Linaria becerrae (Plantaginaceae), a new endemic species from the southern Spain, and remarks on what Linaria salzmannii is and is not

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Abstract

A new species of the genus Linaria is described, illustrated and compared with its morphologically closest relatives from L. sect. Versicolores: L. salzmannii, L. viscosa and L. spartea. Furthermore, the identity of L. salzmannii, with which it has been usually misidentified, is discussed. The new species occurs on molasse substrates, forming part of communities of ephemeral annual herbs, in the province of Málaga (southern Spain), near the locality El Chorro. Synonymy is revised for the concerned names, and an identification key is reported for the Iberian taxa of L. sect. Versicolores.

Key words: Antirrhineae, endemic plants, Iberian Peninsula, taxonomy

Introduction


Linaria sect. Versicolores (Bentham 1846: 275) Wettstein (1895: 59) includes annual and biennial to perennial species with heteromorphic shoots, fertile ascendant to erect and sterile decumbent or ascendant; flowers arranged in bracteate racemes; corolla personate and spurred, with the lower lip protruding and completely enclosing the throat (palate); bifid or rarely emarginate style with discrete stigmatic areas (a distinctive synapomorphy of this monophyletic section; Fernández-Mazuecos & Vargas 2011, Fernández-Mazuecos et al. 2013); and seeds subreniform, trigonous or tetrahedral, not laterally compressed and unwinged but with conspicuous transverse crests, more rarely smooth. In this section, Viano (1978) included 14 species in the Western Mediterranean, and Fernández-Mazuecos et al. (2013) and Vigalondo et al. (2015) indicated that it is the largest section of the genus, including ca. 30 species and subspecies. Sáez & Bernal (2008) cited 10 species for the Iberian Peninsula, including L. salzmannii Boissier (1841: 456), which is endemic to southern Spain, specifically Granada and Málaga provinces (Sáez & Bernal 2008). However, after visiting different populations of the latter species, we found significant differences between populations growing in each of both cited provinces, mainly concerning corolla colour and morphology.

As a result of Boissier’s visit to southern Spain in 1837, he published numerous new species (Boissier 1838, 1839–1845). Many were named honouring botanists who had previously visited the region and had contributed to the knowledge of its flora, or who had helped Boissier in his work, such as Agardh, Bory, Clemente, Haenseler, Lagasca, López, Prolongo, Rambur, Salzmann, Webb, Willdenow, etc. One of those species, which is the focus of the present contribution, is L. salzmannii Boissier (1841: 456).

The current concept of this species, assigning the Granada and Málaga populations to the same species, was contributed by Boissier himself (1841: 456), who recognised two varieties in his L. salzmannii: i) “var. [a] purpurea”
with violaceous flowers, and ii) “var. [β] flava” Boissier (1841: 456), with yellow flowers. Furthermore, Boissier indicated in the protologue the following type localities for each one: “Varietas α crescit in arenosis regionis montanae, in provinciâ Malacitanâ Salzmann, in viâ à Granada ad pagum Guejar. Alt. circ. 3500′. Varietas β in cultis regionis montanae superioris et alpinae, Sierre Nevada en la Dehesa de San Gerônimo et in latere meridionali suprâ Trevelez. Alt. 4000′–5000′. Fl. aest.” [sic]. However, Boissier did not visit the Málaga populations of this species, which he found near the locality of El Chorro (Cabezudo 1987), a circumstance that is clearly appreciated in the indication of the type locality, as Boissier emphasised with italics the populations that he had personally visited. The mention of the populations in Málaga province was due to the botanist M. Jean Gay, who showed him Salzmann’s herbarium, as stated by Boissier himself (1845: VIII): “M. Jean Gay a trouvé, au milieu de ses occupations nombreuses et multipliées, le temps de parcourir avec moi bien des parties de son riche herbarier, et j’ai pu ainsi examiner toutes les plantes rapportées d’Andalousie par M. Salzmann, et dont il possède la suite complète….”. This was the only time that Boissier had contact with the plant from Málaga province, so that the only material that he used to describe L. salzmannii was collected in Granada province.

Burdet et al. (1990: 618), in their work on the nomenclatural types of the Iberian taxa of the Scrophulariaceae described by E. Boissier, chose a specimen from Granada province ("entre Grenade et Guejar") as lectotype of L. salzmannii, adding the observation that "Nous n’avons pas trouvé dans les herbiers de Genève (G) d’exsiccatum de Salzmann relatif à ce taxon". This is also an indirect evidence that Boissier did not study material from Málaga province to describe this species.

We have visited the type locality of L. salzmannii, situated between the city of Granada and the town of Güéjar, and it is very probable that the original populations have disappeared due to the construction of the Canales reservoir. Nevertheless, we have been able to study the Granada plants at a nearby location, Sierra de Huétor, close to the town of Huétor Santillán. Plants growing in that area show morphological characters matching the detailed illustration in Boissier’s (1841: tab. 128) protologue.

Conversely, the populations from western Málaga differ notably from those of Granada, primarily because of corolla morphology and colour. Taking into account these considerations and after reviewing the most important regional floras (e.g. Willkomm & Lange 1865–1870, Willkomm 1893, Tutin et al. 1972, Valdés et al. 1987, Sáez & Bernal 2008, Blanca et al. 2011, among others), we conclude that the Málaga populations belong to a different taxon, which is described below as a new species of L. sect. Versiclores. Data on its morphological characteristics, distribution and habitat are discussed with regard to other closely related Iberian taxa of that section.

**Taxonomy**

**Linaria becerrae** Blanca, Cueto & J. Fuentes, sp. nov. (Fig. 1A–B)

- Linaria salzmannii auct., non Boissier (1841: 456)

**Type:** SPAIN. Málaga: Ardales, El Chorro, near Iglesia Rupestre and Portezuelos, 450 m elevation, 2 March 2016, G. Blanca, M. Becerra & J. Fuentes (holotype: GDA 62532!).

**Diagnosis:** It differs from Linaria salzmannii Boiss. in having calyx lobes shorter (up to 3.5 mm); corolla smaller [(12–)13–15 mm, spur excluded], upper lip shorter (up to 9 mm), and spur longer (14–16 mm) and straight; corolla uniformly and intensely violet, excepting the yellow palate, with hardly visible veins.

**Description:**—Annual herb. Stems thin, often simple or slightly branched; fertile stems 5–15 cm long, arcuate-ascending, sparsely leafy, bare below the inflorescence, glabrous except the inflorescence, which is glandular-pubescent; sterile stems shorter (up to 7 cm) and more numerous, pubescent. Leaves on fertile stems up to 20 × 1 mm, alternate, linear; those on sterile stems up to 9 × 1.4 mm, 3–4 whorled, oblanceolate. Racemes short, corimbiform, dense, pauciflorous, glandular-pubescent. Bracts 2.5–3 mm long, linear-lanceolate. Pedicels c. 3 mm long, erect, mostly adnate to the axis of the inflorescence, as long as the bracts, slightly longer at fruiting, glandular-pubescent. Calyx 4–5 mm, with lobes up to 3.5 × 0.5–0.9 mm, fused at the base, linear-oblancoate, glandular-pubescent on margins. Corolla personate, spurred, up to 30 mm long (spur included), or (12–)13–15 mm (spur excluded), uniformly and intensely violet, excepting the yellow palate, with hardly visible veins; tube as long as the calyx; upper lip up to 9 mm long, bilobate, with a slit of ca. 3 mm; spur 14–16 mm long, somewhat longer than the rest of the corolla, narrowly conical, straight, violet. Capsule 2.5–3 mm, shorter than the calyx, broadly ellipsoid, apex bilobate; style 4–5 mm long, persistent, apex bifid. Seeds 0.6–0.7 mm, wingless, with deep transverse and slightly sinuous crests, black in colour.
Eponymy:—The specific epithet honours Manuel Becerra, who encouraged our study of the *Linaria* populations from Málaga province, as he himself had already noticed the differences between the new species and *L. salzmannii*.

Distribution and habitat:—*Linaria becerrae* is a species endemic to southern peninsular Spain, restricted to western Málaga province. It grows exclusively on sandy substrates from the decomposition of molasse (conglomerates and detritic sandstones), forming part of communities of ephemeral annual herbs, near the locality El Chorro.

and its closest relatives inhabiting siliceous sands 15−55 cm, erect 5−15 cm, arcuate-sandy molasses 3−5.5 mm long, lobes dolomite sands L. viscosa sandy substrates, siliceous L. becerrae provinces (Sáez & Bernal 2008; Appendix 1), and individuals with yellow flowers and pale-violet flowers (and even with bicoloured corollas) are found even in a single population (Sáez pers. comm.). Furthermore, in agreement with Boissier (see above) coincides with that indicated by Kunze for L. spicata (Kunze) D.A.Sutton, and not differing in other morphological features.

### TABLE 1. Comparison of diagnostic characters of *Linaria becerrae* and its morphologically closest relatives.

<table>
<thead>
<tr>
<th>Character</th>
<th>L. spartea</th>
<th>L. becerrae</th>
<th>L. salzmannii</th>
<th>L. viscosa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stem</strong></td>
<td>15−55 cm, erect</td>
<td>5−15 cm, arculate-ascending</td>
<td>(10−)15−55 cm, erect to arculate-ascending</td>
<td>5−70 cm, erect to arculate-ascending</td>
</tr>
<tr>
<td><strong>Racemes (anthesis)</strong></td>
<td>long, racemiform, lax, glabrous to sparsely glandular-pubescent</td>
<td>short, corymbiform, dense, glandular-pubescent</td>
<td>short, corymbiform, dense, densely glandular-pubescent</td>
<td>short, corymbiform, dense, densely glandular-pubescent</td>
</tr>
<tr>
<td><strong>Pedicels (anthesis)</strong></td>
<td>(2−)3−15 mm, erect-patent, not adnate to the inflorescence axis, much longer than the bracts</td>
<td>c. 3 mm, erect, mostly adnate to the inflorescence axis, as long as the bracts</td>
<td>5−8 mm, erect-patent, ± adnate in his basal part to the inflorescence axis, much longer than the bracts</td>
<td>3.5−8 mm, erect-patent, not adnate to the inflorescence axis, equalling or longer than the bracts</td>
</tr>
<tr>
<td><strong>Calyx</strong></td>
<td>3−5.5 mm long, lobes 0.5−1.3 mm wide, glabrous to sparsely glandular-pubescent</td>
<td>4−5 mm long, lobes 0.5−0.9 mm wide, glandular-pubescent</td>
<td>5−6 mm long, lobes 0.4−0.9 mm wide, densely glandular-pubescent</td>
<td>4−7 mm long, lobes 0.9−1.8 mm wide, densely glandular-pubescent</td>
</tr>
<tr>
<td><strong>Corolla</strong></td>
<td>up to 28 mm</td>
<td>up to 30 mm</td>
<td>up to 25 mm</td>
<td>up to 25(−30) mm</td>
</tr>
<tr>
<td><strong>- spur</strong></td>
<td>6−13 mm long, straight, equaling to somewhat shorter or longer than the rest of the corolla</td>
<td>14−16 mm long, straight, somewhat longer than the rest of the corolla</td>
<td>7−10 mm long, ± curved, much shorter than the rest of the corolla</td>
<td>7−12 mm long, ± curved, equal to or somewhat shorter than the rest of the corolla</td>
</tr>
<tr>
<td><strong>- venation</strong></td>
<td>hardly visible</td>
<td>hardly visible</td>
<td>marked darker veins</td>
<td>hardly visible</td>
</tr>
<tr>
<td><strong>- colour</strong></td>
<td>yellow</td>
<td>uniformly and intensely violet, excepting the yellow palate</td>
<td>yellow to pale violet (excepting the yellow palate)</td>
<td>yellow</td>
</tr>
<tr>
<td><strong>Habitat</strong></td>
<td>siliceous sands</td>
<td>sandy molasses</td>
<td>dolomite sands</td>
<td>sandy substrates, siliceous or particularly calcareous</td>
</tr>
</tbody>
</table>

An additional issue concerns to *L. salzmannii* var. *flava* Boiss., a taxon that has been considered by different authors (Sutton 1988, Sáez & Bernal 2008, Sáez & Sainz 2011, among others) to deserve subspecific rank as *L. viscosa* subsp. *spicata* (Kunze) Sutton (1988: 436) [= *L. spicata* Kunze (1846: 645)]. However, both taxa are undoubtedly synonymous, since they show the same main characteristics, and the type locality mentioned by Boissier for *L. salzmannii* var. *flava* Boiss. (see above) coincides with that indicated by Kunze for *L. spicata* Kunze: “Sierra Nevada, in latere australi ad rivulos regions alpinae”. This taxon occurs in southern Spain, from eastern Malaga and Granada to Jaén and Albacete provinces (Sáez & Bernal 2008; Appendix 1), and individuals with yellow flowers and pale-violet flowers (and even with bicoloured corollas) are found even in a single population (Sáez pers. comm.). Furthermore, in agreement with the molecular results of Fernández-Mazuecos & Vargas (2015), those yellow-flowered and violet-flowered plants usually referred to as *L. viscosa* subsp. *spicata* (Kunze) D.A.Sutton, and not differing in other morphological features.

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of the corolla, indeed belong to a single species (perhaps as mere varieties) to which the name *L. salzmannii* is to be applied.

**List of related accepted species and its synonyms:**

*Linaria spartea* (L.) Chazelles (1790: 38) ≡ *Antirrhinum spartea* Linnaeus (1753: 1197) [Fig. 1D]

*Lectotypus* (designated by Viano 1978: 51): LINN 767.20 [digital image!]

**Distribution:** Iberian Peninsula and southern France

*Linaria salzmannii* Boissier (1841: 456) [Fig. 1C] ≡ *Linaria salzmannii* var. *violacea* Boissier (1841: 456); = *L. salzmannii* var. *flava* Boissier (1841: 456); = *L. spicata* Kunze (1846: 645) ≡ *L. viscosa* subsp. *spicata* (Kunze) Sutton (1988: 436)

**Ind. loc.:** “Varietas α crescit in arenosis regionis montanae, in provinciâ Malacitanâ Salzmann [sic, this locality corresponds indeed to *L. becerrae*], in viâ à Granada ad pagum Guejar. Alt. circ. 3500’’

*Lectotypus* (designated by Burdet et al. 1990: 618): G-BOIS [digital image!]

**Distribution:** Endemic to southeastern Spain (from eastern Málaga and Granada to Albacete and Jaén provinces).

*Linaria viscosa* (L.) Chazelles (1790: 39) ≡ *Antirrhinum viscosum* Linnaeus (1756: 21) [Fig. 1E]


**Distribution:** Southwestern Iberian Peninsula

**Key for the Iberian species of *Linaria* section *Versicolores***

The following identification key is partially based on Sáez & Bernal (2008), to which the names *L. becerrae* and *L. salzmannii* have been added or conveniently applied.

1. Style emarginate at the apex [Subsect. *Elegantes* (Viano) D.A.Sutton] ............................................................... 2
   - Style clearly bilobate to bifid [Subsect. *Versicolores* Benth.] ................................................................. 3
2. Stems fertile 15–45 cm; sepalas 0.4–0.8 mm wide at anthesis, linear-lanceolate or lanceolate .......................................................... *L. elegans*  
   - Stems fertile 6–20 cm; sepals 0.7–1.2 mm wide at anthesis, oblong-lanceolate .............................................. *L. nigricans*
3. Seeds smooth ........................................................................................................................................... *L. pedunculata*
   - Seeds with deep transverse crests .............................................................................................................. 4
4. Perennial herb, with stems erect .................................................................................................................. *L. clementei*
   - Annual herb, with stems decumbent, ascend to erect .............................................................................. 5
5. Corolla violet, purple or pinkish, with yellow palate .................................................................................. 6
   - Corolla yellow or yellowish-white, sometimes with a violet spur ................................................................. 10
6. Pedicels ± adnate in his basal part to the inflorescence axis ................................................................. *L. algarviana*
   - Pedicels not adnate to the inflorescence axis ............................................................................................ 8
7. Corolla with clearly visible darker veins; spur 7–10 mm long, ± curved, much shorter than the rest of the corolla ... *L. salzmannii*
   - Corolla with hardly visible venation; spur 14–16 mm long, straight, somewhat longer than the rest of the corolla .... *L. becerrae*
8. Fertile stems decumbent to ascend .............................................................................................................. 9
   - Fertile stems erect ....................................................................................................................................... 11
9. Inflorescence densely glandular-pubescent; seeds subtrigones ................................................................. *L. onubensis*
   - Inflorescence glabrous to sparsely hairy; seeds reniform .................................................................... *L. incarnata*
10. Corolla yellowish-white with violet spur; upper locule of the capsule clearly more developed than the lower one ... *L. gharbensis*
    - Corolla uniformly yellowish; upper locule of the capsule equally or slightly more developed than the lower one .......... 11
11. Inflorescence lax, glabrous or sparsely hairy ......................................................................................... *L. spartea*
    - Inflorescence dense, corymbiform at anthesis, generally densely glandular-pubescent ................................. 12
12. Pedicels ± adnate in his basal part to the inflorescence axis; calyx lobes 0.4–0.9 mm wide ...................... *L. salzmannii*
    - Pedicels not adnate to the inflorescence axis; calyx lobes 0.9–1.8 mm wide ............................................ *L. viscosa*
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References


LINARIA BECERRAE (PLANTAGINACEAE)

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