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First record of *Plocama brevifolia* in Europe (province of Cadiz, Spain) with taxonomic and ecological remarks

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Abstract. We report the presence of *Plocama brevifolia* (Rubiaceae) in the southwest of the Iberian Peninsula (province of Cadiz, Spain). This discovery is not only the first record of the species in the Iberian Peninsula, but also in Europe. We provide ecological notes focusing on the conservation risks associated with this area. Some taxonomic remarks are also included based on a review of North African herbarium specimens.
Keywords: *Plocama brevifolia*, Cadiz, disjunction, Europe, Iberian Peninsula, new record.

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Introduction

The family Rubiaceae is represented in the Iberian Peninsula by about 77 species (c. 100 taxa if infraspecific variability is considered) and 10 genera, including *Plocama* (sub *Putoria*; Devesa, 2007a) and the recently described genus *Castrila* (Blanca *et al*., 2024).

The genus *Plocama* was described by W. Aiton (1789) based on a single species (*P. pendula* W. Aiton) from the Canary Islands (Hansen & Sunding, 1985). However, in its current conception, *Plocama* encompasses 8 genera that were previously considered independently (i.e., *Aitchisonia*, *Choulettia*, *Crocyllis*, *Gaillonia*, *Jaubertia*, *Pseudogaillonia*, *Pterogaillonia* and *Putoria*). In this sense, it contains 34 species, including those from the Mediterranean region previously included in the genus *Putoria* Pers. (Backlund *et al*., 2007).

Plocama is distributed in the Mediterranean region, South Africa, South and Southwest Asia, and the Canary Islands (Backlund *et al*., 2007). Only two species are known to occur in the Mediterranean region: the widespread *Plocama calabrica* (L.f.) M. Backlund & Thulin, which extends from Iraq to most of the Mediterranean region, including southern Spain (Devesa, 2007b; Marhold, 2011, both sub *Putoria calabrica*; Backlund & Thulin, 2007; GBIF, 2024); and *Plocama brevifolia* (Coss. & Durieu ex Pomel) M. Backlund & Thulin, known only from northwestern Africa (Morocco, Algeria and Melilla -Spain-) (Jury & Rutherford, 2002, sub *Putoria*; Backlund & Thulin, 2007; Dobignard & Chatelain, 2013). The ecology of both species is quite similar; they often grow on calcareous slopes, cliffs and rock outcrops (in the case of *P. calabrica*, also occurring on dolomitic, marl, and marl-gypsum substrates; Devesa, 2007b), often in coastal regions (Backlund & Thulin, 2007). Both species are closely related, being sister species that diverged about 3.8 million years ago (Rincón-Barrado *et al*., 2021). They can be easily distinguished as follows: *P. calabrica* has more or less pedicelled flowers arranged in terminal fascicles, calyx with 4 subequal teeth and a typically pink corolla (Figure 2A), whereas *P. brevifolia* has solitary subsessile or short-pedicelled flowers, a calyx with only 2 well-developed teeth, sometimes accompanied by two small or rudimentary teeth, and a whitish to pinkish-white corolla (Figure 2B, 2C). The chromosome number reported for *P. calabrica* is 2n = 22 (e.g., Ruiz de Clavijo, 1991), whereas it remains unknown for *P. brevifolia*.

As a result of our botanical surveys carried out in the southeast of the province of Cadiz, a new population of *P. brevifolia* was discovered. This population is notably disjunct from the North African populations and represents the first and only record of its presence in the Iberian and European flora.

Material and Methods

In August 2020, two of the authors (F. Muñoz-Secilla and A. Vega-Pérez) detected a population of *P. brevifolia* in the mountain range near San Roque

(province of Cadiz, Spain), which has been periodically surveyed since then until June 2024. Specimens were collected and deposited in the COFC herbarium. For identification purposes, we used dichotomous keys and genus descriptions from major floras of the Iberian Peninsula (Devesa, 2007b), Algeria (Battandier, 1889; Battandier & Trabut, 1902; Quézel & Santa, 1963), and Morocco (Fennane *et al.*, 2014). Additionally, we consulted plant catalogs for Morocco (Jahandiez & Maire, 1934; Jury & Rutherford, 2002) and the most recent revision of the genus *Plocama* for the Mediterranean region (Backlund & Thulin, 2007). We also examined North African material of *Plocama brevifolia* deposited in the herbaria MA, MGC and SEV, as well as digitized photographs of specimens from JE, MO, MPU, NY, and P (Appendix 1). Herbarium acronyms according to Thiers (2024).

Results and Discussion

Plocama brevifolia (Coss. & Durieu ex Pomel) M. Backlund & Thulin in Taxon 56(2): 519 (2007); *Putoria brevifolia* Coss. & Durieu ex Pomel, Nouv. Mat. Fl. Atl.: 79 (1874) [basionym]
Putoria tenella Pomel, Nouv. Mat. Fl. Atl.: 78 (1874); *Putoria brevifolia* var. *tenella* (Pomel) Batt., Fl. Algérie 1: 390 (1890)
Putoria microphylla Pomel, Nouv. Mat. Fl. Atl.: 79 (1874); *Putoria brevifolia* var. *microphylla* (Pomel) Batt., Fl. Algérie 1: 390 (1890)
Putoria brevifolia var. *dyris* Jahand. & Maire in Bull. Soc. Hist. Nat. Afrique N. 14: 71 (1923)
Putoria brevifolia var. *demnatensis* Litard. & Maire in Mém. Soc. Sci. Nat. Maroc 26: 18 (1931)
Putoria brevifolia var. *melillensis* Maire & Sennen in Emberger & Maire, Cat. Pl. Maroc 4: 1132 (1941)

Spain: Cadiz: San Roque, 30STF9116, Miocene bioclastic calcarenite cliffs, 16-IV-2024, *F. Muñoz-Secilla* (COFC 75511).

Plocama brevifolia is found forming cushions or hanging down from cliffs of Miocene bioclastic calcarenites, in a northwest-southeast oriented band about 150 m long and on 70 masl (Figure 1). This area is difficult to access as it is largely concealed by dense surrounding thermomediterranean scrubland (Rivas Martínez, 1987), consisting of *Pistacia lentiscus* L., *Olea europaea* L. subsp. *europaea*, *Rhamnus oleoides* L., *Asparagus albus* L., *Phlomis purpurea* L., *Osyris lanceolata* Hochst. ex Steud., and *Smilax aspera* L., among others. Herbaceous plants such as *Macrochloa tenacissima* (L.) Kunth, *Euphorbia nicaeensis* All., *Ruta angustifolia* Pers., *Micromeria graeca* (L.) Benth. ex Rchb., *Antirrhinum tortuosum* Bosc ex Lam. and *Polygala rupestris* Pourr. are also present.

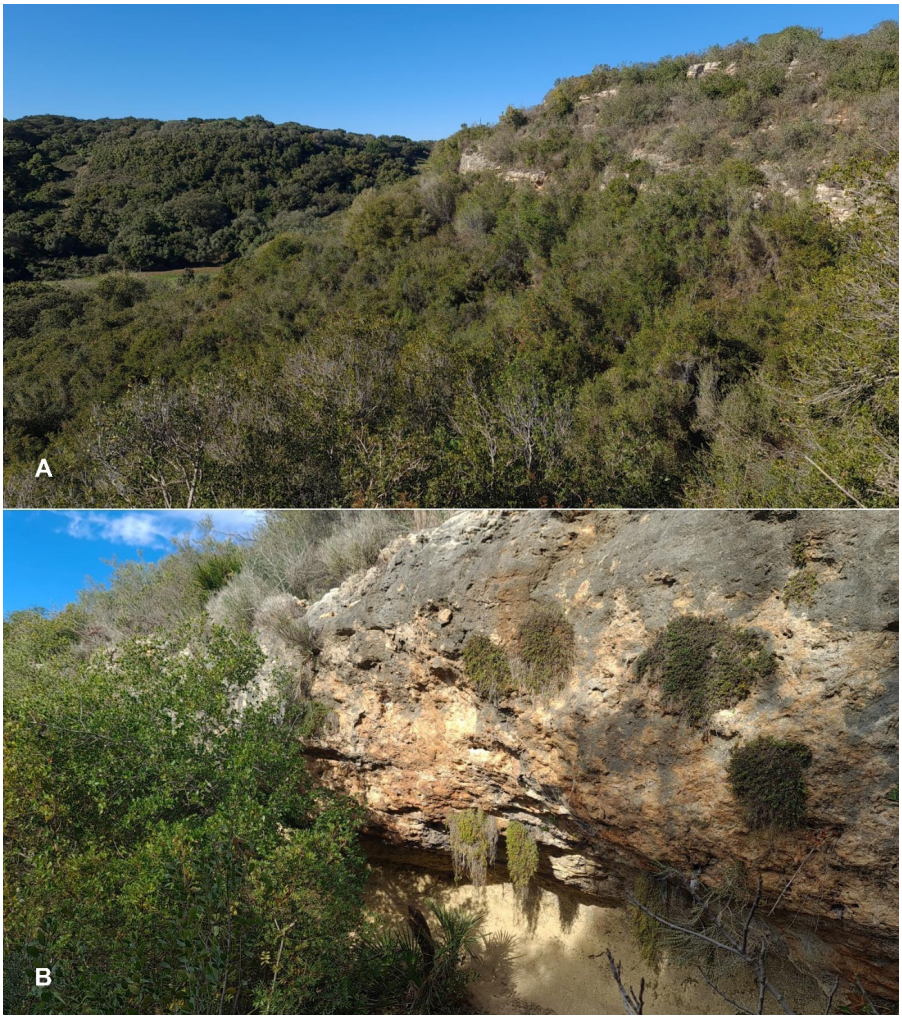

Figure 1. A, Habitat of *Plocama brevifolia* and surrounding vegetation; B, Plants of *P. brevifolia* on calcarenite cliffs.

The population occupies a small area, with around 100 individuals recorded. This rugged enclave is located between the southern end of the Sotogrande urbanization and the Guadalquitón stream, on the northern edge of the so-called Mesas del Guadalquitón, which to the west houses a golf course and the residential area of the San Roque Club, and to the east the A7 highway from Cadiz to Malaga.

The plants of *Plocama brevifolia* we found (Figure 2B-D) are perennial herbs with multiple stems, prostrate or prostrate ascending, often hanging from ledges and crevices. The stems are highly branched and leafy from the base, with the basal leaves remaining dry. They are rough, and the bark on the older parts is thin and often sheds easily. The leaves, measuring 2–9 x 0.5–2 mm, are opposite and somewhat thickened; oblong-lanceolate or narrowly ovate-lanceolate, with revolute margins and tapering into a short petiole; scabrid -with straight hairs or spicules- especially on the underside, which is somewhat discolored -bright green on the upper surface-, midrib often prominent and triangular interpetiolar stipules. Flowers are sessile or subsessile, solitary, terminal, and axillary; the calyx is tubular, with a tube of 2.5–2.7 mm long and unequal teeth (2 teeth of 0.5-0.6 mm, sometimes with other 2 small teeth of about 0.1–0.2 mm); corolla 9–10 mm long, hypocrateriform, whitish or whitish-pinkish, with a tube of 7–8 mm and 4 subequal lobes of 2–2.2 mm, and the fruit is a red berry (Figure 2D).

The specimens of *P. brevifolia* from Cadiz display an extended flowering period [(II)IV-IX(XII)], spanning almost the entire year, similar to that described for the closely related species *Plocama calabrica* (Devesa, 2007b). Fruiting in these specimens has been observed from June to September.

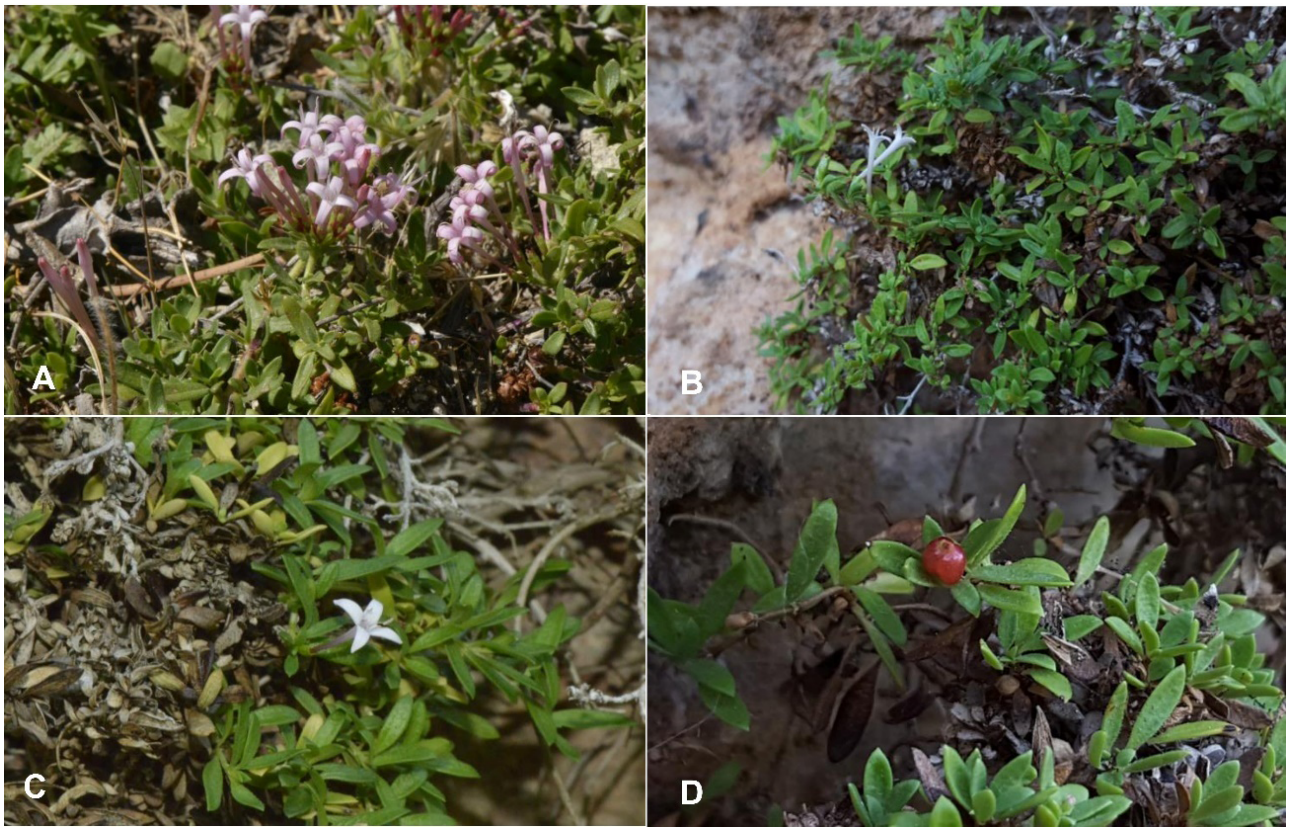

Figure 2. A, *Plocama calabrica*, flowers; B-D, *Plocama brevifolia*: B, C, habit and detail of the flowers; D, fruit.

Taxonomic remarks

Plocama brevifolia exhibits great variability in leaf and flower sizes, especially in the lengths of the corolla tube and calyx teeth. This variation has led several authors to describe several species and infraspecific taxa within the genus *Putoria*. Plants fitting the type (*Putoria brevifolia* Coss. & Durieu ex Pomel), from Oran and its surroundings (Algeria), have the largest corolla lengths, ranging from 13.5 to 18 mm (lobes of 2.7–4.2 mm). Also from Algeria are *Putoria tenella* Pomel, *Putoria microphylla* Pomel and *Putoria brevifolia* var. *melillensis* Maire & Sennen, all of them described from the Tlemcen region, with corolla lengths of 6–12 mm and small leaves (3–5 mm for *Putoria microphylla*) or large leaves (up to 15 mm for *Putoria brevifolia* var. *melillensis*).

In the High Atlas (Morocco), at higher altitudes (1,200–2,350 m asl) and outside the Mediterranean area, plants described as *Putoria brevifolia* var. *dyris* Jahand. & Maire and *Putoria brevifolia* var. *demnatensis* Litard. & Maire have corolla lengths slightly shorter than the previous ones and with deeper lobes [“*A typo differt corolla brevis (vix 5 mm., nec 14-15 mm. longa) usque ad 1/3-2/5 (nec tantum usque ad 1/5) fissa…*” and “*…corolla 5-6 mm longa, usque ad 1/3 et ultra incisa…*”, respectively]. Dobignard (2009) grouped both varieties as a new subspecies, *Plocama brevifolia* subsp. *dyris* (Jahand. & Maire) Dobignard, which is also accepted by Tattou (2014) in his treatment of Moroccan species. However, the information and keys provided by both authors for the recognition of this supposed subspecies (“*Cor.* [corolla] *longue 14–18 mm, à tube*

long, exsert, lobes 4–5 mm") differ from the variation observed in the corollas of the High Atlas plants studied by us and the type specimens, except for the depth of the corolla lobes.

Thus, plants from the High Atlas Mountains (Morocco) have smaller corollas, while those from Oran (Algeria) have larger ones. Plants from the Rif Mountains (Morocco) and the Mediterranean regions of Morocco, Melilla (Spain), and Algeria have an intermediate corolla length that matches the variability observed in the plants collected in Cadiz (Spain). Despite the variability in corolla length, Backlund & Thulin (2007) recognise only one species in their review of the genus for the Mediterranean region. These authors note a continuous variation that prevents the recognition of the taxa involved, merging them all as synonyms of *Plocama brevifolia*. With the detection of the new population, and according to the taxonomic criteria of Backlund & Thulin (2007), the distribution range of *Plocama brevifolia* includes the Mediterranean coastal regions of Morocco, Melilla (Spanish territory) and Algeria, the High Atlas in Morocco, and the southwestern Iberian Peninsula in Cadiz (Spain).

Conservation remarks

Currently, the conservation status of *Plocama brevifolia* has not been assessed by the IUCN. Despite its narrow distribution in the western Mediterranean region, the species is relatively abundant within its range. However, the only known Iberian population, located in Cadiz (Spain), consists of approximately 100 individuals scattered along a stretch of about 150 meters. According to IUCN (2012a,b) Criterion D, this population could be considered Endangered (EN).

The main threat to this population is the high urban pressure. The local government of San Roque has documented intentions to make specific modifications to the General Urban Development Plan (known as PGOU, Plan General de Ordenación Urbana) in two areas (UN–31 and UN–32), which affect the Mesas del Guadalquitón. In particular, one area (UN–31) directly impacts the habitat in which this species grows. These threats, combined with the limited number of individuals and habitat, call for urgent measures to protect the species.

Authorship

FM-S: Conceptualization, research, review and editing. AV-P: Conceptualization, research, review and editing. JAD: Conceptualization, research, first draft, review and editing. GM-S: Conceptualization, research, visualization, first draft, review and editing.

Conflict of interest

None.

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