



## First record of invasive species *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Brassicaceae) in Korea

Seong-Hyun Cho and Young-Dong Kim\*

Department of Life Science, Hallym University, Chuncheon 200-702, Korea

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### 한국 미기록 귀화식물: 마늘냉이(십자화과)

조성현 · 김영동\*

한림대학교 생명과학과

**ABSTRACT:** *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Brassicaceae) is an invasive species which is native in Europe and SW Asia. This species is currently invading the understory of mature temperate forests of North America. In Korea, *A. petiolata* is found to invade and colonize areas at forest margins along roadsides (Samcheok-si, Gangwon-do). This initial investigation serves to inform of the importance of early detection and extermination of this particular weed in Korea.

**Keywords:** unrecorded plant, Brassicaceae, invasive plant, *Alliaria*

**적 요:** 마늘냉이(*Alliaria petiolata* (M. Bieb.) Cavara & Grande)는 유럽과 서남아시아 원산의 십자화과 침입 식물로서 현재 북미의 삼림 하부를 교란시키고 있는 것으로 알려져 있다. 이 종이 강원도 삼척시의 길가 숲을 따라 침입하여 우리나라에도 자라고 있는 것으로 확인되었다. 국내 확산을 막기 위한 기초 정보를 제공하기 위해 이 종에 대한 확인 결과를 보고하고자 한다.

**주요어:** 미기록식물, 십자화과, 침입식물, 마늘냉이속

Brassicaceae (Cruciferae) are pantropical family with 338 genera and ca. 3,700 species which is distributed worldwide (Al-Shehbaz et al., 2006). Most of the taxa are found in temperate regions of the northern hemisphere. According to Koch and Kiefer (2006), however, numerous genera are also found in the southern hemisphere (such as *Draba*, *Lepidium* and *Cardamine*), and some genera are endemic in southern regions (South African genera: *Heliophila*, *Silicularia*, *Brachycarpa*, *Chamira* and *Schlechteria*). In South Korea, there are 29 genera with 77 species, including some introduced species (Oh, 2007).

During a floristic survey of the eastern coastal area of South Korea, a specimen (Cho and Kim 120518-01, HHU) was collected from Samcheok-si (Gangwon-do), and was identified as *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Figs. 2, 3). *Alliaria* Heister ex Fabricius is comprised of two species native in Europe and Southwestern Asia, and naturalized elsewhere as a cosmopolitan weed (Cheo et al., 2001a). *A. petiolata* is also a biennial (and sometimes perennial) species which is distributed within Morocco, the British Isles, north to northern Scandinavia, east to northern India, and western China (Cheo et al., 2001a).

Since the introduction of this weed to the United States as a culinary herb in the 1860s, *A. petiolata* has become one of the most problematic invaders of mesic temperate forests in North America, being the dominant understory species in

\*Author for correspondence: ydkim@hallym.ac.kr

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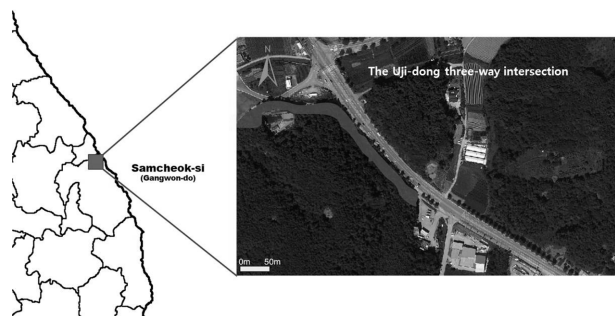
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woodland and flood plain environments, where eradication is difficult (Luken and Thieret, 1997; Cheo et al., 2001a). It has also spread to New Zealand (Bangerter 1985) and North America (Cavers et al. 1979, Gleason and Cronquist 1991).

In the publication of molecular phylogenetic studies based on nuclear Phytochrome A (*PHYA*) (Beilstein et al., 2008), the chloroplast *ndhF* (Beilstein et al., 2008), nuclear chalcone synthase gene (*Chs*) (Zhao et al., 2010), *Alliaria petiolata* and *Thlaspi arvense* L. appeared as sister taxa within the tribe Thlaspiaceae. Morphologically, *Alliaria* and *Thlaspi* differ in the shape of their fruit; *Alliaria* fruit being a terete, and *Thlaspi* fruit an angustiseptate (broad, flat capsule, laterally compressed with a narrow septum) (Cheo et al., 2001a; Cheo et al., 2001b).

In S. Korea, *Alliaria petiolata* has been discovered to be spreading in Samcheok-si, Gangwon-do. The species was found to be invading and colonizing areas at forest margins along roadsides (Figs. 1, 2, 3), in a forest occupied by *Robinia pseudoacacia* L., *Pinus rigida* Mill., *Ailanthus altissima* (Mill.) Swingle. Other members in the forest included *Achyranthes japonica* (Miq.) Nakai, *Boehmeria longispica* Steud., *Commelina communis* L., *Dryopteris lacera* (Thunb.) Kuntze, *Equisetum arvense* L., *Eupatorium rugosum* Houtt., *Humulus japonicus* Siebold & Zucc., *Isodon inflexus* (Thunb.) Kudo, *Polygonum posumbu* Buch.-Ham. ex D. Don, *P. thunbergii* Siebold & Zucc., *Rubus oldhamii* Miq., *Stellaria aquatica* (L.) Scop.

*Alliaria petiolata* was given the Korean name 'Ma-neul-naeng-i' based on the English name garlic mustard. As of the present, this species is only known to be distributed in Samcheok-si. This initial investigation serves to inform of the importance of early detection and extermination of this particular weed in Korea, where invasive species can easily be transported to other areas. A monitoring program should also be initiated in order to detect early invasions of the species in other parts of the country.



**Fig. 1.** The population of *Alliaria petiolata* (M. Bieb.) Cavara & Grande in Samcheok-si, Gangwon-do. The species was found to be invading and colonizing areas at forest margins along roadsides (shaded area).

## Description

*Alliaria* Heister ex Fabricius, Enum. 161. 1759.

Annual or biennial herbs with garlic smell when crushed, glabrous or pubescent, trichomes simple. Stems erect, branched, sparsely hairy below with simple hairs. Leaves basal and cauline; basal leaves long, petiolate, ovate-cordate, crenate, dentate; cauline leaves petiolate, ovate-triangular, dentate. Inflorescence racemes elongated in fruit; pedicels spreading or ascending, thickened in fruit. Flowers: sepals 4, erect, oblong, glabrous, lateral pair not saccate at base; petals 4, white, oblanceolate, ca. two times longer than sepals, narrowed below, apex obtuse; stamens 6, weakly tetradynamous; filaments without appendage; anthers short, ovate or oblong; nectar glands confluent, subtending bases of stamens; ovary cylindrical-terete, 4–20-ovuled; style short, obsolete or distinct, to 6 mm; stigma depressed-capitate, entire. Fruit silique, dehiscent, linear, oblong, terete to subterete, or 4-angled; valves each with prominent midvein and distinct marginal veins, glabrous or scabrous; replum rounded; septum complete, not veined. Seeds plump, oblong, not winged; seed coat longitudinally striate, not mucilaginous when wetted.

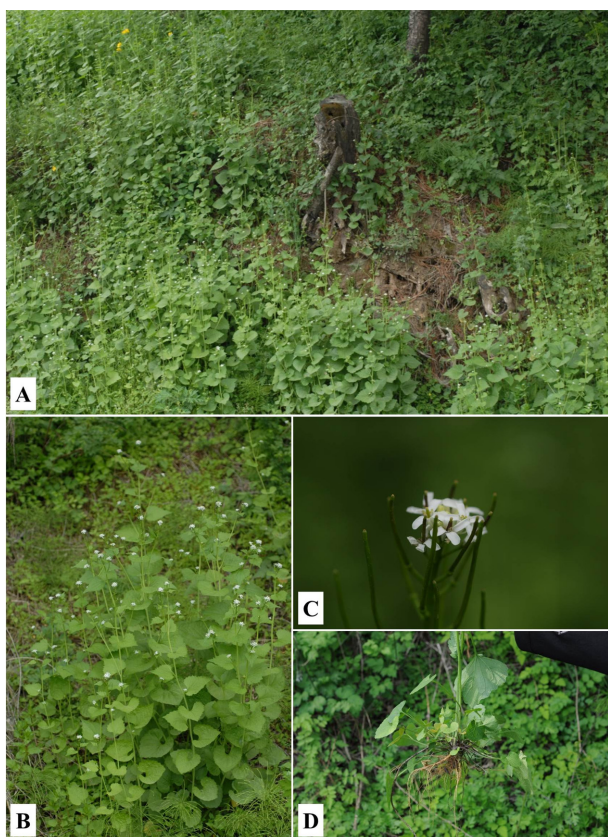
Two species: one endemic to the Caucasus region, the other native to Europe and Southwestern Asia and introduced elsewhere in North America, Asia and Europe.

*Alliaria petiolata* (M. Bieb.) Cavara & Grande, Bull. Orto Bot. Regia Univ. Napoli. 3: 418, 1913.

Korean name: Ma-neul-naeng-i (마늘냉이)

*Arabis petiolata* M. Bieb., Fl. Taur.-Caucas. 2: 126, 1808; *Alliaria alliacea* (Salisb.) Britten & Rendle; *Alliaria fuchsii* Rupr.; *Alliaria mathioli* Rupr.; *Alliaria officinalis* Andr. ex DC.; *Arabis alliaria* Bernh.; *Clypeola alliacea* Crantz; *Crucifera alliaria* E.H.L. Krause; *Erysimum alliaceum* Salisb.; *Erysimum alliaria* L.; *Erysimum cordifolium* Pall.; *Hesperis alliaria* (L.) Lam.; *Sisymbrium alliaceum* Salisb.; *Sisymbrium alliaria* (L.) Scop.

Biennial herb, 20–100 cm tall, erect. Stems simple or branched above, glabrous or hairy basally. Basal leaves loosely rosulate; petiole 3–12 cm, glabrous or pilose; blade cordate to reniform, 1.7–4 × 1.5–5 cm, base cordate, margin dentate, apex obtuse, adaxial surface glabrous, abaxial surface glabrous or hairy along the vein. Cauline leaves: petiole 1–10 cm, glabrous or sparsely pilose; blade ovate, cordate, or deltoid, 6–10.5 ×



**Fig. 2.** *Alliaria petiolata* (M. Bieb.) Cavara & Grande. A, B, Habit; C, Inflorescence; D, Basal leaves and roots.

6.5–10.5 cm, base cordate or truncate, margin dentate, apex acute, adaxial surface glabrous, abaxial surface glabrous or sparsely pilose along the vein. Racemes 10–25-flowered, lowermost flowers bracteate; pedicels 3–5 mm in fruit. Flowers: sepals 2.5–3.5 × 0.7–1.5 mm; petals 4–8 × 2–3 mm; filaments 2–3.5 mm; anthers oblong, 0.7–1 mm; style 1–2 mm. Siliques linear, 4-angled or subterete, 3–7 × 1.2–2.5 mm. Seeds oblong, 2–4.5 × 0.7–2 mm, dark brown or black.

Fl. Apr.–Jun.

Fr. May–Jul.

Distribution: Afghanistan, China, India, Kashmir, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, Russia, Tajikistan, Turkmenistan, Uzbekistan; native to Europe and Southwestern Asia; introduced elsewhere in North America, Asia and Europe

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**Fig. 3.** An examined specimen of *Alliaria petiolata* (M. Bieb.) Cavara & Grande (Cho and Kim 120518-01, HHU).

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