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## THE GENUS *PANDANUS* (PANDANACEAE) IN MADAGASCAR (PART 5)

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

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

### Résumé

Une espèce nouvelle de *Pandanus* sect. *Acanthostyla* de Madagascar est décrite (*P. fetusus* Huynh). *P. petrosus* Martelli, une espèce obscure de cette section, est redécrite en utilisant son type. Une clé des espèces actuellement connues de la section est proposée.

### Summary

A new species of *Pandanus* sect. *Acanthostyla* from Madagascar is described (*P. fetusus* Huynh). *P. petrosus* Martelli, an obscure species of this section, is re-described using its type. A key to the species of the section known at present is tentatively proposed.

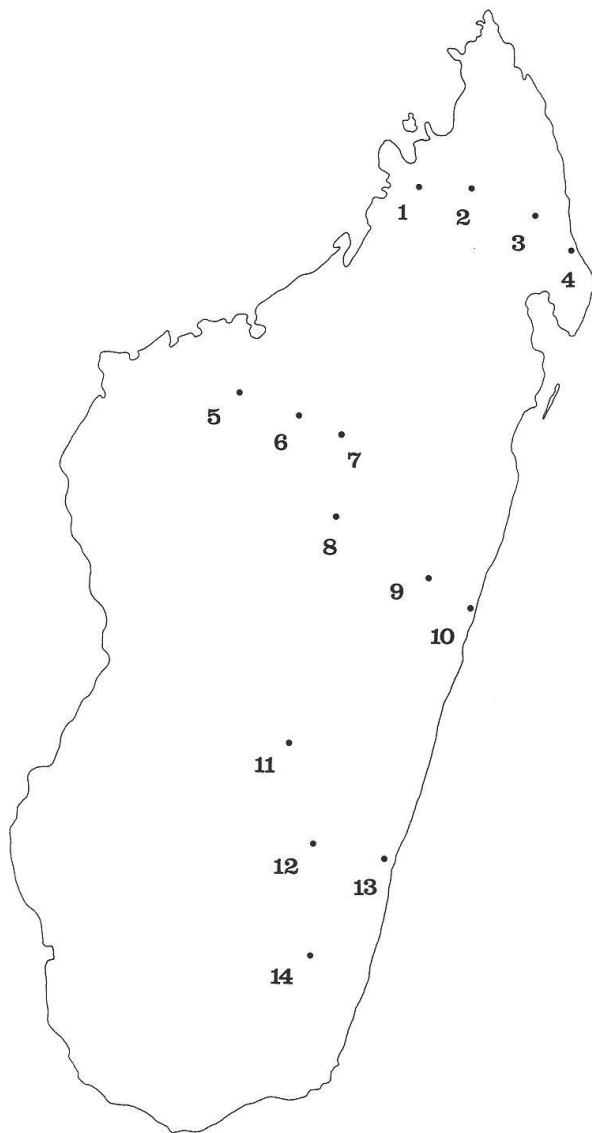
### Zusammenfassung

Eine neue Art *Pandanus* sect. *Acanthostyla* aus Madagaskar wird beschrieben (*P. fetusus* Huynh). *P. petrosus* Martelli, eine wenig bekannte Art dieser Sektion, wird auf der Basis ihres Typs wiederbeschrieben. Ein Schlüssel zur Bestimmung der gegenwärtig bekannten Arten der Sektion wird vorgeschlagen.

### INTRODUCTION

In the course of the present study of the genus *Pandanus* in Madagascar, five unknown species were found in sect. *Acanthostyla* four of which were described in a previous paper (HUYNH, 1999b). The present paper describes the fifth species and new data on *P. petrosus*, which was until

recently an obscure species in the section. In order to facilitate the recognition of these species and the others in sect. *Acanthostyla*, a key to the species of the section known at present will be tentatively proposed. A similar key was previously given by STONE (1970: 581): this was the first time that a key to the species of the section was proposed.



**Figure 1:** Distribution of *Pandanus* sect. *Acanthostyla*. - 1: *P. pluriaculeatus*. - 2: *P. alpestris*, *P. bathiei*, *P. pseudobathiei*. - 3: *P. alveolatus*, *P. tabellarius*. - 4: *P. columnaris*, *P. pluriloculatus*. - 5: *P. pulcher*. - 6: *P. petrosus*. - 7: *P. namaikiensis*. - 8: *P. fetusus*. - 9: *P. laxespicatus*. - 10: *P. comatus*. - 11: *P. acanthostylus*. - 12: *P. andringitrensis*. - 13: *P. longistylus*. - 14: *P. mangokensis*.

**Note:** the location of the species is based on that of their types; it is approximative for most of them.

A distribution map of sect. *Acanthostyla* (fig. 1) is also shown below. Given that most *Pandanus* species in Madagascar have a limited distribution (HUYNH, 1999a: 146), the map is useful in testing the identity of species in this section, in particular new species, by comparing them with the species that have been described from the same or close areas. For example, when *P. pluriaculeatus* (HUYNH, 1999b) was recognized for the first time, the fact that it was the only species of the section found in the Manongarivo massif area suggested that it would be an undescribed species. In order to test this supposition, *P. pluriaculeatus* was compared with the described species of the section that are closest in distribution (fig. 1), viz. *P. alpestris*, *P. bathiei* and *P. pseudobathiei* (Tsaratanana massif), *P. alveolatus* and *P. tabellarius* (Marojejy massif), *P. columnaris* and *P. pluriloculatus* (Antalaha). The comparison revealed that *P. pluriaculeatus* was distinct, since it has a monosyncarpic infructescence while these species have each a polysyncarpic infructescence, besides other differences. Therefore it was not surprising that a subsequent comparison with the other species in the other areas gave a similar result.

The distribution map (fig. 1) also shows that the northernmost species of the section in Madagascar are *P. pluriaculeatus*, *P. alpestris*, *P. bathiei*, *P. pseudobathiei*, *P. alveolatus*, *P. tabellarius*, *P. columnaris* and *P. pluriloculatus*, while *P. mangokensis* is the southernmost, and *P. pulcher* is the only species found in the western part. Thus, it would seem that almost half of the distribution area of the genus in the island has not been visited for collecting sect. *Acanthostyla* (compare fig. 1 in the present paper, with fig. 1 in HUYNH, 1999a), especially the western regions.

OBSERVATIONS	
<b>1. Tentative key to the species of sect. <i>Acanthostyla</i></b>	
1. Syncarps with 15-16 drupes. Styles 2.5-3 mm long. (Leaves 60 x 2 cm)	
<i>P. petrosus</i> Martelli	
1a. Syncarps with drupes at least twice as numerous. Styles longer .....	2
2. Syncarps spicate .....	3
2a. Syncarps solitary .....	18
3. Leaves 3-4 cm wide .....	4
3a. Leaves 1-2.5 cm wide .....	6
4. Style bases on the drupes always deeply separate from one another. Drupes 25 mm long. (Leaves 200 x 4 cm)	
..... <i>P. alpestris</i> Martelli	
4a. Style bases on the drupes never deeply separate from one another. Drupes 14-20 mm long .....	5
5. Drupes 14 x 5-10 mm. Syncarps subglobose, 5 x 4 cm. Stigmas mostly 2-3. (Leaves 140 x 3.5 cm)	
..... <i>P. fetusus</i> Huynh	
5a. Drupes 20 x 15-20 mm. Syncarps oblong/ovate, 8 x 4-5 cm. Stigmas mostly 4-5. (Leaves ... x 3 cm)	
..... <i>P. spinifer</i> Warb.	
6. Pileus tabular, plane convex .....	7
6a. Pileus pyramidal .....	12
7. Stigmas generally 1 or 2 .....	8
7a. Stigmas 3-7 .....	10
8. Leaf blade densely alveolate from the base to the apex at the adaxial face. Leaves abruptly attenuate in the upper part; pleats armed over c. 1 cm with only 1 or 2 prickles. (Leaves 110 x 1.7 cm)	
..... <i>P. alveolatus</i> Huynh	
8a. Leaf blade not so. Leaves gradually attenuate in the upper part; pleats armed over a long run with many more prickles	
.....	9
9. Terminal syncarp of the infructescence ovate; subsequent syncarp almost as large as the terminal syncarp, and with almost as many drupes. Stigmas 1, rarely 2. (Leaves 120 x 2 cm)	
..... <i>P. tabellarius</i> Huynh	
9a. Terminal syncarp of the infructescence subglobose; subsequent syncarp about half as large as the terminal syncarp, and with about half the number of drupes. Stigmas 1, frequently 2-3, sometimes 4. (Leaves 100 x 1.5 cm)	
..... <i>P. pseudobathiei</i> Pic. Serm.	
10. Drupes free by 1/3. (Leaves 120 x 2.2 cm) .....	<i>P. columnaris</i> St. John
10a. Drupes free by 1/6-1/7 .....	11
11. Infructescence with up to 8 syncarps. Syncarps 9 x 4.5 cm, oblong. (Leaves 100 x 1.5 cm) .....	<i>P. acanthostylus</i> Martelli

- 11a. Infructescence with up to 4 syncarps. Syncarps 9 x 6.5 cm, ellipsoid. (Leaves 83 x 1.6 cm) ..... *P. pluriloculatus* St. John
12. Stigmas mostly 1 ..... 13
- 12a. Stigmas 2-4 ..... 14
13. Infructescence with 4 syncarps. Drupes 17 x 8 mm. (Leaves 95 x 2.1 cm) ..... *P. andringitrensis* Huynh
- 13a. Infructescence with up to 8 syncarps. Drupes 13 x 4 mm. (Leaves 90 x 2.5 cm) ..... *P. sparganioides* Baker
14. Infructescence with 9 syncarps; lower syncarps pedicellate. Styles up to 10 mm long. (Leaves 140 x 1.5 cm) .... *P. longistylus* Martelli & Pic. Serm.
- 14a. Infructescence with 2-6 syncarps; lower syncarp(s) sessile. Styles shorter ..... 15
15. Syncarps 2.5 cm in diameter. Drupes 12-15 mm long. (Leaves 80 x 1.4 cm) ..... *P. mangokensis* Martelli
- 15a. Syncarps at least 4-4.5 cm in diameter. Drupes 20 mm long ..... 16
16. Infructescence with 2 syncarps. Stigmas mostly 2. (Leaves 65 x 1.4 cm) ..... *P. bathiei* Martelli
- 16a. Infructescence with 5-6 syncarps. Stigmas mostly 2-3 ..... 17
17. Pileus (without styles) 1/3-1/4 the height of the connate part. Leaves 2.5 cm wide. (Leaves 80 x 2.5 cm) ..... *P. pulcher* Martelli
- 17a. Pileus (without styles) 2/3 the height of the connate part. Leaves 1 cm wide. (Leaves 80 x 1 cm) ..... *P. namakiensis* Martelli
18. Syncarp 12 cm long. Drupes c. 37 mm long. (Leaves unknown) ..... *P. comatus* Martelli
- 18a. Syncarp 5-7 cm long. Drupes at most 25 mm long ..... 19
19. Leaves c. 30 cm long. (Leaves 30 x 1.3 cm) ..... *P. ceratophorus* Baker
- 19a. Leaves 65-100 cm long ..... 20
20. Leaves c. 65 cm long; pleats armed over 3-5 cm. Syncarp ovate. (Leaves 65 x 0.7 cm) .... *P. pluriaculeatus* Huynh
- 20a. Leaves c. 100 cm long; pleats armed over 19-20 cm. Syncarp oblong cylindrical. (Leaves 100 x 1.2 cm) ..... *P. laxespicatus* Martelli

**2. *Pandanus fetosus* Huynh, sp. nova (sect. *Acanthostyla*)**

Arbor. Folia infra infructescentiam c. 140 cm longa, 3.5 cm lata in medio 4 cm supra vaginam, e medio ad apicem sensim attenuata, c. 2 cm caudata, basi amplexicaulia; lamina in sicco perrigida coriacea, in medio revoluta; plicis inermibus; venis longitudinalibus perspicuis in pagina abaxiali minus in adaxiali; venis transversalibus utrinque invisibilibus; denticulis

marginalibus e c. 25 cm supra basim ad apicem praesentibus, antrorsis, in tertia infera ad 1 mm longis 4-5 mm inter se separatis, sursum versus creberrimis, brevioribus, superne vix visibilibus; denticulis costalibus praesentibus in circiter tertia supera, antrorsis, inferne minutis superne vix visibilibus vel obscuris; vagina c. 25 cm longa, 12 cm lata in basi 4 cm apice, e basi ad apicem sensim attenuata, utrinque nitida et partim leviterque nervata. Folia apicalia c. 7.5 cm lata (longitudine ignota), e medio ad apicem sensim attenuata, 3-4 cm caudata; plicis inermibus, visibilibus in parte supera. Infructescentia polysyncarpica; rhachidi inter syncarpium summum et infimum c. 15 cm longa, sinuosa; syncarpiis 8, racemosis, sessilibus, subglobosis vel breviter ellipticis, 4-5 cm longis, 4 cm latis, 2-3 cm inter se separatis, c. 80 drupis praeditis; pedunculo partim conservato in specimine, 13 cm longo, 2 cm crasso in apice, recto, trigono, obscure angulato, leviter porcato inter angulos. Drupae 12-14 mm longae (stylis non inclusis), 5-10 mm latae, 4-7 mm crassae, in 1/3 supera liberae; stigmatibus (1-) 2-3 (-4), linearibus, fere totam longitudinem styli percurrentibus; stylis spiniformibus, complanatis, 5-7 mm longis, leviter curvatis, interdum rectis vel valde arcuatis; pileo late subpyramidalis, truncato, acute angulato, interdum partim obscure angulato, non nitido, laevi, dimidium superum partis liberae obtegenti; endocarpio 12-13 mm alto in axe, apice prope basim stigmatum, basi ad basim drupae, partibus supra loculos seminales separatis, oblongo-deltaideis, c. 6 mm altis; loculis seminalibus oblongo-ellipticis, c. 6-7 x 2 mm, apice prope medium, basi ad basim drupae; mesocarpio supero subnullo in apice, distincto in partibus lateralibus, meduloso, fibroso; mesocarpio infero nullo. Fig. 2-4 & 7.

**Typus:** *Cremers 1818* (holo P!, iso P!); Madagascar, in swamps of the forest of Ambohitantely, East of PK 125 on the

route from Tananarive to Majunga, 5 September 1971; trunk orthotropic, rhythmically branched, infructescence terminal on lateral branches.

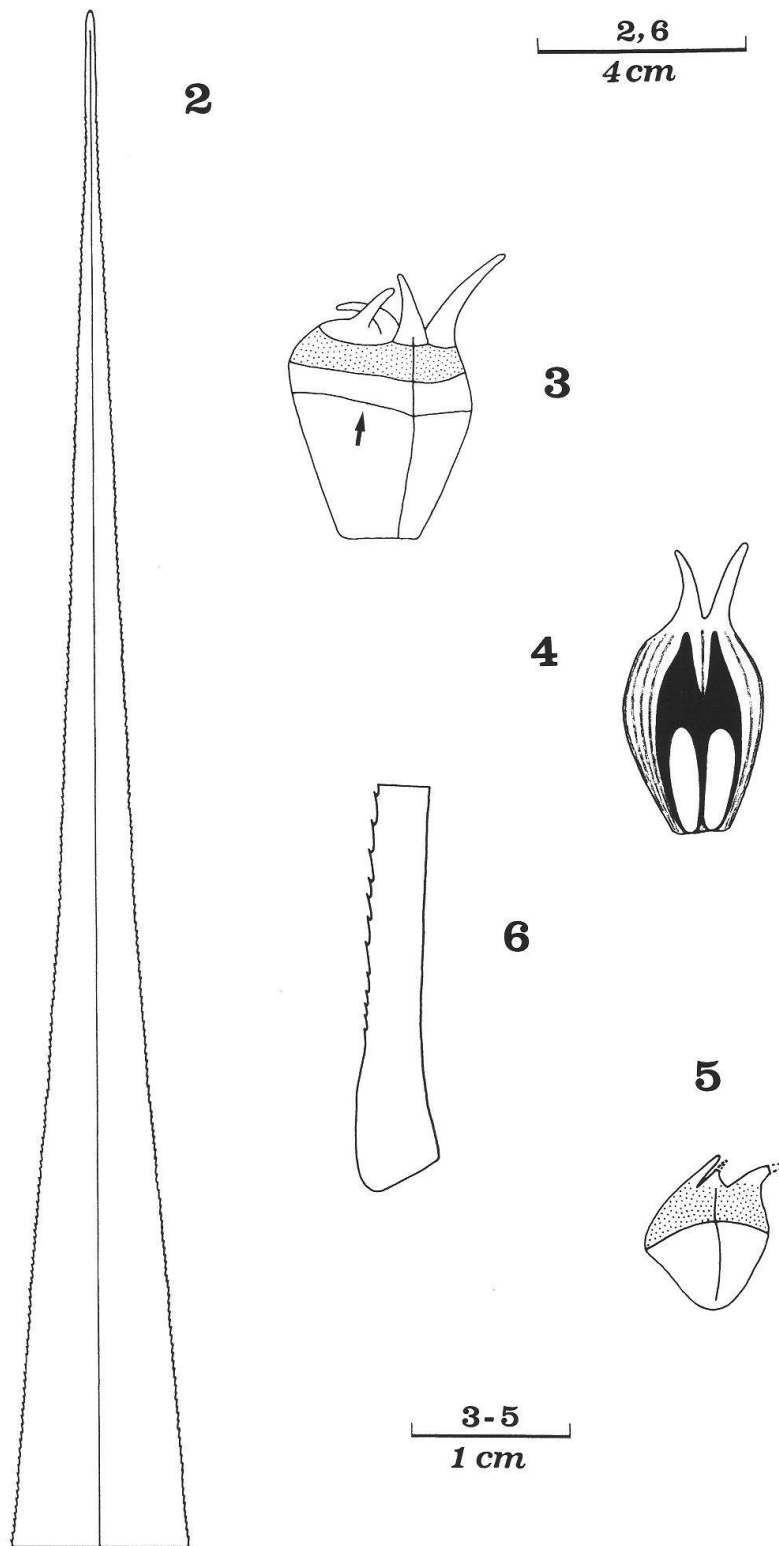
The Ambohitantely forest has its central position at c. 18°11'S 47°17'E.

*P. fetusus* is named in reference to its infructescence rich in syncarps. It is most remarkable in sect. *Acanthostyla* in that it has an infructescence with up to 8 syncarps (fig. 7), drupes with seed locules at the lowermost position (fig. 4), and leaves with unarmed pleats. All three features are rather uncommon in the section.

Apparently there are no species very closely related to *P. fetusus*. Considering its (infructescence) leaves which are 3.5 cm wide, it may be compared with *P. alpestris* (leaves 4 cm wide) and *P. spinifer* (leaves 3 cm wide). These three species have the broadest leaves in the section. Taking its distribution into account, *P. fetusus* may be compared with *P. namaikiensis* and *P. laxespicatus* which are the closest species in distribution (fig. 1). In either comparison, *P. fetusus* emerges as a distinct species (see under Tentative key to the species of sect. *Acanthostyla*).

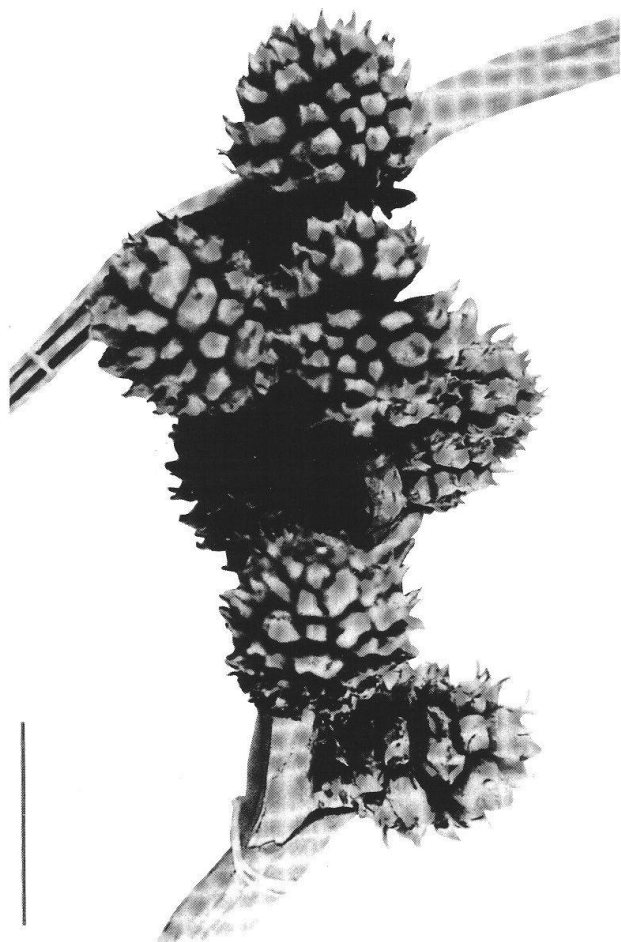
### 3. Further notes on *Pandanus petrosus*

*P. petrosus* was an obscure species by the fact that it had not been suitably described by Martelli (in MARTELLI & PICHISERMOLLI, 1951: 154). Actually, Martelli did not indicate the number of styles on the drupes and the length of the styles, two essential specific characters in sect. *Acanthostyla*. No drupe illustration was given either. In addition, in the diagnosis the infructescence was described as having 3-4 syncarps with c. 30-40 drupes («Syncarpia 3-4 ... phalangibus 30-40 circiter ...») but, by contrast, the field-notes quoted from the type specimen (*Perrier 1095*) say that the syncarps have 15-16 phalanges («Syncarpe à 15-16 fruits»), and in his «Observations» following these field-notes, Martelli indi-



**Figures 2-6:** *Pandanus fetosus* (2-4: *Cremers 1818*, holotype), and *P. petrosus* (5, 6: *Perrier 1095*, type). - 2: Upper part of leaf flattened horizontally, viewed by the adaxial face. - 3: Drupe with four stigmas in lateral view (dotted: pileus; arrowed: lower limit of the free part). - 4: Drupe with two stigmas in axial section (black: endocarp). - 5: Drupe with three stigmas in lateral view (dotted: pileus). - 6: Lower part of leaf, folded along midrib which is on right.





**Figure 7:** *Pandanus fetosus* (Cremers 1818, holotype). - Infructescence with eight syncarps (only six syncarps visible: from the top downward, the terminal syncarp; to the left, the third syncarp; to the right, the fourth syncarp, with drupes separated into two groups; to the right, the fifth syncarp, partly covered by the fourth syncarp; to the left, the seventh syncarp; to the right, the eighth syncarp, the lowermost). Scale bar = 4 cm.

cated that the infructescence had five syncarps («... syncarpes (au nombre de cinq) au sommet du pédoncule ...»).

These contradictions may be (tentatively) explained. As pointed out by Pichi-Sermolli (in MARTELLI & PICHIS-SERMOLLI, 1951: 2), from 1929 to his death in 1934, Martelli no longer studied Madagascar *Pandanus*; and his manuscript, used by Pichi-Sermolli (in MARTELLI & PICHIS-SERMOLLI, 1951), was very far from being terminated, and certain points were only out-

lined («l'ouvrage que Martelli a laissé était bien loin d'être terminé et ... sur certains points il était seulement ébauché»: MARTELLI & PICHIS-SERMOLLI, 1951: 3). This seems to be true for *P. petrosus* as well. In any case, the contradictions render the diagnosis most doubtful, and one may wonder if it actually corresponded to the very type specimen of *P. petrosus*. Therefore, it appears necessary to investigate this specimen in detail and re-describe this species for it to be recognized with certainty.

The type of *P. petrosus* (Perrier 1095, P!) comprises three sheets one of which bears two labels. The first label says: «Assez grêle, 2-4 m, stipe n'ayant pas plus de 10-15 cm de diamètre, peu rameux, port assez diffus, racines adventives rares, manquant parfois. T. et port d'ailleurs variable (sic) suivant l'âge de la plante. Syncarpe (sic) à 15-16 fruits. Bois rocailleux, secs (calcaires), Bekamba sur le causse d'Ankara (Boina), 8e 1900. Cette espèce nettement xérophile est commune dans tous les bois rocailleux et secs de la région occidentale». («T.» would probably say Tige, stem, and «8e 1900», Août 1900, August 1900; «Bekamba» was misread as «Makamba», and «8e 1900» as «Oct. 1900», in MARTELLI & PICHIS-SERMOLLI, 1951: 154.) The second label says: «Bois rocailleux (calcaires) de Namoroka, causse d'Andranomovo, Juillet 1903». This label seems to have been inadvertently placed in the specimen since its field-data were not mentioned in MARTELLI & PICHIS-SERMOLLI (1951).

The type of *P. petrosus* bears leaves and nine separate drupes, but neither infructescences nor syncarps. Nevertheless, since the field-notes indicate that the syncarps comprise 15-16 fruits, these numbers should be considered as being the drupe numbers in the syncarps of this species. The drupes are c. 8 mm long, immature, and have (2-) 3-4 styles; most of the styles were broken; the unbroken styles are 2.5-3 mm long (fig. 5). The leaves are 50-60 cm



long, 15-20 mm wide from the middle to near the base, imbricating and amplexicaul at the base, gradually attenuate from about the upper 1/3 to the apex, subulate; the blade is subcoriaceous, and revolute almost from the base to the apex; the pleats are channeled and unarmed; the longitudinal and transverse veins are both distinct at the abaxial face - this makes that face distinctly tessellate -, less so at the adaxial face; the prickles are whitish, some of them brown at apex; the marginal prickles are present from c. 2.5 cm above the leaf base up to the apex; they are antrorse, some lowermost sometimes perpendicular; in the lower part they are up to 1.5-2 mm long and 5-7 mm apart, in the middle part up to 1 mm long and 5 mm apart, in the upper up to 0.7 mm long and 4-5 mm apart, along the apex up to 0.5 mm long and 3 mm apart; the costal prickles are present along a little more than one half in the upper part, and are generally shorter and closer than the marginal prickles at the same levels; the sheath (fig. 6) is 2-3 cm long, 2.8-3 cm wide as flattened horizontally, at the adaxial face it is nitid, alveolate and not veined longitudinally near the top, veined and not alveolate near the bottom, at the abaxial face it is subnitid, not alveolate, distinctly veined near the margins, not or slightly so near the midrib.

The type of *P. petrosus* described above reveals some unusual features that may facilitate the recognition of this species. Firstly, the syncarps comprise only 15-16 drupes. Such low numbers of drupes in syncarps do not seem to have been observed in any other known species of sect. *Acanthostyla*. Secondly, the leaf sheath does not appear typical of this section. It is short and almost as long as wide (instead of being 2-3 times as long as

wide, as seen in several other species), with the consequence that the lowermost marginal prickles are not more than c. 2.5 cm above the leaf base. That leaf sheath evokes rather sect. *Souleyetia*, or species of sect. *Mammillarisia* that have reniform stigmas. Thirdly, the leaf pleats are unarmed, a feature rather uncommon in sect. *Acanthostyla*. Finally, the styles are exceptionally short, not exceeding 2.5-3 mm in length. Such styles do not seem to have been observed in any other known species of sect. *Acanthostyla*. Although only some unbroken styles are observed in the type of *P. petrosus*, the styles on the drupes preserved in this specimen on the whole gave the impression that this species has short styles (fig. 5); it may therefore be assumed that the styles of this species are 2.5-3 mm long. Certainly, these drupes are immature. However, it is quite certain that their styles will not be longer at maturity since the styles of this section reach their definitive length when the drupes are young, as observed in other species of the section.

In conclusion, *P. petrosus* may be recognized by the following characters: syncarps with 15-16 drupes; leaf sheath c. 3 cm long and 3 cm wide; leaf margins armed from c. 2.5 cm above the base; leaf pleats unarmed; and finally, styles 2.5-3 mm long.

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