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# ON THE IDENTITY OF *RAFFLESIA MANILLANA* TESCHEM. (RAFFLESIACEAE)

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ABSTRACT

Recent collections of *Rafflesia manillana* Teschem. from its type locality in Basey, Samar Island, Philippines, and the description of several new small-diameter *Rafflesia* species in the Philippines necessitated a close re-examination of *R. manillana* throughout its known distributional range. The description of *R. manillana* is hereby amended to include newly recorded characters and to distinguish it from other *Rafflesia* species. An epitype is designated.

**Key words:** endemic plants, *Rafflesia manillana,* Rafflesiaceae, taxonomy, threatened plants

## INTRODUCTION

In 1838, the English naturalist, Hugh Cuming first collected the buds of an undescribed species of *Rafflesia* in Basey, Samar, and sent the same material to Robert Brown in England. Brown had earlier described the type species of the genus as *Rafflesia arnoldii,* from Sumatra almost twenty years before. In 1841, J.E. Teschemacher, curator at the Boston Museum of Natural History received some specimens of *Rafflesia* in bud from the same locality on Samar. At a meeting of the Boston Natural

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History Society on 16 June 1841, Teschemacher read a paper describing a new species, *Rafflesia manillana* which was based on the Samar material. According to the same report, the materials studied by Teschemacher were kept at the Arnold Arboretum herbarium (A) but which cannot be found today. Apparently Teschemacher knew that Cuming's specimen was being studied by Brown but the former could not ascertain when it would be published. And so Teschemacher decided to submit his paper entitled "On a new species of *Rafflesia*, from Manilla" to the Boston Journal of Natural History which published it in 1842. His description of the species, based merely on buds, was obviously incomplete, omitting many important diagnostic floral characters. It also did not record the collector.

In 1844, Brown published the name *Rafflesia cumingii* based on the male bud collected by Cuming in Samar. According to him "the trivial name Manillana, given to this species by Mr. Teschemacher, who has described and figured the male flower, can hardly be retained for a plant not known to grow in Luzon, of which Manilla is the capital, but in the island of Samar, where it was first found by Mr. Hugh Cuming. I have named it, therefore, in honour of the discoverer, …" Miquel (1856: 684) listed *R. cumingii* as the species occurring in the Philippines, with *R. manillana* as a synonym. Mabberley (1999) has shown that *R. cumingii* is a superfluous name "since R. Brown merely renamed Teschemacher's plant to bring it into line with the others named after people."

In his second edition of the Flora de Filipinas (1845), Father Francisco Manuel Blanco described two new species of *Rafflesia*. *Rafflesia philippensis* Blanco (1845: 565) was based on a collection made by Ignatio G. Azaola on April 22, 1840 on Mount Majaijai, Laguna, in southern Luzon. In a note, Blanco mentioned that Father Pedro Navarro had sent him five flowers on a single root from "montes de Basei en Leite," apparently collected from the same place visited by Cuming, and that Navarro had told him with enthusiasm about these monstrous flowers. The latter must have been *R. manillana.* Blanco apparently, and correctly as it turns out, regarded his materials as representing two different species.

In the Supplement of the Flora de Filipinas, *Rafflesia lagascae* Blanco (1845: 595) was added posthumously, and commemorates Mariano Lagasca (1776-1839, "en memoria de nuestro célebre botánico español"). It was collected by Ignatio G. Azaola, also in the Majaijai mountains. Hieronymus (1885), who mixed up the collecting data of the

two Blanco species (also quoted *in toto* by Solms-Laubach, 1891: 241), suggested that Blanco had not included *R. lagascae* in the main text because it was based on the same specimens from which he described *R. philippensis*.

For both species, the descriptions were incomplete and Blanco did not keep a herbarium nor any type specimens so that it is difficult to ascertain what plants he was describing. Merrill (1918: 135) attempted to interpret *R. philippensis* and *R. lagascae* by referring to a collection made by W.H. Brown on Mt. Makiling, Laguna. As this specimen is not from Mount Majaijai, Laguna, the type locality of *R. lagascae* and *R. philippensis*, it perhaps does not represent Blanco's taxa. Naves and Fernandez-Villar in the 3rd volume of the *Gran Edicion* of the Flora de Filipinas (ed. 3, 1879) put the two Blanco species together and combined the previous Spanish descriptions and notes into Latin translations.

In the 4th volume of the *Gran Edicion* (ed. 3, 1880: 174) of the Flora de Filipinas, Fernandez-Villar recognized two *Rafflesia* species, namely the small-diameter *R. cumingii* R. Br. (including *R. philippensis* Blanco and *R. manillana* Teschem.) and the large-diameter *R. patma* Blume (including *R. lagascae* Blanco). As currently recognized, *R. patma* is found only in Sumatra and Java, and perhaps Bali, but not in the Philippines (Nais 2001: 160).

Solms-Laubach (1891), in his treatment of Rafflesiaceae of the world, was the first to recognize *R. manillana* as the correct name for the small-diameter (i.e., *c.* 20 cm) *Rafflesia* in the Philippines and provided a detailed description of the species. In his treatment he reduced the names *R. cumingii, R. lagascae, and R. philippensis* to the synonymy of *R. manillana*.

Since then, the name *R. manillana* has been accepted by later authors, e.g., W.H. Brown (1912, 1919); Merrill (1918: 135, 1923: 120); Pancho (1983: 264); Meijer (1997: 27); Madulid (2000: 39); Nais (2001: 154); Fernando et al. (2004: 272); Fernando and Ong (2005: 264). In the past five years, several new small-diameter *Rafflesia* species have been described from the Philippines (viz. *R. baletei* Barcelona & Cajano, *R. banahawensis* Madulid, Villariba-Tolentino, & Agoo, *R. lobata* Galang & Madulid, and *R. panchoana* Madulid, Buot & Agoo). Many morphological characters of these species seem to overlap so much that it is not easy to distinguish them (See Table 1). Moreover, some recently collected specimens do not conform with these recently published descriptions. It thus becomes necessary to conduct an in-depth study to resolve

Table 1. Comparison of descriptions of small diameter *Rafflesia* species by different authors.

| | *R. manillana* Teschem. (Teschemacher, 1842) | *R. manillana* Teschem. emend. Madulid & Agoo (2007) | *R. panchoana* Madulid, Buot & Agoo (Madulid et al., 2007) | *R. baletei* Barcelona & Cajano (Barcelona et al., 2006) | *R. lobata* Galang & Madulid (Galang and Madulid, 2006) | *R. banahawensis* Madulid, Villariba-Tolentino & Agoo Madulid et al. (2006) |
|---|---|---|---|---|---|---|
| Mature bud size | 2.5 in diam | 7 cm diam | n.i. | 7.5 – 9 cm diam | 6.1-6.5 cm diam | 13-16 cm diam |
| Bract size | 3/8 in in thickness | 1-4 x 2.5 – 5 cm | 2-6 x 3-6 cm | 4-7 x 3.5 – 6.5 cm | n.i. | 7-9 x 5-8 cm |
| Open flower size | n.i. | 11-16 cm diam; 6.5 – 8 cm high | To 24 cm diam; 11 cm high | 9-22 cm diam; | 11-21 cm diam; 6 – 9 cm high | 29.5 – 32 cm diam; |
| Perigone lobes | n.i. | 4-5 x 4 – 5.5 cm; orange to brown | 6-10 x 7-9 cm; reddish to reddish brown | 5 – 7.5 x 5 – 8 cm; dark-, reddish- or rusty brown | 4-5 x 6-7 cm; brown | 9-10 x 9-10.5 cm; reddish |
| Warts on perigone lobes | n.i. | Whitish, round, 5-7 across widest part | Whitish, round, more than 10 across widest part, widely spaced; 2 – 3 x 2 – 5 (7.5) mm | Whitish, irregular in shape | White, oval to oblong | White, oval or elongated horizontally, somewhat coalesced, 8-12 along median part |
| Diaphragm dimensions | n.i. | Incurved; 7-12 cm across; 2-3 cm broad; opening 4-5 cm diam | Upright or inclined towards the center, to 2.5 cm broad, opening 7.5 - 8.5 cm diam | Incurved; 7.5 – 12 cm diam.; opening 3 – 3.5 cm diam. | Outcurved; lobed, each lobe 2 x 3.5 cm; opening to 4.5 cm | Incurved, 3.5-4.0 cm board; 12.5 – 13 cm across, opening 5.5 – 6 cm diam. |
| Diaphragm color | n.i. | White turning orange similar to that of the perigone lobes | Same as perigone lobes | Paler than perigone lobes; inner margin reddish brown, darker than the rest of the diaphragm | n.i. | Same color as perigone lobes; inner margin with distinct white lining |

n.i. = no information

Table 1. (continued)

| | *R. manillana* Teschem. (Teschemacher, 1842) | *R. manillana* Teschem. emend. Madulid & Agoo (2007) | *R. panchoana* Madulid, Buot & Agoo (Madulid et al., 2007) | *R. baletei* Barcelona & Cajano (Barcelona et al., 2006) | *R. lobata* Galang & Madulid (Galang and Madulid, 2006) | *R. banahawensis* Madulid, Villariba-Tolentino & Agoo Madulid et al. (2006) |
|---|---|---|---|---|---|---|
| Warts on diaphragm | n.i. | In 2 rows, white slightly elevated warts, irregularly round, some surrounded by a brown ring, closely spaced; some depressions which are impressions of the warts of the perigone lobes | Flat, irregular shaped somewhat stretched or continuous warts | Reticulate ornamentations that are whitish and sharp-edged forming irregularly shaped but commonly pentagonal areoles | depressions | A network of interconnected elongated, raised white structures |
| Windows | n.i. | Present, round, in 2-3 rows | Present, elongate or somewhat stretched or coalesced, 2-3 rows | absent | present | Present, in 2 rows |
| Ramenta | Tubercles of various forms on interior part of perianth; part of the perianth tube opposite the anthers with thick capillary or glandular hairs, terminated by a glandular knob | White, dense from base to top of tube, lower part long with rounded top, to 3 mm long; middle part shorter and broader top, to 2 mm long; upper part shorter and rounded top, to 1.5 mm long | White, dense from base to top of perianth tube, lower part long with rounded top, middle part shorter and broader top, upper part shorter and rounded top | Dense, nearly evenly distributed all over inner surface of diaphragm and perigone tube, variably branched, to 2 mm long | Lower part of perigone tube columnar and funnel shape and multi-lobed; middle to upper part pustulate | On lower part of perigone tube sparse, 4-5 mm, simple; on middle part dense, 4-5 mm, filiform; on upper part dense, 5 – 6 mm, filiform |
| Disk | Convex, raised edge | 3.5 – 4 cm diam; rim slightly raised | To 6 cm; rim slightly raised | 5-5.5 cm diam; rim raised | 1.5 cm high | 6.5-7 cm diam; rim raised |

n.i. = no information

Table 1. (continued)

| | *R. manillana* Teschem. (Teschemacher, 1842) | *R. manillana* Teschem. emend. Madulid & Agoo (2007) | *R. panchoana* Madulid, Buot & Agoo (Madulid et al., 2007) | *R. baletei* Barcelona & Cajano (Barcelona et al., 2006) | *R. lobata* Galang & Madulid (Galang and Madulid, 2006) | *R. banahawensis* Madulid, Villariba-Tolentino & Agoo Madulid et al. (2006) |
|---|---|---|---|---|---|---|
| Processes | 11, 1/8 in. differing from each other in size and form, summit entire and hispid, hairs resembling pistillary projections; one of the processes is in the center, 10 arranged around it at equal distance | 14-15, conical in males, wedge shape in females, with bristles at the top | 17-24, conical in males, wedge shape in females | 19-26, arranged in 2 concentric rings, laterally compressed, variably branched, pointing outwards toward the rim, reddish orange basally, darker apically | 7-14, elongate | Larger ones 13-15, arranged in a ring, some radially from the center, flattened and jagged at the apices and margins, projecting outwards, reddish; 3 5 processes in central cluster, forming a ring; smaller ones tuberculate, numerous; scattered throughout. |
| Base of column and annulus | Could not perceive any distinct appearance of an annular process at the mouth of the tube of the perianth, although it is not improbable that such a ring may be developed with the flower is open | 4 – 4.5 cm diam, with tubercles | 5.5 – 6.5 cm diam, with bristles | n.i. | 5 cm diam., with bristles | n.i. |
| Anthers | 10 edges covered with hairs resembling tips of the processes on the disk | 11 - 12 | 14 - 18 | 11-14 | 10 - 11 | 14 - 17 |
| Distribution | Basey, Samar Is. | Basey, Samar Is. | Laguna, Luzon Is. | Camarines Sur, Luzon Is. | Antique, Panay Is. | Quezon, Luzon Is. |

n.i. = no information

the taxonomic status of these plants.

Based on the foregoing, it is clear that the descriptions of the small-diameter Philippine *Rafflesia* species made before the 1900s were based on specimens in bud collected from Basey, Samar and referred to as *R. manillana* (including *R. cumingii*, e.g., by Teschemacher, W.H. Brown, Miquel, Meijer, Nais, and Solms-Laubach). Although the material studied by Teschemacher and said to be deposited at the Arnold Arboretum (A) is apparently lost, that seen by R. Brown survives at The Natural History Museum, London (BM) and a digital image was kindly provided to the authors. *Rafflesia philippensis* Blanco was allegedly collected in Majaijai (now Majayjay), Laguna, in southern Luzon but there is no preserved type specimen available for examination. So far no specimens of this species have been collected from this locality again.

Since its first collection in the 1830s, no other specimen of *R. manillana* had been collected from the type locality, until recently. This could be attributed to several factors. There were no botanists interested in studying Philippine *Rafflesia* and the local people may have seen specimens of *Rafflesia* in the forests of Basey but just ignored them or were not interested in them as they had no use for them. In order to complete the characterization of the species, it became important, therefore, to collect fresh specimens, preferably the open flowers of both male and female plant and the fruits.

As the original specimen examined by Teschemacher was only a bud, his description of the species is most certainly incomplete. Missing from the description are important characters such as the size of the male and female flower; ornamentation and colour of the lobes; nature and ornamentation of the upper and lower surface (windows) of the diaphragm; distribution and type of ramenta; size, shape and distribution of the processes in the disk; and annulus. However, Meijer (1997: 27) presented an expanded description of *R. manillana*, based on the original bud specimen at BM, combined with open flowers of specimens collected in Luzon.

In May, 2007 the authors visited Samar and conferred with Forester Manolito Ragub, the Regional Technical Director and the Protected Area Superintendent of the Samar Island National Park, and his technical staff about *Rafflesia manillana* in Basey, the type locality. The local government officials and some residents of Basey also helped in searching for the species in the forest. Luckily, a local resident eventually found a population and collected specimens (male, female, and bud).

With the acquisition of these specimens from Samar, we were able to examine in detail important morphological characters of the male and female flowers and critically evaluate the status of *R. manillana* throughout its supposed distributional range. We also compared this species with the other small-diameter *Rafflesia* materials described within the last five years from other parts of the Philippines, i.e., Laguna, Bicol, and Panay (see Table 1).

## Taxonomic Treatment

***Rafflesia manillana* Teschem. emend. Madulid & Agoo**
Teschemacher (1842) 381, t. 6, (1844) 63, t. 6; Solms-Laubach (1891) 241, t. 26, fig. 7 - 10, Solms-Laubach (1901) 9. --- *Rafflesia cumingii* R. Br. (1844) 23, (1845) 243-244, nom. superfl.; Miquel (1856) 684; Fernandez-Villar (1880) 174. --- Type: *Anonymous* (A, holo, lost). --- Lectotype [icon]: Teschemacher (1842) fig. 6**,** designated here. --- Epitype: Wilfredo Depalco/SINP (Samar Island National Park) 1001 (PNH 252647), Philippines, Samar, Basey, designated here. Plate 1, a-g.

## Description

*Bud c.* 7 cm diameter; windows on the underside of the diaphragm at the lower row *c.* 3 x 3 mm; middle row *c.* 4 x 4 – 5 mm; upper row *c.* 3 x 4 – 5 mm. *Open flower* 6.5 – 8 cm high, 11 – 16 cm wide (with cupule). *Cupule* 2 – 2.5 cm high, 5 – 6 cm wide. *Bracts* in 3 whorls, outer whorl 1 – 2 x 2.5 – 3 cm, middle whorl 2 – 2.5 x 2.5 – 3.5 cm, inner whorl *c.* 4 x 4 – 5 cm. *Perigone lobes* 4 – 5 x 4 – 5.5 cm; warts 5 – 7 across widest part, closely spaced. *Diaphragm* incurved, 7 – 12 cm across, 2 – 3 cm broad, opening 4 – 5 cm; upper surface whitish in bud, turning to the same colour as perigone lobes as it matures, with 2 rows of flat irregularly round warts, with depressions, closely spaced; lower surface with windows, in 2 or 3 rows, round, rarely coalesced; in buds, windows at lower row *c.* 3 x 3 mm; middle row *c.* 4 x 4 – 5 mm; upper row *c.* 3 x 4 – 5 mm. *Perigone tube* to 2.5 – 3.5 cm high, 5 – 9 cm wide; ramenta on lower part of tube stalked with rounded top, to 3 mm long, on middle part with short stalk and broad top, to 2 mm long; on upper part with short stalk and round to broad top, to 1.5 mm long. *Disk* 3.5 – 4 cm diameter, 4 – 8 mm thick; rim to 2 mm high, slightly raised, hairy; processes 14 – 15, 3 – 5 mm high, wedge shape (in female) or conical (in male), hairy on top

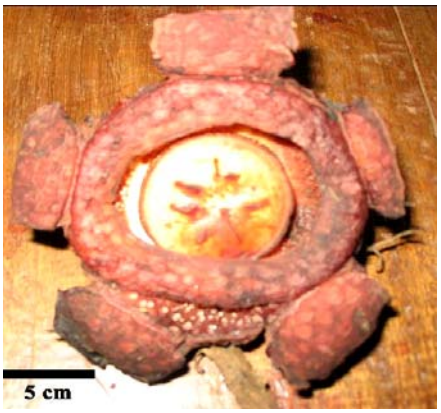


Plate 1a.


Plate 1b.

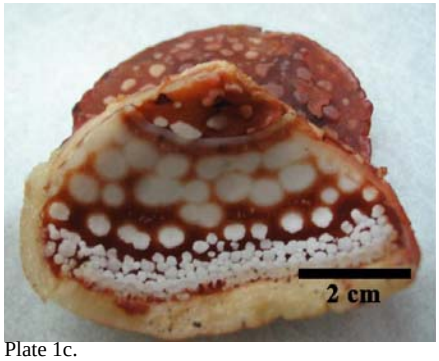


Plate 1c.

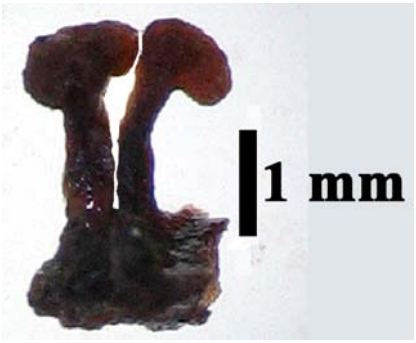


Plate 1d.

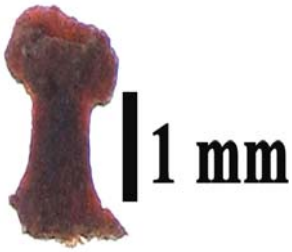


Plate 1e.

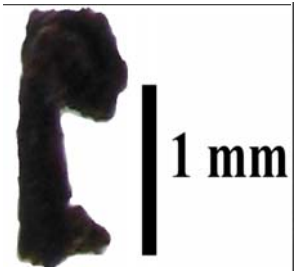


Plate 1f.


Plate 1g.

Plate 1. Diagnostic characters of the flower of *R. manillana*: a. whole flower with incurved diaphragm (Epitype: Wilfredo Depalco/SINP 1001, *PNH 252647*); b. larger and fewer warts on perigone lobes; c. round windows on the underside of the diaphragm; d. ramenta on the lower part of perigone tube; e. ramenta on the middle part of perigone tube; f. ramenta on the upper part of perigone tube; g. tuberculose structures on the annulus and base of the column.

edge. *Male* with anthers 11 or 12, *c.* 3 mm high, *c.* 5 mm diameter; pollen mass 1 – 2 mm wide, anther groove 0.8 – 1 cm wide; column *c.* 8 mm high, 2.2 – 2.5 cm diameter, shallowly grooved, connecting to cavities on the base of the column; base to 6 cm diameter, cavities equal to number of anthers, 1 – 1.2 x 0.7 cm, with tubercles on the surface of the base of the column and along the margins of the cavities; annulus with tubercles on the rim. *Female* stigmatic area *c.* 9 mm broad, papillose; column *c.* 7 mm high, 6 – 7 mm diameter, shallowly grooved; base of the column *c.* 4 cm diameter with radial grooves, to 1.75 cm long and *c.* 5 mm wide, with scattered black tuberculose structures near the edges; annulus with round or tuberculose structures on the rim.

Geographical distribution: Restricted to Basey, southern Samar island, Philippines (in Teschemacher's and Blanco's articles, and in other publications, the type locality is referred to as "Basei, Leite." Basei is now spelt as Basey in modern maps and is a town on the southwestern side of Samar Island. Leite refers to the neighboring island of Leyte to the southwest of Samar and is separated from it by the narrow San Juanico Strait. The reference to Basei being a part of Leite probably arose from the fact that Samar was politically a sub-province of Leyte during the middle part of the 19$^{th}$ century).

Habitat: In lowland primary forests and growing on the host vine *Tetrastigma* sp. (Vitaceae).

Specimens examined: Wilfredo Depalco/SINP 1001 (Epitype designated here, PNH 252647); 1002 (PNH 252648), 1003 (SINP), 1004 (SINP), all collected on 22 June 2007.

Notes: The species is similar to *R. panchoana* Madulid, Buot & Agoo (2007), found on Mt. Makiling, Luzon, at low to medium altitudes. It is similar in size and presence of ramenta but differs in having a consistently incurved diaphragm, larger warts on the perigone lobes, 5-7 warts across the widest part, flat, round warts on the upper surface of the diaphragm, more or less round windows in 2 or 3 rows on the inner side of the diaphragm, and tiny black round tubercles on the base of the column and rim of the annulus.

Conservation status: Critically endangered.


Plate 2a.


Plate 2b.

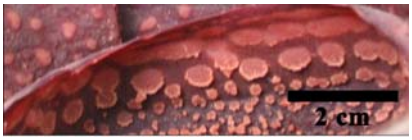


Plate 2c.


Plate 2d.

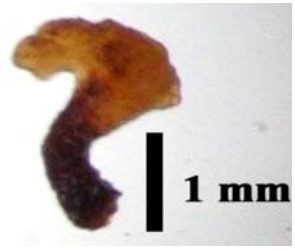


Plate 2e.


Plate 2f.


Plate 2g.

Plate 2. Diagnostic characters of the flower of *R. panchoana*: a. whole flower with open diaphragm (U.S. No. 0090412, bar code 52509); b. smaller and numerous warts on perigone lobes; c. elongated windows on the underside of the diaphragm; d. ramenta on the lower part of perigone tube; e. ramenta on the middle part of perigone tube; f. ramenta on the upper part of perigone tube; g. bristle like structures on the annulus and base of the column.

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