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## Research article

### *Euphorbia balsamifera* subsp. *adenensis* (Euphorbiaceae) new to Socotra and notes on its taxonomy

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*Euphorbia balsamifera* Aiton has been treated since 1965 as a disjunct species with two subspecies, subsp. *balsamifera* in the Canary Islands (Spain) and adjacent parts of northwestern Africa, and subsp. *adenensis* (Deflers) P.R.O.Bally in southwestern Asia and northeastern tropical Africa. However, in 2021, *E. adenensis* Deflers was resurrected based mainly on molecular and morphological data. We now record this taxon (as *E. balsamifera* subsp. *adenensis*) for the first time from Socotra, where it grows as small trees. Only three plants were seen in the southwestern part of the island. We also discuss the claimed morphological differences between *E. balsamifera* and *E. adenensis* that mainly concern size and habit of the plants, leaf shape, degree of fusion of styles, and presence or absence of pubescence on ovaries and fruits. We show that none of these characters can be used for species distinction and suggest that the best way to handle the situation taxonomically is to continue to treat *E. balsamifera* as a widespread and variable species with two geographical subspecies.

Keywords: Canary Islands, disjunct distribution, Yemen

## Introduction

For more than 50 years, since the publication of Bally (1965), the shrub or small tree *Euphorbia balsamifera* Aiton has been treated as a disjunct species with two subspecies, subsp. *balsamifera* in the Canary Islands (Spain) and adjacent parts of northwestern Africa, and subsp. *adenensis* (Deflers) P.R.O.Bally in southwestern Asia and northeastern tropical Africa. This taxonomy was challenged in an ambitious and detailed paper by Riina et al. (2021), who proposed a resurrection of *E. adenensis* Deflers for the latter taxon. However, one of us (MT), who has seen *E. balsamifera* s. lat. numerous times in the Canary Islands, as well as in Yemen, Oman and Somalia, was immediately sceptical about the morphological differences between the two species as claimed by Riina et al. (2021).



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In the Socotra archipelago, *Euphorbia balsamifera* subsp. *adenensis*/*E. adenensis* has previously only been recorded from the island of Abd al Kuri (Miller and Morris 2004, Riina et al. 2021). When now recording it for the first time from the island of Socotra, we take the opportunity to also discuss the differences between *E. balsamifera* and *E. adenensis* as stated by Riina et al. (2021) and to reconsider the taxonomy of these taxa.

### *Euphorbia balsamifera* subsp. *adenensis*

Yemen, Socotra, Qafuz, 12°29'42"N, 53°24'31"E, alt. 435 m a.s.l., 18 May 2024, fr., Weber and Mubarak 10 (Aden Univ., UPS).

This is a first record for Socotra, where three plants, all small trees about 2 m tall, were seen on a rocky slope in a remote and rarely visited area in the southwestern part of the island (Fig. 1). The massive trunks of these plants are exceptional in the species and the trees give the impression of being ageing relics. No young plants could be found and without

regeneration the species would have an uncertain future on the island, where it is obviously native but very rare.

### Notes on taxonomy

In Bally (1965), the combination *Euphorbia balsamifera* subsp. *adenensis* was made in the captions to an illustration and a map (pp. 34 and 36), whereas basionym and bibliographical details were given in the discussion (p. 31). It has been questioned whether this is valid publication according to Art. 33.1 of the ICN (Turland et al. 2018), and to be on the safe side Bally in Bally and Carter (1974: 390), published the combination again, now with name and references together. However, Brummitt (1969), albeit reluctantly, accepted valid publication of *E. balsamifera* subsp. *adenensis* by Bally (1965), and this is the view taken by most authors since then and is also taken here.

Bally (1965) discussed the morphological differences between *Euphorbia balsamifera* and *E. adenensis* and, after a careful check of the material and information available,



Figure 1. *Euphorbia balsamifera* subsp. *adenensis* from Socotra, Qafuz, 18 May 2024. (A) one of three small trees, (B) leaves and fruits. Photographs by Michael Weber.

concluded that characters such as leaf-shape and indumentum of ovaries/capsules overlapped and could not be used for species distinction, the only character remaining being the pistil with styles divided to the base in *E. balsamifera* versus united in their lower half in *E. adenensis*. This was not considered enough to justify the maintenance of *E. adenensis* as a species and subspecies rank was therefore given. Between 1965 and 2020 numerous authors have followed Bally (1965) in treating *E. adenensis* as a subspecies of *E. balsamifera* (Deil and Müller-Hohenstein 1984, Miller and Morris 1988, 2004, Carter 1993, Thulin 1994, Jürgens 1997, Wood 1997, Collenette 1999, Darbyshire et al. 2015). The disjunct species *E. balsamifera* is characterized by its solitary, sessile to shortly pedunculate and usually unisexual cyathia, and its ecarunculate seeds.

However, Bally (1965) overlooked the complex situation in western Africa, where also *E. balsamifera* subsp. *sepium* (N.E.Br.) Maire (Maire 1938), based on *E. sepium* N.E.Br. (Brown 1911), and *E. balsamifera* var. *rogeri* (N.E.Br.) Maire (Maire 1938) or *E. balsamifera* subsp. *rogeri* (N.E.Br.) Guinea (Guinea 1948), based on *E. rogeri* N.E.Br. (Brown 1911), have been proposed. The phylogenetic results presented by Riina et al. (2021), based on extensive data from Villaverde et al. (2018), indicate that *Euphorbia balsamifera* subsp. *sepium* (as *E. sepium*) is sister to *E. balsamifera* subsp. *balsamifera* (as *E. balsamifera*) plus *E. balsamifera* subsp. *adenensis* (as *E. adenensis*), the divergence taking place in the late Miocene (approximately 11 Ma, Megaannum), whereas the divergence between *E. balsamifera* and *E. adenensis* dates back to the early Pliocene (approximately 5 Ma). This divergence time coincides with the mid-Pliocene warm period with increased aridification in Africa (Riina et al. 2021). In contrast, the older split of *E. sepium* predates the formation of the Sahara Desert. In a subsequent paper by Rincón-Barrado et al. (2024), new and younger estimated ages of

divergence were 6.8 Ma for the split between *E. sepium* and *E. balsamifera* plus *E. adenensis*, and 3.7 Ma for the split between *E. balsamifera* and *E. adenensis*.

The phylogenetic data, as well as the morphology, particularly its long linear leaves and densely pubescent capsules, support the resurrection of *Euphorbia sepium* as a distinct species mainly distributed in the western part of the Sahel region (records from Benin, Burkina Faso, Ghana, Mali, Mauritania, Niger, Nigeria, Senegal and Western Sahara) as proposed by Riina et al. (2021). But which are the morphological differences between *E. balsamifera* (in the Canary Islands and adjacent parts of Morocco and Western Sahara) and *E. adenensis* (in Oman, Saudi Arabia, Somalia, Sudan and Yemen) that could motivate species rank for these two taxa?

First, Riina et al. (2021) state in the key that *Euphorbia adenensis* are compact dendroid shrubs, with adult plants usually less than 1 m tall. In the description, the height is further specified as 0.6–0.9(–1.2) m, whereas *E. balsamifera* is said to be open dendroid shrubs (0.2–)0.8–1.5(–4.0) m tall. However, already in the protologue of *E. adenensis* (Deflers 1887), it is described as ‘frutex 4–5 pedalis’, i.e. 1.2–1.5 m tall. There are also specimens such as Miller 2201 from Oman and Guarino and Balaidi H68 from Yemen (both cited by Riina et al. 2021) that, according to the labels, are, respectively, 1.5 and 2 m tall. Furthermore, the plants on Socotra are small trees, about 2 m tall with fairly open crowns (Fig. 1A), at variance with the statements by Riina et al. (2021). In reality, the plants vary greatly in habit and size in both the Canary Islands/northwest Africa and Arabia/northeast Africa. As an example, a plant from the Canary Islands that cannot be described as anything but a compact shrub is shown in Fig. 2.

Second, in the key (Riina et al. 2021) the leaves are said to be obovate-oblong in *Euphorbia adenensis*, versus lanceolate to linear-lanceolate in *E. balsamifera*. This difference



Figure 2. *Euphorbia balsamifera* subsp. *balsamifera* from Canary Islands, La Palma, Garafia. Photograph © Frank Vincentz, shared under a CC BY-SA-license.

was dismissed already by Bally (1965), and the leaves of the plants on Socotra (Fig. 1B) are mostly linear-lanceolate. Actually, the shape of the leaves varies from linear-lanceolate to obovate in both the Canary Islands/northwest Africa and Arabia/northeast Africa.

Third, in the key the styles are said to be fused along the lower half of their length in *Euphorbia adenensis*, whereas they are fused along the lower quarter or less of their length in *E. balsamifera*. According to the descriptions, the styles in *E. adenensis* are fused for 0.9–1.2 mm from the base, whereas in *E. balsamifera* they are fused for (0.2–)0.3–0.5(–0.7) mm. However, in, e.g. Lundqvist 8239 (cited as ‘s.n.’) from Tenerife, the styles are fused for ca 1 mm from the base. In the material from Socotra, the styles are broken off (Fig. 1B) and the character cannot be checked.

Fourth, the ovaries and capsules are described as ‘glabrous, rarely glabrescent’ in *Euphorbia adenensis*, whereas they are ‘slightly pubescent’ in *E. balsamifera*. This character was checked by Bally (1965), who reported specimens with pubescent ovaries and capsules from Somalia and Yemen. According to Bally, ‘the presence or absence of pubescence on the ovary must therefore be ruled out for specific distinction between *E. balsamifera* and *E. adenensis*’. In Fig. 3 plants from southwestern Saudi Arabia are shown with pubescent ovaries and fruits, combined with styles that are free practically to the base and linear-lanceolate leaves. These images are shown in POWO (2025) as examples of ‘*E. adenensis*’, although

judging from morphology, as presented by Riina et al. (2021), they would be typical ‘*E. balsamifera*’.

According to Riina et al. (2021), ‘the most useful characters distinguishing’ *Euphorbia adenensis* and *E. balsamifera* ‘are leaf shape and plant stature’. However, as shown above, these characters, as well as all other characters mentioned by Riina et al. (2021), are useless for species distinction. Although these taxa are monophyletic entities that apparently have been separated for millions of years, they seem to be morphologically indistinguishable. Together they constitute an entity that is strongly supported by both molecular and morphological data. *Euphorbia balsamifera* could well be recognized as a widespread and variable species without any subdivision at all, an alternative apparently considered also by Bally (1965). However, we think that the most appropriate way to handle this situation taxonomically is to follow the decision by Bally (1965) and continue to treat *E. balsamifera* as a species with two geographical subspecies, subsp. *balsamifera* and subsp. *adenensis*. Subspecies may be recognized also when the morphological differences are far from clear-cut and, in this case, the geographical disjunction between the taxa (Fig. 4) makes identification easy.

The wide disjunction seen in *Euphorbia balsamifera* is remarkable but not unique. A similar distribution can be seen in *Bowlesia glandulosa* (Poir.) Kuntze (or *Drusa glandulosa* (Poir.) Bornm.), with occurrences in Macaronesia and Morocco in the west and in northern Somalia in the



Figure 3. *Euphorbia balsamifera* subsp. *adenensis* from Saudi Arabia, SE of Abha, 2205 m a.s.l. (A) tip of branch with leaves and female cyathium, (B) top view of female cyathium with styles free practically to the base, (C) capsule, showing pubescence and almost free styles. Photographs © Abdul Wali Al-Khulaidi.

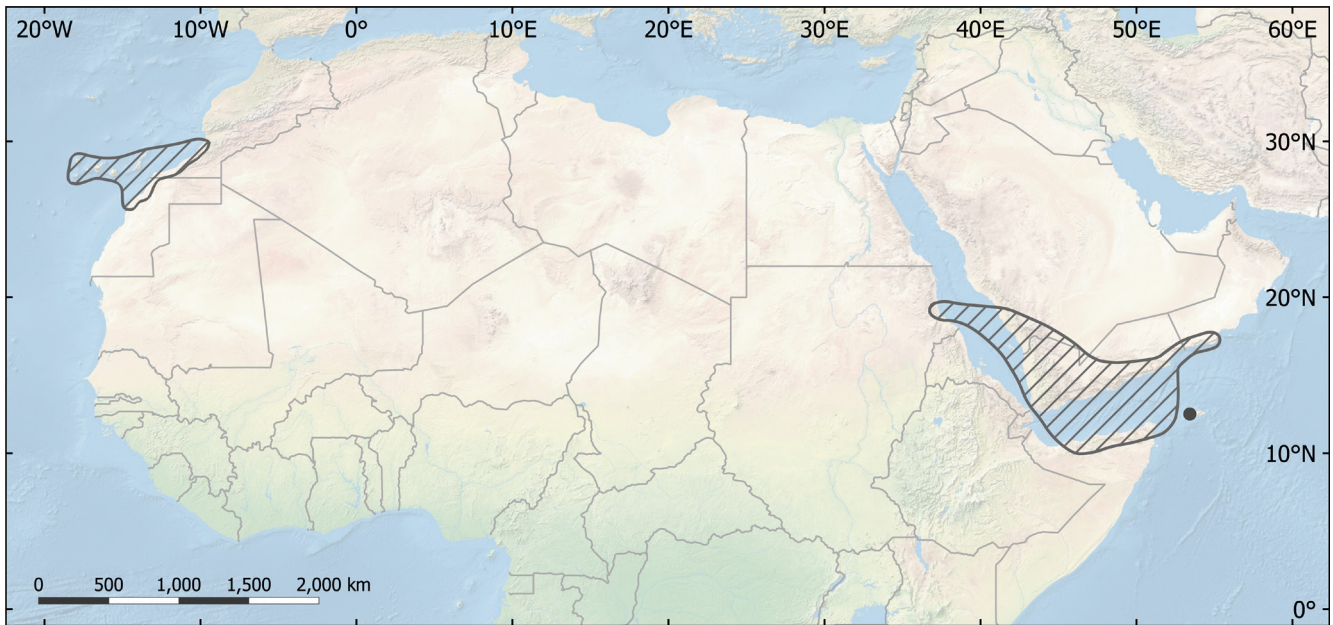


Figure 4. Map showing approximate distribution of *Euphorbia balsamifera* (hatched), with subsp. *balsamifera* in the west and subsp. *adenensis* in the east. The new locality on Socotra is indicated by a black dot.

east (Thulin 1994, 1999). Another example is *Patellifolia procumbens* (C.Sm.) A.J.Scott et al. occurring in the West Mediterranean region/Macaronesia as well as in northern Somalia and Socotra, but in this case there are isolated occurrences also in the Saharan mountains (Thulin et al. 2010). Finally, the widespread *Myrsine africana* L., native to the Azores (Macaronesia), has its nearest occurrences in eastern Africa more than 6000 km away. Just like *E. balsamifera*, it varies greatly in habit, from small shrubs to 6 m tall trees, as well as in leaf shape (Halliday 1984). *Myrsine africana* was found on Socotra in the last decades of the 19th century, but has not been seen there since then and is believed to be extinct (Miller and Morris 2004).

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### Author contributions

**Mats Thulin:** Conceptualization (lead); Data curation (lead); Investigation (lead); Resources (equal); Visualization (equal); Writing – original draft (lead); Writing – review and editing (lead). **Michael H. Weber:** Conceptualization (supporting); Data curation (supporting); Investigation (supporting); Resources (equal); Visualization (equal); Writing – original draft (supporting); Writing – review and editing (supporting). **Sami Ali Mohammed Mubarak:** Conceptualization (supporting); Data curation (supporting); Investigation (supporting); Resources (equal); Visualization (equal); Writing – original draft (supporting); Writing – review and editing (supporting).

### Data availability statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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