Monanthes subrosulata, a new species of M. sect. Sedoidea (Crassulaceae) from La Palma, Canary Islands, Spain

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Abstract

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Monanthes subrosulata (*M.* sect. *Sedoidea*) from La Palma, Canary Islands, Spain, is described as a species new to science and illustrated. Special attention is paid to the morphological characteristics that differentiate it from the other species of the section (*M. anagensis* and *M. laxiflora*), as well as from *M. muralis* (*M.* sect. *Monanthes*).

Additional key words: *Monanthes anagensis*, *M. laxiflora*, *M. muralis*, taxonomy, chorology

Introduction

After the recent treatment of the Moroccan species *Monanthes atlantica* Ball as *Sedum surculosum* Coss. (Mes & 't Hart 1994; 't Hart & Bleij 2003), the genus *Monanthes* Haw. is confined to the Canary Islands and Ilhas Selvagens, two archipelagos that biogeographically comprise the Canarian Province in the Mediterranean Region (Rivas-Martínez 2009), previously known as part of the Macaronesian Region. A total of nine species and two heterotypic subspecies are endemic to the Canary Islands, and only *M. lowei* (A. Paiva) P. Pérez & Acebes is located in the Ilhas Selvagens (Nyffeler 1992; Nyffeler 2003; Bañares 2008).

Infrageneric classifications distinguish three (Nyffeler 1992) or four (Sventenius 1960; Nyffeler 2003) sections in *Monanthes*, all of them accepting *M.* sect. *Sedoidea* Svent. ex Nyffeler with two species: *M. anagensis* Praeger and *M. laxiflora* (DC.) Bolle. These species are genetically closely related (Mes & al. 1997) and morphologically distinct from the other taxa of the genus, especially by their slightly subshrubby, diffusely branched habit, never forming rosettes, and with their inflorescences arising from the tips of the axes. *Monanthes subrosulata*, located in the south and south-eastern parts of La Palma island, shares the above characters and unequivocally belongs to *M.* sect. *Sedoidea*. The most striking character to separate it from the other species of the section is the presence of conspicuous bladder-cell idioblasts (papillae), especially on the leaves (usually inconspicuous and not protruding in *M. anagensis* and *M. laxiflora*), as shown in the species of *M.* sect. *Monanthes*, especially in *M. muralis* (Webb ex Bolle) Hook. f., a species that shares some similarities with plants of *M.* sect. *Sedoidea* by its ascending and tufted habit.

Results and Discussion

Monanthes subrosulata Bañares & A. Acev.-Rodr., **sp. nov.**

Holotypus: Spain, Canary Islands, La Palma, "Canal de Tigalate", 425 m, Mar 2008, *Á. Bañares & A. Acevedo 46878* (TFC; isotypus: B).

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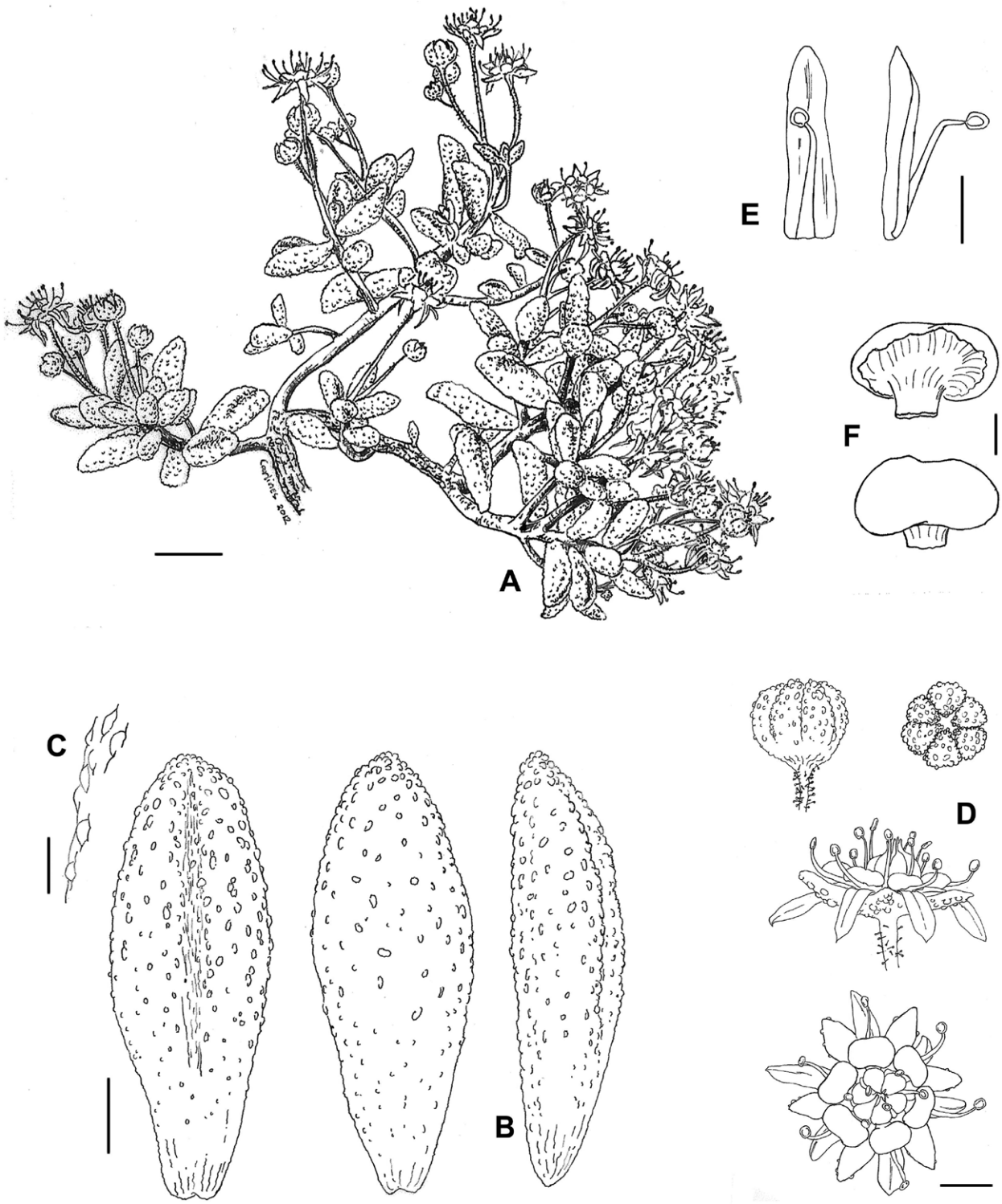

Fig. 1. *Monanthes subrosulata* – A: plant; B: leaves; C: leaf papillae; D: buds and flowers; E: petals and stamens; F: nectaries – Scale bars: A = 1 cm; B, D = 2 mm; C, E = 1 mm; F = 0.5 mm. – Drawings made from the holotype.

Latin description — Plantae suffruticosae, 5–15 cm altae. Axes ascendentes aut decumbentes, 2–3 mm in diametro, non pilosi, papillosi in partibus superioribus. Folia alternanta, non rosulata vel subrosulata, elliptica, 10–13 mm longa, 3.5–5 mm lata, 2.5–3.5 mm crassa, plerumque centraliter et longitudinaliter sulcata in facie ventrale, non pilosa, adusque papillosa, ad apicem acutiuscula. Inflorescentiae terminales, 4–10-florae, pedicellis glanduloso-pubescentibus, pilis 0.2–0.3 mm longis. Flores (5 vel)6-meri, 3–5 mm in diametro. Sepala basaliter connata, lobis ovatis, 2.3–2.5 mm longis, 1.5–1.8 mm latis, plerumque non pilosis, dense papillosis in facie dorsale.

Petala oblonga, 3–3.3 mm longa, 0.8–1.1 mm lata, glabra, apice acuto. Nectaria bilobata, valde unguiculata. Carpella 2.3–2.5 mm longa, 1.3–1.5 mm lata, non pilosa, parce papillosa.

Description — *Suffruticose plants*, diffusely branched, 5–15 cm tall. *Axes* ascending or decumbent, somewhat tortuous, greyish, 2–3 mm in diam., without hairs, basally rugose and usually covered with whitish waxy platelets, distally (around leaves) with prominent and abundant papillae. *Leaves* alternate, not rosulate to subrosulate, usually clustered near tips of axes, dark green, abaxially with a reddish tinge along median portion, elliptic, 10–13 × 3.5–5 mm, 2.5–3.5 mm thick, mostly with a central longitudinal furrow ventrally, without hairs, completely papillose, more prominently so at apex, apex somewhat acute. *Inflorescences* arising from tips of axes, of 1 or 2 regularly branched thyrses, 4–10-flowered; *pedicels* 4–10 mm, glandular-hairy, hairs 0.2–0.3 mm; *buds* globose. *Flowers* (5 or)6-merous, 3–5 mm in diam. *Calyx* without hairs or with very few short glandular hairs; *sepals* basally connate, lobes suffused with red-brown, ovate, 2.3–2.5 × 1.5–1.8 mm, densely papillose abaxially. *Petals* pale green suffused with red, oblong, 3–3.3 × 0.8–1.1 mm, glabrous, apex acute. *Nectaries* suffused with red, bilobate, 1–1.2 × 1.5–1.7 mm, distinctly clawed, apically erose. *Carpels* pale green with a reddish tinge, 2.3–2.5 × 1.3–1.5 mm, without hairs, slightly papillose. Flowering: March to May.

Illustrations — Fig. 1, 3.

Distribution and ecology — South and southeastern parts of the island of La Palma, Canary Islands, Spain. The species is locally common on cliffs and rocky walls in northeastern and north-northeastern exposures at altitudes from 30 m to 570 m (Fig. 2). In the municipality of Villa de Mazo it is found at Salto de Tigalate, 30 m (UTM-WGS84: 28RBS226594); Cruz de la Mancha, 250 m (UTM-WGS84: 28RBS226588); Canal de Tigalate, 450 m (UTM-WGS84: 28RBS225587); and Montes de Luna, 525–570 m (UTM-WGS84: 28RBS225590). In the municipality of Fuencaliente it is found at Los Quemados, 500 m (UTM-WGS84: 28RBS222550); near Faro de Fuencaliente, 370–400 (UTM-WGS84: 28RBS222538); Roque Orchilla, 305 m, (UTM-WGS84: 28RBS222527); and Montaña del Mago, 410 m (UTM-WGS84: 28RBS221534). It is usually established in small holes exposed to humid north winds, associated with xerophytic plants of the Canarian white broom communities (*Retamation rhodorhizoidis* Del Arco & al. 2009) in badlands of recent and historic lava fields. The most common species found in these areas are *Aeonium davidbramwellii* H. Y. Liu, *Davallia canariensis* (L.) Sm., *Euphorbia lamarckii* Sweet, *Kleinia neriifolia* Haw., *Lavandula canariensis* Mill., *Retama rhodorhizoides* Webb & Berthel., *Rubia fruticosa* Aiton, *Rumex lunaria* L., *Schizogyne sericea* (L. f.) DC., *Sonchus bornmuelleri* Pit., and the lichen *Stereocaulon vesuvianum* Pers.

Additional specimens examined (paratypes) — Spain, Canary Islands, La Palma: Cruz de la Mancha, 250 m, NNE, Mar 2008, *Á. Bañares & A. Acevedo 48685* (TFC); sobre el canal de Tigalate, 425 m, NE, Apr 2012, *Á. Bañares & A. Acevedo 48689* (TFC).

Related taxa — *Monanthes subrosulata* belongs to *M.* sect. *Sedoidea* by having a perennial and diffusely branched habit, leaves alternate, not forming rosettes, with internodes somewhat elongate (leaves scattered along axes), inflorescences arising from tips of axes, flowers (5 or)6-merous, pedicels evenly arranged, petals oblong, and nectaries distinctly clawed. In addition, it distinctly shares with the other species of the section axes generally covered with whitish wax platelets and leaves with a central longitudinal furrow ventrally.

Monanthes sect. *Sedoidea* comprises two species: *M. anagensis* and *M. laxiflora*. *M. anagensis* is a single-island endemic from the eastern Anaga mountains in Tenerife. It is a very well-characterized plant by its alternate, long and narrowly elliptic leaves. *M. laxiflora* is the most widespread species and also the most xeromorphic member of the genus. It occurs in La Palma, La Gomera, Tenerife, Gran Canaria, Fuerteventura, and Lanzarote. After its discovery and sole citation by Lems & Holzapfel (1974) in La Palma, the species was neglected there by authors (Santos 1983; Nyffeler 1992; Hohenester & Welss 1993; Bramwell & Bramwell 2001), but its occurrence in northern locations of that island is confirmed here: near Garafía [La Palma: Barranco de Carmona, May 2012, *Á. Acevedo & Á. Rebolé 48687* (TFC)]; El Mudo, Barranco de Magdalena, and also in the centre of the island inside the Caldera de Taburiente National Park from 300 to 800 m [La Palma: Brevera Macha, Caldera de Taburiente National Park, 780 m, N, Mar 2008, *Á. Rebolé 48688* (TFC); La Estrechura, Caldera de Taburiente National Park, 380 m, NE, May 2012, Á. *Bañares & A. Acevedo 48686* (TFC)] (Fig. 2). *M. laxiflora* is a very well-defined taxon by its decussate, ovate to almost suborbicular leaves, usually partly covered by a thick wax layer. It is a very variable plant, and different forms, varieties, and closely related species have been described, such as the often distinguished *M. microbotrys* (Bolle & Webb) Bolle from the eastern islands Fuerteventura and Lanzarote (Bolle 1859, 1892; Bornmüller 1906; Praeger 1932), but these taxa are included in the synonymy of *M. laxiflora* (Nyffeler 1992). This variability – actually under study by the authors – is probably correlated with the different habitats where the species can be found: plants from forested and northern locations are somewhat different to those from arid zones where the species is well adapted with singular xeromorphic features. In fact, our recent discovery of *M. laxiflora* in La Palma exhibits this same feature, with plants from northern locations differ-

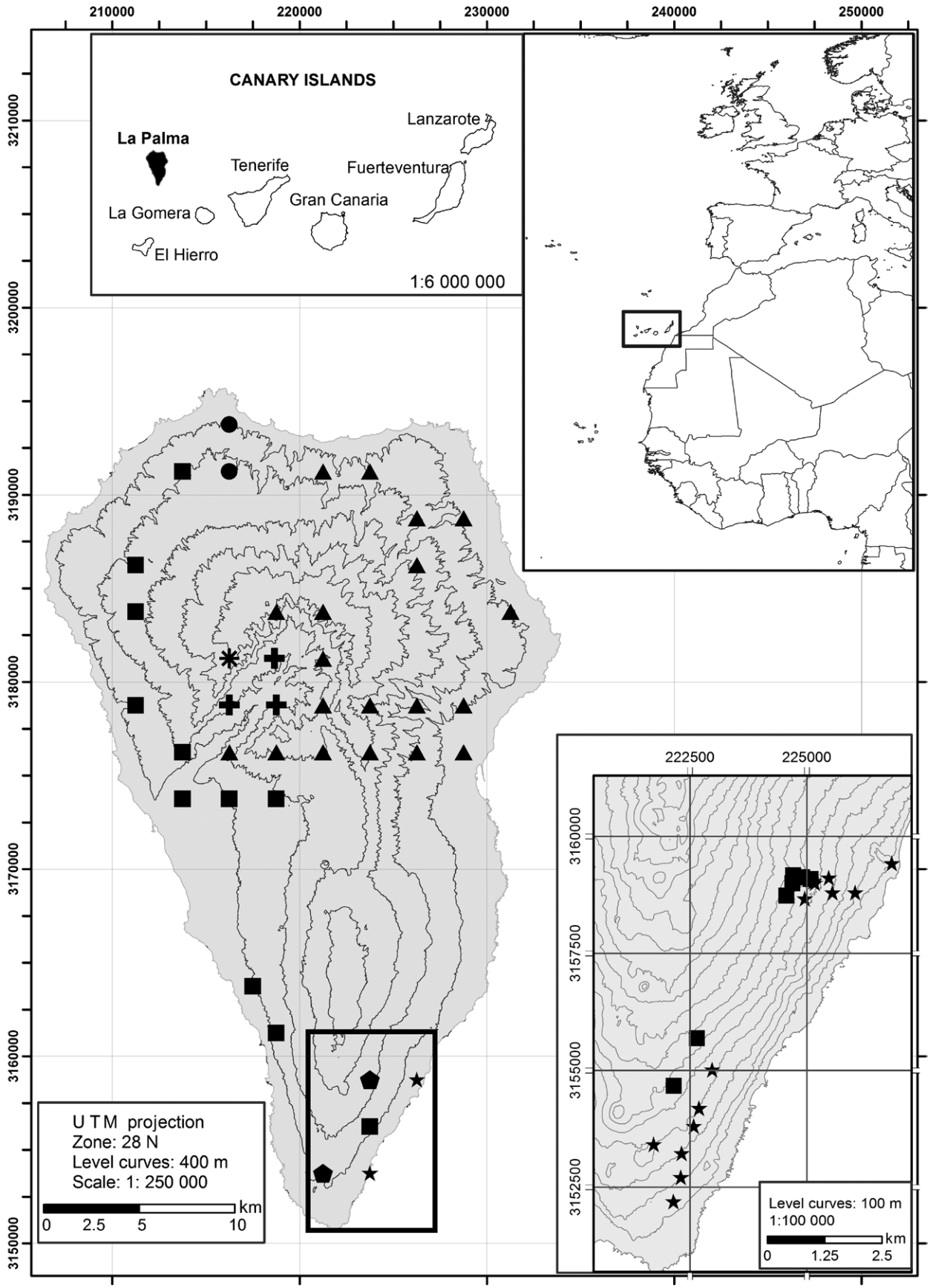

Fig. 2. Distribution of *Monanthes subrosulata* (★, ⬟), *M. laxiflora* (●, ✚), *M. muralis* (■, ✱, ⬟) and *M. polyphylla* subsp. *amydros* (▲, ✱, ✚) on the island of La Palma. Symbols common to more than one taxon indicate co-occurrence of those taxa.

ent to those from the central caldera of the island.

Monanthes subrosulata differs from *M. anagensis* by having axes papillose, usually covered with white platelets, leaves differently sized and entirely papillose, pedicels glandular-hairy, sepals without hairs and dorsally papillose, petals glabrous, nectaries differently sized, and carpels slightly papillose. From *M. laxiflora* it differs by having a less robust habit, leaves alternate, elliptic, differently sized and entirely papillose, pedicels glandular-hairy, sepals and petals without hairs, and nectaries differently sized (see Table 1, mostly based on Nyffeler, 1992).

Among the rest of the species of the genus, only *Monanthes muralis* (*M.* sect. *Monanthes*) can be compared with the new species by having typically a suffruticose habit, axes ascending or decumbent, and axes, leaves, and sepals papillose; *M. muralis* is distributed in the islands of El Hierro and La Palma. *M. subrosulata* differs mainly by having a more robust and non-rosulate habit, axes without hairs and covered with white platelets, leaves larger, without hairs, ventrally with a central longitudinal furrow, calyx without hairs, petals glabrous, and carpels scarcely papillose.

Fig. 3. A–B: an individual of *Monanthes subrosulata* at the type locality (Spain, La Palma, "Canal de Tigalate", 425 m) on 1 Apr 2006. – Photos by Á. Bañares Baudet.

Remarks — After revision of the genus *Monanthes* (Nyffeler 1992), only two species were known on the island of La Palma: *M. muralis* (also present in El Hierro) and *M. polyphylla* subsp. *amydros* Nyffeler (also present in La Gomera; see Bañares 2008). With the present study, two species are added to the flora of La Palma: *M. laxiflora* (known from all islands except El Hierro) and the newly described *M. subrosulata*.

Recently, Nyffeler (1995) extensively illustrated that the genus *Monanthes* forms a comparium or a syngamodeme (a group of taxa capable of hybridizing with one another), a well-known phenomenon in the *Crassulaceae*; thus special attention has been paid to rule out the possibility that *M. subrosulata* could represent a hybrid.

Hybridization processes among species are a common feature in the Canarian flora as the increasing disturbance of the natural habitats by human activities (e.g. roads, waterways) reduces ecological separation and natural barriers that originally played an important role in the speciation process (Brochman 1984; van Hengstum & al. 2012). Extensive hybridization is known to occur among the taxa in the Canarian *Crassulaceae* (Praeger 1932; Bañares 1990, 2007; Voggenreiter 1999). Hybrids of the *Crassulaceae* species are represented in small numbers or as single plants around their parents, usually in newly created habitats but also in co-occurring original locations occupying the same ecological niche. Flowering coincidence, population proximity (up to 50 m), and the presence of efficient pollinators (*Hymenoptera*) facilitate the establishment of hybrids that are easily recognized in growth form and detailed morphology (for the genus *Aeonium* Webb & Berthel. see Voggenreiter, 1999).

References on the chorology of the species of *Monanthes* in La Palma (Santos 1983; Nyffeler 1992; Bañares 2008) and a recent survey in the field revealed two sites with co-occurring taxa (showing a close connection among individuals): (1) *M. laxiflora–M. polyphylla* subsp. *amydros* in the central part of La Palma at La Es-

Table 1. Comparison of morphological characters of the species of *Monanthes* sect. *Sedoidea* and *M. muralis*.

	Monanthes laxiflora	*Monanthes anagensis*	*Monanthes subrosulata*	*Monanthes muralis*
Axes	papillose, without hairs	not papillose, without hairs	papillose, without hairs	papillose, glandular-hairy
	with whitish waxy platelets	without platelets	with platelets	without platelets
Leaves	decussate, not rosulate	alternate, not rosulate, somewhat clustered	alternate, not rosulate to subrosulate, usually clustered	alternate, rosulate
	elliptic or ovate to suborbicular	narrowly elliptic	elliptic	obovate
	5–12 × 3–8 mm, 3–6 mm thick	9–18 × 2–4 mm, 2–4 mm thick	10–13 × 3.5–5 mm, 2.5–3.5 mm thick	6–10 × 3–4 mm, 2 mm thick
	furrowed ventrally	furrowed ventrally	furrowed ventrally	not furrowed
	not papillose or scarcely so	not papillose	papillose	papillose
	with whitish waxy platelets	without platelets	without platelets	without platelets
Pedicel	glabrous or glandular-hairy	glabrous or scarcely glandular-hairy	glandular-hairy	glandular-hairy
	hairs ≤ 0.2 mm	hairs ≤ 0.05 mm	hairs 0.2–0.3 mm	hairs ≤ 0.7 mm
Sepals	papillose dorsally with or without glandular hairs	not papillose without hairs or scarcely hairy	papillose dorsally without hairs	papillose dorsally glandular-hairy
Petals	2.9–4.4 ×0.9–1.4 mm	3.4–4.6 × 1.1–1.6 mm	3–3.3 × 0.8–1.1 mm	2.9–4.1 × 0.5–0.7 mm
	slightly glandular-hairy	slightly glandular-hairy	glabrous	glandular-hairy
Nectaries	clawed	clawed	distinctly clawed	distinctly clawed

trechura, 380 m, close to the Caldera de Taburiente National Park (known as producing hybrids in La Gomera, see Bañares 1990); and (2) *M. subrosulata*–*M. muralis* in southeastern La Palma, but hybrids between these parents have not actually been found in La Palma. Some close populations of *M. muralis* and *M. polyphylla* subsp. *amydros* are also found inside the central Caldera, but the plants are not living together (Fig. 2).

Monanthes subrosulata is located in southern and southeastern La Palma at altitudes from 30 m to 570 m, and their populations occupy a total of 37.5 km^2 (Extent of Presence, see IUCN Standards and Petitions Subcommittee 2010) (Fig. 2). *M. muralis* is distributed in western, southern, and southeastern La Palma at altitudes from 350 m to 1200 m, and it is found co-occurring with the uppermost populations of *M. subrosulata* (separated by only c. 20 m) in Montes de Luna (570 m, UTM-WGS84: 28RBS225590). Other close populations of these species are found in the south of La Palma, around Los Quemados (T. M. Fuencaliente), but without connection among individuals (separated by 700–900 m). No other species have been found within the distribution of the new species so as to consider the possibility of a hybrid origin. *M. laxiflora* and *M. polyphylla* subsp. *amydros* are geographically and ecologically separated, and their nearest populations are considerably remote from the part of the island occupied by *M. subrosulata*, ranging from 20.6 km and 17.5 km distant, respectively.

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