

## Systematic Studies of Asian *Saussurea* (*Asteraceae*) VII. A New Species from Hokkaido and Four New Species from Northern Honshu, Japan

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A new species, *Saussurea kenji-horieana* Kadota from Hokkaido, and four new species, *S. andoana* Kadota, *S. sawae* Kadota, *S. shonaiensis* Kadota and *S. ugoensis* Kadota from Honshu, northern Japan are described. *Saussurea kenji-horieana* from an ultrabasic area of Mt. Kamui-yama, central Hokkaido is different from *S. fauriei* Franch. by having purplish stems, soft, dimly lustrous, subentire, narrowly ovate leaves, 7-seriate involucrel phyllaries, and middle and outer phyllaries roundish at apex. *Saussurea andoana* from Fukaura-machi, the Tsugaru area, Aomori Prefecture is distinguished from *S. katoana* Kadota by having 8-seriate involucrel phyllaries, shorter peduncles, cordate leaf blades with acuminate apices and less developed wings of the stem. *Saussurea shonaiensis* from Yamagata and Akita Prefs. is discriminated from *S. muramatsui* Kitam. by narrower, cylindrical involucrel, 8-seriate involucrel phyllaries and ascending middle and outer phyllaries, capitula short-peduncled and arranged in an umbel-like to spike-like compound inflorescence (synflorescence) and broadly ovate leaf blades. *Saussurea sawae* from Mt. Kamuro-san, on the border between Akita and Yamagata Prefs. is discriminated from *S. ugoensis* Kadota by having larger, bowl-shaped involucrel with longer peduncles, 9-seriate involucrel phyllaries, longer and wider middle and outer phyllaries, acute apices of leaf blades and purplish stem and petioles. *Saussurea ugoensis* mainly from Akita Pref. is different from *S. franchetii* Koidz. by having greenish, thicker involucrel, capitula arranged in an umbel-like corymb, longer subtending leaves and slightly wider stem wings. *Saussurea ugoensis* has been frequently confused with *S. franchetii* Koidz.

(Continued from J. Jpn. Bot. 88: 267–285, 2013)

**Key words:** Hokkaido, Japan, new species, *Saussurea andoana*, *Saussurea kenji-horieana*, *Saussurea sawae*, *Saussurea shonaiensis*, *Saussurea ugoensis*, Tohoku District, ultrabasic area.

This is part of a series of systematic studies of East Asian *Saussurea* (*Asteraceae*) (Kadota 1987, 2004, 2007, 2008, 2009, 2010, 2011a, 2011b, 2011c, 2012, 2013, 2014).

In September 2006 I did field work for the *Saussurea* flora of Yamagata Prefecture, Tohoku District, northern Japan. The aim

was to understand the distribution range of *S. muramatsui* Kitam. in the prefecture. *Saussurea muramatsui* was mainly found in the inland mountains of the prefecture and was also observed in Yuza-machi and Kisagata-machi [currently Nikaho-shi], Akita Prefecture which is adjacent to Yamagata Prefecture. These

localities are coastal and are facing the Japan Sea. However, plants which are similar to *S. muramatsui* but significantly different from this species by having smaller heads and more rows of involucre phyllaries were additionally found there sympatrically. Since then I have investigated the *Saussurea* flora of Yamagata Prefecture and its neighboring region extensively. As a result it is revealed that the plants in question represent an undescribed species. Since the new species is mainly restricted to the Shōnai area of Yamagata Prefecture, this is described as *Saussurea shonaiensis*.

Several alpine species of *Saussurea* are known from Tohoku District, northern Japan (Shimizu 1982, Toyokuni 1988, Kadota 2011a, 2014). Kadota (2009) revised alpine species of *Saussurea* of the Ō-u Mountain Range and described a new species, *S. fuboensis* Kadota. At that time I noticed that the taxonomic treatment of alpine *Saussurea* plants from Mt. Akita-Komaga-take and Mt. Chōkai-san were still problematic, i.e., those plants were frequently confused with *S. franchetii* Koidz. (e.g., Kitamura 1937, Yuhki 1992, Fujiwara 2000). *Saussurea franchetii* was described from Mt. Asahi-dake, in the Asahi Mountains and is considered to be distributed in the southern part of Tohoku District (Hara 1952, Shimizu 1982, Toyokuni 1988, Kadota 2014). I conducted field research of *S. franchetii* in Mt. Nishi-Asahi-dake, the Asahi Mountains, Yamagata Prefecture under the guidance of Mr. Kazuhiro Sawa and Ms. Hideko Takenami [Ikeda] in September 2013. Field work was also done in Mt. Chōkai-san (in 2013) and Mt. Akita-Komaga-take as well as Mt. Kita-Mahiru-dake, the Mahiru Mountains (in 2014), the northern part of Tohoku District. It is clear that the northern plants are significantly different from *S. franchetii* in having robust habit, thicker involucre, heads arranged in a umbel-like corymb etc. and represent an undescribed species. Hence this is described as *Saussurea ugoensis* because this new species is chiefly distributed in Akita Prefecture.

During the survey of *S. ugoensis* stated above, a herbarium specimen was sent to me by Mr. Kazuhiro Sawa in August 2013. This is a gathering from Mt. Kamuro-san, in the Hinoto Mountains located on the border between Yamagata and Akita Prefectures. The plant is clearly different from *S. ugoensis* by having bigger, bowl-shaped involucre and 9-seriate involucre phyllaries. Based on this observation I conducted field research in Mt. Kamuro-san in September of the same year under the guidance of Mr. Sawa. I observed a *Saussurea* population near the summit of Mt. Kamuro-san and understood the plants with bowl-shaped involucre and 9-seriate phyllaries are endemic to the mountain. Consequently the plants are assigned to a new species, *Saussurea sawae*.

*Saussurea muramatsui* Kitam. is distributed on the Japan Sea side of Tohoku District, northern Honshu, Japan (Kadota 2011). In November 2013 some herbarium specimens were given to TNS by Mr. Ichiji Ando, Misawa. The specimens were collections made in Fukaura-machi, Nishi-Tsugaru-gun, Aomori Prefecture, northern Honshu (also on the Japan Sea side). The plants significantly differ from *S. muramatsui* by the coriaceous leaf blades and 8-seriate involucre phyllaries and instead have a morphological resemblance to *S. katoana* Kadota described from Tobishima Island, Sataka-shi, Yamagata Prefecture (Kadota 2013). As a result of this detailed comparison the Fukaura plants represent a new species. This species is described as *Saussurea andoana* after the name of the discoverer.

*Saussurea fauriei* Franch. is a tall, robust perennial with small heads arranged in a corymb and narrowly cylindrical involucre. This species is distributed in Hokkaido, Shikotan Island, the Habomais, Kunashiri Island, the Kuriles and grows in maritime grasslands (Kitamura 1937, 1950, 1980, 1981, Hara 1952, Barkalov 1993, Umezawa 2010, Kadota 2011).

In September 2013 Dr. Kenji Horie, Asahikawa, sent me "*Saussurea fauriei*"

specimens collected from Mt. Kamui-yama, the Horonai Mountains, central Hokkaido. The locality is located in an inland, ultrabasic area. The plants are superficially similar to *S. fauriei*, however, *S. fauriei* has not been found in such inland ultrabasic areas. After a comparison of the plants and *S. fauriei* it is clarified that the plants from Mt. Kamui-yama belong to an undescribed species. This is described as *Saussurea kenji-horieana*.

### Taxonomic treatment

*Saussurea* DC.

Subgenus *Saussurea*.

Sect. *Saussurea*: Lipsch., *Rod Saussurea*: 178 (1979); H. Koyama in K. Iwats. & al., *Fl. Jap.* **IIIb**: 153 (1995); C. Shih & S. Y. Jin, *Fl. Reipubl. Popul. Sin.* **78**(2): 158 (1999).

Sect. *Corymbiferae* auct. non Hook. f.: Nakai in *Bot. Mag. (Tokyo)* **29**: 197 (1915), pro subsect.

Sect. *Lagurostemon* Cass.: Nakai in *Bot. Mag. (Tokyo)* **29**: 195 (1915); Kitam., *Compos. Jap.* **I**: 151 (1937).

Ser. *Faurieorum* Kitam. in *Acta Phytotax. Geobot.* **4**: 5 (1935), ut '*Fauriei*'.

1. *Saussurea kenji-horieana* Kadota, **sp. nov.** [Figs. 1–3]

*Saussurea kenji-horieana* is distinguished from *S. fauriei* Franch. by having purplish stem, soft, dimly lustrous, subentire, narrowly ovate leaves, 7-seriate involucrel phyllaries, and middle and outer phyllaries roundish (without points) at apex.

**Type:** JAPAN. Hokkaido. Kamikawa Subpref., Asahikawa-shi, Toyosato, Horonai Mountains, Mt. Kamui-yama, along river Oroen-gawa, 43°40'16"N 142°13'16"E, alt. 320 m, at a serpentine area, 11 August 2013, Kenji Horie s.n. (TNS01189849–holotype, Fig. 1; TNS01189850–isotype).

A slender, herbaceous perennial, 110–130 cm tall. Rhizome horizontal, thick, 5 cm in diameter, with cord-like roots. Stem erect, purplish, striate, winged, pubescent with brownish multicellular

hairs throughout the surface, 5 times branched in the proximal part; wings up to 5 mm wide, tapered from the petiole base to the internode. Basal leaves withered at anthesis. Cauline leaves gradually diminishing in size from the lower part of the stem. Lower cauline leaves soft and somewhat fleshy, thick, dimly lustrous, sunken along the veins, ovate, 14–23 cm long, 6–12 cm wide, subentire and teeth pointed, glabrous on the adaxial side, densely sericeous with white, multicellular long hairs and golden glandular-dotted on the abaxial side, truncate to cuneate at base, acuminate at apex: petioles 2–5 cm long, winged, semi-amplexicaul, deccurrent to the stem, similarly pubescent to the blades. Upper cauline leaves ovate to narrowly ovate, 6–21 cm long, 2–15 cm wide, shortly petiolate. Flowers in July to August. Capitula 5–9 per corymb, arranged in a compact, dense compound corymb; peduncles 1–4 mm long, ascending at an acute angle, densely pubescent with grayish multicellular hairs. Involucres narrowly cylindrical, greenish, 3–4 mm in diameter (*in vivo* and *in sicco*), 12–13 mm long, sparingly arachnoid; phyllaries 7-seriate, adpressed; outer phyllaries broadly ovate, 2 mm long, roundish at apex; middle phyllaries narrowly ovato-lanceolate, 5 mm long, roundish; inner phyllaries narrowly ovato-lanceolate, 10–11 mm long, obtuse, erect; subtending leaves ovate, 2–3 mm long, acute; setae 6–8 mm long. Corollae pale purplish violet, 13–14 mm long; lobes 4 mm long; throats 2 mm long; tubes 7–8 mm long; anthers 5 mm long, deep bluish purple; tails 1.5 mm long. Pappi 2-whorled, inner 10–11 mm long, outer 2 mm long, whitish. Immature achenes 5 mm long, glabrous, purplish brown.

Additional specimens examined: JAPAN. Hokkaido. **Kamikawa Subpref.**, Asahikawa-shi, Kamui-cho, Toyosato, Horonai Mountains, Mt. Kamui-yama, along the river Oroen-gawa, 43°38'58"N 142°13'17"E, alt. 350 m, at a serpentine area, 7 August 2014, Yuichi Kadota s.n. (TNS).

Japanese name: Kamui-tôhiren (nom. nov.).

新和名: カムイトウヒレン.

Chromosome number  $2n = 26$  (Fig. 3).

Distribution: Mt. Kamui-yama, Horonai



Fig. 1. Type of *Saussurea kenji-horieana* Kadota (JAPAN. Hokkaido. Kamikawa Subpref., Asahikawa-shi, Horonai Mountains, Mt. Kamui-yama, along river Oroen-gawa, alt. 320 m, 11 August 2013, Kenji Horie s.n., TNS01189849, holotype).



Fig. 2. *Saussurea kenji-horieana* Kadota. A. Habit. B. Inflorescence. C. Habitat. D. Leaf blade margin showing pointed teeth. E. Undersurface of leaf blade showing yellowish white glandular dots. F. Wings of stem and petiole. Photo by Dr. Kenji Horie in ultrabasic, tall herbal stand along the river Oroen-gawa, Asahiakwa, Hokkaido, northern Japan on 11 August 2013.

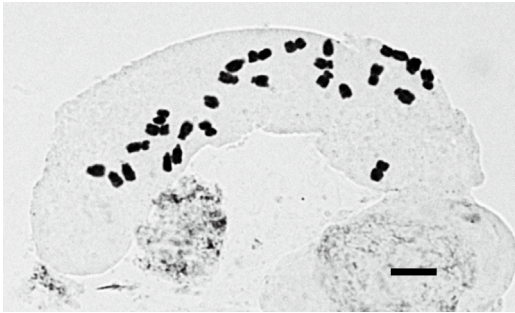


Fig. 3. Somatic chromosome numbers ( $2n = 26$ ) of *Saussurea kenji-horieana* Kadota (Mt. Kamui-yama, Horonai Mountains, Asahikawa, Kamikawa Subpref., Hokkaido, Japan). Scale: 5  $\mu\text{m}$ . Courtesy of Dr. Norihito Miura.

Mountains, Asahikawa Kamikawa Subpref., Hokkaido, northern Japan. Endemic.

**Etymology:** The specific epithet is dedicated to Dr. Kenji Horie, who is the discoverer of this new species.

**Ecology:** *Saussurea kenji-horieana* is known exclusively from the tall herbal stands under scattered summer-green woods on steep slopes in the ultrabasic area of Mt. Kamui-yama, Asahikawa, central Hokkaido.

**Note:** *Saussurea kenji-horieana* is morphologically close to *S. fauriei* Franch. in having taller habit, compact compound corymbs with numerous heads and narrowly cylindrical involucre. But the former is clearly different from the latter by the stem color (purple vs. green), texture of leaves (soft and dimly lustrous vs. subcoriaceous and not lustrous), leaf margin (subentire vs. serrate), the row of involucre phyllaries (7-seriate vs. 5-seriate) and the apex of outer and middle involucre phyllaries (roundish vs. cuspidate). The leaf blades are depressed along the veins on the abaxial side in *S. kenji-horieana*, however, the trait may disappear when dried and pressed. There is a difference in habitat preference between both species: as already stated *S. kenji-horieana* grows in the ultrabasic area of the inland region while *S. fauriei* mainly occurs among tall grassland dominated by *Phragmites australis* in non-ultrabasic areas

of the maritime region, northern and eastern Hokkaido.

Ser. *Imbricatae* Kitam. in Acta Phytotax. Geobot. 4: 8 (1935).

Ser. *Acuminatae* Kitam. in Acta Phytotax. Geobot. 4: 5 (1935), p.p. & Compos. Jap. I: 159 (1937), p.p.

Ser. *Imbricatae* Kitam. in Acta Phytotax. Geobot. 4: 11 (1935) & Compos. Jap. I: 198 (1937), p.p.

Ser. *Tohiren* Kitam. in Acta Phytotax. Geobot. 4: 8 (1935) & Compos. Jap. I: 181 (1937), p.p.

## 2. *Saussurea andoana* Kadota, *sp. nov.*

[Figs. 4–5]

*Saussurea andoana* is distinguished from *S. katoana* Kadota by having 8-seriate involucre phyllaries, shorter peduncles, cordate leaf blades with acuminate apices and less developed wings of the stem.

**Type:** JAPAN. Honshu. Aomori Pref., Nishi-Tsugaru-gun, Fukaura-machi, Henashi, Nabeishi, 'WeSpa Tsubakiyama', alt. ca. 50 m, under *Pinus thunbergii* woods facing the Japan Sea, 2 October 2014, Yuichi Kadota 148003 (TNS01221500–holotype; Fig. 4).

A robust, herbaceous perennial, 50–120 cm tall. Rhizome oblique to horizontal, 1–2 cm in diameter, with cord-like roots. Stem erect, striate, winged, sparingly pubescent with brownish multicellular hairs throughout the surface, 2–5 times branched in the upper part; wings 2–5 mm wide, undulate. Basal leaves withered at anthesis. Cauline leaves gradually diminishing in size from the lower part of the stem. Lower cauline leaves coriaceous, thick, dimly lustrous, cordate, 11–26 cm long, 10–20 cm wide, serrate, almost glabrous on both sides, deeply cordate at base, acuminate at apex; petioles 10–16 cm long, winged, vaginate at base, decurrent to the stem, not amplexicaul, almost glabrous. Upper cauline leaves ovate, 2.5–15 cm long, 1.5–11 cm wide, shortly petiolate. Flowers in September to October. Capitula 2–5, arranged

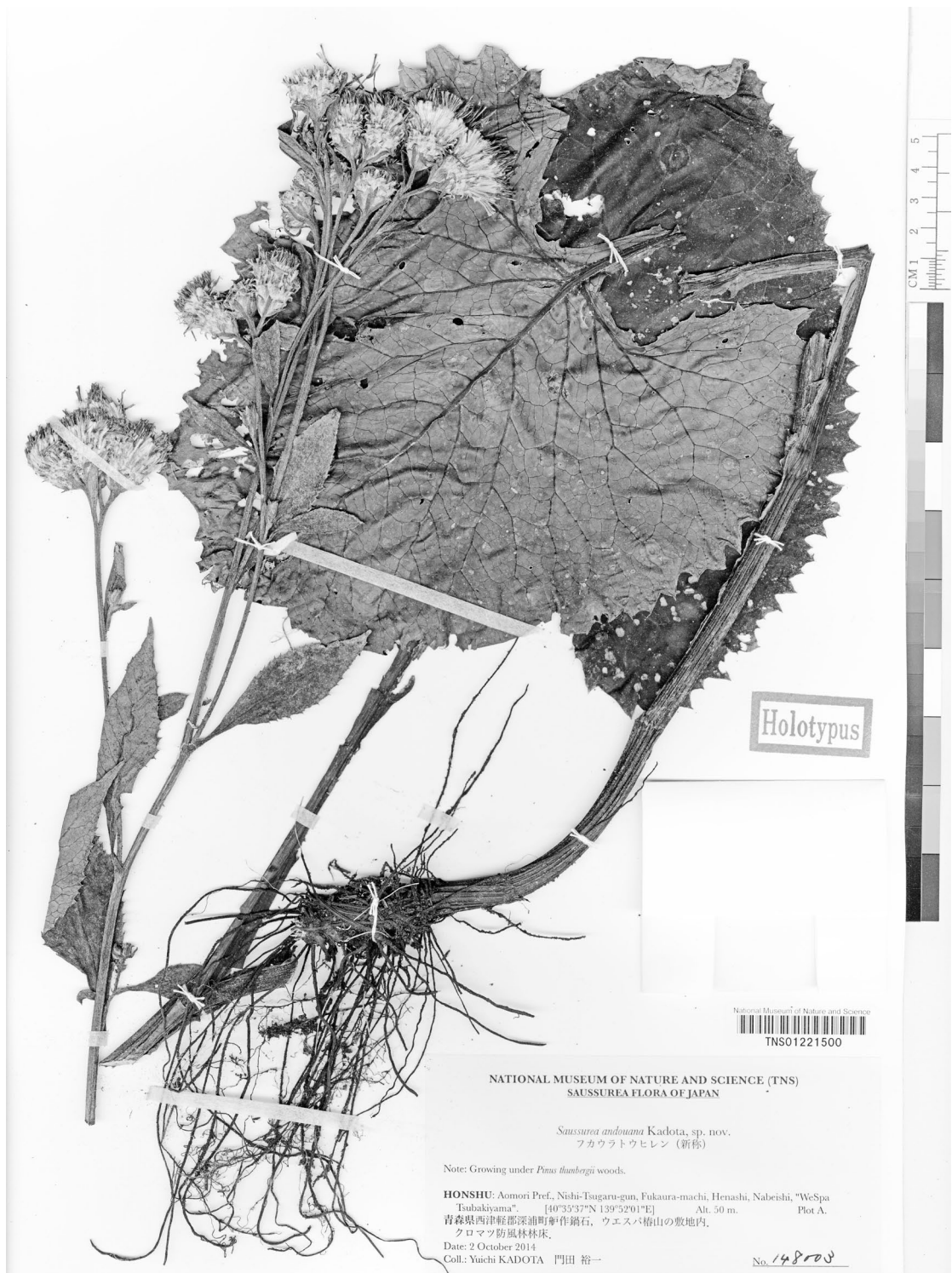


Fig. 4. Type of *Saussurea andonana* Kadota (JAPAN. Honshu. Aomori Pref., Nishi-Tsugaru-gun, Fukaura-machi, Henashi, Nabeishi, 'WeSpa Tsubakiyama', alt. ca. 50 m, 2 October 2014, Yuichi Kadota 148003, TNS01221500, holotype).

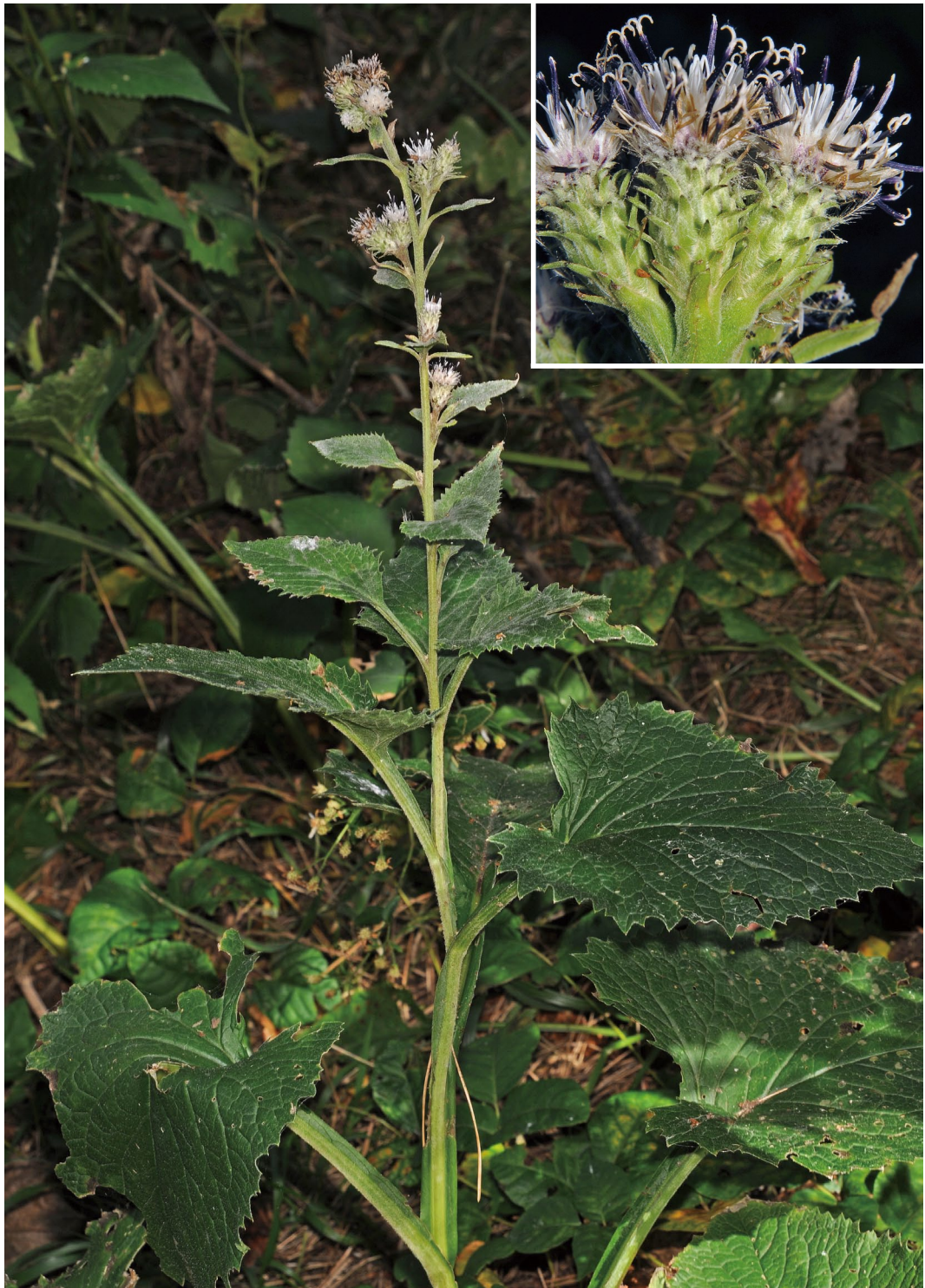


Fig. 5. *Saussurea andoana* Kadota. Right top corner inset shows close-up of involucre. Photos taken on the floor of *Pinus thunbergii* woods, Tsubakiyama, Fukaura-machi, Nishi-Tsugaru-gun, Aomori Pref., Tohoku, northern Japan on 2 October 2014.



in a compact corymb; peduncles 3–5 mm long, ascending at an acute angle, densely pubescent with grayish multicellular hairs. Capitula 1–3 in an axial corymb. Involucres campanulate, greenish, 9–14 mm in diameter (*in vivo*), 10–20 mm in diameter (*in sicco*), 15–17 mm long, more or less arachnoid; phyllaries 8-seriate, ascending; outer phyllaries ovate, 5–6 mm long, acuminate; middle phyllaries narrowly ovate, 10–12 mm long, acuminate; inner phyllaries narrowly ovato-lanceolate, 15 mm long, acute, erect; subtending leaves ovate, 6–8 mm long, acute; setae 4–6 mm long. Corollae faintly purplish violet or almost white, 10–11 mm long; lobes 2–3 mm long; throats 2 mm long; tubes 6 mm long; anthers 5 mm long, deep bluish purple; tails 2 mm long. Pappi 2-whorled, inner 9 mm long, outer 2 mm long, whitish. Achenes 4.5–5.5 mm long, glabrous, light grayish brown, purplish-striated and purplish-spotted.

Japanese name: Fukaura-tôhiren (nom. nov.).

新和名：フカウラトウヒレン.

Distribution: Tsubakiyama, Fukaura-machi, Aomori Pref., Tohoku District, Honshu, northern Japan. Endemic to Japan.

Etymology: The specific epithet is dedicated to Mr. Ichiji Ando, who is the discoverer of this new species.

Ecology: *Saussurea andoana* occurs on the floor of *Pinus thunbergii* woods facing the Japan Sea. These pine woods are sparse and exposed during the sprouting time of the species in early spring. It is considered that the influence of the strong wind may be severe for juvenile plants of this species. Hence the thick and coriaceous leaves of this species may be the result of adaptation to severe environmental conditions. *Saussurea hosoiana* Kadota, *S. neichiana* Kadota and *S. katoana* Kadota occurring along the coastal region of northern Honshu share such thick and coriaceous leaves in common.

Additional specimens examined: **JAPAN**. Honshu. **Aomori Pref.**, Nishi-Tsugaru-gun, Fukaura-machi, Tsubakiyama, 25 Sept. 1966, K. Kimura s.n. (TNS 170365); Fukaura-machi, 'WeSpa Tsubakiyama', alt. ca. 50 m, 11 Nov. 2013, I. Ando 2013-01–2013-03 (TNS01190284–

01190287); Fukaura-machi, 'WeSpa Tsubakiyama', alt. ca. 50 m, 31 Aug. 2014, Y. Shima s.n. (TNS01209744); Fukaura-machi, 'WeSpa Tsubakiyama', alt. ca. 50 m, 15 Sept. 2014, Y. Shima s.n. (TNS01218114–01218117).

Note: *Saussurea andoana* is discriminated from *S. katoana* described from Tobishima Island located on the Japan Sea by the row number of involucral phyllaries (8 vs. 10), the length of peduncles (shorter vs. longer), the shape of leaf blades (ovate vs. broadly ovate) and the width of stem wing (narrow and undulate vs. wide and coarsely dentate). Since the peduncles are short, the shape of compound inflorescences (synflorescence) looks like a spike (Figs. 4–5).

*Saussurea muramatsui* Kitam. (= *S. nipponica* Miq. subsp. *muramatsui* (Kitam.) Kitam.) is clearly different from *S. andoana* by 6-seriate involucral phyllaries and long, patent middle and inner phyllaries. *Saussurea muramatsui* is distributed in Aomori, Akita and Yamagata Prefectures and its range overlaps that of *S. andoana*. However, in Tsubakiyama, the locality of *S. andoana*, *S. muramatsui* has never been found.

### 3. *Saussurea sawae* Kadota, sp. nov.

[Figs. 6–7]

*Saussurea sawae* is discriminated from *S. ugoensis* by having larger, bowl-shaped involucre with longer peduncles, 9-seriate involucral phyllaries, longer and wider middle and outer phyllaries, acute apices of leaf blades and purplish stem and petioles.

**Type: JAPAN**. Honshu. Akita Pref., Yuzawashi, Akinomiya, the Hinoto Mountains, Mt. Kamuro-san, in a tall herb stand, 38°54'13.3"N 140°29'32.2"E, alt. 1270 m, 9 September 2013, Yuichi Kadota 1321001 (TNS01186907–holotype; Fig. 6).

A robust, herbaceous perennial, 60–130 cm tall. Rhizome oblique, thick and ca. 3 cm in diameter, with string-like roots. Stem suberect, strongly striate, narrowly winged, sparingly pubescent with brownish multicellular hairs in the lower part, 2–6 times branched; wings low, 1–3 mm wide. Basal leaves withered at anthesis.

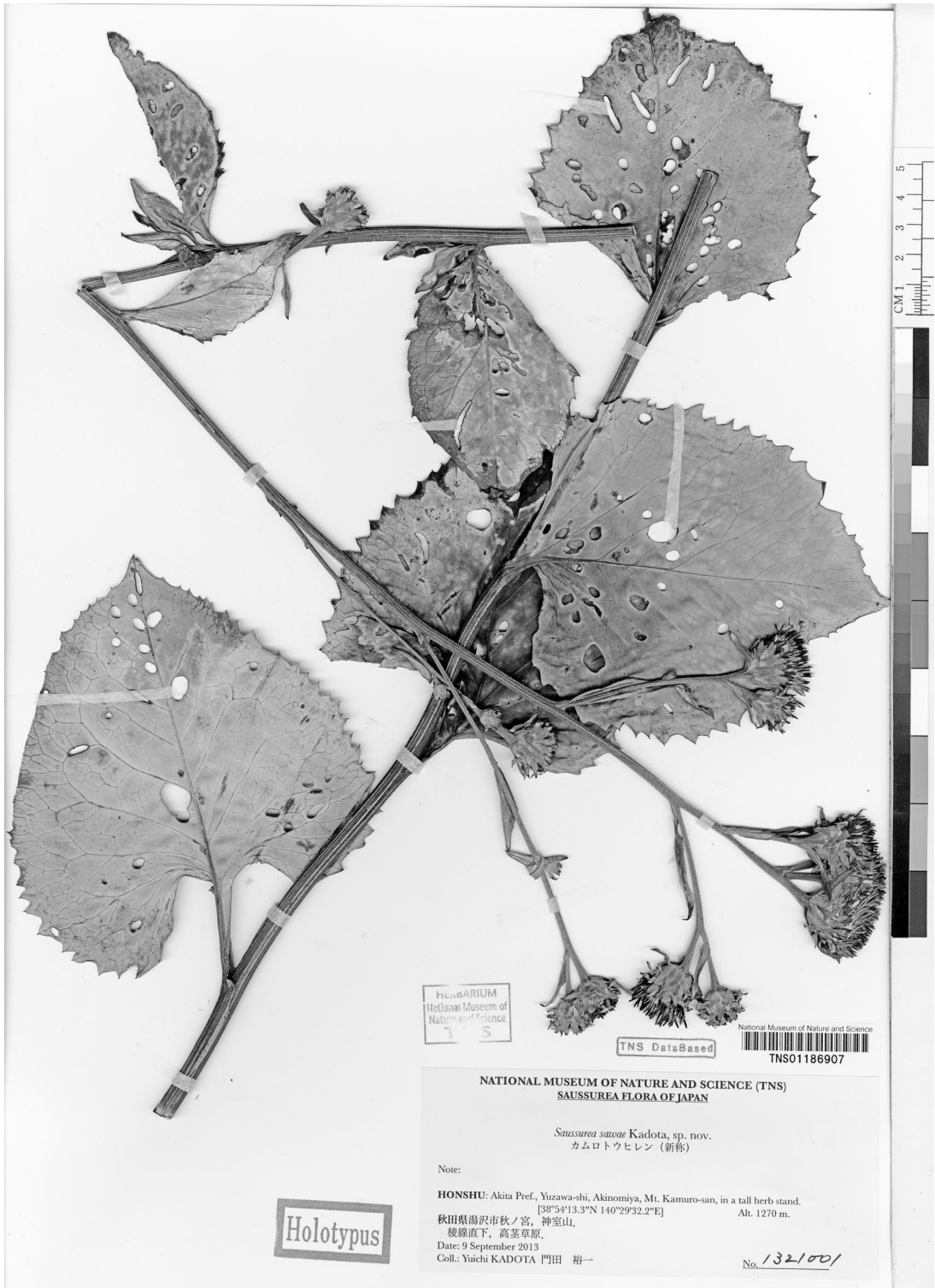


Fig. 6. Type of *Saussurea sawae* Kadota (JAPAN. Honshu. Akita Pref., Yuzawa-shi, Akinomiya, the Hinoto Mountains, Mt. Kamuro-san, alt. 1270 m, 9 September 2013, Yuichi Kadota 1321001, TNS01186907, holotypus).



Fig. 7. *Saussurea sawae* Kadota. Left bottom corner inset shows close-up of involucre. Photos taken at Mt. Kamuro-san, the Hinoto Mountains, Yuzawa-shi, Akita Pref., Tohoku, northern Japan on 9 Sept. 2013.

Lower cauline leaves coriaceous, ovate, 11–25 cm long, 11–18 cm wide, coarsely dentate, sparingly pubescent with short, brownish, multicellular hairs on the adaxial side, glabrous on the abaxial side, deeply cordate at base, acute at apex; petioles 10–28 cm long, glabrous, winged in the upper half or not winged, semi-amplexicaul at base. Middle and upper cauline leaves gradually diminishing in size, ovate, 7–17 cm long, 3–14 cm wide, serrate, shallowly cordate to truncate or cuneate at base, acute at apex, sparingly pubescent with short, brownish, multicellular hairs on the adaxial side, pubescent with long, whitish multicellular hairs along veins on the abaxial side, shortly petiolate; petioles winged, semi-amplexicaul. Flowers in August to September. Capitula arranged in a compact corymb, 1–2 per corymb, peduncles 10–30 mm long in the terminal corymb, sometimes winged, ascending at an obtuse angle, densely pubescent with brownish, multicellular hairs. Involucres bowl-shaped, greenish, 12–15 mm in diameter (*in vivo*), 1.5–2 cm (*in sicco*), 15 mm long, sparingly arachnoid; phyllaries 9-seriate; outer phyllaries ovate, 17 mm long, ascending at an obtuse angle, acuminate; middle phyllaries ovato-lanceolate, 14–15 mm long, patent; inner phyllaries purplish, linear, 12–13 mm long, acuminate; setae 6–8 mm long; subtending leaves 2–3, ovato-lanceolate, 20–23 mm, acute, foliaceous. Corollae faintly purplish violet or rather white, 12 mm long; lobes 4 mm long; throats 2 mm long; tubes 6 mm long; anthers 6 mm long, deep bluish purple; tails 1.5 mm long. Pappi 2-whorled, brownish white; outer 3 mm long; inner 10–12 mm long. Achenes 5 mm long, light reddish gray, purplish-striated and purplish-spotted, striate, glabrous.

Japanese name: Kamuro-tôhiren (nom. nov.).

新和名: カムロトウヒレン.

Distribution: the Hinoto Mountains (Mt. Kamuro-san and Mt. Sumikura-yama), Tohoku District, Honshu, northern Japan. Endemic.

Etymology: The specific epithet is dedicated to Mr. Kazuhiro Sawa, who is the finder of this

new species.

Ecology: *Saussurea sawae* was found to occur among tall herbs and bushes in the alpine zone of the Hinoto Mountains, located on the border between Akita and Yamagata Prefectures, Tohoku District, Honshu, northern Japan.

Additional specimens examined: **JAPAN**. Honshu. **Yamagata Pref.**, Shinjô-shi, the Hinoto Mountains, Mt. Kamuro-san, 22 Aug. 1963. S. Ôrui s.n. (YAMA 13214); Mt. Kamuro-san, alt. 1250 m, 12 Aug. 2013, K. Sawa s.n. (TNS01184760). Mogami-gun, Kaneyama-machi, Mt. Sumikura-yama, alt. 200 m, 14 Sept. 2009, S. Domon s.n. (TNS01187681).

Note: *Saussurea sawae* differs from *S. ugoensis* by the shape of capitula (bowl-shaped vs. campanulate to cylindrical), the length of peduncles (10–30 cm long vs. 4–7 mm long), the row number of involucrel phyllaries (9-seriate vs. 6-seriate), the shape and the length of outer involucrel phyllaries (ovate and 17 mm long vs. narrowly ovate and 13 mm long) and middle ones (ovato-lanceolate and 14–15 mm long vs. narrowly ovato-lanceolate and 11–12 mm long), the shape of leaf blade apex (acute vs. cuspidate) and the color of stem and petioles (more or less purplish vs. greenish). The branches are divaricate and the compound inflorescence as a whole looks like a panicle in *S. sawae*.

*Saussurea sawae* has the largest capitula among the species of Japanese *Saussurea*.

#### 4. *Saussurea shonaiensis* Kadota, **sp. nov.**

[Figs. 8–9]

*Saussurea nipponica* Miq. subsp. *muramatsui* auct. non Kitam.: Yuhki, New Fl. Yamagata: 286 (1992), excl. pl. Isl. Tobishima. The Tobishima plants should be ascribed to *S. katoana* Kadota (2013).

*Saussurea shonaiensis* is discriminated from *S. muramatsui* Kitam. by narrower, cylindrical involucrel, 8-seriate involucrel phyllaries and ascending middle and outer phyllaries, capitula short-peduncled and arranged in an umbel-like to spike-like compound inflorescence (synflorescence) and broadly ovate leaf blades.

**Type:** **JAPAN**. Honshu. Yamagata Pref.,

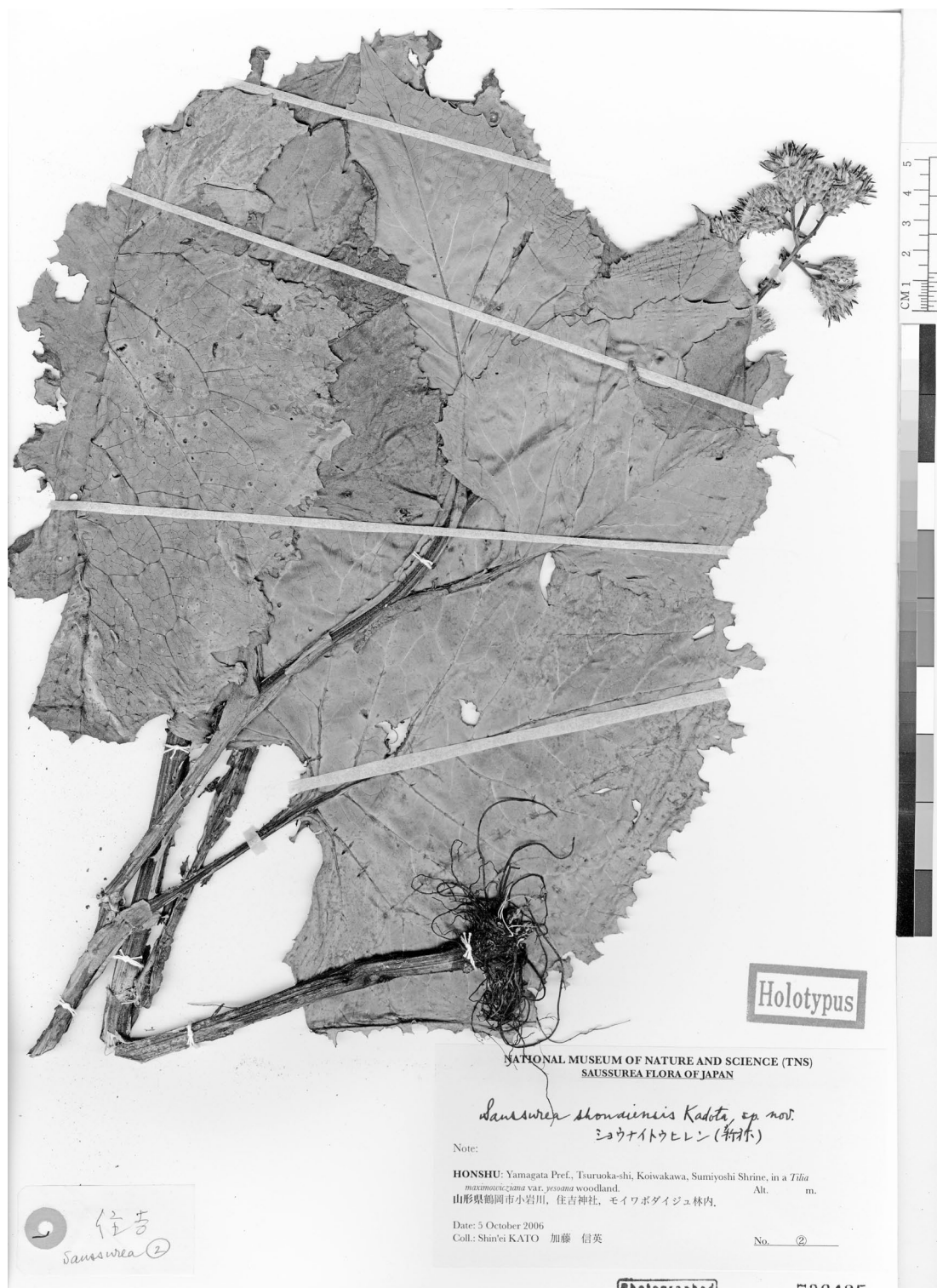


Fig. 8. Type of *Saussurea shonaiensis* Kadota (JAPAN. Honshu. Yamagata Pref., Tsuruoka-shi, Koiwakawa, Sumiyoshi-jinja shrine, 3 October 2006, Shin-ei Kato s.n., TNS 736425, holotype).



Fig. 9. *Saussurea shonaiensis* Kadota. Right top corner inset shows close-up of involucre. Photos taken at Mt. Takadate-yama, Tsuruoka-shi, Yamagata Pref., Tohoku, northern Japan on 22 Sept. 2014.

Tsuruoka-shi, Koiwakawa, Sumiyoshi-jinja shrine, in a *Tilia maximowicziana* var. *yesoana* woods, 3 October 2006, Shin-ei Kato s.n. (TNS 736425–holotype, Fig. 8; TNS 736426, 01209816–isotypes).

A medium-sized, herbaceous perennial, 65–86 cm tall. Rhizome oblique, thick and 2–3 cm in diameter, with string-like roots. Stem suberect, striate, prominently winged, sparingly pubescent with brownish multicellular hairs in the lower part, 4–8 times branched; wings 3–5 mm wide. Basal leaves withered at anthesis. Lower cauline leaves subcoriaceous to herbaceous, broadly ovate or suborbicular to ovate, 17–25 cm long, 13–20 cm wide, coarsely dentate, sparingly pubescent with short, brownish, multicellular hairs on the adaxial side, glabrous on the abaxial side, deeply to shallowly cordate at base, acute to short-cuspidate at apex; petioles 8–18 cm long, almost glabrous, winged, semi-amplexicaul at base decurrent to the stem. Middle and upper cauline leaves abruptly diminishing in size, ovate to narrowly ovate, 5–13 cm long, 1–8 cm wide, serrate, shallowly cordate to truncate or cuneate at base, acute at apex, pubescent with short, brownish, multicellular hairs on the adaxial side, pubescent with long, whitish multicellular hairs along veins on the abaxial side, shortly petiolate; petioles winged, semi-amplexicaul. Flowers in August to October. Capitula 2–3 per corymb, arranged in a loose racemose, compound inflorescence; peduncles short, 2–3 mm long in the terminal corymb, ascending at an obtuse angle, densely pubescent with brownish, multicellular hairs. Involucres cylindrical, greenish, 7–10 mm in diameter (*in vivo*), 1–1.5 cm (*in sicco*), 13–15 mm long, densely arachnoid; phyllaries 8-seriate; outer phyllaries ovate, 7–8 mm long, ascending, acuminate; middle phyllaries ovato-lanceolate, 8–9 mm long, ascending; inner phyllaries pale purplish, ovato-lanceolate, 10–12 mm long, acuminate; setae 7–8 mm long; subtending leaves 2–4, narrowly ovate, 6–7 mm, acute. Corollae faintly purplish violet, 12–13

mm long; lobes 4 mm long; throats 2 mm long; tubes 6–7 mm long; anthers 6 mm long, deep bluish purple; tails 1 mm long. Pappi 2-whorled, brownish white; outer 4 mm long; inner 9 mm long. Achenes 5 mm long, light gray, purplish-striated and purplish-spotted, striate, glabrous.

Japanese name: Shônai-tôhiren (nom. nov.).

新和名：シヨウナイトウヒレン。

Distribution: Yamagata and Akita Prefs., Tohoku District, Honshu, northern Japan. Endemic to Japan.

Etymology: The specific epithet and the Japanese name are derived from the Shônai area of Yamagata Prefecture, where this new species was first discovered and is predominantly distributed. The Shônai area is located in the west of Yamagata Prefecture and faces the Japan Sea.

Ecology: *Saussurea shonaiensis* occurs on the floor of summer-green woods and *Pinus thunbergii* woods or in maritime grasslands facing the Japan Sea.

Additional specimens examined: **JAPAN**. Honshu. **Akita Pref.**, Nikaho-shi, Kisagata-machi, Misaki, 39°06'N 139°52'E, alt. 20 m, 22 Sept. 2006, Y. Kadota 066421–066424 (TNS 758701–758702, 759633–759634); Misaki, alt. 50 m, 29 Sept. 2012, Y. Horii 35616, 35624 (TNS01170201, 01170211); Misaki, 16 Oct. 2012, S. Kato s.n. (TNS01190314–01190318, 01209807). **Yamagata Pref.**, Sakata-shi [former Akumi-gun, Yawata-cho], Oct. 1933, I. Sato s.n. (TNS 55055). Akumi-gun, Yuza-machi, Misaki, 39°06'N 139°52'E, alt. 20 m, 22 Sept. 2006, Y. Kadota 066413–066416 (TNS 758697–758700); Misaki, 39°06'N 139°52'E, alt. 20 m, 22 Sept. 2006, Y. Kadota s.n. (TNS01174133). Tsuruoka-shi, Sanze, Hayama, west coast, 24 Aug. 1990, S. Kato 3-8 (TNS01209814); Tsuruoka-shi, Sanze, Sanze-Kihi-jinja shrine, 38°42'23"N 139°40'14"E alt. 20 m, 22 Sept. 2014, Y. Kadota s.n. (TNS); Tsuruoka-shi, on the eastern foot of Mt. Takadate-yama, Zenpôji, 27 Sept. 1999, S. Kato 3-5 (TNS01209811); Tsuruoka-shi, Ôyama, on the foot of Mt. Takadate-yama, along the pond Kami-ike, 27 Sept. 1999, S. Kato 3-6 (TNS01209812); Tsuruoka-shi, Yura, eastern mountains, 7 Oct. 1990, S. Kato 3-7 (TNS01209813); Tsuruoka-shi, Mt. Atsumi-dake, 17 Oct. 1990, S. Kato 3-9 (TNS01209815); Tsuruoka-shi, Nanakubo, on the floor of *Pinus thunbergii* woods, 9 Oct. 2006, S. Kato 3-2 (TNS01209808); Mt. Takadate-yama, on the ridge, along the road, 12 Oct. 2012, S. Kato 3-3 (TNS01185062–01185065, 01190311–01190313, 01209809); Tsuruoka-shi, Mt. Takadate-yama, at the

southern part of the summit, 15 Oct. 2006, S. Kato 3-4 (TNS01209810); Tsuruoka-shi, Kanezawa, Mt. Takadate-yama, 38°45'40"N 139°44'42"E alt. 210 m, 22 Sept. 2014, Y. Kadota s.n. (TNS); Tsuruoka-shi, Wasada, along summer-green woods along the coast, 14 Oct. 2012, S. Kato B (TNS01185066–01185070); Wasada, southern mountains, 14 Oct. 2012, S. Kato s.n. (TNS011903129–01190320); Tsuruoka-shi, Wasada, 38°34'13"N 139°33'32"E alt. 60 m, 22 Sept. 2014, Y. Kadota (TNS).

Note: *Saussurea shonaiensis* differs from *S. muramatsui* by the shape of involucre (narrower and cylindrical vs. wider and campanulate), the row number of involucral phyllaries (8-seriate vs. 6-seriate), the direction of middle and outer involucral phyllaries and the texture of leaf blades (subcoriaceous vs. herbaceous).

5. *Saussurea ugoensis* Kadota, **sp. nov.**

[Figs. 10–11]

*Saussurea franchetii* auct. non Koidz.: Yuhki, New Fl. Yamagata: 286 (1992), pl. Mt. Chôkai-san; Kadota in M. Kato & Ebihara, Endemic Pl. Jap.: 386, map 1548 (2011), p.p.

*Saussurea ugoensis* is different from *S. franchetii* Koidz. by having greenish, thicker involucre, capitula arranged in umbel-like corymbs, longer subtending leaves and slightly wider stem wings.

**Type:** JAPAN. Honshu. Akita Pref., Senboku-shi, Obonai, Mts. Akita-Komaga-take, Mt. Oname-dake, 39°45'59"N 140°47'56"E, alt. 1450 m, 2 September 2014, Y. Kadota 145102 (TNS01218119–holotype, Fig. 10; TNS01218127–isotype).

A medium-sized, herbaceous perennial, 35–110 cm tall. Rhizome oblique, thick and 1–2 cm in diameter, with string-like roots. Stem suberect to slightly ascending, striate, narrowly winged, sparingly pubescent with brownish multicellular hairs, 1–3 times branched; wings 1–2 mm wide. Basal leaves predominantly withered at anthesis. Lower cauline leaves subcoriaceous, ovate to narrowly ovate to triangular-ovate, 10–17 cm long, 7–14 cm wide, coarsely dentate, sparingly pubescent with short, brownish, multicellular hairs on the adaxial side, densely pubescent with brownish, flexuous, multicellular hairs along

veins on the abaxial side, deeply cordate to cordate at base, cuspidate at apex; petioles 10–25 cm long, glabrous, winged in the upper half or not winged, semi-amplexicaul at base. Middle and upper cauline leaves gradually diminishing in size, ovate, 5–12 cm long, 2.5–8 cm wide, serrate, truncate to cuneate at base, cuspidate at apex, similarly pubescent to the lower cauline leaves, shortly petiolate; petioles winged, semi-amplexicaul. Flowers in August to September. Capitula arranged in a compact, umbel-like corymb, 3–6 per corymb, peduncles 4–7 mm long in the terminal corymb, ascending at an acute angle, densely pubescent with brownish, multicellular hairs. Involucre cylindrical to campanulate, greenish, 8–15 mm in diameter (*in vivo*), 1–2 cm (*in sicco*), 10–17 mm long, sparingly arachnoid; phyllaries 6-seriate; outer phyllaries narrowly ovate, 13 mm long, ascending to patent, acuminate; middle phyllaries narrowly ovato-lanceolate, 11–12 mm long, patent; inner phyllaries purplish, lanceolate, 12 mm long, acuminate; setae 5–7 mm long; subtending leaves 2–3, narrowly ovato-lanceolate, 10–25 mm, acuminate, foliaceous. Corollae faintly purplish violet or rather white, 11–12 mm long; lobes 3–4 mm long; throats 2 mm long; tubes 5–6 mm long; anthers 6 mm long, deep bluish purple; tail 1.5 mm long. Pappi 2-whorled, brownish white; outer 3 mm long; inner 8 mm long. Immature achenes 5 mm long, purplish, glabrous.

Japanese name: Ugo-tôhiren (nom. nov.).

新和名: ウゴトウヒレン.

Distribution: Mt. Yakeishi-dake, Mt. Akita-Komaga-take, the Mahiru Mountains, Mt. Chôkai-san, the Hinoto Mountains, Tohoku District, Honshu, northern Japan. Endemic.

Etymology: The specific epithet and the Japanese name are derived from the old name of Akita Prefecture, where *Saussurea ugoensis* is predominantly distributed.

Ecology: *Saussurea ugoensis* is one of the dominant species in the alpine herbal stands of the distribution range.





Fig. 10. Type of *Saussurea ugoensis* Kadota (JAPAN. Honshu. Akita Pref., Senboku-shi, Obonai, Mts. Akita-Komaga-take, Mt. Oname-dake, alt. 1450 m, 2 September 2014, Y. Kadota 145102, TNS01218119, holotype).



Fig. 11. *Saussurea ugoensis* Kadota. Left top corner inset shows close-up of involucre. Photos taken at Mt. Oname-dake, Mts. Akita-Komaga-take, Obonai, Senboku-shi, Akita Pref., Tohoku, northern Japan on 2 Sept. 2014.

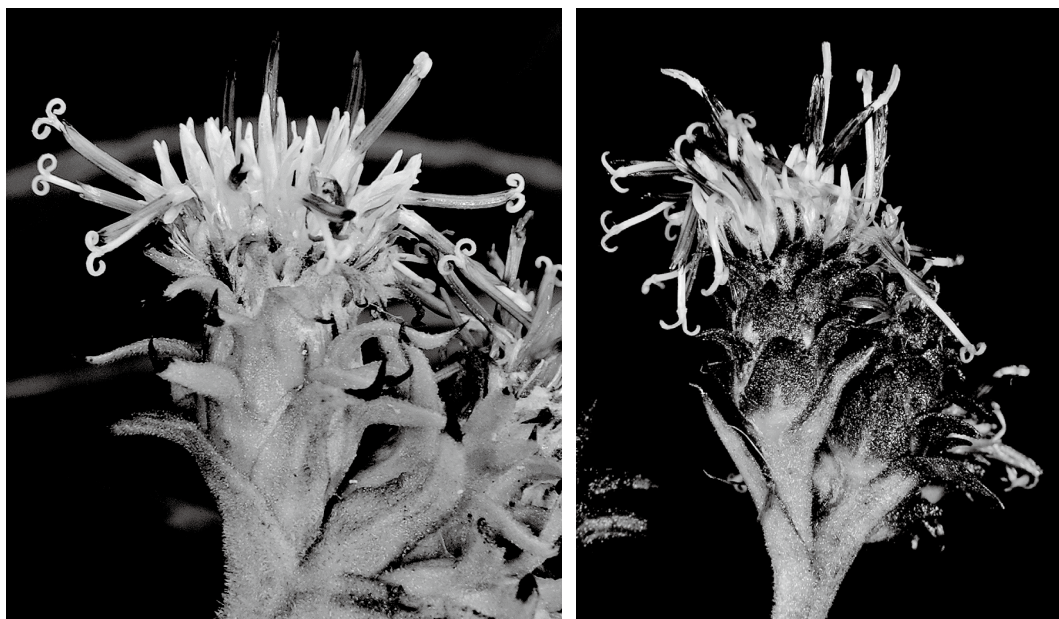


Fig. 12. Comparison in involucre between *Saussurea ugoensis* Kadota (left) and *S. franchetii* Koidz. (right). Left. Mt. Oname-dake, Mts. Akita-Komaga-take, Senboku-shi, Akita Pref. Right. Mt. Nishi-Asahi-dake, the Asahi Mountains, Nishikawa-cho, Yamagata Pref.

Additional specimens examined: **JAPAN**. Honshu. **Iwate Pref.**, Ôshû-shi, Mt. Yakeishi-dake, 14 Aug. 1934, H. Iwabuchi 97069–97070 (TNS 176308, 902960). Kitakami-shi, Mt. (Yakeishi-)Komaga-take, 2 Aug. 1941, H. Iwabuchi (TNS 79751). Waga-gun, Nishi-Waga-machi, Iwasaki, Mt. Ushigata-yama, 26 Aug. 1957, M. Kikuchi 21 (KYO). **Akita Pref.**, Senboku-shi, Obonai, Mt. Komaga-take, 9 Aug. 1931, H. Koidzumi 31442 (TNS 178956); Mt. Komaga-take, 27 Aug. 1932, Y. Fukuda 194 (KYO); Mt. Komaga-take, 19 Aug. 1936, A. Kobayashi s.n. (TNS 55058); Mt. Komaga-take, 19 Aug. 1936, A. Kobayashi s.n. (KYO); Mt. Komaga-take, 22 Aug. 1937, A. Kobayashi 6 (KYO); Mt. Komaga-take, 20 Sept. 1958, M. Kikuchi 20 (KYO); Mt. Komaga-take, 8 Aug. 1963, K. Nishio s.n. (TNS 155818); Mts. Komaga-take, Mt. O-dake, alt. 1600 m, 10 Sept. 1988, Y. Horii 1494 (KYO); Mt. Akita-Komaga-take, 18 Aug. 1998, T. Yamada s.n. (TNS 675589); Mts. Akita-Komaga-take, Mt. O-dake, alt. 1400–1500 m, 17 Aug. 1999, T. Yamada s.n. (TNS 685671–685672); Mts. Akita-Komaga-take, Mt. Akakura-dake, alt. 1400–1500 m, 10 Aug. 1999, T. Yamada s.n. (TNS 685673); Mts. Akita-Komaga-take, Mt. Oname-dake, 39°45'59"N 140°47'56"E, alt. 1450 m, 2 Sept. 2014, Y. Kadota s.n. (TNS). Senboku-shi, Tazawako, Obonai [former Kakunodate-machi], Mahiru Mountains, Mt. Asahi-dake, alt. 1376 m, 16 Aug. 1991, Y. Horii s.n. (TNS 575099–575102); Mt. Asahi-dake, at the summit, 6 Sept. 1992, Y. Horii 809 (KYO); Mt. Asahi-dake, alt. 1200 m, 16 Aug. 1997, Y. Horii 1439 (TNS

649342); Mt. Kaibuki-dake, 16 Sept. 1990, Y. Horii 994, 998 (KYO); Hachitaki-sawa to Mt. Waga-dake, 16 Aug. 1992, T. Sato 3 (TNS 642004). Daisen-shi, Ôta-cho, Mt. Kabuto-yama, alt. 950 m, 25 Aug. 1991, T. Sato s.n. (TNS 575103). Senboku-gun, Misato-machi [former Senhata-machi], Mahiru Mountains, Mt. Mahiru-dake, alt. 970 m, 23 Aug. 1998, Y. Horii 1907 (TNS 671572), Y. Horii 1958 (KYO). Yurijonjô-shi, Chôkai-cho, Hinoto Mountains, Mt. Hinoto-dake, 'Kaze-no-col', alt. 1000 m, herbal stand, 21 Aug. 1988, Y. Horii s.n. (KYO). **Yamagata Pref.**, Akumigun, Yuza-machi, Mts. Chôkai-san, Mt. Inakura-dake, 9 Sept. 1990, Y. Horii 1658 (KYO); Mt. Chôkai-san, Kôjirô-sawa gorge, alt. 1440 m, 17 Sept. 2012, K. Sawa s.n. (TNS01174134). Sakata-shi, Mt. Chôkai-san, Kawarajuku, alt. ca. 1550 m, 11 Aug. 1950, M. Furuse 16955 (KYO). Shinjô-shi, Mt. Mokuzô-san, alt. 950 m, 18 Aug. 2013, K. Sawa s.n. (TNS01187679–01187680).

Note: *Saussurea ugoensis* has been frequently confused with *S. franchetii* Koidz. However, the former is discriminated from the latter by the involucre (greenish and thicker vs. purplish black and thinner; Fig. 12), the shape of compound inflorescence (umbel-like corymb vs. panicle-like corymb), the relative length of subtending leaves to the involucre (longer vs. shorter) and the width of stem wings (wide vs.

thin).

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## 門田裕一：アジア産トウヒレン属（キク科）の分類学的研究 VII. 北海道産の1新種と本州産の4新種

キク科トウヒレン属において、北海道から1新種カムイトウヒレン *Saussurea kenji-horieana* Kadota, 本州から4新種、フカウラトウヒレン *S. andoana* Kadota, カムロトウヒレン *S. sawae* Kadota, ショウナイトウヒレン *S. shonaiensis* Kadota, ウゴトウヒレン *S. ugoensis* Kadota を報告した。

1) カムイトウヒレン (基準産地:北海道旭川市神居山) カムイトウヒレンは北海道旭川市幌内山地に分布し、超塩基性岩地の急斜面の高茎草原に生える。形態的には、同じく北海道に分布し、海岸草原に生えるフォーリアザミ *S. fauriei* Franch. に似るが、①茎は紫色を帯び、②茎葉は軟らかく、鈍い光沢があり、緑がやや全縁状で、鋸歯は小さな突起状になり、③総苞片は7列で、④総苞外片と中片の先端は円頭となる。茎葉の向軸面では脈に沿って凹むがこの性質は標本では失われる。

2) フカウラトウヒレン (基準産地:青森県西津軽郡深浦町椿山)

フカウラトウヒレンは青森県深浦町の海岸沿いのクロマツ林床に生育する。同様にクロマツ林に生える山形県飛鳥から記載されたトビシマトウヒレン *S. katoana* Kadota に似るが、①総苞片が8列で、②頭花の柄が短く、③葉身が心形で先端が鋭尖形となり、④茎の翼があまり発達しないことで区別される。

3) カムロトウヒレン (基準産地:秋田県湯沢市神室山)

カムロトウヒレンは秋田県と山形県の県境に位置する丁(ひのと)山地に分布し、ウゴトウヒレンから、①総苞が椀形となり、②頭花の柄が長く、③総苞片が9列で、総苞中片と外片がより長くかつ幅が広く、④葉身の先端が短く尖り、⑤茎や葉柄が紫色を帯びる点で異なる。

4) ショウナイトウヒレン (基準産地:山形県鶴岡市小岩川)

ショウナイトウヒレンはトガヒゴタイ *S. muramatsui* Kitam. から、①総苞がより細く、②総苞片が8列、③総苞中片と外片は斜上し、④頭花の柄が短く、複花序は散形状あるいは穂状になり、⑤葉は広卵形になる点で区別される。ショウナイトウヒレンは山形県庄内地方に主に分布するほか、鳥海山の山麓部(秋田県側及び山形県側)にも分布する。

5) ウゴトウヒレン (基準産地:秋田県仙北市秋田駒ヶ岳)

ウゴトウヒレンは秋田駒ヶ岳の他、焼石岳、鳥海山、真昼山地に分布し、ミヤマキタアザミ *S. franchetii* Koidz. とは、①総苞が鐘形でより太くかつ緑色で、②頭花は散形状につき、③苞葉がより長く、④茎の翼がより発達することで区別される。

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