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Studies of *Impatiens* (Balsaminaceae) of Nepal 1. *Impatiens amplexicaulis* Edgew. and *I. chungtienensis* Y. L. Chen

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Abstract *Impatiens amplexicaulis* Edgew. and *I. chungtienensis* Y.L.Chen are taxonomically revised and a new section name, sect. *Sulcatae* S.Akiyama & H.Ohba, is proposed. *Impatiens amplexicaulis* distributed in NW Himalaya, and the species reported from Nepal shoud be referred to *I. chungtienensis*. These two are distinguished by the shape of the lower sepal.

Key words: Flora of Nepal, Himalaya, *Impatiens*, Nepal, new section.

Based on the studies of *Impatiens* in both the Himalaya and SW China (Akiyama, 1987; Akiyama *et al.*, 1991, 1992a, 1992b, 1995a, 1995b, 1996a, 1996b, 1999, 2009; Akiyama and Ohba, 1993, 2000; Akiyama and Wu, 2008; Fujihashi *et al.*, 2002; Sugawara *et al.*, 1994, 1997), we wish to revise the species from Nepal for the Flora of Nepal project (Watson *et al.*, 2010). The terminology and measurements of the flowers follows Akiyama *et al.* (1991).

Taxonomic studies of Himalayan *Impatiens* were initiated by de Candolle (1824), Roxburgh (1820–24), and Don (1825). Their treatments of Himalayan species were mostly based on Wallich collections from Nepal. Royle (1834) described several *Impatiens* from the western Himalaya based on his own collections. After *Impatiens* of the western Himalaya was studied by Edgeworth (1846), Hooker (1874–75) revised all Indian and Nepalese *Impatiens* and classified them into two groups with several subgroups. Later Hooker (1904, 1905) published two synopses of *Impatiens* from this area.

In this paper we revise *Impatiens amplexicaulis* and allied species mainly based on herbarium specimens preserved in A, BM, E, GH, K, KUN, NY, TI, TNS, US, and also on materials collected by the authors.

1) On the infrageneric classification

Impatiens amplexicaulis and its allies are here classified in a new section, sect. *Sulcatae* S.Akiyama & H.Ohba, characterized by a combination of characteristics: leaves opposite at middle and base of stem; ascending racemose inflorescences with flowers usually subumbellately arranged on long peduncle; purplish flowers; and linear or clavate capsules. Hooker (1874) classified species with linear or clavate fruit in section "*Oppositifoliae* and *Verticillatae*" (in Series B). But the names "*Oppositifoliae* and *Verticillatae*" are not valid. We therefore propose a new section, *Sulcatae*. Section *Sulcatae*, ranging from the Himalaya to SW China, comprises at least four species, *I. amplexicaulis* Edgew. (Fig. 1), *I. glandulifera* Royle (Fig. 2), *I. sulcata* Wall. (Fig. 3), and *I. chungtienensis* Y.L.Chen (Fig. 4), and two uncertain species that are not known to occur in Nepal, *I. thomsonii* Hook.f. (Fig. 5) from the western Himalaya and *I. fragicolor* Marq. & Airy

Fig. 1. Lectotype of *Impatiens amplexicaulis* Edgew. (M.P. Edgeworth 333 in 1844, K000694628).

Fig. 2. *Impatiens glandulifera* Royle (= *I. roylei* Walp.) identified by Hooker (Edgeworth 1068, K000481167).

Fig. 3. Type of *Impatiens sulcata* Wall. (Wallich 4764A, K001039845 [right], 001039846 [left]). © The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

Fig. 4. Isotype of *Impatiens chungtienensis* Y.L.Chen (K. M. Feng 2025, 15 Aug. 1939, A).

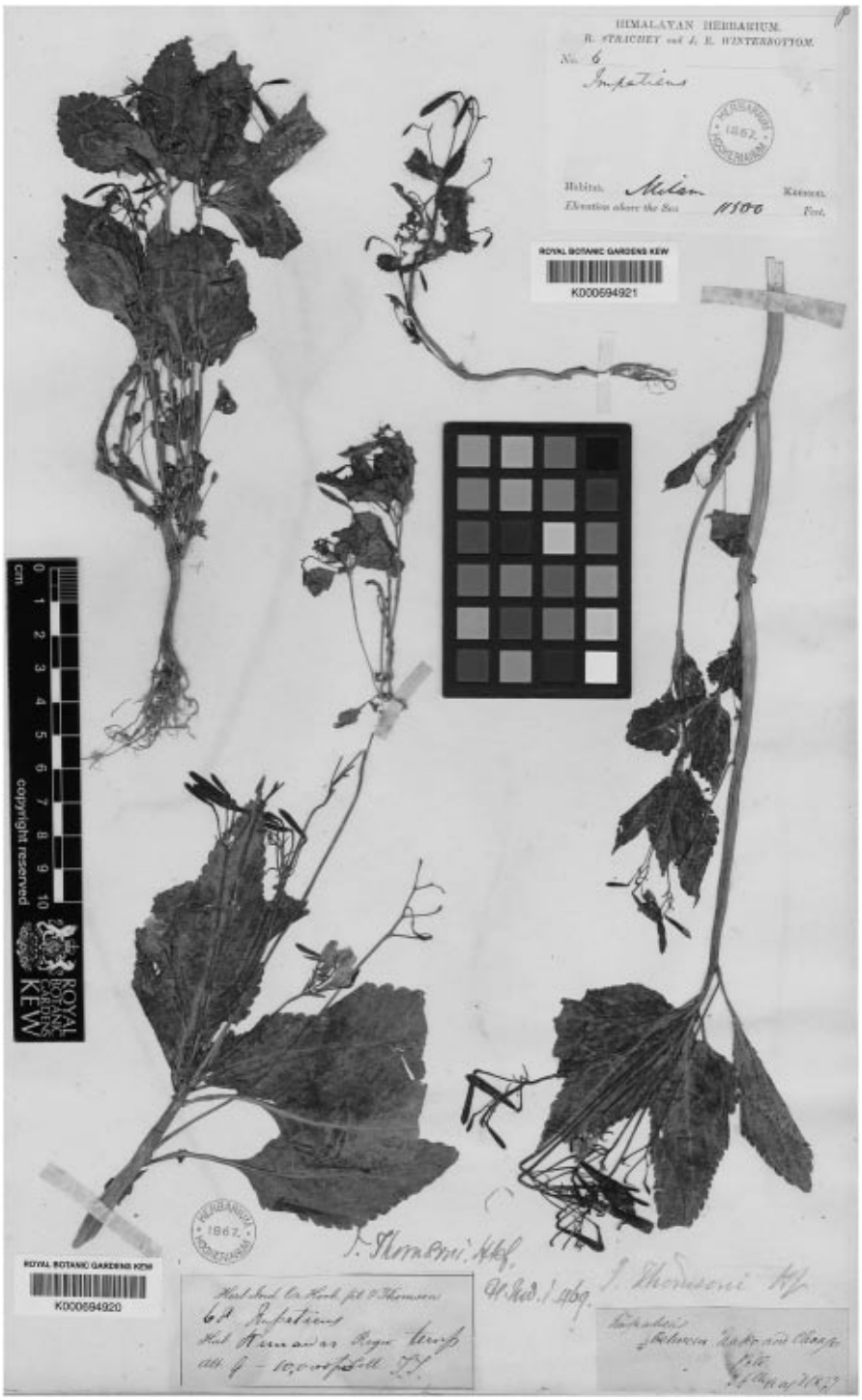

Fig. 5. Syntype of *Impatiens thomsonii* Hook.f. (T. Thomson s.n., K000694920). © The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

Fig. 6. Holotype of *Impatiens fragicolor* Marq. & Airy Shaw (F. K. Ward 5924, K000694670). © The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.

Shaw (Fig. 6) from southeastern Tibet. Warburg and Reiche (1895) classified these species, with the exception of *I. fragicolor*, in the heterogeneous sect. *Salpingochilon* Warb., which consists of species with turgid, linear or clavate fruit.

2) *Impatiens amplexicaulis*

Impatiens amplexicaulis is characterized by amplexicaul leaves (Hooker and Thomson, 1860; Hooker, 1875; Chen, 2001; Chen *et al.*, 2007). It ranges through the Himalaya from Punjab to Nepal (Hara, 1979) and Tibet (Chen, 2001; Chen *et al.*, 2007). In describing it from the western Himalaya, Edgeworth (1846) gave the location "Hab. Himala, in umbrosis, alt. ped. 7000–8000. Simla, Sambi." At Kew we found one specimen with amplexicaul leaves in the apical part of the stem collected by Edgeworth in Simla, alt. 6–7000 ped. in 1844, that corresponds well with the original description in the amplexicaul leaves and bucciniform lower sepal with suddenly incurved spur [...galeâ obtusâ calcare subiter incurvo...] (Edgeworth, 1846). We select this specimen as the lectotype, even though the altitude differs from that given in the original description. The lectotype has an analytical sketch on the sheet with the initials "J D H" (= J. D. Hooker) and also a dissected flower pasted on a small sheet in a capsule which is considered to be the basis for the analytical sketch (Fig. 1, dissected flower pasted on small sheet taken from capsule and photographed).

The flowers of the plant mounted on the sheet (Fig. 1) and the dissected flower in the capsule (Fig. 7) are different. The flowers on the plant have a bucciniform lower sepal abruptly constricted into the incurved spur (Fig. 8d), as mentioned in the original description, but the dissected flower in the capsule is navicular and constricted into a distally curved straight spur (Fig. 7). This sketched flower is smaller, with the lower sepal 12 mm deep including a spur.

Hara (1979) cited three specimens, Polunin, Sykes & Williams *4908* from W Nepal, Polunin *1642* from C Nepal, and Hara *et al. 720737* from E Nepal, as *I. amplexicaulis*. Those specimens

Fig. 7. Dissected flower in capsule on lectotype sheet of *Impatiens amplexicaulis*.

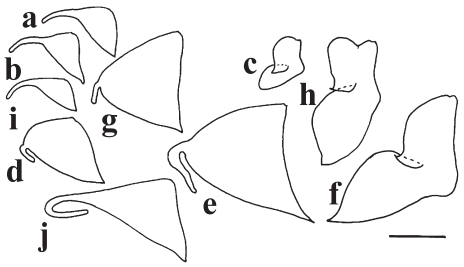

Fig. 8. Lower sepal (a, b, d, e, g, i, j) and lateral united petals (c, f, h) of the species of *Impatiens* sect. *Sulcatae*. a: *I. chungtienensis* (K. M. Feng 2025, 15 Aug. 1939, A, isotype), b, c: *I. chungtienensis* (H. Ohba *et al.* 9154522, TI). d: *I. amplexicaulis* (M. P. Edgeworth 333 in 1844, K000694628, lectotype). e, f: *I. sulcata* (H. Ohba *et al.* 8520276, TI) (from Akiyama *et al.*, 1991). g, h: *I. glandulifera* (H. Igarashi s.n., 16 Oct. 1998, TNS) (from Akiyama, 1999). i: *I. thomsonii* (T. Thomson s.n., K000694920, syntype). j: *I. fragicolor* (F. K. Ward 5924, K000694670, holotype). Scale bar = 1 cm.

and others determined as *I. amplexicaulis* by Hara have flowers the same as the dissected flower in the capsule and different from those of the lectotype. In 1991, we collected such plants and observed the flowers in the field and in dissections (Fig. 9).

Chen (1978) described *I. chungtienensis* from

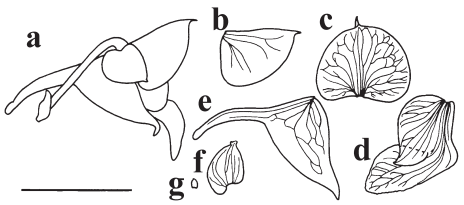

Fig. 9. *Impatiens chungtienensis* (H. Ohba *et al.* 9154522, TI). a: flower. b & c: dorsal petal. d: lateral united petals. e: lower sepal. f: outer lateral sepal. g: inner lateral sepal. Scale bar = 1 cm.

Xianggelila (formerly Zhongdian [Chungtien]), NW Yunnan distinguishing it from *I. amplexicaulis* by the shape of the leaves, the number of lateral veins, color of the flowers, shape of the sepals and petals, and the length and shape of the spur of the lower sepal. Chen (1978) wrote that the lower sepal of *I. amplexicaulis* is abruptly narrowed into an inflexed, short spur, while that of *I. chungtienensis* is broadly funnelform and gradually narrowed into an incurved spur 6–7[9 in key] mm long. Figure 1-2 of Chen (1978) shows the shape of the sepals and petals which correspond well with his description.

Later, in Flora Xizangica (Chen, 1986) and in Flora Reipubl. Popularis Sin. vol. 47 (Chen, 2001), Chen provided illustrations of *I. amplexicaulis* with analytical figures of the sepals and petals. Both illustrations are nearly the same as the analytical figures of the sepals and petals which are in *I. chungtienensis* (Chen, 1978). That is, the lower sepal is not abruptly narrowed into an inflexed short spur as in *I. amplexicaulis* and does not correspond with the original description.

We observed isotypes of *I. chungtienensis* in KUN and A (Fig. 4), and also authentic specimens of other species in sect. *Sulcatae.* The shape of the lower sepals and spur and the shape of the lateral united petals (Fig. 8) are diagnostic in *Impatiens*. We found that *I. chungtienensis* (Fig. 8a) corresponds well with the plants identified as *I. amplexicaulis* (Fig. 8b) from Nepal.

Pusalkar and Singh (2010) noted similarities in the flowers of *I. amplexicaulis*, *I. sulcata* (*I. gigantea* Edgew.), and *I. glandulifera* (*I. roylei* Walp.), but paying no attention to the analytical sketch on the lectotype with the initials "J D H." They published a new species, *I. badrinathii* Pusalkar & Singh. In examining specimens from the western Himalaya, Nepal, and China, we determined that *I. badrinathii* is conspecific with *I. chungtienensis* in China. *Impatiens chungtienensis* is the correct name for the species long known as *I. amplexicaulis* in Nepal.

[Systematic treatment]

Impatiens L. Lectotype: *I. noli-tangere* L. (Reveal, see Jarvis *et al.*, 1993).

Sect. **Sulcatae** S.Akiyama & H.Ohba, sect. nov.

Type: *I. sulcata* Wall.

Impatiens sect. *Salpingochilon* Warb. in Engl. & Prantl, Pflanzenfam., 3, 5: 391 (1895), pro parte.

Impatiens sect. *Oppositifoliae* and *Verticillatae* (in Series B) Hook. f., Fl. Brit. Ind. **1**: 441 (1874), nom. inval.

Impatiens sect. *Racemus* S.X.Yu, Balsaminac. China: 65 (2012), nom. nud., pro parte.

Inflorescences ascending, racemose with many flowers [Type 1a (Akiyama and Ohba, 2000)]. Leaves opposite at base and middle of stem, alternate on apical part of stem. Flowers usually reddish purple; lower sepal bucciniform or navicular.

Distribution. Himalaya and adjacent SW China, some species naturalized in Europe, E Asia (incl. Japan), North America.

Species: *I. amplexicaulis* Edgew., *I. chungtienensis* Y.L.Chen, *I. fragicolor* Marq. & Airy Shaw, *I. glandulifera* Royle, *I. sulcata* Wall. (type), and *I. thomsonii* Hook.f.

Impatiens amplexicaulis Edgew. in Trans. Linn. Soc. 20: 37 (1846). Y. L. Chen in Acta Phytotax. Sin. 16(2): 40 (1978); in Fl. Xizang. 3: 167, 176, excl. fig. 71 (1986); in Fl. Reipubl. Popularis Sin. 47(2): 88, excl. fig. 22 1–8 (2001). Chen, Akiyama and Ohba in Fl. China 12: 75 (2007). Lectotype: Simla, 6–7,000 ped. (M. P. Edgeworth 333 in 1844, K000694628). [Figs. 1

and 8d]

Plants erect, (20–)30–60 cm tall or more. Stem usually glabrous. Leaves opposite basally, alternate in upper part of stem and on branches, not aggregated at upper part of stem, sessile, usually amplexicaul; lamina narrowly oblong to narrowly oblong-lanceolate, (5–)7.5–12 cm long, (1.5–)1.8–3.5 cm wide, base rounded or shallowly cordate, margins finely serrate to crenate, teeth often gland-tipped, apex acuminate to acute, both surfaces nearly glabrous. Peduncles 2.4–4 cm long, glabrous. Inflorescences racemose, axillary, not aggregated on apical part of stem, with 3–6(or 7) flowers. Pedicels 9–14 mm long, glabrous, with small leaf-like bract at base. Bracts subulate to narrowly lanceolate, 3–4 mm long, less than 1 mm wide. Flowers 18–28 mm long, 15–24 mm deep. Lateral sepals 2, ovate, ca. 5 mm long, apiculate. Lower sepal bucciniform, 10–16 mm long, 8–11 mm deep (excluding spur), constricted into spur; spur downwardly curved, 3–5 mm long. Dorsal petal ca. 8 mm long, without crest-like appendage. Lateral united petals 21–22 mm long. Stamens 5; anthers without appendages. Fruit 1.5–3 cm long, linear, glabrous.

Specimens examined. **NW Himalaya**. Basharhr, Baturi Gad (J. H. Lace 362, 5 July 1890, K). Deobaw, 9,000 ft. (J. S. Gamble 27319, Sept. 1898, K). Kote (Kothi), Kulu, 8,300 ft. (W. O. Douglas s.n., 29 July 1951, US, 2 sheets). 9,000 ft. (W. O. Douglas s.n., 30 July 1951, US). Near Nagcunda (C. B. Clarke s.n., E). Kotghud (C. B. Clarke s.n., E). **Simla**. Regio temp., 6–8,000 ped. (T. T. [Thomson], BM, K). (Lady Dalhousie s.n., Aug. 1831, K). Gakho, 7,500 feet (Herb. G. Watt 9701, 20 Sept. 1888, E, NY).

Impatiens chungtienensis Y.L.Chen in Acta Phytotax. Sin. 16(2): 40, 44, fig. 1-2 (1978); in Reipubl. Popularis Sin. 47(2): 88 (2001). Chen, Akiyama and Ohba in Fl. China 12: 75 (2007). Type: China, NW Yunnan, SE of Chungtien (K. M. Feng 2025, 15 Aug. 1939, PE holotype, A and KUN isotypes). [Figs. 4, 7, 8a, b, c, and 9]

I. badrinathii Pusalkar and Singh in Taiwania **55**(1): 13, fig. 1 A–W (2010), syn. nov.

I. amplexicaulis auct. non Edgew.: Y.L.Chen in Fl. Xizang. 3: fig. 71 (1986); in Fl. Reipubl. Popularis Sin. 47(2): fig. 22 1–8 (2001). Hara in Hara and Williams, Enum. Fl. Pl. Nepal 2: 78 (1979). Akiyama, Ohba and Wu in Bull. Natn. Sci. Mus., Tokyo, Ser. B, 21: 152 (1995).

Plants erect, (20–)30–60 cm tall or more. Stem usually glabrous. Leaves opposite basally, alternate on upper part of stem and lateral branches, not aggregated at upper part of stem, sessile, usually amplexicaul; lamina narrowly oblong to narrowly oblong-ovate to narrowly oblong-lanceolate, 5–13 cm long, 1.5–4 cm wide, base rounded or shallowly cordate, margins finely serrate to crenate, teeth often gland-tipped, apex acuminate to acute, both surfaces nearly glabrous. Peduncles 1–4 cm long, glabrous. Inflorescences racemose, axillary, not aggregated on apical part of stem, with 3–6(or 7) flowers. Pedicels 7–13 mm long, glabrous, with small leaf-like bract at base. Bracts subulate to narrowly lanceolate, 2–4 mm long, less than 1 mm wide. Flowers 10–20 mm long, 10–20 mm deep. Lateral sepals 4; outer ones lanceolate to ovate, ca. 3 mm long, apiculate; inner sepals minute. Lower sepal navicular, 6–12 mm long, 3–8 mm deep (excluding spur), gradually tapering toward spur or constricted into spur; spur straight, slightly curved at apex, ca. 7 mm long. Dorsal petal slightly cucullate, ca. 7 mm long, ca. 8 mm wide when flattened, apex acuminate, rounded or obtuse, without crest-like appendage. Lateral united petals 11–14 mm long; upper lobe rounded-rectangular, ca. 4–7 mm long and wide, apex acute; lower lobe semi-orbicular or narrowly ovate, ca. 6.5 mm long, ca. 4 mm wide, apex rounded. Stamens 5; anthers without appendages. Fruit 1.5–2.5 cm long, linear, glabrous.

Specimens examined. **NW Himalaya**. Jaunsar, Deoban, 9,000 ft. (J. S. Gamble 27319, Sept. 1898, K, 2 sheets). **Western Himalaya. Brit. Garhwal**. near the Keeari Pass, 11–12,000 ft. (Duthie 3899, 9 Sept. 1885, K). Dakhwani, 9–10,000 ft. (J. F. Duthie 3899, 7 Sept. 1885,

BM). Bok Hill, 8–9,000 ft. (Native coll. s.n. July 1900, K). **Kumaon**. Nághing Dárma, 6–9,000 ft. (Inayat 23975, K). Dhauli Valley, 10–11,000 ft. (Duthie 5424, 6 Aug. 1886, K). Garbyong, Kali Valley, (Duthie's coll. 23994, 13 Sept. 1900, K, 2 sheets). Tola, Gori Valley, (Inayat 24003, 15 Aug. 1900, K). Garbyang, Kali Valley, (Inayat 23994, 13 Sept. 1900, K). **Nepal**. Mumigaon, S. E. of Jumla, 9,000 ft. (Polunin, Sykes & Williams 4908, 24 July 1952, BM). Mustang, Samar (28°55′N, 83°49′E), 3,400 m (S. Noshiro *et al.* 20106075, 4 Aug. 2010, TI); Samar–Bhena La Pass (28°56′N, 83°50′E), 3,400 m (F. Miyamoto *et al.* 20230066, 16 Aug. 2002, TI). Gandaki Zone, Gorkha Distr., Khang Sang Fu Gompa (M. Suzuki *et al.* 9485288, 5 Aug. 1994, TI). Central, Bagmati Zone, Rasuma Distr., Langtang village area, 11,500 ft. (O. Polunin 1563, 1 Aug. 1949, BM); Central, Langtang forest area, c. 9,500 ft. (O. Polunin 1642, 1 Aug. 1949, BM); Langtang-Kyangjing, 28°13′N, 85°31′E, 3,600 m (H. Kanai *et al.* 672491, 13 July 1970, TI); Lama Hotel–Langtang–Shingdum (S. Noshiro 9154522, 31 Aug. 1991, TI). Central, Nagthali Gyang, c. 9,500 ft. (O. Polunin 1608, 1 Aug. 1949, BM). Below Mugu, Mugu Khola, 11,500 ft. (Polunin, Sykes & Williams 3015, 24 Aug. 1952, BM, E). Nr. Balangra Pass, 12,000 ft. (Polunin, Sykes & Williams 2590, 26 July 1952, BM, E). E Nepal, Sankhuwasawa Distr., Chhurchathanga-Piling La-Thudam, 27°46′N, 87°30′E (H. Ohashi *et al.* 770670, 11 Aug. 1977, TI); Tudam, 11,300 ft. (L. W. Beer 9408, 20 July 1971, BM); 27°45′N, 87°33′E (H. Ohashi *et al.* 772317, 14 Aug. 1977, TI); 3,400 m (H. Kanai *et al.* 720737, 25 June 1972, TI). **Cultivated**: Hort. Kew, in 1900 (K).

The lower sepal of *I. amplexicaulis* (Fig. 8d), *I. sulcata* (Fig. 8e) and *I. glandulifera* (Fig. 8 g) is similar in being abruptly constricted into downwardly curving spur, but smaller, and quite different from the spur of *I. chungtienensis* (Fig. 8a, b). The lower sepal of *I. thomsonii* (Fig. 8i) and *I. fragicolor* (Fig. 8j) is similar to *I. chungtienensis* in shape, but the spur of *I. fragicolor* is larger. The apex of the upper lobe of the lateral united petals of *I. chungtienensis* (Fig. 8c) is acute as in *I. sulcata* (Fig. 8f) and *I. glandulifera* (Fig. 8h).

Misinterpretation of *I. amplexicaulis* appears to be based on the dissected flower and analytical sketch on the lectotype of *I. amplexicaulis*, which are more appropriately agree with *I. chungtienensis*.

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