A SYNOPSIS OF THE AFRICAN SPECIES OF *PANDANUS*[1]

BENJAMIN C. STONE[2]

The taxonomy of the African species of *Pandanus* is presently in a very unsatisfactory state. Since Warburg's monograph in 1900, a number of species have been described which have never been critically compared. The treatment by Warburg was itself very sketchy, as several species were founded on the poorest of specimens and unfortunately some have also been incorrectly, or inexactly, described. The earliest known African species was published by Palisot de Beauvois in 1804 (*Pandanus candelabrum*). Next described was *Heterostigma heudelotianus* Gaudich., 1843, now called *Pandanus heudelotianus* (Gaud.) Balf. f. In 1887, Henriques described *P. thomensis* from São-Thomé Island in the Gulf of Guinea; this was furnished with a particularly good description and figure. Rendle in 1894 in a paper entitled "Tropical African Screw Pines" attempted a complete review of the African species; he recognized eight species, five from West Africa and three from East Africa; of these, five were newly proposed species (*P. barterianus*, *P. welwitschii*, *P. rabaiensis*, *P. kirkii*, and *P. livingstonianus*). Up to this time, not much had been effected toward a subgeneric classification of the genus.

Warburg paid special attention to the African species of *Pandanus*. His monograph of 1900 includes 16 species credited to Africa, of which eight were species which he had described. Equally important was his attempt to establish a sound subgeneric, or rather sectional classification of the genus. The African species were arranged under Section *Keura*, *Vinsonia*, and *Sussea*. Sect. *Keura* is now correctly called *Pandanus*, since it includes the type species of the genus. Both *Vinsonia* and *Sussea* are names which Warburg took from the work of Gaudichaud, but these being invalid names (according to our present nomenclatural rules) effectively date only from Warburg's usage in 1900.

Since 1900, nine more species have been described. There are therefore at present 25 species to account for in any review of the African species. This does not include some *nomina nuda* and illegitimate names.

Martelli (1933) showed that one of the species described by Warburg and which he thought was from Africa, *Pandanus platycarpus* Warb., was wrongly localized; it proved to be from Java. This reduces the total to 24.

These 24 species are listed below according to the section of the genus to which they belong. After each is added a commentary on the present state of our knowledge of the species. Several names are reduced to the status of new synonyms.

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[2] School of Biological Sciences, University of Malaya, Kuala Lumpur, Malaysia.

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FIGURES 1–2. *Pandanus kirkii* Rendle, at Oyster Bay, Dar-es-Salaam, Tanzania.—1. Adult trees.—2. Pistillate tree with immature head of fruit.

SECT. PANDANUS

Type species: *P. odoratissimus* L. f.
Type locality: Ceylon.
Syn. Sect. *Keura* (Forssk.) Kurz.

(1) *Pandanus kirkii* Rendle, Jour. Bot. 32: 326. 1894.—FIGS. 1–6.

Wright, in Thiselton-Dyer, Fl. Trop. Afr. CXLVIII Ord., 127.
TYPE: "Mainland opposite Zanzibar, Dr. Kirk, 1867 (Mus. Kew)."

P. heddei Warb., Pflanzenr. 3. IV. 9: 46. 1900. *Syn. nov.*
TYPE: *Hedde 31*, Dar-es-Salaam, beach.
P. usaramensis Martelli, Webbia 4: 415. 1914. *Syn. nov.*
TYPE: *Stuhlmann*, 1905, Dar-es-Salaam.
P. warburgii Martelli, Webbia 4: 36, *t. 37, fig. 4–6.* 1914; (*P. kirkii* Warb. *non* Rendle). *Syn. nov.*
TYPE: *Holtz*, East Africa.

Since Martelli has concluded that *Pandanus platycarpus* Warb. is not from Zanzibar as stated by Warburg (who gives E. H. L. Krauss as the collector) but is rather from Java, this can be omitted from synonymy.

Pandanus maximus Martelli, from Comoro, is probably but a large-fruited variety of *P. kirkii.*

Pandanus kirkii includes a number of minor forms, principally differing in the morphology of the phalanges, but in ways which are known to be quite standard and essentially meaningless from a taxonomic standpoint. The proportions of the phalanges, their differing dimensions, the depth of the sinuses between carpel tips, number of carpels per phalange, *etc.*, are all characters the variation of which has been demonstrated (Stone, 1967*b*) to occur in *P. odoratissimus* in a quite parallel way, without taxonomic import. This species probably occurs interruptedly all along the tropical East African coast wherever there is sandy beach habitat.

"Mainland opposite Zanzibar, 1867, Dr. Kirk" (K, holotype). [Note: Dr. Kirk was a companion of Livingstone on some of his African explorations.] KENYA: Kwale District, Twiga, 14 mi. S of Mombasa, tree 15 ft., no stilts, above high tide mark, with *Hyphaene, Salvadora, Pemphis, Ehretia, Cocos*, etc. *Verdcourt 3287* (EAH). —Kwale Districts, K7, N & S, Jadini, sealevel, tree 25 ft., with stilts, leaves ensiform just over 3 ft. long, peduncle to 1 ft. long, phalanges 6–11-celled, green becoming yellow-brown, together with *Casuarina* and *Guettarda speciosa* and *Sideroxylon inerme*, on sand just above high water-mark, *Greenway 9642* (EAH), pistillate and staminate. ZANZIBAR: Muaka, sealevel, *Vaughan 2308* (EAH), staminate. Mkadi Kis, "common all round the coast and on Pemba Isl." sand or coral rock, Mangapwani, *Greenway 1138* (EAH), staminate. TANZANIA: Tanga District, Kogome beach, 7 mi. NE of Pangani; coastal forest; near high-water mark in sandy areas on fringe of thick low shrubby cover; branched tree 15 m, bark smooth, dark gray; leaves glaucous; heads solitary, green; 5–9-celled drupes; *Drummond & Hemsley 3245* (EAH). [This specimen bore an unpublished name based on the adjective "cuneate" annotated by H. St. John.] Dar-es-Salaam, sealevel, *Leippert 5501* (EAH), staminate infl. only. Dar-es-Salaam, Oyster Bay, *Stone 7731, 7732, 7733, 7734* (all KLU). 6 mi. SE of Bagamoyo Mbagani, HWM, *Harris & Gardiner 2559* (KLU).

These specimens are only moderately variable, and there seems no difficulty in considering them all to represent *Pandanus kirkii.* The leaves reach 127 cm long and 4.7–6.6 cm wide. The marginal teeth near the base range from 1–3 mm long. The male inflorescences showed about 13 spikes up to 7 × 2.5 cm. Leaf characters varied over a very narrow range. Phalanges differed considerably but

FIGURES 3–4. *Pandanus kirkii* Rendle; Oyster Bay, Dar-es-Salaam.—3. Juvenile plant.—4. Adult tree; base of trunk, showing proproots.

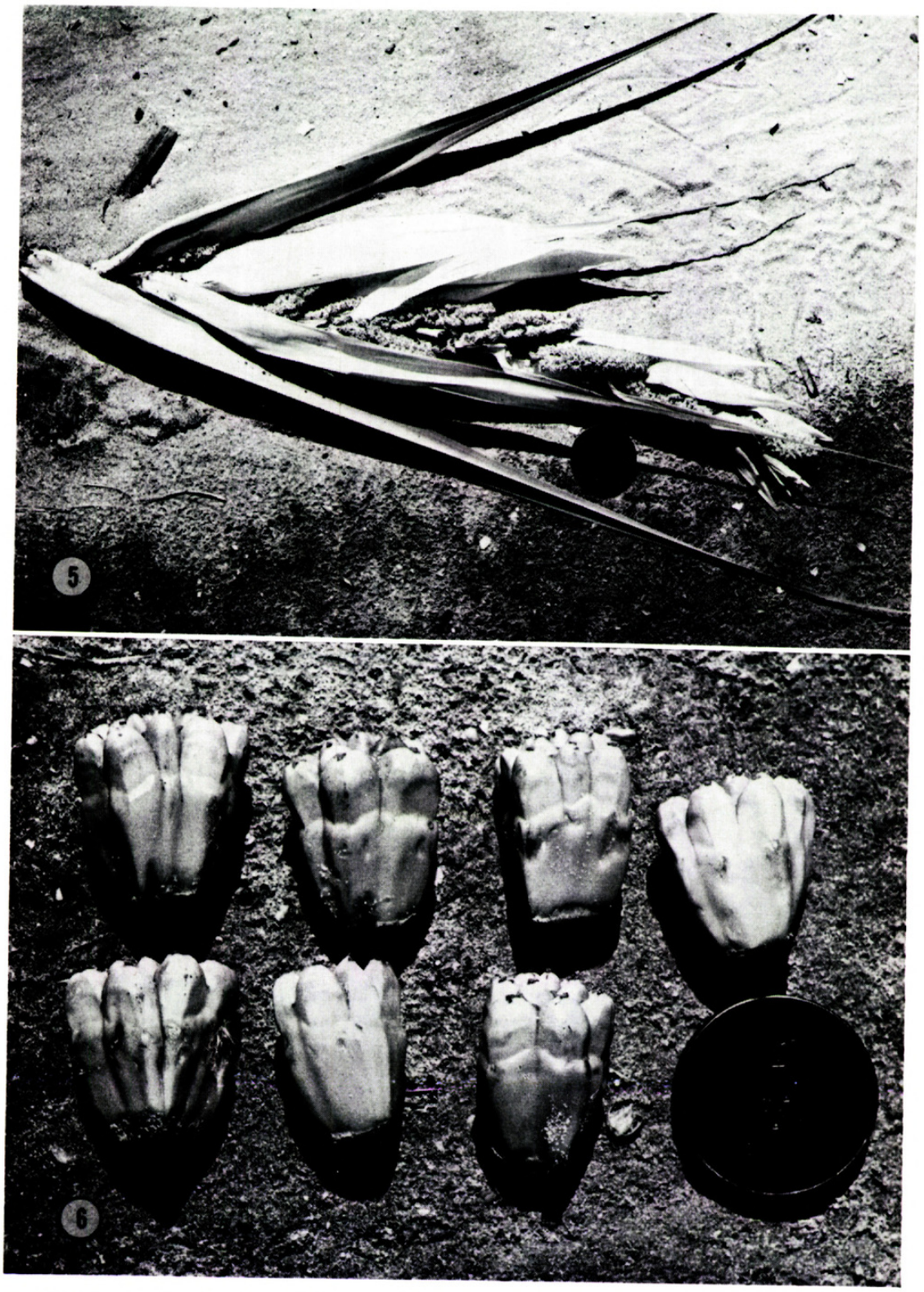
mainly in absolute dimensions (the largest ones about twice the size of the smallest) and in the depth of the sinuses separating the carpel tips, these reaching a depth of 7–8 mm or even more. Carpel number remained quite steady (generally, 5–11; mean at 9).

As the collectors' notes verify, this is typically a plant of sandy beaches just above high-water mark. Also "coral rock" is mentioned as a habitat. The plant associates are characteristic sandy-beach species.

Rendle's original description of this species was very brief; he noted however a similarity to *Pandanus odoratissimus*. In this he was certainly correct. This similarity is so marked that I do not feel it is necessary to provide an extended description. Instead it seems sufficient to refer to the very complete description which I have supplied earlier for *Pandanus odoratissimus* L. f., *sensu lato* (Stone, 1967*b*), and to single out the points of difference between that and the present species.

Pandanus kirkii: marginal teeth of leaves, near the base, relatively short, rarely over 2–2.5 mm long, greenish-white to white. Ripe phalanges with weakly developed shoulders, or none (see Fig. 6); pericarp yellow-orange.

Pandanus odoratissimus: marginal teeth of leaves, near the base relatively long, usually at least 4–6 mm and sometimes to 8–11 mm long,



FIGURES 5–6. *Pandanus kirkii* Rendle; Oyster Bay, Dar-es-Salaam.—5. Staminate inflorescence. (*Stone 7731.*)—6. Phalanges (fully ripe); black disc (lenscap) is 5 cm wide. (*Stone 7732.*)

white. Ripe phalanges with strongly developed shoulders (Stone, 1967*b*, Fig. 4, 6), red, dark red, or vermilion.

As I have pointed out (Stone, 1967*a*) the carpels forming a phalange are variable in number, and although previously much taxonomic weight was placed on this feature, it is not now considered entirely dependable. With reference to normal carpel, number, this is in *Pandanus kirkii* apparently somewhat higher than in *P. odoratissimus*. Rendle in his original description states that *P. kirkii* has phalanges of 7–9 carpels; Warburg (1900) modifies this to 8–14 (and also states "Zanzibar" as the locality, while Rendle clearly specifies "mainland opposite Zanzibar."). For his *P. heddei*, Warburg does not give carpel number, though in the key it comes after the heading "Drupae multiloculares." Martelli's illustration of this species (1914: *tav. XI, fig. 8*) shows a phalange with 6 carpels. His illustration of *P. usaramensis* Martelli (1914: *tav. XIII, fig. 4*) shows a phalange of 10 carpels. *Pandanus warburgii* Martelli is "*P. kirkii* Warb. *non* Rendle," and the type is presumably the "Zanzibar" specimen noted by Warburg as having 8–14 carpels per phalange. As for *Pandanus maximus* Martelli, the phalange illustrated by Martelli (1914: *tav. XI, fig. 2*) is 12-carpellate, but it is moreover rather larger than any specimens of African *P. kirkii* which I have seen.

It is hoped that the liberal inclusion of illustrations here will add to ease of identification of *Pandanus kirkii* (Figs. 1–6).

Probably the most interesting outcome of this study of *Pandanus kirkii* is that it proves to differ constantly from *P. odoratissimus* in a few, apparently rather trivial, characters, but at the same time approaches more closely the characters of the Pacific Island species *P. tectorius* Parkinson[3] and its immediate allies.

It is not at present possible to discuss in detail the comparable features of *Pandanus kirkii* and *P. tectorius*. By emphasizing their similarity in contrast to *P. odoratissimus* I wish merely to show that these three taxa (which have been split up into many finer components by Martelli, Warburg, and St. John) whether or not it is agreed that they are species or "superspecies" or something in between, occupy three distinct regions within which great internal variation occurs that is in my opinion of little taxonomic importance and display a few constant characters. The length and color of the leaf-margin teeth, the color of the ripe fruit pericarp, and the development (or lack of same) of the phalange shoulders, are these relatively constant features. Certainly they assort into three groups; and the distinction between *P. odoratissimus*, and the other two, is more obvious than that between *P. kirkii* and *P. tectorius*. In some ways it may be said that *P. kirkii* is intermediate between the others; in some other ways, it is very much more like *P. tectorius* than like *P. odoratissimus*. Difficulties arise to prevent much more cogent discussion, chiefly the great, and difficult, variation of the Pacific Island forms. As I have already stated, even if we accepted the name *P. tectorius* (by providing a neotype from the classic locality, Tahiti) this does not mean acceptance of either a narrow or a broad species concept. That Martelli could

[3] *Pandanus tectorius* is a controversial name that requires neotypification, if it is to be used at all with any precision. I imply a Tahitian form.

describe seven species from Tahiti alone (without mentioning *P. tectorius*!) and many others from Polynesian Islands; yet also treated *P. tectorius* as a complex species having many varieties (in such places as the Philippines, Borneo, Java, and New Caledonia), and even seemed to think that the "pure" form (with no varietal epithet) occurred on Rodriguez Island (Mascarenes), shows clearly the importance of the problems that arise in attempting comparisons.

Despite these thorny problems it is worthwhile to emphasize the evidently stronger differences between *Pandanus kirkii* and *P. odoratissimus*, because of their bearing on geographical relationships. That is to say, the available evidence shows three (at least) mainly non-overlapping areas of distribution associated with the character-complexes ("species") described. These are, first: Coasts of India (Bombay and south, then north to Bengal); Maldives; Ceylon; coasts of Burma, Thailand, Malaya, East Sumatra, "Indo-China," Hong-kong, Borneo, Philippines (especially the western side), Celebes. This area is the "home" of *P. odoratissimus*. (I have reason also to include Taiwan and at least the South Ryukyu Islands). The second area: The entire tropical coast of East Africa; probably also Comoro Islands (? *P. maximus*); probably Seychelles (*P. balfourii*); possibly Rodriguez. This is the area of *P. kirkii* and its immediate relatives. The third area: The Eastern Pacific; Melanesia; probably North Queensland; Sunda Islands west to Java (and probable slight overlap with the first area). This is the area of *P. tectorius* and its relatives. How many species are involved it is too early to tell. (*P. boninensis* hardly can be distinguished from *P. fragrans* Gaud. of the Marianas; some Hawaiian and Tahitian forms look extraordinarily similar; *etc.*) On the basis of these areas we can discriminate two reasonably homogeneous taxa, *P. kirkii* and *P. odoratissimus*, which I think can fairly be treated as species, and which occupy the first two areas mentioned. The remaining area contains, very probably, more than one species of this immediate relationship (*P. tectorius*, *P. fragrans*, and *P. pedunculatus* R. Br. are among those which appear to have the best claims to rank as species), and certainly a large number of minor taxa (some so minor as cultivars). Significantly, it is this latter area which includes forms that most closely resemble *Pandanus kirkii*. There may however be a "cline" evident between *P. odoratissimus* in Ceylon, through the Maldive and Laccadive Atoll populations, to *P. kirkii*. One difficulty here is that *P. odoratissimus* is a cultivated plant. As will be seen below, it is definitely known from Zanzibar. The possibility of hybridization must be kept in mind; yet it does not seem very much in evidence.

(2) *Pandanus odoratissimus* L. f., Suppl. 424. 1781.

TYPE: Ceylon, *Thunberg*.

ZANZIBAR: Pemba Island, Mtambele Gai Lamtungi, 14 mi. S of Chakechake, in wet meadow-groves; cultivated trees to 8 m × 10 cm; lvs. glaucous beneath; spines of basal margins 6 mm long; those of midrib retrorse. *St. John 26611* (EAH), staminate. "Flowers worn as garlands by women."

Quite typical of the species is this specimen from Pemba. It is cultivated partly for the leaves, partly for the fragrant male inflorescences. Use of the plant is widespread in India, Ceylon, Malaysia, *etc.*, but this is the first unambiguous record from Africa.

The plants may easily be distinguished from *Pandanus kirkii* by the much longer and very white leaf spines. The phalanges differ in being dark red, with very markedly developed shoulders. It is generally the male plants, however, which are in cultivation; the female may well be absent from Pemba.

SECT. DAUPHINENSIA
St. John, Pacif. Sci. 14: 228. 1960.

Type species: *P. dauphinensis* Martelli (Madagascar).
Type locality: Ft. Dauphin, S. Madagascar.
Syn. "*Dorystigma*" Gaud. (*nom. illeg.*); *Doornia* De Vriese; both as genera.

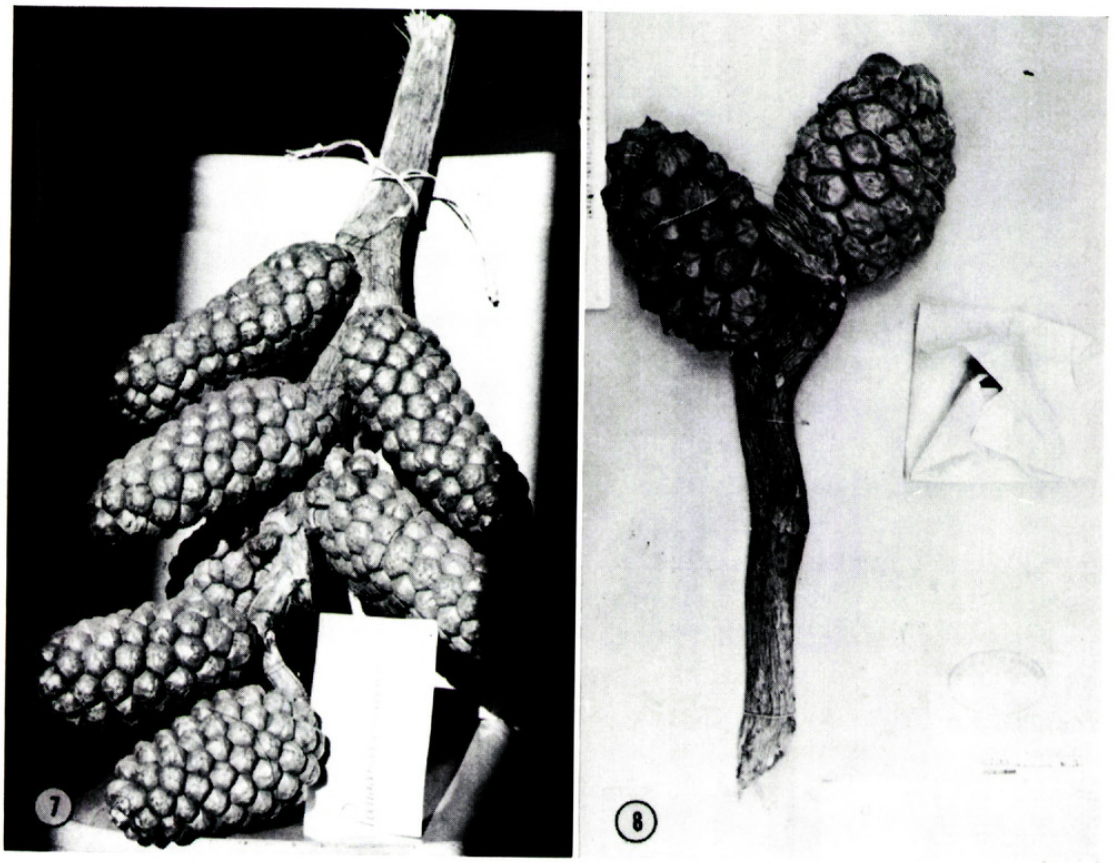
The species of this section are found in the Mascarene Islands, Madagascar, and Africa. All of them, not only the African species, are in a state of more or less confusion. The species early described were very briefly characterized; in several cases the original specimens are inadequate or they have been lost or destroyed. Later species, even if well described, have hardly been critically compared to the older species. This appalling state of ambiguity still shrouds our knowledge of this section in Africa. On the other hand, it is a very clear-cut section, and can easily be distinguished from the other sections present in Africa. From sect. *Pandanus*, the present section differs in having the pistillate inflorescence compound of several (as many as 13) cephalia spicately or racemosely arranged on a long, stout peduncle. The phalanges differ in having flat tops, the stigmas small, sessile, and reniform-rounded, arranged around the edge of (or rarely slightly within) a central, polygonal, slightly depressed areola. The individual carpels, in other words, present no individuality except as (1) stigmas, externally; and (2) seed-containing locules, internally.

(1) *Pandanus rabaiensis* Rendle, Jour. Bot. 32: 325. 1894; Jour. Linn. Soc. Bot. 30: 432, *t. 34., figs. 1–6.* 1895.—FIG. 7.

TYPE: "Rabai Hills, Mombasa, W. E. Taylor, 1886 (Herb. Mus. Brit.)."

P. stuhlmanni Warb., Pflanzenr. 3. IV. 9: 57. 1900. *Syn. nov.*

Rendle's original description of this was so brief that Warburg (1900) considered it "incertae sedis" (Warburg apparently seldom if ever used specimens from other herbaria on loan for study, a major drawback in his work). Rendle had first said: "*P. Rabaiensis* Rendle in Journ. Linn. Soc. ined. A species with the stamens spicately arranged in the stalked male flowers; and fruits somewhat resembling those of the Malagasy *P. utilis* Bory but with a shorter, more rounded top." This description (which was followed by a more complete one in Jour. Linn. Soc. Bot. 30: 432. 1895), though it legalizes the name, conveys no idea in the least of the plant it is supposed to portray; yet it is the only description seen (apparently) by Warburg, who merely translates this into Latin: "Drupae *P. utili* paullo similia, sed apice breviore et magis rotundato." Truly a case of the blind leading the blind! In the Herbarium of the British Museum (Natural History) there is still preserved the type of *P. rabaiensis*. It is provided with several sketches and notes by Rendle. A study of this specimen clearly shows that it is a species of sect. *Dauphinensia* and further suggests that Warburg's *P. stuhlmannii* is the same. Drawings of the phalanges, both pistillate and staminate,



FIGURES 7–8.—*Pandanus rabaiensis* Rendle. Dar-es-Salaam, coll. 1909. (Specimen in FI.) Fruiting spadix.—8. *Pandanus goetzei* Warb. Fruiting spadix. (*Greenway 4192.*)

are attached to the sheets; these are clearly the basis of Martelli's published illustrations (1914: *tav. 23*). It is not possible to verify whether the staminate material is truly conspecific; the fruits must be selected as the proper lectotype material.

Pandanus goetzei Warb. is very similar. Warburg differentiates it from *P. stuhlmannii* by the shape of the cephalia (ovate rather than oblong) and the larger drupes (4 cm *versus* 3 cm). The type is destroyed, but a photo in the Martelli Herbarium (FI) shows a peduncle with 4 ovoid cephalia, according to Warburg's description 10–12 × 8–10 cm. Warburg states "syncarpia compluria" which may mean that there may have been more than 4; indeed the photo suggests that one (a terminal one) may be lacking. I have seen no authentic material of *P. stuhlmanii.* In the East African Herbarium (Nairobi) there are some specimens identified as *P. stuhlmannii* and some as *P. goetzei.* One of them (*Greenway 2584*) bears the determination *P. goetzei* and the signature, Max Burret. Burret probably identified a duplicate in the Berlin Herbarium before World War II, and it seems plausible that he was able to compare it with Warburg's type specimen. It is from Zanzibar (Yozani, in swamp forest). I think, however, that it is *P. rabaiensis.* Another specimen in EAH, *Greenway 5380*, is certainly the same species; it is from Mafia Island, Tanganyika, at 20 feet altitude. The specimens in EAH annotated as *P. stuhlmannii* are generally from higher altitudes; *Drummond & Hemsley 1420* is from the Eastern Usambara hills, at 1100 m; other

specimens are from approximately the same locality ("Amani"). One specimen from this area is determined as *P. goetzei* (*St. John 26602*). It seems very difficult to believe that these are specimens which pertain to more than one species, and I consider that they are *P. goetzei*.

In the Martelli Herbarium (FI) there is a fruiting spadix without indication of collector; the label says "*Pandanus rabaiensis*; Dar-es-Salaam, 1909." This has noticeably oblong cephalia, and they are more numerous on the spadix, probably 8 or 9 in all. This corresponds reasonably well with the type of *P. rabaiensis*.

If there are really two species, one with fewer, ovoid cephalia; the other with more numerous, oblong, cephalia, then the probable correct names for these seem to be *P. goetzei* Warb. for the former, and *P. rabaiensis* Rendle (syn. *P. stuhlmannii* Warb.) for the latter. It is also possible that the former is principally found in upper altitudes (*e. g.* 1000 m) while the latter is essentially of the lowlands, and not far from the coast. However, all these distinctions are of rather dubious value. It is simply impossible at present to decide how many species are represented, but it seems very probable that one, or possibly two, species are involved; surely not three.

In the key to *Pandanus* by Dale and Greenway (in their book *Kenya Trees and Shrubs*, 1961) two species are included, *P. kirkii* and *P. rabaiensis*. Of the latter they say: "Tree usually associated with fresh or brackish water; drupes 1–5–celled, 1.5″ long." Brenan and Greenway, in "Checklist of the Forest Trees and Shrubs of the British Empire, no. 5" list both *P. stuhlmannii* Warb. and *P. goetzei* Warb. but omit *P. rabaiensis*.

TANZANIA: Mafia Island, in *Philippia mafiensis* formation, wet valley bottoms, Utmaini-Miwani, *Greenway 5380* (EAH). Zanzibar, Yozani, *Greenway 2584, 1302*; *Vaughan 2287* (all EAH).

(2) *Pandanus goetzei* Warb., Bot. Jahrb. Syst. 33: 350. 1900; Planzenr. 3. IV. 9: 57. 1900.—FIG. 8.

TYPE: "German East Africa, Uhehe, Lofio River" (*Goetz*).

KENYA: E. Usambara, Bomole Hill, Amani; 1100 m, *Drummond & Hemsley 1420* (EAH); *Greenway 4192* (EAH); *St. John 26602* (EAH).

(3) *Pandanus engleri* Warb., Bot. Jahrb. Syst. 34: 151. 1904.

TYPE: Tanzania, Usambara W., "schluchten unterhalb Sakare, 800 m." Engler, Reise nach Ostafrik. no. 981. Sept. 1902.

Warburg says "very close to *P. goetzei* from Uhehe." He describes the cephalia as oblong and the drupes as 3–5-celled. It seems very dubiously distinct.

Martelli gives no illustration. The type collection perhaps is destroyed, but many of the Berlin monocots were saved. Fresh collections from the type locality would be necessary to establish the identity of this species. Very likely, it will prove to be a synonym of *Pandanus goetzei*.

SECT. VINSONIA

Warb. Pflanzenr. 3. IV. 9: 44. 1900, *pro parte*

Type species: *Pandanus utilis* Bory.
Type locality: Mascarene Islands or Madagascar.

(1) *Pandanus utilis* Bory, Voy. 2: 3. 1804.

TYPE: Madagascar, *Bory*; or Reunion?
TANZANIA: Amani, cult. in plantation BH-7; to 30 ft. Tall, *Greenway 1714* (EAH). Leaf spines red.

In Africa, found in cultivation only.

The stiffly erect very glaucous leaves, with red marginal spines, the solitary pendulous oblate cephalium with green-and-orange phalanges all quickly identify this species.

(2) *Pandanus thomensis* Henriques, Soc. Brot. Bol. 5: 206, *pl. E.* 1887.

TYPE: São Thomé Isl., Gulf of Guinea. "Regio inferior usque 500 m (Moller); ins. Rollas (F. Quintas)."

A well-characterized species.

The closest relative seems to be the very recently described *P. mayotteensis* St. John, from Mayotte Island in the Comoro group.

DOUBTFUL SPECIES

Pandanus hahnii Warb. Pflanzenr. 3. IV. 9: 56. 1900.

TYPE: Martinique, *Hahn*, in cultivation.

Derivation dubious: East African Islands?

The species of sect. *Vinsonia* are well-marked and few. There should be no difficulty in identifying these in Africa.

SECT. HETEROSTIGMA
(Gaudichaud, as genus, Atl. Bot. Voy. Bonite, *t.* 25. 1843)
B. C. Stone, *stat. nov.*

Type species: *Pandanus heudelotianus* (Gaud.) Balf. f., Jour. Linn. Soc. 17: 49. 1879.
Type locality: Senegambia, *Heudelot*. Near Dakar.

The following species were included in sect. *Sussea* by Warburg, Martelli, and other authors, or were not assigned to sections. *Heterostigma* Gaud. has been resuscitated at sectional rank for a group of species found in Africa and Madagascar.

The classification of this section is in a pitiful state. Virtually none of the species in Africa are represented by adequate specimens. The original descriptions are generally far below the standard required for clarity and comprehensibility. Once again, though, as was the case in sect. *Dauphinensia*, the species remain in a sort of impenetrable miasma, yet the section itself is very well-characterized and easy to distinguish both in the field and in the herbarium, especially the former.

Vast difference exists between C. H. Wright's treatment of the African *Pandanus* (in Thiselton-Dyer, Fl. Trop. Afr. Order CXLVIII, pp. 127 *et. seq.*) and Hutchinson's treatment in Hutchinson & Dalziel, *Flora of West Tropical Africa* (fam. 176, p. 392, and *fig. 318*). Wright accepts 16 species (of course for both East and West Tropical Africa); while Hutchinson accepts one species, *viz. P. candelabrum* Beauv., under which he includes *P. heudelotianus*, *P.*

kamerunensis, *P. barterianus*, *P. leonensis* Hort., *P. unwinii*, and suggests that the following should also be included: *P. togoensis* and *P. kerstingii*. Of these, Wright accepted the first three as distinct and *P. candelabrum* as further distinct; the remainder he does not mention, several having later dates. *Pandanus leonensis* Hort. is in any case a doubtful horticultural plant and only a *nomen nudum*. Nevertheless, this should demonstrate a considerable difference in opinion. According to Hutchinson's notes, he had available about a dozen more specimens to study than did Wright.

Under these circumstances I can do no more than list the names which at least will group them properly in one section. W = Africa, E = East Africa.

(1) *Pandanus heudelotianus* (Gaud.) Balf. f., Jour. Linn. Soc. Bot. 17: 49. 1879.
(W) *Heterostigma heudelotianum* Gaud., Bot. Voy. Bonite *t. 25, fig. 15–31.* 1843.
TYPE: Senegambia, *Heudelot*, in upper Guinea, [= Nigeria].

(2) *Pandanus candelabrum* Beauv., Fl. Benin & Oware 1: 37, *t. 21–22.* 1804.
(W) *Tuckeya candelabrum* (Beauv.) Gaud., Bot. Voy. Bonite *t. 26, fig. 10–20.* 1843.
TYPE: Benin, West Africa, "Banks of the River Formosa, near Agathon" (*Beauvois*), = Nigeria.

(3) *Pandanus kamerunensis* Warb., Pflanzenr. 3. IV. 9: 66. 1900.
(W) TYPE: Cameroons, *Schran.*

(4) *Pandanus barterianus* Rendle, Jour. Bot. 32: 324. 1894.
(W) TYPE: Fernando Po, *Barter 2.*

(5) *Pandanus welwitschii* Rendle, Jour. Bot. 32: 324, *t. 347.* 1894.
(W) TYPE: Angola, Pungo Andongo, banks of Cuanza R. nr. Candumba and Ilha Calemba, *Welwitsch 5770, 1015.*

(6) *Pandanus livingstonianus* Rendle, Jour. Bot. 32: 326. 1894.
(E) TYPE: Mozambique, Delta of the Zambesi R., mouth of Luabo R., *Kirk.*

(7) *Pandanus petersii* Warb., Pflanzenr. 3. IV. 9: 66, *fig. 17: J–L.* 1900.
(E) TYPE: Mozambique, on banks of Lucuare and Munanche Rivers, *Peters.*

(8) *Pandanus teuszii* Warb., Pflanzenr. 3. IV. 9: 67. 1900.
(W) TYPE: Gaboon, *Teusz.*

(9) *Pandanus chiliocarpus* Stapf, Jour. Linn. Soc. Bot. 37: 530. 1906.
(C.E.) TYPE: Uganda, Toro, by the Usonei and Durra Rivers, *Dawe 523.*

(10) *Pandanus umbellatus* Martelli, Webbia 4: 435. 1914.
(W) TYPE: Ivory Coast, Guinea, *Jolly 32* (staminate). This may be the male of *P. candelabrum.*

(11) *Pandanus togoensis* Warb., Notizbl. Bot. Gart. Berl.-Dahlem App. 22: 43. 1909.
(W) TYPE: Togoland, W. Trop. Afr.
This species was omitted in Martelli's listing (1913).

(12) *Pandanus unwinii* Martelli, Webbia 2: 434. 1908.
(W) TYPE: South Nigeria, near Benin, *A. H. Unwin*, Sept. 1907 (FI).
Reduced to *P. candelabrum* by Hutchinson, I believe correctly.

INCERTAE SEDIS

(1) *Pandanus hemiacanthus* Peter, Fedde Rep. Sp. Nov. Beih. 40(1): 100, 111. 1929.
TYPE: Tanzania.

(2) *Pandanus kerstingii* Warb. Notizbl. Bot. Gart. Berl. App. 22: 3, 43. 1909.
TYPE: West Tropical Africa.
Misspelled by Martelli ("Kerstingerii").

NOMINA NUDA

(1) *Pandanus sessilis* Bojer, Hort. Maurit. 302. 1837. Pemba Isl. (nr. Zanzibar).

(2) *Pandanus leonensis* Hort. *ex* Wendl. Ind. Palm 46. 1854. Guinea.

NOMEN SUBNUDUM

(3) *Pandanus butayei* De Wildeman, Rev. cultures Coloniales 10: 15. 1902.
Lower Belgian Congo, N'Lemfu. R. P. Butaye, *Gillet 2250.*

This has a rather diffuse description which is probably legitimate and suggests that the plant is a "Sussea," which probably means it belongs in sect. *Heterostigma.*

LITERATURE CITED

MARTELLI, U. 1913. Enumerazione della Pandanaceae. Webbia 4: 1–40.

———. 1914. Le specie e varieta nuove di '*Pandanus*' menzionate nella 'Enumerazione delle Pandanaceae'; & Tavole I–XLIII. Webbia 4: 399–435.

———. 1933. Il *Pandanus platycarpus* Warb. non e di origine africana ma asiatica. Atti Soc. Tosc. Sci. Nat. Proc. Processi Verbali 42: 55–59.

STONE, B. C. 1967*a*. Carpel number as a taxonomic criterion in *Pandanus*. Amer. Jour. Bot. 54: 939–944.

———. 1967*b*. Studies of Malesian Pandanaceae, I. Polymorphism in *Pandanus odoratissimus* L. f. of Asia. Gard. Bull. Singapore 22: 231–257, *1 tab., 6 figs.*

WARBURG, O. 1900. Pandanaceae. *In* A. Engler, "Das Pflanzenreich." 3 (IV. 9). 1–99.