



Aristolochia wenshanensis, a new species of Aristolochiaceae from karst region in southeastern Yunnan, China

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ABSTRACT: *Aristolochia wenshanensis* Lei Cai, D.M.He & Z.L.Dao, a new species of Aristolochiaceae from southeastern Yunnan, China, is described and illustrated. The new species is morphologically most similar to *A. mulunensis* Y.S.Huang & Yan Liu in the shape of the leaf blade and perianth, but it can be easily distinguished by structure and color of the flower, shape of leaf blade base, especially the perianth shape, colour and texture. According to morphology the new species belongs to *Aristolochia* subgenus *Siphisia*. We also provide a table and notes to distinguish several other morphologically similar *Aristolochia* species.

KEY WORDS: Aristolochiaceae, *Aristolochia wenshanensis*, China, new taxa, karst region, flora of Yunnan

INTRODUCTION

The genus *Aristolochia* L. (1753) of Aristolochiaceae comprises more than 550 species distributed mainly throughout tropical and subtropical regions, with some species extending into temperate regions (González, 2012). Recently, several new species have been described from Yunnan, Guangxi, Guangdong and Hainan provinces (Gong *et al.*, 2018; Huang *et al.*, 2013, 2015; Lu and Wang, 2014; Peng *et al.*, 2019; Xu *et al.*, 2011; Yang *et al.*, 2018; Zhou *et al.*, 2019; Zhu *et al.*, 2016, 2017, 2018a, 2018b). From China more than 70 *Aristolochia* species are known which are belonging to subgenus *Aristolochia* and *Siphisia*. The highest diversity is found in southern and southwestern China. (Hwang, 1988; Hwang *et al.*, 2003; Tao, 1997).

Although, Zhu *et al.* reinstated the *Aristolochia* subgen. *Siphisia* as an independent genus *Isotrema* Raf. (Zhu *et al.*, 2019a), three new *Isotrema* species got recently described from China (Li *et al.*, 2019; Zhou *et al.*, 2019; Zhu *et al.*, 2019b), but most scientists still advise to use the name *Aristolochia* rather than *Isotrema* (Ohi-Toma and Murata, 2016), and here, we still use the traditional generic name *Aristolochia* to describe a new species, because the genus name *Isotrema* is controversial.

In March 2019, during field investigations of the karst region in southeastern Yunnan, China, an unknown species of *Aristolochia* was collected from Wenshan City. After careful examination of the relevant specimens and literature of the genus *Aristolochia* of the neighbouring countries (Do *et al.*, 2015, 2017, 2018; Do and Nghiem, 2017; Hwang, 1988; Hwang *et al.*, 2003; Huang *et al.*, 2013; Ma, 1989; Ma and Cheng, 1989; Tao, 1997; Yang, 1988, Zhu *et al.*,

2019a), especially comparing the morphology of the flower, we conclude that this plant represents a new species to science due to the strongly curved perianth with a 3-lobed limb, and especially the 3-lobed gynostemium, anthers paired on the outer surface of each gynostemium segment, the new species belongs morphologically to *Aristolochia* subgenus *Siphisia*. Here, the new species *Aristolochia wenshanensis* Lei Cai, D.M.He & Z.L.Dao is described and illustrated, and its morphological characters are compared with morphologically similar species such as *A. mulunensis* Y.S.Huang & Yan Liu and several other related species of subgenus *Siphisia* (Fig. 3; Table 1).

TAXONOMIC TREATMENT

Aristolochia wenshanensis Lei Cai, D.M.He & Z.L.Dao, *sp. nov.* 文山馬兜鈴 Figs. 1 & 2

Diagnosis: *Aristolochia wenshanensis* resembles *A. mulunensis* in the shape of the leaf blade and perianth, but can be easily distinguished from the latter by the inconspicuous bracteole; perianth outside pale red with purple veins, densely rusty-villous; basal utricle inside purple black, ca. 8 mm in diam., lower tube purple with white patches, densely pubescent, ca. 6 mm in diam., upper tube, inside purple; limb subrotundate-peltate, lobes yellowish brown with tiny papillae, forming a wide campanulate limb in the center, ca. 1.8 cm in diam.

Type: China. Yunnan: Wenshan City, Xinjie Town, Caoguoshan Village, Qiqitian, 23°06'N, 103°57'E, elev. 1669 m, limestone forest, in flowering, 23 March 2019, Lei Cai & D.M. He CL225 (holotype: KUN!, isotypes: KUN!, TAI!).

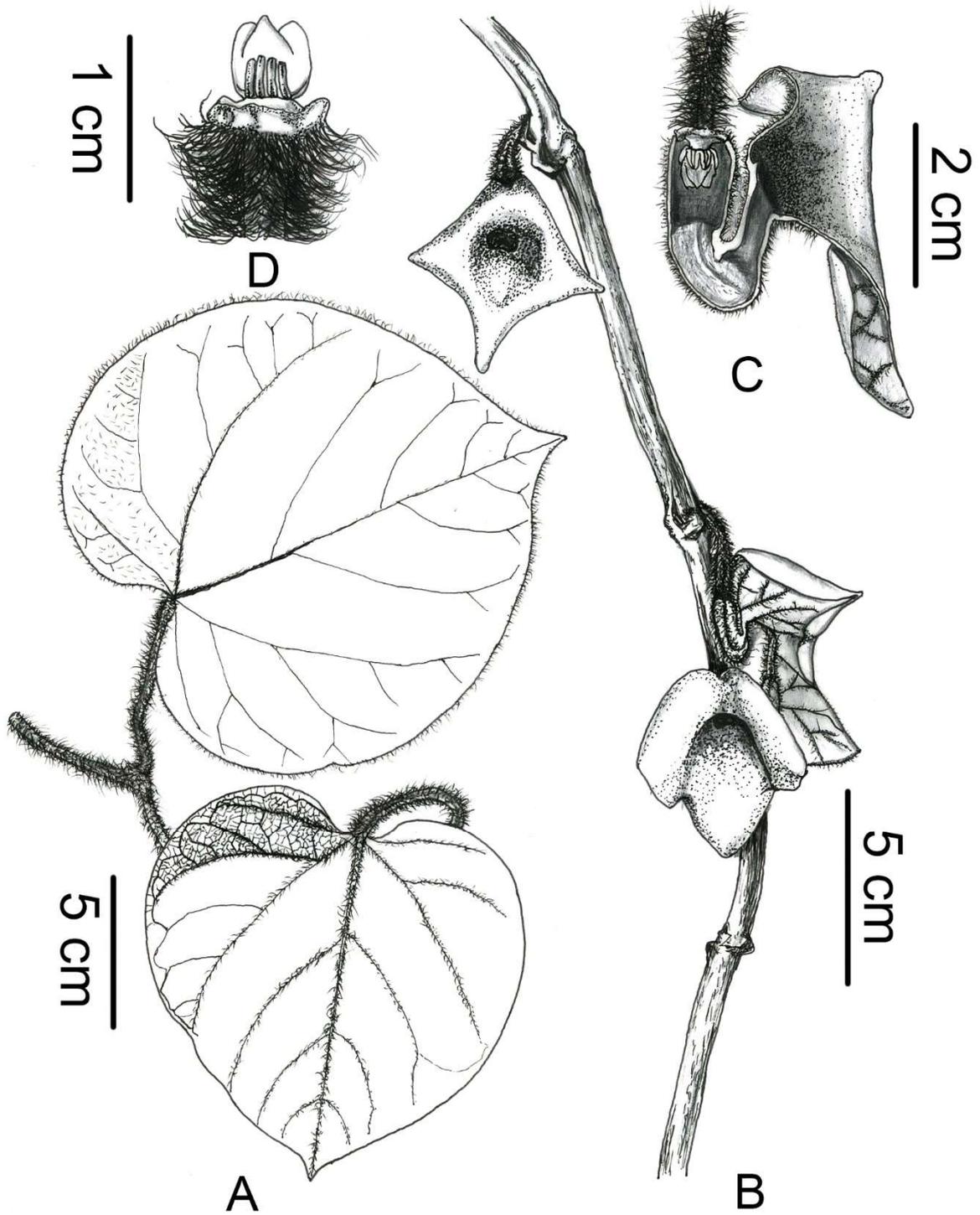


Fig. 1. *Aristolochia wenshanensis* Lei Cai, D.M.He & Z.L.Dao sp. nov. A. Habit with leaves. B. Habit with flowers. C. Opened flower showing the internal structure. D. Gynostemium and ovary. Illustration by Xuan-Lin Zhu.

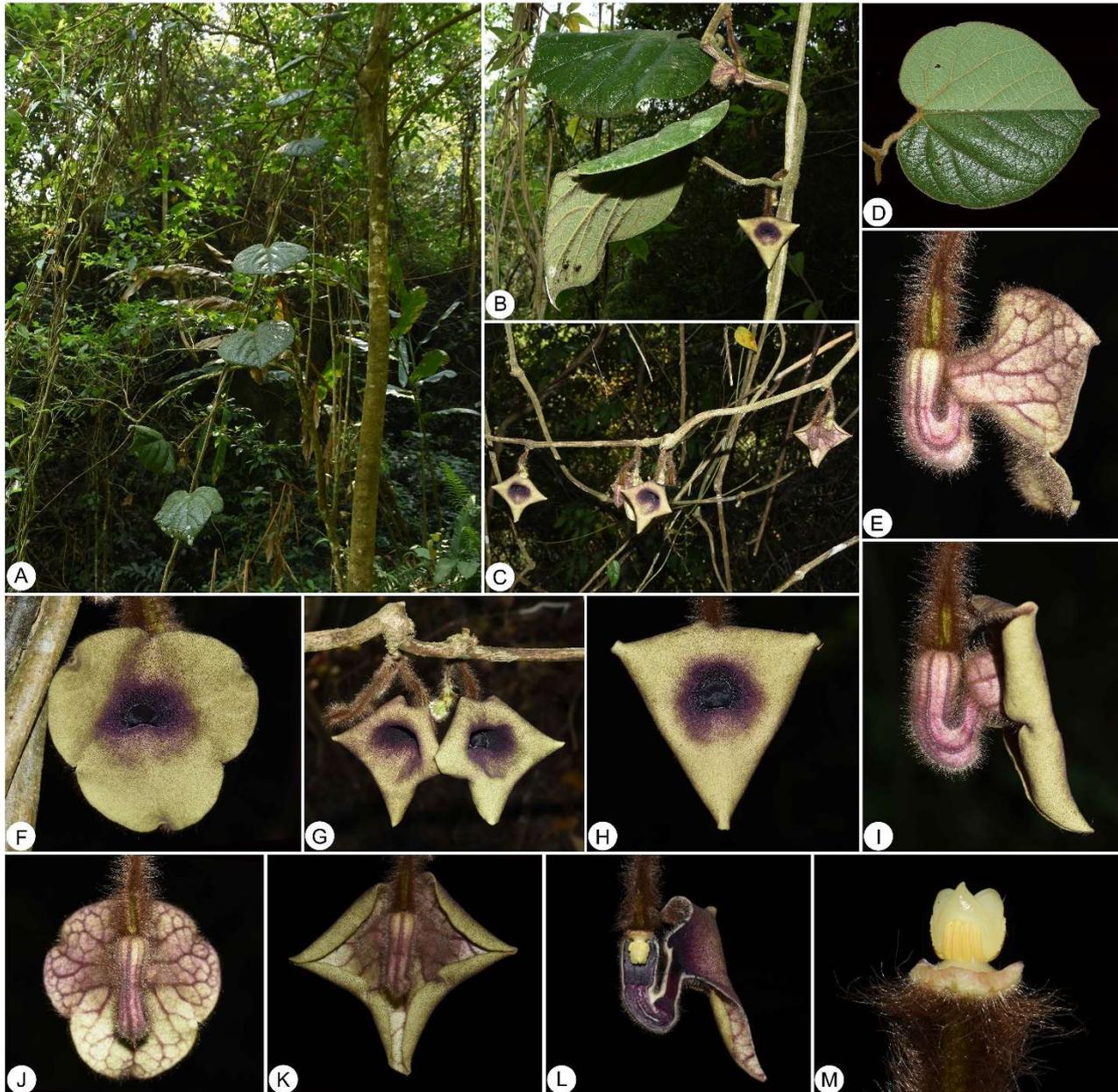


Fig. 2. *Aristolochia wenshanensis* Lei Cai, D.M.He & Z.L.Dao sp. nov. **A.** Habitat. **B & C.** Plants with flowers. **D.** Adaxial and abaxial leaf surfaces. **E & I.** Lateral view of flowers. **F-H.** Frontal view of flowers. **J & K.** Back view of flowers. **L.** Opened flower showing the internal structure. **H.** Gynostemium and ovary. Photographs by Lei Cai.

Perennial climbing woody liana. Stems densely rusty villous when young, old branchlets glabrous. Petiole 5–12 cm long, ca. 3 mm in diam., densely rusty villous; leaf blade cordate or ovate-cordate to orbicular, 12–32 × 10–28 cm, thickish papery, base wide cordate, sinus 1.5–4.5 cm deep, apex acute to acuminate, margin entire, adaxially dark green, sparsely villous, densely rusty villous along veins and midrib, gradually shedding, abaxially light green, pubescent, densely rusty pubescent and villous along veins, gradually shedding, with 4–7 lateral veins to each side of midrib. Cymes in axils of

leafy shoots or stems, 2–4-flowered. Pedicel pendulous, 2.2–4.5 cm long, densely rusty-villous, bracteole inconspicuous. Perianth horseshoe shaped (in lateral view), 4.5–6.0 cm high, outside pale red with purple veins, densely rusty-villous, basal tube 2.6–3.2 cm long, inside purple black at base with pubescent, inflated slightly, ca. 8 mm in diam., purple with white patches above base, densely pubescent, ca. 6 mm in diam., upper tube cylindrical, inside purple, ca. 4 mm in diam.; limb subrotundate apically, 3.0–5.2 cm in diam., purple inside, densely papillae; lobes yellowish brown with tiny



Fig. 3. *Aristolochia wenshanensis* (A-C by Lei Cai) and *Aristolochia mulunensis* (D-F by Yu-Song Huang). **A & D.** Frontal view of flowers. **B & E.** Lateral view of flowers. **C & F.** Opened flower showing the internal structure.

papillae, subequal, semicircular, ca. 1.5 cm in diam., reflexed outwards later; forming a wide campanulate limb in the center, ca. 1.8 cm in diam.; throat suborbicular, purple black, ca. 0.7 cm in diam. Gynostemium ca. 0.5 cm high, 3-lobed, apex of lobes volute, smooth; anthers 6, ca. 2 mm long, yellow, adnate in 3 pairs to the base of gynostemium, opposite the lobes. Ovary terete, 0.8–1.2 cm long, 0.2–0.4 cm in diameter, densely rusty villous. Capsule and seeds unknown.

Phenology: Flowering has been observed from March to May; fruiting unknown.

Etymology: The specific epithet ‘*wenshanensis*’ refers to the type locality where the new species was found, Wenshan City, Yunnan Province, China.

Distribution and Ecology: *Aristolochia wenshanensis* is currently known from the type locality in karst region with two populations and 6 individuals; it is also distributed in Gejiu City, Honghe Hani and Yi Autonomous Prefecture after consulting other scholars (pers. communication, Meng-Qi Han, Institute of Botany, Chinese Academy of Sciences). The species grows on shaded slopes of karst landform under the evergreen broad-leaved forests and climbs on other woody plants.

Conservation status: *Aristolochia wenshanensis* might be endangered. However, more field research is needed to evaluate the population size, the level of threats, and to assign a conservation status. Furthermore, we saw some roots of *Aristolochia* species at the herbal

medicine market in Wenshan City. A farmer grew many *Aristolochia* species in his garden including several individuals of *A. wenshanensis* because of their traditional medicinal value. How to protect these plants is our ongoing research task.

Additional Specimens Examined: China. Yunnan: Honghe Hani and Yi Autonomous Prefecture, Gejiu City, Kafang Town, Dabaqi Village, limestone hills, in flowering, 25 March 2017, M.Q. Han HMQ1293 (paratype: IBK!).

Notes: The new species most resembles *Aristolochia mulunensis* on the morphology, however, *A. wenshanensis* can be clearly distinguished from the latter species by several vegetative characters (see Table 1 and Fig. 3). It is also similar to several other related *Aristolochia* species, including *A. austroszechuanica* and *A. kwangsiensis* (limb abruptly expanded discoid without a wide campanulate limb on both species), but the limb lobes of *A. wenshanensis* reflexed outwards, forming a wide campanulate limb in the center, and it also obviously different from the shape and color of the tube from the former two; *A. wenshanensis* is also similar to *A. pseudocaulialata* in shape of leaf blade and perianth, but the later with limb abruptly expanded discoid, throat 1–1.5 cm in diam., yellow, lower half with pink dots, limb lobes red with densely dark red warts, these characteristics can be clearly distinguished from *A. wenshanensis* (see Table 1).



Table 1. Morphological comparisons among *Aristolochia wenshanensis*, *A. mulunensis*, *A. austroszechuanica*, *A. kwangsiensis* and *A. pseudocaulialata*.

Characters	<i>A. wenshanensis</i>	<i>A. mulunensis</i>	<i>A. austroszechuanica</i>	<i>A. kwangsiensis</i>	<i>A. pseudocaulialata</i>
Leaf blade	base wide cordate, apex acute to acuminate	base cordate or auriculate, apex obtuse or acute	base cordate, apex acute to obtuse	base cordate or auriculate, apex obtuse or acute	base shallowly cordate to cordate, apex obtuse to acute
Bracteole	unconspicuous	subulate, 2–4 mm long, densely brownish-hirsute	unconspicuous	subulate, 3–6 mm, densely hirsute	ovate-deltoid, ca. 1.5 mm long, abaxially densely villous
Perianth	outside pale red with purple veins, densely rusty-villous	outside purple, densely brownish-hirsute	outside yellowish green, densely brownish-hirsute	outside yellowish green, densely brownish-hirsute	outside pale red with purple veins, densely rusty-villous
Utricle	basal tube inside purple black at base, ca. 8 mm in diam.	basal tube inside white and purple at base, ca. 6 mm in diam.	basal tube inside dark purple at base, ca. 10 mm in diam.	basal tube inside white with pale purple at base, ca. 10 mm in diam.	basal tube inside dark red at base, ca. 5 mm in diam.
Lower tube	purple with white patches above base, densely pubescent, ca. 6 mm in diam.	white above base, glabrous, ca. 4 mm in diam.	white above base, glabrous, ca. 6 mm in diam.	white with purple patches above base, glabrous, ca. 7 mm in diam.	white above base, glabrous, ca. 12 mm in diam.
Upper tube	inside purple	inside white with purple patches	inside yellow	inside white	inside red with yellow patches
Throat	ca. 7 mm in diam., purple black	ca. 4 mm in diam., purple	6–9 mm in diam., reddish brown	4–5 mm in diam., yellow	1.0–1.5 cm in diam., yellow
Limb	subrotundate, 3.0–5.2 cm in diam., purple black inside, densely papillae, forming a wide campanulate limb in the center, ca. 1.8 cm in diam.	discoid suborbicular, 3.5–5.5 cm in diam., mauve with protuberance dark purple inside, densely verrucose, campanulate limb obscure	abruptly expanded discoid, 3–4.5 cm in diam.	abruptly expanded discoid, 3.5–4.5 cm in diam.	discoid, 3.0–3.5 cm in diam.
Lobes	yellowish brown with tiny papillae	purple with densely verrucose	yellowish green, with dense small purple warts	dark purple with densely dark red spinous process	red with densely dark red warts
Gynostemium	apex of lobes acute	apex of lobes round	apex of lobes obtuse	apex of lobes obtuse	apex of lobes acute

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LITERATURE CITED

- Do, T.V., C.Q. Truong and H.T.T. Huynh. 2017. *Aristolochia neinhuisii* (Aristolochiaceae), a new species from Vietnam. *Ann. Bot. Fenn.* **54**(4-6): 203–208.
- Do, T.V. and T.D. Nghiem. 2017. Taxonomic notes on some *Aristolochia* species in Vietnam. *Taiwania* **62**(2): 216–218.
- Do, T.V., H.T. Luu, S. Wanke and C. Neinhuis. 2015. Three New Species and Three New Records of *Aristolochia* Subgenus *Siphisia* from Vietnam including a Key to the Asian Species. *Sys. Bot.* **40**(3): 671–691.
- Do, T.V., T.T.H. Vu, H.T. Luu and T.T. Nguyen. 2018. *Aristolochia nuichuaensis* (subg. *Siphisia*, Aristolochiaceae), a New Species, an Updated Key and a Checklist to the Species of *Siphisia* in Vietnam. *Ann. Bot. Fenn.* **56**(1-3): 107–113.
- Gong, Q.B., S. Landrein, H.C. Xi, X.D. Ma, Z.H. Yang, K.W. He and J.Y. Shen. 2018. *Aristolochia tongbiguanensis*, a new species of Aristolochiaceae from Yunnan, China. *Taiwania* **63**(3): 183–187.
- González, F. 2012. Florística y sistemática filogenética innecesariamente disyuntas: El caso de *Aristolochia*, *Euglypha* y *Holostylis* (Aristolochiaceae). *Revista de la Academia Colombiana de Ciencias Exactas Físicas y Naturales* **36**: 193–202. [in Spanish]
- Huang, Y.S., R.C. Peng, W.N. Tan, G.F. Wei and Y. Liu. 2013. *Aristolochia mulunensis* (Aristolochiaceae), a new species from limestone areas in Guangxi, China. *Ann. Bot. Fenn.* **50**(3): 175–178.
- Huang, Y.S., Y.D. Peng, B.Y. Huang, H.Z. Lv and C.R. Lin. 2015. *Aristolochia gongchengensis* (Aristolochiaceae), a new species from the limestone areas in Guangxi, China. *Ann. Bot. Fenn.* **52**(5-6): 396–400.
- Hwang, S.M. 1988. *Aristolochia* L. In: Kiu, H.S. and Y.R. Ling. (eds.), *Flora Reipublicae Popularis Sinicae*, vol. 24. Science Press, Beijing pp. 199–245. [in Chinese]



- Hwang, S.M., L.M. Kelly and M.G. Gilbert. 2003. *Aristolochia* L. In: Wu Z.Y. & P.H. Raven (Ed.) *Flora of China*. vol. 5. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, USA. pp. 258–269.
- Li, R.T., Z.W. Wang, J. Wang, X.X. Zhu and H. Xu. 2019. *Isotrema sanyaense*, a new species of Aristolochiaceae from Hainan, China. *Phytokeys* **128**: 85–96.
- Lu, C.T. and J.C. Wang. 2014. *Aristolochia yujungiana* (Aristolochiaceae): a new species from Taiwan. *Taiwan Journal of Forest Science* **29**: 291–299.
- Ma, J.S. 1989. A revision of *Aristolochia* Linn. from E. & S. Asia. *Acta Phytotaxon. Sin.* **27**(5): 321–364.
- Ma, J.S. and C.Y. Cheng. 1989. New taxa of Chinese *Aristolochia* L.. *Acta Phytotaxon. Sin.* **27**(4): 293–297.
- Ohi-Toma, T. and J. Murata. 2016. Nomenclature of *Isotrema*, *Siphisia*, and *Endodeca*, and their related infrageneric taxa of *Aristolochia* (Aristolochiaceae), *Taxon* **65**(1): 152–157.
- Peng, Y.D., S.R. Gadagkar, J. Li, Y.Y. Xie, X.Y. Huang, H.Z. Lu, B.Y. Huang and L.Y. Yu. 2019. *Aristolochia kechangensis* sp. nov. (Aristolochiaceae) from Guangxi, China. *Nord. J. Bot.* **37**(9): 1–7.
- Tao, D.D. 1997. *Aristolochia* L. In: Chen, S.K. (ed.), *Flora Yunnanica*, vol.8. Science Press, Beijing pp. 7–25. [in Chinese]
- Xu, H., Y.D. Li, H.J. Yang and H.Q. Chen. 2011. Two new species of *Aristolochia* (Aristolochiaceae) from Hainan Island, China. *Novon* **21**(2): 285–289.
- Yang, B., H.B. Ding, X.S. Zhou, X.X. Zhu, R. Li, M.B. Maw and Y.H. Tan. 2018. *Aristolochia sinoburmanica* (Aristolochiaceae), a new species from north Myanmar. *Phytokeys* **94**: 13–22.
- Yang, Z.L. 1988. New taxa of the genus *Aristolochia* from Sichuan. *Journal of Wuhan Botanical Research* **6**(1): 31–35.
- Zhou, X.X., G.B. Jiang, X.X. Zhu, Z.Y. Liu, Y. Huang, G.T. Wang and R.J. Wang. 2019. *Isotrema plagiostomum* (Aristolochiaceae), a new species from Guangdong, South China. *Phytotaxa* **405**(4): 221–225.
- Zhu, X.X., B. Shen, Z.P. Sun, B. Chen, S. Liao and J.S. Ma. 2018b. Two New Species of *Aristolochia* (Aristolochiaceae) from Yunnan, China. *Novon* **26**(3): 298–306.
- Zhu, X.X., H.L. Zheng, J. Wang, Y.Q. Gao and J.S. Ma. 2019b. Taxonomic studies on the genus *Isotrema* (Aristolochiaceae) from China: I. *I. cangshanense*, a new species from Yunnan. *PhytoKeys* **134**: 115–124.
- Zhu, X.X., S. Liao, J.N. Liu, C. Zhang and J.S. Ma. 2018a. The taxonomic revision of Asian *Aristolochia* (Aristolochiaceae) IV: lectotypification of *A. caulialata*, with a new species from Yunnan, China - *A. pseudocaulialata*. *Phytotaxa* **364**(1): 49–60.
- Zhu, X.X., S. Liao, L. Zhang, Z.H. Wang, C. Du and J.S. Ma. 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.
- Zhu, X.X., S. Liao, Z.X. Ma, B. Xu, Z.H. Wang, Y. Wang and J.S. Ma. 2017. 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.
- Zhu, X.X., X.Q. Li, S. Liao, C. Du, Y. Wang, Z.H. Wang, J. Yan, Y.J. Zuo and J.S. Ma. 2019a. Reinstatement of *Isotrema*, a new generic delimitation of *Aristolochia* subgen. *Siphisia* (Aristolochiaceae). *Phytotaxa* **401**(1): 1–23.