

SAMOAN PANDANACEAE

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## INTRODUCTION

When Professor Karl Rechanger kindly asked me to study the family of Pandanaceae for his interesting works on the botany of Samoa, New Guinea, and the Solomon Islands,<sup>1</sup> I did not expect that after a relatively short time I should be writing again on the same subject, the Pandanaceae of Samoa. The numerous collections recently made by Mr. D. W. Garber and Dr. Erling Christophersen<sup>2</sup> of Bernice P. Bishop Museum and by Professor W. A. Setchell of the University of California offered opportunity for a revision of the species found in Samoa, or "Archipel des Navigateurs," as it was called by Bougainville (1768). I am glad to have had the opportunity of studying these collections, and I thank the collectors for the privilege. I am also grateful to the Director of Bernice P. Bishop Museum for having entrusted to me such an important collection.

I do not think it necessary to relate here the political or geographical history of Samoa. I will only call attention to the important work by Prof. W. A. Setchell,<sup>3</sup> in which the vegetation of these islands is particularly well described.

The following pages do not complete the study of Samoan Pandanaceae, I am sure. The plants so far described are from Savaii, Upolu, Tutuila, Ofu, and Tau. I have seen no specimens from the small volcanic islands, Manono, Apolima, Fanuatapu, Namua, Nuu-tele, Nuula, Aunuu, and Olosenga, nor from Rose atoll. But I am sure that some different species or varieties of *Pandanus* must live there and would not wonder if some *Freycinetia* also might be found there.

## Genus FREYCINETIA

### *Freycinetia Reinecki* Warburg.

Folia 60 et ultra 100 cm. longa, prae floralia 2.5-3 cm., inferiora 5-5.5 cm. lata, late linearia, sensim attenuata, acuminata, versus basim paullo dentata et

<sup>1</sup> Rechanger, Karl, Botanische und Zoologische Ergebnisse wissenschaftlicher Forschungsreise nach den Samoa-Inseln. . . : Akad. Wiss. Wien, Denkschr., vol. 85, 1910. *Plantae novae pacificae*: Fedde Rep. Nov. Spec., vol. 4, p. 229, 1907.

<sup>2</sup> Christophersen, Erling, Flowering plants of Samoa, B. P. Bishop Mus., Bull., 1934.

<sup>3</sup> Setchell, W. A., American Samoa: Carnegie Inst., Pub. 341, 1924.

amplectentia, utrinque longitudinaliter crebre venosa et in pagina inferiore ± tessellata; folia, non praefloralia, in dimidia parte basilari utrinque valide tessellato—scaber, marginibus basim et ad apicem versus tantum minute denticulatis; costa media, in pagina inferiore filiforme basim versus evanescente, in dimidia superiori parte minute spinuloso-serrata; auriculis persistentibus, membranaceis, longissimis (etiam 13 cm.) 1-1.5 cm. latis ambitu convexo-lanceolatis, acutis, apice adnatis, late, remote et distincte transverse venatis, margine integribus. Inflorescentia mascula terminalis, magna, circiter 10 cm. terna plurimis spathis carnosis, acuminatis involuta; pedicellis 3.5 cm. longis, 5 mm. crassis, glabris, in sicco longitudinaliter striatulis, parte antherifera, cylindracea, 5 cm. longa, circiter 1 cm. crassa, addensata. Filamentis elongatis, 3 mm. filiformibus; antheris parvis (1 mm.), globoso-oblongis. Syncarpia terna vel quaterna (Warburg) bina (fide Christophersen), terminale; pedicellis 4.5-5 cm. elongatis, 3-5 (10 Warburg) mm. crassis, parte fructifera (syncarpio) multo elongata, strobiliforme, 7-9 cm. longa, 2.5-3 cm. crassa, numerosissimis baccis dense constructa. Baccae circiter 13 mm. longae, angustae, sublineares vix lagaeniformes, cum parte seminifera succulenta, 5-6 mm. longa ad basim sita, parte sterile consistente, subaequilonga, apicem versus subcornea cum vertice capitato, circulare vel bilobo, supra plano, anulo latiusculo, laeve cinto. Stigmata bina, distincta vel interdum confluentia. Semina lineari-naviculaeformia, fere 2 mm. longa cum strophiliolo indistincto.

Tutuila: wireless trail, back of Pago Pago, Dec. 26, 1924, Garber, nos. 906 (male) and 907 (female). Upolu: Lake Lanuboo, altitude 700 meters (leaves only), Aug. 8, 1929, Christophersen, no. 127; forest, Malololelei, Lanutoo, altitude 700 meters, Aug. 5, 1929, Christophersen, no. 60. Savaii: forest above Matavanu, altitude 900 meters, Aug. 5, 1931, Christophersen, no. 2264.

A rather common species known to the natives as *ie-ie*. Reinecke collected it in different localities in Samoa, as is evident from his different field numbers: 255, 255a, 255b, 253, 362. All these specimens are female. No male plant was known before that collected by Garber. The leaves nearest the inflorescence differ from the lower ones in being wider and in having the blade distinctly transversely tessellated.

**Freycinetia samoensis** Warburg in Engler, Bot. Jahrb. 25, p. 579, pl. 8, fig. A.

Folia spathacea, cm. 70 circiter longa, in parte basilari dilatato-rotundata (5-6 cm.), ibique amplectentia, sensim in parte foliacea attenuato-acuminato-subulata, utrinque longitudinaliter crebre valide venata, in parte basilari transverse tessellata, marginibus et costa media, brevissime, minutissime, remotiuscule denticulatis; auriculis membranaceis, angustis, attenuato-acuminatis, persistentibus. Folia spathacea superiora basi non dilatato-rotundata, sed lata (7 cm.), coriacea crassiuscula? (in sicco), sensim attenuato-acuminato-subulata, longitudinaliter crebre et valide venosa; marginibus et costa media, apice tantum,

sicut in foliis, denticulatis; spathae plurimae, crassae?, coriaceae (in sicco), latae 8 cm. ovatae, acuminato-subulatae vel ovato-acutae, inferiores 25 cm. longae. Inflorescentia staminifera terminalis, quaterna, pedunculo brevi, pedicellis 4.5-5 cm. longis, 4-6 mm. crassis, levibus, parte staminifera densiflora, 7.5-9.5 cm. longa, cylindracea, 1-1.5 cm. circiter diam. filamentis brevibus, antheris latiusculis, oblongo-rotundatis.

Savaii: forest above Matavanu crater, altitude 800 meters, Sept. 23, 1929, Christophersen, no. 831; and altitude 900 meters, July 14, 1929, Christophersen, nos. 2058 and 2198. Upolu: forest, Malolo-lei, Lanutoo, altitude 700 meters, August, 1929, Christophersen, nos. 61 and 401. Tutuila: top of Pioa, scrub forest, altitude 500 meters, Jan. 2, 1932, Christophersen no. 3495 (sterile). Tau: altitude 2200 feet, Jan. 28, 1922, Garber, no. 750.

*Freycinetia samoensis* was described from specimens collected on Tutuila by Reinecke. It seems to be rather widely distributed through Samoa. Until recently the male plant was unknown. The native name is *lau-ie-ie*.

***Freycinetia hombronii*** Martelli in Reching, Wiss. Forschungsreise nach Samoa (1910) 56.

Scandens; caulis 5-10 mm. crassus, internodiis brevibus, 7-12 mm. longis, in sicco longitudinaliter rugosis. Folia circiter 40 cm. longa, angusta, 10-18 mm. lata, sensim attenuato-acuminato-subulata, in parte basilari canaliculata, amplexentia ceterum plana, longitudinaliter minute venosa; marginibus in parte basilare et apicale plus minusve parce et breviter serrato-denticulatis; costa media, in pagina inferiori tenuissima, parte basilare excepta, remote et minute denticulata; auriculis membranaceis, subpersistentibus, 5-6 cm. longis, ambitu convexis, 1 cm. latis ad basim, sensim attenuato-acuminatis, apice adnatis. Inflorescentia cum pedunculo circiter 3 cm. longo, 4-8 mm. crasso, pedicellis 3-4 et etiam 7 (fide Christophersen), 2-3 cm. longis, 2 mm. crassis antice applanatis, ad apicem spinuloso-scabridis et secundum angulos per totam longitudinem spinuloso-denticulatis. Syncarpia cylindracea, 4-5 cm. longa et 2 cm. in diametro (in forma cylindracea), vel subgloboso 1.5-2 vel 3 cm. in diametro; baccae numerosae sublagaeniformes, 7 mm. longae, pentagonae, parte libera 3 mm. longa sublignosa rotundato-rostrata parte seminifera succulenta connata, pentagona, costulata, cuneata; area stigmatifera circulari vel angulosa ab anulo corneo nitido cincta; stigmata confluentia 4-5; semina naviculaeformia recta.

Savaii: forest above Letui, altitude 1000 meters, Sept. 27, 1929, Christophersen, no. 736; forest on crater rim above Matavanu, altitude 1000 meters, July 15, 1931, Christophersen, no. 2017; Le To, above Salailua, wet forest, altitude 750 meters, Oct. 21, 1931, Christophersen, nos. 2898 (male) and 2945; same locality and collector, altitude 1200 to 1300 meters, September, 1931, no. 2750. Upolu:

forest ridge above Malololelei, Lanutoo trail, altitude 700 meters, Aug. 8, 1929, Christophersen, nos. 132, 196, and 403. Tutuila: ridge trail to radio station, back of Pago Pago, Dec. 26, 1924, Garber, no. 930.

The native name is *ie-ie laulili*. The roots are used for fish traps.

Some years ago I saw for the first time in Paris Herbarium a sterile specimen of this plant collected by Mr. Hombron in Samoa, and I judged it belonged to a different *Freycinetia* from all others known in those islands. I was confirmed in that opinion when I observed Rechinger's collections, although those specimens were sterile, too. Nevertheless I described them as a new species. Now among the rich collections made by Garber and Christophersen in Samoa there are some specimens of *Freycinetia Hombronii* with well-developed fruits. As their syncarps are cylindrical or globose I was doubtful whether to consider them as two separate species, or one as a variety of the other; but as I could not see any other difference between them I thought it better to consider them as varieties. In no. 736 the syncarps are globose, not wide in diameter, but variable. On the contrary, in no. 132 they are cylindrical. The fruits of neither number are ripe. The specimens collected by Garber, no. 930, are particularly interesting, although sterile, as they show the differences between the leaves and auricles of the young branches and those of the fertile ones. On the young branches the leaves are wider and longer with auricles more developed.

#### Genus PANDANUS

#### Subgenus KEURA

Phalanges manifeste e carpidiis  $\pm$  numerosis et elevatis formatae in circulo vel irregulariter dispositis. Stamina in columna subfasciculata vel racemosa constituta.

#### KEY TO SPECIES

Marginibus foliorum  $\pm$  ferociter armatis.

Phalanges latae  
pyriformes vel  
angustatae quasi  
pedunculatae

5-6 cm. latae, 9 cm. longae, loculis 11-12  
et stigmatibus vix prominentibus.....1. *navigatorum*

Phalanges clavato-pyriformes	3.5-4 cm. latae, 7.5 cm. longae, loculis 4-5 convexo pyramidatis a sulcis separatis. Stigmata crassa multo prominentia.....	<b>2. calostigma samoana</b> forma samoana
Phalanges subprismaticae	3 cm. latae, 5 cm. longae, loculis 4-6 subaequalibus, rotundatis, paullo prominentibus et a sulcis mediocriter profundis separatis .....	<b>3. scopulorum</b>
	3 cm. in diametro, 7 cm. longae, longitudinaliter acutae angulosae et sulculatae, loculis 5-9, elevatis pyramidato-rotundatis.....	<b>4. tutuilaensis</b>
Phalanges cuneato-turbinatae	Lateribus longitudinaliter latis non acute angulosis. 6 cm. longae, 3.5-4.5 cm. latae, loculis 5-6, quam digiti anularis crassis, rotundatis paullo elevatis.....	<b>5. salailuensis</b>
	Lateribus longitudinaliter plus-minus crebre acute angulosis et canaliculatis. 5 cm. longae, 3.5-4 cm. diam., loculis 7-8 quam digiti minoris crassis, subpyramidatis paullo prominentibus et a sulcis paullo profundis separatis.....	<b>6. sabulorum</b>
	6-7 cm. longae, 3-5 cm. latae, loculis numerosis 9-14, digiti minoris crassis, elevatis, rotundato-pyramidatis, acutiusculis profunde separatis.....	<b>7. tauensis</b>
	5 cm. longae, 2.5-3 cm. latae, loculis 4-7, digiti minoris crassis, rotundatis subprofunde separatis .....	<b>8. upoluensis</b>
	Valide longitudinaliter costulato angulosae, 4 cm. longae, loculis 5-7 acute pyramidatis et a sulcis profundissimis separatis.....	varietas <b>angulosa</b>
	Parvae 3.5 cm. longae, 9-12 cm. crassae, loculis pusillis 2 a sulcis profundis separatis .....	varietas <b>minor</b>
Phalanges subprismatico-cuneatae vel turbinatae	5 cm. longae, 2-3 cm. latae, loculis 5-7, elevatis, pyramidatis, profunde et late separatis, in disco latiusculo explanatis....	<b>9. turritis</b>
	4-4.5 cm. longae, 2.5-3.5 cm. latae, loculis 4-5, elevatis, pyramidatis acute angulosis a sulcis profundis et late divis in disco lato explanatis .....	<b>10. lanutooensis</b>
	Turbinatae .....	forma <b>A</b>

Marginibus foliorum inermibus vel subinermibus vel cum  
 dentibus minutis acicularis ..... 11. *odoratissimus* varietas *savaiensis*  
 Marginibus foliorum semper inermibus.....varietas *laevis*



PLATE 1.—Phalanges of *Pandanus navigatorum* Martelli. Reduced.

***Pandanus navigatorum* species nova (pls. 1, 9, 10).**

Arbor trunco nudo, ad basim aliquas radices subbreves fulcrantes emittente, candelabriforme valide et longe plure ramoso, ramis robustis expansis divaricato-ascendentibus longe ramulosis. Folia erecto-incurva adulta valde coriacea 130 cm. circiter longa, 12 cm. lata (ad basim), sensim usque ad apicem attenuata, longe acuminato-subulata; marginibus dentato-serratis, dentibus haud crebribus, brevibus, acutis vel breviter in subula terminatis; costa media in pagina inferiore prominente, acuta, basim versus, longo tractu, inermi, dein plus minusve remotiuscule, breviter et minute denticulata; lamina in parte basilari paginae inferioris, transverse crebre et minute valide tessellata, deinsuper utrinque, sed praecipue in pagina inferiore, longitudinaliter crebre et minute venata, apicem versus, in pagina superiore, secundum margines et costulam, a lineis dentium impressis e praefoliatione enatis longitudinaliter percursa. Syn-



carpium solitarium, cernuum, subglobosum, circiter 25 cm. in diametro plurimis phalangibus instructum. Phalanges pyriformes, e medio in base angustissima attenuatae, 9 cm. longae, 5-6 cm. latae, in dimidia superiore parte liberae, inter se adproximatae, ibique in toto subglobosae, pentagonae, irregulariter plus minusve acute angulosae; lateribus planis vel canaliculatis vel secundum loculorum suturas, a sulco plus minusve profundo, angusto, longitudinaliter usque vel ultra dimidio phalangis percursis; vertice phalangium convexiusculo, loculis numerosis 11-12, interioribus interdum multo minoribus, convexiusculis, rotundatis, paullo prominentibus, pentagonis, a sulcis superficialibus vel subprofundis, anguste separatis. Stigmata parva et paullo prominentia. Endocarpium osseum in dimidia superiore parte phalangis locatum, fere 2.5 cm, spissum, inferne truncatum, supra, in toto, rotundatum subpyramidatum, profunde irregulariter rimosum.

Savaii: open fern country, near Manase plantation, altitude 100 meters, Aug. 16, 1931, Christophersen, no. 2410.

Some years ago in the herbarium at Kew Gardens I observed a beautiful syncarp of a *Pandanus* sent in 1878 by Rev. S. J. Whitmee. On the label was written only "Pacific Islands." In 1878 Whitmee was in Samoa and sent to Kew Gardens some specimens of fruit, but made no note of the locality. So the native country of that *Pandanus* remained unknown to me, and I preferred to wait before describing the new species. Now I can do this, because among the *Pandanus* collected in Samoa by Christophersen I find the same species.

**2. *Pandanus calostigma* Martelli forma *samoana* Martelli (pl. 2).**

Phalanges longiores, quam in forma typica, 7.5 cm. longae, pyriforme-clavatae, sensim usque ad basim attenuatae, acute-angulosae, vertice convexo-rotundatae, loculis convexo-pyramidatis, latis, brevibus, a stigmate crasso, latissimo, prominenti superatis.

Ofu: Mafafa, coconut grove, May 26, 1925, Garber, no. 984.

I consider this a variety of the species which I described from Tubuai.<sup>4</sup> It differs only in the greater length of the phalanges, which are almost as long as those of *P. carolinianus*; in being more club-shaped and a little more protracted; and in having more acute longitudinal corners, the apex less rounded, and the locules less deeply divided from each other.

**3. *Pandanus scopulorum* Martelli (pl. 2).**

Arbor 5 m. alta. Folia crasse coriacea, ultra 160 cm. longa, basim versus 10 cm. lata, sensim attenuata et acumen latiusculum, subulatum et longum protracta; in pagina inferiore, basim versus (in sicco), conspicue minute transverse venato-tessellata, deinsuper minute crebre sed leviter longitudinaliter venata; costa media prominente, acuta, praeter basim versus remotiuscule serrata, dentibus brevibus, marginibus, si basim versus excipias, creberrime serratis,

<sup>4</sup> Martelli, Ugolino, *Pandanus*: Webbia, vol. 2, p. 428, 1908.

dentibus subbrevis, subulatis, basi incrassatis, in pagina superiore, e medio ad apicem, quatuor lineis dentium e praefoliatione enatis percursa, duobus secundum margines et duobus a latere costulae. Syncarpium oblongum, 28 × 21 cm., solitarium, cernuum, pedunculatum, numerosis phalangibus instructum. Phalanges subprismatico-cuneatae circiter 5 cm. longae, 30-42 mm. in diametro (ad verticem), in basim sensim attenuatae, lateribus latis, subplanis; parte libera brevissima; supra, in toto explanatae; loculis 4-6, subaequalibus, crassiusculis, parum prominentibus, a sulcis profundis separatis, rotundato-subangulosis, vertice in disco irregulari explanatis. Stigmata parvula, prominentia, subhypocrepiformia. Endocarpium osseum in media parte phalangis situm, circiter 2.5 cm. spissum, superne pyramidatum, dentatum, inferne subplanum; mesocarpium superum cum cavernis latis; inferum fibrosum.



PLATE 2.—Phalanges of *Pandanus*: 1-2, *P. calostigma* forma *samocna* Martelli; 3-5, *P. scopulorum* Martelli. Reduced.

Savaii: rocky shore between Puapua and Samalaeulu, Oct. 10, 1929, Christophersen, no. 912.

4. *Pandanus tutuilaensis* Martelli (pls. 3, 9, 10).

Arbor 5-6 m. alta, trunco nudo, superne collecto-ramosa, copiose foliosa ad apicem ramorum; foliis erectis, apicem reflexis. Syncarpium solitarium pendulum oblongum, 30 × 19 cm. Phalanges 7 cm. longae, plus minusve compressae, 3.5 cm. in diametro, 2.5-3 cm. crassae, basim versus attenuatae, in parte superiore, dimidio minus, liberae et prismaticae, vertice, in toto plano-convexae; lateribus subplanis, secundum suturas loculorum leviter sed late concavo-cannaliculatis haud sulcatis; loculis 5-9 subaequalibus, latiusculis, elevatis, pyramidato-rotundatis, acute-angulosis, subprofunde at late separatis. Stigma parvum ad verticem loculorum, hypocrepicum. Endocarpium osseum in dimidia superiore parte phalangis, situm, superne late pyramidato-rotundatum, 3.5 cm. spissum laeviter fimbriatum; mesocarpium superum cum cavernis latis, medulloso-fibrosis; inferum fibrosum, 3 cm. longum.

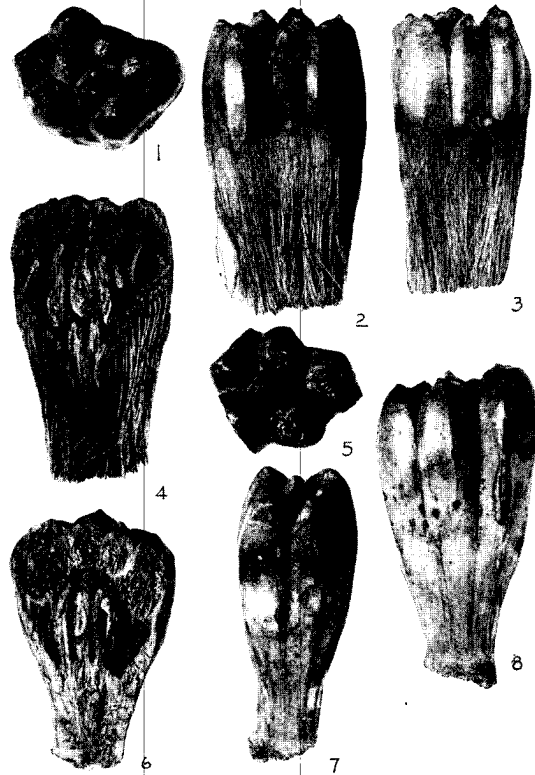


PLATE 3.—Phalanges of *Pandanus*: 1-4, *P. tutuilaensis* Martelli; 5-8, *P. tauiensis* Martelli. Reduced.

Savaii: open fern country, near Manase plantation, altitude 100 + meters, Aug. 16-18, 1929 and 1931, Christophersen, nos. 672 and

2409. Tutuila: Matafaau, Reinecke, no. 459 (in Boissier's herbarium, named *P. Reineckei* Warburg).

Of no. 2409 I have a syncarp; of no. 1971 one leaf only, as the syncarp of this number was lost in a fire. Of no. 1971 there is a photograph of the whole plant with fruit. I consider no. 1971 the same as no. 2409.

*P. tutuilaensis* resembles *P. Macfarlanei* of Tahiti, and perhaps it is only a peculiar Samoan form of it. In Boissier's herbarium, under the name *P. Reineckei* Warburg, I saw some phalanges collected in Tutuila by Dr. Reinecke (no. 459); but they are in no way related to *P. Reineckei* Warburg, which is a "Hombronia." These specimens are undoubtedly referable to *Keura*. I consider these phalanges belong to my *P. tutuilaensis*.

##### 5. *Pandanus salailuaensis* Martelli (pl. 4).

Folia 180 cm. longa, 8 cm. lata, fere e dimidia apicali parte sensim attenuata et in longum flagellum terminata, coriacea; marginibus serratis, dentibus in parte basilarum folii, subdistantibus, ad basim incrassatis, in parte apicali subapproximatis; lamina utrinque crebre minute longitudinaliter venata et in parte apicali, paginae superioris, a 6 lineis, secundum margines et costam, dentibus impressis e praefoliatione enatis percursa; costa media, in pagina inferiore, acuta et prominente, basim versus, inerme, dein dentibus remotis, apicem versus crebrioribus, brevibus, subulatis, adpressis. Syncarpium oblongum, 18 × 21 cm. Phalanges numerosae, 6 cm. longae, 3.5-4.5 cm. latae (ad apicem), persaepe compressae, 2-2.5 cm. crassae, ambitu turbinatae vix convexae et sensim in basim, 1.5-2 cm. latam, attenuatae, fere in dimidia parte superiore liberae, superne planae; loculis perpaucis, 5-6, quasi digiti anularis crassitudine, subaequalibus, rotundatis, subangulosis, inter se a sulcis vix profundis separatis; stigma minusculum haud prominulum, apicale; lateribus phalangium paullo conspicue longitudinaliter concavo-late-subcanaliculatis et secundum suturas druparum, in parte libera tantum, a sulco angusto notatis. Endocarpium osseum, in dimidia parte phalangis locatum, 2.5 cm. spissum, in sectione longitudinali, in toto, supra rotundato-pyramidatum, rimulosum, inferne excavatum. Mesocarpium utrinque fibrosum, 1.5 cm. spissum.

Savaii: rocky coast, Salailua to Lataitai, altitude about 5 meters, Sept. 18, 1931, Christophersen, no. 2656.

##### 6. *Pandanus subulorum* Martelli (pl. 5).

Folia in surculum terminantia, chartaceo-subcoriacea, circiter 80 cm. longa, sensim attenuato-acuminata et in flagellum longiusculum protracta, 6 cm. lata; marginibus dentatis, dentibus brevibus, subulatis, erecto-subapproximatis; costa media, in pagina inferiore, prominente et acuta, basim versus, longo tractu, inerme, dein in primo minute et remotiuscule, apicem versus crebre, denticulato-serrata. Lamina utrinque, sed praecipue in pagina inferiore, validiuscule longitudinaliter venata, in dimidio apicali, in pagina superiore, sex lineis dentium, paullo conspicuis, impressis e praefoliatione enatis percursa. Syncarpium 14 cm.

longum, 15 cm. latum (fide Christophersen). Phalanges parviusculae, cuneatae, 5 cm. longae, 3.5-4 cm. latae (ad verticem), interdum compressae, 2 cm. crassae, sensim in basim (7-12 mm. latae) attenuatae, subprismaticae, vertice in toto leviter rotundatae; loculis 7-9, raro 5-6, mediocribus brevibus et paululum prominentibus, rotundato-subpyramidatis, sulcis manifestis sed vix profundis inter se separatis; lateribus phalangium subplanis, longitudinaliter laeviter concavo-subcanaliculatis, interdum, secundum suturas aliquarum druparum, in parte libera phalangis tantum, a sulco angustissimo percursis. Endocarpium osseum 24 mm. spissum, in dimidia superiore parte phalangis situm, opposite bipyramidatum, supra truncatum et leviter rimulosum, inferne truncato-subexcavatum; mesocarpium superum breve, 9-12 mm. spissum cum cavernis rotundatis, mediocribus; infernum fibrosum, 15 mm. longum.

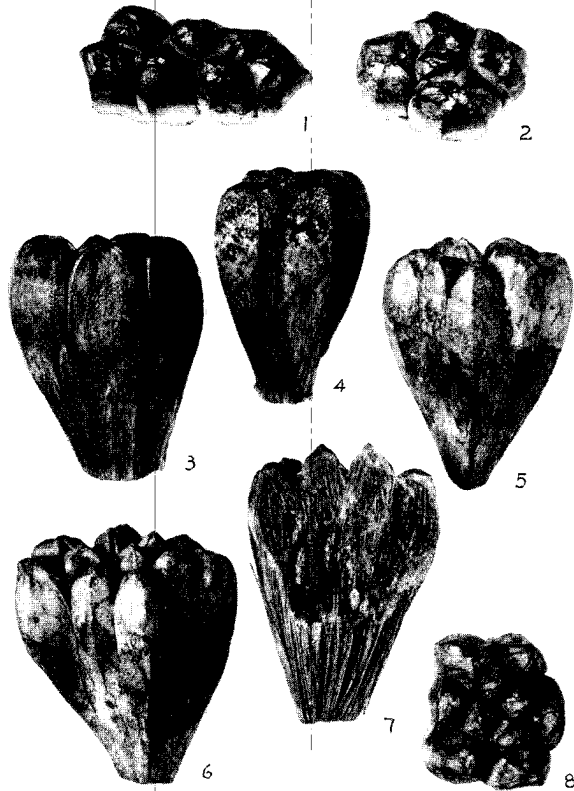


PLATE 4.—Phalanges of *Pandanus*: 1-5, *P. salailuaensis* Martelli; 6-8, *P. tauensis* Martelli. Reduced.

Savaii: sandy beach at Salailua to Lataitai, Sept. 18, 1931, Christophersen, no. 2657.

In the dimensions of the syncarp the collector has given the width greater than the length, which seems to me very strange.

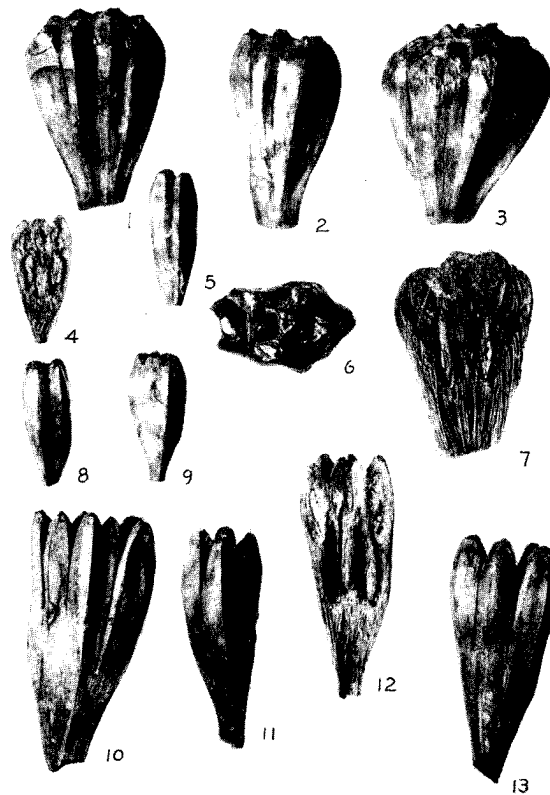


PLATE 5.—Phalanges of *Pandanus*: 1-3, 6-7, *P. subulorum* Martelli; 4-5, 8-9, *P. upoluensis* varietas *minor* Martelli; 10-13, *P. upoluensis* varietas *angulosa* Martelli. Reduced.

7. *Pandanus tauensis* Martelli (pls. 3, 4, 9).

Arbor 4-5 m. alta (fide Garber). Folia 1.5 cm. circiter longa, coriacea, 8-9 cm. lata (ad basim), sensim usque ad apicem in acumen longum, subulatum attenuata; marginibus dentatis, dentibus brevibus, satis dissitis, erectis; lamina, in parte basilari, utrinque transverse prominule tessellata, reliquum longitudinaliter minute venata, in pagina superiore et partis apicalis, lineis subinconspicuis longitudinalibus dentibus impressis e praefoliatione enatis percursa; costa media, in pagina inferiore, acuta et prominente, basim versus, longo tractu, inermi dein irregulariter denticulata, dentibus remotis, brevibus, acicularibus, subadpressis. Syncarpium magnum, globosum, circiter 25 cm. diam. vel oblongum 22 × 24 cm. Phalanges numerosae, 6-7 cm. longae, 3-5 cm. latae (ad apicem),

compressae, 2-3 cm. crassae, cuneatae, sensim usque ad basim (circiter 1.5 cm. latam) attenuatae, in dimidia superiore parte liberae, vertice, in toto, subplanae; lateribus irregulariter valide et acute angulosis, canaliculatis et longitudinaliter usque ad dimidiam superiorem partem phalangis secundum suturas druparum a sulco angusto notatis; vertice in toto subplano. Loculis numerosis, 9-14, quam digito minimo crassis, rotundato-pyramidatis, vel pyramidatis elevatis et acutiusculis inter se profunde et late separatis. Stigma minutum apicale, prominulum. Endocarpium osseum, in dimidio vel vix in superiore parte phalangis situm, 3 cm. spissum et in sectione longitudinali, superne pyramidato-rotundato-fimbriatum, inferne excavatum vel subplanum. Mesocarpium superum cavernosum, cavernis oblongis, medullosa-fibrosis; inferum 2.5 cm. longum, compacto-fibrosum.

Savaai: open fern country near Manase plantation, altitude 100 meters, Aug. 16, 1931, Christophersen, no. 2411; rocky shore at Taga, Oct. 6, 1931, Christophersen, no. 2819. Tau: sandy beach at Faga, altitude 3 to 4 meters, Sept. 11, 1921, Garber, no. 665.

The native name is *lau paogo*.

In this species may be included Christophersen's no. 1854, of which I have seen a leaf and a photograph of the syncarp.

#### 8. *Pandanus upoluensis* Martelli (pls. 6, 7).

*Pandanus tectorius* variety *upoluensis* in Rechinger, Bot. u. Zool. Ergeb. v. Samoa, Neu-Guinea, u. Salomon Ins., p. 56, fig. 4, 1911; Webbia, Enum. Pand., vol. 4, tav. 17, figs. 11-13, tav. 18, figs. 4-19.

Savaai: Taga, rocky coast, altitude about 3 meters, Oct. 6, 1931, Christophersen, no. 2828; sea level, collected by a native, Leai, Nov. 16, 1929, nos. 669, 670, 671 (Christophersen), no. 670 from Fagalo, altitude not given.

Native names are *fala uli*, *fala toto*, *fala*.

It is a tree living on the coast on the recent lava flow. Setchell<sup>6</sup> says he found this plant "on the 'taipupu,' or 'iron-bound' coast, forming a definite belt back of the Scaevola belt (or association)." Christophersen writes that the syncarp, not yet ripe, measures 17 by 16 cm.

#### *Pandanus upoluensis* varietas *angulosa* Martelli (pl. 5).

Phalanges acute-cuneatae et acute-angulosae, obscure et irregulariter pentagonae, 5 cm. longae, 16-32 mm. in diametro (ad apicem), forma druparum digiti minimi subtilior, longitudinaliter, clare conspicua; drupae 5-7, longitudinaliter acutiuscule angulosae, a caniculis plus minusve profundis et secundum suturas a sulco angustissimo notatae, apicem versus pyramidato-subrotundatae vel acutae, vertice in disco minusculo explanatae, inter se a sulcis profundis-

<sup>6</sup> Setchell, W. A., American Samoa: Carnegie Inst. Pub. 341, p. 116, 1924.

simis angustis separatae. Stigmata apicalia, parvula, prominula, hyporepica. Endocarpium osseum in dimidia superiore parte phalangis locatum, elongatum 27 mm. circiter, in sectione longitudinali, superne subpyramidatum, fimbriatum, inferne subconcauum; mesocarpium superum cavernosum, cavernis oblongis, angustis, 7-17 mm. longis, inferum fibrosum, circiter 25 mm. longum.

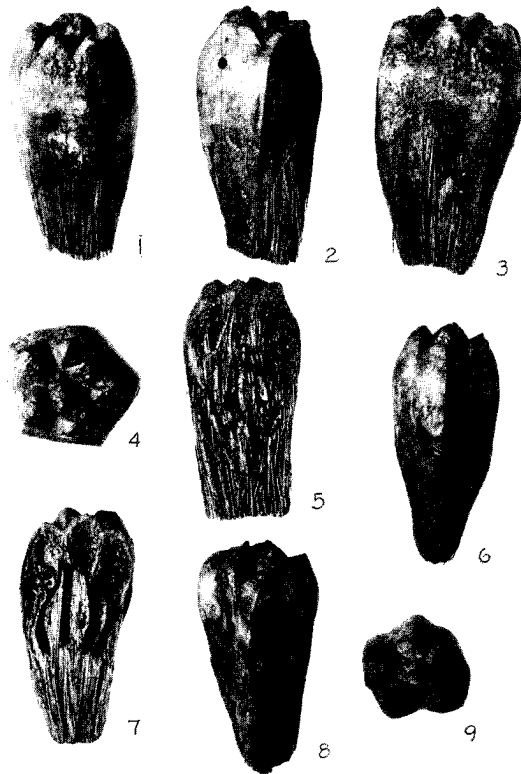


PLATE 6.—Phalanges of *Pandanus*: 1-5, *P. turritus* Martelli; 6-9, *P. upoluensis* Martelli. Reduced.

Savaii: Sili, cultivated, Nov. 13, 1931, Christophersen, no. 3131, from a necklace.

The phalanges of this specimen were found at Savaii by Christophersen, forming a necklace of a native, as also were those of *P. upoluensis* varietas *minor*. It is for that reason that the phalanges are pierced.

I think this *Pandanus* should not be separated from *P. upoluensis* except as a variety or form. The phalanges of *P. upoluensis* are very



variable in shape, examples of which I have in my herbarium. Very like the phalanges from Savaii are some collected on the island of Buka, of the Solomon Islands, by Prof. O. Warburg (no. 18133, Berlin Herbarium), and also some collected by Rechinger in New Britain (no. 3578). But the locules in the specimen from Savaii are more deeply separated from one another and are longer pyramidal. Also, on the sides of the phalanges and not extending below their upper half are very narrow, deep furrows.

**Pandanus upoluensis** varietas **minor** Martelli (pl. 5).

Phalanges parvulae, 3-3.5 cm. longae, 9-12 mm. crassae, interdum compressae, subprismaticae, acute angulosae, basim versus angustatae, apice truncatae, loculis pusillis, 4-5 interdum 2, a sulco profundo separatis. Stigma apicale minimum. Endocarpium osseum in medio phalangis situm, circiter 1.5 cm. spissum; superne rotundatum, inferne truncatum; mesocarpium superum cum cavernis parvis; inferum fibrosum.

Savaii: Sili, cultivated, Nov. 13, 1931, Christophersen, no. 3132, from a necklace.

This variety is very interesting and has a distinct feature, the phalanges being very small and thin. It looks so different from ordinary *P. upoluensis* that if I had not seen many intergrading specimens I would have considered it a different species. It grows also on Buka, one of the Solomon Islands. The phalanges described here formed a necklace worn by a native—a common use made of them in Polynesia. In the collections of the Botanical Museum at Berlin I saw a very interesting necklace of *Pandanus* fruits. Setchell has published a photograph of this ornament, which belongs to the species *P. upoluensis*, not to variety *minor* or *angulatus*.

**9. Pandanus turritus** Martelli (pls. 6, 7).

Folia 1-1.5 m. longa, 5.5-7 cm. lata, valde coriacea, sensim attenuata et longe acuminato-subulata, utrinque longitudinaliter crebre venata; costa media acuta et prominente, in parte basilari inermis, dein minute spinosa, apicem versus crebre minute serrata; marginibus basilariibus inermibus, caeteris serratis, dentibus brevibus, acicularis; in dimidia superiore parte paginae superioris a 6 lineis impressis dentium e prefoliatione longitudinaliter enatis percurta. Syncarpium globosum 16 × 16 cm. diam. Phalanges circiter 5-5.5 cm. longae, prismatico-cuneatae, acute-angulosae, in tertia circiter superiore parte 2.5-3 cm. diam., ibique convexo, pyramidato-truncatae, dehinc usque ad basim latiusculam sensim attenuatae lateribus latis, planis vel vix concavis; loculis 3-7 elevatis, inter se profunde et late separatis, pyramidatis, truncatis ad verticem in disco parviusculo explanatis. Stigmata parva haud vel vix prominentia. Endocarpium osseum in medio phalangis situm, fere 2 cm. spissum, superne, in sectione longitudinale late triangulare, apiculatum. Mesocarpium superum et inferum fibrosum.

Upolu: swamp near Tiavi, altitude 720 meters (empty phalanges), Aug. 12, 1929, Christophersen, no. 170; edge of Lake Lanutoo, altitude 700 meters, Aug. 8, 1929, Christophersen, nos. 120 and 121 (empty phalanges). Savaii: Sealetele, rocky coast, altitude 5 meters Aug. 22, 1931, Christophersen, no. 2473.

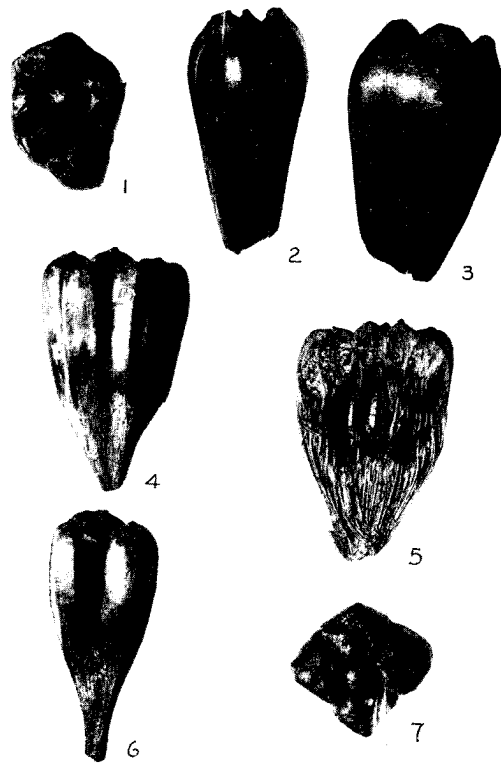


PLATE 7.—Phalanges of *Pandanus*: 1-3, *P. turritus* Martelli; 4-7, *P. upoluensis* Martelli. Reduced.

Closely related to *P. lanutooensis*. *P. turritus* lives at high elevations, at 700 meters, as is noted on the labels of specimens nos. 120, 121, and 170, all of which have empty but well-shaped phalanges. I am surprised to see the same species, Christophersen no. 2473, with well-developed phalanges, collected on Savaii on the rocky coast at an altitude of 5 meters; I suppose labels may have been mixed. I named this species *P. turritus* because the locules of the phalanges

stand up like small towers and look like a turreted crown. The native name is *lau fala*.



PLATE 8.—Phalanges of *Pandanus*: 1-6, 8, *P. lanutoensis* Martelli; 7, 9-12, *P. lanutoensis* forma *A* Martelli. Reduced.

**10. *Pandanus lanutoensis* Martelli (pl. 8).**

Arbor 2-5 m. alta. Folia sub-rigida, 1 m. circiter longa, crasse coriacea, ad basim 5-7 cm. lata, lanceolata sensim attenuata usque in longum acumen subulatum; lamina, imae basi, utrinque levia caeterum longitudinaliter creberrime minutissime sed (in sicco) manifeste venulosa; in pagina inferiore, basim versus, plus minusve transverse venulosa et tessellata; in dimidia apicali parte paginae superioris juxta margines et costam mediam a duobus lineis vix spectabilibus, impressionis dentium e praefoliatione enatis percursa; costa media subtus angusta, prominente et in tertia basilari inerme vel dentibus parvis, brevibus, acutis munita, caeterum minutissime dense et acute serrata; marginibus in parte basilari inermibus, dein minute dense serratis, dentibus brevissimis, subadpressis, acutis, rectis. Syncarpium solitarium globosum, 10 X 10 cm.; pha-

## Subgenus HOMBRONIA

Phalanges biloculi 1-2 seriatim dispositi; stamina sine columna in rachis crassis peltatis dense conferta.

12. *Pandanus Reineckei* Warburg in Engl. Bot. Jahrb., p. 581, 1898.

Arbor 3-5 interdum etiam 8 m. alta. Folia 1-1,5 m. longa, crasse coriacea, basi 9-10 cm. lata, sensim attenuata usque ad apicem et in acumen angustum longum, robustiusculum terminata; lamina, basim versus utrinque, scabrida causa transverse crebre et crassiuscule venoso-tessellata, et praecipue in pagina inferiore longitudinaliter crebre venulosa, in pagina superiore, apicem versus secundum margines, lineis impressis dentium e praefoliatione enatis, percursa; marginibus in parte basilari inermibus, caetero creberrime subirregulariter dentatis, dentibus interdum robustis, ad basim incrassatis, adscendentibus, acutis vel subulatis, apicalibus brevissimis rectis; costa media in pagina inferiore angusta, prominente, acuta, in parte basilari inerme, dein remote et crasse dentata, caetero denticulata, dentibus erectis a marginalibus simillimis. Syncarpium solitarium, pendulum, globosum vel suboblongum, 14 × 17 vel 15 × 15 cm. vel oblongum 21 × 15 cm. Phalanges 4-6 cm. longae, mono-, bi-, vel tricarpidiatae; 2-4 cm. latae, apice rotundatae, carpidia (loculis) a sulculo separata. Stigma superans, circiter 3 mm. longum a latere disci lati, plano-rhomboidei situm. Endocarpium osseum variabile, saepe in parte mediana phalangis locatum, in sectione longitudinale elongatum, 3,5 cm., inferne cuneatum, basi subtruncatum, superne in pyramidem centralem longam productum. Mesocarpium superum cum cavernis latiusculis spongioso-fibrosi; inferum fibrosum.

Tutuila: top of S. Pioa, forest, Sept. 10, 1929, Christophersen, no. 1219; Matafao ridge, forest, altitude 500 meters, Dec., 1929, Christophersen, no. 1022. Savaii: forest above Matavanu, altitude 900 meters, July 14, 1931, Christophersen, no. 2059; Mataaga, swampy place in forest, altitude 1,000 meters, Sept. 15, 1929, Christophersen, no. 625; Mataulanu lake, altitude 900 meters, Oct. 3, 1929, Christophersen, no. 861. Upolu: swamp near Tiavi, altitude 720 meters, Aug. 12, 1929, Christophersen, no. 169.

This is the *Pandanus* which, according to Setchell, forms "a conspicuous association on the overhanging edge of a ridge about 535 to 540 meters altitude. This ridge came to be known to our party as 'Pandanus Ridge.'" It seems to be confined to high elevations, between 550 and 1,000 meters. The native name is *paogo*.

## Subgenus CORONATI

Phalanges obscure pluricarpidiatae; stigmata infra apice proxime in corona disposita.

13. *Pandanus Whitmeeanus* Martelli in *Webbia*, vol. 1, p. 364, 1905, et *Enumer. Pan.* in *Webbia*, vol. 4, pt. 1, tav. 22, figs. 4-6, 1913.

Folia 180 cm. et etiam (fide Christophersen), 3 m. longa, 10 cm. circiter lata (ad basim), loriformia, apicem sensim attenuato-longe acuminato-subulata, haud flagellifera, coriacea, pagina inferiore, in parte basilari, laeve, in superiore punctis alveolatis crebre sparse conspersa; lamina utrinque longitudinaliter crebre minuteque venata, basim versus interdum, brevi tractu, secundum margines tantum minute sed prominule transverse tessellata, a plicis laterali-bus longitudinaliter, submanifestis percursa, plicis, in parte extrema apicali, denticulatis; costa media in parte basilari, paginae inferioris, evanescente, dein lata, inerme in parte apicali lineari, acuta et prominente, fere in dimidia superiore parte tantum crebre minute et acute serrata; marginibus laminae in parte extrema basilari inermibus et angustissime membranaceo-alatis, deinsuper acute serratis, dentibus acutis, brevibus, interdum, in parte basilari, curvo-ascendenti-bus. Drupae 7 cm. longae, fere 3.5 cm. latae, 2.5 cm. crassae, plus minus compressae, oblongae, basi sensim attenuatae, acute exagonae, apice explanatae. Stigmata plurima (6-8) circum et infra marginem areolae terminalis lateraliter radiatim disposita, sessilia, plana, elliptica, 5 mm. longa, 2 mm. lata. Pars mesocarpica superseminalis plena, medullosa-fibrosa, 3 cm. lata, 2.5 cm. longa; endocarpium lapideum subcentrale totam latitudinem drupae tenens.

Savaii: Safotu, cultivated, Sept., 1931, Christophersen and E. Stehlin, no. 3597. Tutuila: top of Pioa, scrub forest, altitude 500 meters, Jan. 2, 1932, Christophersen, no. 3580.

#### SPECIES EXCLUDENDA

- Pandanus samoensis* Warburg in *Engl. Bot. Jahrb.*, 1893, p. 580, pl. 8, C, et *Pflanzenr.*, p. 73, 1900.

Warburg established his *P. samoensis* from a specimen collected in 1894 at Vailele, Upolu, by Dr. F. Reinecke. As the spadix is so young that the features of the fruit are not sufficiently developed, the author judged it belongs to the subgenus *Lophostigma*. The male flowers, which he found with the same specimen, he rightly judged belong to the subgenus *Keura*, probably to *P. tectorius*, and supposed that they may have been mixed in the collection. I saw the type specimen in the Botanical Museum in Berlin, and I am sure that no confusion took place there. For male and female flowers belong to the same species, and they do not belong to *Lophostigma* but to *Keura*.

The figure (Warburg in *Jahrb.*, 1878, pl. 8, C) shows very clearly that the structure of the stigma is that of a young *Keura* and not of a *Lophostigma*. Besides, the figure shows the upper part only of a

drupe. If present, the lower part would show the multiple formation of phalanx, and this I was able to confirm on examining the type specimen. It seems to me that when ripe the phalanges of *P. samoensis* Warburg must have locules deeply separated, almost like those of *P. upoluensis* varietas *angulosa*.

I think *P. samoensis* Warburg is a *Keura*, probably *P. upoluensis*; but I think it better to leave it as an undefinable name.