Pandanus Tsingycola Callm. & Nusb. (Pandanaceae), a New Species Endemic to Western Madagascar

Authors: Callmander, Martin W., Bolliger, Ralph, Hanitrarivo, R. Mitia, and Nusbaumer, Louis

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Pandanus tsingycola Callm. & Nusb. (Pandanaceae), a new species endemic to western Madagascar

Martin W. Callmander, Ralph Bolliger, R. Mitia Hanitrarivo & Louis Nusbaumer

Abstract

CALLMANDER, M. W., R. BOLLIGER, R. M. HANITRARIVO & L. NUSBAUMER (2013). Pandanus tsingycola Callm. & Nusb. (Pandanaceae), a new species endemic to western Madagascar. *Candollea* 68: 229-235. In English, English and French abstracts.

A recent intensive inventory in the Beanka region in western Madagascar has led to the discovery of a new species of *Pandanaceae,* described here as *Pandanus tsingycola* Callm. & Nusb. This remarkable species can be easily distinguished from all other known species by the unique shape and configuration of its syncarps. These possess few phalanges (6-7) that are incompletely united (with up to 38 carpels) with each of these carpels bearing an erect to curved, acute, thorny stigma. *Pandanus tsingycola* seems to be endemic to the limestone "tsingy" formation of Beanka.

Key-words

PANDANACEAE – *Pandanus* – Madagascar – Beanka – Tsingy – Taxonomy – Conservation IUCN Red List

Résumé

CALLMANDER, M. W., R. BOLLIGER, R. M. HANITRARIVO & L. NUSBAUMER (2013). Pandanus tsingycola Callm. & Nusb. (Pandanaceae), une nouvelle espèce endémique de l'ouest de Madagascar. *Candollea* 68: 229-235. En anglais, résumés anglais et français.

Un récent inventaire intensif de la région de Beanka à Madagascar a permis la découverte d'une nouvelle espèce de *Pandanaceae, Pandanus tsingycola* Callm. & Nusb. Cette remarquable espèce peut être facilement distinguée de toutes les autres espèces connues par la forme et la configuration uniques de son syncarpe. Celui-ci possède peu de phalanges (6-7), incomplètement soudées (comprenant jusqu'à 38 carpelles) avec chacun des carpelles pourvus d'un stigmate érigé ou courbé, aigu et épineux. *Pandanus tsingycola* semble être endémique de la formation calcaire des «tsingy» de Beanka.

Addresses of the authors: MWC: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri, 63166-0299, U.S.A. and Conservatoire et Jardin botaniques de la Ville de Genève, ch. de l'Impératrice 1, CP 60, 1292 Chambésy, Switzerland. Email: **martin.callmander@mobot.org**

RB, LN: Université de Genève, Laboratoire de botanique systématique et biodiversité and Conservatoire et Jardin botaniques de la Ville de Genève, ch. de l'Impératrice 1, CP 60, 1292 Chambésy, Switzerland.

RMH: Université d'Antananarivo, Faculté des Sciences, Département de Biologie et Ecologie Végétales, 101 Antananarivo, Madagascar.

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Introduction

Madagascar is renowned for the spectacular eroded landscapes of its karstic massifs, known as "tsingy" in Malagasy. The most impressive areas of this kind are Bemaraha, a protected UNESCO World Heritage site (UNESCO, 2013) in the western part of the island, and Ankarana, a National Park in northern Madagascar (Fig 1). The hot and humid austral summer between December to March [annual precipitation: ca. 1000-1500 mm in Bemaraha, ca. 2000 mm in Ankarana (VERESS & al., 2009)] facilitate a profound and rapid erosion of the limestone surface (ROSSI, 1983) and the collapse of former cave systems, thus forming this remarkable tropical karst landform, which consists of extensive fields of giant, grikes with their edges and peaks frequently eroded into sharp pinnacles parallel to each other (VERESS & al., 2008). These formations possess a unique biodiversity: the deciduous forests in more sheltered areas and the xeric habitats of exposed rock support numerous narrowly endemic species (LEANDRI, 1951; BARDOT-VAUCOULON, 1997; CALLMANDER & al., 2010; BOLLIGER, 2011).

The biodiversity of several of the tsingy limestone formations is not well known, and many of them are under serious threat due to human pressure for timber. Beanka, an area to the north of Bemaraha (Fig. 1), has been the subject of intensive biodiversity inventories during the past decade in conjunction with a collaborative effort to protect its mosaic of sandstone and "tsingy" landforms and the plants and animals they support. The inventories of the birds (GOODMAN & al., 2011) and land snails (GRIFFITHS & HERBERT, 2013), have already lead to discovery of new species, and some new plant species have already been described (LETSARA & al., 2012). The ca. 14,000 hectares of Beanka are now under formal conservation

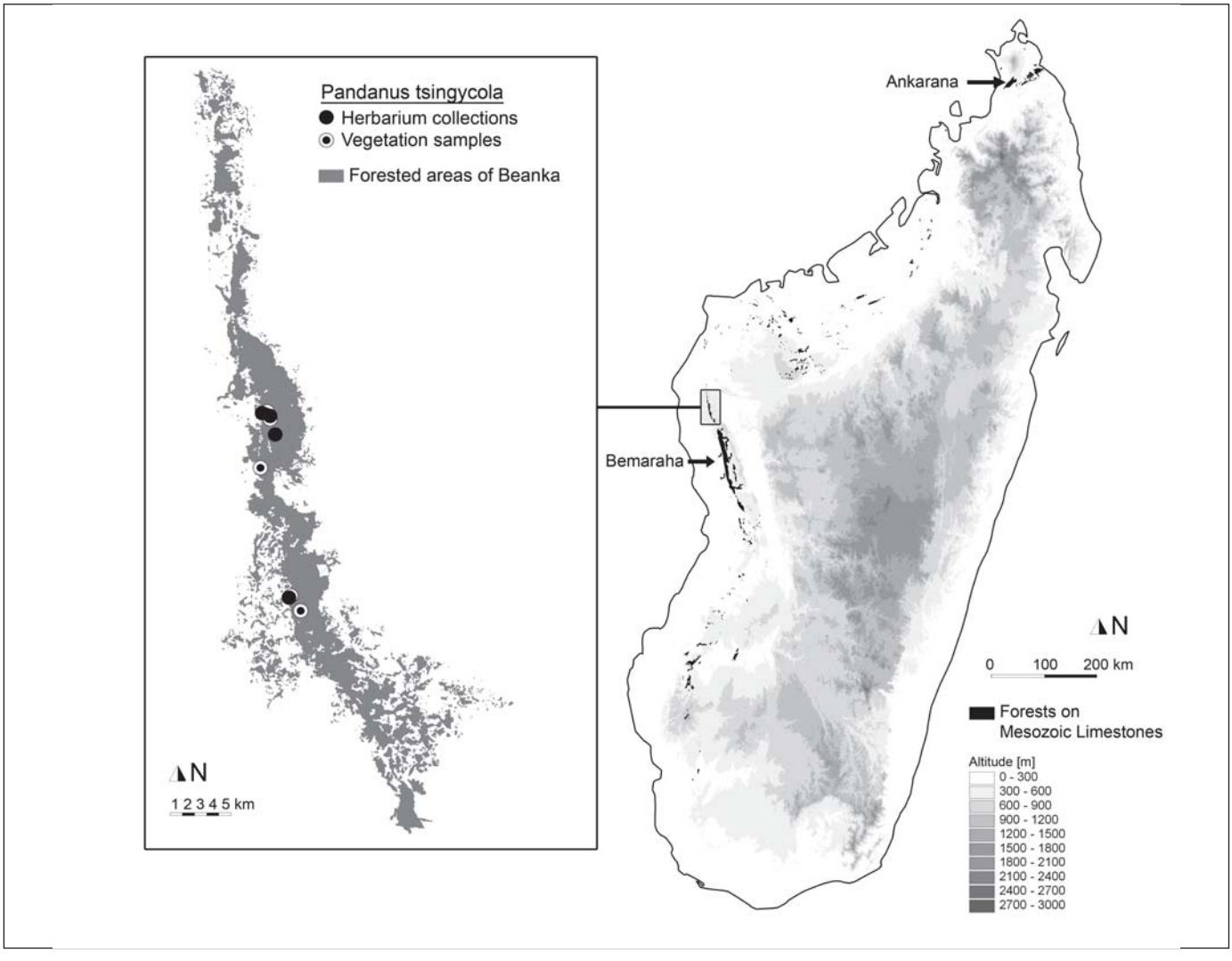

Fig. 1. – Distribution of *Pandanus tsingycola* Callm. & Nusb. in Madagascar with highlight on the remaining forests on Mesozoic limestones on the whole island (right) as delimited by MOAT & SMITH (2007) and of the forested areas on the detailed map of the Beanka region (left). Ankarana and Bemaraha are highlighted.

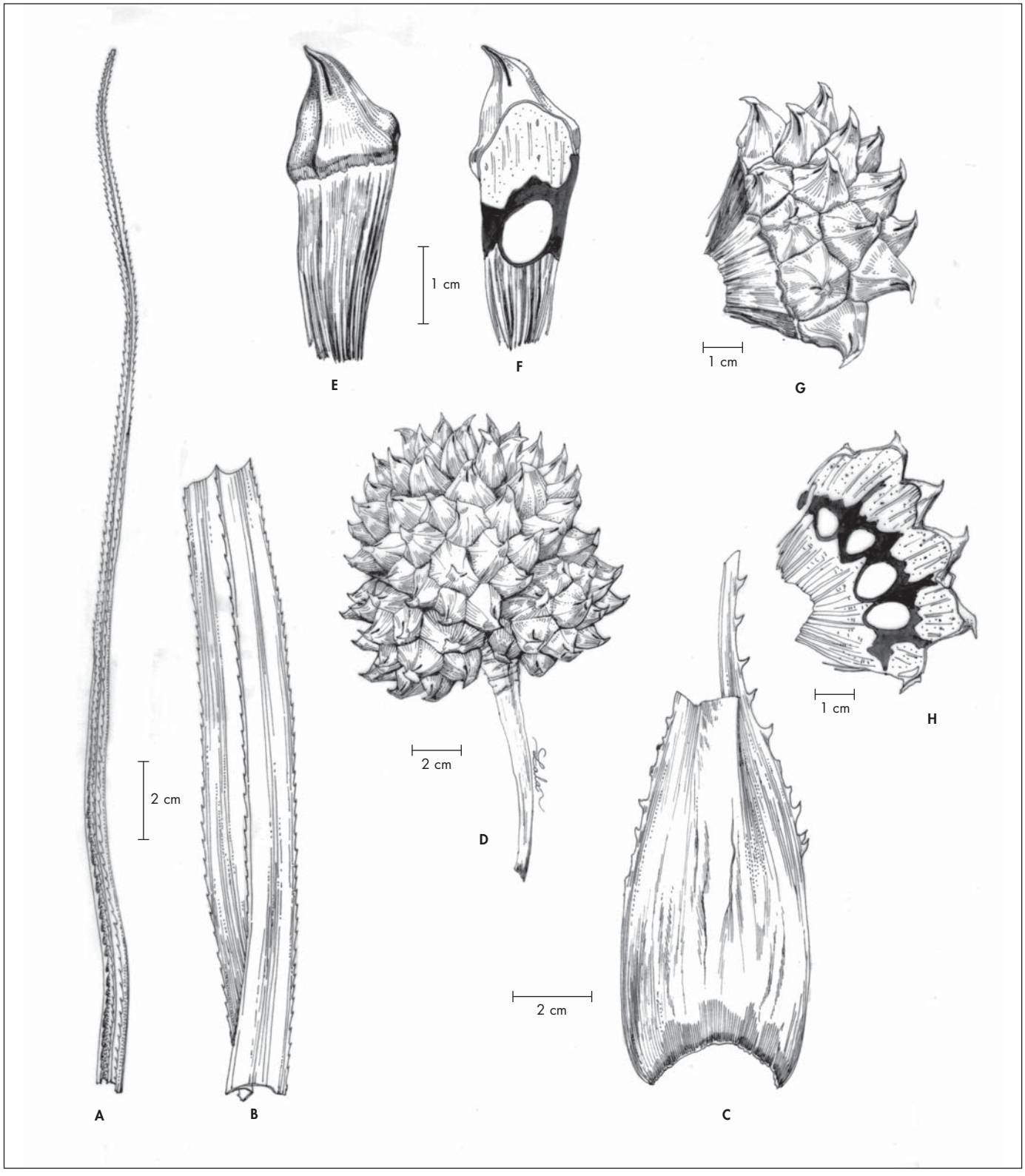

Fig. 2. – *Pandanus tsingycola* Callm. & Nusb. **A.** Tip of a leaf; **B**. Median section of a leaf; **C**. Basal section of a leaf; **D.** Syncarp; **E.** Single carpel detached from a phalange; **F.** Cross section of a single carpel; **G.** Phalange; **H.** Cross section of a phalange.

[*Nusbaumer & al. 3117*, TEF] [Drawing: R. Andriamiarisoa]

Fig. 3. – *Pandanus tsingycola* Callm. & Nusb. **A.** Ecology on *tsingy*; **B.** General habit; **C-D.** Syncarp. [**A, C:** *Bolliger & al. 121*; **B, D:** *Hanitrarivo & al. 376*] [Photos: **A, C:** R. Bolliger; **B, D:** R. M. Hanitrarivo]

management by the Malagasy NGO: Biodiversity Conservation Madagascar (BCM). Between 2009 and 2012, plant collecting effort at Beanka has intensified. The botanical inventories led by teams from the Conservatoire et Jardin botaniques de la Ville de Genève and the Missouri Botanical Garden in collaboration with the Département de Biologie et Ecologie Végétales de l'Université d'Antananarivo, the Parc Botanique et Zoologique of Tsimbazaza and the Vahatra and Famelona Associations in Antananarivo. These inventories resulted in the discovery of an unknown species of *Pandanus* Parkinson *(Pandanaceae)* that we describe here as new:

Pandanus tsingycola Callm. & Nusb., **spec. nova** (Fig. 2-3).

Typus: Madagascar. Prov. Mahajanga: Beanka, partie sud, Andoloposa, 18°00'52"S 44°29'56"E, 255 m, 20.III. 2012, fr., *Hanitrarivo, Bolliger & Rakotozafy 376* (holo-: G [G00341180, carpo]!; iso-: MO!, P [P00836310, P00700 913 carpo]!, PH!, TEF!).

Haec species a congeneris madagascariensibus syncarpio ex phalangibus grandibus perpaucis (7 ad 9) incomplete connatis maturitate secedentibus constante, quaque phalange ex carpellis (21 ad) 27 ad 33 (ad 38) constante, quoque carpello ad apicem in pileum pyramidalem abiente atque pileis ad cristas apicales vel ad marginem paginae apicalis truncatae stigmate solitario erecto curvatove acuto spiniformi praeditis distinguitur.

Treelet to 3-5 m tall, generally decumbent on *tsingy*, stem prickly, up to 8 cm diam., dried leaves persistent, pending below the crown of green leaves, surrounding the stem. *Leaves* 110-170 cm long, 2.5-3.7 cm wide in the middle, 3.5-4 cm wide near the sheath, gradually attenuate in the upper part, flagellate (ca. 20 cm long), coriaceous; longitudinal and transverse veins visible on both surfaces; prickles white *in vivo*; marginal prickles beginning at (6-)7-8 cm above the base and extending to the apex, antrorse (rarely retrorse in the lower 1/3), 4-5 mm in the lower third, 2-5(-10) mm apart, strong, to 1-3 mm in the mid third; 4-10(-12) mm apart, to < 1 mm in the distal third, 2-3 mm apart; midrib armed in the upper 2/3, prickles small (< 1 mm), irregularly disposed (4-12 mm) in the middle, then regularly disposed, spaced (2-5 mm) as long as on the marginal in the distal 1/3; sheath 5 cm long, ca. 4-5 cm wide at apex ca. 9-11 cm large at base. *Infrutescence* terminal, a solitary syncarp pending at maturity, on a straight peduncle; syncarp 14-17 × 12-14 cm, irregularly shaped, the outline variable determined by the number and the position of the phalanges; peduncle (13-)15-20 cm long, 1.5-2.2 cm wide at apex, 1.-1.4 cm in the middle, straight, trigonous, veins visible, first bract borne 6-12 cm from the base of syncarp, 3-4 bracts scares along peduncle and the remaining bracts crowded at the base of the syncarp; lower bracts leaf-like, upper bracts boat-shape at base and flagellate in the distal part. *Phalange,* 6-7 per syncarp, (5-)6-7(-8) cm high, 9-11.5 cm wide, 5-6(-7) cm thick, (3-)4(-5) angled; carpels (21-)27-33 (-38), incompletely united, free in the upper ca. 1/5-2/5, tapering to the base; pileus divided by apical sinuses 1-2 cm deep into acute pyramids (sometimes slightly flattened at apex) as many as there are carpels. *Stigma* (21-)27-33(-38) per phalange (one per carpel), erect to curved, acute, thorny, on the apical ridges or on the edge of the truncate apical face of the pyramidal pileus, brown *in vivo*, generally prolonged by a sinus 0.6-1(-1.3) cm long towards the centre of the carpel, invaginated; endocarp 1.2-2.5 cm long in the centre, 1-2 cm wide, 1.5-2 cm away from the stigmas; seed locule oblong, 1-1.2 × 0.6-0.9 mm, superior and inferior mesocarp thick and fibrous. *Staminate* plant unknown.

Distribution. – Pandanus tsingycola is only known from the Beanka tsingy in western Madagascar (Fig. 1). During botanical and vegetation studies in the region, several populations were observed on "tsingy", and herbarium samples were collected at four study sites.

Habitat and ecology. – Pandanus tsingycola occurs on highly eroded limestone "tsingy" in plane areas with discontinuous soil, up to an altitude of 330 m. *Pandanus tsingycola* grows in primary dry decidous forests with open canopies reaching 12 to 15 m where the species is generally gregarious and sometimes comprises more than 90% of the vegetation cover (Fig. 3A). A study of the vegetation in Beanka (Rakotozafy & al., *pers. comm.*) based on 46 linear transects following the methodology of Gautier & al. (1994), showed that the new *Pandanus* is an indicator species sensu Dufrêne & Legendre (1997) of the vegetation type described above refered to as "Pandanus thicket". This vegetation type is unique in their study in being characterized by the presence of a single (vs. numerous) indicator species. Furthermore, the species diversity is relatively low in "Pandanus thicket" with only 98 different taxa vs. 180 to 339 taxa for the other four vegetation types (Rakotozafy & al., *pers. comm.*). The most frequently recorded species occurring with *P. tsingycola* in vegetation surveys include: *Antiaris toxicaria* subsp. *madagascariensis* (H. Perrier) C. C. Berg, *Dioscorea antaly* Jum. & H. Perrier, *Givotia stipularis* Radcl.-Sm., *Hildegardia erythrosiphon* (Baill.) Kosterm., *Kirkia leandrii* (Capuron) Stannard, *Neobeguea leandriana* J.-F. Leroy, *Omphalea occidentalis* Leandri, *Poupartia sp.,* as well as *Hymenodictyon leandrii* Cavaco and *Allophylus sp.*, species that also occur in other vegetation types.

Conservation status. – With only four collections known and five reliable field observations, an "Extent Of Occurrence" (EOO) of ca. 19 km^2, an "Area Of Occupancy" (AOO) of 54 km^2 and two subpopulations (calculation following Callmander & al., 2007), within the new Protected Area of Beanka with a temporary protection status, *Pandanus tsingycola* is assigned a preliminary status of "Vulnerable" (VU D2) (IUCN, 2012).

Table 1. – Principal morphological characters differentiating the new species, *Pandanus tsyingycola* Callm. & Nusb., from *P. biceps* B. C. Stone & J.-L. Guillaumet and *P. nusbaumeri* Callm. & L. Gaut.

	Leaf length [cm]	Phalange dimensions (H x L) [cm]	Number of phalanges per syncarp	Number of carpels per phalange	Stigma (shape and localisation)
***P. tsingycola* Callm. & Nusb.**	110-170	6-7 × 9-11.5	6-7	(21-)27-33(-38)	erect to curved, acute, thorny, on the apical ridges or on the side of the truncate apical face of the pyramidal pileus
***P. biceps* B. C. Stone & J.-L Guillaumet**	170(-250)	4.5 × 2.8	2	14-20	reniform, generally distal on a truncate pyramidal pileus
***P. nusbaumeri* Callm. & L. Gaut.**	100-110	3.5-4.5 × ca. 5-6	17-18	(3-)5-8(-14)	slightly spinescent, sub-vertical, prominent at the center of each acute pyramidal pileus

Notes. – *Pandanus tsingycola* is morphologically unique among the genus. The new species bears syncarps with very few (7-9) incompletely fused phalanges which detach at maturity (Fig. 2). The general shape of syncarp is irregular, its outline variable - determined by the number and the position of the few phalanges (Fig. 2). Each of these phalanges is composed of (21-)27-33(-38) pyramidal carpels, with a single erect to curved, acute, thorny stigma, on the apical ridges or on the edge of the truncate apical face of this pyramidal pileus (Fig. 3). The overall morphology of its phalange recalls those of *P. biceps* B. C. Stone & J.-L. Guillaumet and to some extent to *P. nusbaumeri* Callm. & L. Gaut. Both occur in the extreme north of Madagascar: *P. biceps* is endemic to the Ankarana massif (Stone & Guillaumet, 1970) and *P. nusbaumeri* is endemic to the western leeward side of the Montagne d'Ambre (Callmander & al., 2009). All three species have incompletely united phalanges formed by several individual carpels with a more or less pyramidal pileus. However these species differ from the new species by several morphological characters (see Table 1).

Paratypi. – **Madagascar. Prov. Mahajanga:** Beanka, Partie N, Ambabaky, 17°52'22"S 44°29'06"E, 185 m, 23.I.2012, fr., *Bolliger, Hanitrarivo & Rakotozafy 121* (G [G00341216], FI, P, MO, TEF); Beanka, Partie N, Ambabaky, 17°53'20"S 44°29'31"E, 303 m, 17.XI. 2011, fr., *Gautier, Tahinarivony & Bolliger 5635* (G [G00340555], TEF); Beanka, Partie N, Ambabaky, 17°52'29"S 44°29'19"E, 221 m, 14.XII. 2011, fr., *Nusbaumer & al. 3117* (G [G00341179], K, TEF).

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