

Morphological characteristics of *Balanophora* aff. *elongata* Blume and *Balanophora latisejala* (Tiegh.) Lecomte

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Abstract

This study aimed to provide the description of two species belonging to genus *Balanophora* J.R.&G.Forst in Vietnam. The sample collected in Phong Tho district (Lai Chau province, Vietnam) possessed morphological features which were very close to *Balanophora elongata* Blume and was identified as *Balanophora* aff. *elongata* Blume while the sample collected in Duc Trong district (Lam Dong province) was identified as *Balanophora latisejala* (Tiegh.) Lecomte. Morphological characteristics of these two samples were described in details and illustrated with photographs and drawing as well as compared to some other species of genus *Balanophora* J.R.&G.Forst. which also have zygomorphic male flowers. The results provided database on botanical characteristics of *Balanophora* species in Vietnam.

INTRODUCTION

Genus *Balanophora* J.R.&G. Forst (family Balanophoraceae) consisted of 19 parasitic plants which distributed from tropical regions of Africa and Australia, temperate to tropical Asia and The Pacific Islands. In Vietnam, this genus comprised nine species, one subspecies and one variety including *Balanophora abbreviata* Blume, *Balanophora cucphuongensis* N.T.Ban, *Balanophora elongata* Blume, *Balanophora fungosa* J.R.&G.Forst., *Balanophora fungosa* subsp. *indica* (Arnott) B.Hansen, *Balanophora fungosa* var. *globosa* (Jungh.) B.Hansen, *Balanophora latisejala* (Tiegh.) Lecomte, *Balanophora laxiflora* Hemsl (N.T. Ban, 2005), *Balanophora subcupularis* PC. Tam (N.T. Tung et al., 2017), *Balanophora tobircola* Makino (N.T. Tung et al., 2018), *Balanophora harlandii* Hook.f. (B.H. Quang et al., 2018); however the botanical database of some

Balanophora species such as *B. abbreviata*, *B. cucphuongensis*, *B. elongata* and *B. latisejala* was still very limited. In this paper, we provided description of morphological characteristics with illustration of two species belonging to genus *Balanophora* J.R.&G.Forst. Also its morphological features were compared to some other species of genus *Balanophora* J.R.&G.Forst which also possessed zygomorphic male flowers. This paper provided the additional database of botanical characteristics of *Balanophora* species in Vietnam which would be useful in identifying these species in Vietnam.

MATERIAL AND METHODS

All descriptions of the collected species were made from fresh flowering plants which were collected in Phong Tho district (Lai Chau prov.,

Vietnam) in November 2017 (**BE**) and Duc Trong district (Lam Dong prov., Vietnam) in September 2017 (**BLS**). Comparative morphological methods were used to identify the plants. The cited specimens were preserved in the Herbarium of Museum of Biology, Faculty of Biology, VNU University of Science, Vietnam National University (VNU), Hanoi with the voucher specimens numbers of **BE** and **BLS** were HNU 024055 and HNU 022612, respectively.

The morphological features of the species were compared to some species of genus *Balanophora* J.R.&G.Forst. with zygomorphic male flowers.

RESULTS

Taxonomic treatment

Sample **BE** was identified as *Balanophora* aff. *elongata* Blume based on comparison between its macroscopical characteristics and those of *Balanophora elongata* Blume described in literature (Hansen 1972). The morphological features of sample **BE** were described as follows: Plant dioecious. Tubers repeatedly branched, surface covered with warts and scattered stellate lenticels; branches cylindrical, 1.5-2 x 2-3 cm. Scapes white to pink, 2-10 cm. Leaves 7-15, spirally arranged, imbricate, gradually increasing in size upwards, elliptic, obtuse, longitudinally striate when dry. Male inflorescence narrowly ovoid, white, 3-5 cm.

Male flowers: subtended by truncate bract, pedicellate, zygomorphic, 4(-5)-6(-7) merous, 6-8 mm in diam. Perianth lobes 4-5mm; median tepals broadly ovate, apex truncate; lateral tepals lanceolate, apex acute; anthers longitudinally dehiscent. Female inflorescences pink to reddish brown, ellipsoid. Female flowers: basally on spadicles and main axis of inflorescence. (**Fig. 1 & Fig. 3**)

Sample **BLS** was identified as *Balanophora latisejala* (Tiegh.) Lecomte based of the similarities in its morphological characteristics and those of *B. latisejala* (Tiegh.) Lecomte described in literature (Hansen 1972). The macroscopical features of sample **BLS** were described as follows: Plant dioecious. yellowish-white to grey. Tubers branch from the base; single tuber subspherical-ellipsoid. Surface of tubers fine granular with scattered stellate lenticels. Leaves 3-4(-6), distichous, well spaced. Male inflorescence long-ellipsoid, 5-10 cm long with flowers expanded. Male flowers zygomorphic, 4-5 merous. A normally developed 4-merous flower consists of two narrow, ovate, acute lateral tepals and two wide, nearly square, truncate median tepals (sometimes the upper median tepals is split into two in a 5-merous flower). Anther cells 16-20, parallel, opening longitudinally. Female inflorescence long ellipsoid or almost cylindrical. Female flowers: yellow, on main axis of inflorescence as well as on spadicles. (**Fig. 1 & Fig.**

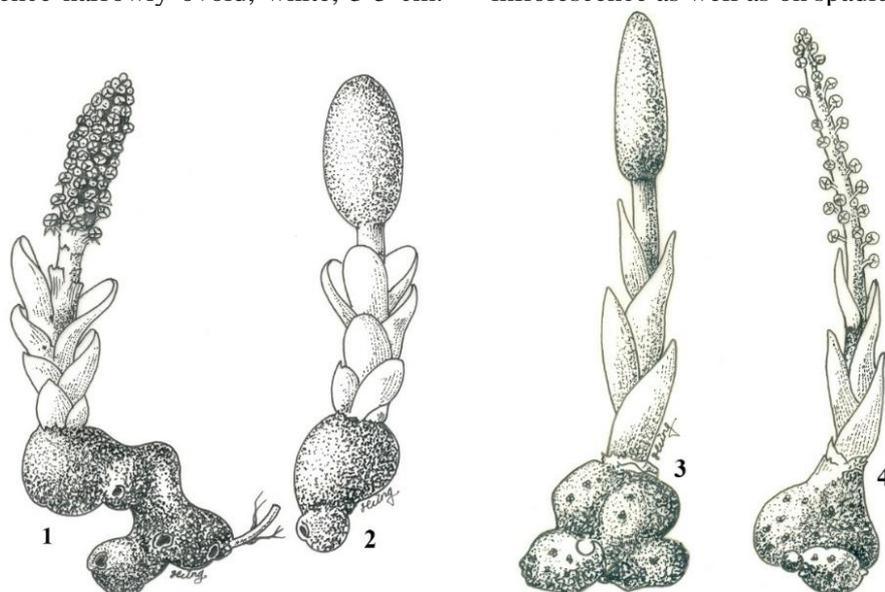


Figure 1. Drawing of two *Balanophora* species

1-2. *Balanophora* aff. *elongata* Blume: 1. Male flowering plant, 2. Female flowering plant;
3-4. *Balanophora latisejala* (Tiegh.) Lecomte: 3. Female flowering plant, 4. Male flowering plant

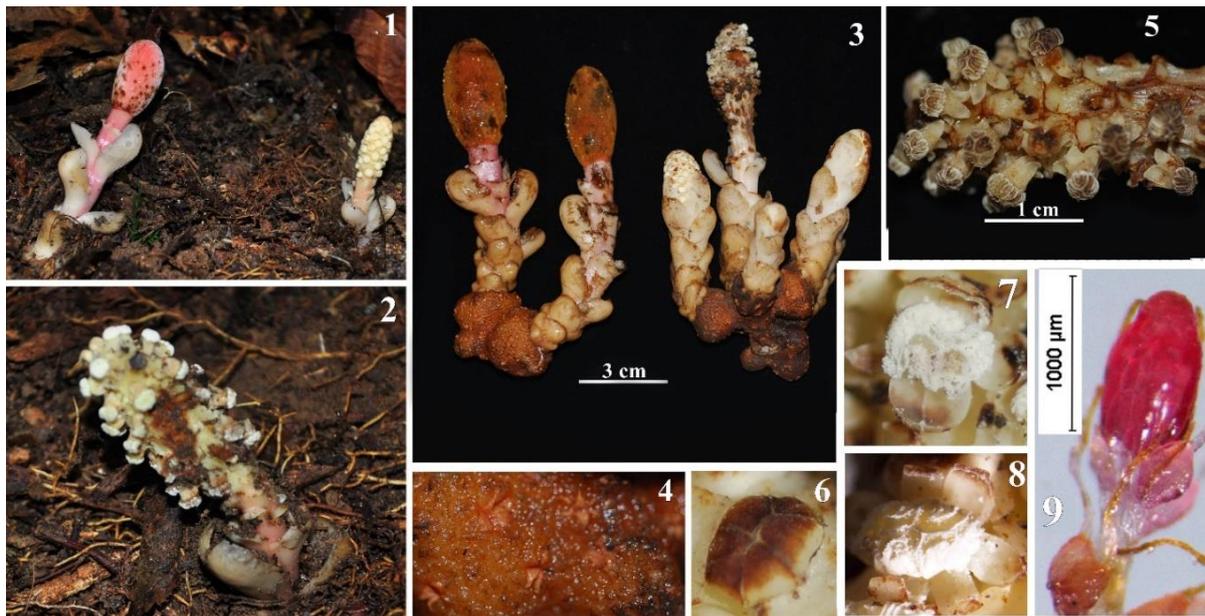


Figure 2. Morphological characteristics of *Balanophora* aff. *elongata* Blume
 1,2. Habitat; 3. Female (left) and male (right) flowering plants; 4. Surface of rhizome with stellate lenticels;
 5. Male inflorescence; 6,7,8. Male flowers; 9. Female flowers and spadicle

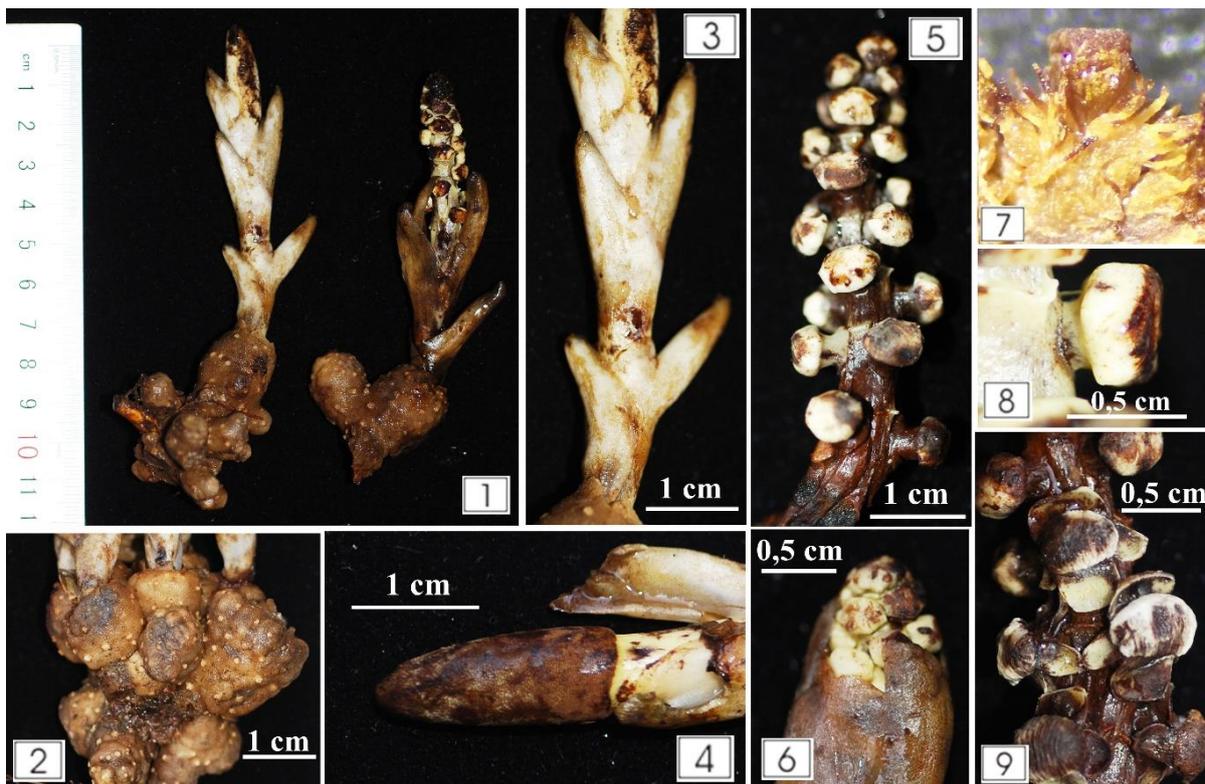


Figure 3. Morphological characteristics of *Balanophora latisejala* (Tiegh.) Lecomte
 1. Flowering plant; 2. Rhizome; 3. Leaves; 4. Female inflorescence;
 5,6. Male inflorescence; 7. Female flowers and spadicle; 8,9. Male flowers

Table 1. Morphological comparison of some *Balanophora* species

Features	<i>Balanophora</i> aff. <i>elongata</i> (BE)	<i>Balanophora latisejala</i> (BLS)	<i>Balanophora laxiflora</i>	<i>Balanophora polyandra</i>
Colour	- Female inflorescence red brown - Scape white to pink	- yellowish-white to yellow	- red to dark red	- yellowish orange to dark red - Scapes reddish orange
Leaves	7-15, spirally arrange, imbricate, longitudinally striate when dry	3-4 (-6), distichous	8-14, alternate, elliptic-oblong	4-12, decussate but spirally arranged apically on scape
Inflorescence	Male inflorescence narrowly ovoid; Female inflorescences ellipsoid	Male inflorescences long-ellipsoid	Male inflorescences cylindric; Female inflorescences ovoid-spheroid to oblong-ellipsoid	Male inflorescences narrowly ellipsoid; Female inflorescences ellipsoid to oblong-ovoid
Male flower	- zygomorphic; pedicles ...-... mm long, ... mm in diam. - 4(-5)-6(-7) merous, 6-8 mm in diam; median tepals broadly ovate, apex truncate; lateral tepals lanceolate, apex acute	- zygomorphic; pedicles 3-4 mm long; - 4-merous flowers: two narrow, ovate, acute lateral tepals and two wide, nearly square, truncate median tepals (the upper median tepals is split into two in a 5-merous flower)	- zygomorphic, subsessile, - anthers broken up into many locelli, dehiscent by short slits - perianth lobes 4-6, suborbicular to ovate, 2-3 mm, apex acute to obtuse	- zygomorphic, 1 cm in diam., pedicels short or flowers sessile. - perianth lobes 4-6, reflexed; lateral lobes deltoid to ovate, apex acute; apical and lower lobes oblong
Female flowers	Pink, inserted on main axis of inflorescence and basic of spadicle	on main axis of inflorescence as well as on spadicles	on basal stipe of spadicle and main axis of inflorescence	on basal stipe of spadicles and on main axis of inflorescence.

Morphological comparison with some *Balanophora* species

These two *Balanophora* samples collected in Lai Chau prov. and Lam Dong prov. were dioecious plant with zygomorphic male flowers. These characteristics were similar to those of some *Balanophora* species such as *B. laxiflora*, *B. latisejala*, *B. polyandra*. The morphological characteristics of the studied samples were compared to these species (Table 1).

Discussion

The morphological characteristics of sample BE collected in Lai Chau prov. were similar to those of *B. elongata* described by Hansen (Hansen

1972): Tubers repeatedly branched; leaves spirally arrange, imbricate, longitudinally striate when dry; the shape of male and female inflorescences; male flower zygomorphic with median tepals broadly ovate, apex truncate and lateral tepals lanceolate, apex acute. Only some small differences were recorded: *B. elongata* described in literature have upper leaves appressed to and partly concealing the flowering inflorescences (Hansen 1972) white the leaves of the sample BE didn't cover the inflorescence. In this case, the scientific name of sample BE was identified as *Balanophora* aff. *elongata*. Also in this paper, the morphological characteristics of *Balanophora latisejala*

(Tiegh.) Lecomte collected in Vietnam were described in detail and illustrated with pictures for the first time.

Conclusion

The sample collected in Phong Tho district (Lai Chau prov., Vietnam) and the sample collected in Duc Trong district (Lam Dong prov.) were identified as *Balanophora* aff. *elongata* Blume and *Balanophora latisejala* (Tiegh.) Lecomte. The morphological characteristics of these two species were compared to those of other *Balanophora* species which possessed zygomorphic male flowers. The data reported in the paper would be useful in identifying the *Balanophora* species in Vietnam.

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