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Objekttyp: **Article**

Zeitschrift: **Bulletin de la Société Neuchâteloise des Sciences Naturelles**

Band (Jahr): **121 (1998)**

PDF erstellt am: **16.08.2024**

Persistenter Link: https://doi.org/10.5169/seals-89508

THE GENUS *PANDANUS* (PANDANACEAE) IN MADAGASCAR (PART 2)

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Mots-clés: Afrique, Madagascar, *Pandanus* sect. *Foullioya*, Pandanacées, Taxonomie

Key-Words: Africa, Madagascar, *Pandanus* sect. *Foullioya*, Pandanaceae, Taxonomy

Résumé

Deux espèces nouvelles de *Pandanus* de Madagascar appartenant à la sect. *Foullioya* (*P. barbellatus* Huynh, *P. sylvicola* Huynh), et une sous-section nouvelle de cette section (subsect. *Barbellati* Huynh), sont décrites. Une clé des espèces actuellement connues de la section est proposée.

Summary

Two new species of *Pandanus* from Madagascar of sect. *Foullioya* (*P. barbellatus* Huynh, *P. sylvicola* Huynh), and a new subsection of this section (subsect. *Barbellati* Huynh), are described. A key to the species of the section known at present is tentatively proposed.

Zusammenfassung

Zwei neue *Pandanus*-Arten aus Madagaskar von Sektion *Foullioya* (*P. barbellatus* Huynh, *P. sylvicola* Huynh), und eine neue Subsektion dieser Sektion (subsect. *Barbellati* Huynh), werden beschrieben. Ein Schlüssel zur Bestimmung der gegenwärtig bekannten Arten der Sektion wird vorgeschlagen.

INTRODUCTION

Pandanus sect. *Foullioya* is endemic to Madagascar. It is characterized by unilocular drupes with a stigma deeply divided into two lobes. The type species, *P. pygmaeus* Thouars, has been known since 1808. It is very characteristic with its low shrubby habit (about 1 m high), its short and narrow leaves (30-40 x 0.6-0.9 cm), and its infructescence with 4-5 small syncarps. It is widespread in the South-eastern part of Madagascar where it forms dense thickets along streams, and was therefore the most collected of the section. However, for a century and a half after it was described, no other species were found in the section.

In 1951 four other species were added to the section: *P. bilamellatus* Martelli, *P. longecuspidatus* Pic. Serm., *P. malgassicus* Pic. Serm., and *P. pseudocollinus* Pic. Serm., described in MARTELLI & PICHI-SERMOLLI (1951). *P. bilamellatus* showed that the infructes-

cence of the section may have up to 8 syncarps, while *P. longecuspidatus* and *P. pseudocollinus* showed that its distribution also includes the North-eastern part of Madagascar, thus extending almost from the North to the South of the island. Nevertheless, no species has been found in the Western part. *P. boivinii* Solms, from Nosy Be, for which only staminate plant was known, was later tentatively placed in the section by STONE (1970: 592). Although efforts have been and will be made to hunt for its pistillate plant, it is doubtful that this species still exists.

In the course of the present study, two other species were found, also in the Eastern part, increasing the number of species of sect. *Foullioya* to seven. One of the new species is so peculiar as to form a new subsection. The new species and the new subsection are described below.

OBSERVATIONS

1. Tentative key to the species of sect. *Foullioya*

1. Terminal syncarp of infructescence oblong ovoid, 8 x 5.5 cm, 3-angled, divided laterally into costal and intercostal faces (costal faces composed of broad and divergent drupes; intercostal faces, of broad and divergent drupes in the peripheral part but of narrow and convergent drupes in the central part). Stigma lobes strongly recurved so as to be face to face with one another at the drupe backside. Leaves 130-140 cm long

Subsect. *Barbellati*
P. barbellatus

- Terminal syncarp of infructescence globose/subglobose, at most 2-3 cm in diameter, not divided laterally into costal and intercostal faces. Stigma lobes not recurved so as to be face to face with one another at the drupe backside. Leaves 30-60 cm long

Subsect. *Foullioya* 2

2. Leaf apex abruptly attenuate, cuspidate/subcuspidate 3

- Leaf apex gradually attenuate, not cuspidate/subcuspidate 5

3. Pileus 2/3 of the total length of the drupe. Leaf margins with remote prickles in the upper part

P. pseudocollinus

- Pileus 1/4-1/3 of the total length of the drupe. Leaf margins with close prickles in the upper part 4

4. Leaves chartaceous, 30-40 cm long. Drupes 25-30 per syncarp; endocarp globose; lower mesocarp occupying the lower third of the drupe

P. longecuspidatus

- Leaves coriaceous, 55-60 cm long. Drupes 70 per syncarp; endocarp clavate; lower mesocarp nil

P. sylvicola

5. Syncarps 8 per infructescence

P. bilamellatus

- Syncarps 4-5 per infructescence 6

6. Leaves 50 x 1.2 cm; lower marginal prickles close, 2 (- 3) mm apart

P. malgassicus

- Leaves 30-40 x 0.6-0.9 cm; lower marginal prickles remote, 5-9 mm apart

P. pygmaeus

2. *Pandanus sylvicola* Huynh, sp. nov. (sect. *Foullioya*)

Folia 55-60 cm longa 2.3-2.5 cm lata in parte supera, 1.6 cm lata prope basim, in 2/10 superis abrupte attenuata, subcuspidata, 3-4 cm caudata, tertia infera deorsum versus sensim attenuata, basi amplexicaulia; in sicco coriacea, brunnea/brun-

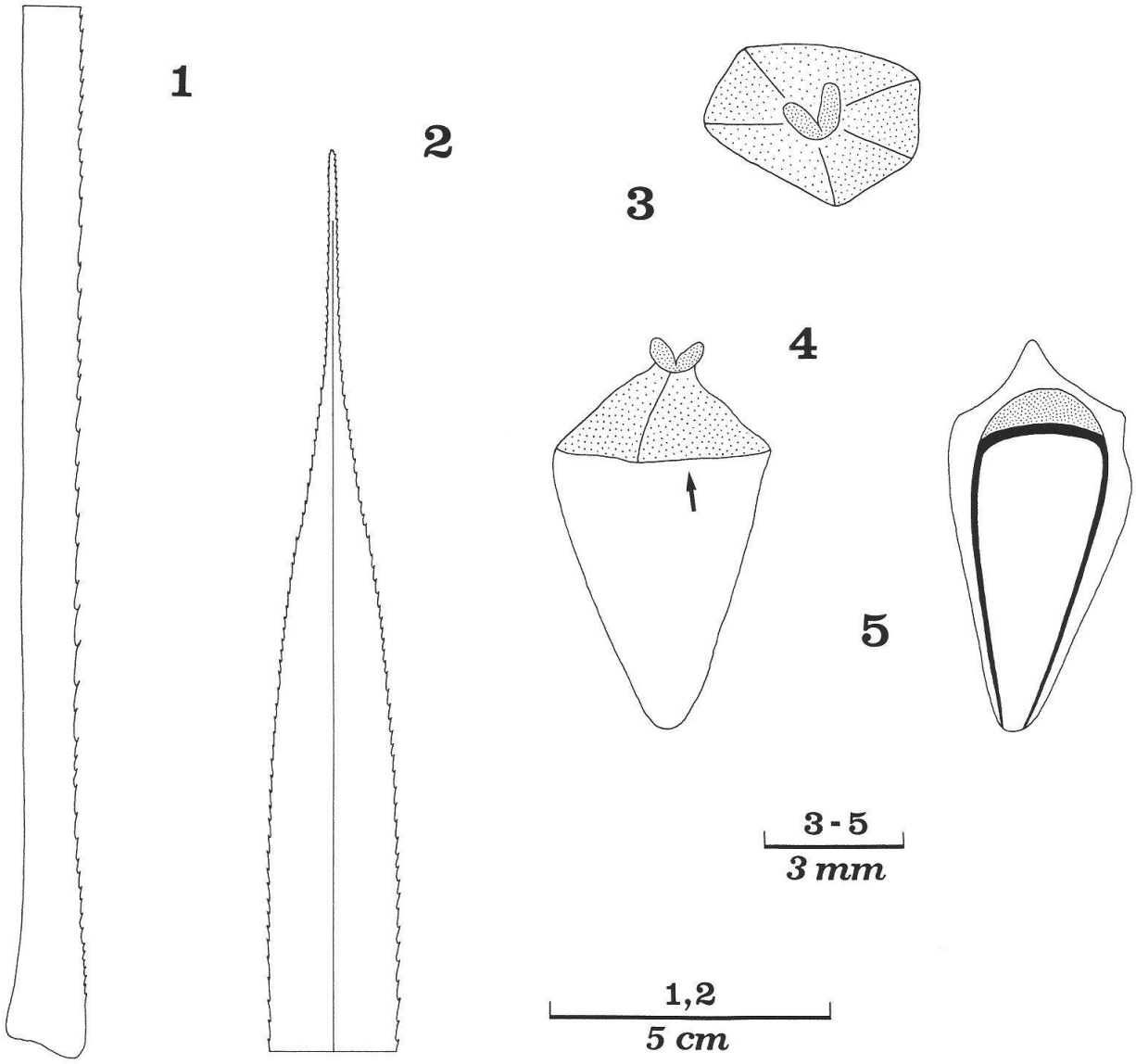
neola, e basi laminae ad basim caudae fortiter revoluta; plicis subdistinctis, inermibus; venis longitudinalibus distinctis in ambabus paginis sed transversalibus invisibilibus, interdum obscuris in pagina abaxiali; denticulis marginalibus e circa 1 cm supra basim ad apicem praesentibus, omnibus antrorsis, albidis interdum brunneis in apice, in tertia infera minutis densiusculis deinde ad 1.5-2 mm longis 7-8 mm inter se separatis sursum versus ad apicem omnibus minutis, in media ad 4-5 mm inter se separatis, in supera inferne ad 3-4 mm inter se separatis superne densis; denticulis costalibus praesentibus in tertia supera solum, omnibus minutis plerumque magis distantibus quam marginalibus proximis; vagina circa 1 cm longa 2.5 cm lata, basim versus leviter expansa, pagina abaxiali dense longitudinaliter venata, adaxiali inferne dense longitudinaliter venata superne laevi nitidaque. Infructescentia 6-syncarpica; syncarpiis racemosis, sessilibus, globosis vel subglobosis, mediis grandissimis 2 cm longis 1.8 cm latis circa 70 drupis compositis; pedunculo 8.5 cm longo 6 mm lato, acute triquetro, dense longitudinaliter nervato. Basi infructescentiae ad apicem: bractea 14-15 cm longa 1.4 cm lata, syncarpium infimum sustinens, naviculare, 3-4 cm caudata; deinde 8 cm longa 1.6 cm lata, naviculare, 2-3 cm caudata; 6 cm longa 2.4 cm lata, naviculare, vix caudata; 4.5 cm longa 2 cm lata, naviculare, non caudata; 3 cm longa 1 cm lata, naviculare, non caudata; postremo paulo brevior angustiorque, naviculare, non caudata; margines omnes tote armati, costae mediae ± similiter armatae. Drupae ad 9 mm longae 4-5 mm latae 3-4 mm crassae, in 1/3-1/4 supera liberae; pileo late pyramidali, 2-3 mm alto, partem liberam tote obtegenti; stigmate unico, bilobato, lobis divergentibus, verticalibus vel obliquis, vel horizontalibus cum superficiebus papillatis expositis; endocarpio tenuissimo praecipue in partibus lateralibus, usque ad basim extenso, apice plano circiter 1/5 supera locato; mesocarpio supero semi-lunato, circa 0.8 mm alto, medulloso, intra fibris destituto; loculo seminali clavato, 6.5 mm longo 2.5 mm lato; mesocarpio infero nullo. (fig. 1-6).

Type: *Cremers 2121* (holo MO!); Madagascar, in forest between Foulpointe and Andondabe, 12 May 1972.

Foulpointe, now Mahavelona, is at about 17°41'S 49°31'E; Andondabe, 17°46'S 49°23'E.

P. sylvicola appears closest to *P. longecuspidatus*, from which it differs in the following characters. Its syncarps may have up to about 70 drupes; the pileus of its drupes is large pyramidal (fig. 4); its endocarp is clavate and its lower mesocarp nil (fig. 5); its leaves are coriaceous and 55-60 cm long. In *P. longecuspidatus*: the drupe number per syncarp does not exceed 25-30; the pileus is hemispheric; the endocarp is globose; the lower mesocarp occupies the lower third of the drupe; the leaves are chartaceous and 30-40 cm long (MARTELLI & PICHI-SERMOLLI, 1951: 107-108, fig. 18h). The leaves, also, are more abruptly attenuate in the upper part than those of *P. sylvicola* (compare fig. 18f in MARTELLI & PICHI-SERMOLLI, 1951, with fig. 2 in the present paper). Furthermore, *P. longecuspidatus* was found in the Antalaha region (14°54'S 50°17'E), while *P. sylvicola* was found much further south (between 17°41'S 49°31'E and 17°46'S 49°23'E). Given the endemism of *Pandanus* species in Madagascar, this remote distribution also suggests that *P. sylvicola* is distinct from *P. longecuspidatus*.

The infructescence of *P. sylvicola*, composed of small and globose/subglobose syncarps (fig. 6), is typical of sect. *Foullioya*, as seen in other species in the section (MARTELLI & PICHI-SERMOLLI, 1951: fig. 18). Its drupe with lower mesocarp nil (fig. 5) recalls that of *P. pseudocollinus* where the lower mesocarp is almost nil



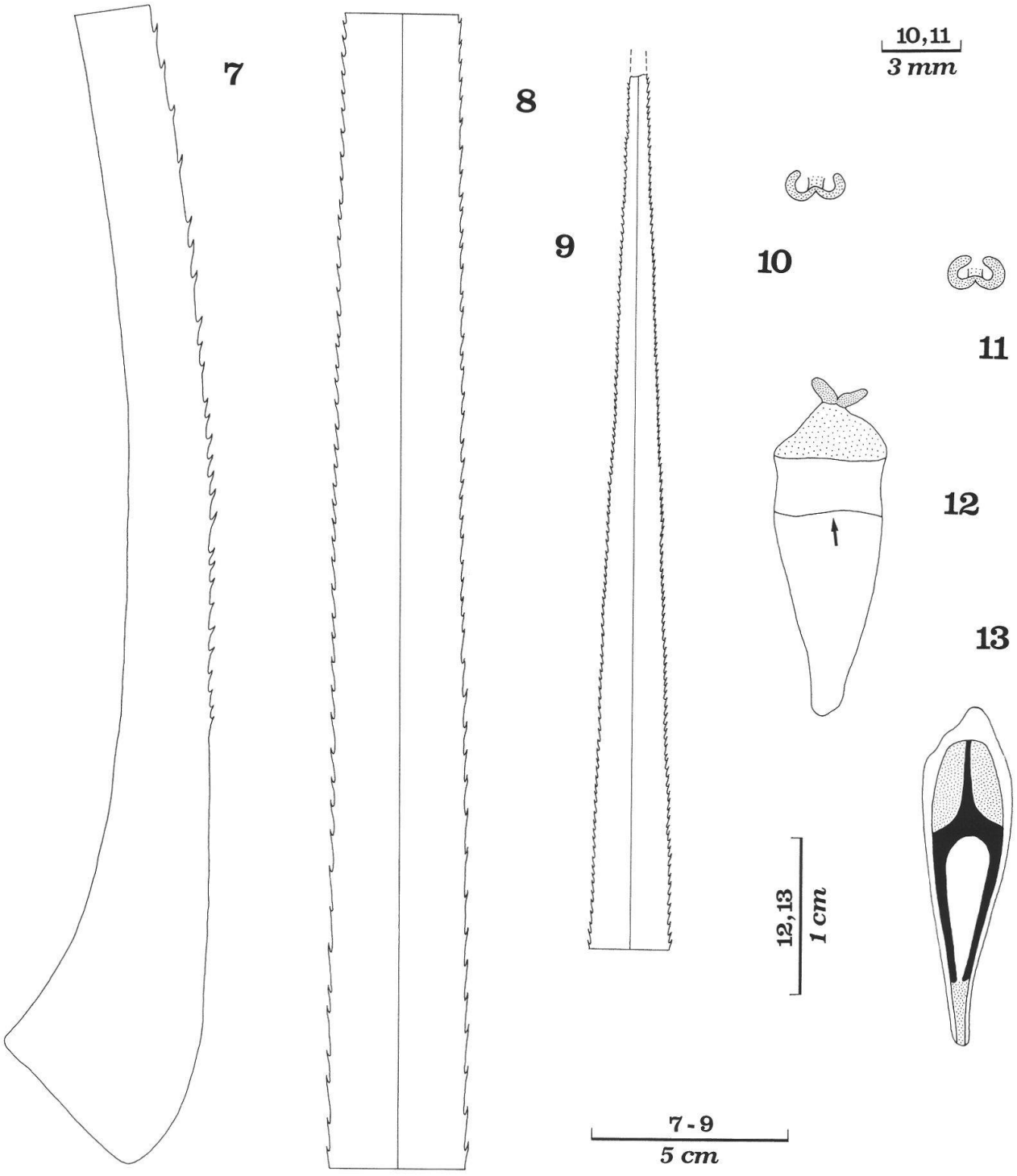
Figures 1-5: *Pandanus sylvicola* Huynh (*Cremers 2121*, holotype). --- **1**: Basal part of leaf viewed by abaxial face (one lateral half only shown). --- **2**: Apical part of leaf, flattened horizontally, viewed by adaxial face. --- **3, 4**: Drupes in apical view and lateral view respectively, showing stigma (densely dotted), pileus (sparsely dotted), and upper limit of connate part (arrow). --- **5**: Drupe in longitudinal section passing by stigma, showing endocarp (black) and upper mesocarp (dotted).

(MARTELLI & PICHI-SERMOLLI, 1951: 111, fig. 18r). In the drupe, the upper mesocarp is bordered by a layer of longitudinal fibres which extend from apex to base, thus also bordering the endocarp; however it does do not have fibres within.

Figure 6: *Pandanus sylvicola* Huynh (*Cremers 2121*, holotype). Infructescence (from the top downwards: the terminal syncarp, shown by the upper arrow, partially covered by bract; to the left, the third syncarp, almost entirely covered by bract; to the right, the fourth syncarp, the largest one visible; to the left, the fifth syncarp; to the right, the sixth syncarp, the lowermost; peduncle shown by the lower arrow; the second syncarp is invisible, superimposed by the terminal syncarp and the fourth syncarp). Scale bar = 2 cm.

3. *Pandanus barbellatus* Huynh, sp. nov. (sect. *Foullioya*)

Folia 135-140 cm longa 3.5 cm lata in medio 4 cm lata prope basim, in dimidio supero sensim attenuata, in sicco coriacea; plicis inermibus; venis longitudinalibus distinctis in pagina abaxiali, minus in adaxiali, transversalibus visibilibus in parte infera paginae adaxialis solum; denticulis marginalibus e circa 12 cm supra basim ad apicem praesentibus, stramineis sed apice brunneis, omnibus antrorsis, in tertia infera usque ad 4 mm longis 15 mm inter se separatis, in media 4 mm longis 10 mm inter se separatis, in supera 2-3 mm longis inferne 5 mm inter se separatis superne 2 mm vel minus; denticulis costalibus praesentibus in 2/3 superis solum, 1/3-1/2 brevioribus sed ± tam distantibus quam marginalibus proximis; vagina circa 9 cm lata in medio, ut videtur 5 cm longa, venis longitudinalibus partim visibilibus in ambabus paginis, transversalibus invisibilibus in pagina abaxiali partim visibilibus in adaxiali. Infructescentia 4-syncarpica; pedunculo ex parte conservato 1 cm crasso, perspicue triquetro, multi-canaliculato inter angulos, sparsim verrucato. Syncarpium terminale grandissimum, oblongo ovoideum, 8 cm longum 5.5 cm latum, circa 600 drupis praeditum, triquetrum; superficiebus costalibus drupis latis divergentibus compositis, intercostalibus drupis latis divergentibus in parte peripherica sed angustis convergentibus in centrali; bractea circa 6 cm longa 2.5 cm lata, naviculari, leviter acuminate, marginibus fere e basi ad apicem armatis, costa media apice in brevissimo spatio solum armata. Syncarpia infera leviter ovoidea, 5.5-6 cm longa 4-4.5 cm lata, sessilia. Drupae syncarpii terminalis longissimae, circa 22 mm longae 5 mm latae 4 mm crassae, in tertia supera liberae; pileo pyramidali, dimidium superum partis liberae obtegenti; stigmatibus unicis, raro 2, bilobatis, lobis fortiter recurvatis; endocarpio circa 15 mm



Figures 7-13: *Pandanus barbellatus* Huynh (*Malcomber 2655*, holotype). --- **7**: Basal part of leaf folded along midnerve, this on left (the vagina amputated of 2-3 cm). --- **8, 9**: Middle and apical part of the same leaf, flattened horizontally, viewed by adaxial face. --- **10, 11**: Two stigmas viewed from above (compare with stigmas in fig. 14). --- **12**: Drupe in lateral view, showing stigma (densely dotted), pileus (sparsely dotted), and upper limit of connate part (arrow). --- **13**: Drupe in longitudinal section passing by stigma, showing endocarp (black), upper and lower mesocarp (both dotted).

alto, 2 mm ab apice drupae distanti 4 mm a basi, ex apice loculi seminalis sursum versus sensim attenuato; loculo seminali 8-9 mm longo 3 mm lato, clavato, centro leviter inframediano; mesocarpio supero circa 6 mm alto, medulloso, intra fibris destituto, basi prope apicem loculi seminalis locato; mesocarpio infero 4 mm longo, non medulloso, intra fibris destituto. (fig. 7-14).

Type: *Malcomber 2655* (holo P!; iso MO!); Madagascar, NW of Tolanaro, Andohahela Réserve Intégrale, parcelle 2, 24°57'S 46°39'E, alt. 30 m, 24 December 1993; streamside tree 6 m tall, fruit green.

In the infructescence of *P. barbellatus*, the terminal syncarp has three costal faces and three intercostal faces; the latter faces are quite different in drupe width from the former faces, as described above; the narrowest drupes are located in the central part of the intercostal faces (fig. 14). The lower syncarps have smaller and fewer drupes; the difference in drupe width between the costal and intercostal faces is hardly visible. The second syncarp is 5.5 cm long and 4.5 cm wide, located at about 3.5 cm from the base of the terminal syncarp, separated from this by two internodes, the upper internode about 1 cm long, the lower internode 2.5 cm. The third syncarp, 6 cm long and 4 cm wide, is at about 1.5 cm from the base of the second syncarp, and is separated from it by one internode. The fourth syncarp, 6 cm long and 3.8 cm wide, is at about 2.5 cm from the base of the third syncarp, and is separated from it by two internodes, the upper internode about 2 cm long, the lower internode 0.5 cm.

In the drupe of *P. barbellatus*, the two mesocarps are bordered by a layer of longitudinal fibres which extend from apex to base. However they do not have fibres within. The layer also borders the endocarp.

P. barbellatus is named in reference to its stigma whose lobes are recurved (fig. 10 and 11) like a moustache.

With its infructescence, stigma, and leaves, *P. barbellatus* appears isolated in sect. *Foullioya*, and can therefore be easily recognized. The terminal syncarp of the infructescence is oblong ovoid, tri-angled, up to 8 cm long and 5.5 cm wide, and comprises a very large number of drupes (up to about 600). In lateral view, it shows six faces: three costal faces, composed of broad and divergent drupes; three intercostal faces, of broad and divergent drupes in the peripheral part, but of narrow and convergent drupes in the central part (fig. 14).

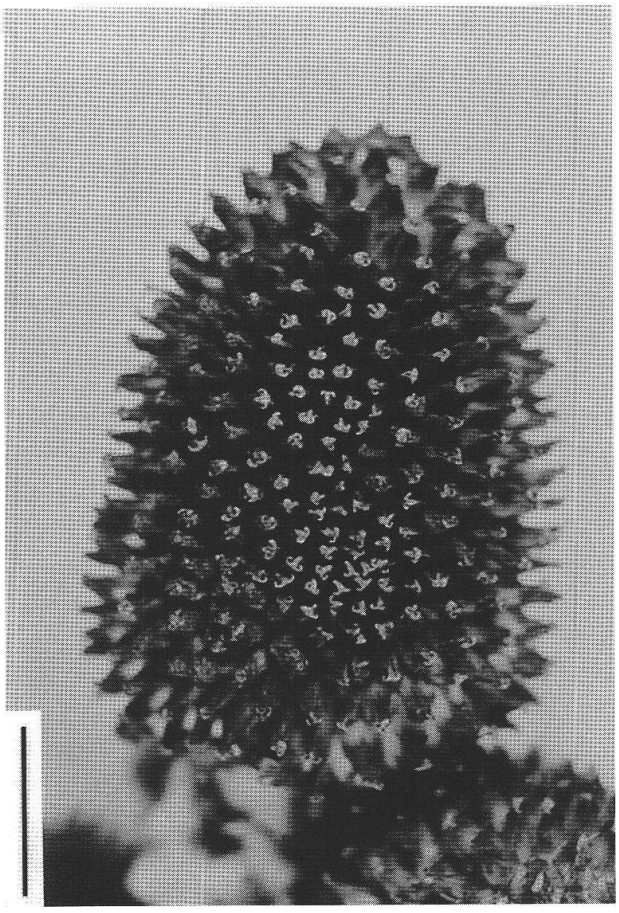


Figure 14: *Pandanus barbellatus* Huynh (*Malcomber 2655*, holotype). Terminal syncarp of a 4-syncarpic infructescence in lateral view, showing an intercostal face (compare stigmas in central part of the face with those in fig. 10 and 11). Scale bar = 2 cm.

This type of syncarp evokes that of sect. *Heterostigma*, another section of *Pandanus* in Madagascar: in this respect, *P. barbellatus* may constitute a phylogenetic link between these two sections. The stigma lobes are long and strongly recurved so as to be face to face with one another at the drupe backside (fig. 10 and 11), as can be seen on several drupe apices in the central part of fig. 14 (these are «white» points). The leaves are up to 140 cm. In the other species of the section, by contrast: the terminal syncarp is globose or subglobose, not tri-angled, at most 2-3 cm in diameter, not divided laterally into costal and intercostal faces, and comprises at most about 70 drupes; the stigma lobes are divergent (fig. 3) and may be slightly curved, but are not recurved like those of *P. barbellatus* (fig. 10 and 11); the leaves do not exceed 50-60 cm in length. With its unusual characters mentioned above, *P. barbellatus* strongly suggests a section of its own which is closest to sect. *Foullioya*. However, given its stigma deeply divided into two lobes, a characteristic to date considered proper to sect. *Foullioya*, *P. barbellatus* is maintained in this section as the type of a subsection, which is defined below:

4. *Pandanus* sect. *Foullioya* Warb. subsect. *Barbellati* Huynh, subsect. nov.

Stigma 2 lobis fortiter recurvatis profunde divisum. Syncarpium terminale oblongo ovoideum, triquetrum, magnum (circa 8 x 5.5 cm); superficiebus costalibus drupis latis divergentibus compositis, intercostalibus drupis latis divergentibus in parte peripherica sed angustis convergentibus in centrali; drupis numerosissimis (circa 600). Folium longum (circa 140 cm).

Type: *P. barbellatus* Huynh.

ACKNOWLEDGEMENTS

The author is deeply indebted to the Missouri Botanical Garden, St. Louis, and the Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris, for the loan of materials. Part of the Grant No. 31-45707.95 of the Swiss National Science Foundation was used.

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