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Isotrema putalengense, a new species of Aristolochiaceae from northern Vietnam and two new combinations in *Isotrema*

Quoc Binh Nguyen[1], Hieu Cuong Nguyen[2], Duc Binh Tran[3], Phuong Hanh Nguyen[3], Hong Truong Luu[2]
1 Vietnam National Museum of Nature, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Street, Cau Giay District, Hanoi, Vietnam **2** Southern Institute of Ecology and Graduate University of Science and Technology, Vietnam Academy of Science and Technology, 1D, TL29 Street, District 12, Ho Chi Minh City, Vietnam **3** Institute of Ecology and Biological Resource, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Street, Cau Giay District, Hanoi, Vietnam.

Corresponding authors: Quoc Binh Nguyen (binhzing@gmail.com); Hong Truong Luu (hongtruongluu@gmail.com)

Abstract

Isotrema putalengense Luu, Q.B.Nguyen & H.C.Nguyen is described as a new species from northern Vietnam. It looks most morphologically like *I. wardianum* but is distinguishable by a combination of different leafy and floral characters. Morphological comparison between the new plant and closest species is provided. In addition, combinations of two recently described *Aristolochia* species are made, namely *Isotrema vuquangense* (T.V.Do) Luu, Q.B.Nguyen & H.C.Nguyen and *Isotrema yachangense* (B.G.Huang, Yan Liu & Y.S.Huang) Luu, Q.B.Nguyen & H.C.Nguyen.

Keywords

Aristolochia subgenus *Siphisia*, combination, *Isotrema*, new species, Vietnam.

Introduction

Isotrema Raf. (Aristolochiaceae) was recently resurrected as a genus independent from *Aristolochia* L. (Zhu et al. 2019e). Species of *Isotrema* are in fact those of *Aristolochia* subgenus *Siphisia* (Duch.) O.C.Schmidt (Schmidt 1935) and differ from others of *Aristolochia* by having perianth strongly curved, gynostemium 3-lobed, anthers paired on the outer surface of each gynostemium segment, and capsule dehiscing basipetally. This generic concept is followed in many later publications (Li et al. 2019; Zhou et al. 2019; Zhu et al. 2019a; Zhu et al. 2019c; Zhu et al. 2019d; Cai et al. 2020a; Wang et al. 2020a; Wang et al. 2020b). Although several other authors still prefer assigning their newly described species under *Aristolochia* subgenus *Siphisia* (e.g., Cai et al. 2020b; Luo et al. 2020; Zhou et al. 2020; Do et al. 2021), of which *Isotrema* was accepted as one of synonyms in the most recent nomenclatural review of *Aristolochia*-related taxa by Ohi-Toma and Murata (2016), the phylogenetic results by Zhu et al. (2019e) appear to be robust because of their extensive samples of Asian species and combination of molecular, chromosomic and morphological data. Therefore, *Isotrema* is followed in this paper.

To date, more than one hundred *Isotrema* species have been described, including those named under *Aristolochia* (e.g., Liu and Deng 2009; Xu et al. 2011; Yao 2012; Huang et al. 2013; Wu et al. 2013; Do et al. 2014; Lu and Wang 2014; Nguyen et al. 2014; Ohi-Toma et al. 2014; Huang et al. 2015; Wu et al. 2015; Zhu et al. 2015; Do et al. 2016; Do et al. 2017; Do et al. 2018; Zhu et al. 2018; Zhou et al. 2019; Zhu et al. 2019e; Cai et al. 2020a; Cai et al. 2020b; Do et al. 2021). Prior to this paper, 18 *Isotrema* species have been recorded for Vietnam (Lecomte 1909; Schmidt 1935; Pham-hoang 2000; Do et al. 2014; Do et al. 2015a; Do et al. 2015b; Do et al. 2016; Do et al. 2017; Do and Li 2018; Lai et al. 2019; Do et al. 2021).

During our botanical surveys in Pu Ta Leng Mountain, Lai Chau Province of northern Vietnam in 2020, we encountered a species that looks very much like *I. wardianum* (J.S. Ma) X.X. Zhu, S. Liao & J.S. Ma from China, India and Myanmar (Ma 1989; Zhu et al. 2019e; Wang et al. 2020b). After careful examination of the plant, we concluded it is a new species that is described here. Terminology follows Hou (1984) and Do et al. (2015a).

Taxonomy treatments

Isotrema putalengense Luu, Q.B.Nguyen & H.C.Nguyen, sp. nov.

Figure 1

Type. VIETNAM. Lai Chau Province, Tam Duong District, Pu Ta Leng Mountain, 22°27'17"N, 103°33'07"E, 2329 m elevation, 14 June 2020, *Nguyen Quoc Binh, Tran Duc Binh, Doan Hoang Son, Nguyen Hieu Cuong SH992* (holotype, VNMN!; isotypes, SGN!, VNMN!).

Diagnosis. The new species is most morphologically similar to *I. wardianum* in the shape of leaves and flowers but differs in having adaxially and abaxially pubescent (vs. adaxially glabrous, abaxially subglabrous or glabrous) leaves with larger leaf lamina (15–20 × 4–6 cm vs. 12–16 × 3–4 cm), longer pedicel (2.5–3 cm vs. 1–2.5 cm), purple (vs. yellow) bracteoles , flowers on old woody stems (vs. axillary), basally truncate perianth limb that is ovoid in front view, straight extended from upper tube and with purple apex (vs. basally obtuse, oblong in front view, forming obtuse angle with upper tube and with yellow apex), indistinct utricle from lower tube and 7–8 mm in diameter (vs. distinct and 5 mm in diameter), U-shaped (vs. V-shaped) tube notch, internally black purple upper tube with slightly sunken longitudinal black purple veins (vs. internally purple, with several prominent longitudinal yellow veins), and truncate to slightly obtuse and irregularly toothed (vs. obtuse and entire) stigma lobes.

Description. Liana perennial, woody. Stems terete. Petioles 3–4.5 cm long, densely pubescent; laminas lanceolate to slightly pandurate, 15–20 × 4–6 cm, adaxially sparsely pubescent, abaxially pubescent, margin entire, base auriculate, apex acute; veins palmate, 1 pair from base, lateral veins 3–4-paired; venation slightly adaxially sunken, abaxially prominent. Flowers on old woody stems, solitary; pedicel 2.5–3 cm, densely brown villous; bracteole inserted on basal half of pedicel, triangular, 5–5.5 mm long, 4–5.5 mm wide at base, densely brown villous, persistent. Ovary yellowish, 1.8–2.1 cm, 0.3–0.4 cm in diameter, densely brown villous, 6-ridged. Perianth horseshoe-shaped (in lateral view), 4–4.5

cm high, yellowish to purple, outside densely yellowish to brown hirsute with parallel veins, inside dark purple. Utricle indistinct from the tube, cylindrical, 0.7–0.9 cm long, 0.7–0.8 cm in diameter, outside light yellow, inside pilose and dark purple. Tube 3.5–4.0 cm, horseshoe-shaped, folded upwards at its middle forming a U-shaped notch, inside grabrous; lower tube 1.7–1.9 cm high x 0.6–0.7 cm in diameter, basally light yellow, apically purple; upper tube 0.6–0.7 cm long x 0.5–0.6 cm in diameter, parallel to the utricle, slightly constricted at the middle, purple; limb cylindric, ovoid in front view, curved forward, with truncate base, 2.5–2.7 cm long × 1.2–1.3 cm in diameter, inside dark red with dense dark-purple papillae, 3-lobed, lobes wide triangle, 0.5–1.3 mm high × 2–4 mm wide; throat ca. 3–4 mm high x 2 mm wide; annulus hemispherical, 0.5–0.6 cm high × 0.6–0.7 cm in diameter at base. Anthers 6, oblong, 2–2.2 mm long, adnate in 3 pairs to base of gynostemium. Gynostemium 3.5–4 mm long x 3.5–4 mm in diameter, stipitate; stipe ca. 0.5 mm; stigma connate, slightly 3-lobed; lobes truncate to slightly obtuse and irregularly toothed. Fruits not seen.

Phenology. Flowering found in June, fruiting unknown.

Etymology. The specific epithet refers to the type locality, Pu Ta Leng Mountain.

Common and vernacular names. Putaleng's pipevine (Vietnamese name: Phòng kỷ Pu Ta Leng).

Distribution and habitat. The new species is currently only known from the closed broadleaved evergreen forest on Pu Ta Leng Mountain, Tam Duong District, Lai Chau Province. It grows on humid fertile soils.

Preliminary conservation status. The plant was recorded in a small population with few scattered individuals. It may be found in adjacent similar forests on the Fan Si Pan Mountain Range. Given, this fact, it is provisionally assigned as Data Deficient until more information is recorded (IUCN Standards and Petitions Subcommittee, 2017).

Discussion. *Isotrema putalengense* is most morphologically similar to *I. wardianum* but they have a number of differences as expressed in the diagnosis. Besides, the new species is also close to *I. utriforme* (S.M. Hwang) X.X. Zhu, S. Liao & J.S. Ma (Hwang 1981; Zhu et al. 2019e) in the shape of leaves and flowers but the latter has glabrous and longer (4–8 cm) petiole, glabrous leaves, yellow-green flowers borne in axils of leafy shoots, ovate-lanceolate bracteoles inserted above middle of peduncle, short upper tube (3–4 mm), convex annulus, saccate limb with ovate-deltate and erect lobes, 3 mm long gynostemium and stigma with 3 obtuse lobes. The shape of flowers in the new species looks like that in *I. pseudoutriforme* (X.X. Zhu & J.S. Ma) X.X. Zhu, Jun Wang & J.S. Ma and *I. ovatifolium* (S.M. Hwang) X.X. Zhu, S. Liao & J.S. Ma (Hwang 1981; Zhu et al. 2019b; Zhu et al. 2019e) but *I. pseudoutriforme* has ovate to narrowly ovate and plain light yellow flowers, uncurved limb forming obtuse angle with upper tuber and ring-like annulus and *I. ovatifolium* has ovate leaves, purple-red flowers in axils of leafy shoots, flat annulus and strongly 3-lobed stigma with obtuse lobes. The key morphological differences between the new species and those closest species are presented in Table 1.

The leaves of the new species may recall those of *I. cucurbitoides* (C.F. Liang) X.X. Zhu, S. Liao & J.S. Ma (Liang 1975; Hwang et al. 2003; Zhu et al. 2019e) and *I. yangii* X.X.Zhu & J.S.Ma (Zhu et al. 2019b; Wang et al. 2020a) but these two species are readily different in a number of characters: *I. cucurbifoides* has leaves with 7-10 pairs of lateral veins, brownish

flowers in axils of leafy shoots, ovate bracteoles, geniculately curved tube, 20 mm long utricle and deeply lobed perianth limb straight extended from upper tube and with 5–7 mm long lanceolate-acuminate lobes while *I. yangii* has leaves with 6–15-pairs of lateral veins, yellowish-white perianth with distinct purple stripes, 25–35 mm long utricles, internally smooth and pinkish or ochre perianth limb that is deeply 3-lobed and straight extended from upper tube and 16–24 mm long limb lobes.

Notably, the notch at the bent perianth tube of *I. putalengense* is obviously U-shaped while it is quite properly V-shaped in the above compared species except *I. pseudoutriforme* where the U-shaped notch is much narrower than that in the new species. Our field observations provisionally indicate that the notch shape is stable in and could be typical for *Isotrema* species. This character is more representative on longitudinal dissection of the perianth tube. However, its value as a supplemental taxonomic character for species identification has not been paid attention to in former *Isotrema* studies and needs further examination.

New combinations for some species of *Isotrema*

As result from their study, Zhu et al. (2019e) has already transferred almost species of *Aristolochia* subgenus *Siphisia* to *Isotrema*. Another four combinations were made for later described species (Wang et al. 2020a). Following this generic concept, here we propose new combinations for the other taxa of the subgenus that were described recently.

Isotrema vuquangense **(**T.V.Do) Luu, Q.B.Nguyen & H.C.Nguyen, **comb. nov.** ≡ *Aristolochia vuquangensis* T.V.Do. Phytotaxa 500 (1): 41. 2021.

Isotrema yachangense (B.G.Huang, Yan Liu & Y.S.Huang) Luu, Q.B.Nguyen & H.C.Nguyen, **comb. nov.** ≡ *Aristolochia yachangensis* B.G.Huang, Yan Liu & Y.S.Huang. PhytoKeys 153: 51. 2020.

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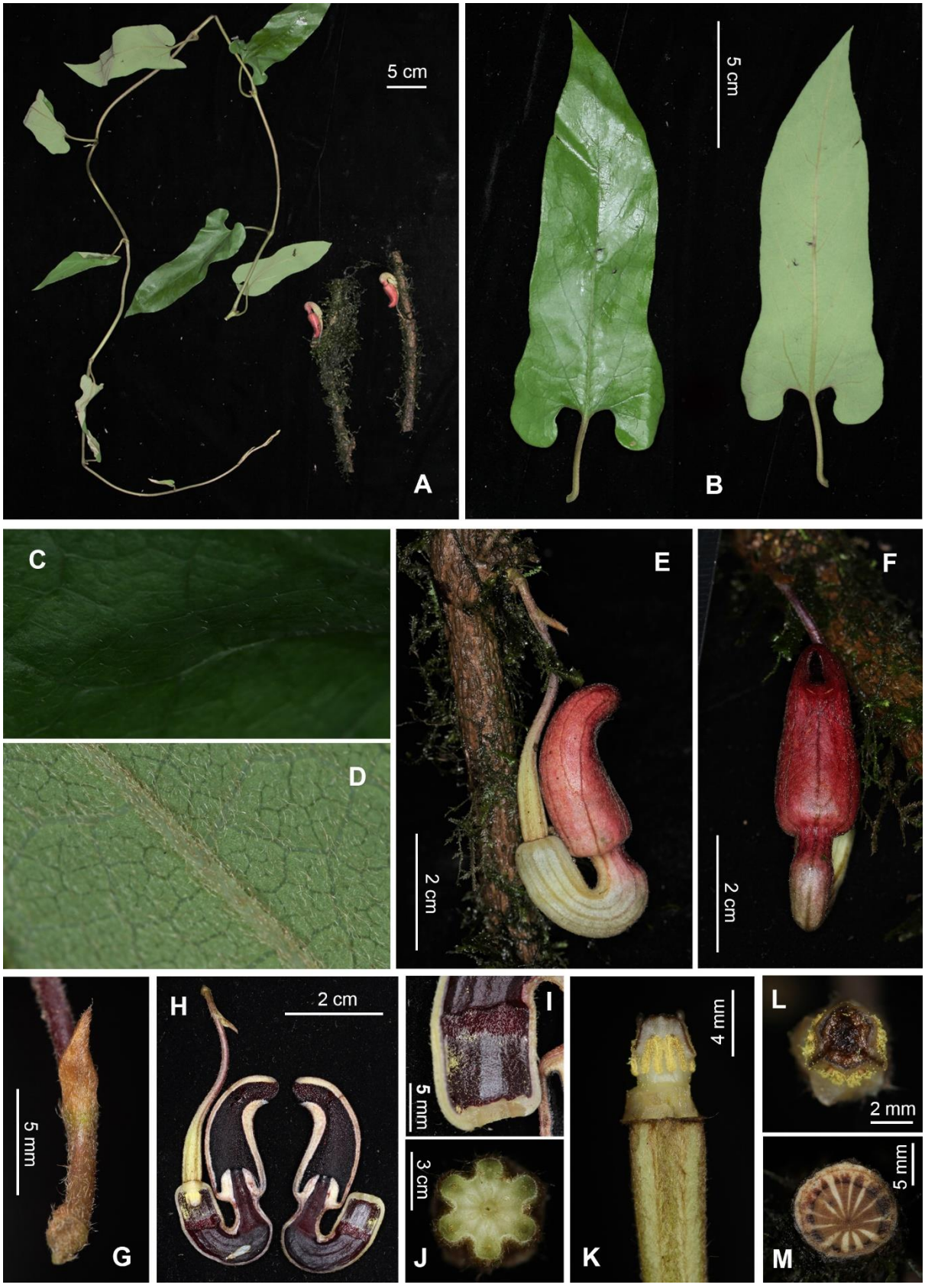

Figure 1. *Isotrema putalengense*. A. Habit. B. Leaf. C Leaf lamina, adaxial surface. D. Leaf lamina, abaxial surface. E. Flower, side view. F. Flower, front view. G. Bracteole. H. Perianth, longitudinal dissection. I. Utricle, inside. J. Ovary, cross section.

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Table 1. Morphological differences between *Isotrema putalengense* and close species.

Characters	***I. ovatifolium***	***I. pseudoutriforme***	***I. putalengense***	***I. utriforme***	***I. wardianum***
Petiole	villous, 3–5 cm long	densely pubescent, 2–5 cm long	densely pubescent, 3–4.5 cm long	glabrous, 4–8 cm long	densely villous, 3–5 cm long
Lamina	ovate, 5–13 × 4–8 cm, with cordate base, abaxially villous, adaxially glabrescent (densely villous when young)	ovate to narrowly ovate, 10–22 × 7–13 cm, with cordate base, adaxially sparsely pubescent, abaxially densely pubescent	lanceolate to slightly pandurate, 15–20 × 4–6 cm, with auriculate base, adaxially sparsely pubescent, abaxially pubescent	ovate-lanceolate, 10–17 × 3–4 cm, with auriculate base, glabrous	lanceolate, 12–16 × 3–4 cm, with auriculate base, adaxially glabrous, abaxially subglabrous or glabrous
Pedicel	3–6 cm long	1.8–5 cm long	2.5–3 cm long	4–6 cm long	1–2.5 cm long
Bracteoles	ovate, inserted on basal 1/2 of pedicel	ovate, inserted on basal half and/or distal half of pedicel	triangular, inserted on basal half of pedicel	ovate-lanceolate, inserted above distal half of pedicel	ovate, inserted on basal half of pedicel
Flower position	axillary	axillary, sometimes on stems	on old woody stems	axillary	axillary
Perianth limb	subcylindric, straightly extended from upper tube, purple-red, 1.5–2.5 cm long × 1–1.5 cm in diameter, with several slightly sunken (?) longitudinal black purple veins and base indistinct	cylindric, forming obtuse angle with upper tuber, light yellow, 2–3 cm long × 1–1.7 cm in diameter, with several slightly sunken (?) longitudinal black purple veins and obtuse base	cylindric, ovoid in front view, straight extended from upper tube, purple, 2.5–2.7 cm long × 1.2–1.3 cm in diameter, with several slightly sunken longitudinal black purple veins and truncate base	ovoid, straight extended from upper tube, yellow-green, 1–2 cm long x ca. 1 cm in widest diameter, with several slightly sunken (?) longitudinal black purple veins and obtuse base	cylindric, oblong in front view, forming obtuse angle with upper tube, purple with yellow apex, ca. 2.5 cm long x 0.9 cm in diameter, with several prominent longitudinal yellow veins and obtuse base

Limb lobes	subrounded or nearly truncate	triangle or wide triangle	wide triangle	ovate-deltate	wide triangle
Perianth throat	ca. 2.5 mm wide	ca. 6 mm wide	ca. 3–4 mm wide	ca. 1 mm wide	ca. 2–3 mm wide
Utricle	indistinct from lower tube, 3–5 mm in diameter, purple-red	indistinct from lower tube, ca. 7–9 mm in diameter, light yellow	indistinct from lower tube, 7–8 mm in diameter, light yellow	indistinct from lower tube, 3–4 mm in diameter, yellow-green	distinct from lower tube, 5 mmm long x 5 mm in diameter, light yellow
Tube notch	V-shaped	U-shaped	U-shaped	V-shaped	V-shaped
Upper tube	ca. 3–5 mm long x 3–4 cm in diameter, purple-red	3–4 mm long x 6–8 cm in diameter, light yellow	6–7 mm long x 5–6 mm in diameter, purple	ca. 3–5 mm long x 5–6 mm in diameter, yellow-green	ca. 10 mm long x 6 mm in diameter, purple
Annulus	flat	ring-like, raised	hemispherical	convex	hemispherical
Anther	ca. 2 mm long	1.5 mm long	2–2.2 mm long	ca. 2 mm long	ca. 2 mm long
Gynostemium	ca. 3–3.5 mm long	3 mm long	3.5–4 mm long	3 mm long	ca. 3.5 mm long
Stigma lobes	obtuse, entire	round, entire	truncate to slightly obtuse, irregularly toothed	obtuse, entire	obtuse, entire