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Saussurea albifolia M. J. Nam & H. T. Im (Compositae), a new species from the Baekdudaegan Area, Korea

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Saussurea albifolia, a new species, is reported from the Baekdudaegan Mountains. It has distinctive morphological characteristics that distinguish it from other congeneric species of *Saussurea* in Korea; radical leaves persist or withered till flowering, white tomentose leaf beneath, campanulate involucre with brown-cobwebby hairs, and dark purplish phyllaries with acuminate tips. *Saussurea albifolia* is a new, endemic species, narrowly restricted to the Korean Peninsula as a consequence of adaptation to alpine or subalpine environments of the Baekdudaegan Area. Among the Korean species of *Saussurea*, *S. gracilis* Maxim., *S. insularis* Kitam., and *S. seoulensis* Nakai are morphologically similar to *S. albifolia* by having leaves with white hairs beneath and persistent radical leaves during blooming period. It has been well understood that *Saussurea* is one of the highly diversified and adaptable groups in Asteraceae and also that the currently recognized species in Korea likely significant underestimates its diversity on the Korean Peninsula.

Keywords: Asteraceae, Baekdudaegan Area, endemic species, Hambaek-chui, new species, *Saussurea albifolia*

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Saussurea DC. (Compositae) is composed of approximately 380 species (Lipschitz, 1979), occurring mainly at high altitudes in Asia. While some species, such as *S. maximowiczii* Herd., *S. grandifolia* Maxim., and *S. odontolepis* Maxim. occur widely throughout northeastern Asia, others are very narrowly restricted to limited regions as a consequence of local geographical adaptations. Thirty-two species of *Saussurea*, of which 17 (53%) are endemics, have been recognized in the Korean Peninsula (Im, 2017). During the last nearly three decades, we described two endemics, i.e., *S. chabyoungsanica* H. T. Im (Im *et al*., 1997) and *S. grandicapitula* W. Lee & H. T. Im (Lee & Im, 2007), and two unreported species, i.e., *S. nipponica* subsp. *higomontana* (Honda) Im (Hong and Im, 2007) and *S. insularis* Kitam. (Hong & Im, 2001). We also acknowledge presumably a distinct taxon of *Saussurea* from the Namhae Islands, which requires a taxonomic description (unpublished data). The number of *Saussurea* species in Japan has increased significantly from 25 species (Kitamura *et al*., 1982) to 63 species (Kadota, 2017) during almost the same period. It has been well understood that *Saussurea* is one of the highly diversified and adaptable groups in Asteraceae and also that the currently recognized species in Korea is likely significant underestimates its diversity on the Korean Peninsula. Recently, in the course of studying Korean endemic plants, we discovered a new species of *Saussurea* endemic to Korea in the Baekdudaegan Area (Mt. Cheongok, Mt. Hambaek, Mt. Taebaek, Mt. Sobaek, and Mt. Sinseonbong).

***Saussurea albifolia* M. J. Nam & H. T. Im,** sp. nov. (Fig. 1, 2)

Perennial herbs. Rhizomes obliquely prostrating with many fibrous rootlets. Stems 3−7 mm diam. at base, 40−80 cm long, erect, loosely branched, striate on upper part, yellowish white hairs when young. Leaves alternate, adaxial surface pale green with bristle, abaxial surface white or yellowish white tomentose; radical leaves in rosettes, persistent or wither away at anthesis, petiole 4−16 cm long; blade cordate or deltoid-cordate, 5.5−14 × 5−11

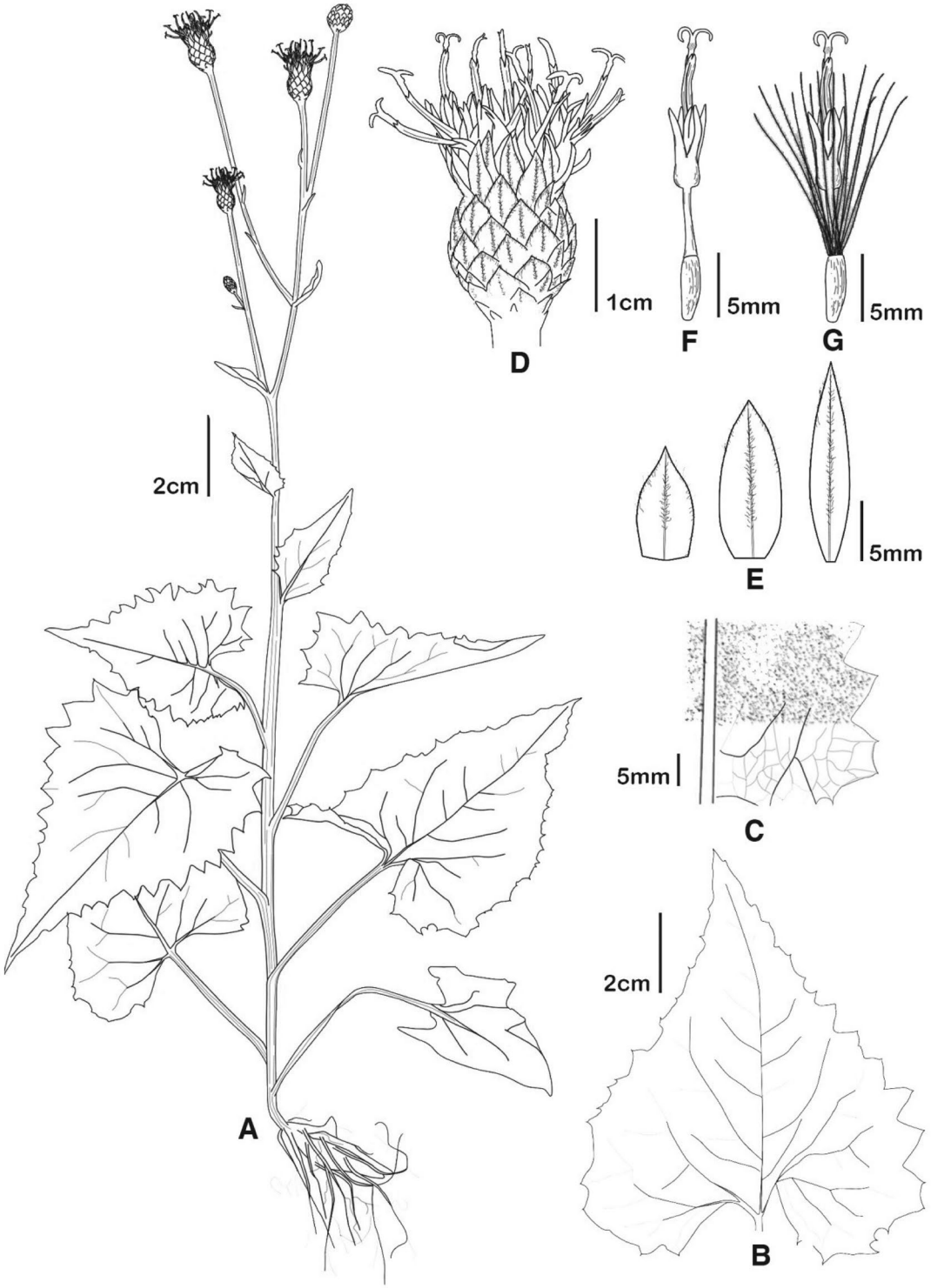

Fig. 1. *Saussurea albifolia* M. J. Nam et H. T. Im. A. Habit; B. Leaf shape; C. Abaxial leaf surface; D. Involucre; E. Phyllaries (outer/middle/inner, from left to right); F. Florets; G. Achene and pappus.

cm, apex acuminate, base shallow or deep cordate, margins mucronate-toothed; median and upper cauline leaves gradually smaller upward, petiolate or sessile, blade lanceolate to linear. Heads several in loosely corymbose synflorescence, 1.2−1.9 cm in diam.; peduncles 2.3−9 cm long; involucre campanulate, 14−16 × 8−12 mm, grey-

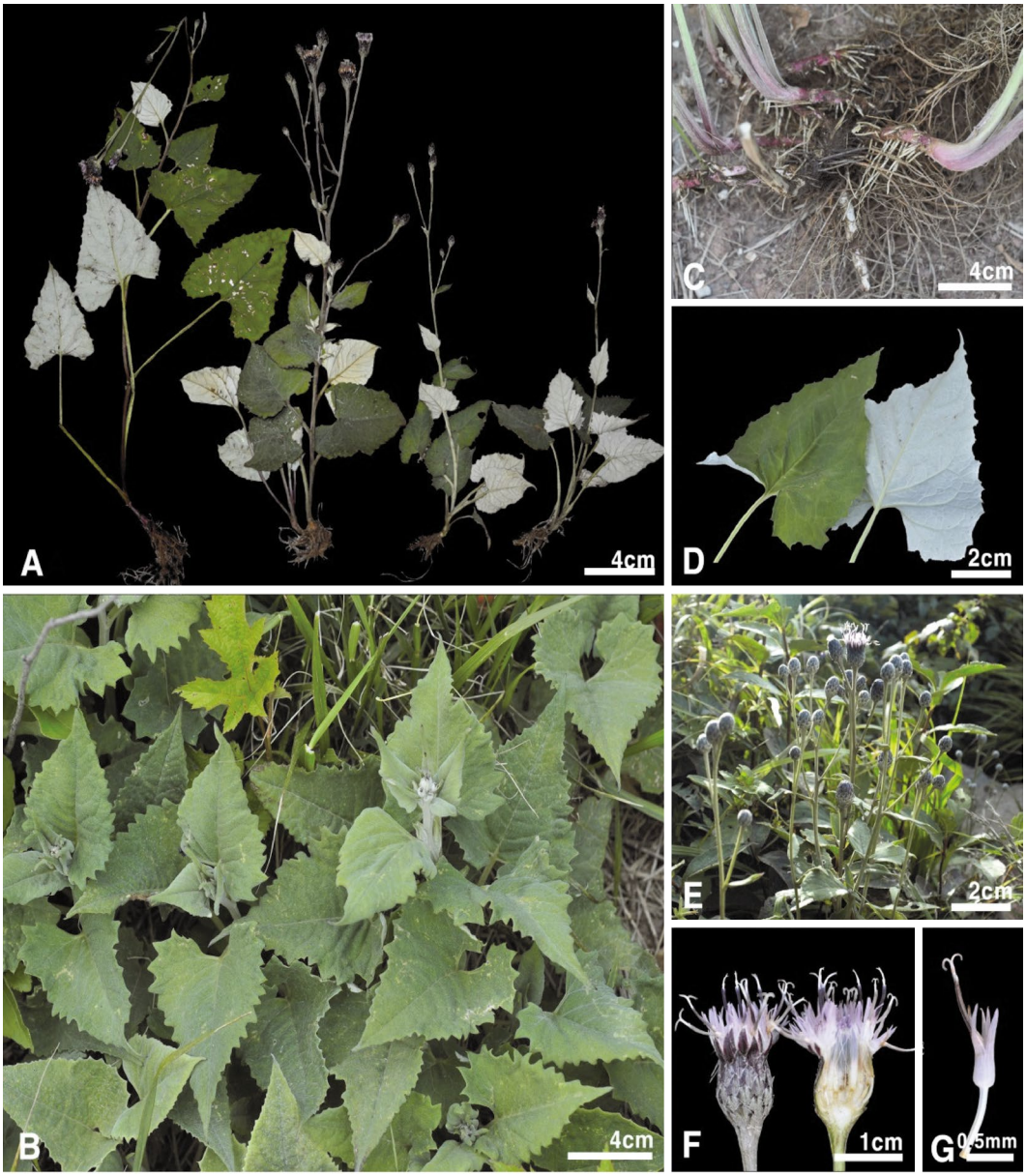

Fig. 2. Characteristics of *Saussurea albifolia* M. J. Nam et H. T. Im. A. Morphological variation among fully mature individuals observed in the Mt. Hambaek population; B. Young plants in the bolting stage (Aug. 31. 2019); C. Well-developed rhizomes; D. Adaxial (left) and abaxial (right) leaf surfaces; E. Loose corymbose with several heads; F. Campanulate involucre; G. Tubular florets.

white cobwebby; phyllaries 5−7 seriate, dark purplish on middle and upper part; outer phyllaries oval-lanceolate, apex mucronate or acute; middle phyllaries oblong or oblong-lanceolate; inner phyllaries linear. Florets pale purple; corolla tubular 9−11 mm long, wide part and narrow part same length, limb 5-lobed. Cypselae cylindrical, 5−6 mm long; pappus bristles 2 seriate; outer series 0.5−1.8 mm long; inner series grayish white, 9−10 mm long.

Holotype. Korea, Gangwon-do, Taebaek-si, Mt. Hambaek, elev. 1,540 m, 31 Sep. 2019, H. T. Im, *195703* (holotype: CNU).

Flowering. Sep. to Oct.

Korean name. Ham-baek-chui (함백취)

Distribution. High mountain region of Gangwon-do and Gyongsangbuk-do, Korea (Fig. 3).

Specimens examined. Korea, Gangwon-do, Samcheok-si, Jungbong Valley − Mt. Cheongok, elev. 1,350 m, 28 Aug. 2009, H. T. Im & W. G. Kim, *093406* (CNU); Gangwon-do, Taebaek-si, Mt. Hambaek, elev. 1,540 m, 31 Aug. 2019, H. T. Im, *195704a*/*b* (CNU); Gangwon-do, Jeongseon-gun, Gohan-eup, Mt. Hambaek, elev. 1,481 m, 19 Sep. 2012, Y. H. Hong *et al*. *KOSPVP0000256638*

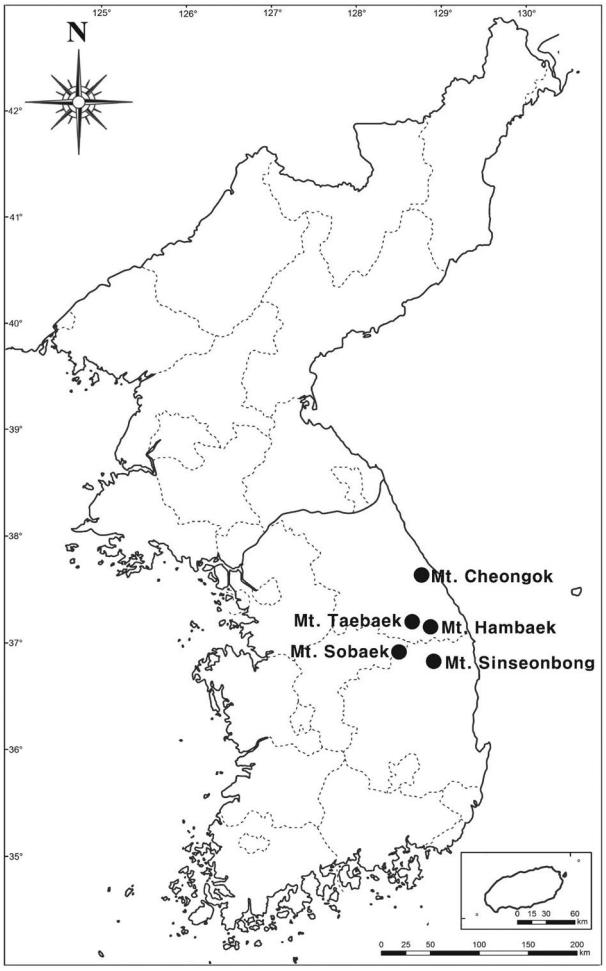

Fig. 3. Distribution of *Saussurea albifolia* M. J. Nam et H. T. Im. in the Baekdudaegan Area.

(KB); Gangwon-do, Taebaek-si, Sodo-dong, Mt. Taebaek, elev. 1,447 m, 27 Sep. 2008, G. Y. Chung *et al. VP-KB-378164-1249* (KB); Chungcheongbuk-do, Danyang-gun, Danyang-eup, Mt. Sobaek, elev. 1,371 m, 1 Sep. 2009, I. C. Hwang *et al. KOSPVP0000205099* (KB); Gyeongsangbuk-do, Bonghwa-gun, Chunyang-myeon, Mt. Sinseonbong, elev. 1,370 m, 27 Sep. 2008, G. Y. Chung *et al. VP-KB-378177-1248* (KB).

As a newly described species, *S. albifolia* can be easily distinguished from congeneric species in Korea. The species appears to be highly variable in plant height and radical leaves. For example, some individuals in the same population are as small as 40 cm in height with apparent and persistent radical leaves, while others are as tall as 80 cm in height without radical leaves during blooming period (Fig. 2A). The leaves are cordate or deltoid-cordate, and adaxial surface is pale green with bristles, while abaxial surface is whitish or yellowish tomentose (Fig. 2D). The number of capitula can range from 3 to 22, composing loose corymb (Fig. 2E). It has large campanulate involucre, with the size of 14−16 × 8−12 mm and with grey-white cobwebby, and outer surface of phyllaries are dark purplish on middle and upper parts with acuminate tips (Fig. 2F). The tubular florets are 9−11 mm long, with nearly equal length of wide and narrow parts of the corolla tube (Fig. 2G).

Among the Korean species of *Saussurea*, *S. gracilis* Maxim. *S. seoulensis* Nakai, and *S. insularis* Kitam. are morphologically similar to *S. albifolia* by having leaves with white hairy beneath and persistent radical leaves during blooming period. Major morphological differences between *S. albifolia* and these three morphologically

Table 1. Comparison of morphological characteristics and distribution pattern between newly described *S. albifolia* and three morphologically similar species, *S. seoulensis*, *S. gracilis*, and *S. insularis*.

	S. albifolia	*S. gracilis*	*S. seoulensis*	*S. insularis*
Stem	Well-branched	Well-branched	Scape-like	Well-branched
Inflorescence	Corymbose	Corymbose	Racemous-corymbose	Corymbose
Involucre	Campanulate, 14−16 × 8−12 mm	Tubular, 12.5−16 × 5−9.5 mm	Campanulate, 14−15 × 15−17 mm	Tubular, 10−11 mm × 5−7 mm
Outer surface of phyllaries	Dark purplish on middle and upper part	Sage green but some are dark purplish on upper part	Sage green but some are dark purplish on upper part	Sage green but some are dark purplish on upper part
Leaf base	Shallow or deep cordate	Cordate	Cordate	Cordate or sagittate-cordate
Abaxial leaf surface	White tomentose	White tomentose	Whitish cobwebby	Whitish cobwebby while young
Distribution	Endemic to high mountain region around the Baekdudaegan Area	Widely in Korea and Japan (except Hokkaido)	Endemic to Central Korea	Southern Korea and Tsushima (Japan)

similar species are shown in Table 1. *Saussurea albfolia* is distinctive from *S. gracilis* because *S. gracilis* has a tubular involucre, whereas that of *S. albifolia* is campanulate. *Saussurea albifolia* can be easily distinguished from *S. seoulensis* and *S. insularis* because the adaxial leaf surface of *S. albifolia* is white tomentose, whereas that of *S. seoulensis* and *S. insularis* is whitish cobwebby. Identification key for the above four *Saussurea* species is below.

1. Abaxial leaf surface whitish cobwebby.
   2. Inflorescence racemous-corymbose, involucre campanualte ····· *S. seoulensis*
   2. Inflorescence corymbose, involucre tubular ····· ····· *S. insularis*
1. Abaxial leaf surface white tomentose.
   3. Involucre tubular ····· *S. gracilis*
   3. Involucre campanulate ····· *S. albifolia*

In terms of the phylogenetic position of newly described *S. albifolia*, it forms a clade with *S. seoulensis* and *S. gracilis*, based on data from the nuclear ribosomal DNA (nrDNA) internal transcribed spacer (ITS) and external transcribed spacer (ETS) regions (in preparation). Although this phylogenetic relationship appears to be corroborated based on some morphological characteristics shared among these taxa, the precise position of *S. albifolia* within *Saussurea* needs to be verified.

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