

The Genus *Rafflesia* R.Br. (Rafflesiaceae) in the Philippines

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A review of the Philippine species of *Rafflesia* R.Br. is presented, including the description of a new species, *Rafflesia mira*, from Mindanao Island. A key to the identification of all four Philippine species is provided.

Key words: *Rafflesia*, *Rafflesia manillana*, *Rafflesia schadenbergiana*, *Rafflesia speciosa*, *Rafflesia mira*, plant root parasites, Campostela Valley Province, Mindanao, Philippines

INTRODUCTION

Before the publication of the monographic revision of Meijer (1997) for Flora Malesiana and the recent excellent treatise of Nais (2001), only two species of *Rafflesia* R.Br. were known from the Philippine Islands. One of these, *Rafflesia manillana* Teschem., was the first to be described from the archipelago in 1841, and has thus far, been recorded from three of the larger islands, viz. Luzon, Samar, and Leyte. *Rafflesia schadenbergiana* Göpp., described in 1882, is known only from Mindanao Island. About 120 years later, a third species, *Rafflesia speciosa* Barcelona & Fernando, was described from Panay Island in the central part of the Philippine archipelago (Barcelona & Fernando 2002). All three *Rafflesia* species have recently been included in the Philippine National List of Threatened Plants under the Critically Endangered Species Category.

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In this paper we describe a new species, *Rafflesia mira*, the second recorded from Mindanao Island. This brings to a total of four species, all endemic, now known from the Philippine Islands. A key to all the Philippine species is provided.

KEY TO THE PHILIPPINE SPECIES OF *RAFFLESIA*

- 1a Flowers 14-20 cm in diameter; diaphragm, 1-1.5 cm broad from insertion to opening, orifice to 5-7 cm diameter; anthers c. 15. Luzon, Samar, Leyte Islands 1. *Rafflesia manillana*
- 1b Flowers > 20 cm in diameter; diaphragm 4.5-8.0 cm broad from insertion to opening, orifice 9.5-16 cm diameter; anthers > 15. Panay and Mindanao Islands 2
- 2a Perigone lobes with 4-5 warts across the middle part; warts generally large, laterally stretched, coalesced or partly connected; mature open flowers to 80 cm in diameter. Mindanao Island 2. *Rafflesia schadenbergiana*
- 2b Perigone lobes with > 5 warts across the middle part; warts generally small and scattered; mature open flowers < 80 cm in diameter 3
- 3a Warts on perigone lobes narrower and filiform; diaphragm 18-20 cm in diameter; processes on outer rim of disk with narrower bases, to 6 mm. Panay Island 3. *Rafflesia speciosa*
- 3b Warts on perigone lobes broader and thicker; diaphragm 22-29 cm in diameter; processes on outer rim of disk with broader bases, to 10 mm. Mindanao Island 4. *Rafflesia mira* sp. nov.

1. *Rafflesia manillana* Teschem.

Rafflesia manillana Teschem. in Boston Journal of Natural History 4: 63 (1841); Brown in Philippine Journal of Science 7: 209 (1912); Merrill, Enumeration of Philippine Flowering Plants 2: 120 (1923); Pancho, Vascular Flora of Mount Makiling and Vicinity 312 (1983); Meijer in Flora Malesiana 13: 27 (1997); Madulid, Philippine Plants Endangered Plants 39 (2000); Nais, *Rafflesia* of the World 154 (2001); Fernando *et al.*, Flowering Plants and Ferns of Mt. Makiling 272 (2004). — Type: Navarro *s.n.* (*A, non vidi*), Philippines, Leyte Island.

Rafflesia philippensis Blanco, Flora de Filipinas, ed. 2, 565 (1845). — Type: Navarro specimen from Laguna Prov., Luzon (now lost, *fide* Meijer 1997)

Rafflesia cumingii R. Br. in Transactions of the Linnean Society 19: 243 (1845). — Type: Cuming collection (BM, *non vidi*), likely from the same site as Navarro specimen from Leyte (*fide* Meijer 1997)

Rafflesia lagascae Blanco, Flora de Filipinas, ed. 3, 231 (1879) (*nomen nudum, fide* Meijer 1997).

Mature buds to 6.5-8 cm in diameter, cupule 2.5-3 cm high, 4-6 cm wide, bud scales up to 5.5-7 cm long. Flowers 14-20 cm in diameter and 7-9 cm high when expanded. Perigone lobes light reddish brown, 4-6 cm long and 5-7 cm wide, white warts a mixture of larger circular with oval ones, about 10-13 across the middle part of the lobe, mixed with numerous white dots. Diaphragm c. 6.5-8.5 cm in diameter,

c. 1-1.5 cm broad from insertion to opening, strongly curved inwards along the opening; orifice to 7 cm diameter; upper face rather densely randomly covered with oblongish white warts. Disk 3.2-4.8 cm in diameter including the rim, c. 2 cm above the base of the perianth tube, exposed while the flower is open; rim of disk with a 3-5 mm high raised part. Processes about 12-20 (-30), sometimes almost devoid in the centre of the disk, 3.5-5.5 mm long, apex cylindric, with bushy cilia, some nearly prostrate on disk, pointing outwards. Neck of column 1.3-1.8 cm in diameter, narrower in male flowers. One prominent annulus, 3 mm broad, 30-38 mm in diameter around the base of the column. Perigone tube c. 2.5 cm deep, 5 cm wide; ramenta at the inner side in about 12 rows, little stalked outgrowths, 0.5-1 mm high, multi-lobed at apex, virtually absent near the base of the perianth tube, close to the annulus; in a 1 cm wide zone below the diaphragm with short, warty lobed, whitish, 2-3 mm wide warts. Male flowers with 10-15 anthers, not hidden in a sulcus as in the larger-flowered species, but attached rather close to the lower margin of the disk; corresponding with each anther in the central column a deep groove which runs down below the anther to the column base. Female flowers with ovary 2.5-3.3 cm wide at apex, 1.0 cm high, above the annulus without grooves or with very faint ones, less room under the corona (overhang) of the disk than in male flowers, with a papillose stigmatic zone on its lower side. Fruit a berry, c. 5.5 x 6.5 cm with remnants of disk prominent at apex; walls thick, those in upper part cracked into squarish segments resembling the carapace of a turtle, brownish-black; cupule c. 6 cm in diameter, 1.7 cm high; cavity or ovarial part c. 2 x 5 cm, with whitish tissue and numerous, minute, brown to dark brown seeds.

Notes — The fruit of *R. manillana* is here described for the first time based on Fernando 1733 (LBC) collected in August 2004 from Mt. Makiling. This species is considered the smallest known *Rafflesia* (Meijer 1997, Nais 2001) and with the most narrow diaphragm from insertion to opening. It has been recorded from Luzon, Samar and Leyte Islands (Merrill 1923, Meijer 1997). Except those cited by Merrill (1923: 121) and a collection from Mt Isarog (Madulid 2000, Barcelona & Fernando 2002) and nearby Mt. Banahaw (Barcelona, pers. comm.), both also on Luzon Island, all of the modern records and specimen collections of this species are from Mt. Makiling where only a few active populations are known (Fernando *et al.* 2004). This species is now also known from Mt. Natib in Bataan Province and Peñablanca in Cagayan Province on Luzon Island (Co & Balete, pers. comm.). The Cagayan Province locality of this species represents the northernmost geographical limit of the genus. *Rafflesia manillana* is regarded as a rare and endangered species (Tan *et al.* 1986, Gruèzo 1990, Meijer 1997, Madulid 2000, Nais 2001).

2. *Rafflesia schadenbergiana* Göpp.

Rafflesia schadenbergiana Göppert in Gartenflora 34: 3 (1884); Merrill, Enumeration of Philippine Flowering Plants 2: 121 (1923); Meijer in Flora Malesiana 13: 33 (1997); Nais, *Rafflesia* of the World 174 (2001). — Type: Schadenberg & Koch *s.n.* (= *Hieronymus s.n.*) (holotype K, isotype WRSL, *non vidi*), Philippines, Mindanao Island, Davao Prov., Mt. Apo.

Mature buds 16-20 cm in diameter, cupule 10-14 cm in diameter, bracts up to 17-18 cm long, 12-13 cm wide. *Flowers* about 80 cm in diameter. *Perigone lobes* 25-26 cm in diameter, with yellowish whitish warts which are laterally stretched, irregularly shaped, partly connected; warts about 4 or 5 across the middle part of the perigone lobe. *Diaphragm* 25-30 cm diameter, 6-8 cm broad from insertion to opening, orifice 13-14 cm in diameter, margin with pinkish zone, lower face except the marginal zone provided with ramenta *c.* 4-5 mm long. *Ramenta* on the inside of the flower tube 7-10 mm long, filiform, somewhat thickened at the apex, or branched, partly in fascicles. *Disk* 12-13 cm in diameter. *Processes* 30-50. Male flowers with 26-38 (-40) anthers.

Notes — *Rafflesia schadenbergiana* has the largest flower of the Philippine species of *Rafflesia*, nearly four times those of *R. manillana*, reaching to about 80 cm in diameter (Meijer 1997). It is still known only from the type specimen (WRSL, K) collected in 1882 at *c.* 800 m alt. on Mt. Apo on Mindanao Island (Meijer 1997). Nais (2001) recorded this species from nearby Mt. Matutum based on relayed information on a supposed collection of a bud, but it is not known if the identity of the specimen has been confirmed.

3. *Rafflesia speciosa* Barcelona & Fernando

Rafflesia speciosa Barcelona & Fernando, Kew Bulletin 57: 648 (2002). — Type: *Barcelona 1221* (holotype PNH, isotype LBC), Philippines, Panay Island, Antique Prov., Mt. Poras, Sibalom Natural Park.

Mature buds 18-20 cm in diameter; cupule of mature flowers 2.5 cm high, 8.5 cm wide, bud scales to 11 cm long. *Flowers* (45-)50-56 cm in diameter, 13-16 cm high when expanded. *Perigone lobes* generally orbicular, (10-)12 -18.5(-20) cm long, 14-22.5 cm wide, *c.* 1 cm thick near the base, dark-, reddish- or rusty-brown, becoming paler with age; upper surface warty; warts 18-20 across the middle part of the perigone lobe, whitish, generally small and narrow, rather scattered, irregular in shape, whitish on a reddish-brown background in new bloom, undersurface smooth with white, roundish blots; margin entire to sinuate. *Diaphragm* 18-20 cm in diameter, to 7 mm thick, 2.5-6 cm broad from insertion to opening, usually darker than the perigone lobes, upper surface appearing generally smooth, devoid of the white warts present on the perigone lobes, instead numerous smaller irregular white specks present all over, some occurring in groups that form two concentric rings around the rim, very prominent in newly opened flowers and fading with age, appearing brown on dark background when dry; the rim entire, whitish; orifice 9.5-10 cm in diameter. *Disk* *c.* 9.5-12 (-14.3) cm in diameter, *c.* 6 mm thick, dome-shaped centrally, yellow-orange becoming reddish-orange at the periphery; rim of disk steeply raised with 1.0-1.5 cm raised part, entire to irregularly finely crenulate, reddish orange in new bloom; column to 2.5 cm above the base of the perianth tube, or *c.* 6.5 cm from cupule base to the tip of disk, neck of column to 5.5 cm diameter. *Processes* (17-)20-27(-31), usually arranged in 2-3 concentric rings pointing outward towards the rim, to 1.3 - 2.3 cm long, *c.* 6 mm wide at base, reddish proximally, darker distally. *Ramenta* distributed all over the undersurface of the diaphragm, those above the perigone attachments

generally stouter and reduced to tubercles, those below to *c.* 2 mm long, becoming shorter towards the diaphragm base, simple or shallowly variably lobed. *Male flowers* with 19-24 anthers; anthers *c.* 4.5 x 5 mm, anther cavity *c.* 1.3 x 1.0 cm, densely hairy. Female flowers not known.

Notes — This was until recently one of the most interesting botanical discoveries in the Philippines in recent years. It is still known only from Panay Island.

4. *Rafflesia mira* Fernando & Ong, *sp. nov.*

Figures 1 & 2

Flores 45-57 cm diametro. *Lobi perigonii ad circa* 10.5-14 cm longi 15.6-21 cm lati. *Diaphragma* circa 22-29 cm diametro. *Flores masculi antheris* 22-24. *Rafflesia speciosa* Barcelona & Fernando (*species Panayense*) *magnitudine floris similis sed lobi perigonii verruculis differt.* **Typus:** Philippines, Mindanao Island, Campostela Valley Prov., Mt. Candalaga, Fernando & Ng 1653 (holotypus LBC).

Immature buds to 6.3-7 cm in diameter, to 5-6.5 cm high including cupule. *Flowers* 45-57 cm in diameter, to 14 cm high when expanded. *Perigone lobes* *c.* 10.5-14 cm long x 15.6-21 cm wide, reddish-brown, upper surface warty; warts whitish, generally small and narrow, rather scattered, irregular in shape, prominently raised, up to 12-22 warts across the middle part of the perigone lobe; up to 5-9 mm thick of area along the rim of the margins often smooth, distinct, and darker colored. *Diaphragm* 22-29 cm in diameter, circular, or appearing pentangular at insertion with perigone lobes, *c.* 4.5-5.7 cm broad from insertion to opening, slightly darker than the perigone lobes, appearing generally smooth and without white warts; the upper surface decaying with prominent depressions of similar size as the warts on the perigone lobes; the rim darker and smoother, curved inwards; orifice 14-16.6 cm in diameter. *Disk* *c.* 8.5-10.5 cm diameter, rim of disk raised 3-5 mm. *Processes* 38-40, the outermost ones distinctly arranged in a concentric ring of up to 23, \pm flattened, with bases oriented radially from the center, 5-8 mm tall to 10 mm at base, inner processes scattered in central portion of disk and with shorter and narrower bases. *Male flowers* with 22-24 anthers.

Distribution and habitat — Philippines, Mindanao Island, in mid-montane rain forest, *c.* 900 m alt. growing on steep slope about 15 m from a waterfall. Endemic. Host plant: *Tetrastigma loheri* Gagnep. (Vitaceae). Voucher: Fernando & Ng 1654 (LBC).

Specimen examined — Philippines: Mindanao Island, Campostela Valley Prov., Mt. Candalaga, Fernando & Ng 1653 (holotype LBC).

Notes — The specific epithet refers to the wonderful and surprising discovery of this remarkable new species. The species is rare and known thus far only from a single site on Mt. Candalaga. It was first seen and photographed in 1999 on the same site. Unlike the two other well-known species of *Rafflesia* (*R. manillana* and *R. speciosa*) in the Philippines that usually flower from February to April, *R. mira* apparently flowers mainly in August to September. The pattern and size of the warts on the perigone lobes in this species is clearly different from that of

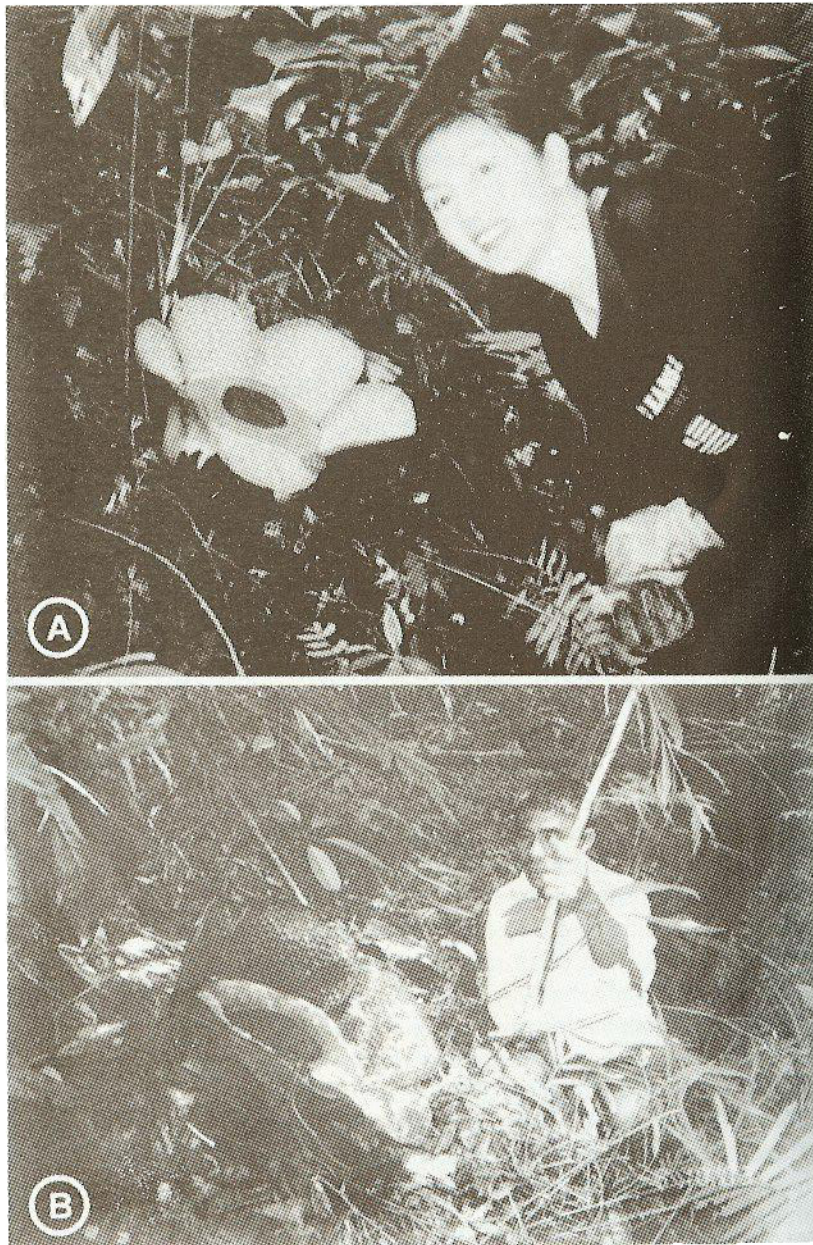


Figure 1. *Rafflesia mira* Fernando & Ong *sp.nov.*, Mt. Candalaga, Campostela Valley Province, Mindanao Island, Philippines. A. Newly opened flower (Photo courtesy of Sonia Garcia). B. Flower in early stage of decay (Photo courtesy of Rhonson Ng).

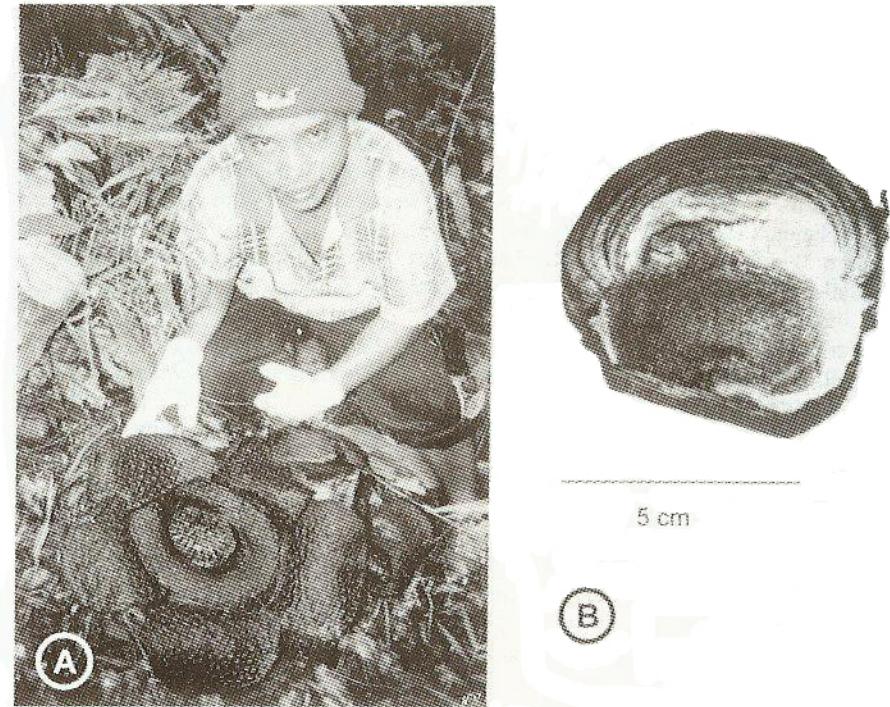


Figure 2. *Rafflesia mira* Fernando & Ong *sp.nov.*, Mt. Candalaga, Campostela Valley Province, Mindanao Island, Philippines. A. Flower in very advanced stage of decay. (Photo courtesy of Rhonson Ng). B. Flower bud in longitudinal section. (Photo: E.S. Fernando).

R. schadenbergiana, a species recorded from nearby Mt. Apo for more than a hundred years, but still known only from the type specimen. *Rafflesia mira* is similar to *R. speciosa* in size and dimensions, but the warts on the perigone lobes are broader and thicker and their pattern is also very different. The large flowers of this *Rafflesia* has become an ecotourism attraction for Mt. Candalaga known as one of the country's most challenging mountains with numerous river crossings and waterfalls.

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We dedicate this new species to Ms. Sonia V. Garcia, Regional Director of the Department of Tourism, Region IX and to Mr. Arsenio L. Yanong Jr., Mayor of the Municipality of Maragusan, Campostela Valley Province. Ms. Garcia first brought to our attention the presence of this species on the mountain. We thank the municipal government of Maragusan, especially Mayor Arsenio L. Yanong Jr. and Ms. Edna Tecson for hospitality and the Center for Integrative Development Studies, University of the Philippines Diliman, Quezon City for logistical help. We specially thank Mr. Rhonson Ng and Mr. Bobong for excellent assistance in the field. Ms. Garcia and Mr. Ng also provided the photographs.

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