سرده پیاز (تیره نرگسیان) در ایران: وضعیت گونه پیاز تره‌ای و خویشاوندانش

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چکیده. *Allium ampeloprasum* به‌عنوان یک آرایه جدید برای فلور ایران گزارش می‌شود. این گونه از نظر ریخت‌شناسی بسیار شبیه به گونه‌های *Allium atroviolaceum* و *Allium iranicum* است. ریخت‌شناسی این گونه با دو گونه نزدیک آن مقایسه و توضیحاتی در مورد رابطه خویشاوندی آنها ارایه می‌شود. شرح کامل، تصاویر گیاه در رویشگاه طبیعی و نقشه پراکنش آن در ایران نیز نمایش داده می‌شود. علاوه براین، لکتوتیپ گونه *A. atroviolaceum* در این مطالعه معرفی می‌گردد.

واژه‌های کلیدی. آرایه‌شناسی، آسیا، الگوی پراکنش، فلور، لکتوتیپ

The genus *Allium* (Amaryllidaceae) in Iran: on the status of *Allium ampeloprasum* L. and its relatives

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Abstract. *Allium ampeloprasum* (Amaryllidaceae) is recorded as a new taxon for the flora of Iran. It is morphologically most similar to *Allium atroviolaceum* and *Allium iranicum*. This species is compared with its two aforementioned relative species and some notes are given on its affinities. A full description, images and a distribution map are also provided. In addition, a lectotype is selected for *A. atroviolaceum*.

Keywords. Asia, distribution pattern, flora, lectotype, taxonomy

INTRODUCTION

The genus *Allium* L. (Amaryllidaceae) comprises more than 900 species, making it one of the largest monocotyledonous genera (Govaerts *et al*., 2013). *Allium* species have adapted to diverse habitats and display a remarkable polymorphism, which is the main reason for the widely recognized difficulties in their taxonomy and classification (Fritsch & Friesen, 2002). Members of *Allium* are distributed mainly in the Mediterranean regions, southwestern and parts of Central Asia (Mathew, 1996; Fritsch *et al*., 2010). Southwestern Asia, especially Iran, is known as an important center of diversity of this genus (Akhavan *et al*., 2014). The most recent classification of the genus proposes 15 subgenera and 56 sections in the genus (Friesen *et al*., 2006). This genus has been reported with 139 species in the area of Flora Iranica, among which 75 species are present in Iran (Wendelbo, 1971).

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The recent investigations have shown that this number should be increased considerably (Khassanov *et al*., 2006; Razyfard *et al*., 2011; Memariani *et al*., 2012). Currently, about 121 species are known to grow in Iran (Fritsch & Maroofi, 2010) classified into 7 subgenera and 29-30 sections (Friesen *et al*., 2006; Fritsch *et al*., 2006). *Allium* subg. *Allium* is the largest subgenus, comprising almost 40% of the total species (ca. 280 species) classified in 10 sections (Hanelt, 1996; Friesen *et al*., 2006).

Allium sect. *Allium* is one of the most economically important sections of the genus, comprising several medicinal and edible species such as *A. porrum* L. (leek), *A. sativum* L. (garlic), and *A. ampeloprasum* L. (wild leek). The species of the section bear well-developed bulbs, solid (V-shaped or flat) or fistulose leaves and stamens arranged in two whorls, the outer three usually simple and the inner three markedly tricuspidate (Mathew, 1996). It has been suggested that those members distinctly dimorphic in stamens, i.e. the members of *A.* sect. *Allium*, stand apart from the other sections of *A.* subg. *Allium* (Hanelt, 1996).

Allium sect. *Allium* comprises about 112–115 species worldwide, of which at least 30, including 6 endemics, grow in Alborz and Zagros mountain ranges in the North and the West of Iran (Wendelbo, 1971; Mathew, 1996; Hosseinzadeh *et al*., 2009; Miryeganeh & Movafeghi, 2009). Wendelbo (1971) listed two subspecies under *A. ampeloprasum*: subsp. *iranicum* Wendelbo and subsp. *ampeloprasum* in Iran. However, he considered *A. ampeloprasum* subsp. *iranicum* to be distributed only in Iran, and separated it from *A. atroviolaceum* Boiss. by having acute tepals and stamen filaments non-verrucate on surface. Later on, this subspecies was raised to specific rank as *A. iranicum* (Wendelbo) Wendelbo, still considered to be closely related to *A. ampeloprasum* which should be absent in Iran wildly (Wendelbo, 1985).

The reports showed that *A. ampeloprasum* comprises a species complex with various ploidy levels of 2n = 16-64 (Hirschegger *et al*., 2010; Guenaoui, *et al*., 2013) over the Mediterranean countries (Mathew, 1996; Fritsch & Friesen, 2002). The members of the complex were divided into four horticultural groups: leek, kurrat, great headed garlic (GHG) and pearl onion (Jones & Mann, 1963). Other domesticated species were later recorded as Tare Irani, Prei-anak, pearl-onion, and mushu-ninniku (Tahbaz, 1971; Van der Meer & Hanelt, 1990; Ariga *et al*., 2002). Based on the recent molecular data, the tetraploid accessions of *A. ampeloprasum* form a single subgroup closely related to *A. atroviolaceum* and *A. iranicum*, but interspecific relationships still remain unresolved (Hirschegger *et al*., 2010).

The aims of the present study were: 1) to clarify possible occurrence of *A. ampeloprasum* in Iran, 2) to provide a complete description for this taxon, and 3) to compare it with its close relatives, i.e. *A. atroviolaceum* and *A. iranicum.*

Table 1. Collection data for three species of *Allium* sect. *Allium* examined in Iran.

Species	Collection data
A. ampeloprasum L.	Mazandaran: SE Behshahr, Hezarjarib village, 1900 m, M. Khorasani 45224 (TUH); SW Sari, Dodangeh dam, 1350 m, M. Khorasani 5983 (GUH); S Babol, Khajeh Kola village, 1300 m, M. Khorasani & M. R. Rahimi 5984 (GUH).
A. atroviolaceum Boiss.	Mazandaran: Babol, 3 km to Mosakheyl village, toward Mehdikheyl village, 600 m, M. Khorasani 5985 (GUH) Kurdestan: Dehgolan, Sis village, 1904 m, M. Khorasani 5986 (GUH). Hamedan: 2 km to Asad Abad, 1672 m, M. Khorasani 5987 (GUH).
A. iranicum (Wendelbo) Wendelbo	Mazandaran: Haraz road, Vana region, 1439 m, M. Khorasani 5988 (GUH). Kordestan: Road of Kooleh to Divandarreh, 15 km to Divandarreh, Tazeh Abad village, 2120 m, M. Khorasani 5989 (GUH). Hamedan: Asad Abad, after Khandagh village, Ghasem abad village, Karkas mountain (Karkasin) 2896 m, M. Khorasani 5990 (GUH).

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MATERIALS AND METHODS

In order to address the status of *A. ampeloprasum* in Iran, extensive field collections were conducted during 2014-2016 in Iran. Many parts of Alborz and Zagros mountain ranges were visited by the first author. The sampling was focused on the following taxa: *A. ampeloprasum*, *A. atroviolaceum* and *A. iranicum*. The specimens were studied and photographed in field from several localities and scored for certain morphological features. A list of voucher specimens for this study, held in the herbaria GUH (Guilan University Herbarium) and TUH (University of Tehran Herbarium), is provided in Table 1. In addition, we examined the photographs of the type materials provided by various virtual herbaria and 'Global Plants on JSTOR' (https://plants.jstor.org/) of the mentioned taxa.

RESULTS AND DISCUSSION

Taxonomic treatment

Allium ampeloprasum L., Sp. Pl. 294 (1753) (Fig. 1).

Syn.: *Porrum sativum* (L.) Mill., Gard. Dict. (ed. 8) 1, 1768; *P. ampeloprasum* (L.) Mill., Gard. Dict. (ed. 8) 2, 1768; *Allium laetum* Salisb., Prodr. Stirp. Chap. Allerton 235, 1796; *A. porrum* var. *ampeloprasum* (L.) Mirb., Dict. Sci. Nat. (ed. 2) 1: 384, 1816; *A. porraceum* Gray, Nat. Arr. Brit. Pl. 2: 181, 1821; *A. halleri* G. Don, Monogr. All. 15, 1827; *P. commune* Rchb., Fl. Germ. Excurs. 111, 1830; *P. amethystinum* Rchb., Fl. Germ. Excurs. 140(16), 1831; *A. ascendens* Ten., Syll. Pl. Fl. Neapol. 164, 1831; *A. holmense* Mill. ex Kunth, Enum. Pl. 4: 384, 1843; *A. ampeloprasum* var. *porrum* (L.) J.Gay, Ann. Sci. Nat., Bot. III, 8: 218, 1847; *A. adscendens* Kunth, Enum. Pl. 4: 385, 1843; *A. pylium* De Not., Index Sem. (Genoa) 30. 1843; *A. lineare* Mill. [illeg. non L.], Enum. Pl. [Kunth] 4: 419, 1843; *A. bertolonii* De Not., Repert. Fl. Ligust. 414, 1844; *A. spectabile* De Not., Repert. Fl. Ligust. 414, 1844; *A. babingtonii* Borrer, Engl. Bot. t. 2906, 1849; *A. durieuanum* Walp., Ann. Bot. Syst. 1: 860, 1849; *A. byzantinum* K.Koch, Linnaea 22: 240, 1849; *A. albescens* Guss., Enum. Pl. Inarim. 338, 1855; *A. gasparrinii* Guss., Enum. Pl. Inarim. 337, 1855; *A. ampeloprasum* var. *babingtonii* (Borrer) Syme, Engl. Bot. ed. 3, 9: 204, 1869; *A. ampeloprasum* var. *bulbiferum* Syme, Engl. Bot. ed. 3, 9: 204, 1869; *A. duriaeanum* Regel [illeg.], Trudy Imp. S.-Peterburgsk. Bot. Sada 3(2): 54, 1875; *A. ampeloprasum* var. *wiedemannii* Regel, Trudy Imp. S.-Peterburgsk. Bot. Sada 3(2): 55, 1875; *A. ampeloprasum* var. *bertolonii* (De Not.) Nyman, Consp. Fl. Eur. 735, 1882; *A. ampeloprasum* var. *gasparrinii* (Guss.) Nyman, Consp. Fl. Eur. 735, 1882; *A. ampeloprasum* subsp. *halleri* Nyman, Consp. Fl. Eur. 735, 1882; *A. ampeloprasum* subsp. *thessalum* (Boiss.) Nyman, Consp. Fl. Eur. 735, 1882; *A. scorodoprasum* subsp. *babingtonii* (Borrer) Nyman, Consp. Fl. Eur. 736, 1882; *A. syriacum* Boiss., Fl. Orient 5: 232, 1882; *A. thessalum* Boiss., Fl. Orient. 5: 232, 1882; *A. ampeloprasum* var. *bulgaricum* Podp., Verh. K. K. Zool.-Bot. Ges. Wien 52: 676, 1902; *A. ampeloprasum* var. *pylium* (De Not.) Asch. & Graebn., Syn. Mitteleur. Fl. 3: 107, 1905; *A. ampeloprasum* var. *ampeloprasum* f. *holmense* (Asch. & Graebn.) Holmboe, Veg. Cyp. 45 1914; *A. ampeloprasum* var. *holmense* Asch. & Graebn., Syn. Mitteleur. Fl. 3: 105, 1905; *A. scopulicola* Font Quer, Butl. Inst. Catalana Hist. Nat. 24: 144, 1924; *A. kurrat* Schweinf. ex K.Krause, Notizbl. Bot. Gart. Berlin-Dahlem 9: 524, 1926; *A. ampeloprasum* var. *gracile* Cavara, Bull. Orto Bot. Regia Univ. Napoli 9(1): 46, 1927; *A. ampeloprasum* subsp. *porrum* (L.) Hayek, Repert. Spec. Nov. Regni Veg. Beih. 30(3): 39 1932; *A. ampeloprasum* var. *caudatum* Pamp., Arch. Bot. (Forlì) 12: 21, 1936; (*A. porrum* var. *kurrat* (Schweinf. ex K.Krause) Seregin, Novosti Sist. Vyssh. Rast. 36: 102. 2004.

Phenology: Flowering in May-June and fruiting in July-August.

Ecology: *Allium ampeloprasum* grows in wet soils in association with other species such as *Urtica dioica* L. and *Salix alba* L. in Iran. It prefers clay soils in the shadow of trees. It is known in several localities in Mazandaran Province as wild and probably has a wider distribution range in humid areas of north Iran. Specimens seen in Iran (Fig. 4): Northeast, Prov. Mazandaran: SE Behshahr, Hezarjarib village, 1900 m, N 36° 39' 43.14", E 53° 38' 23.43", 13 June 2014, M. Khorasani 45224 (TUH); SW Sari, Dodange dam, 1350 m, N 36° 28' 12.94", E 53° 4' 23.86", 29 May 2015, M. Khorasani 5983 (GUH); S Babol, Khajehkola village, 1300 m, N 36° 21' 23.08", E 52° 47' 42.73", 20 May 2015, M. Khorasani & M. R. Rahimi 5984 (GUH).

Description: Herbaceous, bulbous plants. Bulbs ovoid to subglobose, aggregate, 3-5 × 4-5 cm; outer tunics papery, ± longitudinally splitting, white; the innermost tunics coriaceous, yellowish; bulblets 3-4, placing at base and tip of bulbs, 0.5-0.6 mm diam., yellowish-brown. Leaves 6–8, narrowly lanceolate to linear, alternate, thick, ascending arcuately, canaliculate, glabrous, deep green, 35-45×1.5-3(5) cm; sheath 5-11 cm long, glabrous, initially green, after anthesis white-greyish, soon decaying. Scape cylindrical, erect, smooth, strong, green, 50-130

(180) cm long, near base 1.5-2 cm diam. Spathe funnel shaped, caudate, thick, initially deep green, covering the inflorescence, after anthesis white with green veins, divided into 1-3(4) ovate to semi-globose parts. Inflorescence globose, dense, many-flowered (up to 200), ca. 7-8 cm in diam, in the fruiting stage even larger. Pedicel thick, wire like, straight, stiff, unequal, 3-4 (5) cm long, same color as tepals, upper side pale pink-whitish. Tepals oblong, navicular, obtuse, throughout verrucose, 4-5 mm long, 2-3 mm wide, only basally united, erect after anthesis, pale pink, purple-whitish, lilac or green, sometimes with a green or purple midvein. Filaments longer than tepals, basally 0.5-0.7 mm connate and 1-1.5 mm adnate to the tepals, white or purplish, dimorphic, with three simple and triangular filaments (5–6 mm long) with minute lateral cusps and three tricuspidate filaments filiform at apex with expanding lateral cusps (8-12 mm long), white, verrucose. Anther oblong, 0.8-1.2 mm long, pinkish. Ovary subglobose, pear-shaped with ± sharp bulges, surface finely coarse, sessile, 5 × 3 mm, green. Style narrowly conical, thread like, 3-4 mm long, white. Stigma undivided, subcapitate, white. Capsule triangular-subglobose, 5-6 × 4-5 mm, opening with 3 narrow slits, valves subovate, light brown. Seeds 1(-2) per capsule, ovate, drop-shaped, acuminate, 3 × 2 mm, blackish in color.

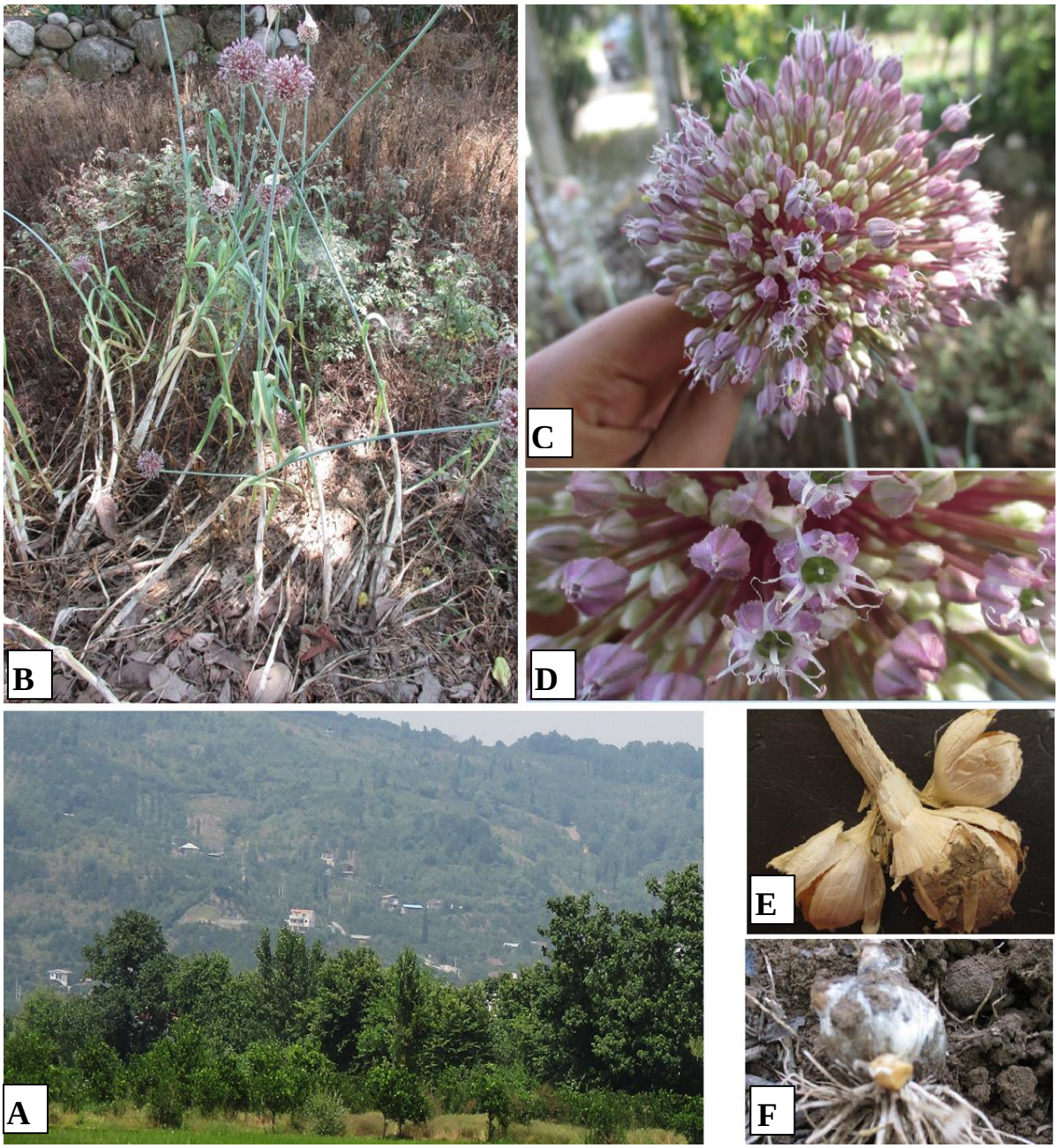

Fig. 1. *Allium ampeloprasum*. **A:** Habitat; **B:** Habit; **C, D:** Inflorescence with the verrucose tepals and the filiform filaments; **E:** Aggregate bulb; **F:** Bulblets in base and apex of bulb, (Photo by M. Khorasani).

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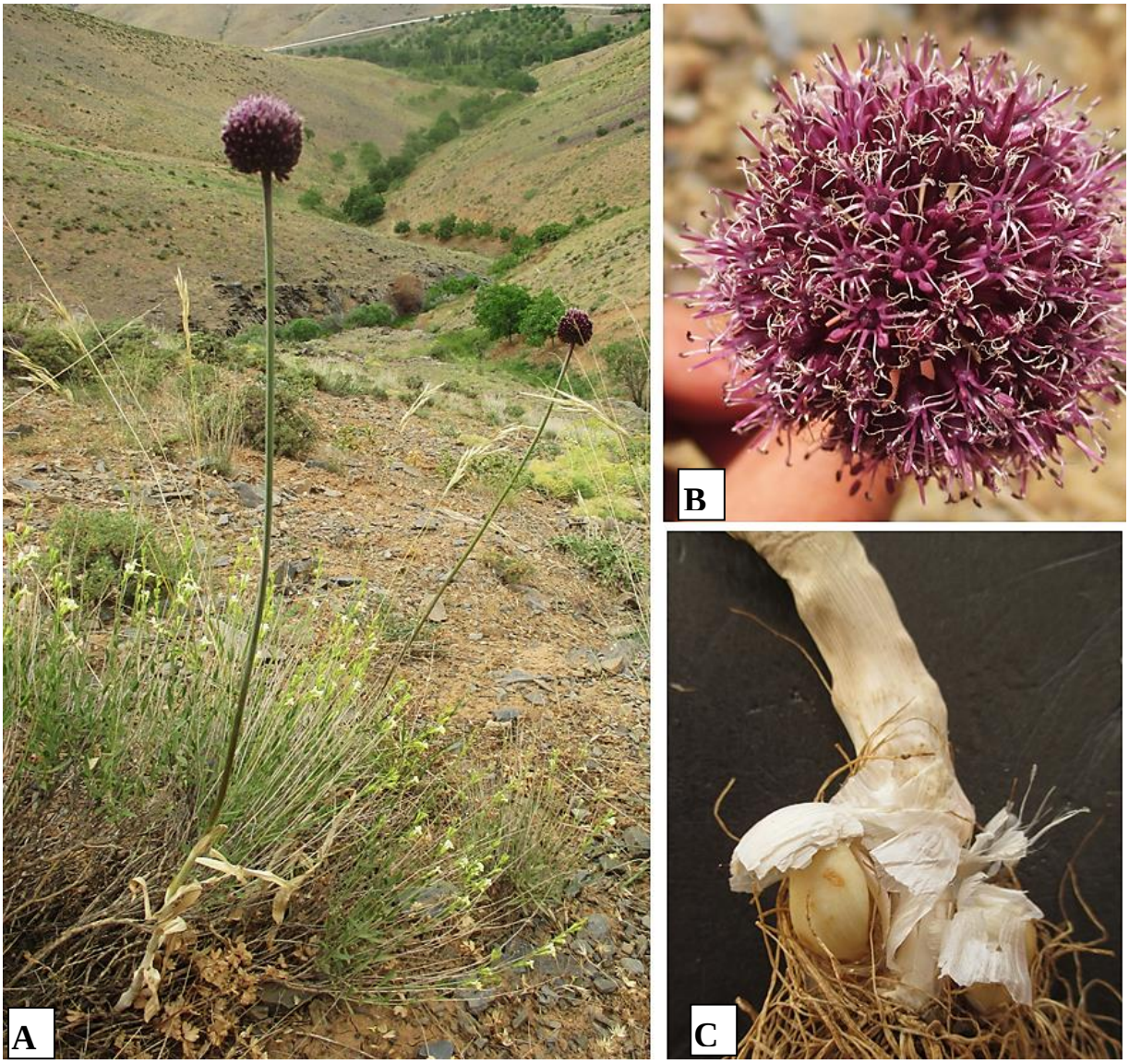

Fig. 2. *Allium iranicum*. **A:** Habit; **B:** Inflorescence; **C:** Aggregate bulb and bulblets at the base and on the scape, (Photo by M. Khorasani).

Note: According to the description given in Flora of the U.S.S.R. (Vvedensky, 1935), the main features of *A. ampeloprasum* are as follows: a scape arising laterally from the bulb leading to its easy recognition from its closely related species, i.e. *A. iranicum*, previously identified as a subspecies of *A. ampeloprasum* in Flora Iranica (Wendelbo, 1971) and Flora of Turkey (Kolmann, 1984). *Allium ampeloprasum* is known from Europe to Asia, especially in regions such as England, west Mediterranean, Turkey, Iraq, Syria, Cyprus, Lebanon, Palestine, Jordan, Egypt, Arabia, Russia, Turkmenistan, Kazakhstan, east Caspian Sea, and Caucasus mountains (Vvedensky, 1935; Wendelbo, 1971; Kolmann, 1984; Wendelbo, 1985; Mathew, 1996; Fritsch & Friesen, 2002). Therefore, the occurrence of this species in Iran is not unexpected.

The species is closely related to *A. iranicum* and *A. atroviolaceum* (*A.* sect. *Allium*) due to verrucate tepals and ovaries, dimorphic filaments and alternate leaves, but differs from them by several characters (Table 2). The absence of bulblets on the scape and the obtuse tepals in *A. ampeloprasum* are the most important characteristic features separating *A. ampeloprasum* from *A. iranicum*. It differs from *A. atroviolaceum* by having pale pink and purple-whitish flowers, subglobose bulblets and papery or coriaceous tunics (Figs. 1-3). A previous study indicated six independent groups in *A.* sect. *Allium* based on tunic type, presence of bulbils in inflorescence, shape of leaf and mode of anther anthesis (Mathew, 1996). In the same work, in *A. ampeloprasum* group, three close species, i.e. *A. iranicum*, *A. atroviolaceum* and *A. ampeloprasum* were separated from each other, based on tunic type, shape and position of bulblets, leaf shape and color, and shape of tepals, which are consistent with our findings.

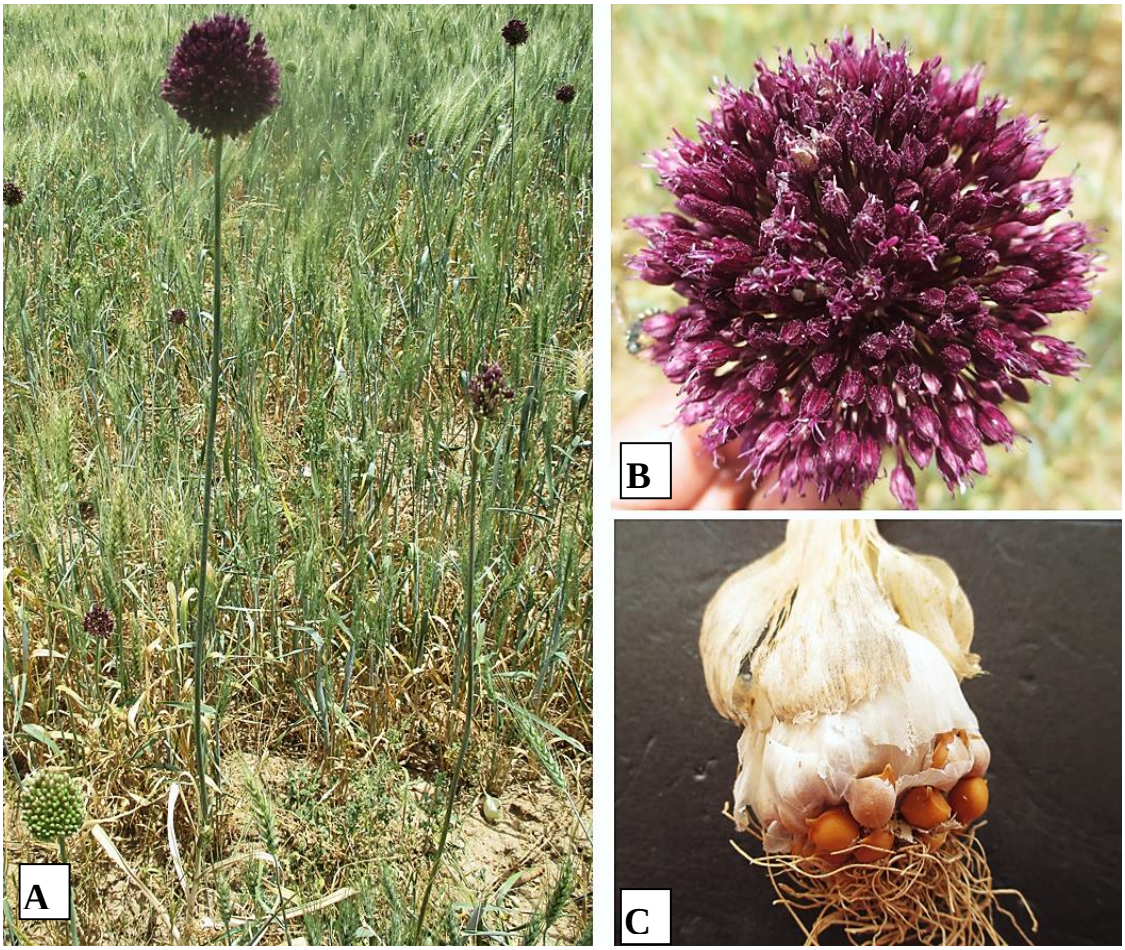

Fig. 3. *Allium atroviolaceum*. **A:** Habit; **B:** Inflorescence; **C:** Solitary bulb and bulblets at the base of bulb, (Photo by M. Khorasani).

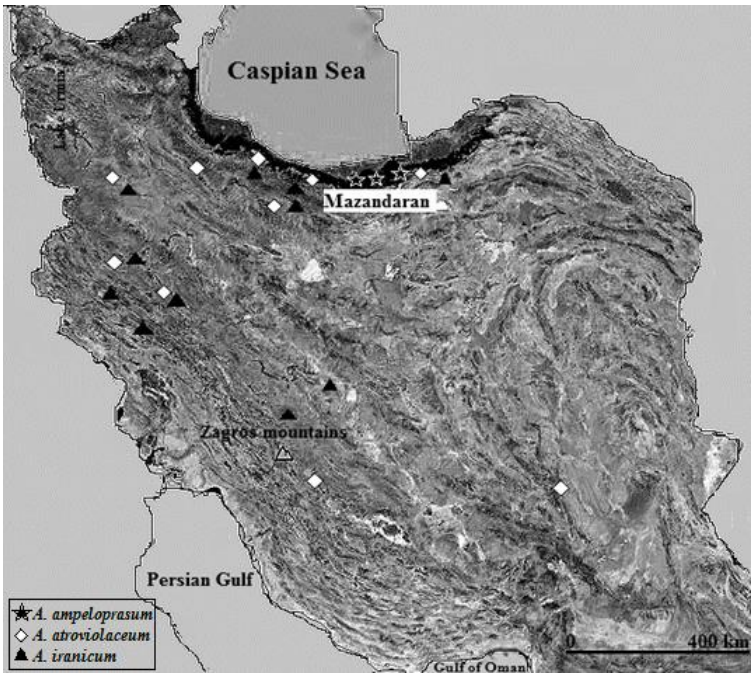

Fig. 4. Distribution map of *A. ampeloprasum* (white star) and its allies: *A. atroviolaceum* (white square) and *A. iranicum* (black triangle), according to the collection data and herbaria specimens by the authors.

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Table 2. Morphological comparison between *A. ampeloprasum* and its two relatives.

Characters	*A. ampeloprasum*	*A. iranicum*	*A. atroviolaceum*
Bulb	aggregate–solitary	aggregate	solitary
Bulblet position	base and tip of bulb	base and on the scape	base of bulb
Outer tunics	papery, entire, prolonged into a long collar–whitish	papery–white	reticulate fibrous–brown
Inner tunics	coriaceous	Papery	papery
Scape length	50–130 (180)× 1.5–2 cm	40–60 ×0.3– 0.8 cm	50–100×0.4–0.9 cm
Scape type	lateral and central	Centeral	central
Leaf size	35–45 ×1.5–3 (5) cm	20–45×0.6–0.9 cm	19–28×0.4–1 cm
Pedicel color	purple, reddish, lilac or green	Purple	purple
Tepal color	pale pink, purple–whitish, lilac or green, sometimes with a green or purple midvein	bright pink, with purple midvein or purple in upper part, shining	dark purple or blackish–maroon, sometimes vinous–purple, rarely dirty greenish
Tepal apex	obtuse	± acute	obtuse
Ovary color	green	Purple	purple or green
Verrucae in the base of the filaments	present	± present	± present
Bulblet shape	subglobose and helmet-shaped	elliptic and helmet-shaped	elliptic and helmet-shaped

Based on our field observations, *A. ampeloprasum* is growing wild in Iran and not, as previously reported (Wendelbo, 1981), only as a cultivated plant (Fig. 3). According to available data and obtained findings, we recognize *A. ampeloprasum* to be separated from *A. iranicum* and follow the treatment in Flora of U.S.S.R. (Vvedensky, 1935), Flora of Iraq (Wendelbo, 1985) and the review of Mathew (1996) on *A.* sect. *Allium* on this species group.

Typification of *Allium atroviolaceum*

Allium atroviolaceum Boiss., Diagn. Pl. Orient. ser. 1, 7: 112, 1846.

Type: Iran. In monte Sabs-Buschom prope u. Schiras, 31.5.1842, *K.G.T. Kotschy 450* (lectotype designated here: G, barcode G00164986!; isolectotypes, BM, barcode BM000958288!, FI, barcode FI012000, , G!, barcodes, G00164987!, G00164988!, GOET, barcode GOET000718!, K, barcode K000464376!, L, barcode L0041350!, LE, barcodes LE00010808!, LE00010809!, MO, barcode MO-149473!, P, barcodes P00747749!, P00601092!, P00601093!).

There are many duplicates of the type specimens in different herbaria. In G we found three specimens, thus, no single specimen could serve as holotype. Therefore, here we select the aforementioned specimen as the lectotype because it was the most complete one and agreed well with the protologue.

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