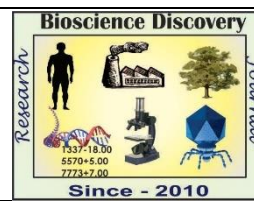


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Research Article



First record of *Balanophora tobiracola* Makino (Balanophoraceae) from Viet Nam

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Abstract

We reported the first record of a plant species, *Balanophora tobiracola* Makino (Balanophoraceae), from Viet Nam. This species was found in a low mountainous area of Bac Son district, Lang Son province, northeastern Vietnam. It is distinguished from other species of *Balanophora* by characteristics of male flowers inserted among female flowers on the androgynous inflorescence. Diagnoses and morphological characteristics of this species are described in details with illustrations in comparison with those of other species of *Balanophora* J.R. Forst & G. Forst from Vietnam.

INTRODUCTION

Balanophora J.R. Forst & G. Forst, a genus of the family Balanophoraceae, currently comprises 19 species, which are known from tropical regions of Africa and Australia, temperate to tropical Asia, and the Pacific Islands (Shumei H and Murata J., 2003). In Viet Nam, Prof. Pham Hoang Ho recorded 5 species of genus *Balanophora* J.R. Forst & G. Forst (*Balanophora abbreviata* Bl., *Balanophora latisejala* (Tiegh.) Lecomte, *Balanophora fungosa* var. *fungosa*, *Balanophora fungosa* Forst. & Forst.f. subsp. *indica* (Arn.) B. Hans., *Balanophora laxiflora* Hemsl.) (Pham, 2003). According to Prof. Nguyen Tien Ban, genus *Balanophora* recorded 7 species: *Balanophora abbreviata* Blume, *Balanophora cucphuongensis* N. T. Ban, *Balanophora elongata* Blume, *Balanophora fungosa* Forst. & Amp; Forst.f., *Balanophora indica* (Arnott) Griff., *Balanophora latisejala* (Tiegh.) Lecomte, *Balanophora laxiflora* Hemsl Ban (N. T., 2005). Recently, *Balanophora subcupularis* PC. Tam was published as a new record species for Flora of Viet Nam (Tung NT *et al.*, 2017).

The genus *Balanophora* J.R. Forst & G. Forst includes monoecious and dioecious plants, which are characterized by rhizome branched or unbranched with small scaly warts and/or stellate lenticels on rhizome surface, leaves opposite, alternate and distichous or spiral, or whorled, sessile, fleshy or scalelike, Inflorescences spadixlike, cylindric, ellipsoid, ovoid-globose, or globose, enlarged after anthesis.

While conducting field surveys on diversity and distribution of *Balanophora* J.R. Forst & G. Forst, we first found *Balanophora tobiracola* Makino in Viet Nam. In this paper, we provide description, illustration of the morphologic features of the species and comparison with other species of *Balanophora* J.R. Forst & G. Forst.

MATERIALS AND METHODS

All descriptions were made from living flowering plants which were collected in Bac Son district (Lang Son prov., Viet Nam) and herbarium specimens. Comparative morphological methods which are still the standard methods in botanical classification were used to identify plants.

The cited specimens were preserved in the herbarium of Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology.

Taxonomic treatment

Balanophora tobiracola Makino (Fig.1 & Fig.2)

Synonym names: *Balanophora wrightii* Makino, *Balanophora harlandii* var. *spiralis* P.C. Tam

Plants monoecious, pale yellowish to dark reddish, 4.0-15.0 cm. Rhizome branched, surface scabrous, branches subspheroid, 1.0-2.0 cm in diam. Leaves 4-8, oblong lanceolate to oblong ovate, scale

like, obtuse, light yellow. Scape yellowish, 1-6 x 0.5-0.7 cm. Inflorescences androgynous, ovoidly cylindrical-oblong to ovoid, obtuse, densely covered with female flowers and spadicles. Male flowers are scatteredly inserted between female flowers and spadicles, pedicellate, 1.5-2.5 mm in diam. Perianth lobes 3, ovate, anthers 3, transversely dehiscent, spadicles subglobose, shortly stiped, light yellow. Female flowers are pale yellowish or reddish, inserted on main axis of inflorescence.

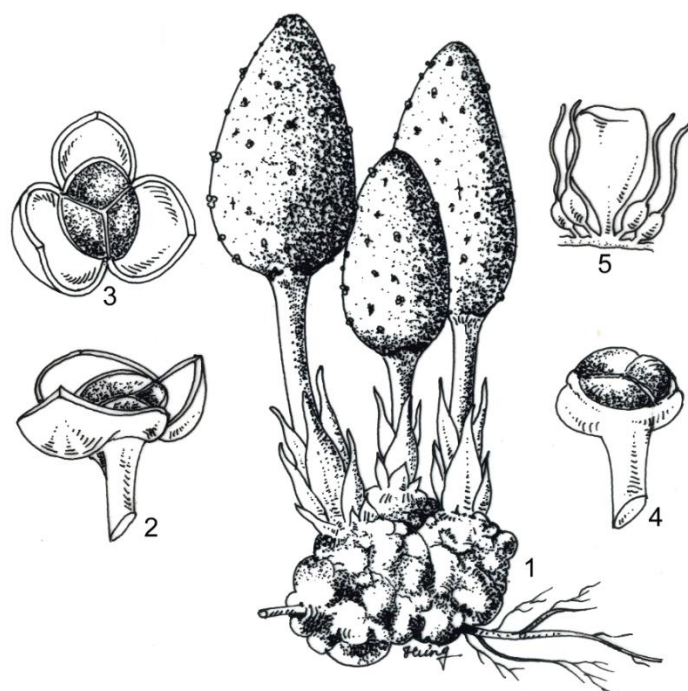


Figure 1. Drawing of *Balanophora tobiracola* Makino
1. Flowering plant; 2,3,4. Male flowers; 5. Female flowers and spadicle

Phenology: Flowering between November and January

Distribution: China (Guangdong, Guangxi, Hunan, Jiangxi), Taiwan, Japan. In Viet Nam, this species was found in a low mountainous area of Bac Son district, Lang Son province at the altitude of 500 - 700m

Specimens examined

JAPAN. C. Wright, 1853, K000674606, Royal Botanic Gardens, Loo-Choo Islands; C. Wright, 1853-1856, GH00035985, The Gray Herbarium, Ryukyu Islands; S. Yamaguchi, 10 Nov 1910, MAK004170, Makino Hebarium, Tokyo Metropolitan University, Kagoshima Pref., Ibusuki Co., Kiire Town, Bot. Mag. Tokyo XXIV, 290 (Dec. 1910)

Taxonomic note

1853-1856, Species *Balanophora wrightii* Makino was discovered by C. Wright in Ryukyu Islands (Japan). The specimen has been preserved at The Gray Herbarium. It was re-identified by Makino (1911) and H. Hara (1939) as *Balanophora wrightii* Makino

1910, *Balanophora tobiracola* Makino was published in Bot. Mag. Tokyo XXIV, page 290-292 (Makino T., 1910).

1984, Tam Pui-Cheng described a new species, *Balanophora harlandii* Hook. f. var. *spiralis* in the Bulletin of Botanical research. However, it was resulted from misclassification of materials of *Balanophora tobiracola* Makino (Tam Pui-cheung, 1984).

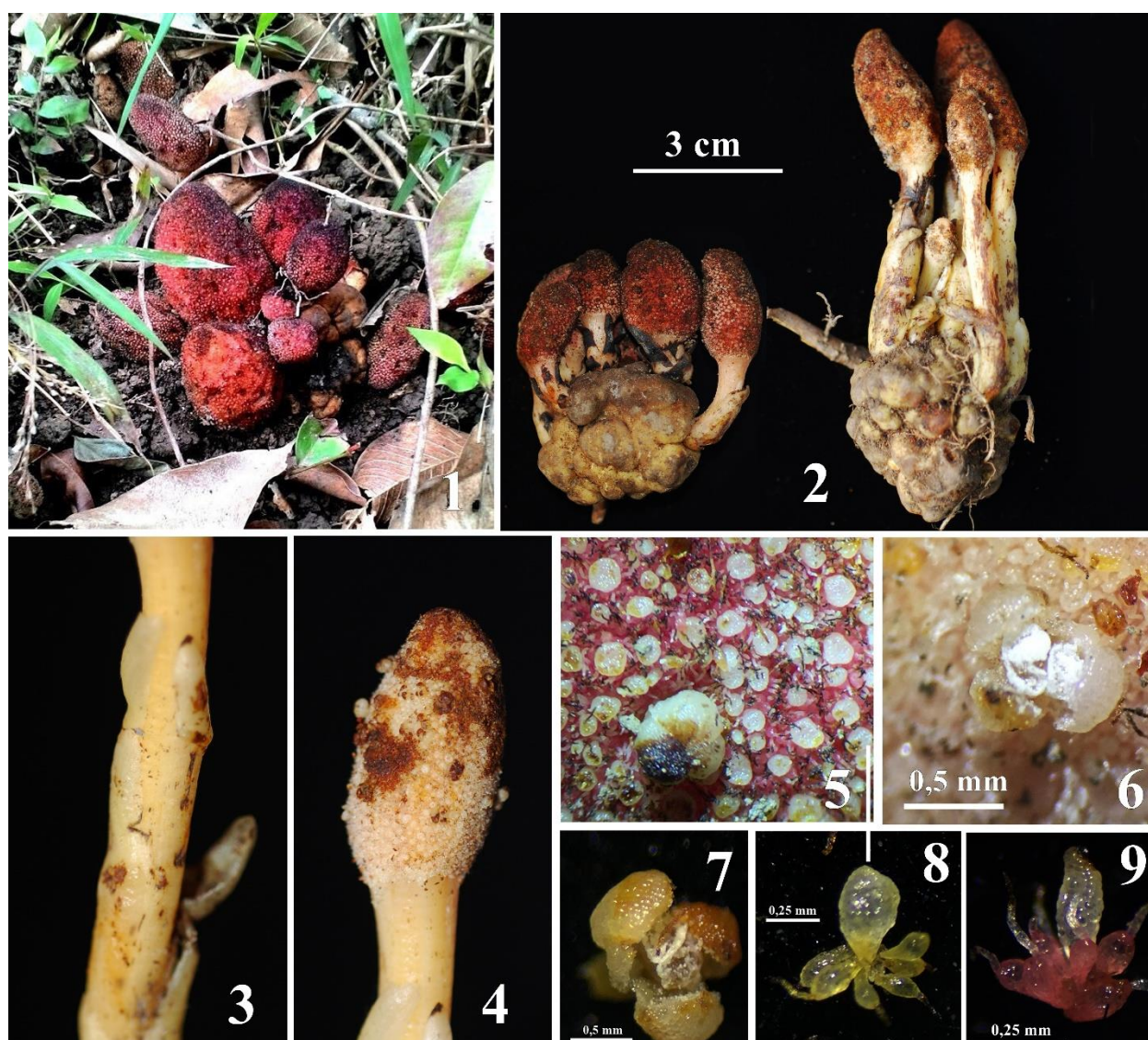


Figure 2. Morphological features of *Balanophora tobiracola* Makino

1. Habitat; 2. Whole plant with inflorescence; 3. Scape with leaves; 4. Androgynous inflorescence; 5. Surface view of inflorescence; 6,7. Male flowers; 8,9. Female flowers and spadicle

Conservation status

Of the family Balanophoraceae, three species are listed in the 2007 Red Data Book of Vietnam: *Balanophora cucphuongensis* Ban, *Balanophora laxiflora* Hemsl. and *Rhopalocnemis phalloides* Jungh. (N. T. Ban, 2007). In recent years, local people exploited some species of *Balanophoraceae* for traditional medicines to treat different diseases including weak physiology, impotence, back pain,

kidney tonic and anorexia (folk medicine). Therefore, several species of this family (*Balanophora fungosa* Forst. & Forst.f., *Balanophora laxiflora* Hemsl., *Rhopalocnemis phalloides* Jungh, *Balanophora latisejala* (Tiegh.) Lecomte, *Balanophora indica* (Arnott) Griff., *Balanophora elongata* Blume) have been over-exploited in the wild.

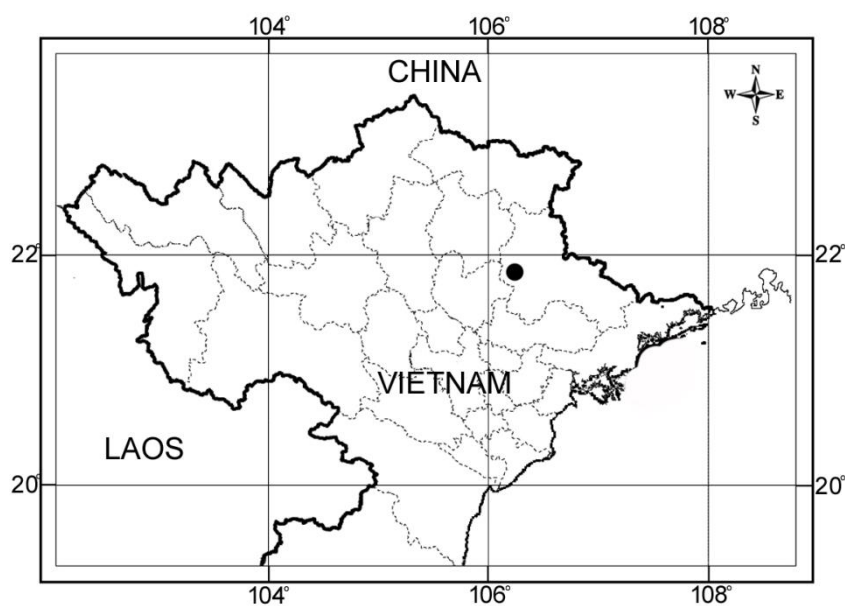


Figure 3. Distribution of *Balanophora tobiracola* Makino in VietNam

It is likely that over exploitation of these species is very common without any management from the local’s administration. For *Balanophora tobiracola* Makino, this species is only found out in a low mountainous area of Bac Son district, Lang Son province. Its distribution is narrow with few individuals of each colony. Alternatively, habitats of the species are gradually dwindling due to indiscriminate exploitation by indigenous people who makes this species potentially endangered in

the wild. We suggest that conservation of this species should be considered as soon as possible in Vietnam.

Discussion

Balanophora tobiracola Makino has male flowers with perianth lobes 3. This characteristic was similar to some other species of genus *Balanophora* J.R. Forst & G. Forst. Table 1 shows a comparison of some species of the genus *Balanophora* J.R. Forst & G. Forst.

Table 1. Morphologic features comparison of some species of genus *Balanophora*

Features	<i>B. tobiracola</i>	<i>B. involucrata</i>	<i>B. fargesii</i>	<i>B. harlandii</i>
Plant	Monoecious	Dioecious	Monoecious	Dioecious
Leaves	Scattered on scape	Verticillate and connate into a sheathlike whorl	Connate into a single sheathlike whorl	subopposite or spiraled
Scapes	yellowish	yellow to orange	yellow to orange	red to yellow
Inflorescence	- androgynous	- unisexual	- androgynous	- unisexual
Male flowers	- 3 merous - scattered between spadicles and female flowers	- usually 3 merous - insert basally in aveolus	- 3 merous - male flowers basal to female flowers	- 3 merous - inserted basally in aveolus
Female flowers	- inserted on main axis of inflorescence	only on main axis of inflorescences	- only on main axis of inflorescences	- only on main axis of inflorescences

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