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Reinstatement of the Sino-Himalayan species *Senecio pentanthus* (Asteraceae, Senecioneae)

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Abstract

Senecio pentanthus (Asteraceae, Senecioneae) has been previously placed in synonymy with *Synotis triligulata*. Our critical examination of herbarium specimens (including type material) and living plants of *S. pentanthus* demonstrates that it can be easily distinguished from *Syn. triligulata* by the leaf serration and the number of phyllaries and florets. We therefore reinstate the independent specific status of *S. pentanthus* and propose a new combination, i.e. *Syn. pentantha*. Lectotypification is made for *Syn. pentantha* herein. A key to all the known species in *Syn*. ser. *Microglossae* and *Syn. vagans*, a species placed in *Syn*. ser. *Erectae* but actually more closely similar to those in the former series, is provided.

Key words: Compositae, misidentification, new combination, *Synotis*, taxonomy

Introduction

Synotis (Clarke 1876: 177) Jeffrey & Chen (1984: 285) (Asteraceae, Senecioneae) is a genus segregated from the notoriously species-rich *Senecio* Linnaeus (1753: 866). It consists of about 57 species endemic to the Sino-Himalayan region except for *Syn. atractylidifolia* (Ling 1937: 24) Jeffrey & Chen (1984: 338), which occurs in northern China (Chen 1999, Chen *et al.* 2011, Jeffrey & Chen 1984, Tang *et al.* 2013a, b, c, 2014a, b, Tong *et al*. 2016).

Senecio pentanthus Merrill (1941: 188) was described on the basis of a single collection, *Vernay-Cutting Exped. 88* (= *F. K. Ward 88*) (GH, NY; Fig. 1A, B), from Kang-fang, northern Myanmar. In the protologue, the author stated that it was closely allied to *S. triligulatus* Hamilton ex Don (1825: 178) (= *Synotis triligulata* (Hamilton ex Don) Jeffrey & Chen (1984: 329)) and apparently also to *S. saluenensis* Diels (1912: 193) (= *Syn. saluenensis* (Diels) Jeffrey & Chen (1984: 330)), but it was characterized by its slender heads which were usually only 5-flowered, three of the flowers being perfect and two pistillate, the latter with distinctly reduced corollas.

Senecio triligulatus was described on the basis of a single collection from Nepal, i.e. *Hamilton s.n.* (BM; Fig. 2). In the protologue, Don (1825) did not mention the number of phyllaries and florets, although from the specific epithet it can be assumed that the ray florets should number 3. Candolle (1838) recognized this species and explicitly stated that it had 8 phyllaries and 10 florets, 3 of the florets being ligulate. Hooker (1881) also recognized this species and extended its distributional range to include Bhutan, northern India (Sikkim), and Myanmar. Gagnepain (1924) further reported its occurrence in China and northern Thailand. All these were accepted by later authors including Handel-Mazzetti (1937), Hu (1968a), Koyama (1969), Wu (1984), and Pan (1985).

In establishing the genus *Synotis*, Jeffrey & Chen (1984) transferred *Senecio triligulatus* to it as *Syn. triligulata*. Meanwhile, they reduced, without giving a particular reason, both *S. pentanthus* and *S. acuminatus* f. *breviligulatus* Handel-Mazzetti (1937: 637) to the synonymy of *Syn. triligulata*. *Senecio acuminatus* f. *breviligulatus* was described on the basis of a single collection, *J. F. Rock 1793* (B, E, US; Fig. 3), from Thailand and recognized by Hu (1968a). Jeffrey & Chen's (1984) treatment was accepted by Chen (1994, 1999), Wu (1984), Liu (2004), Chen & Jin (2005), and Chen *et al*. (2011).

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FIGURE 1. Type specimens of *Synotis pentantha* (= *Senecio pentanthus*). **A**. Myanmar, Kang-fang, *Vernay-Cutting Exped. 88* (= *F. K. Ward 88*; GH, holotype); **B**. Same locality, *Vernay-Cutting Exped. 88* (= *F. K. Ward 88*; NY, isotype). Note that the inset in Fig. 1B shows a close-up of a capitulum.

Our critical examination of specimens of *Senecio pentanthus* and *Synotis triligulata* has convinced us that they are easily distinguishable from each other by the leaf serration and the number of phyllaries and florets. The former is a fairly widespread species whereas the latter is currently known only from Nepal. We therefore reinstated the independent specific status of *S. pentanthus* and transferred it to the genus *Synotis*.

Material and methods

For morphological comparisons, we critically checked herbarium specimens or high-resolution images of specimens of *Senecio pentanthus*, *Synotis triligulata* and similar species kept in BM, E, GH, HITBC, IBSC, K, KUN, NY, P, PE, and US. We also observed a population of *S. pentanthus* in Jingdong, southwestern Yunnan, China, and transplanted some living plants from this population to the glasshouse of the South China Botanical Garden of the Chinese Academy of Sciences in Guangzhou.

Results and discussion

As shown in Figs. 1, 3, and 4, *Senecio pentanthus* is morphologically distinct and can be readily distinguished from *Synotis triligulata* (Fig. 2) by the regularly mucronate (vs. irregularly serrate) leaf margin and by having fewer phyllaries (5 vs. 7–8), ray florets (2–3 vs. 3–4) and disc florets (2–3 vs. 6–8). Gagnepain (1924), Handel-Mazzetti (1937), Hu (1968a, b), Koyama (1969), Jeffrey & Chen (1984), Wu (1984), Pan (1985), Chen (1999), Liu (2004), Chen & Jin (2005), and Chen *et al*. (2011) all recognized *S. triligulatus* or *Syn. triligulata* as a very widespread species occurring from Nepal to southwestern China, but the results of our examination of relevant specimens indicate that it is restricted to Nepal. Almost all the specimens cited under *S. triligulatus* or *Syn. triligulata* by Hooker (1881), Gagnepain (1924), Handel-Mazzetti (1937), Hu (1968b), Wu (1984), and Jeffrey & Chen (1984) should be referred to *S. pentanthus*. Among them is the specimen *J. F. Rock 1793* (US; Fig. 4), an isotype of *Senecio acuminatus* f. *breviligulatus*. The

specimen *A. Henry 9086 A* (E), which was collected from Yunnan, China and cited under *S. triligulatus* by Koyama (1969), actually belongs to *Syn. saluenensis* due to the discoid capitula with 8 phyllaries and 10–11 florets. It is worth noting that *G. Forrest 9474* (K), the specimen that Jeffrey & Chen (1984) sampled for the floral micromorphological observation of *Syn*. *triligulata*, actually belongs to *S. pentanthus*.

FIGURE 2. Holotype sheet of *Synotis triligulata*. Note that the inset shows a close-up of a capitulum.

In conclusion, *Senecio pentanthus* and *Synotis triligulata* are morphologically two distinct species. The former is a fairly widespread species occurring in Bhutan, China (Xizang, Yunnan), northeastern India, Myanmar, Nepal and northern Thailand whereas the latter is restrictedly distributed in Nepal. The following treatment, therefore, is necessary.

Taxonomic treatment

Synotis triligulata (Hamilton ex Don) Jeffrey & Chen (1984: 329). *Senecio triligulatus* Hamilton ex Don (1825: 178). Fig. 2.

Type:—NEPAL. Narainhetty, *Hamilton s.n.* (holotype BM!). Fig. 2.

Subshrubby herb, erect, up to 150 cm tall. Stems slender, glabrescent, branching. Leaves shortly petiolate, elliptic-lanceolate to broadly oblong-elliptic, 5–12 cm long, 2–4 cm broad, thinly papery, glabrous on both surfaces, pinnately veined, lateral veins 5–8, prominent abaxially, base rounded or broadly cuneate, margin coarsely and irregularly serrate, apex long acuminate; petiole 1–2 cm long, glabrous, exauriculate; leaves of synflorescence-branches smaller, otherwise similar. Capitula radiate, numerous in lax axillary and terminal rounded compound corymbs; peduncles 6–10 mm long, slender, sparsely puberulent; bracts linear-subulate, minute. Involucres cylindrical, 4–5 mm long, ca. 1 mm broad, minutely calyculate; bracts of calyculus 1–3, subulate; phyllaries 7 or 8, linear-oblong, ca. 1 mm broad, glabrous, margin broadly scarious, apically obtuse or subacute, puberulent. Ray florets 3 or 4; corolla yellow, 4–5 mm long, tube ca. 2 mm long, lamina ca. 3.5 mm long, usually shorter than the style. Disc florets 6 or 7; corolla yellow, ca. 5 mm long, tube 2 mm long, limb funnelform, ca. 3 mm long; lobes oblong-lanceolate, ca. 2.5 mm long, apically acute. Anthers 2.5mm long; anther tails unknown. Achenes ca. 1.5–2 mm long, glabrous. Pappus white, 6–7 mm long.

Distribution and Habitat:—*Synotis triligulata* is currently known only from Nepal (Fig. 5). It grows in open forests with little understory at elevations between 1800 and 2200 m above sea level.

Phenology:—Flowering February−April; fruiting April−May.

Additional specimens examined:—NEPAL: Solukhumbu, Deku Valley, above Nunlata, *R. Sykes 31/00* (E); Precise locality unknown, *A. Zimmermann 1963* (E), *Wallich Num. List 3111* (E, K, NY, P).

Notes:—In addition to the type collection, we have been able to see only another three collections of this species. On the field label of the collection *R. Sykes 31/00* (E), the collector noted that the species was very local.

According to Jeffrey & Chen (1984), the genus *Synotis* is divisible into two well-marked sections, sect. *Synotis* and sect. *Atractylidifoliae* Jeffrey & Chen (1984: 338); all but one of the species (*Syn. atractylidifolia* (Ling 1937: 24) Jeffrey & Chen (1984: 338)) fall within sect. *Synotis*, which itself is divisible into five not very clearly differentiated series. *Synotis triligulata* is readily referable to *Syn*. ser. *Microglossae* Jeffrey & Chen (1984: 327) by having leafy stems, small, 9–11-flowered, minutely radiate capitula and more or less round-topped inflorescences.

Synotis pentantha (Merrill) M. Tang, C. Ren & Q. E. Yang, **comb**. **nov**. *Senecio pentanthus* Merrill (1941: 188). Figs. 1, 3, 4.

Type:—MYANMAR. Northern Myanmar, Kang-fang, *Vernay-Cutting Exped. 88* (= *F. K. Ward 88*) (holotype GH!; isotype NY!). Fig. 1.

= *Senecio acuminatus* f. *breviligulatus* Handel-Mazzetti (1937: 637).

Type:—THAILAND. Chiang Mai: Doi Chang Mountain, 1260–1765 m a.s.l., 11 January 1922, *J. F. Rock 1793* (holotype B, not seen; isotypes E!, US!). Fig. 3.

—*Senecio triligulatus* auct.: Hooker (1881: 356); Gagnepain (1924: 637); Handel-Mazzetti (1937: 637); Hu (1968b: 148), Wu (1984: 1431); Pan (1985: 823), p.p.

—*Synotis triligulata* auct.: Jeffrey & Chen (1984: 329); Chen (1994: 2093, 1999: 206), Liu (2004: 402); Chen & Jin (2005: 527); Chen *et al*. (2011: 502), p.p.

Subshrubby herb, erect, up to 180 cm tall. Stems flexuous, slender, branching, glabrescent. Leaves shortly petiolate, elliptic-lanceolate to broadly oblong-elliptic, 7–15 cm long, 4–6 cm broad, membranous or thinly papery, glabrous on both surfaces, adaxially nitid, pinnately veined, lateral veins 7–10, arcuate-ascending and intra-marginally uniting, prominent abaxially, base rounded or broadly cuneate and sometimes unequal, margin usually regularly mucronate, apex long acuminate or acuminate-caudate; petiole 1–2 cm long, glabrous, not auriculate; leaves of synflorescence-branches smaller, otherwise similar. Capitula minutely radiate, very numerous, arranged in rather dense axillary and

terminal rounded compound corymbs; peduncles 3–6 mm long, slender, sparsely puberulent; bracts linear-subulate, minute. Involucres cylindrical, 3–4 mm long, ca. 1 mm broad, minutely calyculate; bracts of calyculus 1–3, subulate; phyllaries 5, linear-oblong, ca. 1 mm broad, glabrous, margin broadly scarious, apically obtuse or subacute and puberulent. Ray florets 2 or 3; corolla yellowish-white, 4–5 mm long, tube ca. 2 mm long, lamina minute, up to 2.5 mm long, usually shorter than the style. Disc florets 2 or 3; corolla yellowish-white, ca. 5 mm long, tube ca. 2 mm long, limb funnelform; lobes oblong-lanceolate, ca. 2.5 mm long, apically acute. Anthers ca. 2.5 mm long; anther tails ca. 1.5 times the length of the anther-collars. Achenes ca. 1.5 mm long; glabrous. Pappus white, ca. 5 mm long.

FIGURE 3. An isotype sheet of *Senecio acuminatus* f. *breviligulatus*.

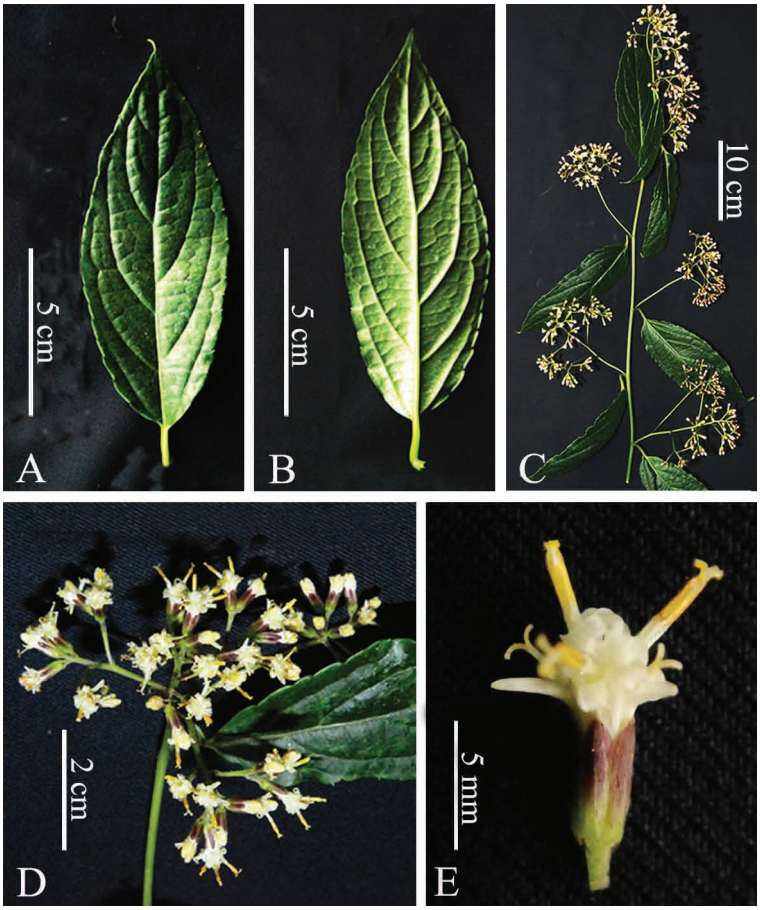

FIGURE 4. *Synotis pentantha* (= *Senecio pentanthus*), collected from Jingdong in Yunnan, China and cultivated in the glasshouse of the South China Botanical Garden, Chinese Academy of Sciences in Guangzhou. **A**. Leaf blade (adaxial surface). **B**. Leaf blade (abaxial surface). **C**. Synflorescence. **D**. Branch of synflorescence. **E**. Capitulum.

Distribution and Habitat:—*Synotis pentantha* is widely distributed in Bhutan, China (Xizang, Yunnan), northeastern India, Myanmar, Nepal, and northern Thailand (Fig. 5). It grows in open forests, on forest margins, or among scrub at elevations between 1100–2400 m above sea level.

Phenology:—Flowering October−February; fruiting January−April.

Additional specimens examined:—BHUTAN. Precise locality unknown: *W. Griffith 2163* (E).

CHINA. Yunnan: Baoshan, *C. Chen 929* (PE); Binchuan, *1950* (KUN, PE), *H. Li et al. 438* (KUN), *T.N. Liou 17771* (PE), *21846* (KUN, PE), *H.C. Wang 1948* (KUN, PE); Dali, *H.C. Wang 4626* (PE); Eryuan, *J.M. Delavay 1219* (P), *2309* (P); E'shan, *E'shan Exped. 345* (KUN), *444* (KUN); Fugong, *Bijiang Exped. 181* (KUN); Jingdong, *P.Y. Chiu 52786* (PE), *52981* (PE), *53391* (PE), *M.K. Li 1989* (KUN), *2170* (HITBC, KUN), *2715* (KUN, PE), *2763* (KUN), *C. Ren & L.Y. Wang 427* (IBSC), *C.A. Wu 2181* (KUN), *S.G. Xu 4409* (KUN, PE), *Z.H. Yang et al. 101509* (KUN); Jinghong, *T.G. Gao 498* (PE); Longling, *H.T. Tsai 55038* (E, KUN, PE), *55066* (E, KUN, PE), *55540* (KUN, PE); Lushui, *South-to-north Water Diversion Project Exped. 8109* (KUN, PE) , *H.T. Tsai 56746* (KUN, PE); Mangshi, *C. Chen 393* (KUN), *H.T. Tsai 56806* (PE), *56930* (KUN, PE); Tengchong, *G. Forrest 8211* (E), *9399* (E), *9474* (E, K), *15973* (E, K), *25326* (E, K, PE), *J.F. Rock 7963* (E, US); Yangbi, *R.C. Ching 25333* (PE), *T.N. Liou 22751* (PE), *22905* (KUN, PE), *Sino-British Exped. 458* (KUN), *Sino-German Exped. 939* (KUN), *Vernonia 458* (E), *Z.H. Yang 101874* (PE); Yimen, *Anonymous 3438* (KUN), *13287* (HITBC), *H. Sun 1509* (KUN), *G.D. Tao 9066* (KUN); Yuxi, *Anonymous 4186* (KUN); Zhenkang, *C.W. Wang 72530* (KUN). Xizang: Nyalam, *Y.T. Chang & K.Y. Lang 3214* (PE), *3215* (PE).

MYANMAR. Kang-fang, *J. Keenan et al. 3362* (E), *3932* (E).

NEPAL. Bhurungdi Khola, *D.A. Staiton et al. 5363* (E).

THAILAND. Chiang Mai, *A. F. G. Kerr 4419* (P).

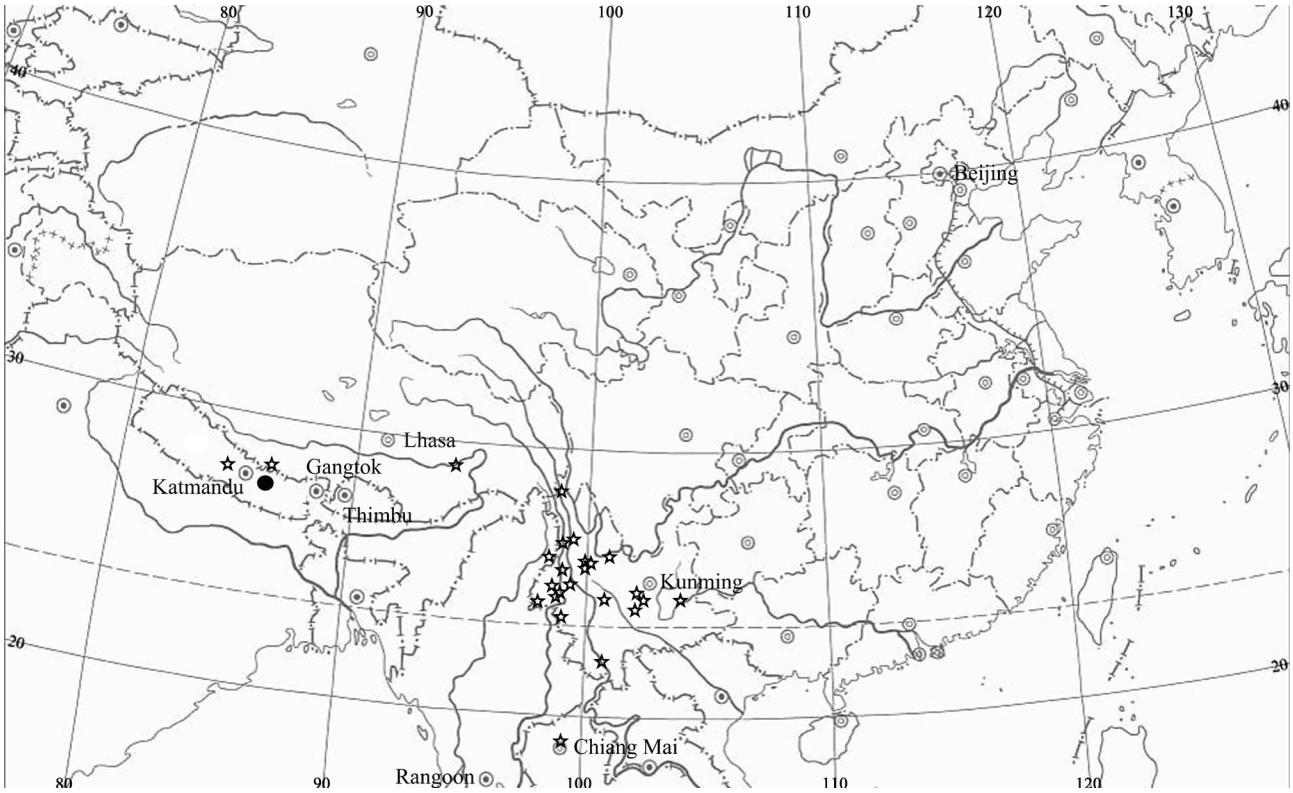

FIGURE 5. Distribution of *Synotis pentantha* (☆) and *Synotis triligulata* (●). Note that the locations of the former species in Bhutan and northern India are not given due to the incomplete geographical information of the specimens examined.

Note:—Just as *Synotis triligulata*, *Syn*. *pentantha* is readily referable to *Syn*. ser. *Microglossae* by having leafy stems, small, 4–6-flowered, minutely radiate capitula and more or less round-topped inflorescences. With the reinstatement of the independent specific status of this species, *Syn*. ser. *Microglossae* currently includes nine species (Jeffrey & Chen 1984, Tang *et al*. 2013a), namely *Syn. auriculata* Jeffrey & Chen (1999: 330), *Syn. baoshanensis* Tang *et al*. (2013a: 2), *Syn. glomerata* (Jeffrey in Smith 1916: 326) Jeffrey & Chen (1984: 327), *Syn. lushaiensis* (Fischer 1929: 6) Jeffrey & Chen (1984: 288), *Syn. pentantha*, *Syn. rhabdos* (Clarke 1887: 25) Jeffrey & Chen (1984: 288), *Syn. saluenensis*, *Syn*. *simonsii* (Clarke 1876: 188) Jeffrey & Chen (1984: 288), and *Syn. triligulata*. *Synotis vagans* (Wallich ex Candolle 1838: 368) Jeffrey & Chen (1984: 288) (Fig. 6), a species from Nepal that was placed in *Syn*. ser. *Erectae* (Clarke 1876: 177) Jeffrey & Chen (1984: 310) by Jeffrey & Chen (1984), is also more or less similar to those species of *Syn*. ser. *Microglossae*, even hardly distinguishable from the northeastern Indian species *Syn*. *lushaiensis*, with the capitula in both of them being conspicuously radiate. *Synotis vagans* is distinct from *Syn. pentantha* by having conspicuously (vs. minutely) radiate capitula and 8 (vs. 5) phyllaries. All the species just mentioned can be keyed out as follows:

Key to *Synotis pentantha* and its similar species

1. Capitula conspicuously radiate 2
– Capitula minutely radiate 3
2. Leaves with prominent, distinct veins beneath ..... *Syn. lushaensis*
– Leaves with obscure veins beneath ..... *Syn. vagans*
3. Corymbs dense, glomeruliform, 2–4 cm long 4
– Corymbs more lax, spreading, 4.5–10 cm long 5
4. Leaves coarsely and deeply serrate, auriculate at the base ..... *Syn. rhabdos*
– Leaves finely and shallowly serrate, exauriculate ..... *Syn. glomerata*
5. Leaves broadly ovate, ovate-lanceolate or elliptic 6
– Leaves narrowly lanceolate or narrowly oblong 9
6. Phyllaries 5; disc florets 2 or 3 ..... *Syn. penantha*
– Phyllaries 7–10; disc florets 5–10 7
7. Capitula 3.5–4 × 1.5 mm; phyllaries 6–8 mm long; marginal florets ligulate, conspicuous ..... *S. triligulata*
– Capitula 4 × 2.7 mm; phyllaries ca. 4 mm long; marginal florets minute, filiform 8

8. Stems, veins on abaxial surface of leaves and peduncles all densely glandular fulvous-pubescent ..... *Syn. saluenensis*
– Stems and leaves glabrous; peduncles pubescent ..... *Syn. simonsii*
9. Leaves auriculate at the base ..... *Syn. auriculata*
– Leaves exauriculate ..... *Syn. baoshanensis*

FIGURE 6. Type specimens of *Synotis vagans*. A. Nepal, *Wallich 3108* (syntype, E). **B**. Nepal, *Wallich 3108* (syntype, K). Note that the inset in Fig. 1A shows a close-up of three capitula.

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