

# A TAXONOMIC REVISION OF THE GENUS SISYMBRIUM (BRASSICACEAE) IN IRAN

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In a revision of the genus *Sisymbrium* L. in Iran the specimens of several herbaria were studied, moreover, the studies were completed in the field. Based on the studies an identification key to the Iranian species was constructed. Moreover, full description of the genus and species was prepared for the Flora of Iran. A short list of studied specimens is provided. The results also showed that *S. integrimum* and *S. brassiciforme* are synonymous, *S. runcinatum* var. *hirsutum* is a true member of the flora of Iran and *S. gaubae* is a distinct species. Based on these studies *S. kermanicum* collected from Jebal Barez in Kerman province was formerly described as a new species. *Neotorularia aculeolata* is transferred again to the genus *Sisymbrium* as *S. aculeolatum*. Presence of *S. damascenum* sometimes recorded from Iran is not proved.

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Key words. *Sisymbrium*, *Brassicaceae*, taxonomy, Iran.

## بررسی های تاکسونومی جنس *Sisymbrium* در ایران

منصوره خداشناس و مصطفی اسدی

جهت بررسی تاکسونومی جنس *Sisymbrium* در ایران نمونه های گیاهی جنس در هرباریوم های مختلف ایران مطالعه و جهت تکمیل مطالعات به رویشگاه های گیاهان مراجعه گردید. کلید شناسایی گونه ها و واحد های تحت گونه ارایه می گردد و شرح جنس و گونه ها برای درج در فلور ایران تهیه شده است. همچنین لیست کوتاهی از نمونه های دیده شده ارایه می گردد. بر اساس تحقیقات انجام یافته گونه *Sisymbrium integrimum* مترادف گونه *S. brassiciforme* تشخیص داده می شود، واریته *S. runcinatum* var. *hirsutum* از ایران گزارش می شود و گونه *S. gaubae* به عنوان گونه مستقلی ذکر می گردد. گونه *Neotorularia aculeolata* در جنس *Sisymbrium* و با نام *S. aculeolatum* حفظ می گردد. حضور گونه *S. damascenum* در ایران تایید نمی گردد.

## INTRODUCTION

The genus *Sisymbrium* (*Brassicaceae*) is a large and heterogeneous taxon, comprises about 96 species in the world (Warwick & al. 2002) and 11 species in Iran. It was divided by Schulz (1924, 1936) to 14 sections, but as indicated by Al-Shehbaz (1988) and Warwick & al. (2002) these sections are artificially delimited, and this genus is polyphyletic. The majority of species have pinnately divided lower leaves, yellow flowers, terete, linear or rarely conical fruits, three-veined valves, two lobed or capitate stigmas, uniseriate seeds, and incumbent cotyledons. Some species are difficult to circumscribe due to the variation in morphological characters, which in many cases are overlapped,

therefore species delimitation is blur. The aim of this study is to examine morphological characteristics of the species in details and to provide a taxonomic account of the genus in Iran for the project Flora of Iran (Assadi 1978).

## MATERIALS AND METHODS

About two hundred specimens belong to 11 species collected from different localities in Iran. The specimens of several herbaria in Iran including TARI, IRAN, TUH, FUMH and several provincial herbaria in Iran were studied morphologically. The morphological characters were studied in the field and the range of

variations was measured directly on the specimens. Several references were used, but Flora Iranica (Hedge 1965) as one of the last revisions of the genus in Iran was used as a base of studies. The new herbarium collections are preserved in the Herbarium of the Organization of Agricultural and Natural Resources Research Center of Kerman Province, duplicates in TARI.

## RESULTS AND DISCUSSION

- 1- Lower flowers solitary at the axils of the bracts, subsessile
  - 8- *S. runcinatum*
  - Flowers in racemes, pedicellate, ebracteate 2
- 2- Fruits conical, at the base somewhat broader 3
  - Fruits cylindrical 5
- 3- Flowers white or in dry state pink 10. *S. aculeolatum*
  - Flowers yellow 4
- 4- Fruits appressed to stem, 9-17mm long 11. *S. officinale*
  - Fruits erect-spreading, not appressed to stem, 20-40 mm long 9. *S. erysimoides*
- 5- Fruiting pedicels as thick as fruits 6
  - Fruiting pedicels thinner than fruits 8
- 6- The upper leaves entire, if lobbed then terminal lobe is oblong or lanceolate, two outer sepals not cuculate, stigma clavate 7. *S. orientale*
  - The upper stem leaves pinnate; terminal lobe linear or filiform, two outer sepals cuculate, stigma ± bilobed 7
- 7- Petals broadly obovate, 9-14 mm long and 3/5- 8 mm wide. Fruiting pedicels 3/5- 6 mm long. Style 2/5 – 5 mm long. Stigma with 2 deep lobes 6. *S. septulatum*
  - Petals narrow obovate, 6 - 9 mm long and 1/5- 3/5 mm wide. Fruiting pedicels 5- 12 mm long. Style 0/5 – 1 mm long. Stigma with 2 short lobes 5. *S. altissimum*
- 8- Fruits or fruiting pedicels pubescent 9
  - Fruits and fruiting pedicels glabrous 12
- 9- Fruits glabrous or rarely with sparse hairs 10
  - Fruits with dense hairs 13. *S. damascenum*
- 10- Fruiting pedicels drooping or recurved 12. *S. kermanicum*
  - Fruiting pedicels erect – spreading 11
- 11- Flowers small. Petals 2 – 3/5mm long and 0/5 – 1 mm broad. 3. *S. Irio*
  - Flowers large. Petals 5- 7/5 mm or rarely 8 mm long 4. *S. Loeselii*
- 12- Plants biennial. Fruits recurved 1. *S. brassiciforme*
  - Plants perennials. Fruits erect 2. *S. gaubae*

**1. *S. brassiciforme*** C. A. Mey. in Ledeb., FL. Alt. 3: 129 (1831).

Syn.: *Sisymbrium integerrimum* Rech. f. & Aell., Phytion 3: 67 (1951).

Hedge (1965) reported *S. brassiciforme* and *S. integerrimum* in flora Iranica. The main difference between these two species was mentioned as pinnate leaves in the former and entire leaves in the latter (Hedge 1965). The two species were studied in the field from the type locality of *S. integerrimum* and other areas in Iran and also on the herbarium specimens, the

leaf character is variable at the margin from entire to divided or somewhat lobed, therefore the two species are regarded as synonymous.

*Selected specimens.* Kerman: Rayen, bellow the waterfall, 2700m, Khodashenas 5501.- Khorasan: Dizbadolia, 1830 m, Khodashenas and Vali 5502.

**2. *S. gaubae*** Rech. f. & Bornm., Feddes Repert . 48: 34 (1940).

*Selected specimens.* Tehran: Firoozkooh road, 2000 m, Assadi and Mozaffarian 35293; Karaj, Garmdarreh, 1700 m, Assadi 27531.

This species is the only perennial *Sisymbrium* in Iran. It is similar to *S. brassiciforme* but differs from it by having spreading fruits via recurved.

**3. *S. Irio*** L., Sp. Pl. 659 (1753).

*Selected specimens.* Hamadan: 1800 m, Hatamie 279.- Hormozgan: Genoo mountain, Khodashenas 5510.- Bushehr: 700 m, Runemark and Mozaffarian 54.- Kerman: 1800 m, Khodashenas 5508.

**4. *S. Loeselii*** L., Cent . Plant.1 : 18 no. 49 (1755).

Syn.: *S. hastifolium* Stapf, Dnkschr. Akad. Wien, Math-Nat .K1.51, 2:299 (1889); *S. glabratum* Q.E.schulz in Engler, Pflanzler. 86 (Iv.105): 99 (1924).

*Selected specimens.* Mazandaran: Haraz road, Abgarm, 2210 m, Foroughi 918.- Gilan: 40 km after Ghazvin towards Rasht, 1150 m, Babakhanloo and Amin 6764.- Kermanshah: Milemikhan, Gahvareh, 1430 m, Khodashenas and Nematie 5509.- Khorassan: Dizbadolia, 1830 m, Khodashenas 5511. -Tehran: Damavand, 1800 m, Mozaffarian 32226.

In the key in Flora Iranica (Hedge 1965) this species and *S. Irio* are characterized by the situation of young fruits to flowers. Morphological results showed that this character is not constant . Size of petals and sepals are good diagnostic character as mentioned in the key.

**5. *S. altissimum*** L., Sp .Pl. 659 (1753).

Syn.: *S. pannonicum* Jacq' PL. Rar.1: 12 tab.123 (1781-86).

*Selected specimens.* Azerbaijan: Tabriz, 2200 – 2600m Mozaffarian and Assadi 846.- Kordeatan: Sannandaj, 1300-1400 m, Fatahie and Khaledian 29146.- Hamadan: Asad abad, 2500- 2700m, Riazi and Sabeti 64993, 36771.- Khorasan: Torbate Jam, 890 m Iranshahr 67544.- Tehran: Shahrestanak, 2200 m, Mozaffarian 6115.

**6. *S. septulatum*** DC., Reg. Veg. Syst. Nat. 2:471(1821).

Syn.: *S. Pannonicum* Boiss, Fl. Or.1: 217 (1867); *Brassica erucastroides* Stapf, Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 51: 306 (1882).

*Selected specimens.* Azerbaijan: 35 km after Kivy to Firoozabad, 1180m-1350m, Mozaffarian and Nowroizi 34218; Golmankhaneh, 1400 m, Wendelbo and Assadi 11999; 10 km after Mianeh to Tabriz, 1000, Sabeti 6621.- Fars: Shiraz, Bamoo, 1900m, Dehbozorgy 32816.- Kerman: Shahr Babak 1900m, Hasan abady 2235.- Tehran, Firoozkooh, Zibadasht, 1700m, Bazargan and Arazm 6280.

**7. *S. orientale* L.,** Cent. Pl. 2: 24 (1756).

Syn: *S. columnae* Jacq., Fl. Austr. 4: 12 (1779).

*Selected specimens.* Hormozgan: Before Tarom, 800m, Mozaffarian, 9784; Hajiabad, 660 m, Khodashenas 5505.- Kerman: Sirjan, Dehlarz, 1830m, Khodashenas 5515; Jebal barez, Beside the Road, 2400m, Mirtazadani 6087.

**8. *S. runcinatum* Lag.** ex DC., Reg. Veg. Syst. Nat. 2 : 478 (1821).

The species is divided into two varieties.

1- Plants glabrous *S. runcinatum* var *runcinatum*

- Plants completely hairy

*S. runcinatum* var *hirsutum* (Lag.) Coss.

-var. ***runcinatum***

*Selected specimens.* Golestan: Gonbad, Sharif 16498.- Azerbaijan: Dashte-Moghan, Iranshahr 16502.

-var. ***hirsutum*** (Lag.) Coss., Not. Pl. Crit. (1851).

It is similar to *S. runcinatum* var *runcinatum*, but it differs from it as all parts of the plant covered with simple trichomes.

*Selected specimens.* Golestan: Gonbad, Besh ailan, Sharif 16499.

Hedge (1965) in Flora Iranica named all the Iranian specimens as *S. runcinatum*. But the studied specimens of Iran are well divided into two groups, 1: plants completely glabrous 2: plants completely hairy, therefore in this study *S. runcinatum* is divided to two distinct variety.

**9. *S. erysimoides* Desf.,** Fl. Atlant. 2:84 (1799).

*Selected specimens.* Hormozgan: Bandar abbas, Geno mountain, 1200-2200m, Mozaffarian 59134; Minab, Senderk, 220m, Khodashenas 5504.-Kerman: Kahnij, Deh kahan, 400m, Mirtazadani 5513.

**10. *S. aculeolatum* Boiss.,** Ann Scienc. Nat. Ser. 2, 17: 75 (1842).

Syn.: *Neotorularia aculeolata* ( Boiss. ) Hedge & J. Leonard, Bull. Jard. Bot. Nation. Belg. 56(3-4): 393(1986); *Torularia aculeolata* Schulz., in Engler, Pflanzen. Sisymbrieae 86 (IV. 105): 223 (1924); *Malcolmia aculeolata* (Boiss. ) Boiss. Fl. Or. 1: 226 (1867 ); *Microsisymbrium pulchellum* Rech. f. & Koeie, Anz. Math. Nat. Kl. Akad. Wiss. 1954, 7: 6 (1954).

*Selected specimens.* Kerman: Khabr mountain, 2500m, Poormirzayii and Saber; Bam, Marghak, 1900m, Foroughii 15936.- Baloochestan: 55 km after Khash to Iranshahr, 1500m, Mozaffarian 42902.- Khorasan: 65 km after Tabas to yazd, 1200m, Mozaffarian 77272.

*Sisymbrium aculeolatum*. was originally described by Boissier and then transferred to *Torularia aculeolata* by Schulz (1924). Hedge (1965) accepted it but later on it was transferred to *Neotorularia aculeolata* by Hedge & Leonard (1986). This species is morphologically similar to *Sisymbrium* in flower, fruit and trichome morphology, but it differs from all other species of *Neotorularia* by having non torulose fruits and simple trichomes. By contrast, all other species of *Neotorularia* have distinctly torulose fruits and branched trichomes. This differences support the exclusion of this species from *Neotorularia* and transferring it to *Sisymbrium*.

**11. *S. officinale* (L.)** Scop., Fl.Carn. 2: 26 (1772).

Syn.: *Erysimum officinale* L., Sp. Pl . 660 (1753).

*Selected specimens.* Mazandaran: Ramsar, Javaher deh, 1800m, Khodashenas 5503; Kelar Dasht, 1040m, Sabeti 25809.- Gilan: Manjil, 1600m, Roshan 33970.- Khoozestan: Izeh, Nokond, 830m, Mozaffarian 63110.

**12. *S. kermanicum* Khodashenas & Mirtadzadini.,** Iran . Journ. Bot. 12(1): 94 (2006).

*S. kermanicum* collected from Kerman province and formerly introduced as a new species in the world. This species is well characterized by the following characters. Fruit 50 - 60 mm, spreading and torulose. The apical part of fruit has strict and short hairs.

*Specimen seen.* Kerman: Jebalbarez, Sarzeh, 2450 m, Khodashenas & Mirtadzadini 6017 (holotypus TARI).

**13. *S. damascenum* Boiss. & Gall.** in Boiss., Diagn. Pl. Or. Nov. Ser. 2, 6: 11 (1859).

This species was reported in Flora Iranica (Hedge 1965) from an area between Kerend and Kermanshah. The author of Flora Iranica did not observe the specimen. Researches to find it in mentioned locality and also among the specimens of different herbaria of Iran failed. Therefore, presence of this species in Iran is not improved. The Iranian record might be based on a misidentification.

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