



Pharmacognostic Identification of *Balanophora* J.R. Forst & G. Forst (Balanophoraceae) Endemic in Ha Giang, Viet Nam

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ABSTRACT

Balanophora is a small genus belonging to the family Balanophoraceae. The study was aimed at identification of species of genus *Balanophora* in Ha Giang province, Viet Nam. Three species of the genus *Balanophora* including *Balanophora laxiflora*, *Balanophora fungosa* ssp. *indica* var. *globosa* and *Balanophora fungosa* ssp. *indica* var. *indica* were found in Quan Ba district, Ha Giang province, Viet Nam. Morphological features of the three species were described, illustrated and compared to each other. *Balanophora fungosa* ssp. *indica* var. *indica* was characterized by pink scapes, ellipsoid inflorescences; *Balanophora fungosa* ssp. *indica* var. *globosa* was characterized by surface coarsely tessellated, stellate warts were not distinct, yellow scapes, hoodlike leaves while *Balanophora laxiflora* was characterized by cylindrical male inflorescences, apex acuminate, subsessile male flowers, anthers broken up into many locelli. The results served as database to identify the species of genus *Balanophora* in Ha Giang prov., Viet Nam.

Keywords: *Balanophora*, morphological features, *Balanophora laxiflora*, *Balanophora fungosa* ssp. *indica* var. *indica*, *Balanophora fungosa* ssp. *indica* var. *Globosa*.

Introduction

Balanophora is a small genus belonging to family Balanophoraceae. There are about 19 species of *Balanophora* mainly distributed in tropical Africa and Australia, temperate to tropical Asia, and the Pacific Island.¹ The *Balanophora* species have been reported to have radical scavenging activity; anti-HIV, hypoglycemic, analgesic and anti-inflammatory activities.² In Viet Nam, the genus *Balanophora* have not been researched and there are confusions between species of *Balanophora*. In order to determine the species of genus *Balanophora* J.R. Forst & G. Forst in Ha Giang province, an investigation was carried out from September to December 2016 in the region; Quan Ba district – Ha Giang province. Three species of the genus *Balanophora* J.R. Forst & G. Forst were recorded. In this paper, the morphological features of the three species are described and illustrated pictorially and by drawings, and they were compared. The results were databased for the identification of the *Balanophora* species in Ha Giang.

Materials and Methods

Samples of the three species with mature inflorescences of genus *Balanophora* J.R. Forst & G. Forst were collected in Quan Ba district (Ha Giang province, Viet Nam) between September 2016 and December 2016. All samples were described and illustrated pictorially and by drawings. The scientific names of the samples were identified by comparing to Flora of China,¹ Flora of Malesiana,³ Flora of Thai Land⁴ and herbarium

specimens with the assistance of Dr. Nguyen and Master Nghiem Duc Trong (Department of Botany, Ha Noi University of Pharmacy).

The specimens were preserved in the HNU herbarium, College of Natural Sciences, Viet Nam National University, Ha Noi with the herbarium numbers HNU022615, HNU022607 and HNU022608 for *B. fungosa* ssp. *indica* var. *indica*, *B. fungosa* ssp. *indica* var. *globosa* and *B. laxiflora* respectively. The morphological features of the three species of genus *Balanophora* were described and compared.

Results and Discussion

The present study identified the species of the genus *Balanophora* in the Ha Giang province, Viet Nam. Three species of the genus including *Balanophora laxiflora*, *Balanophora indica* and *Balanophora fungosa* were found in Quan Ba district, Ha Giang province, Viet Nam. The morphological features of the three species were described (Table 1).

Balanophora fungosa ssp. *indica* var. *indica*

Plants dioecious, Rhizome yellowish brown, surface with granular warts and yellow stellate lenticels. Scapes pink, 2,5-7 x 0.6-1.5 cm at anthesis. Leaves 15-20, spirally arranged, imbricate, broadly ovate, apex obtuse. Inflorescences ellipsoid, 1.5-3 x 1.5-2 cm. Male flowers: actinomorphic, subtended by short rudimentary bracts. Pedicel 4-5 mm. Perianth lobes 4-5, ovate-elliptic, apex acute. Synandria subglobose, anthers 4 or 5, U-shape. Female flowers: yellowish, basally on spadicels and the main axis of inflorescences (Figure 1). Fl: Dec-Jan.

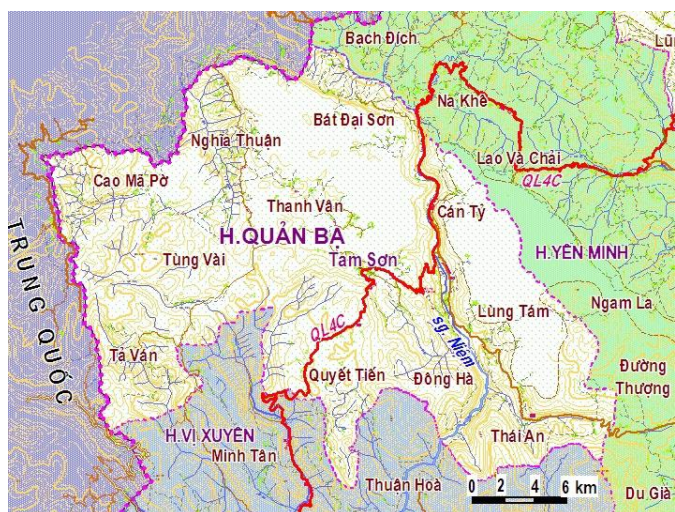
Balanophora fungosa ssp. *indica* var. *globosa*

Plant dioecious. Rhizome brown, unbranched or branched from base, surface coarsely tessellated and stellate warts distinct; branches subglobose, 0,5-5,6 cm in diam. Scapes yellow, 8-15 cm. Leaves 10-20, yellowish orange, spirally arranged, imbricate, broadly ovate to oblong-ovate, to 3 x 2 cm, apex obtuse and hoodlike. Male inflorescences red, ovoid-ellipsoid, 5-7 x 2-4 cm. Male flowers: reddish, actinomorphic. Perianth lobes 4-6 (7), elliptic-lanceolate. 3-8 x 1.5-3 mm. Synandria elliptic-ovate; anthers 4 or 5, U-shaped. Females inflorescences globose,

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2-5 x 2-5 cm. Spadicles subclavate. Female flowers: basally on spadicles and main axis of inflorescence (Figure 3). Fl: Oct-Dec.

Balanophora laxiflora Hemsl

Plants dioecious, red to dark red. Rhizome branched, branches subspherical, surface densely covered with scabrous speckles and yellowish stellate warts. Leaves 8-12, elliptic-oblong. Scapes yellow to red, 5-10 cm. Male inflorescences cylindrical, 5-20 x 0.7-2 cm, apex acuminate. Male flowers: subsessile, zygomorphic; anthers were broken up into many locelli, dehiscent by short slits. Perianth lobes 4-6, suborbicular to ovate, 2-3 mm, apex acute to obtuse. Female inflorescences ovoid-speroid to oblong-ellipsoid, apex acuminate. Spadicles subclavate. Female flowers: on basal stipes of spadicles and the main axis of inflorescence (Figure 4). Fl: Sep-Dec.

The most remarkable features of three *Balanophora* species: *Balanophora fungosa* ssp. *indica* var. *indica* was characterized by pink scapes, ellipsoid inflorescences; *Balanophora fungosa* ssp. *indica* var. *globosa* was characterized by rhizome surface coarsely tessellated, stellate warts were not distinct, yellow scapes, hoodlike leaves while *Balanophora laxiflora* was characterized by cylindric male inflorescences, apex acuminate, subsessile male flowers, anthers broken up into many locelli.

Figure 1: Map of Quan Ba district – Ha Giang province.

(<https://vi.wikipedia.org>)

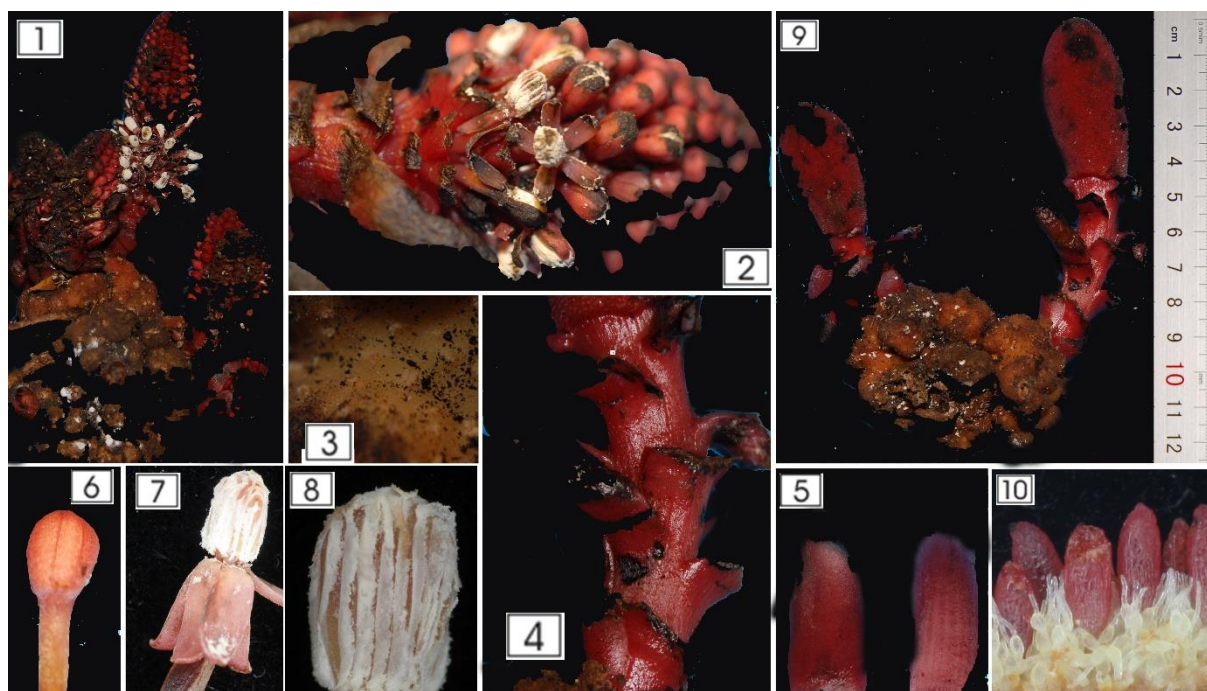


Figure 2: *Balanophora fungosa* ssp. *indica* var. *indica*.

1. Male flowering plant; 2. Male inflorescence; 3. Surface of rhizome; 4. Leaves spirally arranged; 5. Leaves; 6,7,8. Male flowers, 9. Female flowers, 10. Female flowers and spadicles

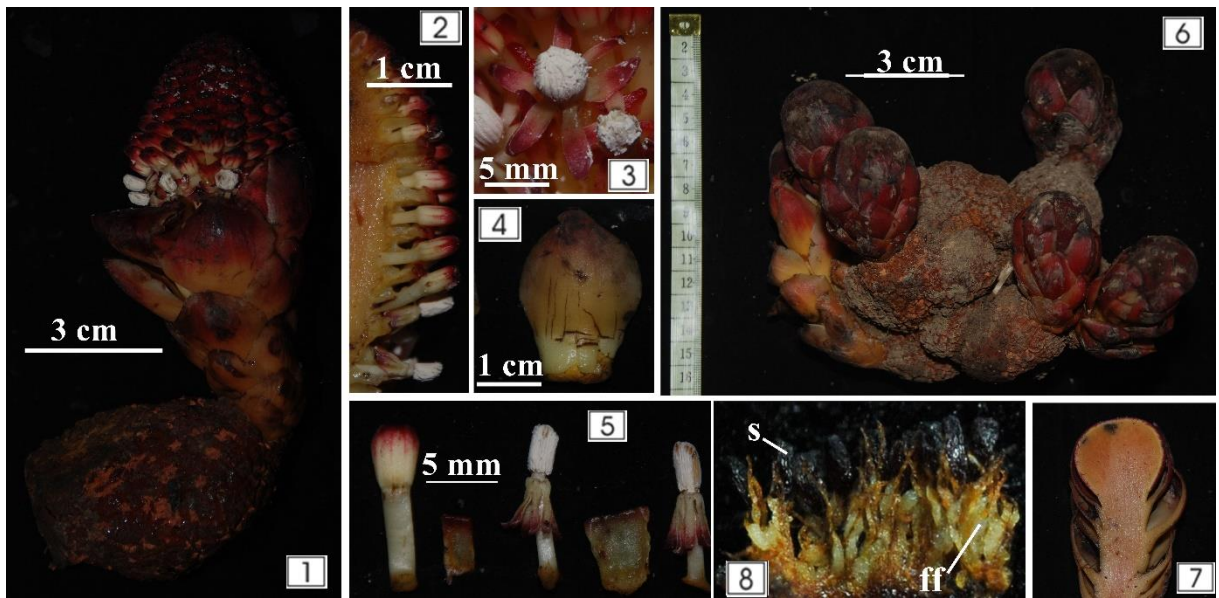


Figure 3: *Balanophora fungosa* ssp. *indica* var. *globosa*.

1. Male flowering plant, 2. Vertical male inflorescence, 3. Male flowers, 4. Leaves, 5. Male flowers and bracts,
6. Female flowering plant, 7. Vertical female inflorescence, 8. Female flowers (ff) and spadices (s).

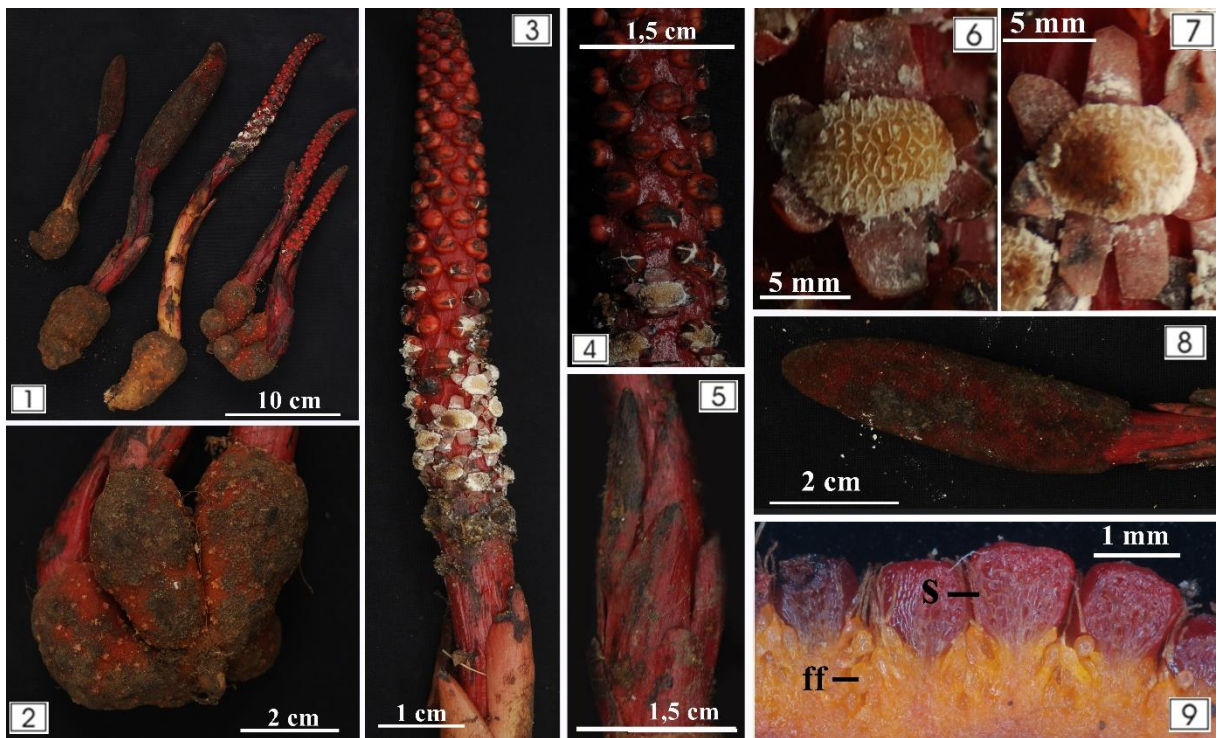


Figure 4: *Balanophora laxiflora* Hemsl.

1. Flowering plant; 2. Rhizome; 3,4. Male inflorescence; 5. Leaves; 6,7. Male flowers; 8. Female inflorescence,
9. Female flowers (ff) and spadices (s).

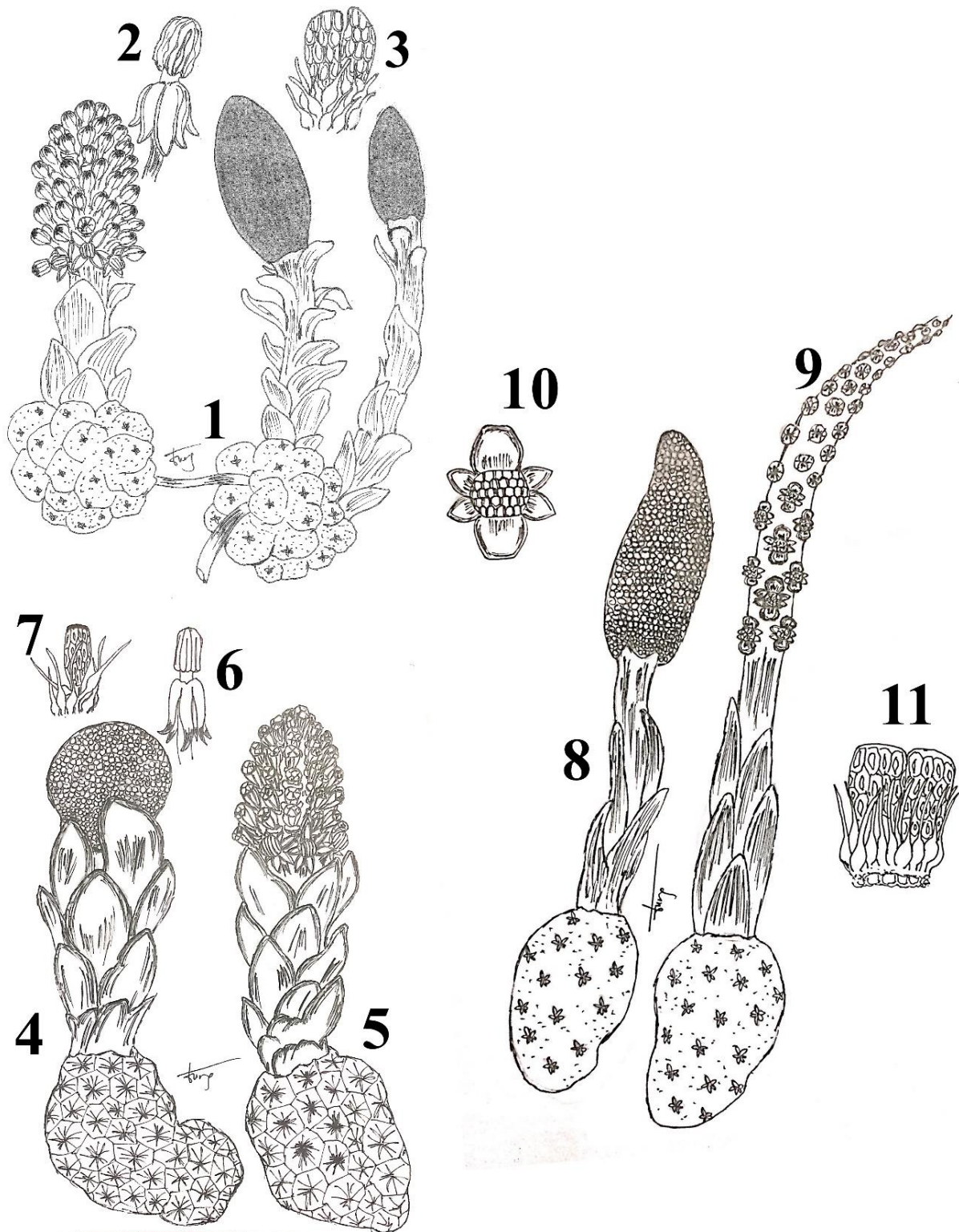


Figure 5: Drawing of species of genus *Balanophora* in Ha Giang province, Viet Nam.

1-3: *Balanophora fungosa* ssp. *Indica* var. *indica*: **1.** Two flowering plants, **2.** Male flower, **3.** Female flowers and spadicle; **4-7:** *Balanophora fungosa* ssp. *Indica* var. *globosa*: **4.** Female flowering plant, **5.** Male flowering plant, **6.** Male flower, **7.** Female flowers and spadicle; **8-11:** *Balanophora laxiflora*: **8.** Female flowering plant, **9.** Male flowering plant, **10.** Male flower, **11.** Female flowers and spadicle.

Table 1: Morphologic features comparison of three species of the genus *Balanophora*.

Features	<i>B. laxiflora</i>	<i>B. fungosa</i> ssp. <i>indica</i> var. <i>indica</i>	<i>B. fungosa</i> ssp. <i>indica</i> var. <i>globosa</i>
Rhizome	surface densely covered with scabrous speckles and yellowish stellate warts	Rhizome yellowish brown	Rhizome brown Stellate warts distinct
Scapes	yellow to red, 5-10 cm	pink, 2,5-7 x 0.6-1.5 cm	yellow, 8-15 cm
Leaves	8-12, elliptic-oblong	15-20, spirally arranged, imbricate, broadly ovate, apex obtuse	Leaves 10-20, yellowish orange, spirally arranged, imbricate, broadly ovate to oblong-ovate, to 3 x 2 cm, apex obtuse and hoodlike
Inflorescences	Male inflorescences cylindric, 5-20 x 0.7-2 cm, apex acuminate Female inflorescences ovoid-speroid to oblong-ellipsoid, apex acuminate	ellipsoid	Male inflorescences red, ovoid-ellipsoid Females inflorescences globose
Male flowers	subsessile, zygomorphic.	actinomorphic	reddish, actinomorphic
Perianth lobes of male flowers	4-6, suborbicular to ovate, 2-3 mm, apex acute to obtuse	4-5, ovate-elliptic, apex acute	4-6 (7), elliptic-lanceolate
Female flowers	on basal stipes of spadicles and main axis of inflorescence	yellowish, basally on spadicles and main axis of inflorescence	basally on spadicles and main axis of inflorescence

Conclusion

The three species of genus *Balanophora* J.R. Forst & G. Forst collected in Quan Ba district, Ha Giang province, Viet Nam were pharmacognostically identified, described and illustrated with pictures and drawings. Comparative analysis of the species was documented. The results of this study provide a complete database for the identification of the species of genus *Balanophora* J.R. Forst & G. Forst in Ha Giang, Viet Nam.

Conflict of interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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