

SYNOPSIS OF THE GENUS *ALYSSUM* IN IRAN

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A complete, up to date checklist of *Alyssum* species reported from Iran is presented in this review. The distribution of these species was considered in Iran and in the adjacent countries, too. Additional records were obtained from Flora Iranica, Flora of Turkey and other references. In Iran some species (e. g., *Alyssum hezarmasjedensis*, *A. mozaffarianii*, *A. persicum*, *A. polycladum*, *A. stipitatum*, *A. turgidum*) have very restricted distribution. Iran is the second important locality for the following species: *A. anatolicum*, *A. contemptum*, *A. filiforme*, *A. iranicum*, *A. lycaonicum*, *A. niveum*, *A. penjwinense*. The other *Alyssum* species are widespread in Iran and in the adjacent countries.

Key words: *Alyssum*, biodiversity, distribution, Iran

INTRODUCTION

The genus *Alyssum* L. includes about 230 species around the world (Al-Shehbaz *et al.* 2006, Bailey *et al.* 2006, Persson 1971). The accepted list and literature review of genus *Alyssum* L. available in the IPNI database contain 187 species worldwide. In Flora Iranica 31 *Alyssum* species were reported from Iran by Rechinger (1968). Recently (since 1990) the number of Iranian *Alyssum* species has been increased considerably by Kavousi and his coworkers. Currently 53 *Alyssum* species are known from Iran, which are classifying in 5 sections (Kavousi *et al.* 2010, 2011, Kavousi and Nazari 2014). Several new species have been described directly from Iran, such as *Alyssum mozaffarianii* Kavousi, *A. stipitatum* Kavousi et T. R. Dudley and *A. hezarmasjedensis* Kavousi et Naza-

ri. The other 19 species are contributed in Flora Iranica. A complete list of the Iranian *Alyssum* species and an overview on their distribution in Iran and in other adjacent localities are given in this study.

MATERIALS AND METHODS

All known localities of *Alyssum* in Iran were studied according to the information obtained from the publications and from herbarium specimens in the following Iranian herbaria: Institute of Forest and Rangelands, Shahid Beheshti University, Isfahan University, Evin, TUH, and FUMH. Specimen records were also checked in the following foreign herbaria: Vienna, St-Petersburg, Ankara, Ghazi, Hacceteppe, Hungary, Tbilisi herbaria.

Furthermore, references as Baumgartner (1909), Boissier (1867), Davis (1965), Dudley (1964*a, b*, 1965, 1968), Duman and Aytaç (2000), Kavousi (2001), Kavousi *et al.* (2010, 2011), Nazari *et al.* (2013), Nyárády (1927, 1929, 1949), Orcan (1999), Orcan and Binzet (2006), and Orcan and Mısırdalı (1998) have been used and considered for literature review.

DISCUSSION

According to Dudley (1964*a, b*), the *Alyssum* genus has 6 sections worldwide and 5 of them have been recognised in Iran as well. The section *Tetradenia* including three perennial and spinose species, i.e. *A. cochleatum*, *A. lapeyrousianum* and *A. spinosum*, is known from North Africa, the Mediterranean Europe and the Pyrenees. None of these three species has been found and reported from Iran up to date.

The number of species in the sections *Psilonema*, *Meniocus*, *Alyssum*, *Gamosepalum* and *Odontarrhena* in Iran are 3, 3, 16, 11 and 20 species, respectively.

An overview is presented below with short descriptions of all *Alyssum* sections, full list of species in each sections and the distribution of the species in Iran and other countries.

Section *Meniocus* (Desv.) Hook. in Benth. and Hook., Gen. Plant. 1: 74 (1862)

Plant annual, long filaments unilaterally winged and toothed. Short filaments unilaterally winged and toothed. Short filaments with free, or basically connate appendages. Nectaries globose. Silicles dehiscent, glabrous, or with indumentums or simple seta (rarely forked), frequently papillose, locules 2–4(–8), ovulate with distinctly lateral placentation; valves always compressed. Seeds winged or wingless, mucilaginous.

Alyssum heterotrichum Boiss., Diagn. Pl. Orient., ser. 1, 6: 15 (1845). – Iran, Kazakhstan.

Alyssum linifolium Steph. ex Willd., Spec. Plant., ed. 4, 3(1): 467 (1800). – Iran, Turkey, Europe, North Africa, Caucasus, Siberia, India, Australia, Levant.

Alyssum menioides Boiss., Ann. Sci. Nat., Bot. sér. 2, Paris, 17: 158 (1842). – Afghanistan, Iran.

Section *Ppsilon* (Meyer) Hook. in Benth. and Hook.,
Gen. Plant. 1: 74 (1862)

Plants annual. Filaments always slender, wingless, edentate, and unappendaged. Nectaries erect and peg-like or globose, silicles dehiscent, glabrous, or with monomorphic or dimorphic indumentums, held in the same direction as pedicels and with biovulate locules; valves equally inflated. Seeds winged or wingless, mucilaginous.

Alyssum alyssoides (L.) L., Syst. Nat., ed. 10, 2: 1130 (1759). – Europe, North Africa, East India, USA, Canada, Argentina, Iran.

Alyssum dasycarpum Steph. ex Willd., Spec. Plant., ed. 4, 3(1): 467 (1800). – Europe, Levant, Caucasus, East India.

Alyssum homalocarpum (Fish. et Meyer) Boiss., Fl. Orient. 1: 285 (1867). – Egypt, Arabia, Iraq, Iran, Pakistan, Syria, Jordan, Palestine.

Section *Alyssum* L. Boiss., Fl. Orient. 1: 264, 274 (1867)

Plants annual, biennial, or if perennial then with sterile shoots and winter rosettes. Sepals monomorphic, free, but often persistent in fruit; inner surface always glabrous. Petals predominantly yellow, occasionally pale, and rarely whitish. Filaments free, unilaterally or bilaterally winged, and/or dentate, and/or appendaged. Nectaries globose, glabrous, or with monomorphic or wingless, mucilaginous.

Alyssum aizoides Boiss., Ann. Sci. Nat., Bot. sér. 2, Paris, 17: 153 (1842). – Turkey, Iran.

Alyssum contemptum Schott et Kotschy, Oesterr. Bot. Wochenbl. 4(22): 177 (1854). – Turkey, Levant, Iran.

Alyssum desertorum Stapf, Denkschr. Akad. Wien, Math. Naturw. 51: 33 (1886). – Europe, Asia, USA.

Alyssum iranicum Hausskn. ex Baumg., Jahresb. Landes-Gymn. Baden bei Wien 48: 9 (1911). – Levant, Turkey, Iran.

Alyssum lanceolatum Baumg., Jahresb. Landes-Gymn. Baden bei Wien 48: 11 (1911) – Iran, Afghanistan.

Alyssum marginatum Steud. ex Boiss., Ann. Sci. Nat., Bot. sér. 2, Paris, 17: 157 (1842). – Levant, Turkey, Russia, India.

Alyssum minus (L.) Rothm., Repert. Spec. Nov. Regni Veg. 50: 77 (1941). – Europe, North Africa, Asia.

Alyssum minutum Schlecht ex DC., Syst. Nat. 2: 319 (1821). – Southeastern and Eastern Europe, North Africa, Crete, Cyprus, Aegean Island, Turkey, Syria, Iran.

Alyssum muellerii Boiss. et Buhse, Nouv. Mém. Soc. Imp. Nat. Moscou 12: 16 (1860). – Russia, Armenia, Caucasus, Northern Iran.

Alyssum persicum Boiss., Ann. Sci. Nat., Bot. sér. 2, Paris, 17: 152 (1842). – Iran.

Alyssum repens Baumg., Enum. Stirp. Transsilv. 2: 237 (1816). – Europe, Levant, Caucasia, Iran.

Alyssum stapfii Vierh., Verh. zool.-bot. Ges. Wien 64: 260. t. 7, fig. 1 (1916). – Turkey, Levant, Afghanistan, Iran.

Alyssum strictum Willd., Spec. Plant., ed. 4, 3(1): 464 (1800). – Levant, Caucasia, Iran.

Alyssum strigosum Banks et Soland., in Russell, Nat. Hist. Aleppo, ed. 2, 2: 257 (1794). – Europe, North Africa, Levant, Iran, Afghanistan.

Alyssum szovitsianum Fisch. et C. A. Mey., Index Semin. Hort. Petrop. 4: 31 (1837). – Levant, India, Iran.

Alyssum turkestanicum Regel et Schmalh., in Regel, Descr. Pl. Nov. Rar. Fedtsch. 6. (1882). – Transcaspia, Iran, Afghanistan.

Section *Gamosepalum* (Hauskn.) T. R. Dudley,
J. Arnold. Arbor. 45: 70 (1964)

Plants perennial, with sterile shoots. Sepals distinctly dimorphic, always persistent, and often inflated in fruit, appearing connate because of interlocking indumentum, inner surfaces with indumentum. Petal whitish with purple venation at limb bases, or yellow, long filaments bilaterally winged, edentate and appendaged connate, or if free then contiguous with overlapping wings, short filaments with basal, connate appendages or teeth. Silicles dehiscent. Always with indumentum, held in the same direction as pedicles, and with bi-ovulate locules, valves equally or unequally inflated. Seeds narrowly winged or wingless, mucilaginous.

Alyssum baumgartnerianum Bornm. ex Baumg., Jahresb. Landes-Gymn. Baden bei Wien 48: 6. (1911). – Turkey, Syria, Lebanon, Palestine, Iran.

Alyssum cornigii T. R. Dudley, J. Arnold Arb. 45: 72, figs 1–11 (1964). – Turkey, Iran.

Alyssum harputicum T. R. Dudley, J. Arnold Arb. 45: 76, pl. IV, figs 1–12 (1964). – Turkey, Iran.

Alyssum hezarmasjedensis Kavousi et Nazari, Novon, 23(1): 59 (2014). – Iran.

Alyssum lepidoto-stellatum (Hausskn. et Bornm.) T. R. Dudley, J. Arnold Arbor. 45: 70 (1964). – Turkey, Iran.

Alyssum lycaonicum (O. E. Schulz) T. R. Dudley, J. Arnold Arb. 45: 79. – Turkey, Iran.

Alyssum niveum T. R. Dudley, J. Arnold Arb. 45: 78, pl. III, fig. 12 (1964). – Turkey, Iran.

Alyssum paphlagonicum (Hausskn.) T. R. Dudley, J. Arnold Arb. 45: 71 (1964). – Turkey, Iran.

Alyssum sulphureum T. R. Dudley et Hub.-Mor., J. Arnold Arb. 45: 74, pl. IV, figs 13–26 (1964). – Turkey, Syria, Iraq.

Alyssum tetrastemon Boiss., Ann. Sci. Nat., Bot. sér. 2, Paris, 17: 153 (1842). – Turkey, Iran.

Alyssum thymops (Hub.-Mor. et Reese) T. R. Dudley, J. Arnold Arb. 45: 71 (1964). – Turkey, Iran.

Section *Odontarrhena* (Meyer) Koch,
Synops. Fl. Germ. Helv. p. 59 (1835).

Plants perennial, with sterile shoots and winter rosettes, rarely biennial. Pedicels rigid, divergent and spreading, or slender, sigmoid and deflexed. Petals yellow, usually obovate, rarely with basal appendages. Long filaments free, always unilaterally or bilaterally winged, and variously dentate. Short filaments always with free or connate appendages, or teeth. Silicles dehiscent or indehiscent, glabrous or with indumentum, or rarely papillose, held in the same direction as pedicels or pendulous, and with uniovulate locules; valves equally or unequally inflated, or compressed and undulate (samaroid and papyraceous in subsect. *Samarifera*). Seeds winged or wingless, rarely mucilaginous.

Alyssum anatolicum Hausskn. ex Nyár., Bul. Grad. Bot. Univ. Cluj 9: 40, t. 5, fig. 111; t. 6, fig. 46; t. 7, fig. 56; t. 9, figs 62–63; pl. 29 (1929). – Turkey, Iran.

Alyssum argenteum All., Misc. Taur. 5: 73 (1774). – Italy, Iran, Balkans.

Alyssum bracteatum Boiss. et Buhse, Nouv. Mem. Soc. Imp. Nat. Moscou 12: 18 (1860). – Iran, Caucasia.

Alyssum callichroum Boiss., Diagn. Pl. Orient., sér. 2, 5: 34 (1856). – Turkey, Iran.

Alyssum condensatum Boiss. et Hausskn. ex Boiss., Fl. Orient. 1: 268 (1867). – Iran, Turkey, Syria, Lebanon, Iraq.

- Alyssum constellatum* Boiss., Ann. Sci. Nat., Bot. sér. 4, Paris, 2: 244 (1854). – Iran, Turkey, Iraq.
- Alyssum filiforme* Nyár., Bul. Grad. Bot. Univ. Cluj 9: 35, t. 5, fig. 79; t. 6, fig. 40; t. 7, fig. 49; t. 10, fig. 53 (1929). – Iran, Turkey.
- Alyssum inflatum* Nyár., Bul. Grad. Bot. Univ. Cluj 9: 43, t. 5, fig. 113; t. 6, fig. 41; t. 7, figs 50–51; t. 9, figs 54–58 (1929). – Iran, Transcaspien.
- Alyssum lanigerum* DC., Syst. Nat. 2: 308 (1821). – Iraq, east to Afghanistan.
- Alyssum longistylum* Grossh., in Grossheim and Schischk. Schedula Herb. Pl. Or. Exsicc. 18 (1924). – Iran, Armenia, Caucasia, Crimea.
- Alyssum mozaffarianii* Kavousi, Iranian J. Bot. 9(1): 48 (2001). – Iran.
- Alyssum murale* Waldst. et Kit., Descr. Icon. Pl. Rar. Hung. 1: 5, t. 6 (1799). – Europe, Levant, Iran.
- Alyssum obtusifolium* Steven ex DC., Syst. Nat. 2: 305 (1821). – Iran, Russia, Turkey.
- Alyssum penjwinense* T. R. Dudley, Notes Roy. Bot. Gard. Edinburgh 24: 162, pl. 7, fig. 4 (1962). – Iran, Iraq.
- Alyssum polycladum* Rech. f., Phytion 3: 55 (1951). – Iran.
- Alyssum sibiricum* Willd., Spec. Plant., ed. 4, 3(1): 465 (1800). – Iran, Balkans, Turkey, Crimea, Caucasia.
- Alyssum singarense* Boiss. et Hausskn. ex Boiss., Fl. Orient. Suppl. 49. (1888). – Iran, Iraq.
- Alyssum stipitatum* Kavousi et T. R. Dudley, Iranian J. Bot. 9(1): 48. – Iran.
- Alyssum tortuosum* Waldst. et Kit., Descr. Icon. Pl. Rar. Hung. 1: 94, t. 91 (1799). – Iran, Europe to Siberia.
- Alyssum turgidum* T. R. Dudley, Great Basin Naturalist 24(1): 7, pl. I, figs A–E, G–K (1964). – Iran.

RESULTS

Boissier (1867) in *Flora orientalis* presented 14 *Alyssum* species for the first time from Iran (Persia) as *A. bracteatum*, *A. lanigerum*, *A. minimum*, *A. persicum*, *A. bungei*, *A. argenteum*, *A. hirsutum*, *A. campestre*, *A. szovitsianum*, *A. marginatum*, *A. heterotrichum*, *A. linifolium*, *A. dasycarpum* and *A. murale*. The above list was completed in *Flora Iranica* (T. R. Dudley in Rechinger 1968) with *Alyssum homalocarpum*, *A. contemptum*, *A. strictum*, *A. alyssoides*, *A. meniocoides*, *A. desertorum*, *A. stapfii*, *A. repens*, *A. iranicum*, *A. lanceolatum*, *A. baumgartnerianum*, *A. constellatum*, *A. longistylum*, *A. polycladum*, *A. inflatum*, and *A. turgidum*.

In recent years *Alyssum mozaffarianii*, *A. stipitatum*, *A. callichroum*, *A. sibiricum*, *A. condensatum*, *A. harputicum*, and *A. obtusifolium* were reported by Kavousi (2001), *Alyssum tetrastemon*, *A. paphlagonicum*, *A. niveum*, *A. sulphure-*

um, *A. lepidoto-stellatum*, *A. corningii*, and *A. thymops* by Kavousi *et al.* (2010); and *A. anatolicum* and *A. filiforme* by Kavousi *et al.* (2011). A new species, *Alyssum hezarmasjedensis* was described recently from Iran by Kavousi and Nazari (2014).

In our recent investigations at Khorassan Mts; Esfarayen, Saluk, Shah-Jahan and Shahvar Peak, *A. aizoides* and *A. tortuosum* have been reported for the first time from Iran (Nazari *et al.* 2013).

Alyssum aizoides is only known from Turkey. *Alyssum tortuosum*, known with a wide distribution from eastern Europe and Siberia, was synonymised erroneously with *A. inflatum* (Akhani 2003), since there are a lot of differences between the two species.

Currently 53 *Alyssum* species are known from Iran and it seems that Iran is the centre for endemism of this genus. More field investigations are necessary to reveal more information on Iranian *Alyssum*.

Iran is very rich in *Alyssum* taxa. Several species have been reported for the first time from Iran, from those special areas with species forming a principle vegetation communities special in central Alborse and eastern Alborse in north east Khorassan.

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