

Synopsis of *Euphorbia* subgen. *Esula* sect. *Helioscopia* (Euphorbiaceae) in Iran with the description of *Euphorbia mazandaranica* sp. nov.

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Euphorbia subgen. *Esula* with about 480 species is one of the most diverse and complex lineages of the giant genus *Euphorbia*. Species of this subgenus are usually herbaceous and are mainly distributed in temperate areas of the Northern Hemisphere. This paper updates the taxonomy and distribution of *Euphorbia* (subgen. *Esula*) sect. *Helioscopia* in Iran since the publication of ‘Flora Iranica’ in 1964. We provide a key, species descriptions, illustrations (for most species), distribution maps, brief characterization of ecology as well as relevant notes for the 12 species of this section occurring in Iran. As a result of this revision, *E. altissima* var. *altissima* is reported as new for the country, and a new species from northern Iran, *Euphorbia mazandaranica*, is described and illustrated. With the exception of *E. helioscopia*, a widespread weed in temperate regions worldwide, the remaining species occur in the Alborz, Zagros and northwestern regions of Iran.

Euphorbia L. is one of the largest genera of flowering plants with about 2000 species (Govaerts et al. 2000, Frodin 2004, Bruyns et al. 2006, Riina and Berry 2011). *Euphorbia* species show a high diversity of growth forms and are distributed on all continents from sea level to 4000 m a.s.l., occupying a great variety of habitats. Southwest Asia is an important center of diversity for *Euphorbia* with about 230 species, most of them in *E.* subgen. *Esula* Pers. (Boissier 1879, Parsa 1949, Prokhanov 1949, Rechinger 1964, Rechinger and Schiman-Czeika 1964, Radcliffe-Smith 1980, 1982, 1986, Collenette 1999, Govaerts et al. 2000, Riina et al. 2013). Subgenus *Esula* comprises ca 480 species of mostly non-succulent herbs and shrubs distributed mainly in the Northern Hemisphere (Horn et al. 2012). Iran has the largest number of taxa in southwest Asia with about 90 species including several endemics and even undescribed species (Rechinger and Schiman-Czeika 1964, Mobayen 1979, Mobayen 1984, Akhane 2004, Nasseh and Joharchi 2004, Djavadi et al. 2006, Nasseh et al. 2006, Pahlevani 2006, Sajedi et al. 2006, Pahlevani 2007, Pahlevani and Riina 2011, Pahlevani and Mozaffarian 2011, Pahlevani et al. 2011b).

Ongoing taxonomic revisions of different groups of *Euphorbia* in Iran as part of the *Euphorbia* Planetary Biodiversity Inventory project (Esser et al. 2009), has raised the number of species occurring in the country from 65 (Rechinger and Schiman-Czeika 1964) to more than 90

(Pahlevani 2007, Pahlevani and Riina 2011, Pahlevani and Mozaffarian 2011, Pahlevani and Akhane 2011, Pahlevani et al. 2011a, 2011b). This taxonomic revision is motivated by the ecological importance of this genus in different Iranian plant communities, the weedy nature of some *Euphorbia* species, as well as the presence of some rare or endemic species in Iran. Many species are rich in chemical compounds, including carcinogenic, skin-irritant, and anti-cancer agents. Lastly, detailed descriptions and illustrations are lacking in the first sixth volumes of ‘Flora Iranica’ (Rechinger and Schiman-Czeika 1964) where Euphorbiaceae was treated (Akhane 2006). Our goals are to update the taxonomy and geographic distribution of *Euphorbia* sect. *Helioscopia* in Iran since the treatment of ‘Flora Iranica’ in 1964, and to provide a key and illustrations to facilitate species identification.

Material and methods

Species of sect. *Helioscopia* were revised using existing holdings in Iranian herbaria, especially FAR, IRAN, and TARI, including recently collected specimens by the first author. A few specimens from FUMH, K, M, TUH as well as the private herbarium of Akhane (Herb. Akhane, Dept of Plant Sciences, Univ. of Tehran) were also included. All specimens were studied and identified using relevant

taxonomic literature and floras (Boissier 1879, Prokhanov 1949, Khan 1964, Rechinger and Schiman-Czeika 1964, Radcliffe-Smith and Tutin 1968, Radcliffe-Smith 1980, 1982, 1986, Govaerts et al. 2000, Geltman 2009) and were compared with type collections hold in several herbaria with rich collections from Eurasia. Types were also searched online at JSTOR Plant Science (<http://plants.jstor.org>) and the Berlin digital herbarium (ww2.bgbm.org/Herbarium). Included in the synopsis of each species are the following details: accepted name, types, synonymy, description, illustration (for most species), brief characterization of ecology, flowering and fruiting time, habitat, distribution map, relevant notes, and examined specimens.

Results and discussion

'Flora Iranica' (Rechinger and Schiman-Czeika 1964) included all together 20 species in *E.* sect. *Helioscopia*, and 12 of them were reported from Iran. According to the present revision, some of those names are synonyms (*E. unilateralis* Blakelock, *E. guestii* Blakelock), two species are not found in Iran despite extensive fieldwork and herbarium research (*E. schottiana* Boiss., *E. coniosperma* Boiss.), and four others belong to different sections or clades within *E.* subgen. *Esula* (*E. bungei* Boiss., *E. gaillardotii* Boiss. & Blanche *E. turkestanica* Regel, *E. phymatosperma* Boiss.). We recognize 12 species of *E.* sect. *Helioscopia* in Iran, including one new record (*E. altissima* var. *altissima*) and one new species (*E. mazandarunica*).

We consider *Euphorbia* subg. *Esula* sect. *Chamaebuxus* Lázaro with ca 95 species (Geltman 2009) part of sect. *Helioscopia* as it has been suggested by recent molecular phylogenetic analyses (Kryukov et al. 2010, Salmaki et al. 2011) where members of sect. *Chamaebuxus* are well embedded within a clade including most species of sect. *Helioscopia*. Boissier (1879) and Rechinger and Schiman-Czeika (1964) treated sect. *Chamaebuxus* as subsect. *Galarhoei* Boiss. and sect. *Tithymalus* Boiss. Prokhanov (1949) treated the group as subgen. *Paralias* sect. *Tulocarpa* (Rafin.) Prokh., divided into three subsections, i.e. *Lutescentes* Prokh., *Purpuratae* Prokh. and *Helioscopiae* Prokh. Radcliffe-Smith (1982) treated sect. *Chamaebuxus* as sect. *Helioscopia* with two subsections separated by their life history: subsect. *Galarhoei* (perennials) and subsect. *Helioscopiae* (annuals). According to recent phylogenetic studies on subgenus *Esula* using DNA sequence data (Kryukov et al. 2010, Barres et al. 2011, Frajman and Schönschwetter 2011, Peirson et al. 2014), it is clear that life history in subgen. *Esula* is not phylogenetically stable and thus not a reliable character for infrageneric classification. However, in sect. *Helioscopia* life history is a useful character for distinguishing species. The main feature characterizing sect. *Helioscopia* is the rounded involucre glands with entire margins and without appendages (Rechinger and Schiman-Czeika 1964, Radcliffe-Smith and Tutin 1968, Radcliffe-Smith 1982). However, this feature is also present in species from other lineages within subg. *Esula*. Species of sect. *Helioscopia* are annual or perennial with fruits bearing different kinds of

ornaments on their surface and seeds with a smooth and usually shiny surface. Notable exceptions regarding fruit and seed morphology are *E. helioscopia* with ornamented seeds and smooth fruits, and *E. mazandarunica*, *E. microsphaera* and *E. eriophora* with smooth fruits. Based on morphological features, including capsule and seed morphology, a subdivision of sect. *Helioscopia* into several subsections seems appropriate. However, comprehensive molecular phylogenetic studies are underway to further evaluate the taxonomic subdivision of this diverse section of subgen. *Esula*.

Euphorbia schottiana was recorded by Rechinger and Schiman-Czeika (1964) from western Iran (Lorestan Province, Shahbazan). However, after several collection trips to that region and study of most specimens deposited in Iranian herbaria, no specimen of *E. schottiana* has been found. The source of the confusion probably comes from an Iranian Specimen, seen by Rechinger and Schiman-Czeika at W, identified as *E. schottiana* (M. Koie 465). This specimen corresponds to an immature individual of *E. condylocarpa*. *Euphorbia schottiana* is distributed in the Mediterranean region and it is unlikely that it occurs in Iran. The record in 'Flora Iranica' (Rechinger and Schiman-Czeika 1964) is probably a misidentification. For all these reasons, we excluded *E. schottiana* from the present taxonomic treatment. This issue was also discussed by Radcliffe-Smith (1982) who pointed out that the occurrence of *E. schottiana* in Iran seemed rather unlikely. Another doubtful species is *E. gaillardotii*, which is reported from Iran (Govaerts et al. 2000), but so far we have not found any record for that species in the country. It seems that Govaerts et al. (2000) used Parsa (Flore de L' Iran) as their source for this record. Parsa (1949) indicated two *E. gaillardotii* specimens (Lazar 966, 1087 at K) from Isfahan and Soleymanieh to Tehran, respectively. These two specimens could not be located at K for further study; however it should be noticed that Soleymanieh is a city in Iraq. There are many problems with Parsa's work, such as misidentification and wrong information about the geographic distribution of species, not only in Euphorbiaceae but in other families as well (Lamond 1977).

The species *E. phymatosperma*, present in Iran, which used to be treated under sect. *Helioscopia* is excluded from this treatment following our molecular phylogenetic analyses (Riina et al. 2013), which place *E. phymatosperma* in a different lineage outside the sect. *Helioscopia* clade.

Euphorbia L. (1753, p. 157)

Taxonomic synonym: *Tithymalus* Gaertn. (1790, p. 115) nom. cons.

E. subgen. *Esula* Pers. (1806, p. 14).

Type: *E. esula* L.

Usually erect herbs or sometimes dendroid shrubs. Leaves exstipulate, usually alternate, symmetrical at the base, sessile or subsessile. Cyathia in pleiochasial cymes (rays). Glands without petaloid appendages. Seeds usually carunculate.

***E. sect. Helioscopia* Dumort. (1827, p. 87)**

Type: *Euphorbia helioscopia* L.

Taxonomic synonym: *E. sect. Chamaebuxus* Lázaro (1896, p. 282).

Annual or perennial herbs, rarely subshrubs, tuberous or not, erect or ascendent. Leaves pinnately nerved, membranous, sessile or petiolate. Involucral glands rounded. Capsules usually warty, rarely smooth, glabrous or pilose. Seeds usually smooth, sometimes ornamented, carunculate or rarely ecarunculate.

Key to the Iranian species of *E. sect. Helioscopia*

1. Annuals 2
 - Perennials 6
2. Seeds smooth 3
 - Seeds ornamented 5
3. Capsules densely tuberculate 12. *E. stricta*
 - Capsules smooth 4
4. Capsules spherical, glabrous to sparingly pilose; seeds carunculate 8. *E. microsphaera*
 - Capsules obviously trilobate, pilose; seeds ecarunculate 5. *E. eriophora*
5. Seeds foveolate 8. *E. helioscopia*
 - Seeds striate-rugulose 10. *E. rhabdotosperma*
6. Capsules smooth (rarely with a few short warts or granulate), glabrous or rarely sparingly pilose 7
 - Capsules tuberculate or verrucose, glabrous or pilose 8
7. Cauline leaves sessile, linear-lanceolate, 5.5–10.0 × 0.5–1.0 cm, with minutely serrulate and cartilaginous margin; terminal rays 3–4-chotomous 1. *E. altissima* var. *altissima*
 - Cauline leaves petiolate, elliptic-lanceolate to ovate-oblong, 3.5–10.0 × 1.5–4.0 cm, with entire margin; terminal rays 2-chotomous 7. *E. mazandaranica*
8. Cauline leaves cordate-auriculate at base; root a fusiform tuber 3. *E. condylocarpa*
 - Cauline leaves rounded or cuneate; root not forming a tuber 9
9. Stems scaly at base 10
 - Stems not scaly at base 11
10. Axillary rays numerous (>7); capsules 8–10 mm in diameter; seeds 4 mm wide 6. *E. macrocarpa*
 - Axillary rays 0–4; capsules 5.0–6.5 mm diameter; seeds up to 3 mm wide 7. *E. grisophylla*
11. Cauline leaves broadly ovate, up to 3.5 cm at the widest portion, petiolate, white pilose, especially at margin and main vein; terminal rays dichotomous 11. *E. squamosa*
 - Cauline leaves oblong-lanceolate, not more than 2 mm at the widest portion, sessile, glabrous; terminal rays 3–4-chotomous 9. *E. orientalis*

1. *Euphorbia altissima* Boiss. var. *altissima* (Fig. 1)

Based on the same type: *Tithymalus altissimus* (Boiss.) Klotzsch and Garcke (1860, p. 80). **Type:** Hab. ad rivulos Denisleh et Laodiceam in Phrygia australi, legi flor. Jun

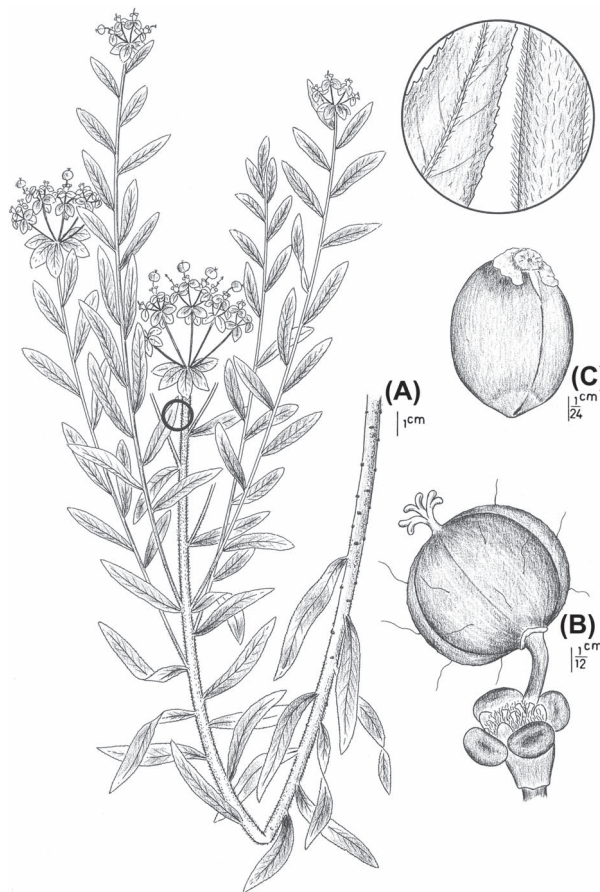


Figure 1. *Euphorbia altissima* var. *altissima*. (A) habit, (B) cyathium and fruit, (C) seed. Drawn from voucher specimen from west Azarbaijan: road of Talatappeh towards Urmieh, Gol-e Marz village, TARI 68340.

1842, P. E. Boissier, s.n (lectotype designated here: G-BOISS!; isolectotypes: GH00282013!, P00552405!, P00552406!).

Perennial herbs, up to 2 m high. Stems erect, pilose or villous, with violet spots. Cauline leaves linear-lanceolate to elliptic-lanceolate, hirsute, 5.5–10.0 × 0.5–1.0 cm, sessile, with tapering base and acute apex, mucronate, with serrulate margin and prominent white midrib. Terminal rays 4–7, 3- or 4-chotomous, once dichotomous; axillary rays 0–5. Ray leaves like cauline leaves but smaller, 1.0–1.5 × 0.5–1.0 cm, sessile, cuneate or truncate at base, subacute at apex, mucronate, with serrulate to subentire margin. Raylet leaves ovate-rotundate, cuneate-truncate at base, cuspidate at apex, with serrulate margin. Cyathia: involucre turbinate, 2.0–2.5 mm in diameter, lobes short-oblong; glands elliptic and rounded, brownish. Capsules subglobose, trilobate, 5.0–5.5 mm in diameter, smooth or granulate, glabrous or rarely sparingly pilose. Seeds ellipsoidal, 2.5 mm long (excluding the caruncle), smooth, dark brown; caruncle reniform, 0.25 mm long, yellowish. Flowering and fruiting in June to August.

Habitat

In moist depressions, on the banks of small irrigation ditches, pools, springs and streams, in fields, at 700–1400 m a.s.l.

Distribution

Old World: Iran (northwest), northern Iraq, Turkey, Syria, Lebanon, Cyprus. An Irano-Turanian element (Fig. 2). Not previously reported from Iran.

Specimen examined

Iran. West Azerbaijan: road of Talatappéh towards Urmieh, Gol-e Marz village, Izadpanah and Taheri 68340 (TARI).

2. *Euphorbia condylocarpa* M. Bieb. (1808, p. 377) (Fig. 3)

Basionym: *Tithymalus condylocarpus* (M. Bieb.) Klotzsch and Garcke (1859, publ. 1860, p. 78). **Type:** Turkey, in Montosis Caucasi, circa acidulam Narzana, s.d., Marschall von Bieberstein s.n. (LE, n.v.).

Taxonomic synonyms: *Euphorbia amplexicaulis* Ledeb. (1850, p. 567) nom. illeg., non Hook. f. 1847 – *Euphorbia cardiophylla* Boiss. & Heldr. (1853, p.107). – *Tithymalus amplexicaulis* Klotzsch & Garcke (1859, publ. 1860, p. 80). – *Tithymalus cardiophyllus* (Boiss. & Heldr.) Klotzsch & Garcke (1859, publ. 1860, p. 78).

Perennial herbs, 10–35 cm high, with a fusiform-cylindrical tuber; stems prostrate, decumbent or erect, glabrous. Cauline leaves oblong, elliptic-oblong or linear-lanceolate, 1.5–3.5 × 0.5–1.5 cm, sessile, at base auriculate-cordate or dilated-cordate and amplexicaul only in one side, obtuse to subacute at apex, with entire, subentire or serrate margin. Terminal rays 3–6, unbranched or once dichotomous; axillary rays 3–10. Ray leaves triangular-lanceolate or oblong-triangular, 1.0–1.5 × 0.5–1.0 cm, sessile, cuneate or

truncate at base, obtuse-acute at apex, with entire-serrate margin. Raylet leaves rhombic-reniform, wider than long, cuneate-truncate at base, cuspidate or not at apex, with more or less serrate or subentire margin. Cyathia: involucre subglobular-turbinate, 2.0–2.5 mm in diameter, with short-oblong lobes; glands elliptic and rounded, brownish. Capsules subglobulose, trilobate, 4.0–5.5 (6.0) mm in diameter, covered with subglobular-conical processes, glabrous. Seeds compressed ellipsoidal, 3.0–3.5 mm long (excluding the caruncle), smooth, dark brown; caruncle reniform, 0.5 mm long, yellowish. Flowering and fruiting in April to May.

Habitat

Mountain slopes, oak forests, meadows, rocky slopes and steppe forests on limestone, at 1500–2500 m a.s.l.

Distribution

Old World: Iran (north, northwest, west and southwest), northern Iraq, Turkey, Caucasus (Georgia, Armenia, Azerbaijan and Russia). An Irano-Turanian element, restricted to the Zagros, Alborz and Arasbaran protected area ranges in Iran (Fig. 2).

Specimens examined

Iran. East Azerbaijan: Arasbaran protected area, between Kalaleh and Mahmoud-abad, Assadi 73941 (TARI); Arasbaran protected area, west part of Makidi, Assadi and Masoumi 20255 (TARI); Kalibar, from Makidi to Vinagh, Wendelbo and Assadi 17062 (TARI); Arasbaran protected area, between Doghrun Mt and Saigran-Dagh, Assadi and Sardabi 24170 (TARI); Fars: Kuh-e-Bamu, northeast of

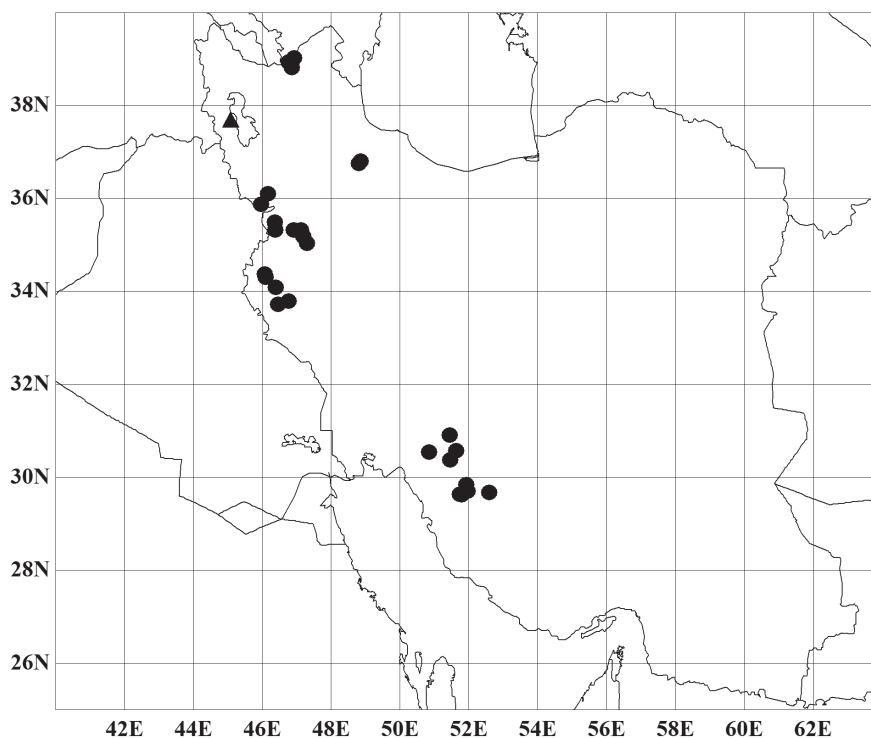


Figure 2. Distribution of *Euphorbia altissima* (triangle) var. *altissima* and *E. condylocarpa* (circle) in Iran.

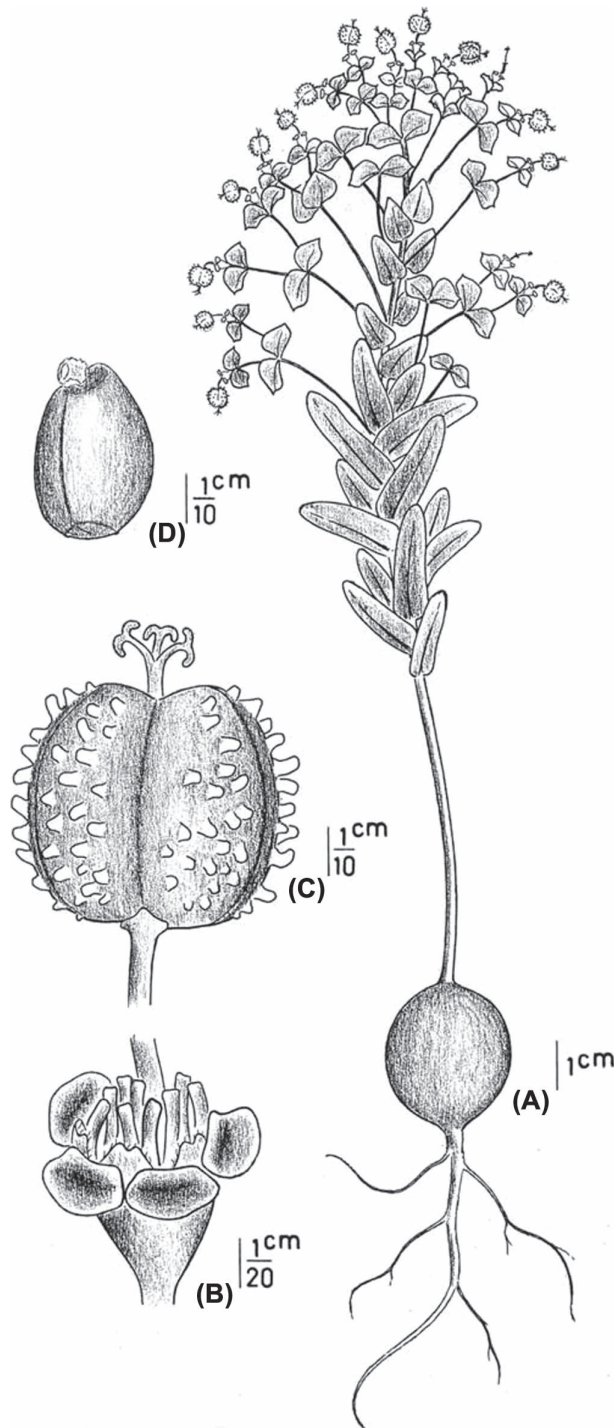


Figure 3. *Euphorbia condylocarpa*. (A) habit, (B) cyathium, (C) fruit, (D) seed. Drawn from voucher specimen from Zanjan, 70 km from Zanjan to Gilvan, IRAN 56262.

Shiraz, Archibald 1408 (K); Ridges south of Kuh Chang, east of Kazerun, Archibald 1296 (K); 23 km from Babameidan to Yasuj, Assadi and Aboohamze 38425 (TARI); Arjan-Parishan protected area, gardane-ye galu Khajei, Ghasemi 47339 (IRAN); Kazeroon, Kotale Pirezan, Riazi 4867 (TARI); Shiraz, Kotel-e Pirzan protected area, 2 km after Dasht-e Arjan on the new road of Kazeroun, Salmaki and Zarre 39955 (TUH); Gilan: Manjil to Zanjan, Badamestan, Iranshahr 17994 (IRAN); Ilam:

Reno, Iranshahr 17713 (IRAN); Kohgiluyeh and Boyer-Ahmad: ca 12 km from Yasuj to Ardakhan, before Vaz (Varag) village, Davis and Bokhari D56479 (K); Yasuj, Sisakht, Foroughi 4851 (TARI); Neck Mt, between Churam and Gachsaran, Mozaffarian 77298 (TARI); Kurdistan: Marivan to Saghez, 65 km Marivan, Sajedi and Bahramishad 47340 (IRAN); Baneh, Naheni Mt, Fattah and Khaledian 2381 (TARI); southeast of Sanandaj, 40 km from Sanandaj, Garawa, Fattahi and Khaledian 403

(TARI); Sarvabad, west of Sanandaj, 98 km from Sanandaj, Fattahi and Khaledian 701 (TARI); east of Sanandaj, 12 km to Sanandaj, Fattahi and Khaledian 1296 (TARI); Zanjan: 70 km from Zanjan to Gilvan, Pahlevani and Fritsch 56262 (IRAN).

3. *Euphorbia eriophora* Boiss. (1844, p. 51) (Fig. 4)

Based on the same type: *Tithymalus eriophorus* (Boiss.) Klotzsch and Garcke (1859, publ. 1860, p. 65). **Type:** Turkey (C2): In agris Cariae interioris segetes, specimen

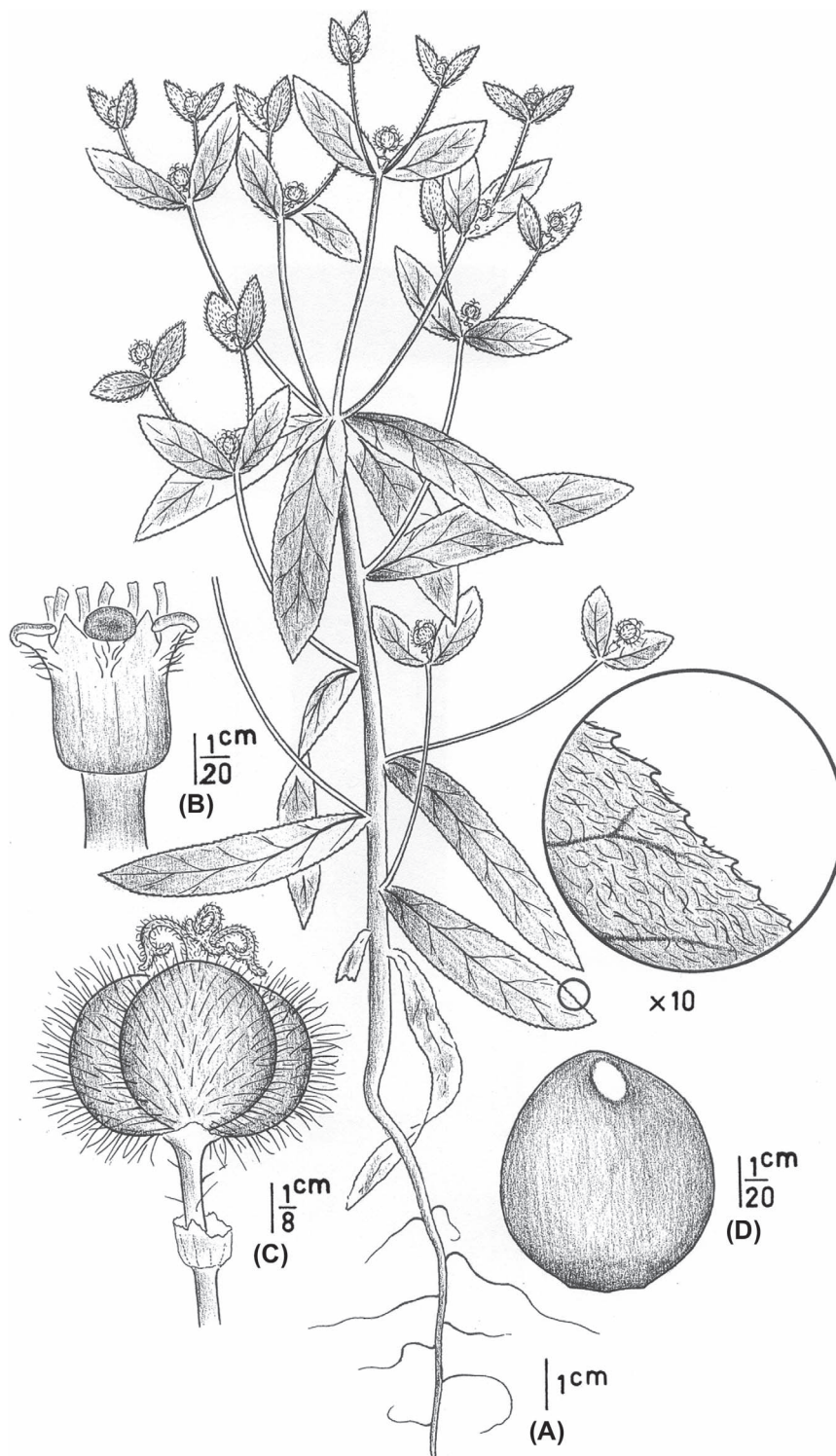


Figure 4. *Euphorbia eriophora*. (A) habit, (B) cyathium, (C) fruit, (D) seed. Drawn from voucher specimen from east Azerbaijan: Mianeh, Ghafankuh, IRAN 46720.

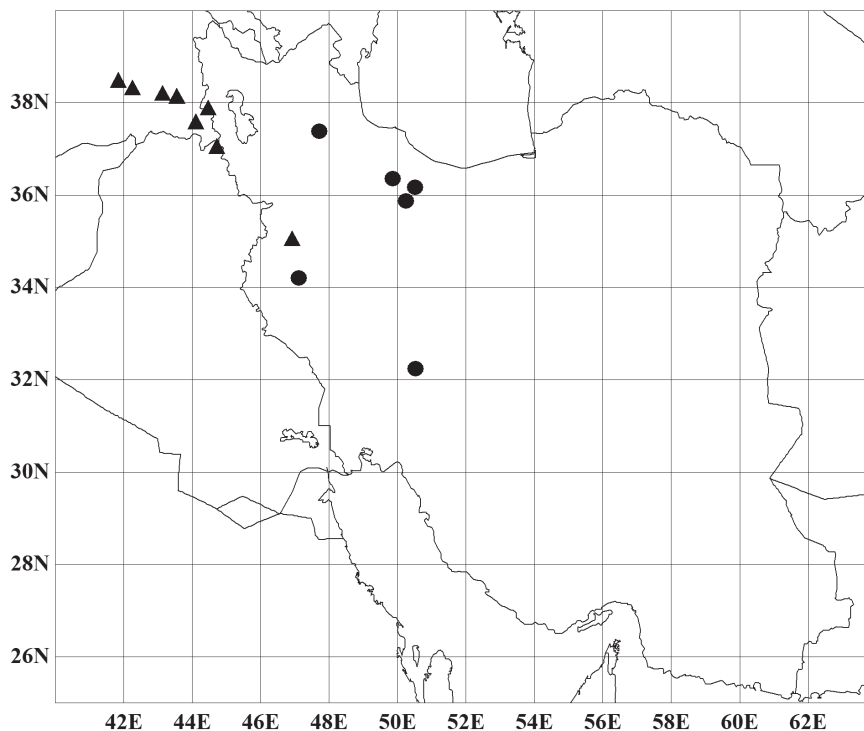


Figure 5. Distribution of *Euphorbia eriophora* (circle) and *E. grisophylla* (triangle) in Iran.

unicum, in planitie ad meridiem Cadmi [Honaz dag], Jun 1842, Boissier s.n. (holotype: G-BOISS!).

Taxonomic synonym: *Euphorbia lasiocarpa* K. Koch. (1849, p. 721), nom. illeg., non Klotzsch 1843.

Annual herbs, up to 45 cm high, pilose or villous. Cauline leaves oblanceolate, 1.5–6.0 × 0.5–1.5 cm, sessile, tapering at base, acute or subacute at apex, with serrulate margin, pilose. Terminal rays 3 (4), three times dichotomous; axillary rays 0–4. Ray leaves ovate-lanceolate, 2.5–5.5 × 1.0–1.5 cm, sessile, rounded or cuneate at base, acute at apex, with serrulate margin. Raylet-leaves oblong-ovate to ovate-lanceolate, cuneate or rounded at base, mucronate at apex, with serrulate margin. Cyathia: involucre campanulate, 1.0–1.5 mm in diameter; glands elliptic and rounded, light brown. Capsules strongly trilobate, 5.0–5.5 mm in diameter, smooth, villous. Seeds ellipsoidal-subglobose, 2.3–2.6 mm long, smooth, grayish-brown; without caruncle. Flowering and fruiting in May to June.

Habitat

On steppe clay plains and in fallow fields at 500–1500 m a.s.l.

Distribution

Old World: northern, northwestern and western Iran, northern Iraq, Armenia, Azerbaijan (Nakhichevan) and Turkey. An Irano-Turanian element, restricted to the Zagros, Alborz and Caucasus regions. *Euphorbia eriophora* is very rare in Iran (Fig. 5).

Specimens examined

Iran. East Azerbaijan: Mianeh, Ghaflankuh, Iranshahr 46720 (IRAN); Ghazvin: Sarkisian 37938 (IRAN); Kermanshah:

anonymous 47693 (IRAN); Chaharmahal va Bakhtiari: Farsan, Dehe Cheshme toward Gushe village, Mozaffarian 97361 (TARI); Alborz: 98 km west of Karaj, Foroughian and Hariri 7625 (TARI); Taleghan, Varkash, Amin and Bazargan 19714 (TARI).

4. *Euphorbia grisophylla* M. S. Khan. (1964, p. 94)

Based on the same type: *Tithymalus grisophyllus* (M. S. Khan) Soják (1972, p. 140). **Type:** Turkey (C10), Prov. Hakari, Cilo dag, in gorge between Cilo yayla and Diz deresi, 8000 ft, rocky slope, 10 Aug 1954, Davis and Polunin 24250 (holotype: E00359918!, isotypes: BM000951563!, K!).

Perennial herbs, up to 90 cm high, arising from a woody stock; stems several, usually simple, sparingly pubescent-pilose to subglabrous, scaly at base. Cauline leaves ovate-oblong, lanceolate or broadly ovate, 3.0–5.5 × 1.0–2.5 cm, subsessile, truncate, cuneate or sometimes subcordate at base, acute or obtuse at apex, with entire margin. Terminal rays 5, once or twice dichotomous; axillary rays 0–4. Ray leaves ovate, broadly ovate or ovate-rhombic, 2–3 × 1.5–2.5 cm, sessile, truncate at base, acute or sometimes cuspidate at apex, with entire-undulate margin. Raylet leaves ovate-deltoid to suborbicular, truncate or shallowly cordate at base, cuspidate and yellowish at apex, with entire margin. Cyathia: involucre campanulate-turbinate, 2 mm in diameter, with oblong-lanceolate lobes; glands elliptic and rounded, brownish. Capsules trilobate, 5.0–6.5 mm in diameter, covered with conic-cylindrical warts, glabrous. Seeds broadly ellipsoidal, up to 4 mm long, smooth or rarely flecked blackish, gray-brownish; caruncle reniform, 0.5 mm long, yellowish. Flowering and fruiting in May to July.

Habitat

Dry rocky igneous and limestone slopes, screes, at 1800–3000 m a.s.l.

Distribution

Old World: western Iran and eastern Turkey. An Irano-Turanian element, restricted to the Zagros Mts (Fig. 5). This species was previously only known from eastern Turkey, but a new record from west Iran (Maroofi 55797) was recently found and illustrated (Pahlevani et al. 2011b).

Specimens examined

Iran. Kurdistan: Sanandaj to Kamiaran, Avalan Mt, Maroofi 55797 (IRAN).

5. *Euphorbia helioscopia* L. (1753 p. 459)

Based on the same type: *Tithymalus helioscopius* (L.) Hill (1768, p. 3). – *Galarhoeus helioscopius* (L.) Haw. (1812, p. 152). – *Euphorbion helioscopium* (L.) St.-Lag. (1880, p. 126). **Type:** Habitat in Europae cultis, Herb. Linn. no. 630.49 (lectotype: LINN, designated by Jafri and El-Gadi (1982, p. 33).

Annual herbs, up to 40 cm high, glabrous or sparingly pilose. Cauline leaves obovate-spathulate, 1.0–3.5 × 0.5–2.0 cm, sessile, attenuate at base, obtuse or retuse at apex,

with serrulate margin in the upper half. Terminal rays 5, at first trichotomous, then once or twice dichotomous; axillary rays absent. Ray leaves obovate, 1.0–2.5 × 0.5–1.8 cm, sessile, attenuate at base, obtuse at apex, with margin serrulate in upper half. Raylet leaves obliquely obovate, asymmetric or rounded at base, obtuse at apex, with margin serrulate in upper half or more. Cyathia: involucre turbinate, 1.5–2.0 mm in diameter; glands elliptic and rounded, light brown. Capsules trilobate, 2.5–3.5 mm in diameter, with smooth surface, glabrous. Seeds ovoid, 1.6–2.0 mm long, foveolate-reticulate, dark brown; caruncle flattened, transversely ovate, 0.4–0.6 mm long, straw yellow. Flowering and fruiting almost all over the year in the absence of severely cold conditions.

Habitat

Ruderal weed in disturbed and cultivated areas and city gardens, streamsides; from sea level to 2500 m a.s.l.

Distribution

Old World and introduced into the New World: a cosmopolitan weed (Fig. 6).

Specimens examined

Iran. Alborz: Shahriar, Esmaili 17407 (FAR); Karaj, Hesarak, Salavati et al 20923 (FAR); Baluchestan:

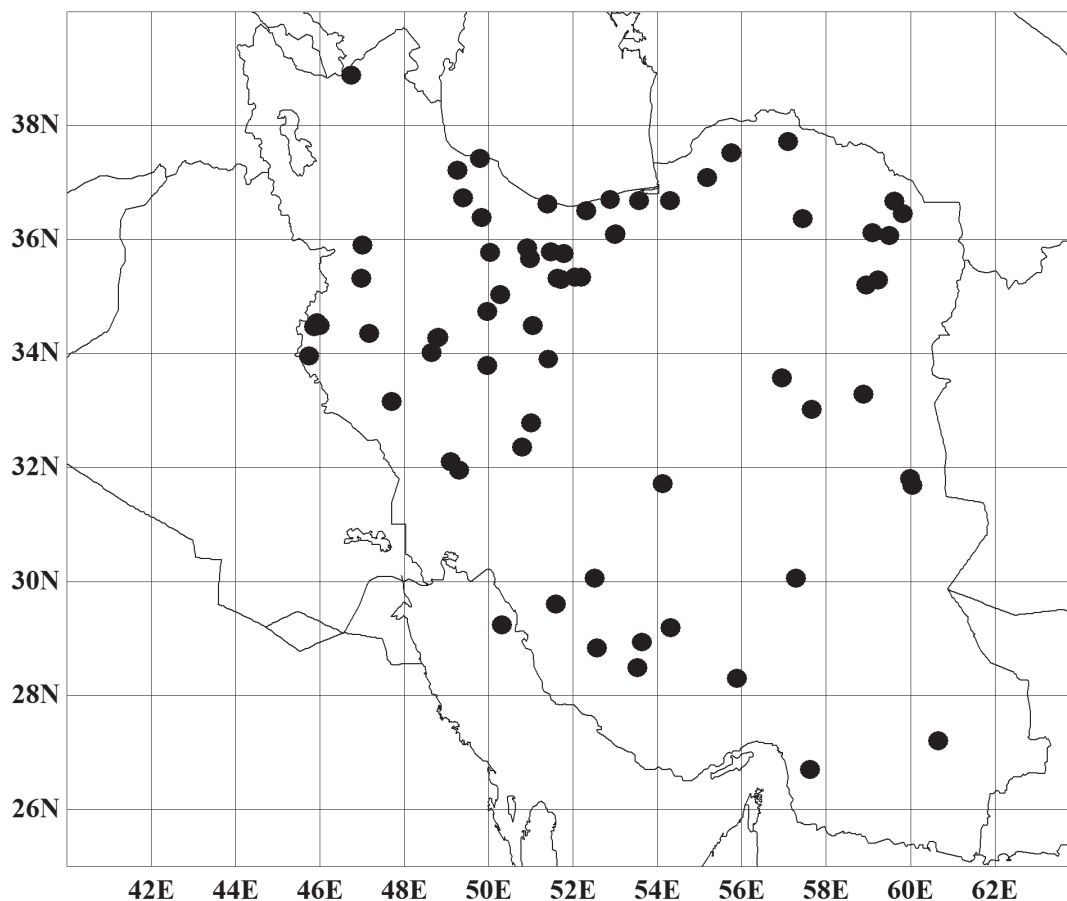


Figure 6. Distribution of *Euphorbia helioscopia* in Iran.

Iranshahr, Manouchehri 17773 (IRAN); Bushehr: Kazeroun, Kaskan, Rasti 4250 (FAR); Persian gulf, Khark Island, Termeh and Moussavi 18080 (IRAN); Chaharmahale-Bakhtiari: Shahrekord, Rokh pass, Khodarahmi 4435 (FAR); east Azerbaijan: Arasbaran protected area, Vaighan to Shabkhaneh, Pahlevani and Asef 54568 (IRAN); Esfahan: Kashan, Saghar-abad village, Tamaddon 34959 (FAR); Varche, Adadsuzan 4423 (FAR); Fars: Fasa, Gholamzadeh 4386 (FAR); Firouz-abad, Kashkouli 17776 (IRAN); Jahrum, Sadeghi 4112 (FAR); Neyriz, Palangan, Shamsi 4488 (FAR); Gilan: Fouman, Asfia 4213 (FAR); near Sefidrud, 100 m to Mangil dam, Ghadimi 4269 (FAR); Zibakenar, Razaee 25913 (FAR); Golestan: Gorgan, 73 km Shahpasand, Termeh 47991 (IRAN); Hamedan: Malayer, Mosaddeghi 4506 (FAR); Hormozgan: Bashagerd, Ghurichi, Iranshahr and Moussavi 44555 (IRAN); Bandar-abbas, Hajiabad, Mozaffarian 52119 (TARI); Kerman: Mahan, Susanzadeh 4330 (FAR). Kermanshah: Rijab, Iranshahr and Dezfoulian 17771 (IRAN); Taghbostan, Alizadeh et al. 17450 (FAR); Pol-e Zahab, 8 km northeast of Pol-e Zahab, Berimvand village, Hatami 2286 (TARI); Khuzestan: Masjed-Soleiman to Lali, Tougah, Iranshahr and Termeh 18079 (IRAN); Kordestan: Sanandaj, Divandarreh, Asef and Torabi 53797 (IRAN); Lorestan: Borujerd, Malayer road, Amini 4142 (FAR); Khorram-abad, Pol-Dokhtar, Ershadi 26274 (FAR); 20 km of Boroujerd, Oshtorinan, Gamshidi 29662 (FAR); Mazandaran: Jouybar, Larim village, Kianmehr 27163 (FAR); Gaduk, Doab, 5 km to Pol-Sefid, Pahlevani 53766 (IRAN); Behshahr, east Behshahr, Rasuli 13516 (FAR); Amol, near forest, Rudgarian 4184 (FAR); Nowshahr, Chalus road, anonymous 4268 (FAR); Sangdeh, Pol-e Sefid, Domanchik 31466 (TARI); northern Khorasan: northwest Bojnourd, 1 km to west of Shirindarreh dam, Memariani and Zangooei 41918 (FUMH); Qazvin, Boien-Zahra, Mirhosseini 29383 (FAR); Alam-out region, Vaghfi 4245 (FAR); Qom: Saveh, Garzan, Toghrud plain, Mohammadi 32425 (FAR); Razavi Khorasan: Torbat-e Heydarieh, Doroudgar 42019 (FAR); Ferdows road, 20 km to Mashhad, Jahanbakhsh 17422 (FAR); 10 km Shadmehr to Kashmar, Ghuch-palang Mt, Faghihnia and Zangooei 26668 (FUMH); northeast of Mashhad, between Pasakuh and Tabadkan, Faghihnia and Zangooei 24977 (FUMH); north of Neyshabur, Somea, Faghihnia and Zangooei 20912 (FUMH); Mashhad, around Kardeh dam, Jahanbakhsh 4408 (FAR); Semnan: Garmsar, Eyvanekey, Shahbodaghi 4494 (FAR); Delbar, Turan, anonymous 4498 (FAR); southern Khorasan: Tabas, northwest of Nayband, Faghihnia and Salehi 31999 (FUMH); Nehbandan, Shusf, Faghihnia and Zangooei 21512 (FUMH); Birjand, Amin-abad, Faghihnia and Zangooei 30362 (FUMH); Between Dayhuk-e Tabas and Ravar-e Kerman, northeast of Nayband, Joharchi and Zangooei 11934 (FUMH); 2 km Ghaen, around Ghanat-e Shahek, Zokaie 375 (FUMH); Tabas, Cheshme Deh-Cheruk, Zokaie 734 (FUMH); Tehran: Gageroud, Ashrafzade 4427 (FAR); Varamin, Manouchehri 17770 (IRAN); Darabad, Nemati 17961 (FAR); Yazd: 40 km to west Yazd, Farashah, Javadi 28647 (FAR); Markazi, Tafresh, Valadabad, Amin and Bazargan 18683 (TARI).

6. *Euphorbia macrocarpa* Boiss. & Buhse (1860, p. 197) (Fig. 7)

Based on the same type: *Tithymalus macrocarpus* (Boiss. & Buhse) Prokh. in V. L. Komarov (1949, p. 350), nom. illeg., non (Benth.) Croizat 1937. – *Tithymalus notabilis* Soják (1972, p. 174).

Type: Persia, Ssamam, 1847 [1 Jun 1848], Buhse s.n. (holotype: G-BOISS!, isotypes: LE!, BR0000005106370!).

Perennial herbs, up to 70 cm high, arising from a woody stock; stems several, simple, sparingly pilose to subglabrous, scaly at base. Cauline leaves lanceolate to oblong, 4.0–7.5 × 1.0–1.8 cm, sessile, rounded to subcordate at base, acute or obtuse at apex, with margin entire or sometimes shallowly denticulate in the distal half of upper leaves. Terminal rays 5–7, dichotomous; axillary rays numerous. Ray leaves ovate to oblong, 2.0–2.5 × 1.0–1.5 cm, sessile, rounded at base, obtuse at apex, with entire margin. Raylet leaves ovate-rhombic to suborbicular, rounded or cuneate at base, obtuse at apex, with entire margin. Cyathia: involucre turbinate, 2–3 mm in diameter, with oblong-lanceolate lobes; glands elliptic and rounded, brownish. Capsules trilobate, 8–10 mm in diameter, their surface densely covered with warts, glabrous. Seeds subglobose, 4 mm long, smooth, gray–brown; caruncle minute. Flowering and fruiting time in May to June.

Habitat

Rocky limestone and serpentine slopes, open ground in oak forests, old volcanic craters, at 1800–3000 m a.s.l.

Distribution

Old World: northern, northwestern and western Iran, eastern Turkey, northern Iraq and Azerbaijan. An Irano–Turanian element, restricted to the Zagros and Alborz Mts (Fig. 8).

Specimens examined

Iran. Kermanshah: Paveh, above the village Shemshir, base of Shahu Mt, Assadi 60749 (TARI); Between Kermanshah and Paveh, before Shemshir, Mansour-Aghai village, kuh-e Shahu, Assadi and Mehregan 89152 (TARI); road of Songhor to Bisotun, Kamijeh, Hamzehee and Asri 87826 (TARI); Kurdistan: 36 km from Sanandaj to Kamiaran, Nashur valley, Assadi 60617 (TARI); ca 15 km from Baneh to Saghez, Vazaneh Mt, Maroofi and Karegar 55861 (IRAN); ca 35 km from Saghez to Baneh, Piromaran village, Nacarouz Mt, Maroofi and Naseri 6141; northwest of Sanandaj, Saral Mt, near Hanegelan village, Maroofi and Rastegar 8570; ca 50 km northwest Sanandaj, Saral, Mozaffarian 71575 (TARI); south of Baneh, 15 km from Baneh to Sanandaj, Fattahi and Bolooki 1409 (TARI); 34 km from Chenareh to Baneh, Assadi 85085 (TARI); on the road of Nosud to Marivan, 6 km to Daraki-Lakhani, Salmaki and Zarre 39561 (TUH); Lorestan: between Khorram-abad and Sepid-dasht, Baghbanan, 60 km to Khorram-abad, Iranshahr 55345 (IRAN); On the road from Nurabad to Nahavand, Islamabad, kuh-e Garin, Assadi and Mehregan 88995 (TARI); Borujerd, Vanai area, kuh-Garin, Assadi and Mehregan 89082 (TARI); west Azerbaijan: south of Urumieh, Gharehaghaj, Balanaj, Kokia village, Ghasemloo valley, Pahlevani and Fritsch 56267 (IRAN).

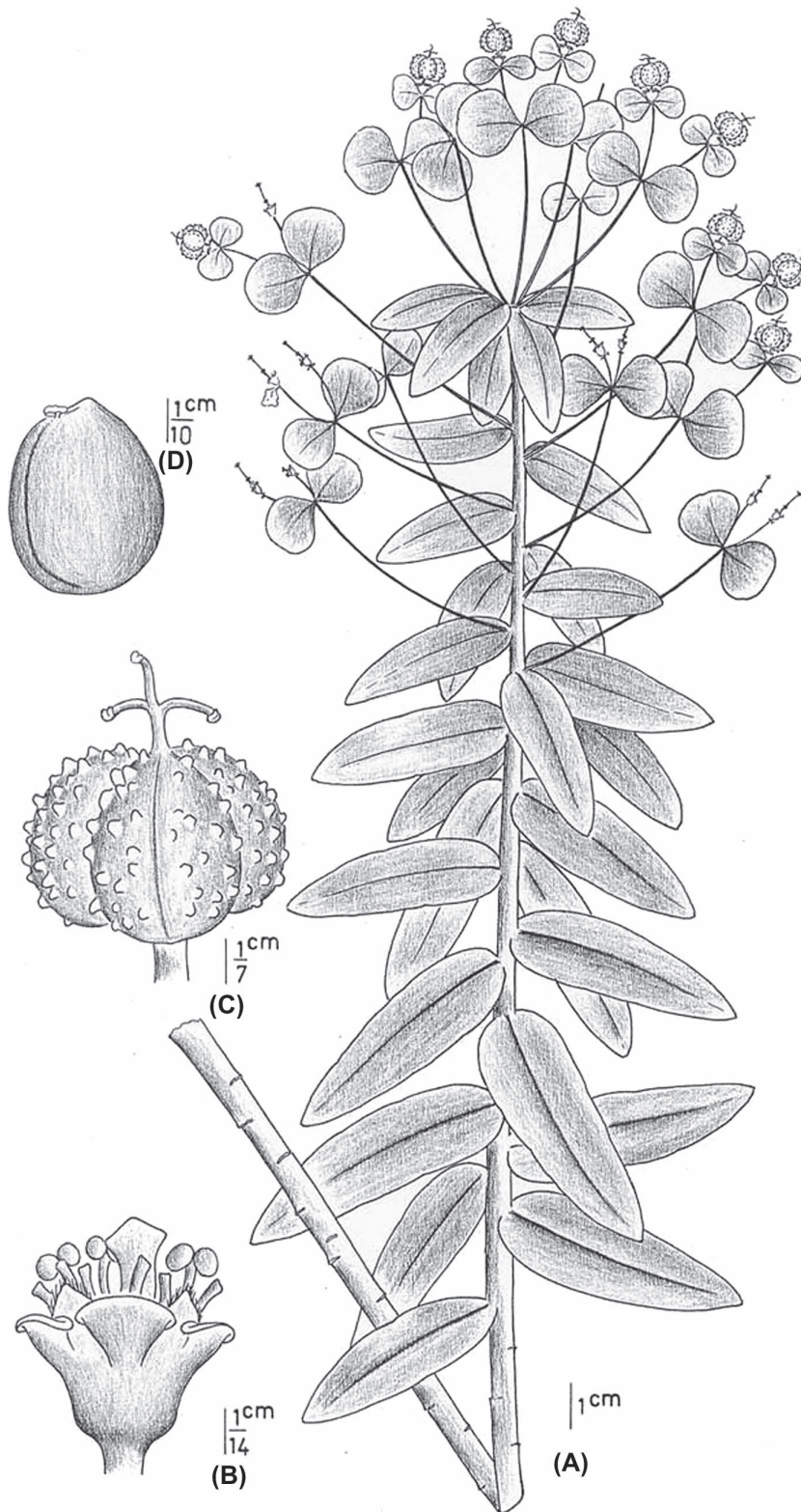


Figure 7. *Euphorbia macrocarpa*. (A) habit, (B) cyathium, (C) fruit, (D) seed. Drawn from voucher specimen from Lorestan: between Khorram-abad and Sepid-dasht, Baghbanan, 60 km to Khorram-abad, IRAN 55345.

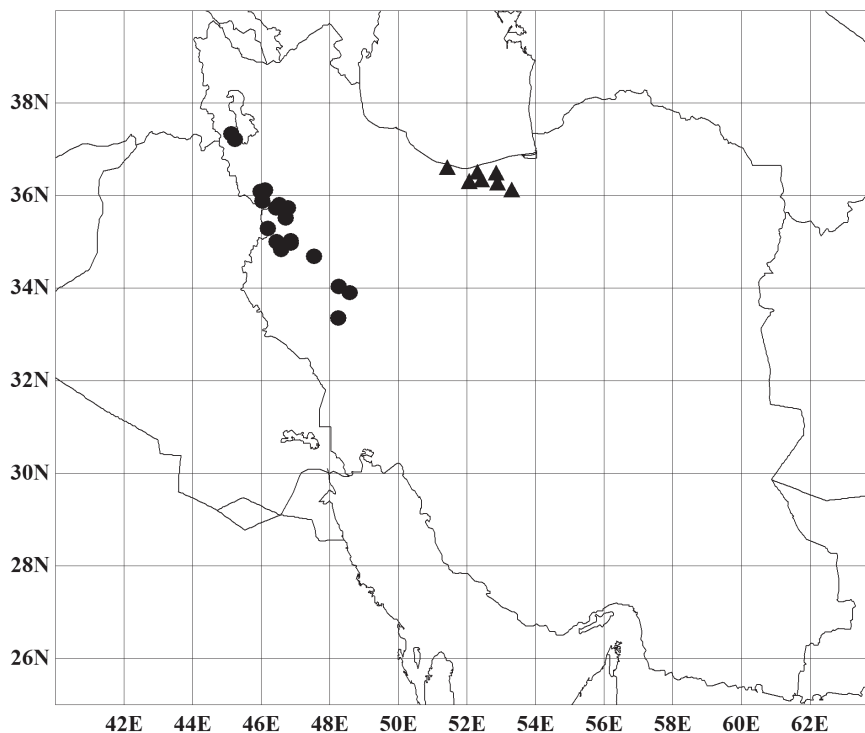


Figure 8. Distribution of *Euphorbia macrocarpa* (circle) and *E. mazandarunica* (triangle) in Iran.

7. *Euphorbia mazandarunica* Pahlevani sp. nov. (Fig. 9–10)

Ab E. microsphaerae Boiss. *habito perenni (non annuo), foliis caulinis petiolatis (non sessilibus), subaxillaribus pilosis (non glabris), margine integris (non denticulatis); umbellae radiis bifidis (non trifidis); involuclorum phyllis integris (non denticulatis), capsula trisulcata (non globosa) differt.*

Type: Iran. Mazandaran, 5 km to Chalus, in the forest, 110 m a.s.l., 36°37'N, 51°25'E, 17 May 2007, Pahlevani and Eskandari 55150 (holotype: IRAN, isotype: IRAN).

Etymology

Euphorbia mazandarunica is named after the Mazandaran province where the species occurs.

Description

Perennial herbs, up to 45 cm high, arising from a woody rootstock; stems single or several, usually 4, simple, usually reddish, sparingly pilose to subglabrous. Cauline leaves elliptic-lanceolate, ovate-oblong, 3.5–10.0 × 1.5–4.0 cm, with 3–5 mm long, sometimes subwinged petiole, attenuate at base, subacute, acute or obtuse at apex, with entire margin, glabrous on the adaxial side, pilose on the abaxial side, especially on the midrib. Terminal rays (4) 5, unequal in length (6–18 cm), dichotomous; axillary rays 0–5. Ray leaves like cauline leaves in all aspects but usually larger. Raylet leaves deltoid-ovate or rhombic-ovate, the most distal ones suborbicular, truncate to rounded at base, rounded, obtuse or sometimes emarginate at apex, with entire margin. Cyathia: involucre turbinate or campanulate, 2 mm in diameter; glands elliptic and rounded, brownish or yellow-

ish. Capsules trilobate, 3–4 mm in diameter, their surface smooth or rarely granulate or with a few short warts, glabrous to subglabrous. Seeds ellipsoidal, 2.0–2.5 mm long, smooth, brownish; caruncle minute (0.25–0.50 mm long), light yellow. Flowering and fruiting in April to May (at least one month earlier than *E. squamosa*).

Habitat

Forest vegetation from sea level to 1450 m a.s.l., including *Fagus orientalis*, *Quercus castaneifolia*, *Acer velutinum* forest (1200 m a.s.l.), and *Quercus petraea*, *Populus caspica*, *Carpinus betulus*, *Pterocarya fraxinifolia* forest (0–150 m a.s.l.).

Distribution

Old World: the species is endemic to the northern forests of Iran (Fig. 8). An Hyrcano–Euxine element.

Similar species

Besides its resemblance to *E. microsphaera*, *E. mazandarunica* is also in close morphological affinity with another perennial spurge, *E. squamosa*. The most important diagnostic characters differentiating these three species are given in Table 1. *Euphorbia squamosa* is distributed from forest areas of the Gilan province to the northwest (Arasbaran protected area) in the east Azarbaijan province and extends to the Caucasus region (Russia, Georgia, Armenia, Azerbaijan, northeast Turkey, northwest Iran), whereas *E. mazandarunica* is restricted to forest areas of the Mazandaran province.

Conservation status

The apparent limited distribution and small populations of *E. mazandarunica* suggest that this species could be

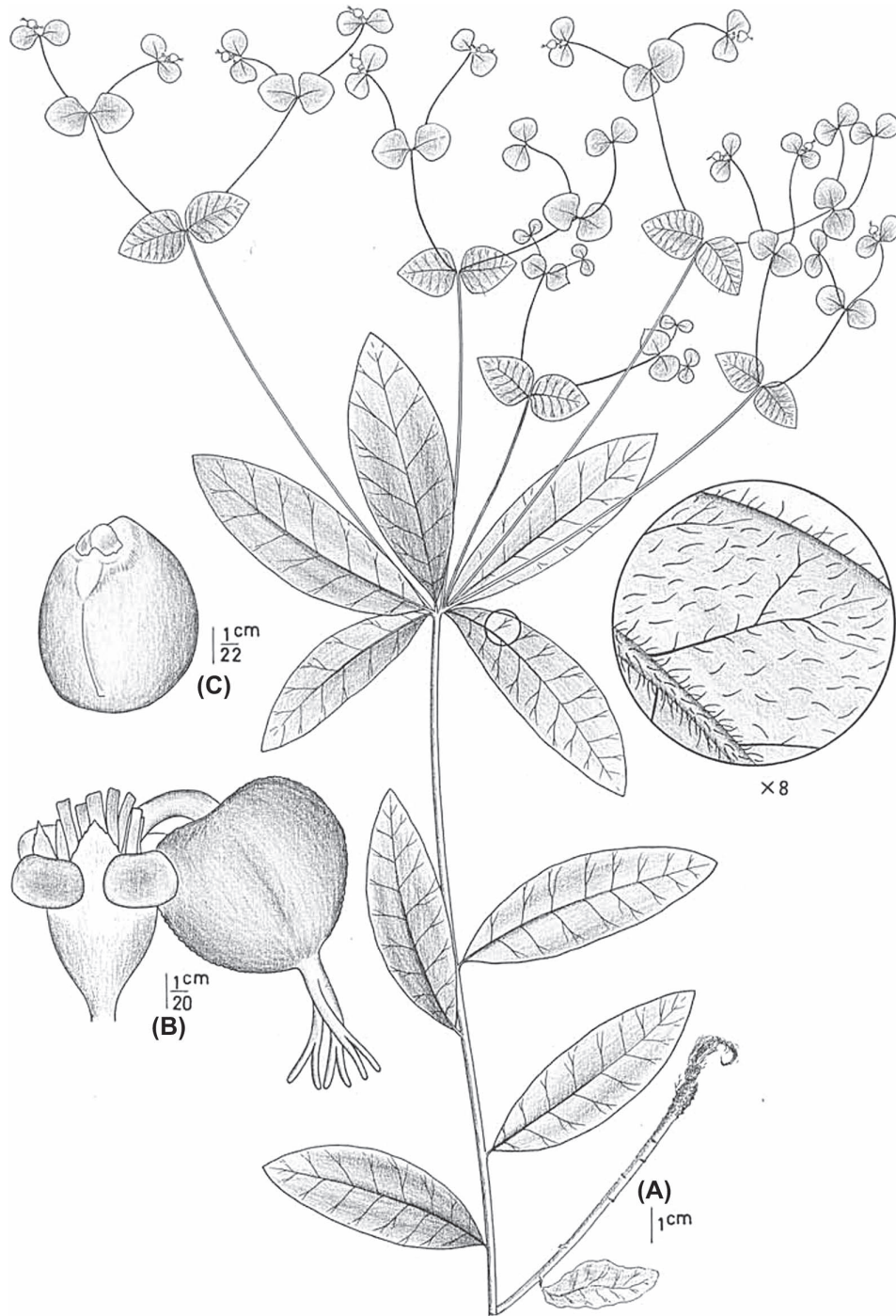


Figure 9. *Euphorbia mazandarunica*. (A) habit, (B) cyathium and fruit, (C) seed. Drawn from voucher specimen from Mazandaran, 5 km to Chalus, IRAN 55150.

threatened; however detailed field studies are needed to determine its conservation status.

Additional specimens examined (paratypes)

Iran. Mazandaran: Amol, Ahmad Chalepey, Baliran village, Amini Rad and Asef 56631 (IRAN); ca 15 km north of Sangdeh on the road to Farim, Assadi 73329 (TARI); Amol, Amol forests, Hashemi moghadam 26135 (FAR); Nur, Chamestan, Vaz, Mozaffarian 72869 (TARI); Ghaemshahr, Niknafs 4153 (FAR); 45 km from tonekabon

to Jannat-Rudbar (36 km from the deviation road to Jannat-Rudbar at Tonekabon-Ramsar main road), Salmaki 39758 (M, TUH); Shirgah, 35 km to Ghaemshahr, Soleimani 4113 (FAR); Chalus forest, Termeh and Moussavi 17989 (IRAN).

8. *Euphorbia microsphaera* Boiss. (1846, p. 87) (Fig. 11)

Based on the same type: *Tithymalus microsphaerus* (Boiss.) Klotzsch and Garcke (1860, p. 74). **Type:** Hab. in humidis

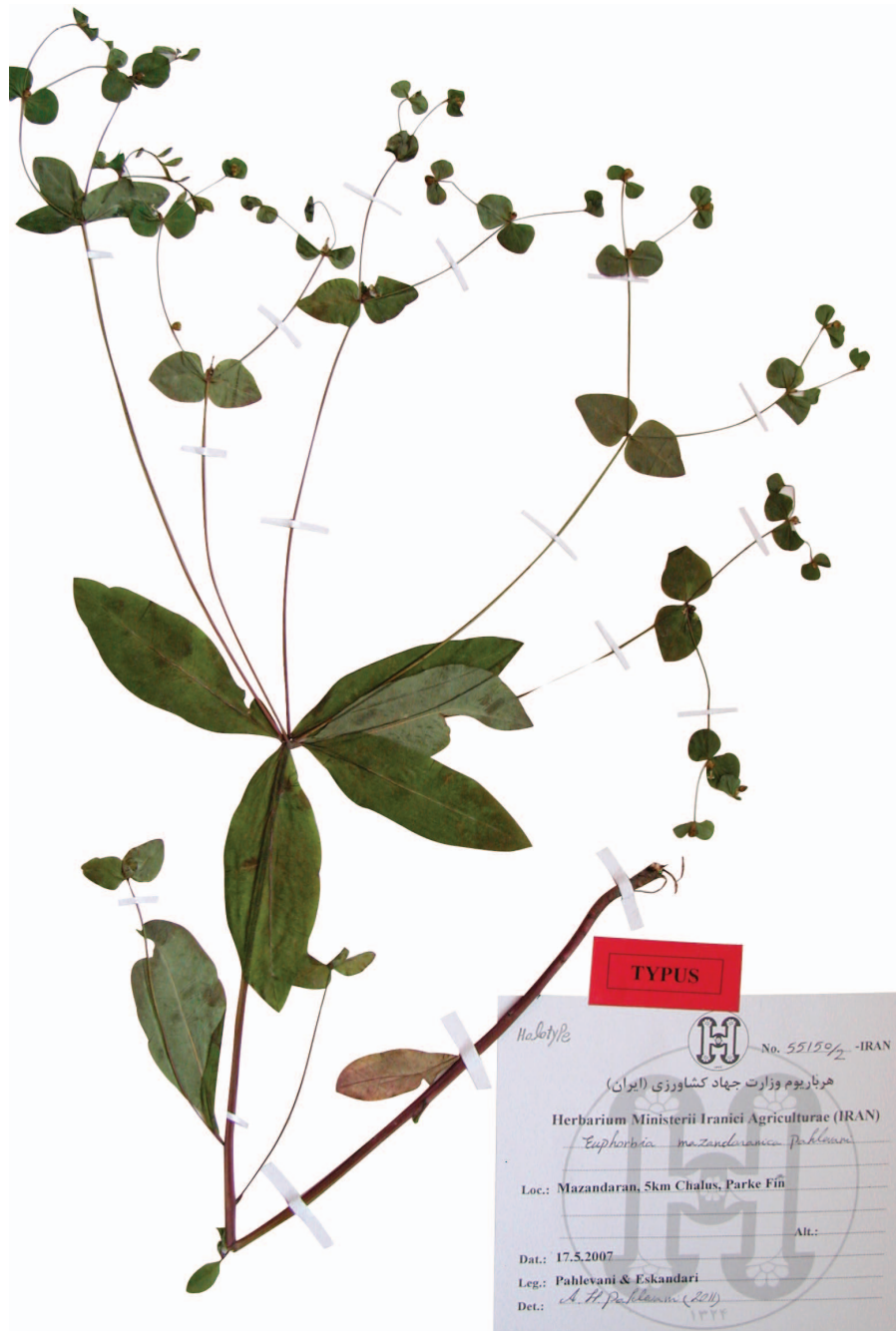


Figure 10. Holotype (IRAN) of *Euphorbia mazandarunica*.

Table 1. Morphological comparison between *Euphorbia mazandarunica* sp. nov., *E. squamosa* and *E. microsphaera*.

Species	<i>E. mazandarunica</i>	<i>E. squamosa</i>	<i>E. microsphaera</i>
Life form	Perennial	Perennial	Annual
Bark	Reddish	Yellowish-green	Yellowish-brown
Margin of cauline leaves	Glabrous, entire-slightly undulate	With prominent white hairs, entire-slightly undulate	Glabrous, serrulate at least in upper half
Terminal rays/Ray-Leaves	4-5	(5)6-9	(4)5-6
Ray-leaves, size	Usually larger or the same size as cauline leaves	Usually smaller than cauline leaves	More or less same size as cauline leaves
Capsule, diameter (mm)	3-4	4.5-5.0	2.5-3.0
Capsule, surface	Smooth or rarely with a few short warts, glabrous-subglabrous	Covered with long cylindrical-filiform warts, glabrous	Smooth, glabrous or sparingly pilose

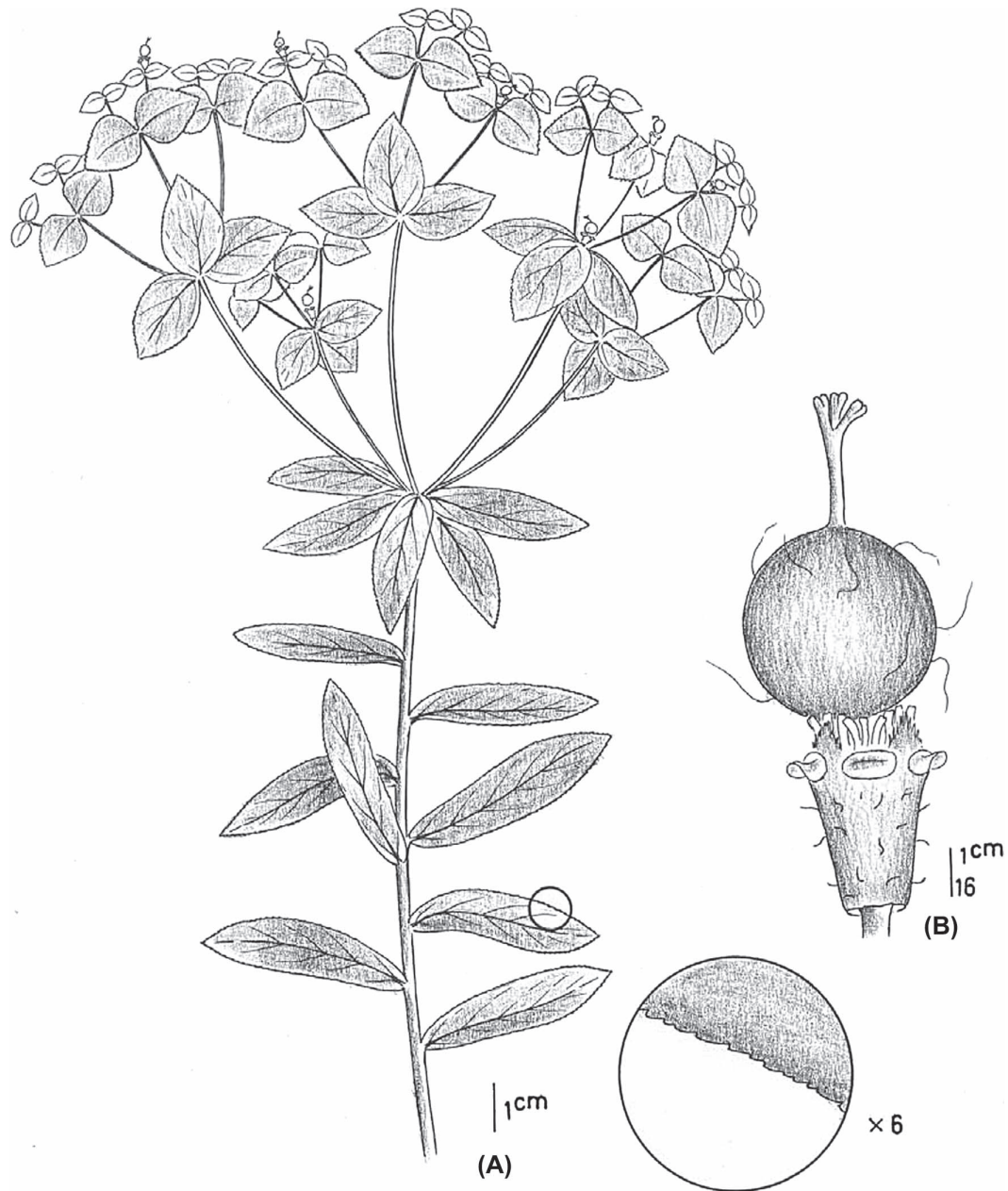


Figure 11. *Euphorbia microsphaera*. (A) habit with detail of leaf margin, (B) cyathium and fruit.

ad radices montis Sabsi-Buschom prope Schiraz, 31 May 1842, Kotschy 448 (holotype: G-BOISS!, isotypes: A00047988!, A00277273!, BM000951541!, CAS00123963!, E00362388!, G-DC!, GOET003734!, JE00002899!, JE00002900!, MPU014907!, MPU014469!, MO-260133!, MO-260134!, MO-260135!, S-G-2584!, US00095369!, WAG0004311!).

Taxonomic synonyms: *Euphorbia mohammerensis* Boiss. in A. P. de Candolle (1862, p. 118), pro syn. – *Euphorbia subtuberculata* C. A. Mey. ex Boiss. in A. P. de Candolle (1862, p. 118). – *Euphorbia unilateralis* Blakelock (1950, publ. 1951, p. 453). – *Tithymalus unilateralis* (Blakelock) Holub (1977 p. 428).

Annual herbs to 70 cm high, glabrous. Cauline leaves oblong-lanceolate to elliptic-lanceolate, 2.5–6.0 × 0.5–1.5 cm, sessile, tapering to a slightly auriculate base, acute, subacute or obtuse at apex, with margin minutely serrulate in upper half. Terminal rays (4) 5 (6), at first 3- or 4-chotomous, then dichotomous; axillary rays absent. Ray leaves like cauline leaves. Raylet leaves ovate-deltoid to ovate-rhombic or elliptic-oblong, rounded, cuneate or rarely slightly cordate at base, acute, subacute or mucronulate at apex, with serrulate margin. Cyathia: involucre turbinate, 1.5–2.0 mm in diameter; glands elliptic and rounded, light brown. Capsules globose to subglobose, not sulcate, 2.5–3.0 mm in diameter, smooth, glabrous or sparingly pilose. Seeds flattened-ellipsoidal,

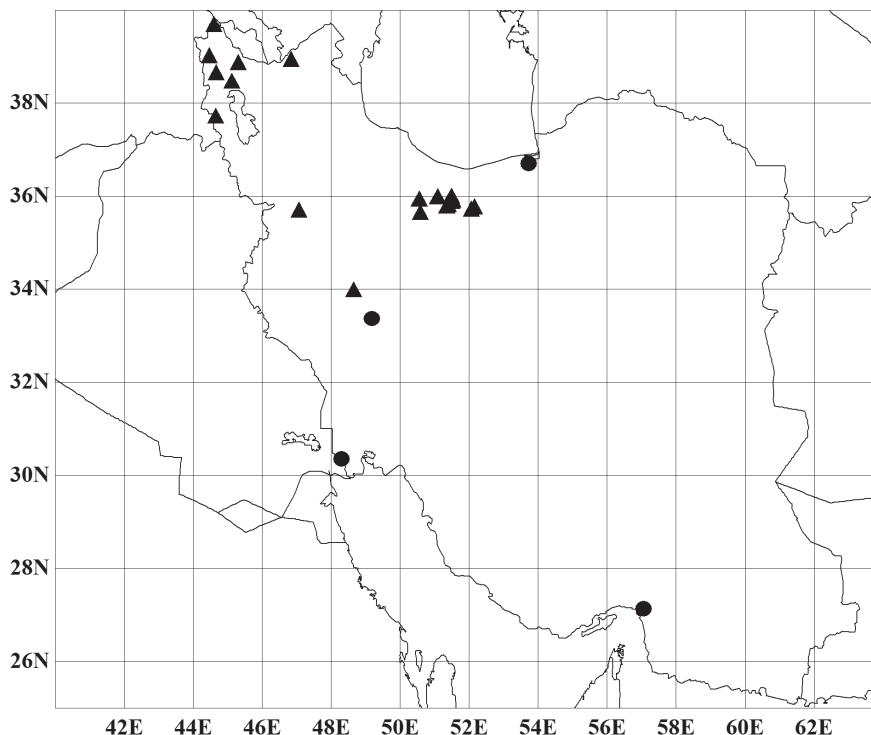


Figure 12. Distribution of *Euphorbia microsphaera* (circle) and *E. orientalis* (triangle) in Iran.

2 mm long (excluding the caruncle), smooth, dark grayish-brown and shiny; caruncle reniform, 0.3–0.4 mm long, yellowish. Flowering and fruiting in April to July.

Habitat

Foothills, marshlands, roadsides, orchards and fields, from sea level to 1900 m a.s.l.

Distribution

Old World: southwest Asia (northern, northwestern, western and southern Iran, Azerbaijan (Talysh), Iraq, Turkey, Palestine, Lebanon, Jordan, Syria) and central Asia (Tajikistan and Uzbekistan). An Irano-Turanian element; in Iran the species is restricted to the Alborz and Zagros Mts (Fig. 12).

Specimens examined

Iran. Mazandaran: Tirtash, Sharif 17841 (IRAN); Hormozgan: Minab, Safavi and Dezfoulian 17840 (IRAN); Golestan: entre Gorgan [Gorgan] et Naudeh [Nodeh], Schmid 5913 (K).

9. *Euphorbia orientalis* L. (1753, p. 460) (Fig. 13)

Based on the same type: *Tithymalus orientalis* (L.) Hill (1768, p. 172/3). – *Galarhoeus orientalis* (L.) Haw. (1812, p. 148). **Type:** Habitat in oriente, Herb. Linn. no. 630.60 (lectotype: LINN, designated by Croizat (1938, p. 98)).

Taxonomic synonyms: *Euphorbia notadenia* Boiss. & Hohen., in P. E. Boissier (1853, p. 111). – *Tithymalus notadenius* (Boiss. & Hohen.) Klotzsch and Garcke (1859, p. 78). – *Euphorbia artvinensis* Bornm. & Woronow (1913, p. 3).

Perennial herbs, ca 1 m high, usually without axillary leafy shoots, glabrous. Cauline leaves linear-lanceolate to

elliptic-lanceolate, 3.5–9.0 × 0.8–1.5 cm, sessile, tapering at base, acute to subacute at apex, with entire margin. Terminal rays 5–8, tri or tetrachotomous; axillary rays (0) 3–16. Ray-leaves broadly ovate, elliptic-ovate to elliptic-lanceolate, 2–4 × 0.8–2.0 cm, sessile, truncate to tapering at base, acute or usually cuspidate at apex, with entire margin. Raylet leaves suborbicular, ovate-rhombic to elliptic-ovate, rounded to truncate at base, cuspidate at apex, with entire margin. Cyathia: involucre turbinate, 2–3 mm in diameter; glands elliptic and rounded, brownish. Capsules trilobate, 4.5–5.5 mm in diameter, their surface with two rows of tubercles on each lobe, pilose to subglabrous. Seeds ellipsoidal, 2.5–3.0 mm long, smooth, pinkish-brown; caruncle minute, 0.5 mm long, white-yellowish. Flowering and fruiting in late June to August.

Habitat

Rocky slopes, screes, valleys, dry river-banks, scrubs, metamorphic rocks and steppe forests, at 700–2400 m a.s.l.

Distribution

Old World: northern, northwestern and western Iran, Azerbaijan (Nakhichevan), Armenia, northern Iraq and eastern Turkey. An Irano-Turanian element, restricted to the Zagros and Alborz Mts (Fig. 12).

Specimens examined

Iran. East Azerbaijan: Marakan protected area, ca 10 km northwest of Marakan, Agh-Dagh Mt, Akhani 7688 Hb. Akhani; Arasbaran Protected area, Vaighan to Veinagh, Assadi and Masoumi 20474 (TARI); Ahar, Gojebel Mt, Termeh 47951 (IRAN); west Azerbaijan: ca 18 km northwest of Khoy, on the road to Shurik, Assadi and Olfat 67700 (TARI);

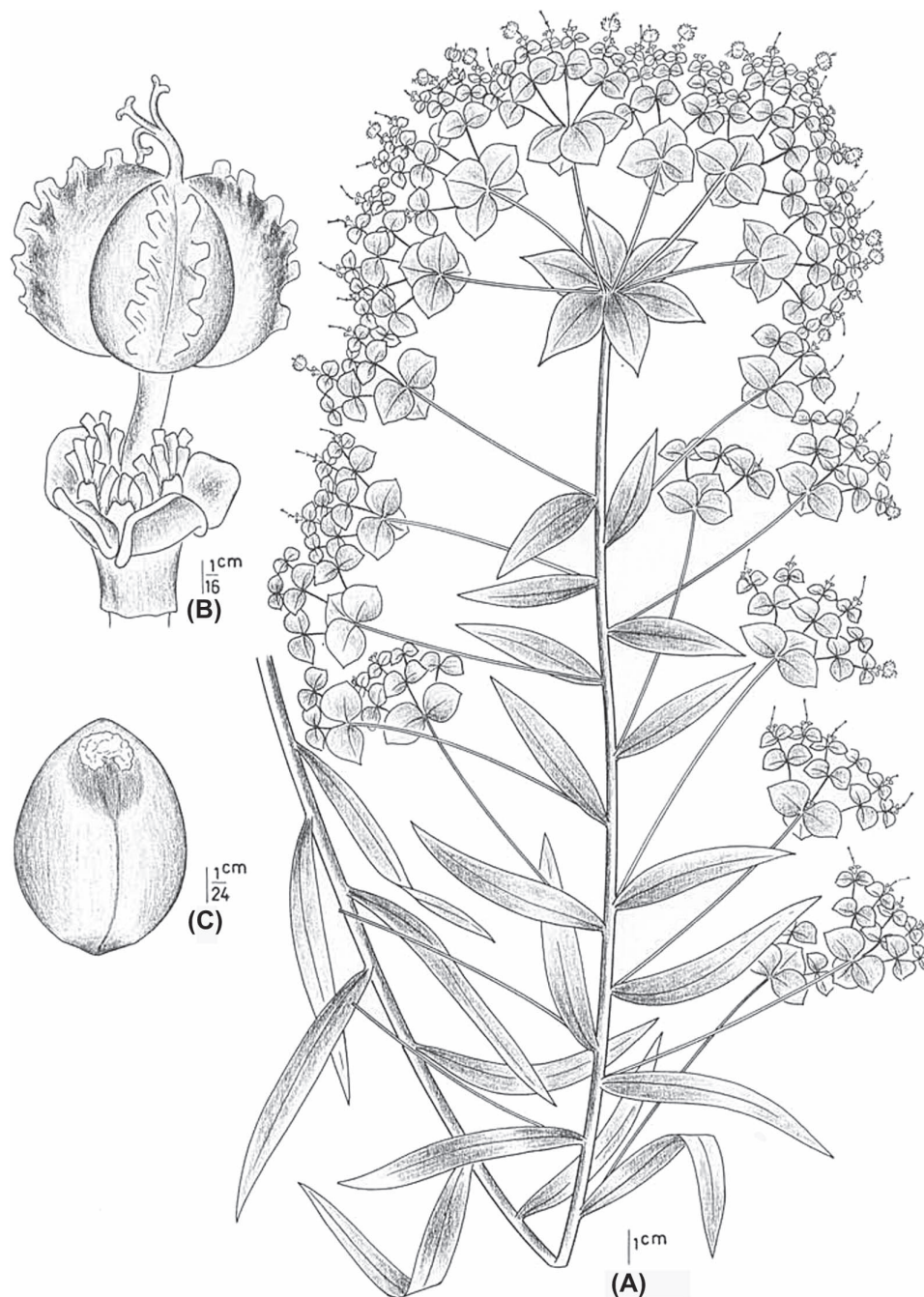


Figure 13. *Euphorbia orientalis*. (A) habit, (B) cyathium and fruit, (C) seed. Drawn from voucher specimen from west Azerbaijan: Makou, Buralan, IRAN 47794/1.

north of Orumieh Lake, Assadi, Taheri and Izadpanah 68485 (TARI); Makou, Buralan, Pahlevani and Amini Rad 47794 (IRAN); Lorestan: Azna, Oshtorankouh, Iranshahr 17850 (IRAN); Tehran: Tehran, Pas-Ghaleh to Touchal Mt, Alava and Termeh 44575 (IRAN); 44 km from Tehran on Shemshak road, Amin 7466 (TARI); north of Tehran, Amin and Bazargan 7562 (TARI); Tehran, Lashgarak to Fasham, 6 km Fasham, Moussavi 17851 (IRAN); Tehran, Darakeh, Ozgol-Chal, Moussavi and Tehrani 44576 (IRAN); Damavand, rocky mountains, north of Veliran village, Mozaffarian 32367 (TARI); Damavand, Dasht-e Mazar, Tizab, Mozaffarian 39891 (TARI); Evine, Darakeh, Haftgel,

Termeh and Zargani 47906 (IRAN); Below Ushan, Wendelbo 18650 (TARI); Damavand, just north of the city, Vavin Mt, Garrubar valley, Mozaffarian 54102 (TARI); Alborz: by Neza, 40 km north of Karadj on the riverbank, Anderson and Petersen 166 (K); Karaj, Kouh-e Dashte, Gauba 17852 (IRAN); Savogbolagh, Rasoulinia 32378 (FAR).

10. *Euphorbia rhabdotosperma* Radcl.-Sm. (1975, p. 129)

Basionym: *Tithymalus rhabdotospermus* (Radcl.-Sm.) Holub (1977, p. 428). **Type:** Turkey, Elmali-Korkuteli, 8 km

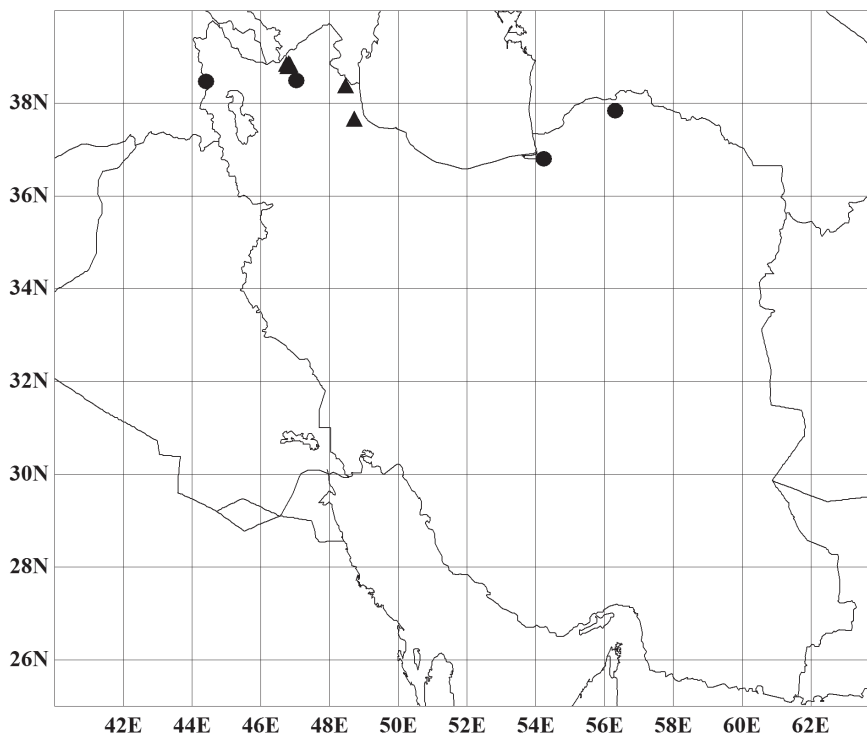


Figure 14. Distribution of *Euphorbia rhabdotosperma* (circle) and *E. squamosa* (triangle) in Iran.

from Elmali, in dry steppe, 1120 m a.s.l., 31 Mar 1962, T. R. Dudley 35223 (holotype: E00359917!, isotype: K!).

Very similar to *E. helioscopia*, but differing in having striate-rugulose seeds, not foveolate-reticulate. Flowering and fruiting time: May to June.

Habitat

Steppes, edge of fields and orchards, at 500–1600 m a.s.l.

Distribution

Old World: Caucasus, east Turkey and northern Iran. An Irano–Turanian element (Fig. 14).

Specimens examined

Iran. East Azarbaijan: Ahar, Purghorban 4165 (FAR); Golestan: Gorgan, Kordkuy, Asal-Donbaleh, Jahan-nema region, Moussavi and Tehrani 47260 (IRAN); northern Khorasan: northwest Bojnurd, 4 km to Ghazanghaye, Memariani and Zangoeei 39490 (FUMH); west Azarbaijan: Khoy, Ghotur, Hedayati 26308 (FAR).

11. *Euphorbia squamosa* Willd. (1799, p. 918) (Fig. 15)

Based on the same type: *Tithymalus squamosus* (Willd.) Klotzsch and Garcke (1860, p. 78). – *Kerasselma squamosa* (Willd.) Raf. (1838, p. 116). **Type:** Turkey, in Cappadocia, Tournefort s.n. (holotype: B-W09358-010!, isotypes: E00362385, photo!), P?).

Taxonomic synonyms: *Euphorbia aspera* M. Bieb. (1808, p. 377). – *Euphorbia muricata* M. Bieb. (1808, p. 378). – *Euphorbia muricata* var. *willhelmsiana* K. Koch (1849,

p. 725). – *Tithymalus asper* (M. Bieb.) Klotzsch and Garcke (1860, p. 78). – *Euphorbia talyschensis* Boiss. & Buhse (1860, p. 196). – *Euphorbia aspera* var. *oligadenia* Boiss. in A. P. De Candolle (1862, p. 124). – *Euphorbia aspera* var. *serrata* Boiss. in A. P. De Candolle (1862, p. 124). – *Euphorbia abchazica* Woronow (1912, p. 3). – *Euphorbia squamosa* var. *serrata* (Boiss.) Oudejans (1992, publ. 1993, p. 188). – *Euphorbia squamosa* var. *talyschensis* (Boiss. & Buhse) Oudejans (1992, publ. 1993, p. 188). – *Euphorbia squamosa* var. *willhelmsiana* (K. Koch) Oudejans (1992, publ. 1993, p. 188).

Perennial herbs, up to 70 cm high, arising from a woody stock; stems few, erect, simple, sparingly pilose. Cauline leaves broadly ovate to elliptic-ovate, 3–11 × 2–4 cm, with 2–9 mm long petiole, attenuate to cuneate at base, obtuse to acute or sometimes mucronulate at apex, with entire margin, glabrous to subglabrous on the adaxial side, white pilose on the abaxial side, especially on midrib and margin. Terminal rays 5–9, once or twice dichotomous; axillary rays (0–1) 2–12. Ray leaves elliptic-ovate to elliptic-lanceolate, 3.0–7.5 × 1.5–3.0 cm, petiolate, attenuate to cuneate at base, acute to subacute at apex, with margin entire to subundulate with whitish hairs. Raylet leaves broadly ovate-deltoid to ovate-rhombic, 1.0–2.5 × 0.8–2.0 cm, truncate to shallowly cordate at base, acute or cuspidate at apex, with entire to subentire margin. Cyathia: involucre turbinate, 1.5–2.0 mm in diameter; glands elliptic and rounded, brownish. Capsules trilobate, 4.5–5.0 mm in diameter, their surface covered with cylindrical-filiform warts, glabrous. Seeds ellipsoidal, 2.5–2.8 mm long, smooth, brown to gray; caruncle minute, less than 0.5 mm long, persistent, yellow to white with brown centre. Flowering and fruiting in June to July.

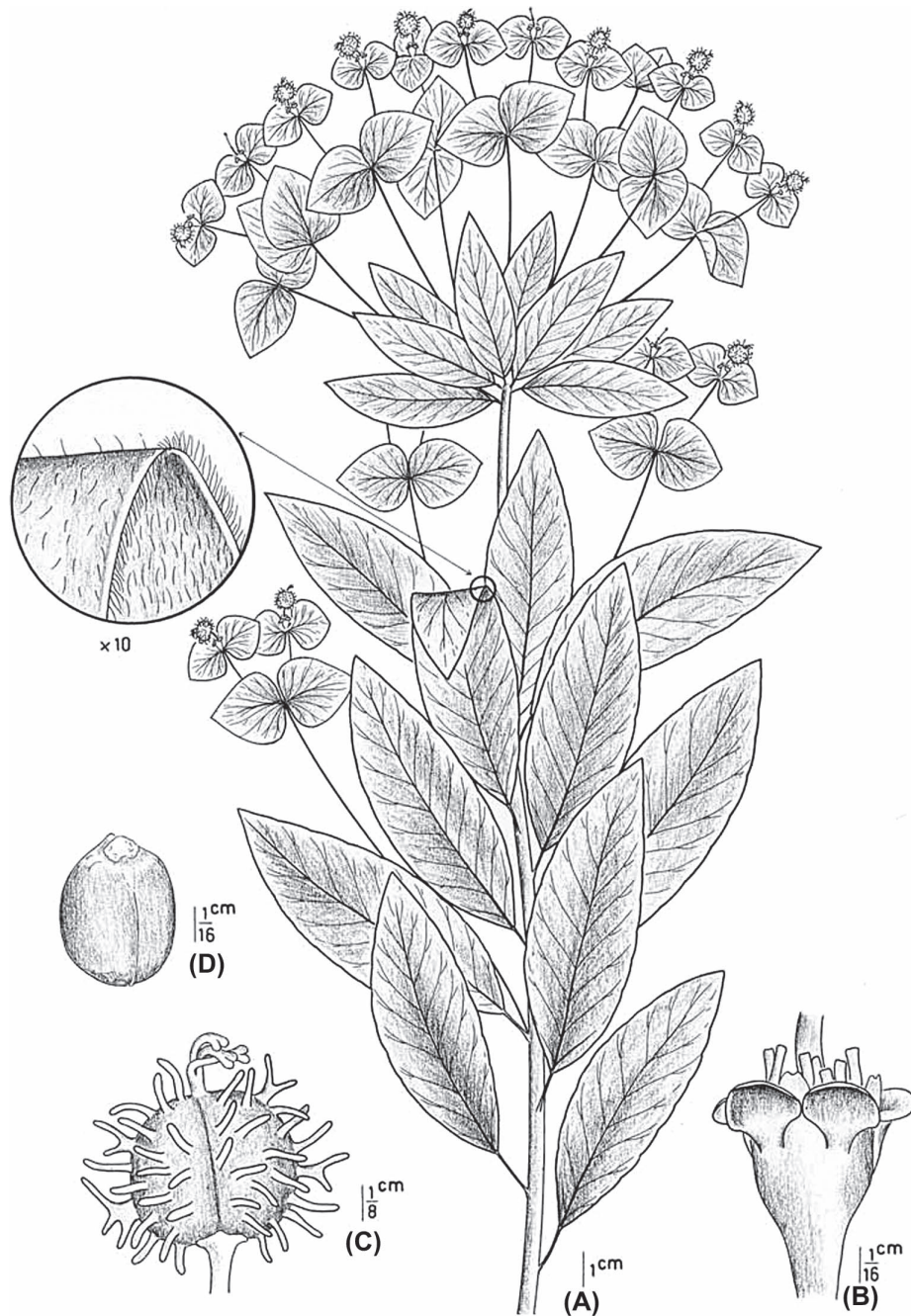


Figure 15. *Euphorbia squamosa*. (A) habit, (B) cyathium, (C) fruit, (D) seed. Drawn from voucher specimen from east Azerbaijan: Arasbaran protected area, Oskolou to Ilankesh, IRAN 54570.

Habitat

In forests (including: *Acer campestre*, *Viburnum lantana*, *Fagus orientalis*, *Quercus* sp.) and sometimes occurring in grassy and calcareous rocky slopes, at 50–2000 m a.s.l.

Distribution

Northern and northwestern Iran, northern Turkey and Caucasus. A Hyrcano–Euxine element (Fig. 14).

Specimens examined

Iran. Ardebil: Ardebil–Astara, Bowles Scholarchip Bot. Expd. 2336 (K); east Azerbaijan: Arasbaran protected area,

Doghroun and Kalan Mt, Assadi and Sardabi 24139 (TARI); Arasbaran protected area, Vaighan to Kharil, Assadi and Vosughi 24861 (TARI); Arasbaran protected area, Toopkhaneh road, Hamzehee and Asri 81458 (TARI); Arasbaran protected area, Inalou to Ilankesh, Pahlevani and Asef 47759 (IRAN); Arasbaran protected area, Ilankesh to Oskolou, Pahlevani and Asef 47359, 47795 (IRAN); Gilan: Khalkhal to Asalem, 17 km to Asalem, Pahlevani and Asef 54565 (IRAN); Asalem to Khalkhal, 12 km Assalem, Termeh and Moussavi 17651 (IRAN).

There is only one collection record (Buhse s.n.) of *E. squamosa* cited in 'Flora Iranica' (Rechinger and

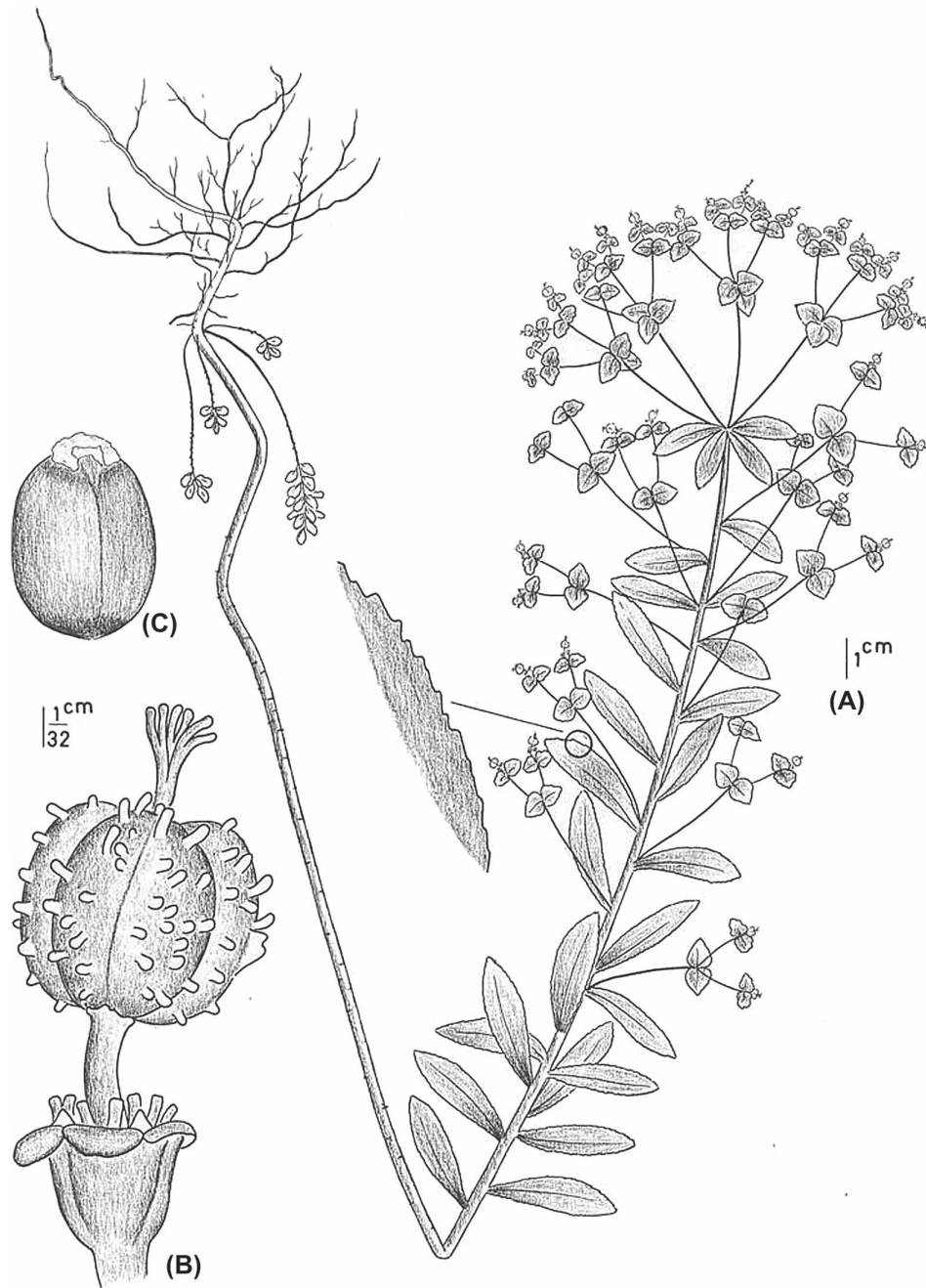


Figure 16. *Euphorbia stricta*. (A) habit, (B) cyathium and fruit, (C) seed. Drawn from voucher specimen from Mazandaran: Chamestan, 3 km Chamestan to Noor, IRAN 53778.

Schimman-Czeika 1964). Khan (1964) indicated that the photo of the type specimen at E was from an unseen specimen at P, which he cited as the holotype. After checking the B–W collection online we found the specimen matching the photo at E, and this sheet (B–W) should be the holotype as indicated above. We did not find any duplicate of the type collection at P, but it is possible that there is a duplicate in that herbarium.

12. *Euphorbia stricta* L. (1759, p. 1049) (Fig. 16)

Based on the same type: *Galarhoeus strictus* (L.) Haw. (1812, p. 151). – *Tithymalus strictus* (L.) Klotzsch and Garcke

(1858, p. 290). – *Euphorbia platyphyllos* var. *stricta* (L.) Fiori in A. Fiori et al. (1901, p. 281).

Taxonomic synonyms: *Euphorbia micrantha* Stephan ex Willd. (1799, p. 905). – *Euphorbia serrulata* Thuill. (1799, p. 237). – *Euphorbia platyphyllos* var. *serrulata* (Thuill.) Pers. (1806, p. 18). – *Galarhoeus micranthus* (Stephan ex Willd.) Haw. (1812, p. 152). – *Tithymalus micranthus* (Stephan ex Willd.) Raf. (1838, p. 115). – *Euphorbia foetida* Hoppe ex W. Koch (1844, p. 724), pro syn. – *Euphorbia stricta* subsp. *micrantha* (Stephan ex Willd.) Nyman (1881, p. 651). – *Euphorbia stricta* subsp. *pubescens* Erdner (1911, p. 569). – *Tithymalus serrulatus* (Thuill.) Holub (1970, p. 94).

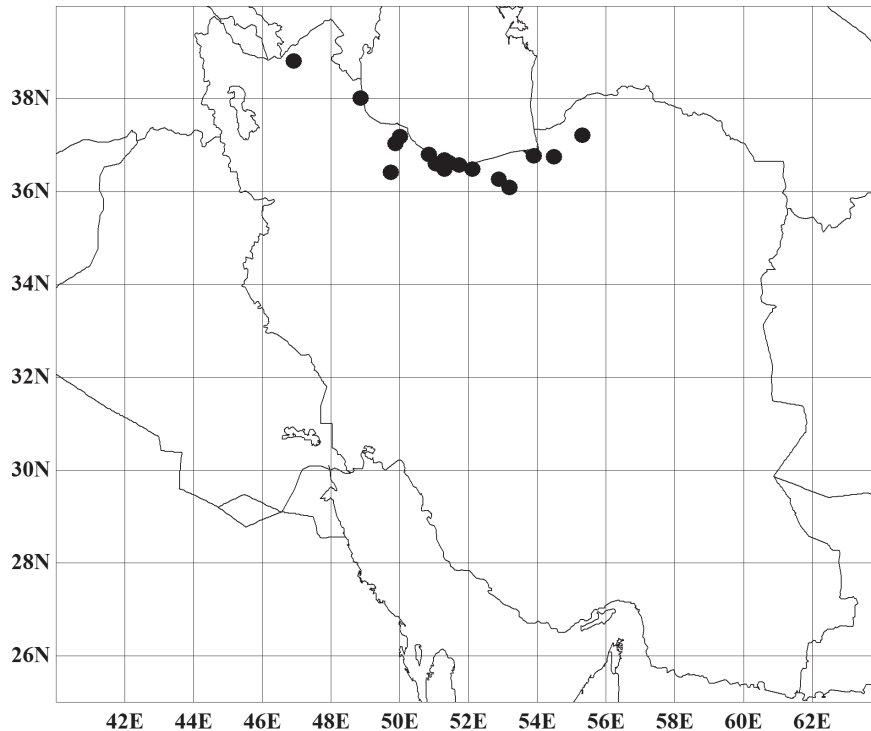


Figure 17. Distribution of *Euphorbia stricta* in Iran.

Annual herbs, 20–60 cm high, glabrous or rarely sparingly pubescent. Cauline leaves oblong-ovate to oblong-oblancoate, $1.5\text{--}5.5 \times 0.5\text{--}2.0$ cm, sessile to subsessile, subamplexicaul or cuneate at base, acute or obtuse at apex, with margin irregularly serrate at upper half. Terminal rays 3 (4–5), trichotomous; axillary rays numerous. Ray leaves like cauline leaves. Raylet leaves ovate-deltoid to ovate-rhombic or suborbicular-reniform, truncate or slightly cordate at base, short cuspidate or obtuse at apex, with serrate margin. Cyathia: involucre campanulate, 1 mm in diameter; glands elliptic and rounded, light brown to yellow. Capsules trilobate, subglobose, 1.5–2.0 mm in diameter, thier surface covered by cylindrical-tuberculate processes, glabrous. Seeds ellipsoidal, 1.3–1.7 mm long, smooth, pinkish–light brown and shiny; caruncle small crescent-shaped, 0.2–0.3 mm long, yellowish. Flowering and fruiting in late May to July.

Habitat

Forests and roadsides from sea level to 2500 m a.s.l.

Distribution

Old World: Europe, Caucasus, Turkey and Iran (northern and northwestern). An Euro–Siberian element (Fig. 17).

Specimens examined

Iran. Golestan: Gorgan, Naharkhoran, Ziarat, Kuh-e Talanbar, Moussavi and Karavar 18160 (IRAN); Minou-Dasht, Sharif 17887 (IRAN); Bandar-e Gaz, Rechinger, Esfandiari and Aellen 17886 (IRAN); Mazandaran: Nowshahr, Shahr-Posht, Sabeti 17714 (IRAN); Chamestan, 3 km Chamestan to Noor, Amini Rad 53778 (IRAN); 8 km Abbass-abad to Kelardasht, Pahlevani and Eskandari 47651

(IRAN); 2 km Nowshahr to Noor, Pahlevani and Eskandari 47654 (IRAN); Chalus, Doab, Veysar, Termeh, Daneshpajuh and Zargani 44603 (IRAN); Pol-e Sefid, Sang-Deh, Miyana, Matin, Daneshpajuh and Fatehi 47246 (IRAN); 25 km Namak-Abroud, Pahlevani and Eskandari 47652 (IRAN); Tonekabon, Shekarak, Shokrgozar 4497 (FAR); Nowshahr, near Sisangan Park, Moallemi 4416 (FAR); Tonekabon, Lashkarak village, anonymous 4496 (FAR); Gilan: Lahijan, Mirkamali 17889 (IRAN); Deylaman, Larukhani to Lanak, Termeh and Daryadel 18161 (IRAN); Lisar valley, Assadi 89450 (TARI); Rasht, Lahijan, Dehkade, Panakhodahi and Baghani 28649 (FAR); east Azerbaijan: Arasbaran protected area, Makidi, Pahlevani and Asef 47798 (IRAN); Qazvin: About 3 km after Kuhin pass, the first pass from Kuhin toward Loshan, Salmaki 39748 (TUH).

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