The first record of *Agrimonia gorovoi* Rumjantsev in Korea (Rosaceae)

Kyong-Sook Chung*

Department of Medicinal Plant Science, Jungwon University, Goesan 28024, Korea

(Received 30 May 2017; Revised 19 June 2017; Accepted 23 June 2017)

ABSTRACT: The distribution of *Agrimonia gorovoi* Rumjantsev in Korea is verified in this study. The species, described as from Primorsky Krai in Russia, was found in Chungcheongnam-do, Gangwon-do, Gyeonggi-do, and Jeollabuk-do provinces and in Incheon, South Korea. The species is characterized by ten stamens, deeply serrated leaflet margins, and long horizontal pilose stems. A Korean name, Gorovoi-jip-sin-na-mul, for the species is newly given, and a taxonomic description of the species and key to four Korea native *Agrimonia* taxa are presented.

Keywords: *Agrimonia*, *Agrimonia gorovoi*, flora of Korea, Rosaceae

Agrimonia L. (1753) comprises about 20 species occurring mainly in temperate zones throughout North America, Central America, the West Indies, southern South America, Europe, Asia, and the southern parts of Africa (Hutchinson, 1964; Robertson, 1974; Kalkman, 2004; Chung, 2008; Kline and Sørensen, 2008). The genus is a perennial herb with rhizomes and yellow flowers on raceme inflorescences, characterized by interrupted pinnately compound leaves and hooked bristly epicalyx segments, and has the type species of *A. eupatoria* L. (Wallroth, 1842; Skalický, 1973; Kalkman, 2004; Chung, 2008) (Fig. 1). The basic chromosome number is $x = 7$, and a range of ploidy levels has been reported ($4x$, $6x$, and $8x$) (Hara and Kurosawa, 1968; Iwatsubo et al., 1993; Kwon et al., 2005). Infrageneric classifications have been proposed based on epicalyx and leaf characteristics (Wallroth, 1842; Skalický, 1973), and some species such as *A. pilosa* Ledeb. and *A. eupatoria* have been used for medicinal and horticultural purposes (Dulger and Gonuz, 2004; Park et al., 2012). Recent molecular phylogenetic investigations consider the genus in subtribe Agrimoniinae, tribe Sanguisorbeae, supertribe Rosodae, subfamily Rosoideae (Eriksson et al., 2003; Potter et al., 2007).

In Korea, three *Agrimonia* taxa have been recognized: *A. coreana* Nakai, *A. nipponica* Koidz., and *A. pilosa* Ledeb., (Chung and Kim, 2000; Choi, 2007). Previously, Park (1974) verified five taxa (*A. pilosa*, *A. pilosa* var. *nepalensis* (D. Don) Nakai, *A. pilosa* var. *nipponica* (Koidz.) Ohwi, *A. pilosa* var.

coreana (Nakai) Liou & Y. L. Chang, and *A. pilosa* f. *davurica* Nakai) in Korea, but most Korean botanists recognized two taxa (*A. pilosa* and *A. coreana*) (Lee, 1980; Lee, 1996; Lee, 2003; Lee, 2006). Flower and fruit sizes, stamen numbers, and leaf and stipule shapes provide diagnostic characteristics for each taxon (Chung and Kim, 2000; Choi, 2007). *Agrimonia pilosa* occurs throughout Eurasia, whereas *A. coreana* and *A. nipponica* occur in East Asia (Chung, 2008). In addition, *A. pilosa* is octoploidy, and *A. coreana* and *A. nipponica* are tetraploidy (Chung, 2008; Kwon et al., 2005). *A. coreana* grows only in mountain areas and flowers approximately one month earlier than the other two species in South Korea (Chung and Kim, 2000).

Agrimonia gorovoi Rumjantsev (1987) was first described from Primorsky Krai, Russia. He distinguished the species by deeply serrated leaflet margins, long horizontal pilose stems, and short-node rhizomes occurring in small populations in humid or swampy grasslands in Khasan (Rumjantsev, 1987) (Fig. 2). Herbarium specimens of *A. gorovoi* were collected in South Korea (Chung, 1999). The specimens resemble *A. pilosa* overall but have deeply serrated leaflets and long hairs on stems (Chung, 1999). However, Chung (1999) failed to identify the specimens and find natural populations of the specimens. To verify the distribution of the species in Korea, the original description, a type specimen, and herbarium collections from Korea were investigated. In addition, field surveys were conducted at the type locality in Russia and herbarium specimen

*Author for correspondence: kchung@jwu.ac.kr

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Fig. 1. Major vegetative and reproductive characters in *Agrimonia* adopted from Chung (2008). **A.** Interrupted pinnately compound leaf: a, terminal leaflet; b–d, lateral leaflets (b, 1st lateral leaflet; c, 2nd lateral leaflet; d, 3rd lateral leaflet); e, f, interstitial leaflets (e, 1st interstitial leaflet; f, 2nd interstitial leaflet); g, stipules. **B.** Flower (petals removed): 1, pedicle bracteole; 2, pedicel; 3, hypanthium bracteole; 4, epicalyx segments; 5, hypanthium. **C.** Fruiting hypanthium: 4, epicalyx segments.

Fig. 2. *Agrimonia gorovoi* Rumjantsev adopted from Rumjantsev (1987). **A.** Pinnately compound leaf with stipules. **B.** Fruiting hypanthium. **C.** Rhizome: a, young shoot (next year); b, old shoot (last year).

collection sites in South Korea. The species is distinctive with deeply serrated leaflet margins and horizontal long hairs (Fig. 2). Recently, natural populations and additional herbarium specimens of the species have been found in Korea.

Taxonomic Treatment

Agrimonia gorovoi Rumjantsev, Bot. Zhurn. (Moscow & Leningrad) 72: 1258, 1987.—TYPE: Russia. Primorsky, Chassan (Khasan), 20 Aug 1986, *P. G. Gorovoi* & *S. Rumjantsev* s.n. (holotype, MHA; isotypes, A![barcodeA00026008], B, L, LPLE, MO, MW, US, VLA).

Korean name: Gorovoi-jip-sin-na-mul (고로보이쥘신나물).

Plant perennial herbs 40–150 cm tall. Roots fibrous on well-developed, short node rhizomes (15–25 mm long). Stems erect, rarely branched above, sparsely long horizontal brownish pilose (ca. 3 mm long). Leaves caulescent, alternate; leaflets (terminal and lateral leaflets) 7–9 in mid-caulis, sessile; terminal leaflets obovate, apex obtuse, base cuneate, margins deeply serrated, 4.3–4.8 × 1.8–2.0 cm, pilose scattered adaxially, pilose and glandular hairs abaxially; lateral leaflets obovate, apex obtuse, base cuneate, margins deeply serrated, largest ones smaller than terminal leaflets by 1 cm long, first interstitial leaflets 3 pairs

Fig. 3. Type and voucher specimens of *Agrimonia gorovoi* Rumjantsev. **A.** Isotype collected in Primorsky Krai, Russia, 20 Aug 1986, *P. G. Gorovoi* et *S. Rumjantsev* s.n. (A). **B.** Voucher specimen collected in Jeollabuk-do province, South Korea, 2 Aug 1959, *T. H. Chung* 26079 (SKK).

with 2 different sizes, middle pair ones largest ca. 1 cm long, other interstitial leaflets usually 1 pair. Stipules flabelliform-falcate, horizontally spreading, regularly incised, ca. 2×1.5 cm. Inflorescences raceme, mainly terminal, loose (ca. 8 fully bloomed flowers/5 cm long-inflorescence). Flowers ca. 13 mm across; pedicel 2.5–3 mm long; pedicel bracteoles 1, deeply tri-fid, hypanthium bracteoles 2, tri-fid; hypanthia obconical, pubescent and glandular; epicalyx segments numerous, persistent, cylindrical, curved at the tip, ca. 1 mm long; petals 5, golden yellow to yellow, obovate, ca. 5×2.4 mm; stamens 10, persistent; filaments light yellow; anthers yellow, capitate, basifixed, dehiscence longitudinal; pistils 2, persistent, simple, free; ovaries pendulous, stylopodial present; locule 1, placentation base; styles 2, pale yellow, filiform, 2–3.5 mm; stigmas reniform, dilated. Achenes 1 or 2 per fruiting hypanthium; fruiting hypanthia semi-obconical or obconical, pilose and glandular, broadly sulcate, many ascending hooked bristly epicalyx segments on upper edges, $(4.38\text{--}5.23\text{--}5.67) \times (3.12\text{--}3.78\text{--}4.01)$ mm.

Flowering: Jun. to Sep.

Distribution: Russia (Primorsky Krai), Korea; sunny meadows and mountain trails.

Specimens examined: RUSSIA. Primorsky: Chassan (Khasan), 20 Aug 1986, *P. G. Gorovoi* & *S. D. Rumjantsev* s.n. (A), 26 Aug 1986, *P. G. Gorovoi* & *S. D. Rumjantsev* s.n. (MO), 17 Aug 2015, *K.-S. Chung* et al. s.n. (KH).

KOREA. Chungcheongnam-do: Gongju-si, Yogu-eup, Sindal-ri, Mt. Beophwasan, 24 Sep 2015, *E.-H. Jung* et al. *Beophwa150709* (KB); Gangwon-do: Pyeongchang-gun, Daegwallyeong siheomjang, 20 Aug 1969, *T.B. Lee* s.n. (SNUA); Gyeonggi-do: Ansan-si, Danwon-gu, Seongam-dong, 20 Oct 2012, *Lee & Lee* s.n. (KB), 23 Sep 2016, *K.-S. Chung* 4055, 4056 (KH); Incheon: Ganghwa-gun, Yangdo-myeon, Dojang-ri, Mt. Jingangsang, 19 Jul 2014, *J.-H. Kim* et al. *Jingang140478* (KB); Jeollabuk-do: Mt. Deogyusansan, 2 Aug 1959, *T. H. Chung* 26079 (SKK).

Taxonomic note: This study expands the distribution range of *A. gorovoi* to Korea, increasing floristic diversity in the

Korean Peninsula. The species resembles *A. pilosa* in leaf shape and fruiting hypanthium size, but is distinguished by deeply serrated leaflet margins and brownish horizontal long pilose stems (Figs. 2, 3). In common, natural populations in Russia and Korea are small and scatter with less than 10 individuals per population. They grow in sunny, open meadows or along mountain trails from 40 to 360 m in elevation. Isotypes of the species isotypes are deposited in a various herbaria, but the collection date of isotypes in MO and B herbaria differs from the holotype collection date of August 20. Verification of the type specimen is needed. Out of 20 species in the genus, four taxa occurs in Korea: *A. coreana*, *A. nipponica*, *A. pilosa*, and *A. gorovoi*. An Eurasian species, *A. pilosa*, is an octoploid, whereas Eastern Asian species, *A. coreana* and *A. nipponica*, are tetraploids (Chung, 2008). The ploidy level of *A. gorovoi* is unknown. Its small-sized and numbered populations require genetic investigations to develop proper conservation and management strategies in evolutionary as well as ethnobotanical aspects.

Key to the species of *Agrimonia* in Korea

1. Lateral leaflets 1–2 pairs in mid-caules, abaxial surface of leaflets densely glandular and tomentose
 2. Flowers more than 10 mm in diameter, stamens 14–18, fruiting hypanthia more than 7 mm long, stipules flabellate *A. coreana* Nakai (산쥬신나물)
 2. Flowers less than 10 mm in diameter, stamens 5–10, fruiting hypanthia less than 7 mm long, stipules falcate *A. nipponica* Koidz. (좁쥬신나물)
1. Lateral leaflets 3–5 pairs in mid-caules, abaxial surface of leaflets scatter glandular or pubescent
 3. Leaflet margins dentate or serrate, stipule margins irregularly dentate, serrate, or entire, stem surfaces whitish non-horizontal pilose *A. pilosa* Ledeb. (쥬신나물)
 3. Leaflet margins deeply serrate, stipule margins regularly incised, stem surfaces brownish, horizontal pilose *A. gorovoi* Rumjantsev (고로보이쥬신나물)

Acknowledgments

The author thank Dr. Feruza Mustafina for the help with Russian references, and would like to thank the curators and staff members of the following herbaria for loans of herbarium specimens: Sung Kyun Kwan University (SKK), Seoul National University (SNUA), Chonnam National University Herbarium (CNU), National Institute of Biological

Resources (KB), and Korea National Arboretum (KH). The comments of two anonymous reviewers and Club J refined the manuscript.

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