with Martelli that it resembles Australian broader-than-long phalanges; and suggests that the basal mesocarp may have been chewed off by animals, or cut off by man. He concludes: "In other words, it seems to me that this could well be a drift phalange from the Marshall or Gilbert Islands. I suggest it is probably one of the large cultivars of *Pandanus fischerianus* Martelli, such as cv. 'edwaan-en-an-Nelu' of the Marshall Islands. I very much doubt that it represents a distinct species. In any case it is an example of unnecessary and unwise description and nomenclature." To this it can be agreed that the type specimen was too meager, but Stone does not report examining the holotype in Berkeley or the clastotype in Firenze. There is nothing wrong with the nomenclature of the species. The cultivar 'edwaan-en-an-Nelu' has phalanges 10–12 cm long, and the endocarp usually in the upper third of the phalange, the leaves 2 m long and 8 cm wide. In these and other characters it differs from *P. Hermsianus*.

As the writer has demonstrated, the holotype of *P. Hermsianus* has the stigmas and the apex of the phalange fresh and unharmed, so that it cannot have drifted in the ocean the thousands of miles from Australia or the Gilbert or the Marshall Islands.

Now there is new evidence on the problem, due to the collection of adequate material of a native *Pandanus, St. John & Fosberg 14,106*, from Fanning Island. It was gathered on Cable Islet, a different and distant islet from Napia, the one with the Gilbertese village.

From these data it is deduced that *P. Hermsianus* is a wild species, endemic to Fanning Island.

Pandanus tectorius Warb., var. *novi-caledonicus* Martelli, cv. 'Kaina,' cultivar nov.

Figs. 6–7

NOM. VERN.: "kaina" (Gilbertese)

DIAGNOSIS OF HOLOTYPE: Tree 3.2 m tall, branched; leaves 1.62 (+0.27?) m long, 7 cm wide (at perhaps 12 cm from the base), 6.8 cm wide near the middle, thickish coriaceous, above shining green, below pale green and apparently glaucous, U-sulcate, 2-pleated, at midsection with 50 parallel secondary veins in each half, the tertiary cross veins faintly visible on the upper side towards the base, forming short oblong meshes, the blade sword-shaped, tapering from the base to the slender apex (the tip lost), the base not preserved; near the base the margins with prickles 2.8–3.6 mm long, 5–14 mm apart, arcuate subulate, ascending, stramineous, with very slight red tips; the midrib below unarmed for about 32 cm, then with prickles 3 mm long, 25–35 mm apart, arcuate subulate, similar, but the first one strongly reflexed, and the following ones appressed ascending; at midsection the margins with prickles 2–3 mm long, 5–12 mm apart, subarcuate subulate, strongly ascending, stramineous below but red-tipped; the nearby midrib below with prickles 2–2.2 mm long, 12–22 mm apart, arcuate subulate, compressed, almost appressed ascending, stramineous with red tips; syncarp not preserved; phalanges 12–13 cm long, 7–8 cm wide, 5.9–6.7 cm thick, broadly pyriform, with 4 major angles and 1–2 secondary ones on each marginal carpel, the lower 2/3 fleshy enlarged, deep orange red, when dry with a slight rounded shoulder, upper 1/3 free, the sides smooth, shining, the apex high convex; carpels 10–13, the marginal ones with their apices obliquely convex, sloping in conformity with the convexity of the phalange apex, each with a shallow concave platform 4–12 mm wide, distal of the stigma, the interior apices 1/4–2/3 as large as the marginal, low convex, symmetrical; stigmas 3.5–5 mm long or wide, apical, elevated and oblique, oval to reniform or even truncate, brown, papillose; proximal sinuses running 1/3–1/4 way to valley bottom; central apical sinuses 1–3 mm deep, nearly straight, very wide; endocarp at upper 2/5 and 3 cm long, bony, mostly stramineous, saucer-shaped, with a central hemispheric mound, the lateral walls 17–22 mm thick, and only around the seed cavity brown, within shining, spirally ridged; seed cavities 25–27 mm long, narrowly cylindric, with many fibers, apparently without seeds and sterile; mesocarp forming in the apex of each carpel a cavern 16–25 mm long, filled with aerenchyma of a few fibers and a few longitudinal white membranes; basal mesocarp 7.5–8 cm long, fibrous and with much edible flesh.

Pacific Ocean, Line Islands, Fanning Island,

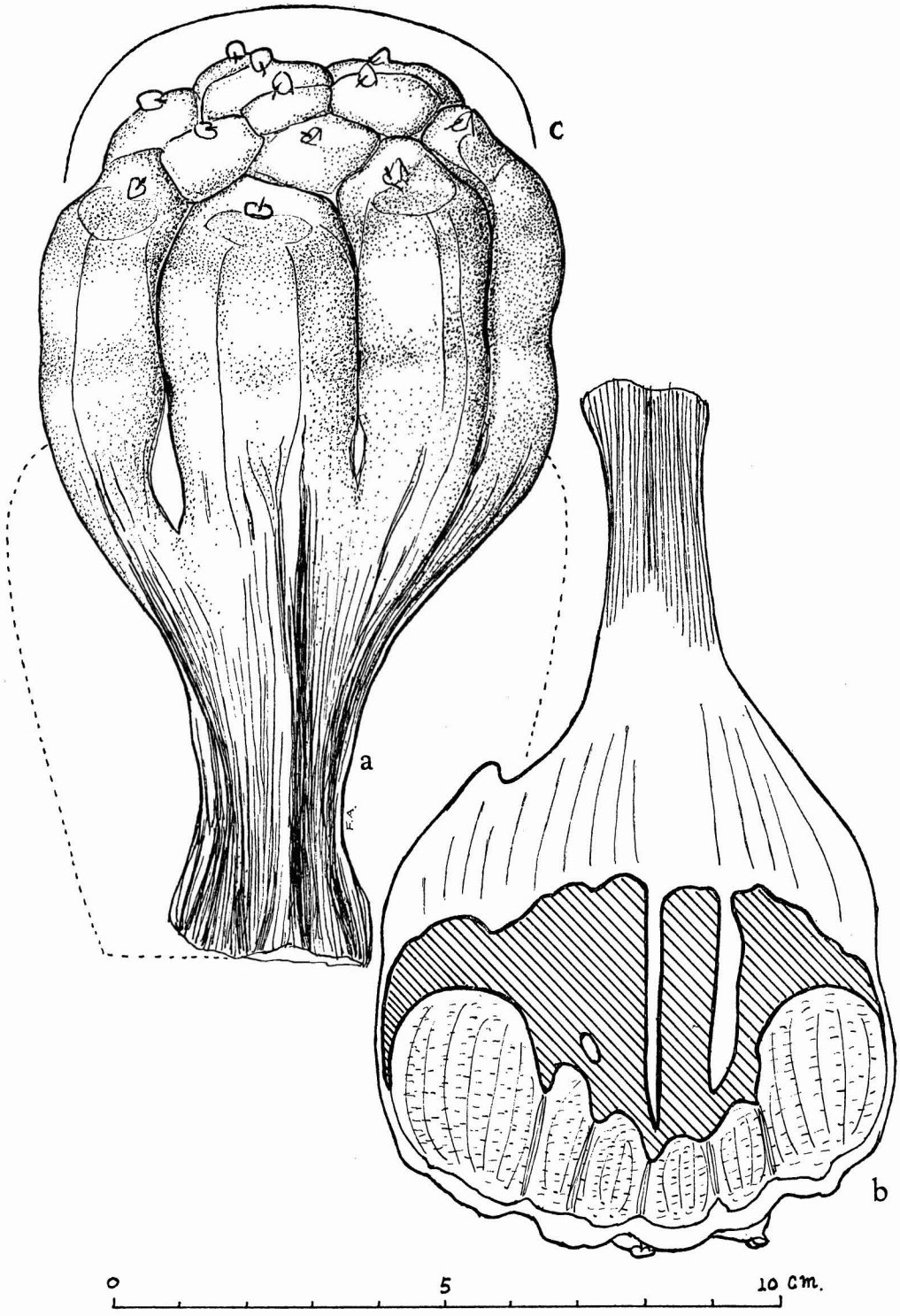

FIG. 6. *Pandanus tectorius* Warb., var. *novi-caledonicus* Martelli, cv. 'kaina,' from holotype. *a*, phalange, lateral view, ×1; *b*, phalange, longitudinal median section, ×1; *c*, profile of phalange apex.

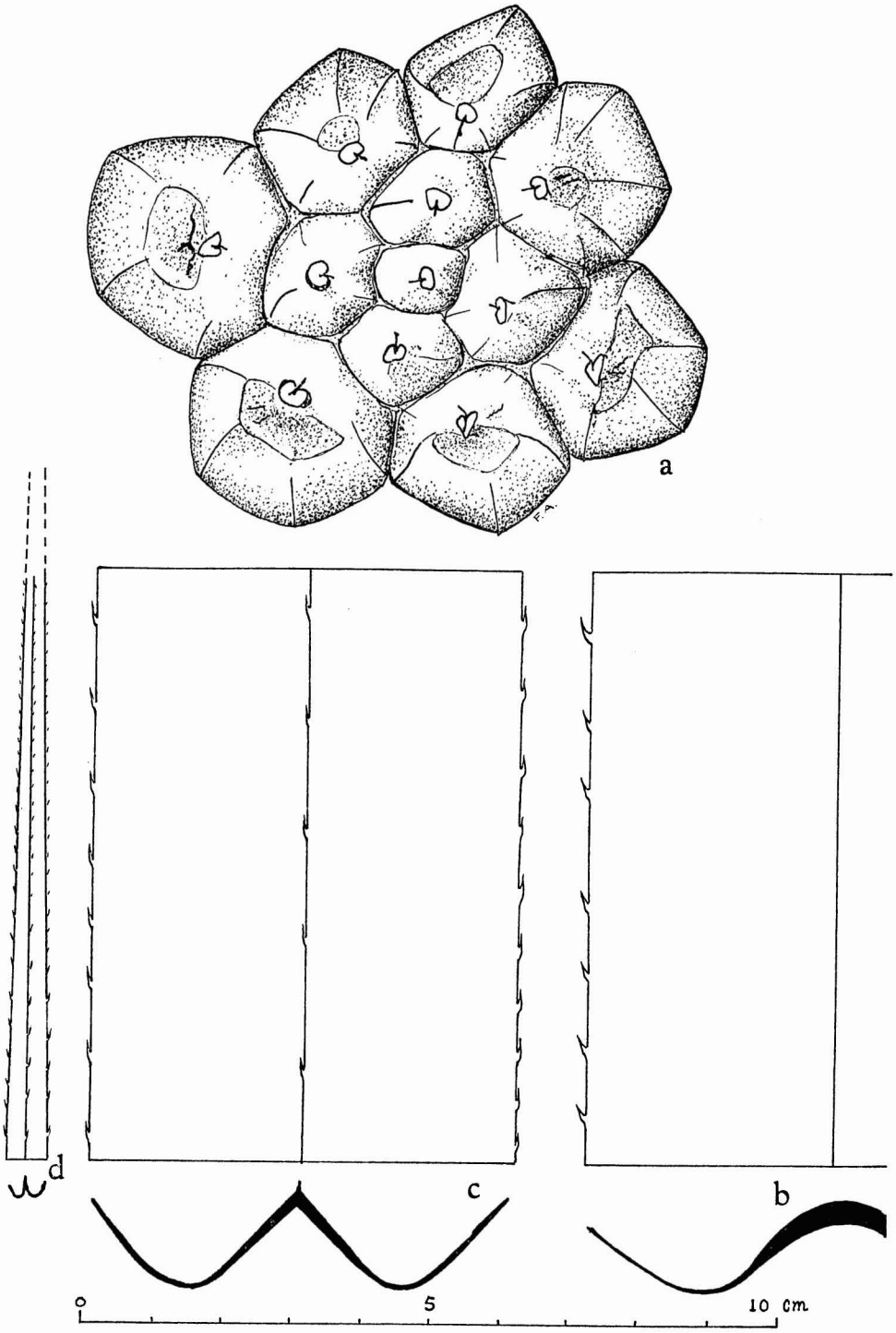

Fig. 7. *Pandanus tectorius* Warb., var. *novi-caledonicus* Martelli, cv. 'Kaina,' from holotype. *a*, phalange, apex, ×1; *b*, half of leaf base, lower side, ×1; *c*, leaf middle, lower side, ×1; *d*, leaf apex, lower side, ×1.

Teuru Mangaro Islet, planted at village, n.e. end of island, 2 July 1965, *C. R. Long 3,524* (BISH).

DISCUSSION: The syncarp as seen in a photograph is elliptic-subglobose and about 31.5 cm in diameter. The photographs were taken by Prof. W. B. Herms in August 1924 in the Gilbertese village. This cultivated variety, seen in 1924, is obviously the same as that collected by Long in the same village in 1965.

No vernacular name for this variety was recorded by the collector, but it was a tree cultivated in the village by the Gilbertese laborers. It is obvious that the tree was introduced from their home land, one of the atolls of the Gilbert Islands. There the *Pandanus* is an important, staple food. Numerous cultivated varieties have been developed, and for them the natives use nearly 200 vernacular names. Not knowing the true cultivar name for this one, it cannot be used, hence the one announced here is arbitrarily chosen. "Te kaina" means the pandanus tree, in Gilbertese speech. So, "kaina," the general name for the whole group, is here used as the new cultivar name. The cultivar is here attached to a somewhat similar wild plant, described as *P. tectorius* Warb., var. *novi-caledonicus* Martelli, a native of New Caledonia.

This plant really belongs in our list of cultivated plants.

GRAMINEAE

Brachiaria plantaginea (Link) Hitch. A weed. *Russell & Tsuda 63.*

Cenchrus echinatus L. A weed. *St. John & Fosberg 14,117*; *Russell & Tsuda.*

Cynodon Dactylon (L.) Pers. In the settlement lawn, fide *Christophersen.*

Eleusine indica (L.) Gaertn. A weed. *Russell & Tsuda*; *Long 3,537.*

Eragrostis tenella (L.) Beauv. ex R. & S. Weed at the settlement. *Long 3,560*; *Russell & Tsuda 36.* This is *E. amabilis* of Christophersen's report.

Lepturus repens (Forst. f.) R. Br. *Arundel*; *Ball 7*; *Christophersen 18*; *Long 3,506*; *3,538*; *3,571*; *3,553*; *Huber & Sibley 3,510*; *Russell & Tsuda 13*; *14.*

Rhynchelytrum repens (Willd.) C. E. Hubb. Weed. *Russell & Tsuda 66.*

CYPERACEAE

Cyperus rotundus L. Weed. *Russell & Tsuda.*

Fimbristylis atollensis St. John. *Ball 8*; *Christophersen 17*; *Long 3,512*; *3,514*; *3,552*; *Russell & Tsuda 49.*

PALMAE

Cocos nucifera L. Cultivated, abundant.

URTICACEAE

Laportea ruderalis (Forst. f.) Chew. Weed. *Ball 10*; *Christophersen 20*; *St. John & Fosberg 14,107*; *14,112*; *Russell & Tsuda 2.*

AMARANTHACEAE

Achyranthes aspera L. Weed. *Arundel*, fide Hemsley.

NYCTAGINACEAE

Boerhavia diffusa L., var. **tetrandra** (Forst. f.) Heimerl. *Ball 5*; *16.*

Pisonia grandis R. Br. *St. John & Fosberg 14,111*; *Long 3,555*; *3,557.*

AIZOACEAE

Sesuvium Portulacastrum (L.) L. *Long 3,533*; *3,591*; *Huber & Sibley 3,578*; *Russell & Tsuda 7.*

PORTULACACEAE

Portulaca lutea Soland. *Christophersen 22.*

P. oleracea L. Weed. *Russell & Tsuda 12.*

LAURACEAE

Cassytha filiformis L. *Long 3,534*; *3,575*; *Russell & Tsuda 39.*

CRUCIFERAE

Lepidium bidentatum Montin. *Arundel*; *Christophersen 16*; *St. John & Fosberg 14,108*; *Long 3,554*; *Russell & Tsuda.* Formerly determined as *L. piscidium*, and *L. owaihiense.*

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers. Weed, escaped from cultivation. *Long 3,526.*

LEGUMINOSAE

Cassia occidentalis L. Weed, fide *Christophersen.*
Crotalaria retusa L. Weed. *Long 3,516.*
Desmodium triflorum (L.) DC. Weed, fide *Christophersen.*

SIMAROUBACEAE

Suriana maritima L. Reported by Streets (1877: 142).

EUPHORBIACEAE

Euphorbia heterophylla L., var. cyathophora (Murr.) Griseb. Weed. *Long 3,518*; *Russell & Tsuda 19.*
E. hirta L. Weed. *Ball 17*; *Long 3,542.* As *E. pilulifera* 1, fide *Arundel.*
E. prostrata Ait. Weed, fide *Christophersen.*
Phyllanthus amarus Schum. Weed. *Ball 2*; *Long 3,544*; *Russell & Tsuda 9.* Formerly determined as *P. niruri.*

TILIACEAE

Triumfetta procumbens Forst. f. *Arundel*; *Ball 13*; *Russell & Tsuda.*

MALVACEAE

Malvastrum coromandelianum (L.) Garcke. Weed, fide *Christophersen.*
Sida fallax Walp. *Arundel*; *Ball 15*; *Russell & Tsuda 8*; *33.*

ASCLEPIADACEAE

Asclepias curassavica L. Weed. *Arundel,* fide Hemsley, 1885.

CONVOLVULACEAE

Ipomoea brasiliensis (L.) Sweet. *Russell & Tsuda 51.*
I. Tuba (Schlecht.) Don. *Arundel*; *Long 3,540*; *Russell & Tsuda 11.* Previously called *I. glaberrima* and *I. grandiflora.*

BORAGINACEAE

Cordia subcordata Lam. *Ball 12*; *Russell & Tsuda* 52.
Heliotropium anomalum H. & A. *Arundel*; *Ball 14*; *Christophersen 21.* Var. **mediale** Johnst. *St. John & Fosberg 14,109*; *14,110*; *Long 3,551*; *3,559*; *3,576*; *Russell & Tsuda 42.*
Messerschmidia argentea (L.) Johnst. *Ball 1*; *Long 3,520.*
Formerly called *Tournefortia argentea.*

VERBENACEAE

Stachytarpheta urticaefolia (Salisb.) Sims. Weed. *Russell & Tsuda 68.*

RUBIACEAE

Borreria laevis (Lam.) Griseb. Weed. *St. John & Fosberg 14,115*; *Russell & Tsuda 6.*

GOODENIACEAE

Scaevola Taccada (Gaertn.) Roxb. *Ball 3*; *St. John & Fosberg 14,116.* Formerly called *Scaevola frutescens.*

COMPOSITAE

Bidens pilosa L., var. pilosa. Weed. *Russell & Tsuda 21.*
Erigeron bonariensis L. Weed, fide *Christophersen.* Formerly called *E. albidus.*
Pluchea odorata (L.) Cass. Weed, *Russell & Tsuda 4.*
Sonchus oleraceus L. Weed, fide *Christophersen.*
Synedrella nodiflora (L.) Gaertn. Weed. *Ball 9*; *Russell & Tsuda 44.*
Vernonia cinerea L. Weed. *Russell & Tsuda 3.*

ORNAMENTALS AND FOOD PLANTS IN CULTIVATION

ARAUCARIACEAE

Araucaria sp. *Russell & Tsuda 57.*

ARACEAE

Colocasia esculenta (L.) Schott, var. antiquorum (Schott) Hubb. & Rehd. *Bryan* (1941: 163).
Cyrtosperma Chamissonis (Schott) Merr. Observed by St. John in 1934 at Gilbertese village.

PALMAE

Phoenix dactylifera L. Observed by Russell & Tsuda.

BROMELIACEAE

Ananas comosus (Stickm.) Merr. *Bryan* (1941: 163).

COMMELINACEAE

Rhoeo spathacea (Sw.) Stearn. *Russell & Tsuda 28.*

LILIACEAE

Crinum asiaticum L. *Russell & Tsuda 24.*
Gloriosa superba L. *Russell & Tsuda 70.*

TACCACEAE

Tacca Leontopetaloides (L.) Ktze. *Bryan* (1941: 163).

MUSACEAE

Musa paradisiaca L. Observed by Russell & Tsuda.

CASUARINACEAE

Casuarina equisetifolia Stickm. *Russell & Tsuda 22.*

MORACEAE

Artocarpus altilis (Parkins. ex Z) Fosb. alt. St. John. *Russell & Tsuda 34; 37.*
Ficus sp. Arundel, fide Hemsley (1885: 116); *Christophersen* (1927: 43).

POLYGONACEAE

Antigonon leptopus H. & A. *Russell & Tsuda 73.*

NYCTAGINACEAE

Bougainvillea sp. *Russell & Tsuda 67.*
Mirabilis Jalapa L. *Russell & Tsuda 71.*

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers. *Russell & Tsuda 72.* Also naturalized.

LEGUMINOSAE

Bauhinia monandra Kurz. *C. R. Long 35B.*
Caesalpinia pulcherrima (L.) Sw. *Russell & Tsuda.*
Leucaena leucocephala (Lam.) de Wit. *Russell & Tsuda 47.*

RUTACEAE

Citrus aurantifolia (Christm.)Swingle. Observed by Russell & Tsuda.

EUPHORBIACEAE

Acalypha Wilkesiana Muell.-Arg. in A. DC. *Russell & Tsuda.*
Codiaeum variegatum (L.) Bl., var. pictum (Lodd.) Muell.-Arg. *Russell & Tsuda 65.*
Manihot esculenta Crantz. *Russell & Tsuda 64.*

ANACARDIACEAE

Mangifera indica L. Observed by Russell & Tsuda.

MALVACEAE

Hibiscus rosa-sinensis L. *Long 3,584.*

GUTTIFERAE

Calophyllum Inophyllum L. *Long 3,583.*

CARICACEAE

Carica Papaya L. *Long 3,504.* Observed by Russell & Tsuda.

PASSIFLORACEAE

Passiflora foetida L., var. hispida (DC.) Killip. *Long 3,497; Russell & Tsuda 29.*

COMBRETACEAE

Terminalia Catappa L. Observed by Russell & Tsuda.

MYRTACEAE

Psidium Guajava L. *Christophersen* (1927: 43).

ARALIACEAE

Polyscias Guilfoylei (Bull) Bailey. *Long 3,499; 3,517.* Var. laciniata (Hort.) Bailey. *St. John & Fosberg 14,114; Russell & Tsuda 77.*
Polyscias Scutellaria (Burm. f.) Fosb. *Russell & Tsuda 25.*

OLEACEAE

Ligustrum sp. *Russell & Tsuda 78.*

APOCYNACEAE

Nerium Oleander L. *Russell & Tsuda 85.*
Plumeria rubra L., forma. *Russell & Tsuda 43.*

VERBENACEAE

Clerodendrum inerme (L.) Gaertn. *Russell & Tsuda 20*; *Fosberg 11,000*. Introduced from the Gilbert Islands, nom. vern., "ti natu."
Lantana Camara L. *Russell & Tsuda 79*.

LABIATAE

Ocimum Basilicum L. *St. John 14,113*.

SOLANACEAE

Capsicum annuum L. Observed by Russell & Tsuda.
Nicotiana Tabaccum L. Arundel, fide Hemsley (1885: 116).

SCROPHULARIACEAE

Russelia equisetiformis L. *Russell & Tsuda* 76.

BIGNONIACEAE

Jacaranda acutifolia Humb. & Bonpl. *Russell & Tsuda 30*.
Spathodea campanulata Beauv. Observed by Russell & Tsuda.

RUBIACEAE

Guettarda speciosa L. *St. John & Fosberg*, in 1943, a single cultivated tree at the settlement; *Russell & Tsuda 26*.
Morinda citrifolia L. *Christophersen* (1927: 43).

CUCURBITACEAE

Cucurbita Pepo L. Observed by Russell & Tsuda.

COMPOSITAE

Gaillardia pulchella Foug., var. picta (Sweet) Gray. *Russell & Tsuda*.
Zinnia sp. Observed by Russell & Tsuda.

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