Taxonomic studies on the genus *Isotrema* (Aristolochiaceae) from China: II. *I. brevilimbum* (Aristolochiaceae), a new species from Guizhou, China

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Abstract

A new species of *Isotrema* was recently discovered from Guizhou, China and is here named as *I. brevilimbum*. It is most similar to *I. ovatifolium* and *I. wardianum*, but differs in the morphology of leaves and flowers. A detailed description for the new species, along with line drawings, photographs, as well as morphological comparisons with similar species, are provided. In addition, the distribution of *I. wardianum* in China is here confirmed.

Keywords

*Aristolochia wardiana*, morphology, subgenus *Siphisia*, taxonomy

Introduction

*Isotrema* Raf. (Aristolochiaceae), previously treated as a subgenus of *Aristolochia* L., was recently reinstated as an independent genus based on molecular and morphological evidence (Zhu et al. 2019a). It can be distinguished from *Aristolochia* by the follow-
ing set of characters: perianth strongly curved, gynostemium 3-lobed, anthers paired on the outer surface of each gynostemium segment, and capsule dehiscing basipetally (Do et al. 2015a; Zhu et al. 2019a). Several new species of *Isotrema* have been found and described from China and its neighbouring countries during recent years (Liu and Deng 2009; Xu et al. 2011; Yao 2012; Huang et al. 2013, 2015; Wu et al. 2013, 2015; Do et al. 2014, 2015a, 2015b, 2015c, 2015d, 2016, 2017, 2019; Huong et al. 2014; Lu and Wáng 2014; Ohi-Toma et al. 2014; Zhu et al. 2015, 2016, 2017a, 2017b, 2018, 2019b, 2019c; Gong et al. 2018; Yang et al. 2018; Li et al. 2019; Peng et al. 2019; Zhou et al. 2019; Cai et al. 2020a, 2020b). Currently, a total of 106 species have been reported from *Isotrema*, most of which are distributed in eastern and southern Asia, with some species further extended to northern and central America (Zhu et al. 2019a). China accommodates ca. 66 species, among which 55 species are endemic (Huang et al. 2003; Li et al. 2019; Peng et al. 2019; Zhou et al. 2019; Zhu et al. 2019a, 2019b, 2019c, 2019d; Cai et al. 2020a, 2020b).

During our recent field explorations to southern China, an unknown species of *Isotrema* was collected. Our subsequent examination of specimens from 39 public herbaria (A, BM, BR, CDBI, CSFI, CSH, E, EMA, GXMI, HAST, HENU, HHBG, HIB, HITBC, HNWP, IBK, IBSC, K, KYO, KUN, L, LBG, LE, NAS, NTUF, P, PE, PEM, SM, SNU, SYS, TAI, TI, W, WCU, WU, WUK, XYTC, YUKU; abbreviations follow Thiers 2020) and study of related literature (Hwang 1981, 1988; Ma 1989a, 1989b; Tao 1997; Huang et al. 2003; Do et al. 2015a; Do and Nghiém 2017; Yang et al. 2018; Zhu et al. 2019a, 2019d) suggested it to be a new species. Hereafter, we describe it as *I. brevilimbum* X.X.Zhu, Jun Wáng & F.Cao. Moreover, *I. wardianum* (J.S. Ma) X.X. Zhu, S. Liao & J.S. Ma was recently published (Zhu et al. 2019a) based on its basionym *A. wardiana* J.S. Ma, previously only known from Myanmar and India (Ma 1989a), which was recently collected from Medog County, Tibet, and here its distribution in China is confirmed. Measurements and morphological characters of *I. brevilimbum*, *I. ovatifolium* and *I. wardianum* were made from both dried specimens and field observations of living plants, as well as including related literature. The morphological characters of the description follow Huang et al. (2003).

**Taxonomy**

*Isotrema brevilimbum* X.X.Zhu, Jun Wáng & F.Cao, sp. nov.
urn:lsid:ipni.org:names:77209990-1

Figures 1, 2A–F, 3, 4A–C, 5

**Type.** China. Guizhou: Weining County, Jinzhong Town, 2226 m alt., 5 Aug 2018, X.X. Zhu et al. ZXX18217 (holotype: CSH–0172289!; isotypes: CSH!, KUN!).

**Diagnosis.** *Isotrema brevilimbum* is morphologically similar to *I. ovatifolium* (S.M. Hwang) X.X. Zhu, S. Liao & J.S. Ma and *I. wardianum* (J.S. Ma) X.X. Zhu, S. Liao
Figure 1. *Isotrema brevilimbum* X.X.Zhu, Jun Wang & F.Cao. **A** Branch, **B** leaf, **C, D** flower, **E** longitudinal-section of flower (showing inside structure), **F** anthers and gynostemium, **G** capsule, **H** seed. Drawn by S.Z. Qiao.
& J.S. Ma, but differs from the former in its lamina long ovate (vs. lamina ovate in *I. ovatifolium*), perianth limb forming right angle with upper tube, length nearly equal to width, and apex dark purple and opened (vs. limb straightly extended from upper tube, length significantly longer than width, and apex dark purple and constricted in *I. ovatifolium*), differs from the latter in its lamina long ovate and abaxially densely villous (vs. lamina lanceolate and abaxially subglabrous or glabrous in *I. wardianum*), perianth limb forming right angle with upper tube, length nearly equal to width, and apex dark purple and opened (vs. limb forming obtuse angle with upper tube, length significantly longer than width, and apex light yellow and constricted in *I. wardianum*).
Figure 3. Holotype of *Isotrema brevilimbum* X.X.Zhu, Jun Wang & F.Cao (CSH–0172289).
Figure 4. Leaves, lateral view of flowers, and longitudinal dissected flowers of *Isotrema brevilimbum* (A–C), *I. ovatifolium* (D–F), and *I. wardianum* (G–I). A–F Photographed by X.X. Zhu G photographed by C. Liu H, I photographed by J.D. Ya.

Description. Climbing shrubs. Stems terete, densely villous when young, old branchlets glabrous. Petioles 1–4 cm long, densely villous; laminas long ovate, 5–13 × 2.5–3.5 cm, adaxially appressed villous, abaxially densely villous, base cordate, margin entire, apex acute; basal veins palmate, 2–3 pairs from base, lateral veins 4–6-paired. Flowers axillary or lateral on young stems, solitary, rarely paired. Pedicels pendulous, 1.5–3 cm long, densely villous; bracteole ovate, conduplicate, ca. 2 × 1 mm, abaxially densely villous, adaxially smooth, inserted on lower part of pedicel. Perianth tube geniculately curved, abaxially vil- lous; basal tube ca. 1 cm long, inside dark red, upper tube ca. 1.5 cm long, inside red; limb short cylinder, length nearly equal to width, ca. 7 × 8 mm, forming right angle with upper tube, apex dark purple, opened, ca. 7 mm wide at mouth, inside dark red with densely tiny dark-purple papillae; throat subcircular, ca. 4 mm wide. Anthers 6, oblong, ca.1.5 mm
long, adnate in 3 pairs to base of gynostemium, opposite to lobes. Gynostemium ca. 3 mm long, 3-lobed. Ovary terete, ca. 8 mm long, densely villous. Capsule cylindric, abaxially densely villous, ca. 4.5 × 2 cm. Seeds ovate, 4–5 × 3–3.5 mm, concave-convex.

**Phenology.** Flowering from May to August, fruiting from July to September.

**Etymology.** The specific epithet refers to the short cylinder perianth limb of the new species. The “brevi” means “short”, “limbum” means “limb”, so the new species is named *Isotrema brevilimbum*.

**Common name (assigned here).** Duan Yan Guan Mu Tong (短檐关木通; Chinese name).

**Distribution and habitat.** The new species is currently only known from Weining County of Guizhou, China. It grows by the roadside of farmland at an altitude of ca. 2200 m.

**Preliminary conservation status.** *Isotrema brevilimbum* is known from a single population including two individuals on the roadside of farmland. The new species is assigned a preliminary status of vulnerable (VU) according to the IUCN Red List Categories (IUCN 2012). However, since very few details exist about its natural distribution, the lack of sufficient data currently does not allow a final risk evaluation and the species might be regarded as data deficient (DD). Further field surveys in western Guizhou and northeastern Yunnan are needed to gain more information on its distri-
bution. Not only is the area not under protection as a nature reserve, but also habitat disturbance brought about by human activities, such as grazing and farming, may have a negative impact on the new species.

Note. *Isotrema wardianum* was previously only known from Myanmar and India. Sun and Zhou (2002) later reported the species from China, according to a specimen collected from Medog County of Tibet (*H. Sun et al. 4935*), but without flower or fruit. Nevertheless, the species had long been neglected by taxonomic studies of Huang et al. (2003), Do et al. (2015a), and Zhu et al. (2019a, 2019d) on Chinese *Isotrema*. It was not until 2018 that we discovered a seedling of *Isotrema* sp. at the same locality as that of *H. Sun et al. 4935* and transplanted it in the nursery of the Kunming Institute of Botany. A year later, the plant grown from this seedling bloomed and enabled us to identify it as *I. wardianum* (Figs 2G–I, 4G–I) and confirm its distribution in China.

**Discussion**

*Isotrema brevilimbum* is morphologically similar to *I. ovatifolium* and *I. wardianum* in the shape, size, and color of flower and the dark-purple papillae in the inner surface of perianth limb, but they can be distinguished by the morphology of lamina, the angle between perianth limb and upper tube, as well as the length and mouth of limb. Detailed morphological comparisons among the three species are summarized in Table 1 and Fig. 4.

**Specimens of Isotrema wardianum examined.** **MYANMAR.** Adung Valley, 12 Apr 1931, F. Kingdon-Ward 9398 (holotype: BM). **CHINA. Tibet:** Medog County, 2100 m, 21 Mar 1993, H. Sun et al. 4935 (KUN); at the same locality, 1705 m, 27 Nov 2018, C. Liu & J.D. Ya 18CS17145 (KUN).

**Specimens of Isotrema ovatifolium examined.** **CHINA. Guizhou:** Weining County, Jinzhong Town, 2232 m, 5 Aug 2018, Zhu et al. ZXX18218 (CSH, KUN); **Sichuan:** Huidong County, 2520 m, 27 Jun 1959, S.K. Wu 1584 (type: SM).

**Table 1.** Morphological comparisons among *Isotrema brevilimbum*, *I. ovatifolium* and *I. wardianum*. These characters were based on field observation, related specimens and literatures (Hwang 1981; Ma 1989a; Huang et al. 2003).

| Characters        | *I. brevilimbum* | *I. ovatifolium* | *I. wardianum* |
|-------------------|------------------|------------------|----------------|
| Lamina            | long ovate, 5–13 × 2.5–3.5 cm, abaxially densely villous, base cordate | ovate, 5–13 × 4–8 cm, abaxially densely villous, base cordate | lanceolate, 12–16 × 3–4 cm, abaxially subglabrous or glabrous, base auriculate |
| Perianth limb     | short cylinder, forming right angle with upper tube, length nearly equal to width, apex dark purple, opened, ca. 7 mm wide at mouth | cylinder, straightly extended from upper tube, length significantly longer than width, apex dark purple, constricted, ca. 1 mm wide at mouth | cylinder, forming obtuse angle with upper tube, length significantly longer than width, apex light yellow, constricted, ca. 3 mm wide at mouth |
| Perianth throat   | ca. 4 mm wide    | ca. 2.5 mm wide  | ca. 2 mm wide  |
| Anthers           | ca. 1.5 mm long  | ca. 1.5 mm long  | ca. 2 mm long  |
| Gynostemium       | ca. 3 mm long    | ca. 3.5 mm long  | ca. 3.5 mm long |
| Capsule           | ca. 4.5 × 2 cm   | ca. 6 × 2 cm     | unknown        |
| Distribution      | China (Guizhou)  | China (Guizhou, Sichuan, Yunnan) | China, Myanmar, India |
Isotrema brachylimitatum

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References

Cai L, He DM, Huang YS, Dao ZL (2020a) *Aristolochia wenshanensis*, a new species of Aristolochiaceae from karst region in southeastern Yunnan, China. Taiwania 65(1): 41–46.

Cai L, Dao ZL, Zhu XX (2020b) *Isotrema heii* (Aristolochiaceae), a new species from southeastern Yunnan, China. Annales Botanici Fennici 57: 125–129. https://doi.org/10.5735/085.057.0117

Do TV, Nghiem TD (2017) Taxonomic notes on some *Aristolochia* species in Vietnam. Taiwania 62(2): 216–218.

Do TV, Luu TH, Wanke S, Neinhuis C (2015a) Three new species and three new records of *Aristolochia* subgenus *Siphisia* from Vietnam including a key to the Asian species. Systematic Botany 40(3): 671–691. https://doi.org/10.1600/036364415X689140

Do TV, Neinhuis C, Wanke S (2015b) A new species of *Aristolochia* subgenus *Siphisia* (Aristolochiaceae) from central Vietnam. Phytotaxa 220(1): 69–76. https://doi.org/10.11646/phytotaxa.220.1.6

Do TV, Nghiem TD, Wanke S, Neinhuis C (2014) *Aristolochia quangbinhensis* (Aristolochiaceae), a new species from Central Vietnam. PhytoKeys 33: 51–59. https://doi.org/10.3897/phytokeys.33.6094

Do TV, Nguyen DQ, Nguyen TQT, Wanke S, Neinhuis C (2015c) *Aristolochia cochinchinesis* (Aristolochiaceae), a new species from southern Vietnam. Annales Botanici Fennici 52(3–4): 268–273. https://doi.org/10.5735/085.052.0321

Do TV, Truong CQ, Huynh HTT (2017) *Aristolochia neinhuisii* (Aristolochiaceae), a new species from Vietnam. Annales Botanici Fennici 54(4–6): 203–208. https://doi.org/10.5735/085.054.0602

Do TV, Vu TTH, Luu HT, Nguyen TT (2019) *Aristolochia nuichuaensis* (subg. *Siphisia*, Aristolochiaceae), a New Species, an updated key and a checklist to the species of *Siphisia* in Vietnam. Annales Botanici Fennici 56(1–3): 107–113. https://doi.org/10.5735/085.056.0116

Do TV, Wanke S, Neinhuis C (2016) *Aristolochia bidoupensis* sp. nov. from southern Vietnam. Nordic Journal of Botany 34(5): 513–516. https://doi.org/10.1111/njb.01066

Do TV, Wanke S, Neinhuis C, Pooma R (2015d) *Aristolochia phuphathanaphongiana* sp. nov. from southwestern Thailand. Nordic Journal of Botany 33(5): 567–571. https://doi.org/10.1111/njb.00889

Gong QB, Landrein S, Xi HC, Ma XD, Yang ZH, He KW, Shen JY (2018) *Aristolochia tongbiquanensis*, a new species of Aristolochiaceae from Yunnan, China. Taiwania 63(3): 183–187.

Hwang SM (1981) Materials for Chinese *Aristolochia*. Zhiwu Fenlei Xuebao 19: 222–231.
Huang SM, Kelly LM, Gilbert MG (2003) *Aristolochia* Linnaeus. In: Wu ZY, Raven PH, Hong DY (Eds) Flora of China 5. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, 258–269.

Huang YS, Peng RC, Tan WN, Wei GF, Liu Y (2013) *Aristolochia mulunensis* (Aristolochiaceae), a new species from limestone areas in Guangxi, China. Annales Botanici Fennici 50(3): 175–178. https://doi.org/10.5735/085.050.0308

Huang YS, Peng YD, Huang BY, Lv HZ, Lin CR (2015) *Aristolochia gongchengensis* (Aristolochiaceae), a new species from the limestone areas in Guangxi, China. Annales Botanici Fennici 52(5–6): 396–400. https://doi.org/10.5735/085.052.0522

Hwang SM (1988) *Aristolochia* Linnaeus. In: Kiu HS, Ling YR (Eds) Flora Reipublicae Popularis Sinicae 24. Science Press, Beijing, 199–245.

Huong NTT, Hai DV, Quang BH, Cuong NT, Khang NS, Vu DQ, Ma JS (2014) *Aristolochia xuanlienensis*, a new species of Aristolochiaceae from Vietnam. Phytotaxa 188(3): 176–180. https://doi.org/10.11646/phytotaxa.188.3.7

IUCN (2012) IUCN Red List Categories and Criteria, Version 3.1 (2nd Ed.) Gland and Cambridge, 32 pp.

Li RT, Wang ZW, Wang J, Zhu XX, Xu H (2019) *Isotrema sanyaense*, a new species of Aristolochiaceae from Hainan, China. PhytoKeys 128: 85–96. https://doi.org/10.3897/phytokeys.128.35042

Liu ZW, Deng YF (2009) *Aristolochia wuana*, a new name in Chinese *Aristolochia* (Aristolochiaceae). Novon 19(3): 370–371. https://doi.org/10.3417/2007151

Lu CT, Wang JC (2014) *Aristolochia yujungiana* (Aristolochiaceae): A new species from Taiwan. Taiwan Linye Kexue 29: 291–299.

Ma JS (1989a) A revision of *Aristolochia* Linn. from E. & S. Asia. Zhiwu Fenlei Xuebao 27: 321–364.

Ma JS (1989b) A revision of *Aristolochia* from Yunnan. Yunnan Zhi Wu Yan Jiu 11: 321–323.

Ohi-Toma T, Watanabe-Toma K, Murata H, Murata J (2014) Morphological variations of *Aristolochia kaempferi* and *A. tanzawana* (Aristolochiaceae) in Japan. Shokubutsu Kenkyu Zasshi 89: 152–163.

Peng YD, Gadagkar SR, Li J, Xie YY, Huang XY, Lu HZ, Huang BY, Yu LY (2019) *Aristolochia kechangensis* sp. nov (Aristolochiaceae) from Guangxi, China. Nordic Journal of Botany 37(9): e02456. https://doi.org/10.1111/njb.02456

Sun H, Zhou ZK (2002) Seed Plants of The Big Bend Gorge of Yalu Tsangpo in SE Tibet, E Himalayas. Yunnan Science & Technology Press, Kunming, 425 pp.

Tao DD (1997) Aristolochia Linnaeus. In: Chen SK (Ed.) Flora Yunnanica 8. Science Press, Beijing, 7–25.

Thiers B (2020) Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden’s virtual Herbarium. http://sweetgum.nybg.org/ih/ [accessed 11 March 2020]

Wu L, Xu WB, Huang YS, Liu Y (2015) *Aristolochia longlinensis* (Aristolochiaceae), a new species from Western Guangxi, China. Novon 23(4): 490–493. https://doi.org/10.3417/2011105

Wu L, Xu WB, Wei GF, Liu Y (2013) *Aristolochia huanjiangensis* (Aristolochiaceae), a new species from Guangxi, China. Annales Botanici Fennici 50(6): 413–416. https://doi.org/10.5735/085.050.0608
Xu H, Li YD, Yang HJ, Chen HQ (2011) Two new species of Aristolochia (Aristolochiaceae) from Hainan Island, China. Novon 21(2): 285–289. https://doi.org/10.3417/2009116
Yang B, Ding HB, Zhou SS, Zhu XX, Li R, Mya BM, Tan YH (2018) Aristolochia sinoburmanica (Aristolochiaceae), a new species from north Myanmar. PhytoKeys 94: 13–22. https://doi.org/10.3897/phytokeys.94.21557
Yao TL (2012) Aristolochia vallisicola (Aristolochiaceae), a new species from Peninsular Malaysia. PhytoKeys 14: 15–22. https://doi.org/10.3897/phytokeys.14.3354
Zhou XX, Jiang GB, Zhu XX, Liu ZY, Huang Y, Wang GT, Wang RJ (2019) Isotrema plagiostomum (Aristolochiaceae), a new species from Guangdong, South China. Phytotaxa 405(4): 221–225. https://doi.org/10.11646/phytotaxa.405.4.7
Zhu XX, Li XQ, Liao S, Du C, Wang Y, Wang ZH, Yan J, Zuo YJ, Ma JS (2019a) Reinstatement of Isotrema, a new generic delimitation of Aristolochia subgen. Siphisia (Aristolochiaceae). Phytotaxa 401(1): 1–23. https://doi.org/10.11646/phytotaxa.401.1.1
Zhu XX, Li XQ, Liao S, Li GD, Ma JS (2019b) The taxonomic revision of Asian Aristolochia (Aristolochiaceae) V: Two new species from Yunnan, China. PhytoKeys 130: 93–106. https://doi.org/10.3897/phytokeys.130.33933
Zhu XX, Liao S, Zhang L, Wang ZH, Du C, Ma JS (2016) The taxonomic revision of Asian Aristolochia (Aristolochiaceae) I: Confirmation and illustration of A. austroszechuanica A faucimaculata and A. yunnanensis var. meionantha from China. Phytotaxa 261(2): 137–146. https://doi.org/10.11646/phytotaxa.261.2.3
Zhu XX, Liao S, Sun ZP, Zhen AG, Ma JS (2017a) The taxonomic revision of Asian Aristolochia (Aristolochiaceae) II: Identities of Aristolochia austroyunnanensis A dabieshanensis and A. hyperxantha – a new species from Zhejiang, China. Phytotaxa 313(1): 61–76. https://doi.org/10.11646/phytotaxa.313.1.4
Zhu XX, Liao S, Ma ZX, Xu B, Wang ZH, Wang Y, Ma JS (2017b) The taxonomic revision of Asian Aristolochia (Aristolochiaceae) III: Two new taxa of Aristolochia and morphological revision for the flower character of A. obliqua from Yunnan, China. Phytotaxa 332(3): 269–279. https://doi.org/10.11646/phytotaxa.332.3.3
Zhu XX, Shen B, Sun ZP, Chen B, Liao S, Ma JS (2018) Two New Species of Aristolochia (Aristolochiaceae) from Yunnan, China. Novon 26(3): 298–306. https://doi.org/10.3417/2018066
Zhu XX, Wang J, Liao S, Ma JS (2019d) Synopsis of Aristolochia L. and Isotrema Raf (Aristolochiaceae) in China. Shengwu Duoyangxing 27(10): 1143–1146. https://doi.org/10.17520/biods.2019183
Zhu XX, Zhang L, Hua ZX, Chen GF, Liao S, Ma JS (2015) Aristolochia weixiensis, a new species of Aristolochiaceae from Yunnan, China. Phytotaxa 230(1): 54–60. https://doi.org/10.11646/phytotaxa.230.1.4
Zhu XX, Zheng HL, Wang J, Gao YQ, Ma JS (2019c) Taxonomic studies on the genus Isotrema (Aristolochiaceae) from China: I. I. cangshanense, a new species from Yunnan. PhytoKeys 134: 115–124. https://doi.org/10.3897/phytokeys.134.37243