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A remarkably disjunct population of *Valerianella multidentata* (Caprifoliaceae) in the south of Spain

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Abstract. We provide the first record of *Valerianella multidentata* Loscos & J. Pardo for the flora of Andalusia (south of Spain). The specimen was collected during fieldwork in the southwest of Cordoba province. This new population illustrates a remarkable expansion of the species' geographic range very disjunct from its northeastern distribution core. The main morphological differences of the fruits between *Valerianella multidentata* and its relatives (*V. coronata* and *V. discoidea*) are provided. A geographical distribution map and detailed pictures of the specimen are also presented.

Keywords: Andalusia, chorology, Cordoba, laguna Amarga, Spain, vascular flora.

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Introduction

The genus *Valerianella* Tourn. ex Mill. (Caprifoliaceae Juss.) comprises between 50 and 65 species (Stevens, 2001; Judd *et al*., 2008; Mabberley, 2009) distributed throughout the Northern Hemisphere and widely represented in the Mediterranean region, where some authors place its center of origin (Bell, 2007). Its taxonomy, which is not considered exceptionally complex, is based principally on carpological characteristics (both the external morphology of the fruit and its internal anatomy), on which the classification into sections of the genus is also based (Soyer-Willemet, 1850; Boissier, 1875). However, previous studies have shown that the shape of the fruit is subject to genetic regulatory mechanisms (Eggers, 1983; Martin & Mathez, 1990) that favor the appearance of very different fruit morphotypes, even in the same species. Many of these disparate morphotypes have traditionally been described as different species, despite actually being forms of the same species (Devesa *et al*., 2005).

Valerianella is represented in the Iberian Peninsula by 11 species (18 taxa, if the infraspecific level is considered), which are included in four sections (Devesa & López, 2007). Most of these taxa are widely distributed in Macaronesia, the Mediterranean region, and part of Asia, except for four taxa, *V. locusta* subsp. *lusitanica* (Pau ex Font Quer) M. Laínz, *V. martinii* Loscos, *V. fusiformis* Pau and *V. multidentata* Loscos & J. Pardo, which are endemic to the Iberian Peninsula (Spain and Portugal). The taxa of this genus are small annual plants with small flowers composed of lightly colored corollas that are not or slightly odorous, with little pollen production and, most probably, not nectariferous (Martin & Mathez, 1990). They are very abundant in therophyte pastures on all types of substrates. Regarding the shape of the fruits, most of the Iberian species are homocarpic, i.e. each individual has only one fruit morphotype. In only two species [*V. echinata* (L.) DC. and *V. orientalis* (Schltdl.) Boiss. & Balansa] the plants are heterocarpic, i.e. each individual produces two or more morphotypes of fruits.

The taxonomic synthesis of the genus for *Flora iberica* (Devesa & López, 2007) has contributed to the knowledge concerning the distribution of the species in this territory. The definition of the distribution area and the limits of some species are, undoubtedly, gradually being improved by reviewing and identifying herbarium vouchers collected after their publication (Solano *et al*., 2017). During our regular field surveys throughout Cordoba province, in the southern Iberian Peninsula (Andalusia, Spain), we detected some plants of the genus *Valerianella* that did not conform to the taxa reported in this territory (Fanlo, 1987; Devesa & López, 2007). After being thoroughly studied, these plants were identified as corresponding to *V. multidentata*, which is a very interesting finding, since this population is at a considerable distance from the distribution area of the species.

Materials and methods

A voucher specimen of the *V. multidentata* collected was deposited in the herbarium of the University of Cordoba

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(COFC). Herbarium specimens of *V. multidentata* preserved at BC, GDA, JACA, MA, SEV (acronyms according to Thiers, 2022) were also revised to compare (see Appendix 1). The characteristics of the fruits of *V. multidentata* are compared with the morphologically closest taxa that occur in the territory (Cordoba province), and some ecological remarks concerning the new population are also presented.

Results and Discussion

Valerianella multidentata is an Iberian endemism that was described from the province of Teruel, and more specifically "[...] ad radices collis Pui-moreno (in loco Rincón caliente) ad fl. Regallo inter Alcañiz et Samper sito [...]" (Loscos & J. Pardo in Willkomm, 1863: 49). Its known distribution includes mainly the northwest quadrant of the Iberian Peninsula (provinces of Burgos, Huesca, Lérida, Tarragona, Zaragoza, in addition to Teruel), although the species also reaches some areas in the center (Madrid and Toledo) and the southeast (Albacete and Murcia), where it is very rare (Devesa & López, 2007; Solano *et al*., 2017) (Figure 1a). We provide the first record for both Cordoba province and Andalusian territory. This new finding extends the distribution area of the species notably to the southwest of Spain, about 270 km to the west of the closest population (Socovos population, in Albacete province) (Figure 1a).

Valerianella multidentata is included in sect. Coronatae Boiss. together with the more widely distributed *V. coronata* (L.) DC. and *V. discoidea* (L.) Loisel. Unlike *V. multidentata*, the last two species are distributed throughout several regions of the world, from Macaronesia to Asia. Both species are found practically throughout the Iberian Peninsula, including the province of Cordoba. The three species are homocarpic and all have fruit (monomorphic or dimorphic) with a persistent calyx forming a toothed crown with six or more hooked teeth (Figure 1d-g), except for *V. coronata* f. *pumila* (L.) Devesa, J. López & R. Gonzalo, whose individuals have an extraordinarily reduced non-coroniform calyx (cf. Devesa & López, 2007). However, they can easily be differentiated based on the shape and dimensions of the diaspore. *Valerianella multidentata* (Figure 1c-e), therefore, differs from the other two species (Figure 1f, g) in that it has smaller fruits (1-1.8 vs. [1.2]1.4-2.5 mm) and a smaller crown −the persistent calyx− [0.7-2 vs. (1)1.4-3 mm] with a greater number of teeth [(7)11-17 vs. 6-12], which are narrowly triangular or linear (vs. awned-triangular) and erect (vs. patent or erect-patent), and it also has loosely ciliated bracteoles (vs. densely ciliated). The carpological characteristics of the specimen collected in Cordoba (see detail of Figure 1c) fall within the variability of *V. multidentata* var. *multidentata* [var. *oscensis* (Fanlo) Devesa, J. López & R. Gonzalo differs as regards the larger size of its fruits; see Devesa *et al*., 2005] and therefore its identification is unequivocal. The taxa grow in therophyte grasslands on all types of substrates in the case of *V. coronata*, while *V. discoidea* and *V. multidentata* prefer calcareous substrates. In particular, *V. multidentata* occurs on degraded land, on calcareous and gypsum substrates, as where the new record was found (Devesa & López, 2007).

The specimen was found on the slopes of Laguna Amarga, a site located in the municipality of Lucena, between the Genil and Anzur rivers, southwest of Cordoba (Figure 1a,b). Laguna Amarga, which takes its name from the bitter taste of its water owing to the high concentration of magnesium sulfate it contains, is a permanent saline lake, unlike the very close Laguna Dulce, which is a temporary and non-saline lagoon. This enclave is located on rocky outcrops composed mainly of clays, evaporite rocks (gypsum, anhydrites, and halites), marls, dolomites, and sandstones embedded in a Triassic matrix (Vera & Martín-Algarra, 2004; Gil-Márquez *et al*., 2021). The vegetation on the slopes surrounding the lake consists of a mosaic of olive groves and other natural vegetation consisting of Mediterranean shrubs belonging to *Pistacio lentisci-Rhamnetalia alaterni* Rivas-Martínez 1975 and *Rosmarinetalia officinalis* Br.-Bl. ex Molinier 1934 orders (Rivas-Martínez *et al*., 2002). Some of these companion species have a preference for calcareous or gypsum soils, but also species that are indifferent to the type of substrate, such as *Ephedra fragilis* Desf., *Pistacia lentiscus* L., *Rhamnus lycioides* subsp. *laderoi* Rivas Mart. & J. M. Pizarro, *Cistus albidus* L., *Phlomis purpurea* L., *Chrysojasminum fruticans* (L.) Banfi, *Salvia rosmarinus* Spenn., *Teucrium pseudochamaepitys* L. and *Phagnalon saxatile* (L.) Cass. It was in the scrub clearings that *V. multidentata* was found, forming part of therophytic grasslands communities of *Brachypodion distachyi* Rivas-Martínez 1978 (Rivas-Martínez *et al*., 2002) alliance, and coexisting with other herbaceous plants such as *Iberodes linifolia* (L.) M. Serrano, R. Carbajal & S. Ortiz. *Iberis pectinata* Boiss., *Helianthemum ledifolium* (L.) Mill., *Helianthemum salicifolium* (L.) Mill., *Centranthus calcitrapae* (L.) Dufr., *Neatostema apulum* (L.) I. M. Johnst., *Lysimachia arvensis* (L.) U. Manns & Anderb. and *Galium murale* (L.) All.

This finding not only constitutes a novelty for the flora of Andalusia but also reveals a notable geographical disjunction of the species. Moreover, the presence of this species in the so-called Peripheral Protection Zone of the Laguna Amarga Natural Reserve adds more interest to this enclave, which is currently included in the Special Plan for the Protection of Physical Habitat of Cordoba province and is also part of the Ramsar List of Wetlands, and Special Protection Area (SPA) under the European Union Directive on the Conservation of Wild Birds (Anon., 2015).

New population sampled

Córdoba: near to Laguna Amarga, 30SUG5631, 410 m asl, 21-IV-2018, *J.A. Devesa & G. Martínez Sagarra*, 408A (COFC 65591).

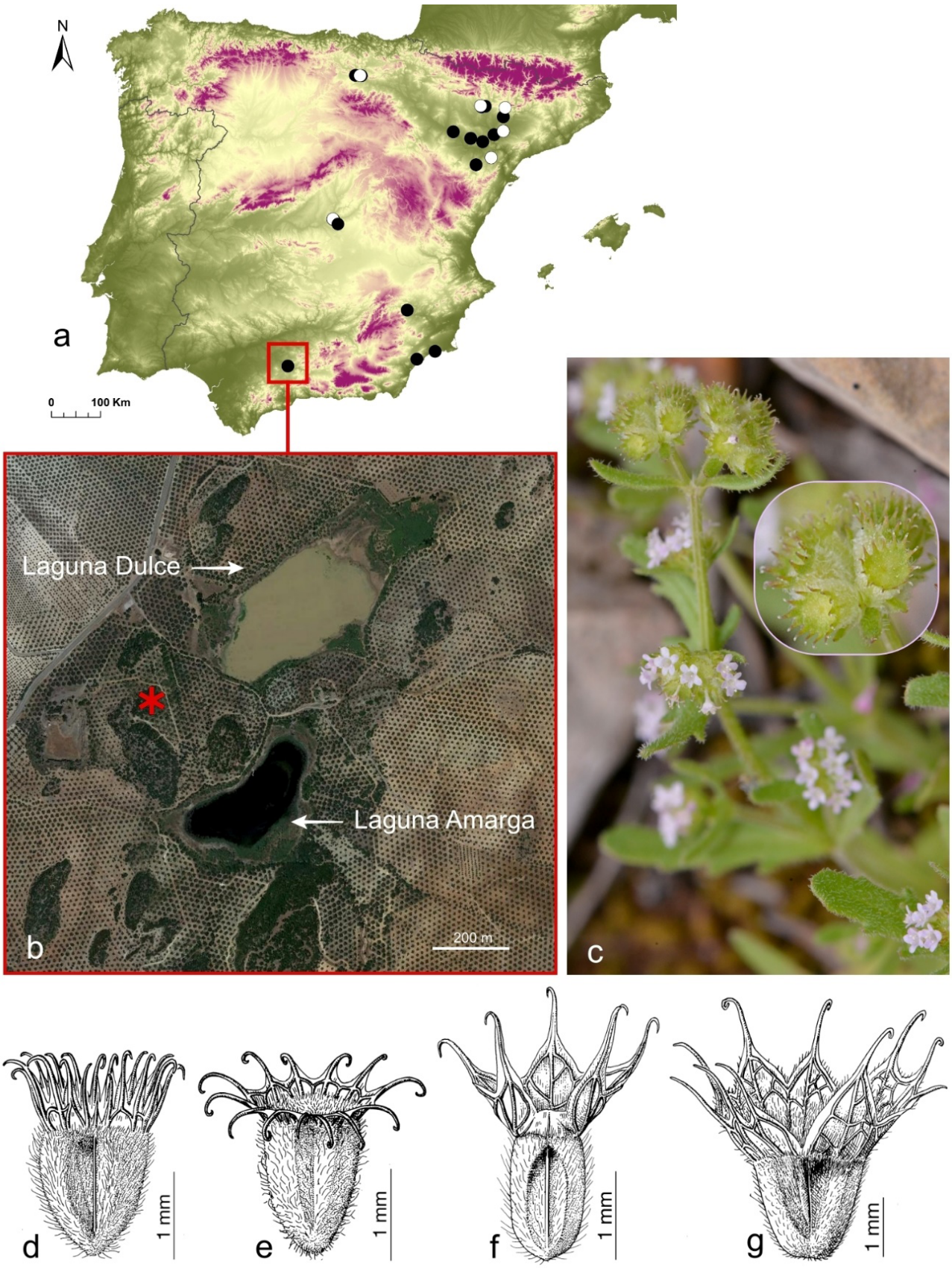

Figure 1. a, Distribution map of the *V. multidentata* (based on the material examined in this study and bibliographical references), black circles represent var. *multidentata*, and white circles var. *oscensis*; b, location of the specimens (red asterisk) in the new population; c, habit of *Valerianella multidentata* var. *multidentata* and detail of the fruits; d-g, drawings of the diaspores (i.e., achenes plus the persistent calyx) of d, *V. multidentata* var. *multidentata*, e, *V. multidentata* var. *oscensis*, f, *V. coronata* (f. *coronata*), g, *V. discoidea* (images of the diaspores courtesy of *Flora iberica* project, adapted from Devesa & López, 2007).

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Appendix 1. List of the specimens examined in this study.

Valerianella multidentata var. *multidentata*:

Albacete: Cortijo de Almírez, Socovos, *C. Aedo & al.* (MA 654737). Burgos: Ameyugo, 17-V-1906 (BC 28179, MA 119262); Ameyugo, 30-V-1910, *Hno. Elías* (MA 119264); Miranda de Ebro, 27-V-1920 (BC 75864, MA 119261); Miranda de Ebro, VI-1936, *M. Losa* (GDA 20103). Córdoba: cercanías de la laguna Amarga, 21-IV-2018, *J.A. Devesa & G. Martínez Sagarra* (COFC 65591) [new population]. Huesca: cerca de Barbastro, 2-V-1985, *J. Pedrol* (MA 419427, MA 326274); entre Peraltilla y Barbastro, a 4-5 km de Peraltilla, 29-V-1989, *J. Pedrol* (MA 509245); Fraga, 5-V-1971, P. *Montserrat & L. Villar* (MA 356062); Serreta Negra de Fraga, 14-V-1977, *Molero* (SEV 94300, BC 653354, GDA 15030, MA 338726); Serreta Negra de Fraga (SEV s/n); Baig Cinca, Vedat de Fraga, 18-V-1972, *O. de Bolòs* (BC 606729). Lérida: cerro de Alfarrás, 27-V-1984, *D. Gómez, G. Montserrat et al.* (JACA 271984). Madrid: Aranjuez, 8-V-1924, *Gros* (MA 119258). Teruel: Castelserás, Loscos (MA 119260); pr. Castelserás, 8-V-1875, *Loscos* (BC 97582). Zaragoza: Nuez de Ebro, 8-V-1951, *O. de Bolos & J. Br.-Bl.* (BC 117985); Montes de la Retuerta de Pina, 10-V-1988, *Blanché & Moreno* (MA 501937).

Valerianella multidentata var. *oscensis*:

Burgos: Miranda de Ebro, 27-V-1920 (MA 119263). Huesca: Estopiñán, ermita de San Marcos, 12-V-1986, *J.V. Ferrández* (MA 581149); Peraltilla, ca. Barbastro, 27-V-1978, *P. Montserrat* (BC 639854, MA 340217, MA 356037, SEV 75338). Madrid: Aranjuez, 11-V-1924, *Font Quer et Gros* (BC 650585); Aranjuez, cerros de Riegal, 8-V-1924, *Gros* (BC 650584); cercanías de Aranjuez, 15-V-1946, *Rivas Goday*, VI-1954 (MA 346126); Aranjuez, 8-V-1924, *Gross* (MA 119258); Aranjuez, Regajal, 11-V-1924, *Font Quer* (MA 119259). Zaragoza: Osera, c. ermita San Martín, 1-V-1988, *J. Ascaso & J. Pedrol* (MA 483686).