

Rafflesia camarinensis (Rafflesiaceae), A New Species from Mt. Asog, Camarines Sur, Luzon Island, Philippines*

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ABSTRACT

Rafflesia camarinensis, a new species of *Rafflesia*, is described from Mt. Asog, Camarines Sur in southeastern Luzon, Philippines. The species is remarkable in being one of the smallest *Rafflesia* in the Philippines with flower diameter measuring just 11-13 cm across. It is distinguished from *R. baletei* from the adjoining Mt. Isarog by various characters more notably its smaller size, dome-shaped perigone lobes, thicker and almost woody texture, less dense warts which are more or less homogeneous and raised, fewer, shorter and randomly distributed processes, and a diaphragm concolorous with the perigone lobes and with continuous thick white warts on its surface. It has a very narrow distribution, is critically endangered and needs immediate conservation actions.

INTRODUCTION

To date, there are 14 species of *Rafflesia* recognized in the Philippines, namely: *R. aurantia* Barcelona, Co & Balete, *R. baletei* Barcelona & Cajano, *R. banoana* Malabrigo, *R. banahawensis* Madulid, Villariba-Tolentino & Agoo, *R. leonardi* Barcelona & Pielser, *R. lobata* Galang & Madulid, *R. magnifica* Madulid, Tandang & Agoo, *R. manillana* Teschem., *R. mixta* Barcelona *et al.*, *R. panchoana* Madulid, Buot & Agoo, *R. schadenbergiana* Goep. ex Hieron., *R. speciosa* Barcelona & Fernando, *R. verrucosa* Balete *et al.*, and *R. consueloae* Galindon, Ong & Fernando. Several names are invalidly published: *R. philippensis* Blanco (Madulid and Agoo, 2015; Agoo *et al.*, 2015) and *R. cumingii* R.Br. (Mabberley, 1999). *R. mira* Fernando & Ong is a dubious name and its identity is uncertain (Madulid and Agoo, 2014) while *R. lagascae* Azaola ex Blanco is a superfluous name (Agoo *et al.* in prep.).

As part of its biodiversity conservation efforts, Camarines Sur State Agricultural College (CSSAC), now known as Central

Bicol State University of Agriculture, received a research grant in 2005 to study what is then known as *Rafflesia manillana* Teschem. found in Mt. Isarog, Camarines Sur. The team led by G. Jaucian Adan and F. Valenzuela conducted several trips to the mountain and located *Rafflesia* flowers which turned out to be a new species, i.e. *R. baletei* (Barcelona *et al.*, 2006).

On February 2006, Jaucian-Adan received a report from D. Bagacina of the Alliance of Sumagang Outdoor Group, telling about a small *Rafflesia* flower in the slopes of Mt. Asog, a mountain within the city limits of Iriga City. Jaucian-Adan and her team then visited the place and saw 14 buds and 3 full bloom flowers that were smaller in size and morphologically different from *R. baletei*. They suspected it to be a new species of *Rafflesia* and immediately notified their school and the City Government of Iriga. The then Mayor of Iriga City, Madelaine Alfelor-Gazmen and the City Council committed to protect the *Rafflesia* area for biodiversity conservation and ecotourism.

The team visited the Philippine National Herbarium, National Museum, Manila to ask for advice from D.A. Madulid, then Chief, Botany Division. A trip was later made to the site by Madulid and E.M. Agoo from De La Salle University, Manila in 2006 together with the Bicol team.

During the subsequent visits of the CSSAC team on February 2006 two sites were identified within a one hectare area along the steep slopes of Inurogan trail.

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Twenty six (26) buds, twelve (12) open flowers and ten (10) senescent flowers were recorded in a privately-owned site. No other site was reported to harbor the species.

TAXONOMIC TREATMENT

Rafflesia camarinensis Valenzuela, Jaucian-Adan, Ago & Madulid, *sp. nov.* (Figs. 1-3, 5-7).

TYPE— PHILIPPINES: Luzon Island, Camarines Sur, Mt. Asog, 400 m, 11 February 2006, Jaucian-Adan & Valenzuela 101 (holotype, PNH).

Mature bud 5-8 cm in diameter. **Cupule** of mature flower rough, hard and woody, dark brown to black, to 6 cm wide and to 2.5 cm high. **Bracts** of bud overlapping, orbicular, dark brown to black color. **Open flowers** 11–13 cm diameter, 8–9 cm high when expanded. **Perigone lobes** broad oval at the apex, straight towards the base, dome-like, stiff and hard, usually slightly erect and not fully expanded and horizontal when mature, 4–6 cm long and 5–6 cm wide, pale orange to coral red when fresh, becoming dark brick red with age; **warts** 6–8 from base to tip, 6–9 across, whitish, elongated or irregularly shaped, elevated. **Diaphragm** 6.5–7.0 cm in

diameter, generally rough with continuous white thick streaks on the surface, inwardly recurved, circular orifice 2.5–3.0 cm in diameter, pale orange, almost the same color as perigone lobes, the rim whitish. **Disc** diameter 4.5–4.9 cm, surface flat, light cream, slightly raised at the rim. **Processes** 16 to 18, scattered on the disc, 5–8 mm long and 3 mm wide at the base, usually splitting towards the apex, red-orange at the base and darker, almost black, at the apex. **Windows** absent. Inner side of diaphragm and perigone tube profusely covered with ramenta. **Ramenta** at the basal part of the tube to 2 mm long, slender and round at the apex; middle part of tube to 1 mm; upper part of tube and inner diaphragm to 1.9 mm, clumped and with a wedge-like apex. **Male flowers** with 12-13 globose or semi-globose anthers, green when fresh; anther sacs 1.5–2 mm diameter; lined with fine, dark bristles. **Female flowers** with fleshy ovary, to 8 cm diameter. **Mature fruits** and seeds not seen.

Local name: Burak sa anupul (Bicol)

Host Plant: *Tetrastigma coriaceum* (DC.) Gagnep.

Etymology: The specific epithet refers to Camarines Sur in the Bicol Region where the species is found.



← **Figure 1 (left):**
A mature bud.

← **Figure 2 (right):**
An open flower of *R. camarinensis* on the forest floor of Mt. Asog



← **Figure 3 (left):**
Close-up of *R. camarinensis* in Mt. Asog.

← **Figure 4 (right):**
Close-up of *R. baletei* in Mt. Isarog taken by F. Valenzuela .

Table 1. Comparison of morphological characters of *R. camarinensis* and other small diameter species.

	<i>Rafflesia camarinensis</i> (this study)	<i>Rafflesia baletei</i> (Barcelona <i>et al.</i> , 2006, 2009)	<i>Rafflesia consueloae</i> (Galindon <i>et al.</i> , 2016)	<i>Rafflesia aurantia</i> (Barcelona <i>et al.</i> , 2009)
Mature bud diameter	5– 8 cm	7.5–9 cm	6.4–9.9 (ave. 8.27 ± 0.82, n=147) cm	8.5–9 cm
Flower diameter	11 – 13 cm diameter, 8 – 9 cm high when expanded	9–22 cm	6.6–12.7 (ave. 9.73 ± 1.33, n=63) cm	c. 20 cm
Perigone lobe orientation	broad oval or rounded at the apex, straight towards the base, dome-like, usually half erect, stiff, thick, hard, almost woody,	erect basally, but recurved halfway distally, sometimes erect throughout their length	generally erect or upright throughout their length; the apex only slightly recurved; the basal parts imbricate	arching, distantly disposed
Perigone color	pale orange to coral red when fresh becoming dark brick red with age	dark-, reddish- or rusty brown, becoming paler with age	reddish brown in fresh bloom, becoming darker with age	orange
Perigone warts	elongated or irregularly shaped	warts very prominent, dense, relatively large, irregular in shape	sharply-edged fine warts and areola-forming ornamentations	warts sharp-edged, areoles forming ornamentations
Diaphragm surface and rim color	pale orange, almost the same color as perigone lobes, the rim whitish.	paler than perigone lobes, the rim reddish brown and darker than the diaphragm	slightly darker or rarely concolorous with perigone lobes, the rim whitish in fresh blooms becoming dark with age	concolorous
Diaphragm warts	generally rough with continuous thick white streaks on the surface, inwardly recurved	reticulate ornamentations that are whitish and sharp edged forming irregularly-shaped but commonly pentagonal areoles	warts thin, with blunt whitish tips when fresh, forming variably-shaped impressions of perigone warts	sharp-edged, areoles forming
Diaphragm diameter	6.5 – 7.0 cm	7–8.5 (–12) cm	3.2–9.0 cm (ave. 6.87 ± 1.11, n=85)	10 cm
Aperture diameter	2.5 – 3.0 cm	3–3.5 cm	1.47–3.85 cm (ave. 2.57 ± 0.58, n=92)	3–3.6 cm
Windows	absent	absent	Absent	absent
Disk diameter	4.5 – 4.9 cm	5 – 5.5 cm	4 – 4.5 cm	
Disk rim	slightly raised	irregularly and shallowly crenulate	irregularly serrate and shallowly to deeply incised	entire
Disk surface color	light cream	glistening cream-white, becoming reddish brown at the periphery	distinctly dull cream white in newly opened flowers	light orange, with prominent processes
Processes number and arrangement	16-18, scattered, randomly arranged	19-26, in 2 concentric rings, with a 3rd ring with 2–3 processes	usually absent, or rarely if present centrally disposed	indefinite
Processes type	longer than wide, usually splitting towards the apex, red-orange at the base and darker, almost black, at the apex	monomorphic, conical, or slightly laterally compressed, often branched	when present monomorphic, the tips with brown acicular hairs or bristles	flattened, polymorphic, variably branched, horizontally oriented in male flowers, vertically oriented in female flowers
Processes length	5–8 mm	to 10 mm	3 mm	central ones 5–10 mm, peripheral ones 0.5 – 2 mm, as tubercles
Ramenta length	2 mm at the base and upper part of the tube, around 1 mm at mid-part	2 mm, longer towards the base of the tube	0.5–3 mm, longer towards the base of the tube	7–10 mm
Number of anthers	12–13	11–14	12–14	12–14



Figure 5: Dried open flower deposited in the PNH (*Holotype: Jaucian-Adan & Valenzuela 101*).



Figure 6: Close-up of diaphragm and processes.



Figure 7: Longitudinal section of female flower

Distribution: Mt. Asog, Iriga City, Camarines Sur, Luzon Island, Philippines. Endemic.

Mt. Asog is an extinct volcano with its last known eruption recorded on January 4, 1614. It rises above the sea level at 1,196 m. Its neighboring mountain, Mt. Isarog, rises to 2,000 m above sea level. It lies in the central section of the Bicol Peninsula within the political boundary of Iriga City and the municipality of Buhi, Camarines Sur province.

Habitat: It usually grows in disturbed lowland forests from 400 to 500 masl on shaded portions of the forest floor with thick layer of leaves and litter.

Phenology: The opening of the flower, which takes several hours, produces a crackling sound.

DISCUSSION

R. camarinensis was initially thought to be conspecific with *R. baletei* from the adjoining mountain, Mt. Isarog, as both are small (i.e. 11-13 cm in the former and 15- 22 cm in the latter) compared to other species, and are superficially similar in appearance (Barcelona *et al.*, 2006; 2009). But closer examination revealed that the two species possess marked and distinct characters. The size range of *R. camarinensis* is generally smaller than *R. baletei*. In fact, *R. camarinensis* can be regarded as the second smallest *Rafflesia* in the Philippines next to the recently described *R. consueloae* Galindon *et al.* from Nueva Ecija in northern central Luzon. The flowers of *R. camarinensis* remain half open even when fully mature unlike *R. baletei* whose lobes fully open and spread outward and horizontally when they mature. The shape of the lobes is dome-like in the former but more or less circular in the latter. The texture of the lobes and diaphragm is thick, and hard, almost woody in the former but less rigid in the latter. The processes are few (16-18) and randomly arranged on the disk while in *R. baletei*, there are more processes (19-26), and are apparently arranged in two concentric rings on the disk. Also strikingly distinct is the surface of the diaphragm which is concolorous with the perigone lobes with continuous white thick streaks. In *R. baletei*, the markings on the diaphragm are discontinuous, thin white specks or “pentagonal areoles”, on a surface darker than the perigone lobes. Comparison of other characters of *R. camarinensis*, *R. baletei* and two other small-sized *Rafflesia* is found below (Table 1).

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