A Revision of *Alyssum* L. Section *Gamosepalum* (Hausskn.) Dudley (*Brassicaceae*), in Iran

Saeedeh Sadat Mirzadeh Vaghefi*, Mostafa Assadi** and Masoud Sheidai*

* 1 Biology Department, Shahid Beheshti University, Tehran, Iran.
** 2 Department of Botany, Research Institute of Forests and Rangelands, Tehran, Iran.

*Corresponding author: mirzadeh@riff-ac.ir

**Received: 13 July 2015 Accepted: 29 September 2015**

**Abstract**

Section *Gamosepalum* has been reported from Turkey for the first time by Dudley. In recent years, several species of this section were reported as new records for Iran. Four species of *Alyssum* section are transferred from sect. *Alyssum* to sect. *Gamosepalum* with considering of important characters in each section. These changes made two synonymies. Five species of *Gamosepalum* section including *A. lanceolatum*, *A. persicum*, *A. lepidoto-stellatum*, *A. mulleri* and *A. baumgartnerianum* are present in Iran. Identification key of accepted species and distribution map of them are given. All specimens examined in the present work are deposited at FUMH, G, TARI and W.

**Key words:** *Alyssum; Gamosepalum; Brassicaceae; Iran; Revision*

**Introduction**

The Brassicaceae comprise 49 tribes, 321 genera, and 3660 species. Of which, 20 genera and 34 species remain to be assigned to tribes (Al-Shehbaz, 2012). The genus *Alyssum* L. consists of about 170–195 species worldwide, native to Europe, Asia and northern Africa (Al-Shehbaz, 1987; Appel and Al-Shehbaz, 2003; Warwick et al., 2006, Li et al., 2014). Most of its species grow in rocky and arid regions. 28 species and 7 varieties, belong to 5 sections were introduced from Iran (Rechinger, 1968). Most of these species, especially those belong to *Alyssum*, section *Gamosepalum* (Hausskn.) Dudley have been known from Turkey, Iraq and Armenia. Rechinger (1968) in Flora Iranica reported *A. baumgartnerianum* from Persia without giving any exact location. Based on Dudley (1964) all species of the genus *Gamosepalum* Hausskn. were transferred to *Alyssum*. Dudley (1964) introduced *Alyssum* section *Gamosepalum* Dudl. with 10 species, namely *A. baumgartnerianum* Bornm., *A. niveum* Dudley, *A. harputicum* Dudley, *A. sulphureum* Dudley and Hub., *A. trestesdon* Boiss. and *A. corningii* Dudley. Later, *A. nezaketiae* by Duman and Aytaç (2000) and *A. misirdalianum* by Orcan and Binzet (2006) were introduced from Turkey. Based on the synopsis of Dudley (1964) species in the genus *Alyssum*, section *Gamosepalum* are recognizable from the other species by dimorphic sepals with simple, furcated and stellate hairs on the inner surface. Kavousi et al. (2011) reported, *Alyssum trestesdon* Boiss., *A. harputicum* T. R. Dudley, *A. lepidoto-stellatum* (Hausskn and Bornm.) T. R. Dudley, *A. paphlagonicum* (Hausskn). T. R. Dudley, *A. niveum* T. R. Dudley, *A. sulphureum* T. R. Dudley and Hub.-Mor., *A. corningii* T. R. Dudley and *A. thymops* (Hub.-Mor. and Reese) T. R. Dudley from Khorassan province in NE Iran. Moreover Kavousi et al. (2014) introduced *A. hezarnisadense* as a new species from Hezarmasjed (Khorasan, Iran) Iran that belongs to Section *Gamosepalum*. The aim of this study is to revice the taxonomy of the Section *Gamosepalum* (Hausskn.) Dudley of the genus *Alyssum* in Iran.
Materials and Methods

Type specimens of species section *Gamosepalum* presented in Herbarium of Natural History Museum of Vienna (W), Herbarium of Boissier (G), Herbarium of Research Institute of Forests and Rangelands (TARI) and Herbarium of Ferdowsi University of Mashhad (FUMH) were studied. All of the species belong to the section *Gamosepalum* that were introduced as new records from Iran, were morphologically investigated. The flowers of them were boiled and dissected. Sepals of types were selected for scanning by electronic microscope (SEM) and light microscope (LM). They were mounted and coated with gold-paladium. After coating specimens were viewed with a SU 3500 Electron microscope at 15 kv. Make a determination key for section *Gamosepalum* in Iran. The Examined specimens for all species of section *Gamosepalum* were illustrated in map (Fig.1).

![Distribution map of A. lanceolatum ( ), A. mulleri (▲), A. persicum (■), A. baumgartnerianum (●) and A. lepidoto-stellatum (✶).](image)

**Fig. 1.** Distribution map of *A. lanceolatum* ( ), *A. mulleri* (▲), *A. persicum* (■), *A. baumgartnerianum* (●) and *A. lepidoto-stellatum* (✶).

Results

**Taxonomic treatment**


Perennials, sepals dimorphic, often persistent and inflated in fruit, inner surface hairy. Petals purple or yellow, spatulate, narrowed and then broadened at the middle of blade. Key to the determination of accepted species of section *Gamosepalum* in Iran

1. Indumentums on upper part of plant consist of stellate hairs with equal and unequal rays... *A. lepidoto-stellatum*
1. Indumentums on upper part of plant consist of lepidote and stellate hairs with long unequal rays.
2. Petals retusa or emarginated, 5.5-7×1.5-2.5 mm......................... A. muelleri
3. Silicule elliptic, 4.5-6×2.5-4.5 mm........... A. baumgartnerianum
4. Petals integra......................... A. niveum

Gen. Dist.

Typus:

   Typus: In declivibus apricis inter Siwas et mt. Yylidsdagh, 1300-1400 m, 1880. Bornmuller 1671 G!
   Typus: Kermanshah: Kuhe Tarikha, STR., W!

   Typus: In the monte Yazd, Buhse, 1358 W!

Typus: Libanon. Dschebel Baruk, Bornm. 11405 W!

Gen. Dist. Iran, Turkey, Russia and Iraq.
Suffrutescent, up to 15 cm. Leaves obtuse, obovate, spathulate, ob lanceolate. Indumentum dimorphic on the upper parts of plant. Petals 5.5-9×1.5-2.5 mm, entire, yellow, with dense, canescent-silvery indumentums of lepidote hairs or sublepidote hairs. Silicule elliptic, 4.5-6×2.5-4.5 mm, styles 2.5-4 mm., hairy at the base.

Examined specimens: Azer baijan: 15 km S. of Marand, Mishu-Daghi mt., 1800-2250 m. Assa di & Mozaffarian 29843 (TARI); 20 km to Tehran-Tabriz road on the road from Ahar, 1450 m, Wendelbo and Assadi 28002 (TARI); 20 km to Siah rud on the road from Kharvana, 900 m. Assadi 86744 (TARI).

Note: The specimens that have collected by Assadi (Assadi 86744-TARI), which look like the figure in Fl. Of Armenia (Takhtajan, 1966), 5: 193 (fig. LXXXIV), as A. muelleri is in fact A. Baumgartenianum, therefore the record of A. muelleri in Armenia might be A. Baumgartenianum.

Typus: Turcomania, Kulan Mountain, pr jouran, 700 m. 28.5.1898. Litwania 569 W!
= A. persicum auct. Fl. Turcoman. et Afghan. nec Boiss. and Buhte (1860).

Gen. Dist. Iran, Afghanistan, Turcomania.
Perennial herb, suffrutescent, silver-greenish, ca. 7-10 cm tall, stem erect or ascending. Indumentum silvery, of many rays, on the upper part of plant dimorphic of lepidote and stellate hairs with long divergent rays. Leaves lanceolate or ob lanceolate, 8-17 × 0.1-0.2 mm. Sepals indumentums of few rayed and branched stellate hairs; inner surface with stellate hairs (Fig. 2b). Petals 5.8 × 2-2.5 mm, entire, yellow or purplue, spathulate, with sparse trichomes. Fruits ovate or obovate, 6-6.5×5-6 mm, truncate at the apex, Styles 3-4.5 mm. long.

A. lanceolatum bears persistent sepals, indumentum on the inner surface of sepals and lepidote trichomes and therefore is transferred from Section Alyssum to Section Gamosepalum. Type specimen of A. hezarmasjedense was studied. All given data on A. lanceolatum was totally matched with those of A. hezarmasjedense and therefore they are regarded as synonyms.

A. coringii, A. sulphureum, A. tetrastemon, A. harputicum and A. thympos were introduced as new records from Iran by Kavousi et al. (2011). The specimens of these species were studied and none of them are proved. They all are variations of A. lanceolatum.

The specimen named A. coringii has a style of 4-4.5 mm long and petals are retuse with 2.5 mm. wide similar to that of A. lanceolatum while in A. coringii style is 1.5-2.5 mm. long and petals are bilobed with 0.5-1 mm. wide. A. sulphureum has bilobed petals and pilose style.while in the specimen named A. sulphureum petals are entire and style is glabrous. The specimen named A. tetrastemon is not in flowering stage, but the other characters of the specimen are closer to A. lanceolatum than A. tetrastemon. The seeds in the specimens are winged similar to that of A. lanceolatum than wingless seeds of A. tetrastemon, also, the length of style is 3-4.5 mm as in A. lanceolatum (not 2-3 mm as in A. tetrastemon) In A. thympos the length of style is 1-5-2 mm. and petals are emarginate (not 4-4.5 long and entire) The specimen that named as A. harputicum have dimorphic indumentums on upper part of plant, similar to A. lanceolatum (in A. harputicum indumentums on the upper part of plant is monomorphic of lepidote hairs), also the other characters are characters of A. lanceolatum.
It is necessary to mention that the distribution of all these records is in the distribution of *A. lanceolatum* and far away from the true distribution of the species in Turkey.

Examined specimens: **Khorassan**: 42 km to Birjand, on the road from Ghayen, 2000 m. Assadi & Amirabadi 84784 (TARI); ca. 50 km. NNE. Kashmar, Kuhe Bezgh, 2900 m. Assadi and Mozaffarian 35764 (TARI); between Ghoochan and Darreh and Sarough and Nazar Soltan mt., 2482m. Nazari 42719(FUMH); 95 km to Mashhad, S.W. Marashk, Hezarmasjed, 2500m. Faghijnia & Zangooei 27570 (FUMH); S. of Mashhad, Moghan, Moghan cave, 2000m. Joharchi & Zangooei 42684 (FUMH); NE of Chaneran, 31km. Boghmej to Hezarmasjed, 2506m. Zangoeei & Nazari 39872 (FUMH); NE of Chaneran, 31km. Boghmej to Hezarmasjed, 2506m. Zangoeei and Nazari 39871 (FUMH); 30 km. S. of Gonabad, Kalat mt., 1700m. Joharchi & Zangoeei 11951(FUMH); 75 km. of old road of Mashhad, Torbat-e Heidaryeh, before Asadabad, Rezaei and Zangoeei 10908 (FUMH); S. of Mashhad, Moghan, Moghan cave, 2000m. Joharchi and Zangoeei 42681 (FUMH); NE of Cheneran, 31km. Boghmej to Hezarmasjed, after Shohadaye Ashayer, 2200m. Nazari 39402 (FUMH); BandarGaz, Tandooreh National Park, Shekarab. 2300m. Assadi et al., 4089W!  

**Discussion**

*Alyssum muelleri, A. persicum, A. lanceolatum and A. iranicum* due to the presence of indumentums on the inner surface of sepals are transferred to section *Gamosepalum* (Fig 2, 3). The members of the sect. *Gamosepalum* in fruiting stage with the lack of sepals are very similar to sect. *Alyssum*. Townsend & Guest (1980) in Flora of Iraq pointed out that the sepals in *A. muelleri* have hairs on the inner surface of sepals but did not change its section from *Alyssum* to *Gamosepalum*.

These studies improve necessity of rank changes from one section to the other. The results also show that in Khorassan province only one species of section *Gamosepalum* occur while the other species i.e. *A. mulleri, A. persicum, and A. iranicum* occur in the other parts of Iran (Rechinger, 1968). The result of this study fills the gap between the main distribution center of the section in Turkey and Khorassan province. The specimen of *A. paphlagonicum* that reported by Kavousi et al. (2011) from Iran is not accessible, due to the incomplete description, unavailable materials and not giving exact locality, presence of this species in Iran remains doubtful.
Fig. 2. SEM photo of sepals on the inner surface in type specimens of *Alyssum iranicum* (A); *A. lanceolatum* (B); *A. persicum* (C).
Acknowledgements

We would like to thank the keepers of the herbaria W (Dr. Vitek and Dr. Igersheim), FUMH (M.R. Jouharchi) and TARI that provided samples and materials for the research.

References


