

## Revision of *Euphorbia* sect. *Chylogala* (Euphorbiaceae)

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DMITRY V. GELTMAN<sup>1</sup>

## Revision of *Euphorbia* sect. *Chylogala* (*Euphorbiaceae*)

### Abstract

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After the rearrangement of the system of *Euphorbia* subg. *Esula* Pers., *E.* sect. *Chylogala* (Fourr.) Prokh. contains four species: *E. alaica* (Prokh.) Prokh. (mountains of Middle Asia), *E. heteradena* Jaub. & Spach (Southwest Asia), *E. retusa* Forrsk. (deserts of North Africa and Southwest Asia) and *E. serrata* L. (West Mediterranean). This group is revised here. Special attention is given to *E. alaica*, a poorly known species from Kyrgyzstan and Tadjikistan. Lectotypes are designated for the names *Euphorbia coriacea* K. Koch, *E. megalantha* Boiss. and *E. megalantha* var. *denticulata* Boiss.

Additional key words: Mediterranean, Southwest Asia, Middle Asia, taxonomy, lectotype

### Introduction

The taxonomic system of the giant genus *Euphorbia* L. (*Euphorbiaceae*) is undergoing an intensive revision: the concept of four subgenera corresponding with major clades has been proposed (Steinmann & Porter 2002; Bruyns & al. 2006; Horn & al. 2012), and systems of subgenera and their sectional divisions have also been developed (Yang & al. 2012; Riina & al. 2013; Dorsey & al. 2013).

The next task for improving *Euphorbia* taxonomy is the preparation of monographs or revisions of particular sections. The aim of this paper is to revise *E.* sect. *Chylogala* (Fourr.) Prokh., which belongs to *E.* subg. *Esula* Pers.

at the JSTOR Plants website (<http://plants.jstor.org>) were also taken into account. For every species, detailed synonymy with typification, description, data on distribution and habitats, as well as pertinent comments are given. Distribution is based on herbarium materials as well as relevant floras, checklists and regional revisions (Vindt 1953; Rechinger & Schiman-Czeika 1964; Khan 1964; Zohary 1972; Radcliffe-Smith 1980, 1982; Pignatti 1982; Zohary & al. 1982; Mouterde 1982; Nasimova 1983; Greuter & al. 1986; Migahid 1988; Benedí & al. 1997; Boulos 2000). Specimens examined are restricted mainly to LE holdings (except *E. alaica*), and labels originally written in Russian are marked by an asterisk (\*) and translated into English; in all other cases the original spelling is kept.

### Material and methods

The work is based mainly on collections in the Herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences (LE) and some holdings from other herbaria (AA, FRU, G, MHA, MW, P, TASH). Resources

### Taxonomic history

Boissier (1862) in his revision of the genus *Euphorbia* separated *E.* (sect. *Tithymalus* (Gaertn.) Roep.) subsect. *Carunculares* Boiss. with *E. caeladenia* Boiss., *E. calypttrata* Coss. & Durieu, *E. connata* Boiss., *E. cornuta*

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Pers., *E. megalantha* Boiss., *E. serrata* L. and *E. stocksiana* Boiss. He mentioned the shape of the caruncle as the most prominent character of this group, as evidenced by its name. Later Fourreau (1869) raised this subsection to generic rank as *Chylogala* Fourr.

Prokhanov in his works on *Euphorbia* of the former USSR treated this group initially as *Tithymalus* Gaertn. subg. *Chylogala* (Fourr.) Prokh. (Prokhanov 1933), and later as *Euphorbia* sect. *Chylogala* (Fourr.) Prokh. (Prokhanov 1949). In his latest paper (Prokhanov 1964), he included eight species in this section and separated them into two subsections: *E.* subsect. *Tibeticae* Prokh. (*E. alaiica* (Prokh.) Prokh., *E. bungei* Boiss., *E. schugnanica* B. Fedtsch., *E. tibetica* Boiss., *E. tranzschelii* (Prokh.) Prokh. and *E. turkestanica* Regel) and *E.* subsect. *Carunculares* (*E. grossheimii* (Prokh.) Prokh. and *E. ispahana* Boiss.). Rechinger & Schiman-Czeika (1964) followed the Boissier system and included in *E.* subsect. *Carunculares* seven species: *E. caeladenia*, *E. cheirolepioides* Rech. f., *E. connata*, *E. halophila* Bornm. & Gauba, *E. heteradena* Jaub. & Spach, *E. multifurcata* Rech.f., Aellen & Esfand. and *E. stocksiana*. On the other hand, Ma & Tseng (1997) listed, as members of *E.* sect. *Chylogala*, *E. altotibetica* Paulsen, *E. tibetica*, *E. turkestanica*, and *E. soongarica* Boiss. (the last species certainly by mistake). Lastly, Baikov (2007) included *E. kozlovii* Prokh. in *E.* sect. *Chylogala*.

There was never any comprehensive revision of this group worldwide. However, summarizing all available data, the following species accepted by Govaerts & al. (2000) could be considered as members of *E.* sect. *Chylogala* as it was outlined by Prokhanov (1964): *Euphorbia alaiica*, *E. altotibetica*, *E. bungei*, *E. caeladenia*, *E. calyprata*, *E. connata*, *E. grossheimii*, *E. heteradena*, *E. kozlovii*, *E. retusa* Forssk., *E. schugnanica*, *E. serrata*, *E. tibetica*, *E. tranzschelii* and *E. turkestanica*.

Recent molecular phylogenetic studies (Riina & al. 2013) showed that the species mentioned above belong to three separate clades (however, forming a distinct grade), which were treated by Riina & al. (2013) as independent sections: *Euphorbia* sect. *Chylogala*, *E.* sect. *Sclerocyathium* (Prokh.) Prokh. and the newly described *E.* sect. *Calypratae* Geltman. Following this concept, *E.* sect. *Chylogala* s.str. includes only four species: *E. alaiica*, *E. heteradena*, *E. retusa* and *E. serrata*. *Euphorbia* sect. *Chylogala* in its new delimitation is revised below.

## Discussion

*Euphorbia alaiica*, *E. heteradena* and *E. serrata* are quite similar morphologically, yet variable, especially in leaf shape and size. Leaf size could also be very variable within species (e.g. *E. heteradena* and *E. serrata*). *E. alaiica* has pilose filaments – a character that is seldom used in *Euphorbia* taxonomy – which easily distinguish it from the other three species in the section. The distribu-

tion patterns of these three species also form successive and non-overlapping geographic ranges: West Mediterranean (*E. serrata*), Southwest Asia (*E. heteradena*) and montane Middle Asia (*E. alaiica*). *Euphorbia serrata* occurs mainly in lowland areas, although it can reach 1200 (1500) m (Benedí & al. 1997), but *E. heteradena* and *E. alaiica* are montane species absent in lowland areas.

*Euphorbia retusa* is more distinct morphologically and ecologically (it is a desert plant); in molecular phylogenetic trees it is sister to a clade including all the other members of the section (Riina & al. 2013). One could speculate that the main speciation diversification events in this group took place near the shores of a drying Paratethis in the course of Alpine orogenesis. Taking into account the high diversity of *Euphorbia* subg. *Esula* in the Mediterranean and neighboring areas (Riina & al. 2013), this could be a common event for several sections of this subgenus.

## Taxonomy

*Euphorbia* sect. *Chylogala* (Fourr.) Prokh. in Komarov, Fl. URSS 14: 384. 1949 ≡ *Euphorbia* subsect. *Carunculares* Boiss. in Candolle, Prodr. 15(2): 111. 1862 ≡ *Chylogala* Fourr. in Ann. Soc. Linn. Lyon, ser. 2, 17: 150. 1869 ≡ *Tithymalus* subg. *Chylogala* (Fourr.) Prokh., Sist. Obzor Moloch. Sr. Azii: 57. 1933 ≡ *Euphorbia* sect. *Carunculares* (Boiss.) Tutin in Feddes Repert. 79: 55. 1968. – Lectotype (designated by Wheeler 1943: 492): *Euphorbia serrata* L.

*Description* — Perennial herbs with lignescent rootstock. *Stem leaves* linear or oblong to ovate, serrate to entire, venation obscure, only main vein prominent. *Terminal rays* 2–5, one or several times dichotomous. *Raylet leaves* 2, free. *Cyathial glands* 4 or rarely 2 or 3, oblong, elliptic or suborbicular, usually with 2 or more horn-like appendages, or without appendages. *Capsule* subconical or ovoid, smooth or minutely verrucose. *Seeds* grayish, cylindrical or near so, smooth, with a prominent caruncle.

## Key to species

1. Stem leaves distinctly irregularly serrulate to almost entire ..... 2
- Stem leaves entire or minutely irregularly serrulate (visible under magnification) ..... 3
2. Ray leaves and raylet leaves ovate, broadened at the base and long caudate-attenuate in upper part; caruncle 1.5–2 mm tall, stalked ..... 1. *E. retusa*
- Ray leaves and raylet leaves from elliptic and semi-orbicular-elliptic to triangular-ovate, not attenuate in upper part; caruncle 0.5–1 mm tall, sessile ..... 3. *E. serrata*
3. Stamen filaments pilose; seeds (without caruncle) to 3 mm long, caruncle c. 1 mm tall; appendages of

glands clavate; plants of montane Middle Asia . . . . .  
 . . . . . 4. *E. alaiica*  
 – Stamen filaments glabrous; seeds (without caruncle)  
 4.5–5.5 mm long, caruncle c. 1.3–2.5 mm tall; ap-  
 pendages of glands horn-like or absent; plants of  
 Southwest Asia . . . . . 2. *E. heteradena*

**1. *Euphorbia retusa*** Forssk., Fl. Aegypt.-Arab.: 93. 1775, nom. cons. prop. [non *E. retusa* (L.) Forssk., l.c. 1775] ≡ *Euphorbia kahirensis* Raeusch., Nomencl. Bot.: 140. 1797 ≡ *Euphorbia cornuta* Pers., Syn. Pl. 2: 17. 1807, nom. illeg. superfl. ≡ *Euphorbia linearis* Schrank in Denkschr. Königl. Akad. Wiss. München 6: 181. 1820, nom. illeg. superfl. [non Retz. 1791] ≡ *Tithymalus cristatus* Raf., Autik. Bot.: 92. 1840 ≡ *Tithymalus cornutus* Schweinf. ex Asch. in Schweinfurth, Beitr. Fl. Aethiop.: 263. 1867, nom. illeg. superfl. – Lectotype (designated by Sennikov & Geltman 2013: 178): Egypt, Cairo, 1762, *Forsskål 1280* (C 10002246!).

**Description** — *Glabrous perennial* with lignescent rootstock. *Stems* erect, numerous, branched, 15–50 cm, commonly forming a tumbleweed structure. *Stem leaves* linear to oblong-ovate, 1.5–3 × 0.1–0.4 cm, base cuneate or rounded, margin usually irregularly serrate, sometimes almost entire, apex rounded, truncate or acute. *Pseudoumbel rays* 2 or 3, 1–3 times dichotomous, 4–15 cm. *Ray leaves and raylet leaves* ovate, broadened at the base and long caudate-attenuate in upper part, 1.5–2.5 × 0.5–1.2 cm. *Cyathia* campanulate, c. 2 mm in diam.; *glands* transversely oblong or trapezoid, with 2 or more short horn-like appendages. *Capsule* ovoid-conic, 4–5 mm; *styles* c. 0.7 mm, free or only slightly fused at base. *Seeds* cylindrical, rounded-quadrangular in cross-section, 2.5–3.5 × 2–2.1 (not including caruncle); *caruncle* conic, longitudinally sulcate, shortly but distinctly stalked, 1.5–2 mm tall.

**Ecology and distribution** — Sandy and gravelly deserts, wadis; sea level to 400 m. Mauritania, Morocco, Algeria, Libya, Tunisia, Egypt, Palestine, Jordan, Saudi Arabia, Iraq (desert part).

**Remarks** — Forsskål (1775) not only described a new species *Euphorbia retusa* Forssk., but also made a combination *E. retusa* (L.) Forssk. based on *E. exigua* L. var. *retusa* L. The two homonyms were therefore validly published, both legitimate with equal priority, and the first choice between them was effectively published by Raeuschel (1797), who renamed the species described by Forsskål to *E. kahirensis* Raeusch. However, this name has never been used since, and *E. retusa* Forssk. has been proposed for conservation against *E. kahirensis* Raeusch. (Sennikov & Geltman 2013).

Govaerts & al. (2000) mentioned *Euphorbia retusa* for Syria, Lebanon, Kuwait and the Gulf States, although

there are doubts concerning its presence in these countries. Mouterde (1984) recorded *E. retusa* as possibly occurring in Syria or Lebanon, but mentioned that it was not yet found there. As for Kuwait, *E. retusa* was not included in the most recent flora of that country (Daoud, 1995), although it was mentioned for it by Radcliffe-Smith (1980). Zohary & al. (1983) mentioned *E. retusa* not only for Kuwait, but also for “Trucial Oman” (mostly United Arab Emirates) and western Yemen. The recent Handbook of Yemen flora (Wood 1997) does not include *E. retusa*. It is obvious that the distribution of this species in the Arabian Peninsula needs to be clarified. Records of this species for Macaronesia and western Pakistan (Radcliffe-Smith 1980) are almost certainly erroneous.

**Specimens examined** — ALGERIA: Graviors de l’Oued – Bikstra, 29 Oct 1893, *Balansa 749* (LE); \*vicinity of Ghardaia, between Berriane and Guerrara, stony plateau in 10 km from Guerrara, 15 Feb 1965, *Botschantsev 252* (LE); \*between cities Bikstra and Touggourt, between Chegga and Stile, 30 Mar 1965, *Botschantsev 810* (LE); \*vicinity of Ghardaia, between Berriane and Guerrara, wadi Magrouna, 2 Apr 1965, *Botschantsev 1014* (LE); EGYPT: in Aegypto interiori prope Cahiram, 1835, *Wiest 508* (LE); Cairo, Apr 1861, *Steudner 537* (LE); aus der Umgegend von Cairo, Mokkaatan, 13 Apr 1866, *Schweinfurth 862* (LE); Suez, in Klee – Gulturen, Apr 1872, *Hildebrandt 87* (LE); in desertis et in dumentosis deserti, Ramses, 20 Feb 1877, *Setourneux 133* (LE); above Helwan, 6 Feb 1944, *Davis 6158B* (LE); \*wadi along the road between Cairo and Suez, 19 Mar 1962, *Botschantsev* (LE); \*desert road between Cairo and Alexandria, 134 km from Alexandria, 9 Apr 1962, *Botschantsev* (LE); \*Sinai, the bank of Suez Canal between Tewfik and Sudr, 7 May 1962, *Botschantsev* (LE); \*west desert, Libyan plateau, road from Mersa-Matruh to Quattara depression, 2 Jun 1962, *Botschantsev* (LE); Sinai Peninsula: 20 km W of Nizzana at road to El Arish, 2 May 1991, *Podlech 49981* (LE). — LIBYA: \*Central zone, the vicinity of El-Agheila, on road, 20 Mar 1978, *Pratov* (LE); 10 km S-W of Gardet al Haiba [Kaiba], 17 Mar 1978, *Pratov 137* (LE). — MOROCCO: Prov. de Goulimine. c. 25 km N Assa an der Straße nach Goulimine (7095), 6 Apr 1990, *Podlech 49105* (LE). — SAUDI ARABIA: In arenosis vallis Hamata Arabiae petraeae, 23 Apr 1835, *Schimper 337* (LE); Arabia petraea, Mar 1846, *Boissier* (LE); TUNISIA: Djebra, 12 Jun 1857, *Kralik* (LE).

**2. *Euphorbia heteradena*** Jaub. & Spach, Ill. Pl. Orient. 2: 42. 1845 ≡ *Tithymalus heteradenus* (Jaub. & Spach) Soják in Čas. Nár. Mus., Odd. Prír. 140: 173. 1972 ≡ *Euphorbia megalantha* var. *gracilis* Boiss. in Candolle, Prodr. 15(2): 112. 1862. – Holotype: [Iran], Isphahan, *Aucher 5313* (P 00702303; isotypes: K, W).

= *Euphorbia ispananica* Boiss., Diagn. Pl. Orient. 7: 91. 1846 ≡ *Tithymalus ispananicus* (Boiss.) Klotzsch & Garcke in Abh. Königl. Akad. Wiss. Berlin 1859: 89. 1860. – Type: [Iran], Ispahan, *Aucher* 5287 (G-BOISS!).

= *Euphorbia megalantha* Boiss., Diagn. Pl. Orient. 7: 95. 1846 ≡ *Tithymalus megalanthus* (Boiss.) Klotzsch & Garcke in Abh. Königl. Akad. Wiss. Berlin 1859: 91. 1860. – **Lectotype (designated here)**: [Iran], in virgultis prope ruinas u. Persepolis sparsim, 20 Apr 1842, *Kotschy* 270 (G-BOISS!; isolectotypes: BM, E, FR, G!, G-DC!, JE, LE!, MA, S, US!, W!).

= *Euphorbia megalantha* var. *denticulata* Boiss. in Candolle, Prodr. 15(2): 112. 1862. – **Lectotype (designated here)**: [Iran], inter Feisabad et Dirachtanschan (inter Chabbi et Kerman), 1 Apr 1859, [*Bunge*] 24 (G-BOISS!; isolectotype: LE!).

= *Euphorbia megalantha* var. *hirtiflora* Boiss. in Candolle, Prodr. 15(2): 112. 1862. – Type: [Iraq], Assyria, 1836, *Aucher* 1823 (G-DC!).

= *Euphorbia coriacea* K. Koch in Linnaea 21: 730. 1849. – **Lectotype (designated here)**: [Azerbaijan, Armenia or Iran], trans amnem Araxen, 1837, *Koch* 867 (LE!).

= *Euphorbia froedinii* Rech. f. in Symb. Bot. Upsal. 11(5): 48. 1952. – Type: [Turkey], Sarik Sifla vid Vansjön, 28 Jun 1939, *Frödin* 202 (UPS).

*Description* — Mostly glabrous, rarely pilose perennial with lignescent rootstock. Stems erect, solitary or numerous, 15–70 cm, simple or branched from the base, sometimes with axillary leafy branches developing later in season. Stem leaves linear to oblong-ovate or elliptic, on axillary branches linear or filiform, 3–8 × 0.3–2 cm, base cuneate or truncate, margin entire, very rarely irregularly serrulate in upper part, apex acute. Pseudoubel rays 3–5, 1 or 2(–4) times dichotomous, (2–)5–15(–20) cm, rarely proliferating with vegetative shoots. Ray leaves oblong-ovate, 3–5.5 × 1.5–2.5 cm; raylet leaves triangular-ovate, 1.5–3.5 × 0.5–1.7. Cyathia 3–4 mm in diam.; involucre deeply lobed; glands 0–4, transversely oblong to semilunate, with or without 2 short horn-like appendages. Capsule ovoid-conic, truncate at apex, c. 6–7 × 5–6 mm, 3-sulcate, lobes rounded, glabrous, smooth; styles 1–2 mm, from 1/3 to 1/2 connate. Seeds cylindrical, rounded quadrangular in cross-section, 4.5–5.5 × 2.7–3 mm (not including caruncle); caruncle conic, sessile, multisulcate, c. 1.3–2.5 mm tall, usually c. 2/5 total length of seed.

*Ecology and distribution* — Montane rocky slopes, steppes, semideserts, river banks, sometimes roadsides and field margins; 1000–2300 m. Turkey (east), Armenia (south), Azerbaijan (Nakhichevan), Iran (west), Iraq (extreme north).

*Specimens examined* — ARMENIA: Araxesthal bei Kartschewan, 12 Jun 1871, *Radde* 20 (LE); \*Erevan, 5 Jul 1893, *Lipsky* (LE); \*Sharuro-Daralagyoz district, valley

of the river East Arpachay, high terrace on left bank up to Army near the monastery, 21 Jul 1925, *Novopokrovsky* 2161 (LE); Arazdajan, 14 Jun 1933, *Takhtadjan* (LE); \*Daralegis, on road between Malishka and Chaikend, 13 Aug 1933, *Takhtadjan* (LE); \*Khosrov nature reserve, right bank of the river Khosrov, 10 Jun 1972, *Lovelius* (LE), \*Vayots Dzor province, vicinity of Sevanakan, 28 Jun 2009, *Gabrieljan & al.* 4 (LE). — AZERBAIJAN: bei Nachitschevan, Vorberge des Illanglidagh, May 1847, *Buhse* (LE); \*Nakhichevan, 1 Jul 1893, *Lipsky* (LE); in siccis vallis fl. Araxis ad stationem ferroviae Negram, 27 May (9 Jun) 1914, *Woronow* (LE); distr. Dzhulfa, inter mtes Darry-dagh et st.v.f. Dzhulfa, in planitis, 4 May 1934, *Karjagin* (LE); \*Chanakay, 7 May 1934, *Ter-Minasyan* (LE); prope p. Dzhagry, in glareosis fl. Dzhagry-tschaj, 12 May 1934, *Prilipko* (LE); \*Norashen district, 2 km north of Diza, in the valley of Arpachai, 10 May 1947, *Grossheim & al.* (LE); \*Shakhbuz district, Kikidagh mountain, 12 Jul 1954, *Tamamschjan & Denisova* (LE); \*near Nakhichevan, 22 Jul 1954, *Tamamschjan & Denisova* (LE); \*between Nakhichevan and Davalu, 11 Aug 1954, *Tamamschjan & Denisova* (LE); \*Ordubad district, between railway station and the town of Ordubad, 5 Jun 1956, *Egorova, Tzvelev & Czerepanov* 24 & 25 (LE); \*Dzhulfa district, south-west spurs of Darradagh mountain, near the bridge of Alindzhachai, 18 Jun 1957, *Tzvelev & Czerepanov* 93 (LE); \*Shakhbuz district, Shakhbuz, 26 Jun 1962, *Gabrieljan* (LE); \*wadi Aza between Dzhulfa and Ordubad, 24 Apr 1966, *Mordak* (LE); \*valley of Gipan-chai, 23 Jun 1972, *Lovelius* (LE); \*Shakhbuz district, vicinity of Garababa, 25 Jun 1974, *Menitsky* (LE); \*vicinity of Karabaglar, 14 Jun 1976, *Gogina* (LE). — IRAN: in locis siccis pr. Badalan in distr. Khoi prov. Aderbeidschan, 8 Jun 1828, *Szovits* (LE); M. Bakhtjar, Jun-Jul 1840, *Bode* (LE); prope urbem Teheran, 22 Apr 1843, *Kotschy* 56 (LE); Vorberge des Ssahend, 22 Jun 1847, *Buhse* 625; Nehmedabad, 10 Jul 1847, *Buhse* 654.4 (LE); Inter Teheran et Tabris, Jun 1859, *Bunge* (LE); prov. Kerman, Kerman, in monte Kuh-i Nasr, 25 May 1892, *Bornmüller* 4690 (LE); prov. Kerman, Kerman, in monte Kuh-tagh-Ali, 2 May 1892, *Bornmüller* 4691 (LE); prov. Yesd, in montosis ad Taft, 6 Apr 1892, *Bornmüller* 4701 (LE); \*Bakhtiar mountains, the vicinity of Dekh-Dur, 6 Apr 1904, *Gadd* 862 (LE); Golpaigan, 17 Apr 1962, *Furse* 1460 (LE); Elburz, 35°E of Teheran foothills, 29 Apr 1962, *Furse* 1639 (LE); 20 miles E of Sagez, 19 May 1962, *Furse* 2136 (LE); route de Kerman à Bam à 42 km de Kerman, 5 May 1972, *Léonard* 6015 (LE); prov. Azerbaijan, 15 km from Zanjan on the road to Bijar, 30 May 1974, *Wendelbo & al.* 11853 (LE); prov. Azarbayejan, 33 km to Shahpur on road from Khoy, 30 Jun 1978, *Assadi & Mozaffarian* 30505 (LE); Iran, prov. Tehran, Alborz Mts, southern slope, 20 km E of Tehran, between Rudhan and Djedjirud, 1 Jun 2001, *Pimenov & al.* (LE). — TURKEY: \*Musha sandzhak, vicinity of Melyazgert, 28 May 1916, *Schischkin* (LE); Van: 5 km S of Bendimahi (Erciş – Van), 3 Jun 1966, *Davis* 44211 (LE).

**3. *Euphorbia serrata* L.**, Sp. Pl.: 459. 1753 ≡ *Tithymalus serratus* (L.) Hill, Hort. Kew.: 172.3. 1768 ≡ *Galarhoeus serratus* (L.) Haw., Syn. Pl. Succ.: 149. 1812 ≡ *Chylogala serrata* (L.) Fourr. in Ann. Soc. Linn. Lyon, n.s., 17: 150. 1869. – Lectotype (designated by Jafri & El-Gadi, 1982: 22): *Löffling* 369, Herb. Linn. No. 630.50 (LINN). = *Tithymalus denticulatus* Moench, Methodus: 668. 1794. – Type unknown.  
 = *Euphorbia serrata* var. *tenuifolia* Pers., Syn. Pl. 2: 17. 1806. – Type: Herb. Pers. (L 0153434).  
 = *Euphorbia serrata* var. *truncata* Pers., Syn. Pl. 2: 17. 1806 ≡ *Euphorbia truncata* (Pers.) Loudon, Hort. Brit., ed. 2: 192. 1832. – Type unknown.  
 = *Euphorbia serrata* var. *phylloclada* Lange in Willkomm & Lange, Prodr. Fl. Hispan. 3: 501. 1877 ≡ *Euphorbia serrata* f. *phylloclada* (Lange) O. Bolòs & Vigo in Butl. Inst. Catalana Hist. Nat., Secc. Bot. 38: 84. 1974. – Type: [Spain], en las orillas del Ebro cerca de ciudad de Caspe, 12 May 1873, *Loscos* (C!).  
 = *Euphorbia serrata* var. *subacaulis* Rouy in Rouy & Foucaud, Fl. France 12: 177. 1910 ≡ *Euphorbia serrata* f. *subacaulis* (Rouy) Oudejans in Collect. Bot. (Barcelona) 21: 187. 1993 [“1992”]. – Type: [France], Aude: Cap Leucate, 6 Apr 1899, *Sennen* (LY!).  
 = *Euphorbia serrata* var. *ternata* Cout., Fl. Portugal: 385. 1913 ≡ *Euphorbia serrata* f. *ternata* (Cout.) Oudejans in Collect. Bot. (Barcelona) 21: 187. 1993 [“1992”]. – Type: [Portugal], “Tras-os-Montes” (?LISE or LISU).

*Description* — *Glabrous perennial* with lignescent rootstock. *Stems* erect, solitary or numerous, 10–60 cm, simple or branched from the base, sometimes with axillary leafy branches in the middle part, developing later in the season. *Stem leaves* linear to ovate and elliptic, uppermost sometimes ovate-triangular, 2–7 × 0.5–1.5 cm, base cuneate or truncate, margin distinctly irregularly serrate, apex mostly acute, rarely rounded or truncate. *Pseudoumbel rays* 3–5, 1–3(–5) times dichotomous, 1–10(–20) cm, very rarely proliferating with vegetative shoots. *Ray leaves* elliptic to triangular-ovate, 1.2–3 × 1.2–3.2 cm; *raylet leaves* semiorbicular to broadly triangular-ovate, 1–2 × 1.5–3(–4) cm, both irregularly serrulate. *Cyathia* 3–4 mm in diam.; *glands* 2–4, transversely oblong to semilunate, with 2 short usually clavate appendages. *Capsule* ovoid-conic, truncate at apex, 5–6 × 4–5 mm; *styles* 1–1.5 mm, ½ fused. *Seeds* cylindrical, rounded-quadrangular in cross-section, 2.7–3.2 × 1.8–2 mm (not including caruncle); *caruncle* conic, sessile or near so, dissected at base, 0.5–1 mm tall.

*Ecology and distribution* — Grasslands, cultivated grounds, pastures, waste places and degraded lands; up to 1200 m. Spain (including Balears), Portugal, France (south), Italy (including Sardinia and Sicily), Macaronesia, Morocco, Algeria, Libya, Tunisia; introduced to Switzerland (now probably extinct), North America

(California) and South Africa. It is considered a noxious weed in California (Riina & al. in press.).

*Specimens examined* — ALGERIA: Oran, Apr 1839, *Bové* (LE); in ditone urbis Alger, loco dicto Kouba, Mar 1879, *Gandoger* 176 (LE); Oran, 29 May 1882, *Debeaux* (LE). — FRANCE: Prope Telonem, *D’Urville* (LE); Avignon, anon., herb. Ledebour (LE); Montpellier, *Kühlewin* (LE); Ad Monspelliam, May 1836, *Bubani* (LE); Toulon (Var), 15 Apr 1854, *Mulsant fil.* (LE); Coteaux au Vinaigrier près Nice, 2 May 1861, *Bourgeau* 263 (LE); Montpellier, 22 May 1900, *Mandon* (LE); Champs et tertres à Béziers (Hérault), Gemenos près Marseille, 23 Apr 1836, anon. (LE); Champs et tertres à Béziers (Hérault), May 1855, *Blanc* in Billot, Flora Galliae et Germaniae exsiccatae 1953 (LE); Dauphine, 1868, *Roepfer* (LE); La Giotat (Roucher du Rhone), Apr 1901, *Koehler* (LE). — ITALY: Flora Pedemontana, Var, Niccia, 1843, *Reichenbach fil.* (LE); Ager nicaeensis, *Fiori & al.*, Fl. Italica Exsiccata 611 (LE); Pedemontanium, Prov. di Torina, S. Vincent in Valle Augustae Praetoriae, 22 May 1908, *Fiori & Béguinot*, Fl. Italica Exsiccata 611bis (LE); Liguria, 1895, *Cesati* (LE). — LIBYA: Tripolitana, Garian, 28 Aug 1962, *Keith* 1016 (LE). — PORTUGAL: Prov. Algarbia, 1848, *Welwitsch* 358 (LE); Province d’Algarve, Loulé, Apr 1881, *Daveau* (LE). — SPAIN: Arties, 31 Aug 1823, *J. Gay* (LE); Granada, in valli fluv. Darru, 27 Jun 1873, *Winkler* (LE); Regnum Granatorre, loc. cultis in Barronco del Caballar prope Almeira, 22 Apr 1879, *Huter & al.* 467 (LE); Grenade, Barranco del Rio Seyura, 1906, *Revenchon* (LE); Barcelona, 25 Apr 1926, *Hno Gonzalo* (LE); S. Esteban de Gormaz (Soria), 12 Sep 1972, *Segura Zubizarreta* (LE). — TUNISIA: Ruines de Lamta près Monaster, 2 May 1883, *Cosson & al.* (LE); Gafsa, in aridis deserti, Apr 1909, *Pitard* (LE).

**4. *Euphorbia alaica*** (Prokh.) Prokh. in Komarov, Fl. URSS 14: 388. 1949 ≡ *Tithymalus alaicus* Prokh., Sist. Obzor Moloch. Sr. Azii: 57. 1933. – Holotype: [Tadjikistan], \*Turkestan range, Isfara basin, wadi Dzhida-Bulak, 17 Aug 1932, *Dzens-Litovskaya* 151 (LE!) – Fig. 1.

*Description* — *Glabrous perennial* with lignescent rootstock. *Stems* erect, solitary or a few, 20–40 cm, sometimes with axillary vegetative shoots. *Stem leaves* oblong-ovate, 2–7 × 0.5–1.7 cm, base rounded, truncate or subcordate, margin minutely irregularly serrate, near the apex almost entire, apex acute, sometimes obtuse. *Pseudoumbel rays* 3–5; 1–3(or 4) times dichotomous, 6–15(–25) cm. *Ray leaves* similar to upper stem leaves, but generally wider; *raylet leaves* triangular-ovate to elliptic, 1.5–4 × 1.5–3.5, entire. *Cyathia* 3–4 mm in diam., filaments pilose; *glands* 2–4, oblong, with 2 distinct clavate appendages. *Capsule* ovoid-conic, truncate at apex, c. 5–6 × 5–6 mm; *styles* 1–1.5 mm, free. *Seeds* oblong-compressed, c. 3 × 2.5 mm; *caruncle* conic, subsessile, sulcate at base, c. 1 mm tall.



Fig. 1. Holotype of *Tithymalus alaicus* ( $\equiv$  *Euphorbia alatica*) – Dzens-Litovskaya 151 (LE).

*Ecology and distribution* — Grasslands and semideserts, mostly in river valleys, on sandstone or limestone substrate; 700–1000 m. Kyrgyzstan (south) and Tadjikistan (north), found in Tien-Shan (Chatkal and Sandalash ranges) and Pamir-Alay (Alay and Turkestan ranges) mountain systems.

The species is restricted to a comparatively small area in the zone of contact between Tien-Shan and Pamir-Alay. About one third of all known specimens were collected in the valley of the Kosonsay River (on labels also Kasansay, Kasaksay, and Kazansay).

*Specimens examined* — KYRGYZSTAN: \*river Kasaksay basin, along the river Zaksay, 30 Aug 1902, *B. Fedtschenko* (LE); \*valley of the river Uridei (Kurgan-say), 30 Aug 1913, *F. Sokolov 107* (LE); \*Western Tien-Shan, Chatkal Range, on the meridian of the Chekmek pass, 6 Aug 1927, *Sovetkina 1079* (TASH); \*Western Tien-Shan, the river Chatkal basin, on the road to upper reaches of the river Sandalash, right bank of the river Sandalash, near Kurgan-tyube, 11 Aug 1938, *Pyataeva & Momotov 636* (TASH); \*Osh Region, Ala-Buka district, western part of the suburb of Shakaftar, 27 Jul 1960, *Ubukeyeva* (FRU); \*Osh Region, Chatkal Range, south slope, river Kazansay basin, 21 Jul 1968, *Ubukeyeva & al.* (LE); \*valley of the river Chatkal: right bank of the river Aksu – left tributary of the river Chatkal, 25 Jul 1970, *Adylov* (TASH); \*Osh Region, Chatkal district, right slope of Chanach-sai, 9–10 km from premountain road to the suspension bridge over the river Chatkal, 30 Sep 1985, *Kuvaev & Manetova 327-2* (MW); \*Dzhalalabad Region, Chatkal Range, the valley of the river Kasansay above the estuary of the river Tereksay, 1700 m, 14 Jun 1996, *Pimenov & al.* (LE); \*Chatkal Range, gorge of the river Kosonsay, 27 Jul 2005, *Lazkov* (FRU, LE). — TADJIKISTAN: \*Turkestan Range, the river Isfara valley, wadi Samarkandek, 16 Aug 1932, *Dzens-Litovskaya 70* (LE); \*Turkestan Range, the river Isfara basin, on road Kim – Kuktyube, 5 Jul 1991, *Gazybaev & al. 48* (TASH).

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## References

Baikov K. S. 2007: *Molochai Severnoy Azii* [Spurges of North Asia]. – Novosibirsk: Nauka Publ.

- Benedí C., Molero J., Simon J. & Vicens J. 1997: *Euphorbia* L. – Pp. 210–285 in: Castroviejo & al., *Flora Iberica* **8**. – Madrid: Real Jardín Botánico.
- Boissier E. 1862: *Euphorbiaceae – Euphorbieae*. – Pp. 3–188 in: Candolle A. P. de, *Prodromus systematis naturalis regni vegetabilis* **15(2)**. – Parisiis: Victoris masson et filli.
- Boulos L. 2000: *Flora of Egypt* **2**. – Cairo: Al Hadara Publishing.
- Bruyns P. V., Mapaya R. J. & Hedderson T. 2006: A new subgeneric classification for *Euphorbia* (*Euphorbiaceae*) in southern Africa based on ITS and psbA-trnH sequence data. – *Taxon* **55**: 397–420.
- Daoud H. S. 1995: *Flora of Kuwait* **1**. – London, Boston & Melbourne: KPI Ltd. in association with Kuwait University.
- Dorsey B. L., Haevermans T., Aubriot X., Morawetz J. J., Riina R., Steinmann V. W. & Berry P. E. 2013: Phylogenetics, morphological evolution, and classification of *Euphorbia* subgenus *Euphorbia*. – *Taxon* **62**: 291–315.
- Forsskål P. 1775: *Flora aegyptiaco-arabica*. – Haunia: Ex officina Mölleri.
- Fourreau M. 1869: Catalogue des plantes du cours du Rhone. – *Ann. Soc. Linn. Lyon*, n.s. **17**: 89–200.
- Govaerts R., Frodin D. G. & Radcliffe-Smith A. 2000: *World Checklist and Bibliography of Euphorbiaceae (and Pandaceae)*. – Kew: Royal Botanic Gardens.
- Greuter W., Burdet H. M. & Long G. (ed.) 1986: *Med-Checklist: A critical inventory of vascular plant names of the circum-mediterranean countries* **3**. – Genève: Editions des Conservatoire et Jardin botaniques de la Ville de Genève.
- Horn J. W., van Ee B. W., Morawetz J. J., Riina R., Steinmann V. W., Berry P. E. & Wurdack K. J. 2012: Phylogenetics and the evolution of major structural characters in the giant genus *Euphorbia* L. (*Euphorbiaceae*). – *Molec. Phylogen. Evol.* **63**: 305–326.
- Jafri S. M. F. & El-Gadi A. 1982: *Flora of Libya* **89**. – Tripoli: Al Faateh University, Department of Botany.
- Khan M. S. 1964: Taxonomic revision of *Euphorbia* in Turkey. – *Notes Royal Bot. Gard. Edinburgh* **25**: 71–161.
- Ma J. S. & Tseng Y. C. 1997: *Euphorbiaceae*. – Pp. 1–150 in: *Flora Reipublicae Popularis Sinicae* **44(3)**. – Beijing: Science Press.
- Migahid A. M. 1988: *Flora of Saudi Arabia*, ed. 3, **1**. – Riyadh: University Libraries, King Saud University.
- Mouterde P. 1984: *Nouvelle flore du Liban et de la Syrie* **2**. – Beyrouth: Dar El-Machreq.
- Nasimova T. 1983: *Euphorbiaceae*. – Pp. 47–79 in: Adylov T. A. (ed.), *Opredelitel rasteniy Sredney Azii* [Manual of plants of Middle Asia] **7**. – Tashkent: Fan.
- Pignatti S. 1982: *Flora d'Italia* **2**. – Bologna: Edagricole.
- Prokhanov Y. I. 1933: *Sistematicheskiy obzor molochaevoy Sredney Azii* [Systematic review of spurges of



- Middle Asia]. – Moscow & Leningrad: Gosudarstvennoe khimiko-tekhnicheskoe izdatel'stvo.
- Prokhanov Y. I. 1949: *Euphorbia* L. – Pp. 304–495 in: Komarov V. L. (ed.), *Flora SSSR* **14**. Moscow & Leningrad: Izdatel'stvo Akademii nauk SSSR.
- Prokhanov Y. I. 1964: Konspekt sistemy molochaev SSSR. Dobavleniya i izmeneniya [Conspectus of the system of spurge of the USSR. Additions and changes]. – *Nov. Sist. Vyssh. Rast.* [**1**]: 226–237.
- Radcliffe-Smith A. 1980: *Euphorbiaceae*. – Pp. 309–362 in: Townsend C. C. & Guest E. (ed.), *Flora of Iraq* **4**. – Baghdad: Ministry of agriculture & agrarian reform, Republic of Iraq.
- Radcliffe-Smith A. 1982: *Euphorbia* L. – Pp. 571–630 in: Davis P. H. (ed.), *Flora of Turkey and the East Aegean Islands* **7**. – Edinburgh: University Press.
- Raeuschel E. A. 1797: *Nomenclator botanicus*, ed. 3., Lipsia: I. G. Feind.
- Rechinger K. H. & Schiman-Czeika H. 1964: *Euphorbiaceae*. – Pp. 1–48 + 20 tab. in: Rechinger K. H. (ed), *Flora Iranica* **6**. – Graz: Akademische Druck- u. Verlagsanstalt.
- Riina R., Peirson J. A., Geltman D. V. & Berry P. E. (in press): *Euphorbia* subgenus *Esula* – In: *Flora of North America* Editorial Committee (ed.), *Flora of North America North of Mexico*. 16+ vols. – New York and Oxford.
- Riina R., Peirson J. A., Geltman D. V., Molero J., Frajman B., Pahlevani A., Barres L., Morawetz J. J., Sal-maki Y., Zarre S., Kryukov A., Bruyns P. V. & Berry P. E. 2013: A worldwide molecular phylogeny and classification of the leafy spurge, *Euphorbia* subgenus *Esula* (*Euphorbiaceae*). – *Taxon* **62**: 316–342.
- Sennikov A. N. & Geltman D. V. 2013: (2119) Proposal to conserve the name *Euphorbia retusa* Forssk. against *Euphorbia retusa* (L.) Forssk. (*Euphorbiaceae*). – *Taxon* **62**: 178–179.
- Steinmann V. W. & Porter J. M. 2002: Phylogenetic relationships in *Euphorbieae* (*Euphorbiaceae*) based on ITS and ndhF sequence data. – *Ann. Missouri Bot. Gard.* **89**: 453–490.
- Vindt J. 1953: *Monographi des Euphorbiacées du Maroc*. – Tanger: Editiones internationales (Travaux de l'Institut scientifique Chérifien **6**).
- Wheeler L. C. 1943: The genera of living *Euphorbieae*. – *Amer. Midl. Nat.* **30**: 456–503.
- Wood J. R. I. 1997: *A handbook of the Yemen flora*. – Kew: Royal Botanic Gardens.
- Yang Y., Riina R., Morawetz J. J., Haevermans T., Aubriot X. & Berry P. E. 2012: Molecular phylogenetics and classification of *Euphorbia* subgenus *Chamaesyce* (*Euphorbiaceae*). – *Taxon* **61**: 764–789.
- Zohary M. 1972: *Flora Palaestina* **2**. – Jerusalem: The Israel Academy of Sciences and Humanities.
- Zohary M., Heyn C. C. & Heller D. 1983: *Conspectus florae orientalis* **2**. – Jerusalem: The Israel Academy of Sciences and Humanities.