

Revision of the Genus *Pandanus* Stickman, Part 28 The Australian Species Published by Robert Brown

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WHEN STILL A YOUNG MAN, Robert Brown served as botanist upon the exploring expedition under Capt. Matthew Flinders which in 1802–1805 surveyed the coasts of southern, eastern, and northern Australia. His collections included specimens of *Pandanus* from the tropical eastern and northern coasts. Two of them he published as new species, and they were the first representatives of the group to be made known from Australia. His manuscript, written on the trip, contains good and lengthy descriptions of these novelties, but when published in 1810 these were drastically condensed to a very few descriptive words for each. These two, *Pandanus pedunculatus* and *P. spiralis*, have been maintained by most subsequent botanists, but have been given very diverse application, all of which interpretations were in reasonable agreement with their brief diagnoses. Type specimens of both are still in the British Museum, and they are here illustrated and described at length, to help Australian botanists understand these first Australian species.

Section *Eydouxia*

Pandanus spiralis R. Br., Prodr. Florae Novae Hollandiae et Insulae Van Diemen 341, 1810; Martelli, Webbia 4(1):31, 90, 94, t. 13, fig. 1–2, 1913.

Figs. 267–269

EXPANDED DIAGNOSIS OF LECTOTYPE: "Trunk often 3.3–4 m tall, terete, unarmed, decumbent at base, as thick as a person's thigh, often scaly from leaf bases, bearing prop roots; leaves in three spirals, strongly imbricate, keeled, the margins with ascending spines, the midrib below with the lower spines reflexed or alternately reflexed and ascending, or more commonly the midrib unarmed; pistillate inflorescence solitary,

ovoid, bracteate" (*vide* Brown's mss.); phalanges 5.8–6 cm long, 7.8–8.8 cm wide, 6.3–7.7 cm thick, suborbicular but with the base broad truncate, obtusely 5–6-angled, the lateral sutures wanting, the sides gently convex, not mortised, mostly developing numerous longitudinal dark cracks, upper $\frac{2}{3}$ free, the apex semiorbicular, smooth, shining, when dried pale, yellowish brown, apical central sinuses mostly 0, but a few 0.1–1 mm deep, straight, dark, or in age splitting and brown, forming a conspicuous superficial tessellate pattern; carpels 19–23, subequal, the apices rounded to form part of the semiorbicular phalange apex, though essentially low convex, each carpel apex has perceptible ridges radiating to the angles, and the few most central ones are very oblate pyramidal or retuse around the summit, but the marginal and near marginal ones have a tiny concave platform distal of the stigma; stigmas 1.5–2 mm wide, reniform to cordate, "whitish," turning brown, papillose, centripetal, the inner flush or slightly tilted centrally, the outer raised and divergent; proximal sinus a broad crack running $\frac{1}{3}$ – $\frac{1}{2}$ way to valley bottom; endocarp centering in lower $\frac{2}{5}$, bony, massive, the lateral walls 10–13 mm thick, bearing lateral shoulders; mesocarp forming in the apex of each carpel a cavity crossed by a few longitudinal fibers and with transverse membranes; basal mesocarp scant, fleshy and fibrous, 3–7 mm long.

STAMINATE PLANT (*Brown* 5,799 in part): Staminate inflorescence subtended by numerous foliaceous bracts, sword-shaped, the outer green and foliaceous, the inner progressively more white, the lower 45 cm long, 5 cm wide, the uppermost 10 cm long, 5 mm wide, all with subulate prickly margins and midrib below, at least towards the tip; staminate spikes numerous, 4–7.5 cm long, 3–3.5 cm in diameter, dense, cylindric; fascicles of stamens 1.5–2.5 mm long, bearing 10–35 stamens; column 6–10 mm long, stout; free filament tips 2–3.5 mm long;

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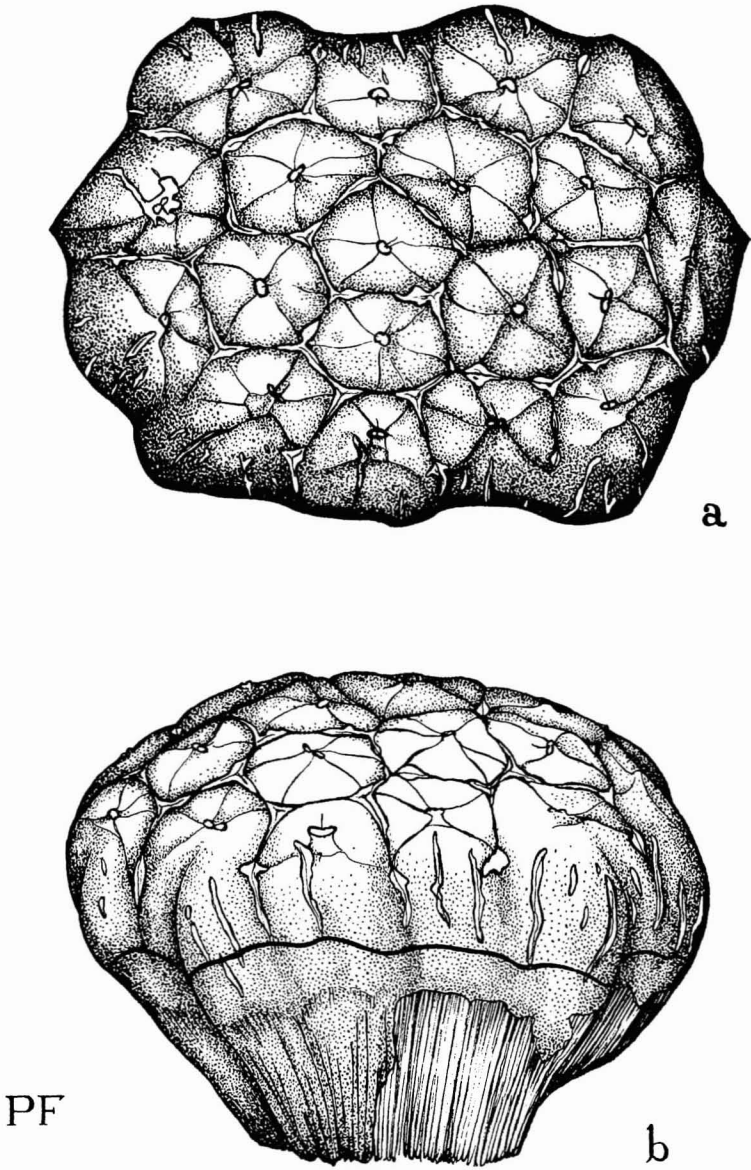


FIG. 267. *Pandanus spiralis* R. Br., from lectotype. *a*, Phalange, apical view, $\times 1$; *b*, phalange, lateral view, $\times 1$.

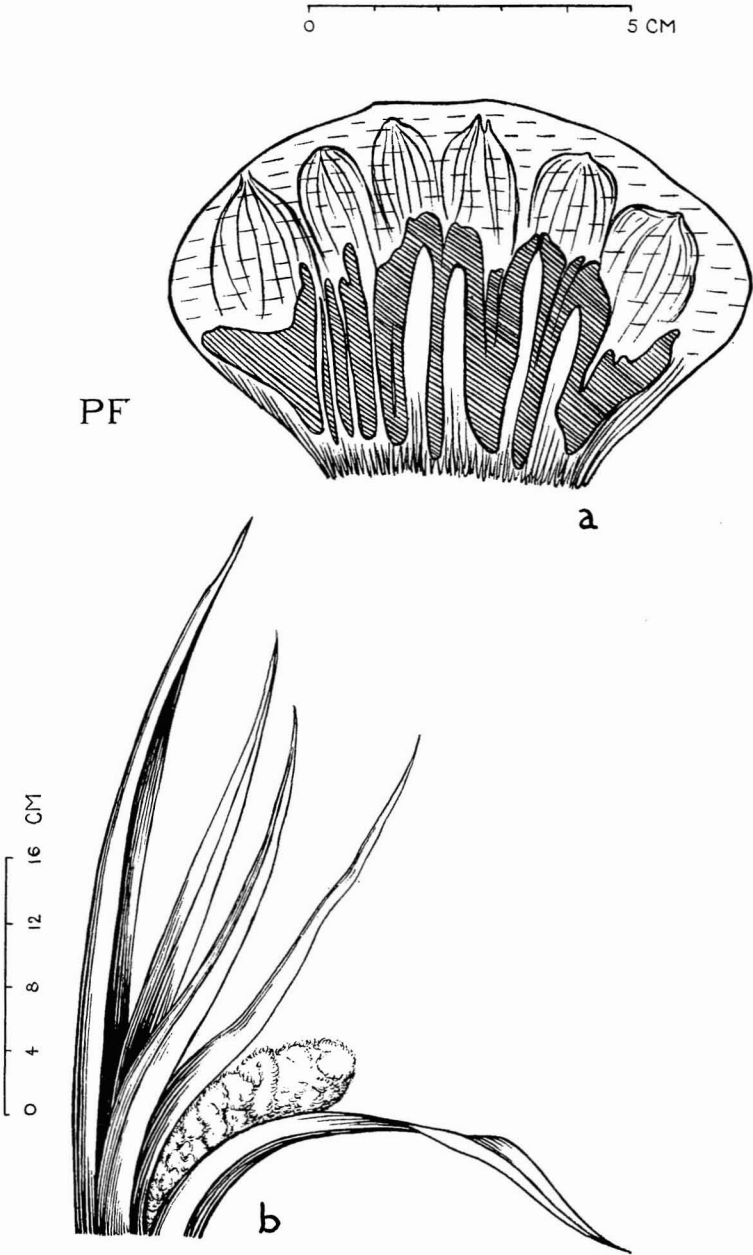


FIG. 268. *Pandanus spiralis* R. Br. *a*, Phalange, longitudinal median section of lectotype, $\times 1$; *b*, staminate inflorescence, from *Brown* 5,799, $\times \frac{1}{4}$.

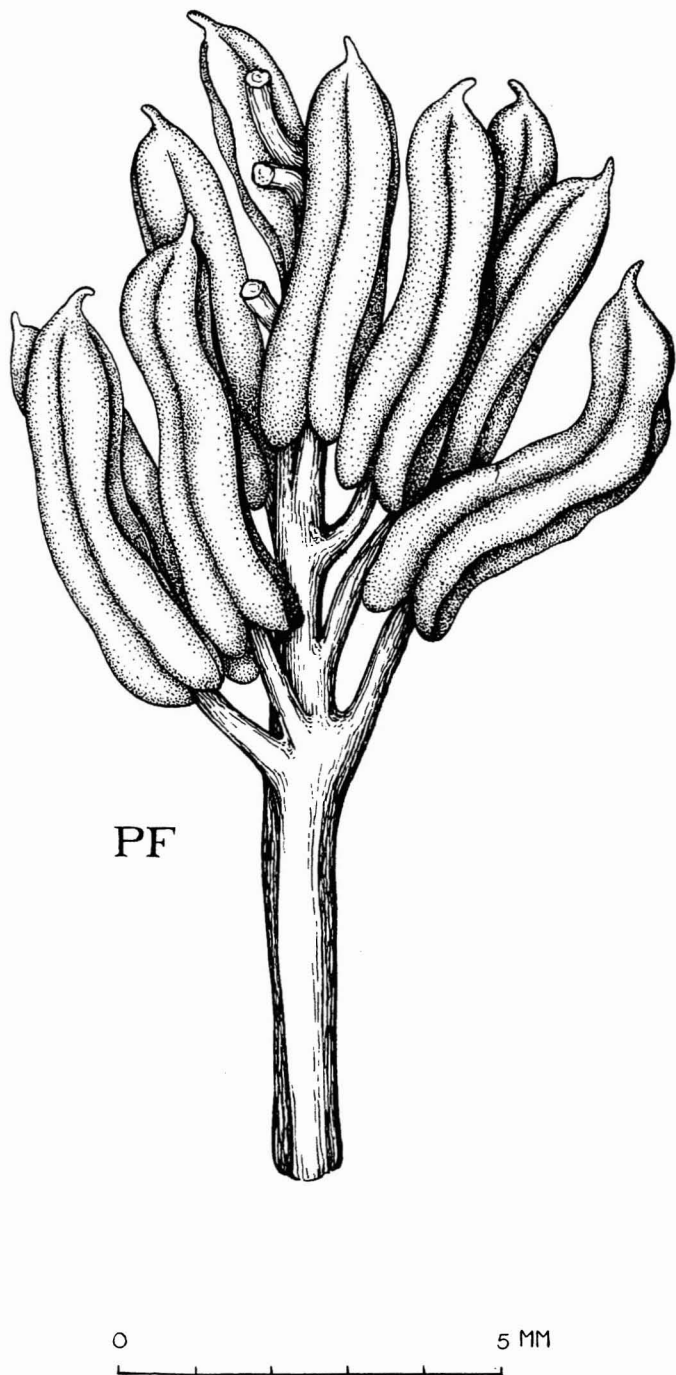


FIG. 269. *Pandanus spiralis* R. Br., from Brown 5,799. Staminate fascicle, $\times 10$.

anthers 4–5 mm long, 0.5 mm wide, almost linear, at apex bearing a subulate prolongation of the connective 0.3–0.4 mm long.

LECTOTYPE: *Iter Australiense*, 1802–5, *R. Brown* 5,799, the pistillate tessellate part (BM), but, as his manuscript reveals, this is more precisely: Gulf of Carpentaria, [Queensland, Wellesley Group of Islands], Island C [Allen I., Island Bay], Nov. 22, 1802, *R. Brown* 5,799, but only the two phalanges with broad tessellate apices (BM).

SPECIMENS EXAMINED: Australia, same data, the staminate inflorescence, *R. Brown* 5,799 (BM, K).

DISCUSSION: *P. spiralis* is a member of the section *Eydouxia*. It was one of the first two species discovered in Australia. Though remarkably distinct, it has had varied treatment, perhaps due to the brevity of the original description. Solms-Laubach (*Linnaea* 42:79, 1878) listed it with the Species Dubiae. Balfour (*Linn. Soc., J. Bot.* 17:56, 1880=1878) made it a synonym of *P. odoratissimus* L. f., as did Warburg (*Pflanzenreich* IV, 9:46, 1900, and Benth & von Mueller (*Fl. Austral.* 7:149, 1878). It was reestablished by Martelli (*Webbia* 4(1):31, 90, 94, 1913; 4(2):t. 13, fig. 1–2, 1914).

Various more recent collections from more or less distant localities have been identified as *P. spiralis*, but all, it seems, incorrectly so. S. T. Blake (*Austral. J. Bot.* 2:130, 1954) stated that Martelli's published illustration was drawn from Hulse's collection from Escape Cliffs. That was implied by the wording of Martelli's legend: "*P. spiralis*: Australia, Cliff. (H. M. ex H. Brit. Mus.)." However, the specimen referred to: Northern Territory, Escape Cliffs, *Hulls* [an error for *W. Hulse*], (MEL), has the phalanges 6.6–7.9 cm wide, has only 8–9 carpels, the central apical sinuses 1.5–3 mm deep, the apical mesocarp cavities 8–11 mm long, suborbicular; and the stigmas 4–5 mm long or wide. This specimen is now determined as *P. convexus* St. John (*Pacif. Sci.* 15:182–184, fig. 10, 1961) and is easily distinguishable from *P. spiralis*. Martelli's illustration of *P. spiralis* does not agree with the *Hulse* collection of *P. convexus*, but on the other hand it does exactly

agree with the broad, many carpeled, unlobed phalanges that are the lectotype of *P. spiralis* R. Br., and it is evident that Martelli really made the drawing from Brown's type. Apparently there are no subsequent collections of *Pandanus* from the Wellesley Islands in the Gulf of Carpentaria.

Martelli's illustration of *P. spiralis* (*Webbia* 4(1):t. 13, fig. 1–2, 1913) showed as Figure 1 an oblique lateral view of a phalange exactly like the larger of the two still in the British Museum of Natural History. His Figure 2 shows a median longitudinal section of a similar phalange. This halved phalange was not found in 1963 in the London herbarium material.

Brown's collection of fruiting *P. spiralis*, still in the British Museum, is a mixture. Besides the lectotype, discussed above, it also contained fruits of a very different species which will be described as *P. Brownii* St. John.

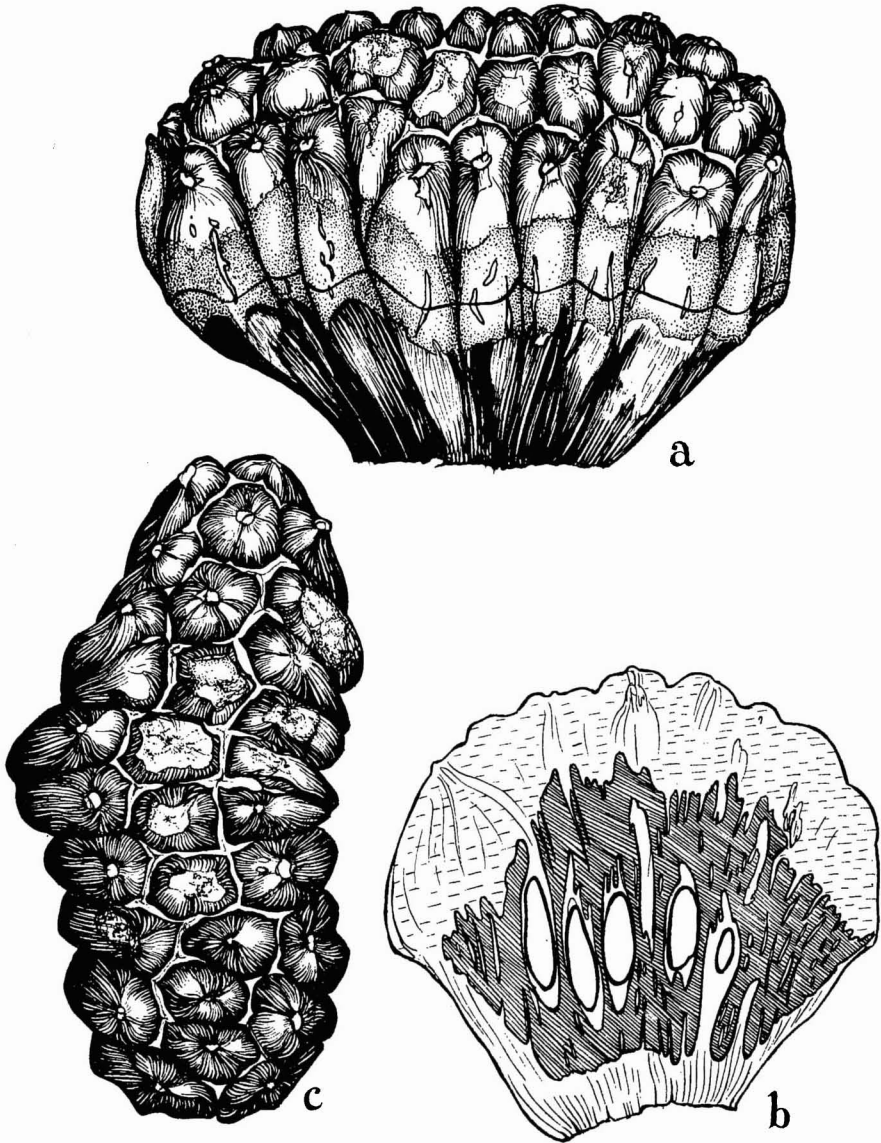
Section *Pandanus*

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

Fig. 270

DIAGNOSIS HOLOTYPE: Solum 2 phalanges, eis 5.9–6.2 cm longis 7.2–8.8 cm latis 4.5–4.7 cm crassis anguste vel late flabellatis compressis cum 6 angulis majoribus et carpelis omnibus in fuga salientibus et aliquis cum 2–3 fugibus longitudinalibus brevibus et valleculis solum in medio lateribus laevibus lucidis curvatis parte $\frac{1}{2}$ supera libera apice rotundato suturis lateralibus omnibus profundis et prominentibus et aliquis in basi extensis, sinibus apicalibus centralibus 3–4 mm profundis in centro V-formatis subrectis deinde recurvatis, carpelis 19–29 plerumque in 3 seriebus eis centralibus oblate pyramidalis-semiorbicularibus illis marginalibus cum stigmatibus in margine apparentibus et cum regione lato concavo subverticali distali, sinibus proximalibus $\frac{1}{2}$ – $\frac{2}{3}$ ad fondam extensis, stigmatibus 2–3 mm latis reniformibus plerumque prostratis eis centralibus horizontalibus illis marginalibus extraobtusis, endocarpio solido 4 cm longo paene submediali osseoso obscure mahoganicolorato lateribus lateralibus 10–11 mm crassis intra circum-striatis lucidis, seminibus 15–18 mm longis ellipsoideis, mesocarpio apicali medullosa denso cum fibris longitudinalibus, sed non in sectionibus partitis, mesocarpio basali parvo fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: It consists of 2 phalanges only; phalanges 5.9–6.2 cm long, 7.2–8.8 cm wide, 4.5–4.7 cm thick, narrowly to broadly fan-shaped in outline, compressed, with 6 major angles and each carpel salient and



P.F.

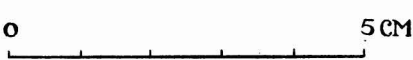


FIG. 270. *Pandanus Brownii* St. John, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$.

forming another ridge and some of the carpels with 2-3 short longitudinal ridges and valleys only at midsection, the sides smooth, shining, curving, upper $\frac{1}{2}$ free, apex rounded, all lateral sutures deep and prominent and several of them extending to the very base; central apical sinuses 3-4 mm deep, V-shaped at center, then recurving, nearly straight; carpels 19-29, mostly in 3 rows, the central ones oblate pyramidal-semiorbicular, the marginal ones with the stigmas appearing marginal and with a broad concave, nearly vertical surface where the outer side reaches the stigma, and a few of the carpels with the stigma slightly remote from the margin which bears a small distal concavity; proximal sinus running $\frac{1}{2}$ - $\frac{2}{3}$ way to valley bottom; stigmas 2-3 mm wide, reniform, mostly flush, the central ones horizontal, the marginal ones flush but facing outward; endocarp massive, 4 cm long, slightly submedian, bony, dark mahogany-colored, the lateral walls 10-11 mm thick, the inner surfaces striate ringed, shining; seeds 15-18 mm long, ellipsoid; apical mesocarp of dense pith, traversed by longitudinal fibers, but not forming perceptible carpelary cavities or structures; basal mesocarp scant, fibrous and fleshy.

HOLOTYPE: Australia, Iter Australiense, 1802-5, R. Brown (BM).

DISCUSSION: *P. Brownii* is a member of the section *Pandanus*, as is the most similar species, *P. Delessertii* Warb., a species known only from the type collection, published by Gaudichaud without description as *Eydouxia Delessertii* and said to come from Bourbon Island. No one has found it there since, and the detailed and careful monograph of the Mascarene species by Vaughan and Wiehe discredits it, and leads us to believe that the species is native elsewhere. It has 19 carpels in 3 rows in the fan-shaped phalange, 4.2 cm long, 6.5 cm wide, 4 cm thick, compressed, flabellate in outline; central apical sinuses little more than creases 0-1 mm deep; stigmas 4-6 mm long, cordate shield-shaped, and all that still remain are obtuse (none acute as shown in Gaudichaud's pl. 18, fig. 7-8). The holotype (P) consists of a single phalange. *P. Brownii* differs in having the phalanges of 19-29 carpels, 5.9-6.2 cm long, 7.2-8.8 cm wide, 4.5-4.7 cm thick; central

apical sinuses 3-4 mm deep, V-shaped; stigmas 2-3 mm wide, reniform. Species of this general type are known only from Australia; so it is concluded that *P. Delessertii* Warb. is probably an Australian species of which Gaudichaud obtained the specimen from some other botanist.

The holotype of *P. Brownii* was mixed with the lectotype of *P. spiralis* R. Br., from Allen Island, Wellesley Group, Gulf of Carpentaria, Queensland, Australia. The type collections of both of Brown's two new species, *P. spiralis* and *P. pedunculatus*, contain mixtures of other species. It appears that either he or his successors who accessioned his herbarium considered each a variable species and added to the boxes other loose fruits which they considered similar. There is no implication that this new species and *P. spiralis* were collected at the same locality. In his manuscript (British Museum) he also has a description of a species from Endeavour Straits, which he called *P. odoratisimus* L. f., but no separate specimen of this is now found in his herbarium in London. There is such a specimen of Brown's collecting now in Edinburgh. It is labeled "*Pandanus odoratisimus* ? North Coast." It is a good staminate inflorescence of a species in the section *Pandanus*, but it cannot be more precisely identified.

Pandanus pedunculatus R. Br., Prodr. Fl. Nov. Holl. 341, 1810 (sect. *Pandanus*).

Fig. 271

EXPANDED DIAGNOSIS OF LECTOTYPE: "Tree 4-5.3 m tall; trunk erect, 1.3-2.6 m tall, below the middle bearing at an acute angle, prop roots that are terete, roughened by remote, small tubercles; branches divaricate, sometimes reclining; leaves in terminal, loose fascicles, broad sword-shaped, above green, below glaucous, striate with fine but prominent veins, the margins ascending denticulate almost to the base, the keel retrorsely roughened scarcely up to the point $\frac{1}{3}$ from the apex; syncarp solitary, terminal, pedunculate, nodding, ovate-globose, of the size of a human head or somewhat more elongate, bearing numerous compact phalanges," (this much extracted from Brown's manuscript); phalange 7.6 cm long, 4.7 cm wide, 3.9 cm thick, pyriform, 4-angled, the sides gently convex, smooth, shining, of the 7 lateral sutures 5 are sealed but 2 are narrow and

evident to the base of the free part of the phalange; carpels "9–11," but 10 on the single lectotype, their apices ovoid, the marginal ones with a small, oblique, deep, concave platform; central apical sinuses 4–5 mm deep, straight, V-shaped; stigmas 1–2 mm wide, elliptic to reniform, centripetal, very oblique, brown, papillose; proximal sinus a short slit, running $\frac{1}{6}$ – $\frac{1}{4}$ way to valley bottom; endocarp apparently suprmedian, but the single phalange was not cut for examination.

LECTOTYPE: Australia, "(T.) v. v.," and his manuscript adds: Sandy Cape, Hervey's Bay, [north end of Great Sandy I., Queensland], July 31, 1802, *R. Brown* 5,799A, the phalange 7.6 cm long, with ovoid carpel apices (BM).

DISCUSSION: *P. pedunculatus* is a member of the section *Pandanus*, though Brown's first identification of it was as *P. odoratissimus* L. f. His manuscript, obviously written in the field, since he recorded, "lect: July 31: descr. Augt. 3," is of 23 lines and is reasonably detailed, but his published diagnosis was of 12 words, of which 8 were descriptive. Of these the only significant ones were "phalangibus 8-18-locularibus : apice conico-lobato; . . ." The species was accepted and given a vague, generalized description by Bentham & von Mueller (Fl. Austral. 7:149, 1878). It was likewise accepted by I. B. Balfour (1878), Warburg (1900), and Martelli (1913). The latter (Webbia 4(1):t. 1, fig. 1–7, 1913) extended the range from Australia to the Loyalty Islands, the Solomon Islands, and the Bismarck Islands, and illustrated the fruits from each area. Each has a different and distinctive appearance. The Australian one was actually drawn, not from Brown's type, though he had studied the British Museum collections, but from a specimen collected by F. von Mueller, labeled merely "Australia." This, as represented in Martelli's herbarium, is a single phalange 5.7 cm long, 4.9 cm wide, broadly obovoid, the scarcely convex apex nearly as wide as the middle; carpels 25 and their apices mostly conic, but a few outer ones ovoid-conic, the central apical sinuses 5–7 mm deep. The present writer does not consider it conspecific with *P. pedunculatus*, nor should it be used as a standard to represent that species. It is here redetermined as *P. Blakei*

St. John. The three collections cited by Martelli from Melanesia are also extraneous, but do not need a detailed discussion here.

Martelli's classification of members of the large and difficult section *Pandanus* fluctuated from his early view that it contained only a widely dispersed littoral species which could not be called *P. odoratissimus* L. f., as that name must be used for an aggregate species; to the view that there were many separate species; to the view that there was one major species, *P. tectorius*, under which many varieties could be recognized; to the view that this should be called *P. odoratissimus* L. f.; and then to reverse swings to one of his previous views. Martelli never printed any general key to the species or taxa he accepted. He long studied *Pandanus* and published on it over a span of 30 years, and his work was good, but in it there are certain inconsistencies. As regards *P. pedunculatus*, the writer finds it to be exclusively Australian, and he has not seen any more recent collections to match the type, and no one has taken it again from the type locality.

Bentham wrote (Fl. Austral. 7:149, 1878), "I found no specimen in Brown's Herbarium, . . ." but he did find one without label which he identified as *P. odoratissimus* L. f. The printed label form for Brown's collections was prepared, and collection (or species) numbers were assigned, by J. J. Bennett when he accessioned the herbarium into the British Museum. Hence, it is likely that the specimen here accepted as the type of *P. pedunculatus* was the one which Bentham had called *P. odoratissimus*.

The collection *Brown* 5,799A is of three phalanges. First, the one just described and here made the lectotype. Second, a phalange 4.7 cm long, 5 cm wide, 4 cm thick, subglobose, broad-based; carpels 10, their apices oblate pyramidal and the marginal ones with a small, concave distal platform; central apical sinuses 2–3 mm deep, and the valleys very wide V-shaped. Third, is a transverse median section 1 cm thick of a phalange with 14 carpels which seems to be identical with no. 2. These last two are surely different from the lectotype, and do not agree with the details of Brown's diagnosis, "phalangibus . . . apice conico-lobato; basi subangustata." Hence, they are here excluded. They may represent Brown's collection from En-

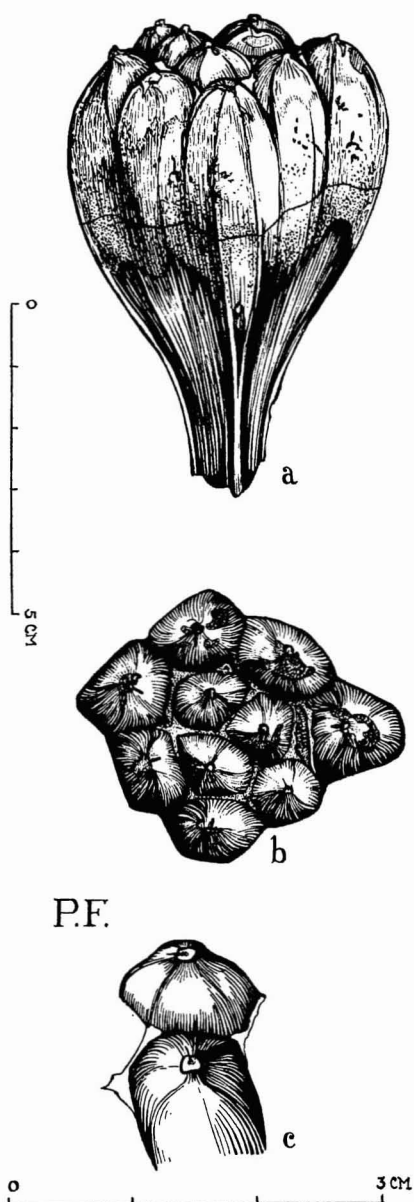


FIG. 271. *Pandanus pedunculatus* R. Br., from lectotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, apical view, $\times 1$; *c*, carpel apices and stigmas, oblique view, $\times 2$.

deavour Strait, Island C, Oct. 30, 1802, which he included in his unpublished manuscript as *P. odoratissimus* L. f., and described with equal detail, but did not publish or list. In the Kew Herbarium there is a sheet with a staminate inflorescence, marked, "ex Herb. R. Brown," and an old label with, "New Holland, North Coast." Since its staminate columns are shorter

and the spikes narrower, it does not seem to represent Brown's *P. spiralis* from the Wellesley Islands, Gulf of Carpentaria, or *P. pedunculatus* from Sandy Cape on the east coast. It may be what he called *P. odoratissimus* from Endeavour Strait. There is no fruiting collection paired with this, and so it must be left undetermined.

Now we return to the consideration of the

mixed collection representing Brown's *P. pedunculatus*. It is possible that, when Brown consolidated his small study set, kept apart while on the expedition, with the ones shipped to London in casks, or when Bennett later sorted

and labeled the specimens, the shorter, broad-based phalanges were dumped in the box with the lectotype of *P. pedunculatus*. In any case, they are different, and are here excluded, as not tallying with the diagnosis of that species.