**Phytotaxa** 220 (1): 043–053

www.mapress.com/phytotaxa/

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http://dx.doi.org/10.11646/phytotaxa.220.1.3

**Sisymbrium isatidifolium** (Brassicaceae): a new species from southern Spain, and the identity of *S. hispanicum* Jacq.

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**Abstract**

A new species of the genus *Sisymbrium* is described, illustrated, and compared with the most closely related ones of the genus, *S. chrysanthum*, *S. hispanicum*, *S. crassifolium*, and *S. assoanum*, and the identity of *S. hispanicum* is discussed. The new species occurs on gypsiferous marls, forming part of the esparto grasslands and cultivated fields in the provinces of Albacete, Jaén, Granada, and Almería (southern Spain). In addition, a distribution map, illustrations, and a description of the habitat of the new species are presented.

**Key words:** Cruciferae, Iberian Peninsula, taxonomy

**Introduction**

The genus *Sisymbrium* Linnaeus (1753: 657), in its more classic conception, includes between 77 and 100 species (Schulz 1924, Romanczuk 1982, Warwick *et al.* 2002), distributed in the Old World (c. 40 spp.) and the New World (c. 50 spp.). More recently, based on molecular (Warwick *et al.* 2002, 2006) and morphological (Warwick & Al-Shehbaz 2003, Al-Shehbaz 2006) phylogenetic studies, *Sisymbrium* consists of only 41 species, all native of the Old World, except *S. linifolium* Nutt. (1834: 12) of North America (Al-Shehbaz 2006, 2012), plus one more recently described from Turkey (Mutlu & Karakuş 2015). The rest of the New World species have been separated into other independent genera (Al-Shehbaz 2006).

The genus *Sisymbrium* (tribe Sisymbrieae De Candolle 1821a: 237) includes annual, biennial to perennial herbs, with simple or no trichomes, more rarely with branched trichomes (only in South African *Sisymbrium burchellii* De Candolle 1821b: 472); leaves entire to pinnatisect, the cauline ones never auriculate or amplexicaul at the base; flowers arranged in ebracteate racemes or sometimes foliaceous; sepals erect to erecto-patent, oblong, the lateral ones slightly gibbose at the base; petals yellow, with blade obovate and attenuated into a claw; lateral nectaries annular, confluent with the middle ones in a ring; androecium tetradynamous; style short and strongly 2–lobed stigmas; fruits linear siliques, valves with 3 veins visible at maturity; seeds uniseriate, with incumbent cotyledons.

In the Iberian Peninsula, the genus *Sisymbrium* is represented by 11–12 species (Ball 1964, Pujadas Salvá 1993). More specifically, the Sect. *Irio* De Candolle (1821a: 238), includes 4 species: *S. irio* Linnaeus (1753: 659), *S. assoanum* Loscos & Pardo (1863: 6), *S. austriacum* Jacquin (1775: 35), and *S. crassifolium* Cavanilles (1802: 437), the last two highly variable and polymorphic. *S. irio* is one of the species that can be easily distinguished from the others by having flowers with very small petals overreached by the young fruits.

Three Iberian Peninsula species are often treated as subspecies of *S. austriacum*: *S. hispanicum* Jacquin (1784: 12, tab. 124), which is also found in North Africa (Quézel & Santa 1962, Maire 1977), *S. contortum* Cavanilles (1802: 436) and *S. chrysanthum* Jordan (1861: 141), which have been distinguished by the size of the silique (shorter, wider in *S. chrysanthum*) and by the indumentums at the base of the stem, glabrous in *S. hispanicum* and hirsute in *S. contortum* (Pujadas Salvá 1993).
According to our data, *S. contortum* is synonymous of *S. hispanicum*, and the plants of southern Spain constitute a new species, which we describe and illustrate in the present paper, discussing its affinities, distribution, and habitat.

**Taxonomy**

*Sisymbrium isatidifolium* Blanca, Cueto & J. Fuentes, sp. nov. (Figs. 1 & 2)

Species related to *Sisymbrium hispanicum*. It differs by its lowermost leaves oblong-obovate, obtuse, dentate to subentire, the middle ones oblong-obovate to oblong-linear, smaller flowers [sepals 2.4–3 mm, petals (3.5–)4–5 mm] and fruits generally smaller [(10–)15–25(–30) × 0.6–0.7 mm].

**Type:**—SPAIN. Granada: Orce, Llano de Almaida, margas yesíferas, 970 m, 30 Mayo 2013, G. Blanca, M. Cueto & J. Fuentes 61401 (holotype GDA!, isotype HUAL!).

Annual to biennial herb, unicaule, glabrous, and glaucous. Stem (15–)20–70 cm, erect, simple, branched in the upper half, often with reddish tones. Leaves alternate, the lowermost 3–25 × 1–4 cm, rosulate, oblong-obovate, obtuse, dentate to subentire, narrowing progressively towards the base, sometimes with reddish tones in the central nerve and throughout the underside of the blade; the middle ones oblong-obovate to oblong-linear, sessile or subsessile, not amplexicaul at the base, serrat or entire, gradually decreasing in size upwards. Synflorescence ramose, corymbiform, with branches sometimes subpatent; racemes of up to 50–60 flowers, ebracteate. Pedicels (3.5–)4–6 mm, straight at flowering and sharply incurved in the fruit, 0.5–0.6 mm thick in the middle and thickening at the apex (to 0.8 mm). Sepals 2.4–3 mm, erect and very open, incurred at the base, oblong, yellow; the lateral ones slightly gibbose at the base. Petals (3.5–)4–5 mm, with obovate blade and attenuated to a claw. Androecium tetradynamous; lateral stamens (2–)2.5–3 mm, the middle ones (3–)3.5–4 mm; anthers 0.7–0.9(–1) mm. Siliques (10–)15–25(–30) × 0.6–0.7 mm, densely arranged, linear, slightly torulose, somewhat compressed, and with three veins well marked at maturity; style 1–1.8 mm, initially thicker and at maturity of the same width as the valves; stigma strongly 2-lobed; seeds 10–20, measuring 0.9–1 × 0.5–0.6 mm, uniseried, with incumbent cotyledons.

**Etymology:**—The specific epithet refers to the similarity of the leaves to those of *Isatis tinctoria* Linnaeus (1753: 670).

**Distribution and habitat:**—*Sisymbrium isatidifolium* is endemic to southern peninsular Spain, restricted to the provinces of Albacete, Jaén, Granada, and Almería (Fig. 3).

Grows on marly and gypsiferous soils, forming part of the open esparto grasslands or weedy and ruderal communities in the mesomediterranean bioclimatic belt at elevations between 550–1500 m. a.s.l. and in a dry ombrotype climate.

**Phenology:**—*Sisymbrium isatidifolium* flowers from May to June, and produces fruits from June to July.

**Additional specimens examined (paratypes):**—SPAIN. Albacete: Balazote y Venta del Conejo, 7–800 m, 17 June 1891, *Porta & Rigo 45437* (MA!); El Salobrar, cerca de Albacete, 740 m, 30SWJ90, 12 June 1986, J. Molero 428015 (MA!); entre Urbanización Casas Viejas y autovía de Jaén, 686 m, 30SWJ917147, 23 May 2012, A. Valdés Franzí 59889 (GDA!); La Felipa, 680 m, 30SXJ0318, 10 May 1986, J.M. Herranz 355668 (MA!); La Pulgosa, 690 m, 30SWJ9813, 29 May 1986, J.M. Herranz 355667 (MA!); N301, km 264, entre Albacete y Chinchilla de Monte Aragón, 710 m, 25 June 1996, A. Schinini et al. 632048 (MA!). Almería: María, carretera AL–9102, sobre el Barranco del Saltador, 1095 m, 30 May 2013, M. Cueto, G. Blanca & J. Fuentes 25586 (HUAL!); María, prox. Cortijo del Ventorrillo, 1015 m, 30 May 2013, M. Cueto, G. Blanca & J. Fuentes 25587 (HUAL!); Oeste de María, 9 June 1976, C. Gómez Campo 619991 (MA!). Granada: Entre Puebla de Don Fadrique y Cañadas de Cañepla, 20 June 1989, G. Blanca & M. Cueto 29584 (GDAC!); Orce, cañada de Don Tomás, 1000 m, 30 May 2013, M. Cueto, G. Blanca & J. Fuentes 25588 (HUAL!); Orce, Fuente Nueva, entre Cortijo Varela y Cortijo del Ñoño o de la Mojonera, 975 m, 30SWG4976, 23 May 2013, G. Blanca, M. Cueto & J. Fuentes 61402 (GDA!). Jaén: Barranco del río Segura, 1500 m, June 1906, E. Reverchon 45469 (MA!); Le Pozo, 1500 m, May 1905, E. Reverchon 45470 (MA!); Le Pozo, 1500 m, June 1905, E. Reverchon 45466 & 45467 (MA!); Sierra de Cazorla, 1500 m, June 1901, E. Reverchon 45468 (MA!).

**Comparison and discussion:**—The identity of *Sisymbrium hispanicum* is controversial. In the original description of this species, Jacquin (1784: 12) indicated that it had “…foliis lanceolatis, serratis, sessilibus”, as can be clearly appreciated in the detailed plate of the species (Tab. 124). This same characteristic also appears in the complete description of the species that this same author included in the what must have been an earlier work, but which appeared two years later (Jacquin, 1786: 69): “…caulem…erectum & ex omnium fere foliorum axillis ramosum. Haec sunt lanceolata, acutiuscula, rariter serrata, sessilia & glaucescensia”. These same characteristics were mentioned by...
later authors such as Willdenow (1801: 507), De Candolle (1821b: 463) and even Willkomm (1880: 799). Nevertheless, this latter author, pointing out the distribution of this species, included the exsiccatata collected by Bourgeau in southern Spain (between Albacete and Chinchilla, Albacete Province, and near María, Almería Province), which correspond to a completely different plant (which we propose as *Sisymbrium isatidifolium*, sp. nov.), characterized by its lowermost leaves oblong-obovate, obtuse, dentate to subentire, the middle ones oblong-obovate to oblong-linear. Since Jacquin (1786) had not indicated a precise location for his species (only the specific epithet make reference to Spain), the details from Willkomm (*l.c.*) prompted a change in the conception of *S. hispanicum*, which has been assumed by later authors (Schulz 1924, Guinea 1970, Pujadas Salvá 1993, among others).

FIGURE 2. A–D Photographs of *Sisymbrium isatidifolium*: A, Habit; B, detail of the basal leaves; C, detail of the raceme; D, siliques.
Although, as stated above, a colour plate illustrates the identity of _S. hispanicum_ (Jacquin 1784: tab. 124), where further details can be seen, we undertook a search for the specimens used at the time by Jacquin. As D’Arcy (1970) commented, there is no single “Jacquin Herbarium”, but rather the material is scattered throughout several European herbaria. Specifically in the Hamburg Herbarium (HBG), the specimen numbered 506246! was chosen as the typus by O.E. Schulz (in sched.), from the herbarium of Willdenow. In this specimen, the leaves are lanceolate and the siliques are up to 27 mm (still immature) with strongly incurvate pedicels.

Other characters that have been used to differentiate a _S. hispanicum_ from other closely related species are the undivided leaves and the lack of indument, especially at the base of the stem. These two characteristics are of only limited use, as some specimens exist in the most closely related species with at least the middle leaves undivided and linear lanceolate (Table 1). Regarding the indument, in the same species and in the same population, specimens can be completely glabrous together with others having hirsute stems, especially towards the base; this character has been used especially to distinguish _S. contortum_, which we consider synonymous of _S. hispanicum_ after a detailed study of the data on the protologue and the typus deposited in the Herbarium del Jardín Botánico de Madrid (MA 476339!).

Table 1 lists the main differences between _Sisymbrium isatidifolium_ and the other more closely related species. It is distinguished from the others by the type of basal and middle leaves. Also, _S. chrysanthum_ is distinguishable by its very short siliques and, especially, for being wider, more or less appressed and parallel to the axis, with similarly appressed pedicels, much thinner than the siliques; _S. hispanicum_ has larger flowers and fruits; _S. crassifolium_ bears much larger flowers and fruits, while _S. assoanum_ has lax racemes, the fruits do not overlap, and the fruiting pedicels are generally longer, straight, and far thinner than the siliques.
### TABLE 1. Comparison of *Sisymbrium isatidifolium* with the more related species of the genus

<table>
<thead>
<tr>
<th>Features</th>
<th><em>S. chrysanthum</em></th>
<th><em>S. hispanicum</em></th>
<th><em>S. isatidifolium</em></th>
<th><em>S. crassifolium</em></th>
<th><em>S. assoanum</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basal leaves</strong></td>
<td>sinuate to runcinate-</td>
<td>lobed-pinnatisect to</td>
<td>oblong-obovate,</td>
<td>sinuate to runcinate-</td>
<td>lobed-pinnatisect</td>
</tr>
<tr>
<td></td>
<td>pinnatifid, sometimes</td>
<td>lirate-pinnatifid,</td>
<td>dentate to subentire,</td>
<td>pinnatifid, sometimes</td>
<td>to lirate-pinnatifid,</td>
</tr>
<tr>
<td></td>
<td>hastate at the base,</td>
<td>hastate at the base,</td>
<td>gradually narrowed</td>
<td>hastate at the base,</td>
<td>hastate at the base,</td>
</tr>
<tr>
<td></td>
<td>petiolate</td>
<td>petiolate</td>
<td>toward the base,</td>
<td>petiolate</td>
<td>petiolate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>oblong-obovate to</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>oblong-linear</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>lobed-pinnatisect and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>petiolar to linear-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>lanceolate and sessile</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Middle leaves</strong></td>
<td>pinnatifid to</td>
<td>lirate-pinnatisect and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>petiolate to linear-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>lanceolate and sessile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Racemes</strong></td>
<td>dense, the fruits</td>
<td>dense, the fruits</td>
<td>lax or ± dense</td>
<td>lax, the fruits not</td>
<td></td>
</tr>
<tr>
<td>(fruiting)</td>
<td>overlapping</td>
<td>overlapping</td>
<td></td>
<td>overlapping</td>
<td></td>
</tr>
<tr>
<td>Sepals</td>
<td>2–3 mm</td>
<td>3–5 mm</td>
<td>(3.5–)4–5 mm</td>
<td>2.5–3(–3.5) mm</td>
<td></td>
</tr>
<tr>
<td>Petals</td>
<td>3.5–5.5(–6) mm</td>
<td>(5–)6–7.5 mm</td>
<td>(3–)4–5 mm</td>
<td>7–12 mm</td>
<td></td>
</tr>
<tr>
<td>Siliques</td>
<td>-length (6–)10–17(–19) mm</td>
<td>-width (15–)20–45(–50) mm</td>
<td>(10–)15–25(–30) mm</td>
<td>(10–)12–35(–42) mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.7–0.8</td>
<td>0.6–0.7</td>
<td>1.2–1.4 mm</td>
<td>0.6–0.7(–1) mm</td>
<td></td>
</tr>
<tr>
<td>Pedicels</td>
<td>5–8 × 0.3–0.6 mm</td>
<td>strongly incurvate,</td>
<td>3–8 × 0.6–1 mm</td>
<td>5–12 × c. 0.2 mm</td>
<td></td>
</tr>
<tr>
<td>(fruiting)</td>
<td>straight to slightly</td>
<td>almost as wide as</td>
<td></td>
<td>subpatent, straight,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>incurvate, relatively</td>
<td>silique</td>
<td></td>
<td>filiform, much thinner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>appressed, much</td>
<td></td>
<td></td>
<td>than the silique</td>
<td></td>
</tr>
<tr>
<td></td>
<td>thinner than the silique</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### List of related recognized species:

*Sisymbrium chrysanthum* Jordan (1861: 141)

*Ind. loc.*: “Hab. in Pyrenaeis…. Cette plante que j’ai reçu du Jardin Botanique de Lyon…”

*Typus*: BM 522261!

*Distribution*: Pyrenees and northern third of the Iberian Peninsula

*Synonyms:*
- *S. austriacum* subsp. *chrysanthum* (Jord.) Rouy & Foucaud (1895: 17)
- *S. pyrenaicum* (L.) Villars (1788: 341), non Linnaeus (1763: 916)
- *S. austriacum* sensu Willkomm (1880: 798), non Jacquin (1775: 35)

*Sisymbrium hispanicum* Jacquin (1784: 12, tab. 124)

*Ind. loc.:* [Not mentioned explicitly]

*Typus*: HBG 506246!

*Distribution*: Northern, central and eastern Iberian Peninsula, and North Africa

*Synonyms:*
- *S. austriacum* subsp. *hispanicum* (Jacq.) P.W. Ball & Heywood in Ball (1961: 17)
- *S. contortum* Cavanilles (1802: 436)
- *S. austriacum* subsp. *contortum* (Cav.) Rouy & Foucaud (1895: 19)

*Sisymbrium crassifolium* Cavanilles (1802: 437)

*Ind. loc.:* “…común en el Real Retiro y Casa de Campo…. Se cultiva en nuestro Jardin” [Madrid]

*Typus*: MA 476341!

*Distribution*: Iberian Peninsula and North Africa

*Synonyms:*
- *S. laxiflorum* Boissier (1838: 9)
Sisymbrium assoanum Loscos & Pardo (1863: 6)

*Ind. loc.*: “Provenit in parte Aragoniae centralis, circa Zaragoza, Caspe…”

Distribution: Center and East of the Iberian Peninsula

**Key for the Iberian Peninsula species:**

1. Flowers axillary (racemes bracteate)........................................................................................................ 2
2. Flowers in terminal and ebracteate racemes .......................................................................................... 3

2. Flowers fasciculate, (1–)2–3(–4) in the axil of the leaves; petals c. 1.5 mm long.......................... *S. polyceratium*
3. Flowers solitary in the axil of the leaves; petals 2.5–3 mm long .................................................. *S. runcinatum*

3. Siliques 0.6–1.7 cm long, subulate-linear; fruiting pedicels appressed to rachis.......................... 4
4. Siliques 2–20 cm long, linear to subulate-linear; fruiting pedicels suberect to patent, not appressed to rachis.. 5

4. Siliques 1.3–1.7 cm long; petals 3–4.2 mm long .............................................................................. *S. officinale*
5. Siliques 0.6–1.1 cm long; petals 1.3–2.2 mm long .............................................................................. *S. cavanillesianum*

5. Fruiting pedicels nearly as wide as fruit............................................................................................... 6
6. Fruiting pedicels narrower than fruit .................................................................................................. 11

6. Siliques subulate-linear, attenuate from the base up to the apex; petals 1.8–2.5 mm long........... *S. erysimoides*
7. Siliques linear; petals longer than 2.5 mm .......................................................................................... 11

7. Distal cauline leaf blades divided into linear of filiform lobes; sepals cucullate ........................... *S. altissimum*
8. Distal cauline leaf blades not divided into linear or filiform lobes; sepals not cucullate ............... 8

8. Siliques 5–20 cm long; racemes with less than 30 flowers................................................................. 9
9. Siliques (1–)1.5–4.5 cm long; racemes 30–60 flowered ................................................................. 10

9. Plants annual; siliques 5–10 cm long, straight or slightly arched, of villose to glabrescent......... *S. orientale*
10. Plants biennial to perennial; siliques 14–20 cm long, markedly arched, glabrous or glabrescent ... *S. macroloma*

10. Basal leaves lobed-pinnatisect to lyrate-pinnatifid, petiolarate; petals (5–)6–7.5 mm long; siliques (15–)20–45(–50) mm long .................................................................................. *S. hispanicum*
11. Basal leaves oblong-obovate, dentate to subentire, gradually narrowed toward the base; petals (3.5–)4–5 mm long; siliques (10–)15–25(–30) mm long .................................................. *S. isatidifolium*

11. Young siliques overtopping flowers; petals 2.5–3.5 mm long...................................................... *S. irio*
12. Young siliques not overtopping flowers; petals 3.5–12 mm long ................................................... 12

12. Petals 7–12 mm long; fruiting pedicels 0.6–1 mm wide .................................................................. *S. crassifolium*
13. Petals 3.5–5.5(–6) mm long; fruiting pedicels 0.2–0.6 mm wide ..................................................... 13

13. Siliques 1–1.3 mm wide; pedicels 0.3–0.6 mm wide, relatively appressed ............................. *S. chrysanthum*
14. Siliques 0.6–0.7 mm wide; pedicels c. 0.2 mm wide, subpatent .................................................. *S. assoanum*

Huesca: Vedad de Fraga, 200 m, 13 June 1985, A. Charpin et al. 371427 (MA!). Madrid: Rivas de Jarama, 28 April 1918, C. Vicioso 45399 (MA!). Teruel: Castelserás, 29 May 1872, F. Loscos y Bernal 202578 (MA!). Toledo: Soto de Oreja, 30TVK5833, 10 March 1977, E. Valdés-Bermejo 315311 (MA!). Zaragoza: Calatayud, 550 m, 26 April 1986, A. Segura Zubizarreta 497049 (MA!); Calatayud, 530 m, 30TXL1378, 7 May 1998, J.M. Pisco García 638902 (MA!).

Bello 798801
SISyMBRIUM ISATIDIFOLIUM
Bello 798797
Bello 798798
Bello 798799
Bello 798800
Bello 798801
Bello 798802
Bello 798803
Bello 798804
SISyMBRIUM ISATIDIFOLIUM (BRASSICACEAE)

Phytotaxa 220 (1) © 2015 Magnolia Press • 51
Acknowledgements

The authors would like to thank D. Belchí for providing the illustration of the new species, two anonymous reviewers for comments, and to David Nesbitt for the language editing. We are also grateful to the herbaria of the Real Jardín Botánico de Madrid (MA), University of Almería (HUAL), University of Granada (GDA and GDAC), and Institut für Allgemeine Botanik (HBG).

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