Notes on six endemic or rare species of *Euphorbia* subg. *Esula* (*Euphorbiaceae*) in Iran

**Abstract**


In the course of the revision of the genus *Euphorbia* in Iran, *E. grisophylla* and *E. sogdiana* are reported as new for the country. *E. erythradenia*, *E. malleata* and *E. spartiformis* are confirmed as rare localised endemics and an epitype is selected for the name *E. spartiformis*. *E. polycaulis* is shown to be the correct name for the more widespread Iranian endemic so far known as *E. decipiens* and *E. sparsiglandulosa* is sunk into the synonymy of this species. All species but *E. polycaulis* are illustrated and the following information is given for each of them: synonymy, description, delimitation from similar species, distribution and specimens examined.


**Introduction**

The number of accepted species in the mega-diverse and world’s second largest genus *Euphorbia* exceeds 2000 species (Govaerts & al. 2000; Bruyns & al. 2006). The genus occupies various habitats in both temperate and tropical regions with the exception of the arctic region. Its members show the whole range of habits from small ephemerals over various forms of herbaceous annuals and perennials to shrubs and trees, many of them being succulents. SW Asia is one of its main centres of diversity.

Most species there belong to subgenus *Esula*, comprising herbaceous annuals and perennials (Boissier 1879; Parsa 1949; Prokhano 1974; Rechinger 1964; Rechinger & Schiman-Czeika 1964; Radcliffe-Smith 1980, 1982, 1986; Collenette 1999; Govaerts & al. 2000). In temperate regions, *E. subg. Esula* is a very complex group, distributed mainly in the northern hemisphere with about 500 species (Bruyns & al. 2006; Riina & Berry 2011). Middle Asia and the Iranian highlands are main centres of diversity of *E. subg. Esula* sect. *Paralias*, to which in Iran almost all rare, endangered, endemic and complex species belong.

Rechinger & Schiman-Czeika (1964) in *Flora Iranica* gave 65 *Euphorbia* species for Iran. Their treatment of the *Euphorbiaceae* in this noble work of 178 parts, edited by the outstanding Austrian botanist Karl Heinz Rechinger (1963–2010) and covering the Iranian highlands (Iran, Afghanistan and parts of Iraq, Azerbaijan, Turkmenistan and Pakistan), belongs to the first six parts, which include no descriptions. Their treatment of *Euphorbia* contains a good number of localised, but sometimes doubtful species, based on very limited material. About 50 years later, the number of *Euphorbia* species in Iran has increased to more than 90 species. Several species were newly described or recorded for Iran (Ponent 1973; Mobayen 1984; Akhani 2004; Djavadi & al. 2006; Nasseh & al. 2006; Pahlevani 2006; Sajedi & al. 2006; Pahlevani 2007; Pahlevani & Riina 2011; Pahlevani & al. 2011; Pahlevani & Akhani 2011, Pahlevani & Mozaffarian 2011), but some names turned out to be
synonyms and some reports to be erroneous (Pahlevani 2007; Pahlevani & Riina 2011; Pahlevani & al. 2011). As a further part of the results of our revisionary work on *Euphorbia* in Iran, the present contribution deals with six rare or endemic species of *E. subg. Esula* in Iran.

**Material and methods**

The study is based on the investigation of herbarium specimens from the following herbaria in Iran: IRAN, TARI, FUMH (abbreviations according to Thiers 2008+), the personal herbarium of H. Akhani (herb. Akhani), currently housed at the Department of Plant Sciences, University of Tehran, and the herbarium of the Research Center of Agricultural and Naturals Resources Kurdistan, Sanandaj. Our revisionary work is further based on the critical evaluation of the following core publications on the subject: Boissier (1862, 1879), Khan (1964), Rechinger & Schiman-Czeika (1964), Prokhanov (1974), Radcliffe-Smith (1982), Govaerts & al. (2000) and Geltman (2005). The distribution maps were generated using the computer program DMAP (Morton 2009).

**Notes on species of *Euphorbia* subg. *Esula* in Iran**

1. *Euphorbia grisophylla* new for Iran (*E. sect. Helioscopia*)


Sparingly pubescent-pilose to subglabrous perennial herbs, up to 90 cm high; *stems* several, usually unbranched, arising from a woody rootstock, scaly at base. *Cauline leaves* ovate-oblong, lanceolate or broadly ovate, 3–5.5 × 1–2.5 cm, truncate, cuneate or sometimes subcordate at base, subsessile, apex acute or obtuse, margin entire, pinnately veined. *Terminal rays* 5; *axillary rays* 0–4. *Ray leaves* ovate, broadly ovate or ovate-rhombic, 2–3 × 1.5–2.5 cm, truncate at the base, apex acute or sometimes cuspidate, margin entire to undulate. *Raylet leaves* ovate-deltoid to suborbicular, truncate or shal-

![Fig. 1. *Euphorbia grisophylla* – A: habit; B: cyathium; C: fruit; D: seed. – After Ma-roofi 55797 (IRAN); drawing by M. Mehranfard.](image)

Table 1. Diagnostic characters of *Euphorbia grisophylla* and *E. macrocarpa*.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cauline leaves</th>
<th>Terminal rays</th>
<th>Axillary rays</th>
<th>Fruit surface</th>
<th>Fruit size</th>
<th>Seed size</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. grisophylla</em></td>
<td>ovate-oblong to broadly ovate</td>
<td>5</td>
<td>0–4</td>
<td>at base smooth but upper surface warty completely warty</td>
<td>5–6.5 mm in diameter</td>
<td>up to 3 mm wide</td>
</tr>
<tr>
<td><em>E. macrocarpa</em></td>
<td>lanceolate to oblong</td>
<td>5–7</td>
<td>numerous</td>
<td></td>
<td>8–10 mm in diameter</td>
<td>4 mm wide</td>
</tr>
</tbody>
</table>
lowly cordate at base, entire, apex cuspidate and yellowish. Cyathia lobes oblong-lanceolate; glands elliptic and rounded, brownish. Capsules trilobate, 5–6.5 mm in diameter, glabrous, covered with conical-cylindrical warts, at base often smooth (without any warts).

Seeds broadly ovoid, 3.5–4 mm long and 2.5–3 mm wide, smooth, grey-brownish, rarely flecked blackish; caruncles widely conical, yellowish, 0.5 mm long. – Fig. 1. – Flowering and fruiting: May–July.

Distribution and habitat. — The species has been known hitherto from E Turkey only and is here reported for the first time from W Iran, occurring in the northern Zagros Mts (Fig. 2). It grows on dry rocky igneous and limestone slopes and screes, at altitudes of 1800–3000 m.

Delimitation. — Euphorbia grisophylla shows a close affinity to E. macrocarpa. The most important diagnostic characters of both species are given in Table 1.


Table 2. Diagnostic characters of Euphorbia sogdiana, E. microsciadia and E. kopetdaghii.

<table>
<thead>
<tr>
<th>Species</th>
<th>Cauline leaves</th>
<th>Venation</th>
<th>Ray length</th>
<th>Gland shape</th>
<th>Gland horn</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. sogdiana</td>
<td>ovate-lanceolate to elliptic-oblong, obtuse, subacute and cuspidate</td>
<td>3–5 distinctive palmate veins</td>
<td>5–12 cm</td>
<td>crescent</td>
<td>pectinate or two long-horned</td>
</tr>
<tr>
<td>E. microsciadia</td>
<td>oblong-elliptic, obtuse to subacute</td>
<td>without distinctive veins or with 1–3 indistinctive palmate veins</td>
<td>less than 5 cm</td>
<td>trapeziform</td>
<td>hornless or two short-horned</td>
</tr>
<tr>
<td>E. kopetdaghii</td>
<td>oblong-linear, acuminate or cuspidate</td>
<td>1–3 distinctive palmate veins</td>
<td>less than 5 cm</td>
<td>crescent</td>
<td>two long-horned or pectinate</td>
</tr>
</tbody>
</table>
in the Kopetdag region in NE Iran (Fig. 4) is here reported for the first time. Its grows on dry mountain slopes at altitudes of 600–2200 m.

Delimitation. — Euphorbia microsciadia and E. kopetdaghi are the closest relatives to E. sogdiana in Iran. The main differences between these three species are given in Table 2.

Euphorbia kopetdaghi is confined to the Kopetdag range (NE Iran, NW Afghanistan and S Turkmenistan) and conspecific with E. aellenii Rech. f., described from the northern part of Khorasan (Rechinger 1951) as was first stated by Geltman (2005) and has been confirmed by our examination of an isotype (Khorasan, Ghuchan to Alamli, Rechinger 4759, IRAN 5078) and other specimens, including newly collected ones. E. microsciadia is rather widespread, ranging from N and W Iran across Afghanistan to W Pakistan.


3. Euphorbia spartiformis (E. sect. Paralias)

Mobayen (1984) described a conspicuous but apparently rare new species of Euphorbia from the Zagros
Mts, which forms spinescent cushions, based on a specimen without fruits and seeds. Having studied additional material, also with fruits and seeds, we here designate an epitype and provide an amended description, an illustration (Fig. 5) and information on the affinities of this narrowly distributed endemic.


Glabrous, glaucous, intricately-branched, spinescent and caespitose subshrubs to 50 cm height. _Stems_ woody with white lamelliform scales, older branches usually terminating in forked obtuse and rather thick spines. _Leaves_ elliptic-ovate, 4–6 × 1–3 mm, glabrous, attenuate at base, sessile-subsessile, apex acute-subacute, margin entire, without conspicuous veins. _Rays_ with falsely dichotomous branching. _Ray and raylet leaves_ similar to cauline leaves. _Cyathia_ lobes ovate-lanceolate and 2–3-dentate; glands crescent, dark reddish or rarely brownish with two rather thick and light reddish horns. _Capsules_ trilobate, pyramid shaped, 3–4 mm long, smooth with long pedicel. _Seeds_ ovoid, 2 mm long (without caruncles), slightly pitted or rather smooth, grey to brown; caruncles conical, 0.5–0.75(–1) mm long. – Fig. 5. – Flowering and fruiting: February–March.

Table 3. Diagnostic characters of _Euphorbia spartiformis_, _E. acanthodes_ and _E. erinacea_.

<table>
<thead>
<tr>
<th>Species</th>
<th>Branches</th>
<th>Bark</th>
<th>Leaves</th>
<th>Glands</th>
<th>Capsules</th>
<th>Caruncles</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. spartiformis</em></td>
<td>obtuse and thick spines</td>
<td>lamellate</td>
<td>without any conspicuous veins, glabrous</td>
<td>dark red or brown</td>
<td>smooth</td>
<td>0.5–0.75(–1) mm long</td>
<td>chasmophyte</td>
</tr>
<tr>
<td><em>E. acanthodes</em></td>
<td>acute and gradually thin spines</td>
<td>rather smooth, yellow</td>
<td>1–3 prominent palmate veins, papillose</td>
<td>yellow- ochreous</td>
<td>smooth</td>
<td>1.2–1.5 mm long</td>
<td>eremophilous on gypsum hills</td>
</tr>
<tr>
<td><em>E. erinacea</em></td>
<td>acute and so intricate spines</td>
<td>smooth, yellowish-brown</td>
<td>midrib only, glabrous</td>
<td>reddish</td>
<td>warty</td>
<td>less than 0.5 mm long</td>
<td>eremophilous</td>
</tr>
</tbody>
</table>

Fig. 5. _Euphorbia spartiformis_ – A: habit; B: cyathium & fruit; C: seed. – After Iranshahr & Termeh 18096 (IRAN); drawing by M. Mehranfard.
Euphorbia acanthodes & E. spartiformis

Fig. 6. Geographical distribution of Euphorbia spartiformis and E. acanthodes.

Distribution and habitat. — The species is restricted to the SE edge of the Zagros Mts (Fig. 6), where it occurs as a chasmophyte at altitudes of 600–1350 m. Co-occurring species are Euphorbia larica, E. granulata, Andrachne telephioides, A. aspera, Convolvulus acanthocladus, Ebenus stellata, Salvia mirzayanii, Cocculus hirsutus, Helianthemum cinereoflavescens, H. lippii, Zumberia majdae, Otostegia persica, O. atherci, Platychaete atherci, Centaura wendelboi, Capparis cartilaginea, Amygdalus eburnea and Caralluma tuberculata.

Delimitation. — Euphorbia spartiformis is morphologically rather similar to E. acanthodes Akhani and E. erinacea Boiss. & Kotschy, endemic species of Iran and Syria, respectively. The differences between these three species are given in Table 3.

The distribution area of the very rare Euphorbia acanthodes is situated in the provinces of Ilam and Khuzestan (a new locality: Khuzestan, road of Dez dam, 14 km E of Andimeshk, Pabot 1088, TARI) (Fig. 6) and is ecologically very different to that of E. spartiformis: E. acanthodes is restricted to gypsum hills along the border of Iran with Iraq. The vegetation of these hills consists of several gypsophilous species, in particular Pteropyrum naefelum, Gypsophila linearifolia, Diplotaxis harra, Albraunia fugax, Crepis aspera, Onobrychis gypsicola, Scabiosa leucactis, Cleome glaucescens, Convolvulus gonoocladius. The only common species in the habitats of E. spartiformis and E. acanthodes is the widespread Helianthemum lippii (Akhani 2004).

A phylogenetic analysis of DNA sequence data (Rii & al., in prep.) revealed that in spite of their morphological similarities E. spartiformis and E. acanthodes are no close relatives, being nested in two different clades.


4. Euphorbia erythradenia recollected (E. sect. Para-
lias subsect. Conicocarpae)


= Euphorbia erythradenia var. obovata Boiss. in Candolle, Prodr. 15(2): 152. 1862.

Glabrous, glaucous perennial herbs, up to 20(–28) cm high. Cauline leaves elliptic-linear, 5–10(–14) × 1–3 mm, without distinguished veins, truncate at base, sessile, apex obtuse or subacute, margin entire. Terminal rays 1–3, 1.5–3(–5) cm long; axillary rays 0–3. Ray leaves elliptic-linear, 5–10 × 1–3 mm, truncate at base, apex obtuse to subacute, margin entire. Raylet leaves small ovate, truncate at base, margin entire, apex obtuse or cuspidate. Cyathia lobes oblong-lanceolate; glands trapeziform, dark reddish, with 2 wide horns, ochreous. Capsules trilobate, 3 mm in diameter, 4–5 mm long, smooth. Seeds ovoid, 2–2.5 mm long (without caruncles), pitted, grey to brown; caruncles conical, 1 mm long. — Fig. 7. — Flowering and fruiting: May–June.

Distribution and habitat. — Among the few collections cited by Rechinger & Schiman-Czeika (1964) for Euphorbia erythradenia, the two from Kerman Province (Bornmüller 4694 and 4695) were misidentified and actually belong to E. gypsicola Rech. f. & Aell., as was stat-

Table 4. Diagnostic characters of Euphorbia erythradenia and E. gedrosiaca.

<table>
<thead>
<tr>
<th>Species</th>
<th>Height of plant</th>
<th>Cauline leaves</th>
<th>Rays number</th>
<th>Rays length</th>
<th>Bifurcation</th>
<th>Glands</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. erythradenia</td>
<td>14–20(–25) cm</td>
<td>5–10 × 1–3 mm</td>
<td>1–2(–3)</td>
<td>1.5–3(–5) cm</td>
<td>one time</td>
<td>dark reddish</td>
</tr>
<tr>
<td>E. gedrosiaca</td>
<td>25–55 cm</td>
<td>11–20 × 3–7 mm</td>
<td>(2–)3–4</td>
<td>3–16 cm</td>
<td>2–3 times</td>
<td>yellowish-brown</td>
</tr>
</tbody>
</table>
ed already by Geltman (2005). The cited collection of Strauss from Arak probably represents *E. gedrosiaca*. We have not traced any collection of *E. erythradenia* in Iranian herbaria and the two collections made by the first author in 2009 (see below), may perhaps be the only ones made since a century.

The species has a very scattered occurrence in the southern Zagros Mts (Fig. 8). It grows on dry, stony slopes, at altitudes of 1900–2500 m.

**Delimitation.** — *Euphorbia erythradenia* is most closely related with *E. gedrosiaca*, which is distributed in central and SE Iran. The most important diagnostic characters for these species are shown in Table 4.

**Specimens examined.** — *IRAN*: FARS: 20 km from Neyriz to Estahban, 27.5. 2009, Pahlevani & Bahramishad 53336 (IRAN); Estahban, Eij Mt., 28.5. 2009, Pahlevani & Bahramishad 53337 (IRAN).

---

**Fig. 7. Euphorbia erythradenia** — A: habit; B: cyathium & fruit; C: seed. — After Pahlevani & Bahramishad 53337 (IRAN); drawing by M. Mehranfard.

**Fig. 8. Geographical distribution of Euphorbia erythradenia.**

---


Glabrous, glaucous perennial herbs with yellowish stems, up to 80 cm high. Cauleine leaves lanceolate, 3–7 × 0.5–2 cm, truncate at base, sessile, apex acute, margin entire, palmately veined. Terminal rays (6–)7–12(–15); axillary rays 0–15. Ray leaves ovate-oblong or ovate-deltoid, 1–3 × 0.5–2.5 cm, truncate or slightly cordate at base, apex acute and cuspidate, margin entire. Raylet leaves ovate-rhombic to ovate-deltoid, cordate at base, margin entire and cartilaginous, apex cuspidate. Cyathia lobes oblong; glands crescent, ochreous, 2-horned. Capsules trilobate, 3–4 mm in diameter, intensely keeled,
Euphorbia malleata is endemic to a rather small area of the central plateau and part of Zagros Mts in the provinces of Esfahan and Yazd (Fig. 10), where it occurs on dry stony slopes and foothills at altitudes of 1900–3200 m.

Rechinger & Schiman-Czeika (1964) quote only three collections of this endemic species. Almost half a century later, despite rather intensive collecting activities by Iranian botanists, still only rather few collections are known, confirming the limited occurrence of this species.

Specimens examined. — IRAN: ESFAHAN: Kashan, Komow, Kargaz Mt., 7.5.1984, Moussavi & Tehrani 44564 (IRAN); Kashan, Abyaneh, Tordal, 7.7.1984, Moussavi & Tehrani 44540 (IRAN); c. 25 km SW of Natanz, foothills of the southern slopes of Karkas Mt., 24.7.2003, Akhani 17148 (herb. Akhani); Kashan, Abyaneh, 30.7.1976, anonymous 47928 (IRAN); Natanz, 30 km from old road of Natanz to Esfahan, Targh village, 26.7.2009, Pahlevani & Bahramishad 53353 (IRAN); Kashan, Ghamsar, Gohroud, 25.8.2010, Pahlevani & Bahramishad 54893 (IRAN); Ardestan to Murcheh-Khort, Tar, 27.5.1974, Iran-shahr 17996 (IRAN); Natanz, Keshe village, Karkas Mt., 26.7.2009, Pahlevani & Bahramishad 53334 (IRAN); Mount Karkas, N of Targh, 15.5.1974, Wendelbo & Foroughi 11455 (TARI); Kouhpaye to Nain, 21.4.1948, Rechinger & al. 17734 (IRAN). — YAZD: Shirkuh, 20 km SSW of Taft, 25.5.1977, Aryavand & al. 1379 (TARI).


Fig. 9. Euphorbia malleata – A: habit; B: cyathium; C: fruit; D: seed. – After Pahlevani & Bahramishad 53353 (IRAN); drawing by M. Mehranfard.

Fig. 10. Geographical distribution of Euphorbia malleata.
**Euphorbia polycaulis** was omitted by Rechinger & Schiman-Czeika (1964), while Govaerts & al. (2000) quote it in the synonymy of _E. decipiens_. Our studies corroborate that both are conspecific, but the correct name of the species is _E. polycaulis_, because this validly published name has priority over _E. decipiens_.

_Euphorbia polycaulis_ is a rather complex, polycarpic species with high morphological plasticity. A comprehensive description and an illustration of the species were given by Pahlevani (2007 under the name _E. decipiens_), because this validly published name has priority over _E. decipiens_.

After close examination of _Euphorbia sparsiglandulosa_ Ponert (1973), an endemic described from Gachsar, situated in Mazandaran Province, it was found that this is also conspecific with _E. polycaulis_. _E. sparsiglandulosa_ was separated from _E. decipiens_ by characters such as the number of rays, size and shape of stem leaves as well as seed colour (Ponert 1973), all being subject of considerable variation and therefore of little taxonomic value.

Erect to subascending glabrous perennial herbs. **Cauline leaves** lanceolate to obovate or oblanceolate-linear. **Rays** 10–30, once or twice bifid. **Capsules** ovate-conical, 4–5 mm long, smooth. **Seeds** 2.5–3 mm long (without caruncle), greyish to whitish (depending on growth stage), malleate and foveolate; caruncles sessile, 0.75–1 mm long, flattened-conical. – Flowering and fruiting: May–July.

**Distribution and habitat.** _Euphorbia polycaulis_ is a species endemic to N, W and C Iran (**Fig. 11**). It occurs on mountain slopes on limestone at altitudes of 1900–3200 m.

**Acknowledgements**

This paper is the results of a research project “A floristic study on _Euphorbiaceae_ in Iran” by the first author, funded by Iranian Research Institute of Plant Protection. We are thankful to Mr Mehranfar for the illustrations, to Prof. R. M. Frietch for editing and Prof. H. Akhani for giving some useful tips. Two anonymous reviewers provided beneficial suggestions which helped to improve the manuscript. We also acknowledge the curators of the listed herbaria for their help during our herbarium visits.

**References**


Nasseh Y., Joharchi M. R. & Zehzad B. 2006: Two new records of the genus _Euphorbia_ (Euphorbiaceae) for...
Pahlevani A. H. 2006: *Euphorbia prostrata*, a noteworthy
new record from the flora of Iran. – Rostaniha 8(2): 89–103.
Pahlevani A. H. 2007: Notes on some species of the gen-
Pahlevani A. H. & Akhani H. 2011: Seed morphology of
Iranian annual species of *Euphorbia (Euphorbiace-
Pahlevani A. H. & Mozaffarian V. 2011: *Euphorbia iran-
shahi* (*Euphorbiaceae*), a new endemic species from
Iran. – Adansonia, ser. 3, 33: 93–99.
Pahlevani A. H. & Riina R. 2011: A synopsis of *Euphor-
bia* subgen. *Chamaesyce* Raf. (*Euphorbiaceae*) in
Pahlevani A. H., Geltman D. V. & Riina R. 2011 [in
press]: Taxonomic revision of *Euphorbia* subsect.
*Myrsineteae* Boiss. for the flora of Iran. – Ann. Bot.
Fenn. 48.
sa A. (ed.), Flore de l’Iran 4. – Tehran: Tehran Uni-
viversity.
Ponert J. 1973: A new species of *Euphorbia* from Iran. – Pesi-
la 45: 361–363.
– Moskva & Leningrad [English translation: Jerusa-
in: Townsend C. C. & Guest E. (ed.), Flora of Iraq
4.1. – Baghdad: Ministry of Agriculture and Agrarian
Reform.
in: Davis P. H. (ed.), Flora of Turkey and the East Aeg-
ean Islands 7. – Edinburgh: Edinburgh University.
Radcliffe-Smith A. 1986: *Euphorbia* L. – Pp. 88–164 in:
Nasir E. & Ali S. I. (ed.), Flora of Pakistan 172. – Ka-
rachi: University of Karachi.
Rechinger K. H. 1951: *Euphorbiaceae et Ranunculaceae*
novae iranicae. – Anz. Österr. Akad. Wiss., Math-
Rechinger K. H. (ed.), Flora of Lowland Iraq. – Wein-
heim: J. Cramer.
Rechinger K. H. & Schiman-Czeika H. 1964: *Euphorbia*
Riina R. & Berry P. E. (coordinators) 2011: *Euphorbia*
Planetary Biodiversity Inventory database. – Published
species of *Euphorbia* for Iran. – Rostaniha 7(1): 73.