

Rafflesia baletei, another new *Rafflesia* (*Rafflesiaceae*) from the Philippines

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Summary. A new species of *Rafflesia*, *R. baletei*, from Mt Isarog in the Bicol Region, Southern Luzon, Philippines, is described. *Rafflesia baletei* is the fifth endemic species and the second of the small-sized species of the genus in the Philippines to have been described so far. It differs from the presumably closely related *R. tengku-adlinii* from Borneo in flower colour and size, perigone ornamentations, and number of anthers. Furthermore, it differs from the similarly-sized *R. manillana* from the Philippines in diaphragm and ramenta morphology and ornamentations, and flower habit.

Key words. *Rafflesia baletei*, Philippines, Luzon, Mt Isarog, parasitic plants.

Introduction

Rafflesia R. Br. (*Rafflesiaceae*) is exclusively holoparasitic on several species of the liana genus *Tetrastigma* (*Vitaceae*) that are distributed throughout Thailand and Western Malesia (Nais 2001). To date, a total of 26 names have been published. Twenty one are recognized as distinct species, of which *R. mira*, from Compostela Valley Province, Mindanao, Philippines, is most recently described (Fernando & Ong 2005).

Until this study, there have been four *Rafflesia* species (all endemic) described from the Philippines, *R. manillana*, *R. speciosa*, *R. schadenbergiana*, and the recently described *R. mira*. *Rafflesia manillana* is the smallest species in the genus with populations only known on Mt Makiling, located in Laguna and Batangas Provinces, until recent discoveries confirmed the existence of additional populations in northern Luzon on, amongst others, Mt Natib in Bataan Province (pers. observ.), and Mt Rabuaran, Barangay Bolos Point, Gattaran, Cagayan Province (Anon 2005). Contrary to what is claimed by Fernando & Ong (2005: 265), populations of *R. manillana* on Mt Banahaw in Quezon and Laguna Provinces, also in Luzon, have not been seen by the first author. In contrast with *R. manillana*, *R. speciosa* from Panay (with active populations confirmed in the lowland forests of Sibalom Natural Park, San Remegio, and Valderrama Municipalities in Antique Province) is currently one of the largest species of

Rafflesia (up to 56 cm in diameter, although unconfirmed data indicate that some flowers may be larger) so far described from the Philippines, second only to *R. schadenbergiana* from Mt Apo in Mindanao. The type (at K) and only specimen of *R. schadenbergiana* collected in 1882 measures about 80 cm across (Meijer 1997). Because the large size of *R. schadenbergiana* makes it very conspicuous, failure to rediscover this species despite continued efforts in the past 150 years, cannot be attributed to the lack of botanical exploration at the type locality and its vicinity. It is much more realistic to assume that *R. schadenbergiana* is extinct. This is especially likely, because the lower slopes of Mt Apo (like the rest of most of the Philippines) have long been converted into farmland and other land uses. *R. mira* has a flower diameter up to 57 cm, which makes it about the same size as *R. speciosa*. The former species has recently been described by Fernando & Ong (2005). The reader is referred to this paper for a key to the Philippine species of *Rafflesia* described at the moment of publication and an updated account of their distribution.

In addition to the above four species of *Rafflesia* and the one that is newly described in this paper, further species of *Rafflesia* in the Philippines have been found and await description. The discovery of *R. speciosa* in 2002 has been a milestone in the history of botany in the country and has sparked a rather

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remarkable interest in finding additional new species of this genus throughout the Philippines (Barcelona & Fernando 2002). Scientists, conservation groups, hobbyists, staff of the tourism industry, and local people have been scrambling to find the largest and the “prettiest” of them all. This awareness has resulted in the discovery and collection of many new records and species of *Rafflesia* in the Philippines in a short time. At the time of writing, a new species from the Sierra Madre Mountain Range of northeastern Luzon is being described (Co *et al.* in prep). Moreover, there is photographic evidence for two additional species that are likely to be new to science, or are at least new records for the Philippines: one is from Northern Luzon (Co, pers. comm.) and the other from South Central Mindanao. Because of the poor condition of the only specimen of the latter species that was collected, it is impossible to use this collection to identify this plant, or alternatively, describe it as a new species. However, a blurry photograph of the same specimen undoubtedly indicates that it is not *R. manillana* but rather another member of the small-sized rafflesias (Meijer 1997). Assuming that all of these recently discovered *Rafflesia* species are new to science or at least new records for the country, they bring the total number of *Rafflesia* species in the Philippines to date to at least eight. This is four times the number of species described in the past 150 years! Furthermore, unconfirmed sightings by locals in several islands in the country indicate that there are more species yet to be discovered. This may mean that, relative to land area, the Philippines is home to the highest number of species of *Rafflesia*. Unfortunately, the collection and scientific study of these very recent discoveries is being hampered by the lack of collecting permits and/or by the absence of competent botanists at the time of discovery.

We here report another new species of *Rafflesia* from the Philippines. This is the result of the recent discovery of several populations of this species on Mt Isarog, Camarines Sur Province, in the Bicol Region of southern Luzon in early 2005. Until our recent collections, the only specimens of *Rafflesia* from the Bicol Region were *Balete* & *Peñas* s.n. (CAHUP), represented by two flowers collected in 1991. These specimens have been misidentified, doubtfully attributed to (Barcelona & Fernando 2002), and reported (Heaney & Regalado 1998; Nais 2001; Fernando *et al.* 2004; Fernando & Ong 2005) as *R. manillana*, most probably because its flowers are similar in size to this species. In addition, morphological differences between these two taxa were obscured by distortion and discoloration of the specimens during the drying process, an unfortunate characteristic of all rafflesias. In March 2005, we were notified by a local family of the presence of a species of a small-sized

Rafflesia different from *R. manillana* in an abaca (*Musa textilis* Née)-dominated area on Mt Isarog. In February 2006, another population of this new species was discovered by a group of mountaineers in the adjacent Mt Asog (or Mt Iriga), just south of Mt Isarog, in the vicinity of Buhi and Iriga City, also in Camarines Sur Province (Escandor 2006a, b). This discovery implies that, although locally rare, this new species may indeed be more widespread in the Bicol Region than previously thought.

***Rafflesia baletei* Barcelona & Cajano sp. nov.** *Rafflesiae manillanae similis solum in floris magnitudine, perigonii lobis verrucis plerumque densioribus maioribus prominentioribus albescentibus differt. Diaphragma plus distincta apertura relative minuta (ut in *R. speciosa* et *R. tengku-adlinii*), cuius pagina exterioris ornamentis reticulatis albescentibus marginibus acutis plerumque areolis pentagonalibus, pagina interiore uniformiter castanea ramentis parum fuscis (paginae ambae maculis albis guttatae in *R. manillana*). Etiam *R. tengku-adlinii* similis diaphragma prominenti, perigonii lobis erectis, sed posterior paginam exteriorem uniformiter coloratam, parum maiorem, perigonia latiora, processos antherasque pauciores differt. Typus: Philippines, Southern Luzon, Bicol Region, Camarines Sur Prov., Ocampo Municipality, Barangay del Rosario, Mt Isarog National Park, *Candelaria et al.* 5526 (holotypus PNH; isotypi, CAHUP, K, SING, US).*

Mature buds 7.5–9 cm in diam.; cupule of mature flowers 3 cm high, 6–6.5 cm wide, bracts or bud scales in 3 overlapping layers, broadly orbicular, 4–7 cm long, 3.5–6.5(–8) cm wide. *Flowers* (9–)15–16 (–20) cm (to 22 cm when fresh) in diam. when fully expanded, 13–13.5 cm high. *Perigone lobes* 5 (or 6 with one rudimentary), orbicular, erect basally but recurved halfway distally, sometimes erect throughout their length, 5–7.5 cm long, 5–8 cm wide (up to 9 cm long, 7.5 cm wide when fresh), one lobe commonly markedly smaller than the rest, 7–9(–11.5) mm thick at base, dark-, reddish- or rusty-brown, becoming paler with age; upper surface warty, warts very prominent, dense, relatively large (up to 1.5 cm long, 4 mm wide), irregular in shape, whitish on a reddish-brown background in new flowers, becoming concolorous with age; undersurface smooth on the topmost lobes in buds, with wart impressions on lobes beneath; floor of perigone tube velutinous. *Diaphragm* 7–8.5 cm (to 12 cm when fresh) in diam., to 7–8 mm thick, paler than the perigone lobes, usually orange brown with central part of the areoles whitish; the outer surface with reticulate ornamentations that are whitish and sharp-edged forming irregularly-shaped but commonly

pentagonal areoles; the inner surface uniformly reddish brown with slightly darker ramentae; the rim sinuate, reddish brown, darker than the rest of the diaphragm; aperture 3–3.5 cm in diam. *Disk* 5–5.5 cm in diameter, to c. 1 cm thick, slightly dome-shaped centrally, glistening cream-white becoming reddish-brown at the periphery; rim of disk steeply raised, raised part c. 7–10 mm high, irregularly and shallowly crenulate; column to 2 cm above the base of the perianth tube or 5–6 cm from cupule base to the tip of disk, neck of column c. 1 cm high, 2.2 cm wide, velutinous laterally; processes (19–)22–24(–26), usually arranged in 2 concentric rings with the 3rd composed of 2 or 3 processes, pointing outward towards the rim, up to 1 cm long, laterally compressed, variably branched, reddish-orange basally, darker apically. *Ramenta* dense, nearly evenly distributed all over the inner surface of the diaphragm and perigone tube, variably branched, sometimes irregularly stellate to 2 mm long, longer towards the base of the perigone tube, slightly shorter but hardly reduced to tubercles towards the diaphragm rim. *Male flowers* with vestigial ovaries and ovules; anthers 11–14, semi-globose, 2–3 mm long, c. 4 mm wide, 2 coalescent anthers not uncommon, anther cavity shallow, finely hairy. *Female flowers* with vestigial anthers; fruits and seeds unknown. Figs 1–5.

DISTRIBUTION AND HABITAT. Philippines, Southern Luzon, Camarines Sur Province, in rocky lowland secondary forests dominated by *Musa textilis* Née (abaca) and bamboos on well-drained soils, often under thick leaf litter, 500–560 m asl; flowering in December to May. Endemic.

ETYMOLOGY. This beautiful *Rafflesia* is named after Mr Danilo Balete, a mammalogist native to the Bicol Region who first discovered and collected this new species. Thereafter, two additional, yet unpublished, new species of *Rafflesia* were discovered by Mr Balete and colleagues along their mammal trap lines during separate fieldtrips in Northern Luzon.

LOCAL NAMES. Unknown.

ECOLOGY. The host plant of *R. baletei* is *Tetrastigma cf. magnum* Merr. (*Vitaceae*); voucher specimens: *Candelaria et al.* 5569, 5606, 5717, 5786 (CAHUP!, PNH!). *Rafflesia baletei* flowers last about 5 days before senescence. Plants were observed only on roots (and prostrate vines) of the host plants that are 0.7–1 cm in diam., buried in soil 2.5–3 cm deep, yet never observed on stems above the ground, which is unlike *R. manillana* that parasitises stems several metres above the ground. In an area that is c. 15 m × 60 m: a total of 20 buds in different stages of development, three flowers in full bloom, and 10 senescent flowers have been observed at one time. Since the substrate is very steep and/or rocky, these portions of the forests are quite inaccessible and not vulnerable to

slash and burn. They are occasionally being used by local people to plant abaca.

SPECIMENS EXAMINED. PHILIPPINES. Southern Luzon, Bicol Region, Camarines Sur Prov., Ocampo Municipality, Barangay del Rosario, Mt Isarog National Park – ridge above Luksohon River (*loco dicto*). In secondary forest dominated by abaca at 545–560 m asl. 14 March 2005, *Candelaria et al.* 5526 (holotype PNH!; isotypes CAHUP!, K!, SING!, US!), *Candelaria et al.* 5527 (CAHUP!, L!, LBC!, PNH!, PUH!, US!); 5528, (CAHUP!, K!, PNH!, US!); 5529 (CAHUP!, PNH!); 4 April 2005, *Candelaria et al.* 5562 (BM!, CAHUP!, NY!, PNH!); 5564 (CAHUP!, PNH!); 5565 (CAHUP!, PNH!); 28 May 2005, *Candelaria et al.* 5718 (CAHUP!); ridge above Tabuan River (*loco dicto*). In secondary forest dominated by bamboos at c. 500 m asl. 6 April 2005, *Candelaria et al.* 5580 (CAHUP!); bank of Tabuan River, on steep slope in dry soil, on roots c. 7–9 mm in diam. and 2.5–3 cm below the ground. 10 June 1991, *Balete, D.S.* and *R. Peñas* s.n. (CAHUP!).

NOTES. Because of morphological resemblance, we hypothesize that *Rafflesia baletei* is presumably most closely related to a newly discovered, but still undescribed *Rafflesia* species from the Sierra Madre Mountain Range, Quirino Province in Northern Luzon (Co *et al.* in prep). Both species have relatively small, erect flowers with a diaphragm aperture between 3–3.6 cm in diam., which is much smaller than in *R. manillana*. The presence of sharp-edged, reticulate ornamentations are characteristic of both species. In *R. baletei*, these are concentrated only on the outer surface of the diaphragm, whereas they extend to the perigone lobes in the putatively new species from Northern Luzon. Both species have few anthers that are hidden in deep sulci, similar to those in the medium to large-sized rafflesias. *Rafflesia baletei*, however, differs from the new species from Luzon by the overall flower colour. The flowers of *R. baletei* are dark-, reddish- or rusty-brown, with the upper surface of the perigone lobes with dense, prominent, relatively large, irregularly-shaped, whitish warts on a reddish-brown background. The other species, on the other hand, has uniformly brick-orange or cinnamon-brown flowers. The ramenta in *R. baletei* are only up to 2 mm long, those of the species from Luzon are much longer, 7–10 mm long.

Rafflesia baletei is also a putative close ally of *R. tengku-adlinii* from Borneo. It differs from this species by the relatively smaller flowers (the smallest open flower is 9 cm, the smallest measured for the genus thus far, although the average size is between 15–16 cm which may reach up to 22 cm in diam. when fresh), dense, large, whitish warts on the perigone lobes and the fewer anthers (11–14 in *R. baletei*, 20 in *R. tengku-adlinii*). *Rafflesia tengku-adlinii* flowers are 20.5–25 cm in diam. and are uniformly bright to dull-orange throughout the entire outer surface.

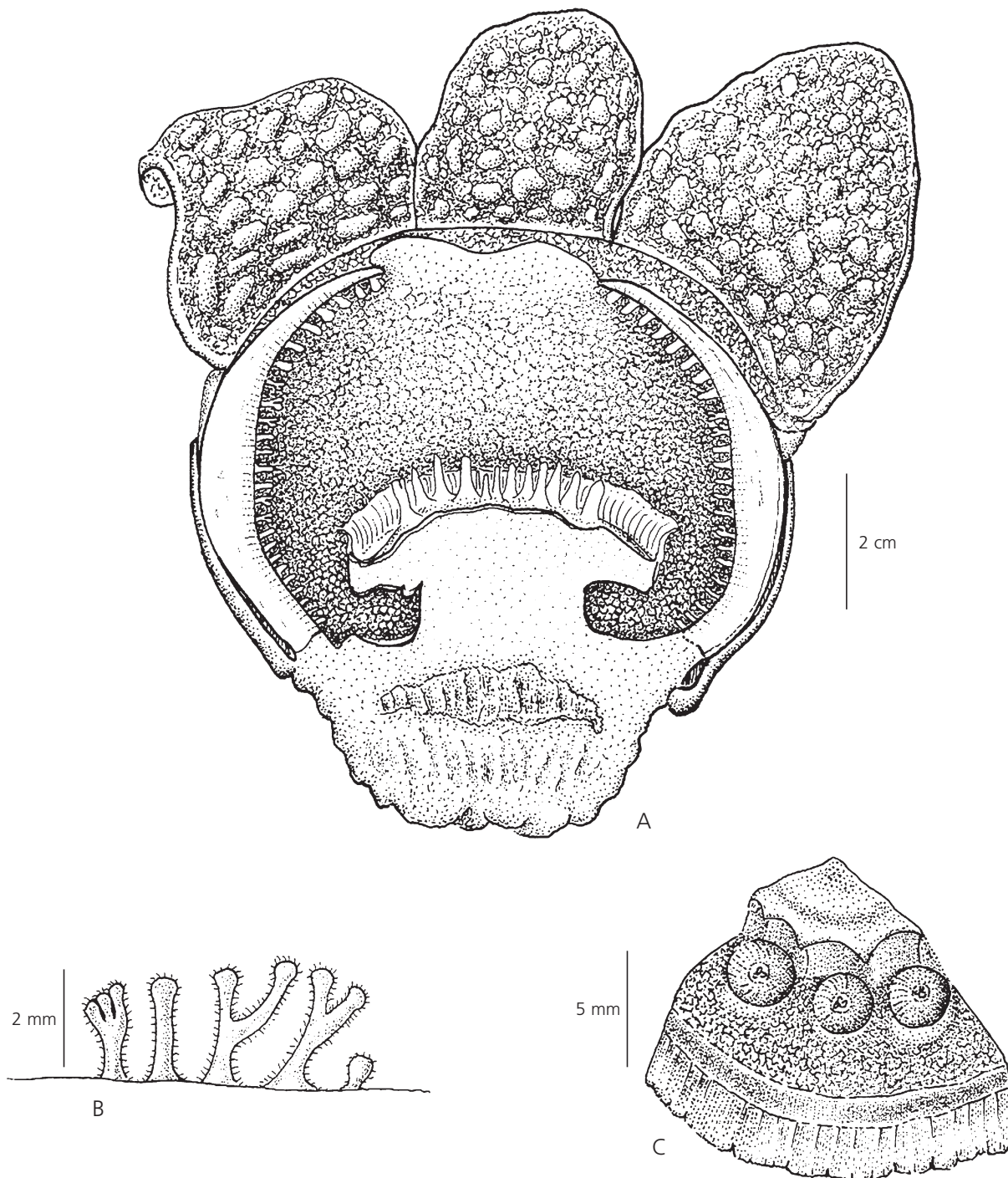


Fig. 1. *Rafflesia baletii*. **A** longitudinal section of a female flower showing inner surface of the disk, perigone tube, and diaphragm; **B** variably shaped ramenta inside the perigone tube; **C** details of anthers on the underside of the disk of a male flower. All from *Candelaria et al.* 5562. DRAWN BY NEMESIO M. DIEGO JR.

Fig. 2 (opposite). *Rafflesia baletii* with plants/flowers at different stages of development.

Fig. 3 (opposite). *Rafflesia baletii* fully expanded mature flower.

Fig. 4 (p. 236). *Rafflesia baletii*. Pronounced diaphragm with reticulate and sharp-edged ornamentation and perigone lobes with dense, prominent, and irregularly-shaped whitish warts.

Fig. 5 (p. 236). *Rafflesia baletii*. Dissected female flower bud showing vestigial anthers, variably branched processes, concolorous inner diaphragm and perigone tube walls with dense ramenta and velutinous floor. From *Candelaria et al.* 5565.

ALL PHOTOS: MARY ANN O. CAJANO.





Finally, *R. baletei* differs from the similarly sized *R. manillana* by the relatively closed diaphragm, the variably branched ramenta of similar colour to the inner diaphragm surface, and the more erect flowers when open. *Rafflesia manillana* has a widely open diaphragm exposing the anther cavity impressions on the column base, very pronounced whitish spots inside the perigone tube that become larger in size towards the diaphragm opening, and the more patent perigone lobes when fully open.

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