First record of *Achillea alpina* L. subsp. *pulchra* (Koidz.) Kitam. (Asteraceae) in Korea

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한국 미기록 식물: 갯톱풀(국화과)

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ABSTRACT: *Achillea alpina* L. subsp. *pulchra* (Koidz.) Kitam., an unrecorded subspecies belonging to the genus *Achillea* of Asteraceae, was discovered and is illustrated here. It is known as an endemic species of Hokkaido, Japan, but we discovered it along the seashore at Uljin in Gyeongsangbuk-do, Korea. Having a relatively equally serrate or dentate leaf margin and sparsely villous involucre, this subspecies is easily distinguished from its related taxa. Based on its habitat, it was termed Gaet-top-pul in Korean. We provide a description, illustrations, photographs and a key of related taxa in Korea.

Keywords: *Achillea*, new record taxa, *Achillea alpina* L. subsp. *pulchra* (Koidz.) Kitam.

적 요: 국화과 톱풀속의 미기록 식물인 갯톱풀(*Achillea alpina* L. subsp. *pulchra* (Koidz.) Kitam.)을 발견하여 기재하고 도해하였다. 갯톱풀은 일본 특산으로 홋카이도 해안가에 자생한다고 알려져 있으나 경상남도 울진군 일대의 해안가에서 분포를 확인하였다. 갯톱풀은 엽연이 비교적 고른 치아상거치 또는 예거치이고, 잎과 총포에 털이 성기어 다른 톱풀속 식물들과 쉽게 구별된다. 국명은 미기록 식물의 자생지를 고려하여 ‘갯톱풀’이라 신칭하였고, 이에 대한 기재, 그림도해, 사진 및 검색표를 제시하였다.

주요어: 톱풀속, 미기록 식물, 갯톱풀

The genus *Achillea* (Asteraceae) is composed of approximately 110–140 species (El-Shazly et al., 2004; Saukel et al., 2003; Guo et al., 2005; Ehrendorfer and Guo, 2006), and grows throughout the northern hemisphere (Davis, 1975). Three species of *Achillea* are known in Korea, *A. alpina* L., *A. acuminata* (Ledeb.) Sch. Bip. and *A. millefolium* L. *A. millefolium* is easily distinguished by having 3-pinnatisect leaves from the other two Korean species with 2-pinnatisect

leaves. *A. acuminata* is distributed mainly in east Siberia, Mongolia, Manchuria and northeast part of Korean Peninsula. Otherwise, *A. alpina* is widely distributed from India to Japan, and has vast morphological variation range. And so, it has been divided into 3 infraspecific taxa in Korea, *A. alpina* L. subsp. *alpina* var. *alpina*, subsp. *alpina* var. *discoidea* (Regel) Kitam., and subsp. *rhodoptarmica* (Nakai) Kitam.

We found *A. alpina* L. subsp. *pulchra* (Koidz.) Kitam. in

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Fig. 1. Location of the first record of *Achillea alpina* subsp. *pulchra*. **A.** Gyeongsangbuk-do (yellow) in South Korea. **B.** Collection area of Gyeongsangbuk-do (gray).

Gyeongsangbuk-do, Uljin during the field investigation in 2014 (Fig. 1). This taxon was reported as a new species from coastal region of Hokkaido, Japan by Koidzumi (1918), and later it was retreated taxonomically by Kitamura (1968) as *A. alpina* subsp. *pulchra* (comb. et stat. nov). It has been considered as an endemic of Hokkaido, Japan (Hara, 1938; Koyama, 1995). We provide the illustration (Fig. 2) and photographs of *A. alpina* subsp. *pulchra* (Fig. 3).

Taxonomic Treatment

Achillea alpina L. subsp. *pulchra* (Koidz.) Kitam., Acta Phytotax. Geobot. 23: 4, 1968; *A. pulchra* Koidzumi, Bot. Mag. Tokyo 32: 59, 1918.

Perennial herbs. Rhizomes creeping. Stem erect, 60–80 cm high, branched in upper part, loosely villous, glandular. Leaves minutely toothed or serrated lobed, loosely or sparsely villous, color green. Basal and lower leaves withered at anthesis. Middle leaves sessile, blade, oblong-linear, 5–9 cm long, 9–13 mm wide, base attenuate, margin relatively equally serrate or dentate, apex acute to obtuse, pellucidly dotted; leaf teeth acute, cartilaginous cuspidate. Inflorescence corymb; erect, terminal, Capitula semi-globose, 9–12 mm in diameter, loosely villous; Involucre 4.5–5 mm wide, 5–5.5 mm long, imbricate, green, with prominent midrib, in 3-series; outer involucre bract short, ovate-oblong, middle involucre bract oblong to lanceolate, inner involucre bract linear-lanceolate; in middle,

green, with prominent midrib; palea oblanceolate; Ligulate florets 7–8, 7–9 mm long, with isolated, ligules white, oval, 3–4 mm long, 2.5–3.5 mm wide, shallowly 3 roundish lobed at apex, tube pellucidly dotted; Disk florets 25–40, bisexual, white, tubular, 5-lobed, 3–5 mm long, glandular. Stamens 5, syngenesious. Achenes oblanceolate, 2–2.5 mm long, 1–1.5 mm wide, winged, wing somewhat thick, brown, pappus absent. Flowering: Jul to Aug. Fruiting: Sep to Oct.

Specimen examined: KOREA. Gyeongsangbuk-do: Uljin, 36°50'06.84"N, 129°26'31.53"E, elev. 15 m, 1 Sep 2016, E. M. Sun and H. S. Kim, SEM201600831001 (KH).

Notes: Four infraspecific taxa of *A. alpina* are distinguished each other in some morphological characters; incised kinds of leaf margin, wide of head, density of hairs on involucre, diameter of involucre, and length of ligulate tube, etc. (Table 1). *A. alpina* subsp. *alpina* var. *alpina* and subsp. *alpina* var. *discoidea* have pinnately cleft margin, densely villous hair on involucre (Fig. 4A, B) and short (1.5 mm long) ligulate tube. Between above two varieties, subsp. *alpina* var. *discoidea* is characterized by having smaller leaves (4–6 cm long, 5–7 mm wide), smaller heads (4–4.5 mm in diameter), smaller involucre (4–5 mm long, 3–4 mm wide) and shorter ligule limb (1 mm long) (Fig. 4B) than those of subsp. *alpina* var. *discoidea*. Otherwise, *A. alpina* subsp. *pulchra* and subsp. *rhodoptarmica* have dentately or serrately lobed margin, loosely villous hair on involucre (Fig. 4C) and long ligulate tube (2–2.5 mm long) (Fig. 5C). And they are distinguished easily from each other by floret colors and habitats. *A. alpina* subsp. *rhodoptarmica*

Fig. 2. *Achillea alpina* subsp. *pulchra*. **A.** Plant. **B–D.** Capitulum. **E.** Leaf adaxial side. **E'.** Leaf abaxial side. **F.** Cartilaginous leaf teeth. **G.** Bracts of involucre and palea (rightmost). **H.** Ligulate floret and involucre bract. **I.** Disk floret and palea. **J.** Ligulate floret. **K.** Disk floret. **L.** Style. **M.** Anther. **N.** Achene.

Fig. 3. *Achillea alpina* subsp. *pulchra*. **A.** Habit. **B.** Stem. **C.** Cross section of stem. **D.** Peduncle. **E.** Leaf. **F.** Leaf adaxial surface. **G.** Leaf abaxial surface. **H.** Corymb. **I.** Capitula. **J.** Bract of involucre. **K.** Palea. **L.** Ligulate floret. **M.** Disk floret. **N.** Achene.

Fig. 4. Involucres of *Achillea alpina*. **A.** *A. alpina* subsp. *alpina* var. *alpina*. **B.** *A. alpina* subsp. *alpina* var. *discoidea*. **C.** *A. alpina* subsp. *pulchra*.

Table 1. Comparison of morphological characters between *Achillea alpina* subsp. *pulchra* and its related taxa.

Characters	<i>A. alpina</i> subsp. <i>alpina</i> var. <i>alpina</i>	<i>A. alpina</i> subsp. <i>alpina</i> var. <i>discoidea</i>	<i>A. alpina</i> subsp. <i>pulchra</i>	<i>A. alpina</i> subsp. <i>rhodoptarmica</i>
Habits	Perennial	Perennial	Perennial	Perennial
Habitat	Mountain	Mountain	Seashores	Mountain
Plant height (cm)	30–80	30–80	60–80	50–80
Leaf blade	shape	Linear-lanceolate	Linear-lanceolate	Linear-lanceolate
	length (cm)	6–10	5–9	5–6
	width (mm)	7–17	9–13	5–8
	apex	Acute to obtuse	Acute to obtuse	Acuminate
	margin	Bi-pinnately cleft	Dentate or serrate	Dentate or serrate
Capitulum	diameter (mm)	7–9	9–12	6–7
Involucre	shape	Semi-globose	Semi-globose	Semi-globose
	hair	Densely villous	Loosely villous	Loosely villous
	length (mm)	5	5–5.5	4–5
	width (mm)	4–5 (7)	4.5–5.5	3–4
	row	3	3	3
Ligulate floret	colour	White	White	Red or pink
	number	5–7	7–8	-
	length (mm)	4–4.5	3–4	4–5
	width (mm)	2.5–3	2.5–3.5	2.7–3.2
	apex	3-lobed	3-lobed	3-lobed
	limb length (mm)	3–4.5	2.5–4	2–2.5
	tube (mm)	1.5	2–2.5	2–2.5
	apex	5-lobed	5-lobed	5-lobed
Disk floret	length (mm)	2–3	3–5	2.5
	width (mm)	2–3	2–2.5	2–2.5
Achene	length (mm)	2–3	2–2.5	2–2.5
	width (mm)	1–1.2	1–1.5	1

Fig. 5. Ligulate floret of *Achillea alpina*. **A.** *A. alpina* subsp. *alpina* var. *alpina*. **B.** *A. alpina* subsp. *alpina* var. *discoidea*. **C.** *A. alpina* subsp. *pulchra*.

Fig. 6. Digital images of specimens of *Achillea alpina* in the University of Tokyo (TI). **A.** *A. alpina* subsp. *pulchra*. **B.** *A. alpina* subsp. *rhodoptarmica*.

has red or pink florets and is distributed only in mountainous region of Gilju and Myeongcheon, Hamgyeongbuk-do (Im, 1999). Because there was no specimen of subsp. *pulchra* and subsp. *rhodoptarmica* in any herbarium of Korea, its morphological characters were gathered from digital images of specimens deposited in the University of Tokyo (TI) (Fig. 6) and literatures (Koidzumi, 1918; Kitamura, 1968). Otherwise subsp. *pulchra* has white florets and is distributed in coastal area of Gyeongsangbuk-do, Uljin.

Key to *A. alpina* subsp. *pulchra* and its related taxa in Korea

1. Leaves pinnately to parted, segments linear
..... *A. alpina* subsp. *alpina* var. *alpina*
2. Capitula campanulate or elliptic, ligulate florets less than 3 mm long
..... *A. alpina* subsp. *alpina* var. *discoidea*
2. Capitula semi-globose, ligulate florets more than 3 mm long
1. Leaves minutely dentate or serrated-lobed, segments acute
3. Ligulate florets white *A. alpina* subsp. *pulchra*
3. Ligulate florets red or pink
..... *A. alpina* subsp. *rhodoptarmica*

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Literature Cited

- Davis, P. H. 1975. Flora of Turkey and the East Aegean Islands. Vol. 5. Edinburgh University Press, Edinburgh, 890 pp.
- Ehrendorfer, F. and Y.-P. Guo. 2006. Multidisciplinary studies on *Achillea sensu lato* (Compositae-Anthemideae): New data on systematics and phylogeography. *Willdenowia* 36: 69–87.
- El-Shazly, A. M., S. S. Hafez and M. Wink. 2004. Comparative study of the essential oils and extracts of *Achillea fragrantissima* (Forssk.) Sch Bip. and *Achillea santolina* L. (Asteraceae) from Egypt. *Pharmazie* 59: 226–230.
- Guo, Y.-P., J. Saukel, R. Mittermayr and F. Ehrendorfer. 2005. AFLP analyses demonstrate genetic divergence, hybridization, and multiple polyploidization in the evolution of *Achillea* (Asteraceae-Anthemideae). *New Phytologist* 166: 273–290.
- Hara, H. 1938. Preliminary report on the Flora of southern Hidaka, Hokkaido (Yezo) XXIV. *Botanical Magazine Tokyo* 52: 1–8.
- Im, R. J. 1999. Flora Coreana Vol. 7 (Asteraceae). The Science and Technology Publishing House, Pyongyang. Pp. 136–145.
- Koyama, H. 1995. Asteraceae (Compositae). In *Flora of Japan*, IIIb, Angiospermae, Dicotyledoneae, Sympetalae (b). Iwatsuki, K., T. Yamazaki, D. E. Boufford and H. Ohba (eds.), Kodansha, Tokyo. Pp. 77–78.
- Kitamura, S. 1968. Compositae of Southeast Asia and Himalayas I (in Japan). *Acta Phytotaxonomica et Geobotanica* 22: 1–19.
- Koidzumi, G. 1918. Contributiones ad florum Asiae orientalis (Continued from Vol. XXXI). *Botanical Magazine Tokyo* 32: 53–63.
- Saukel, J., M. Anceev, Y. P. Guo, A. Vitkova, A. Nedelcheva, V. Goranavo, A. Konakchiev, M. Lambrou, S. Nejati, F. Rauchensteiner and F. Ehrendorfer. 2003. Comments on biosystematics of *Achillea* (Asteraceae-Anthemideae) in Bulgaria. *Phytologia Balcanica* 9: 361–400.