



***Balanophora coralliformis* (Balanophoraceae), a new species from Mt. Mingan, Luzon, Philippines**

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Abstract

Balanophora coralliformis Barcelona, Tandang & Pelsler is described as a new species of Balanophoraceae. It is unique in its coral-like appearance due to the repeated branching of elongated, above-ground tubers and their coarse texture. It most closely resembles *B. papuana* in details of the staminate inflorescence and is sympatric with this species at its only known site in the montane forest of Mt. Mingan, bordering Aurora and Nueva Ecija provinces, Luzon, Philippines.

Introduction

Balanophora J.R. Forster & G. Forster (1775: 99) is a genus of root parasites in temperate and tropical Asia, the Pacific, tropical Australia, the Comores, Madagascar, and tropical Africa (Hansen 1972, 1976). On the basis of morphological differences, Hansen (1999) recognized 15 species of *Balanophora*, but a molecular phylogenetic study of *B. japonica* Makino (1902: 212) and *B. yakushimensis* Hatusima & Masamune (Hatusima 1971: 61) suggests that a more narrow species delimitation might need to be adopted in this genus (Su *et al.* 2012). In the Philippines, thus far three species have been reported: *B. abbreviata* Blume (1827: 87), *B. fungosa* J.R. Forster & G. Forster (1775: 100), and *B. papuana* Schlechter (1913: 68) (Hansen 1976, Pelsler *et al.* 2011 onwards).

During fieldwork on Mt. Mingan within the provinces of Aurora and Nueva Ecija in 2006, Nestor Bartolome and the late Leonardo L. Co photographed a remarkable *Balanophora* plant that differs from all other described species in the genus in the presence of elongated and repeatedly branched above-ground tubers (Nickrent 2006 onwards, DOL28559–62). This is quite a unique feature, because the tubers of other *Balanophora* species are mainly subterranean. The branching pattern and the coarse texture of the segments of the above-ground tubers give this new species a coral-like appearance (Figs. 1 & 2). In February 2014, we visited Mt. Mingan and collected specimens of this taxon. Assuming that the distinct morphological differences between this species and other *Balanophora* are an indication of reproductive isolation, we name and describe it here as a new species under a biological species concept (Mayr 2000).

Taxonomy

Balanophora coralliformis Barcelona, Tandang & Pelsler, *sp. nov.* (Figs. 1 & 2)

Type:—PHILIPPINES. Luzon: Aurora Province, San Luis Municipality, Mt. Mingan, beside trail en route to summit, 15°27'48.8" N, 121°23'43.3" E, c. 1725 m, 23 February 2014, *Barcelona 3895 with Pelsler & Tandang* (staminate plant; holotype: PNH, isotypes: CHR, K, PUH, US).

Balanophora coralliformis differs from all other described *Balanophora* species in the coral-like growth of repeatedly branched above-ground tubers.

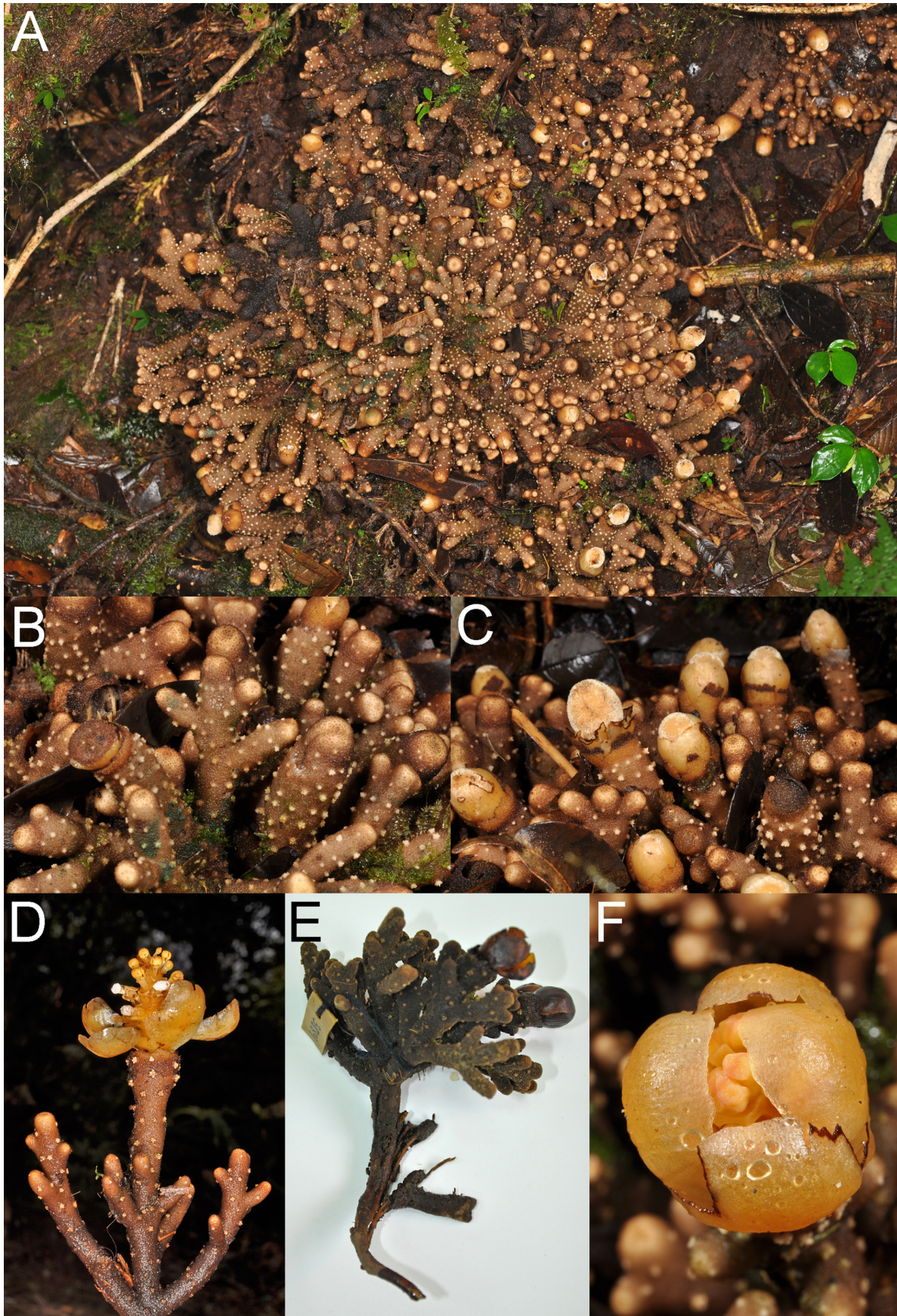


FIGURE 1. *Balanophora coralliformis*. A. Habit of pistillate plant. B. Branching above-ground tubers and young inflorescences of pistillate plant. C. Young inflorescences of pistillate plant. D. Branching above ground tubers and staminate inflorescence. E. Habit of alcohol preserved staminate specimen with young inflorescences showing above-ground tuber mass. F. Young staminate inflorescence. A–C. Barcelona 3890 with Pelsler & Tandang. D & F. Barcelona 3895 with Pelsler & Tandang. E. Barcelona 3889 with Pelsler & Tandang.

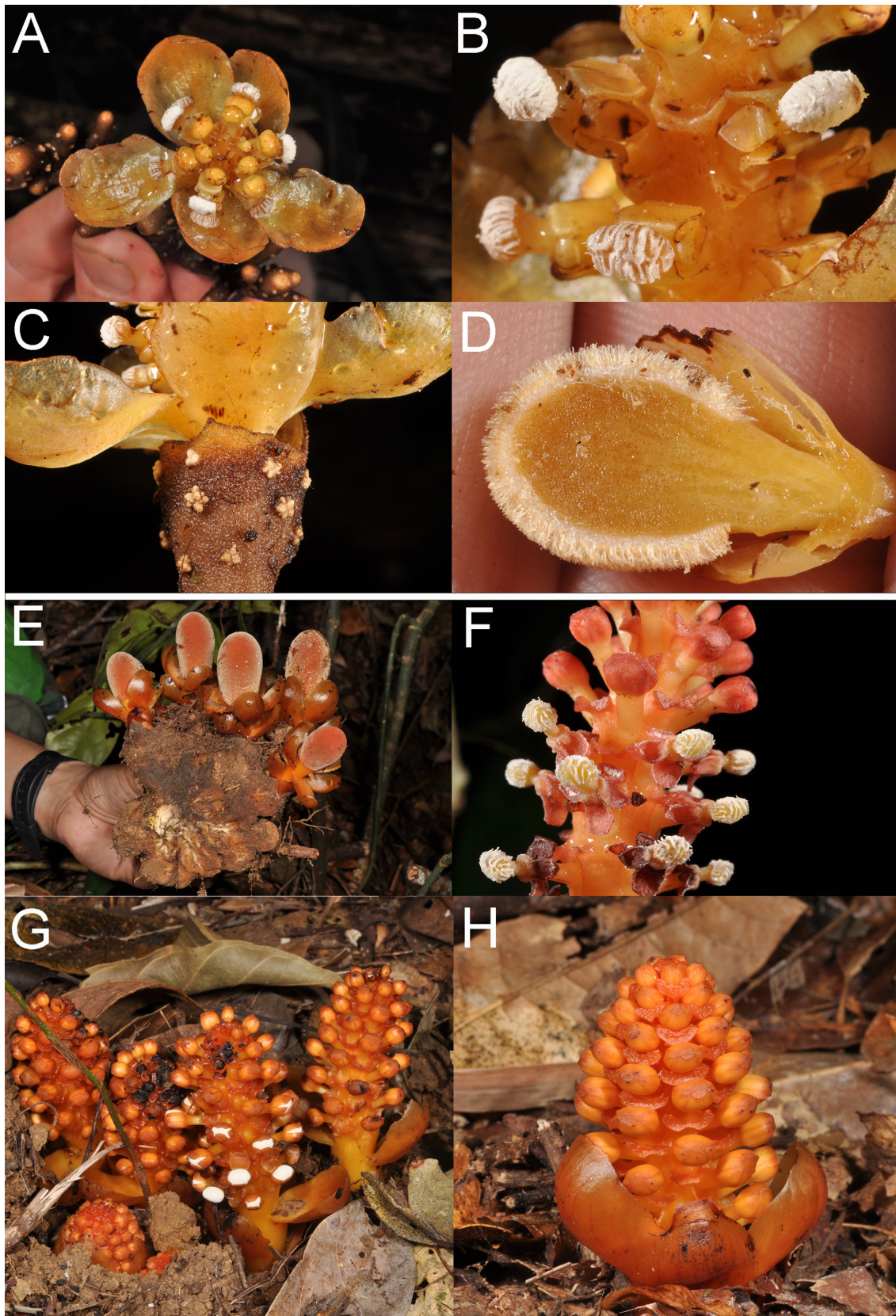


FIGURE 2. A–D. *Balanophora coralliformis*. A. Staminate inflorescence. B. Staminate flowers. C. Leaf arrangement of staminate plant. D. Longitudinal section of young pistillate inflorescence. E–H. *Balanophora papuana*. E. Pistillate plant removed from soil. F. Staminate flowers. G. Habit of staminate plant. H. Young staminate inflorescence showing leaf arrangement. A–C. *Barcelona 3895 with Pelser & Tandang*. D. *Barcelona 3890 with Pelser & Tandang*. E. *Barcelona 3865 with Pelser & Tandang* (PNH; Mt. Mingan, Aurora/Nueva Ecija prov.). F. *Barcelona 3916 with Pelser* (PNH; Brgy. Aningalan, San Remigio Mun., Antique prov.). G. *Barcelona 3866 with Pelser & Tandang* (PNH; Mt. Mingan, Aurora/Nueva Ecija prov.). H. Not collected.

Herbaceous, holoparasitic, dioecious, clump-forming, up to c. 30 cm tall above ground. Tubers predominantly above ground, repeatedly branched at angles of 40–50 degrees; tuber segments elongated, cylindrical, up to c. 5 cm long, 0.5–1.2 cm diam., widening at apex of fertile terminal segments, basal and internal segments dark brown, terminal segments lighter brown towards apex, surface coarse and covered with scattered cream to light brown stellate warts composed of 3–8 globose clusters of cells. Stems individually emerging from apex of terminal tuber segments. Leaves in 2 opposite, decussate pairs, occasionally with an additional single leaf, imbricate, all inserted at nearly the same level, obovate to broadly obovate, spatulate, concave, on the same tuber of nearly the same size, 2.4–2.7 by 1.1–2 cm, base attenuate, margin entire, apex rounded, patent at anthesis, yellow to straw-colored. Inflorescences emerging endogenously from the apex of the tuber segments. Staminate inflorescence terminal, racemose, 3–4 cm by 1.5–2.5 cm; peduncle 0.6–1 cm long; bracts c. 1 mm, truncate; yellow to straw-colored. Staminate flowers 12–16, spirally arranged in conspicuous vertical rows, bisymmetric on account of lateral elongation, 4-merous, pedicels 2–4 mm, tepals recurved at anthesis; median tepals 2, 3–4 mm by 2–3 mm, apex truncate or rounded; lateral tepals 2, 3–4 mm by c. 1.5 mm, apex acute; sterile part of synandrium 1–2 mm; fertile part of synandrium ellipsoid, laterally elongated, 1.5–2 mm long, anterior-posterior width c. 1.5–2 mm, lateral width 2–4 mm; anther cells parallel, running from base to apex of fertile part of synandrium, longitudinally opening, white. Young pistillate inflorescence terminal, spicate, ellipsoid, 1.3–1.6 by 0.9–1.2 cm, peduncle 3–4 mm long, yellow to straw-colored; spadicles (narrowly) obovoid, 0.4–0.5 by 0.15–0.3 mm, apex rounded. Pistillate flowers numerous, minute, largest ones c. 1.5 mm. Fruits not observed.

Distribution and habitat:—Only known from the type locality between 1465 and 1725 m on the SW slopes of Mt. Mingan, in montane mossy forest. Some populations are sympatric with *B. papuana*.

Conservation status:—This species is only known from few (<50) plants at the type locality and has not been found in other areas with similar habitats in the remaining montane forests of Nueva Ecija and Aurora provinces. However, this may be due to the lack of botanical explorations in these adjacent areas. Mt. Mingan is not currently included in the country's Protected Areas by the Department of the Environment and Natural Resources (DENR). As such, the habitat of *B. coralliformis* is under significant threat by activities such as illegal logging and slash-and-burn agriculture. Therefore, we consider this species to be Critically Endangered, CR B1ab(iii,iv); D (IUCN 2001).

The presence of other threatened species such as *Rafflesia lagascae* Blanco (1845: 595) and Philippine Eagle (*Pithecophaga jefferyi*) on the lower slopes of Mt. Mingan further indicates the need to establish Mt. Mingan as a Protected Area.

Etymology:—Named for the coral-like appearance of its above-ground tubers.

Additional specimens examined (paratypes):—PHILIPPINES. Luzon: Aurora Province, San Luis Municipality, Mt. Mingan, beside trail, en route to summit: *Barcelona* 3889 (staminate plant, CAHUP), 3890 (pistillate plant, CHR, K, PNH, PUH), 3891 (pistillate plant, US), 3892 (CAHUP) with *Pelser & Tandang*.

Diagnostic characters:—*Balanophora coralliformis* is easily recognized by its repeatedly branching above-ground tuber segments and their coarse texture reminiscent of a branching stony coral colony. Compared with other *Balanophora* species, most of the tuber mass of *B. coralliformis* is above ground and none of the other species shows a similarly high degree of branching into elongated cylindrical segments.

Although quite different from *B. papuana* in some characters [e.g. branching of tubers and color of inflorescences (yellow to straw-colored vs. light yellow, orange, or red); Figs. 1 & 2], *B. coralliformis* most closely resembles this species, particularly in its reproductive morphology (Figs. 1 & 2), and keys to it in Hansen's (1972) identification key. *Balanophora coralliformis* and *B. papuana* are both dioecious, have patent leaves in two closely set decussate pairs (although some *B. papuana* specimens have three or occasionally up to five pairs of leaves and some *B. coralliformis* have an additional single leaf) that are of similar size on the same tuber. In addition, the staminate flowers of both species are placed in conspicuous vertical rows, shortly pedicellate, and composed of two median tepals that are wider than the two lateral, acute tepals. Furthermore, *B. coralliformis* and *B. papuana* both have a laterally elongated synandrium with long anther cells that reach from the base to the apex of the fertile part of the synandrium (Hansen 1976). Despite the close resemblance between these two species in reproductive morphology, they maintain their distinct vegetative differences in sympatry, as we observed on Mt. Mingan (Figs. 1 & 2).

The tubers of *B. coralliformis* resemble, to some degree, those of *B. elongata* Blume (1827: 87) var. *elongata* from Java and Sumatra (Hansen 1972) and Peninsular Malaysia [Hambali 1980, as *B. hansenii* Hambali (1980: 425)]. These are also elongated and cylindrical. However, the tubers of *B. elongata* var. *elongata* are much less frequently branched above ground. In addition, this taxon differs markedly from *B. coralliformis* in other characters, such as the spiral (as opposed to decussate) leaf arrangement and flowering inflorescences that are partially or entirely covered by the upper leaves (Hansen 1972) instead of being fully exposed (at least in staminate plants; Figs. 1 & 2).

Also the poorly known *B. fungosa* J.R. Forster & G. Forster (1775: 99) ssp. *indica* (Arnott 1838: 37) Hansen (1972: 100) var. *minor* (Eichler in De Candolle 1873: 145) Hansen (1972: 106) from south India, Sri Lanka, and Thailand (Hansen 1972, Nickrent 1997 onwards, Su *et al.* 2012) is described as having elongated, cylindrical tuber segments (Hansen 1972, Su *et al.* 2012), but photos on the Parasitic Plant Connection website (Nickrent 1997 onwards) suggest that these are subterranean. Furthermore, amongst others, the leaves of this variety are more numerous (15–35 vs. 4 or 5) and spirally arranged (vs. opposite), and the staminate flowers are actinomorphic (vs. bisymmetric).

Acknowledgements

We would like to thank Mr. Victor Dacumos and Dr. Florida D. Dacumos of Nueva Ecija University of Science and Technology (NEUST) and Mayor Rolando S. Bue of Gabaldon Municipality for their hospitality. Director Mundita S. Lim, Mrs. Josefina de Leon and Mrs. Cecile G. Francisco of the Biodiversity Management Bureau (BMB), Mr. Jimmy G. Aberim (CENRO Dingalan, Aurora), and Maximo Milan (of PENRO Aurora) helped facilitate the issuance of collecting and transport permits. We thank our guides the Tabliga cousins Marlon, Nestor, Randy, and Rudy for their company and assistance during our fieldwork. Dr. Jan-Frits Veldkamp provided advice regarding typification. Plants of *Balanophora coralliformis* were collected during *Rafflesia* fieldwork supported by the Marsden Fund Council from Government funding, administered by the Royal Society of New Zealand.

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