

A synopsis of *Euphorbia* (*Euphorbiaceae*) for the Caucasus

Обзор видов *Euphorbia* (*Euphorbiaceae*) Кавказа

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Abstract. *Euphorbia* L. (*Euphorbiaceae*), one of the largest genera of angiosperms, is represented in the Caucasus by 80 species. This paper contains a taxonomic treatment for these species and a key for their determination. For every species the following information is provided: accepted name and major synonyms with typification where possible; brief characteristics of habitats; distribution in the Caucasus and indication of geographical element (for indigenous species); and taxonomic and geographical notes if necessary. Lectotypes of *Euphorbia arvalis* Boiss. et Heldr., *E. damascena* Boiss., *E. fossulata* Boiss. et Gaill., *E. iberica* Boiss. var. *intermedia* Boiss., *E. kemulariae* Ter-Chatsch., *E. notadenia* Boiss. et Hohen., *E. platyphyllos* L., *E. paralias* L. and *E. ruderalis* Sheele are newly designated. The indigenous component of Caucasian *Euphorbia* comprises 73 species. The majority belong to three geographical elements: Euro-Siberian (41.10%), Irano-Turanian (20.54%) and Submediterranean (15.07%). There are also 7 alien species mostly of North American origin. Taxonomically, most of Caucasian *Euphorbia* species (70 or 87.5%) belong to subgen. *Esula* and represent 16 of the 21 currently accepted sections. The remaining ten species belong to subgen. *Chamaesyce*.

Keywords: *Euphorbia*, spurge, Caucasus, taxonomy.

Аннотация. *Euphorbia* L. (*Euphorbiaceae*) — один из крупнейших родов цветковых растений — представлен на Кавказе 80 видами. Статья включает ключ для их определения и таксономическую обработку, в которой для каждого вида приводится принятое название, важнейшие синонимы (по возможности с типификацией), краткая характеристика местобитаний, распространение на Кавказе, для аборигенных видов — географический элемент, необходимые примечания. Обозначены лектотипы *Euphorbia arvalis* Boiss. et Heldr., *E. damascena* Boiss., *E. fossulata* Boiss. et Gaill., *E. iberica* Boiss. var. *intermedia* Boiss., *E. kemulariae* Ter-Chatsch., *E. notadenia* Boiss. et Hohen., *E. platyphyllos* L., *E. paralias* L. и *E. ruderalis* Sheele. Аборигенная фракция включает 73 вида; большинство их принадлежит к 3 географическим элементам: евро-сибирскому (41.10%), ирано-туранскому (20.54%) и субсредиземноморскому (15.07%). Семь видов являются чужеродными, большинство их имеет североамериканское происхождение. Таксономически большинство кавказских *Euphorbia* принадлежат к подроду *Esula* (70, или 87.5%) и относятся к 16 секциям из 21 принятой в настоящее время. К подроду *Chamaesyce* принадлежат 10 видов.

Ключевые слова: *Euphorbia*, молочай, Кавказ, систематика.

Euphorbia L. (*Euphorbiaceae*) is one of the largest genera of angiosperms. Its species occur almost worldwide, from the moist tropics to the Polar Circle, and from lowlands to extreme high mountain areas. Preparation of a complete monograph for the genus, or even a synopsis, is an ambitious task which can be achieved only by joint efforts of several research teams working in different parts of the world. Significant steps towards solving this task were done during the implementation of the “*Euphorbia* planetary biodiversity” project (Riina, Berry, 2020).

The Caucasus, a mostly mountainous area located between the Black and the Caspian Seas, is now recognized as one of 36 world biodiversity hotspots (Hoffmann et al., 2016) with the number of vascular

plant species between 5500 (Menitsky, Popova, 2006) and 6350 (Gagnidze et al., 2000). The aim of this paper is to present a synopsis of *Euphorbia* for this area that could be a significant step both towards the preparation of a worldwide *Euphorbia* account and to the completion of a regional taxonomic monograph.

Background to this study

Marschall von Bieberstein (1808) published the first more or less comprehensive synopsis of vascular plants of Crimea and the Caucasus in which he listed 24 *Euphorbia* species. Lipsky (1899) in his mostly compilatory “Flora of the Caucasus” cited 42 species. The famous researcher of the Caucasian flora, A. A. Grossheim in the first edition of his “Flora of the Caucasus” (Gross-

heim, 1932) listed 66 species, and later in the “Guide to plants of the Caucasus” (Grossheim, 1949) 64 species.

Prokhanov (1949) listed 159 species in his *Euphorbia* account for the “Flora of the USSR”, with 63 of them recorded for the Caucasus. This treatment until now has been a very important source for *Euphorbia* taxonomy because of the excellent morphological descriptions and accompanying comments. The Caucasian species in this treatment belong to subgenus *Esula* Pers. (then treated as subgen. *Paralias* (Raf.) Prokh.), with 10 sections, and to subgen. *Chamaesyce* Raf.

Tamamschjan (1962) prepared the *Euphorbia* treatment for the second edition of Grossheim’s “Flora of the Caucasus”. She recorded 68 species and unlike Prokhanov (1949) did not accept subgenera, instead following the sectional subdivisions of Boissier (1862). For every species, a short description and detailed distribution in the Caucasus is provided as well as distribution maps for almost all species.

Publication of the “Flora of the USSR” stimulated preparation of “Floras” of Soviet republics (now independent states) including those of Transcaucasia. The *Euphorbiaceae* treatments for the “Floras” of Georgia (two editions: Ter-Chatschurova (1950); Chintibidze, Gvinianidze (1983)), Azerbaijan (Khalilov, 1955) and Armenia (Ter-Chatschurova, Tamamschjan, 1973) generally followed Prokhanov (1949), but contained important additional information, especially on species distribution because they were based on regional herbarium collections that were not fully consulted in the preparation of the “Flora of the USSR”. Two editions of “Flora of Abkhazia” (Kolakovsky, 1948, 1982) cover very important areas with several endemic and subendemic species. Recently, new synopses on the genus for Armenia (Geltman, Tamanyan, 2016) and Azerbaijan (Geltman, 2016) were published. The Russian part of the Caucasus was covered by Galuschko (1980), but, unfortunately, not all of his records are confirmed by herbarium specimens. Some important novelties in the distribution of *Euphorbia* in the Russian part of the Caucasus are found in recent regional “Floras” and checklists (Ivanov, 1997; Zernov, 2000, 2006; Murtazaliev, 2009; Zernov, Onipchenko, 2011; Shilnikov, 2010, etc.). Recently Ivanov (2019) tried to summarize data on the Russian Caucasus. For spurges he accepted genera *Agaloma* Raf., *Chamaesyce* Raf., *Poinsettia* Graham and *Tithymalus* Gaertn.; unfortunately, in this treatment he repeated some evident mistakes made by Galushko (1980) and published several invalid nomenclatural combinations.

Since the late 1980s I have been working on the *Euphorbia* taxonomy for temperate Eurasia, with

special reference to the Caucasus. As a result, reviews of sections *Peplus* Lázaro (Geltman, 2000), *Esula* (Pers.) Dumort. (Geltman, 2002) and *Paralias* Dumort. (Geltman, 2005) (according to the Prokhanov’s (1949) system) for the Caucasus, Crimea and Asia Minor were published. These long-term studies were summarized in the *Euphorbiaceae* account for the “Caucasian flora conspectus” (Geltman, 2012). This current paper is based mainly on that treatment, but contains some novelties in species composition, as well as a determination key, data on habitats, and more extensive synonymy and commentary.

Material and methods

The area of study follows the limits accepted in the “Caucasian flora conspectus” (Takhtajan, 2003). The northern border follows the southern limit of Europe as usually accepted in the Russian geographical tradition. The southern border coincides with frontiers of Georgia, Armenia and Azerbaijan with Turkey and Iran. It is important to mention that these limits differ from the circumscription of the Caucasian ecoregion according to the World Wildlife Foundation (WWF) and the area accepted in Solomon et al. (2014).

The work is based foremost on the *Euphorbia* holdings of the Caucasian section of the Herbarium of the Komarov Botanical Institute (LE) — about 3500 specimens. Material of other herbaria having important Caucasian collections also have been carefully studied (BAK, ERE, KBHG, KW, LENUD, MHA, MW, TBI, TGM, SBG, SUCH, PGFA). For typification, data of other herbaria (BM, G, K, P, W, etc.) as well as internet resources on type specimens (mainly Global Plants on JSTOR — plants.jstor.org and Virtual Herbaria — <https://herbarium.univie.ac.at/database/search.php>) were important. I also made several field trips to various parts of the Caucasus in 1988–1991, 2002–2004, and 2015–2016.

Morphological terminology used in the key, especially that about synflorescences, generally follows Riina et al. (2013: Fig. 3). Subgeneric and sectional delimitations follow those of Yang et al. (2012) and Riina et al. (2013), with minor modifications. For proper citations of protologues, consulting the *Euphorbiaceae* account of the “World checklist of selected plant families” by Govaerts et al. (2020) was very important.

The taxonomic treatment includes all indigenous and alien species (recorded at least once) as well as ornamental plants with tendency to naturalization. For each species, the following information is provided: accepted name and synonyms related to the area in question, with typification whenever possible; brief characteristics of habitats; distribution in the Caucasus

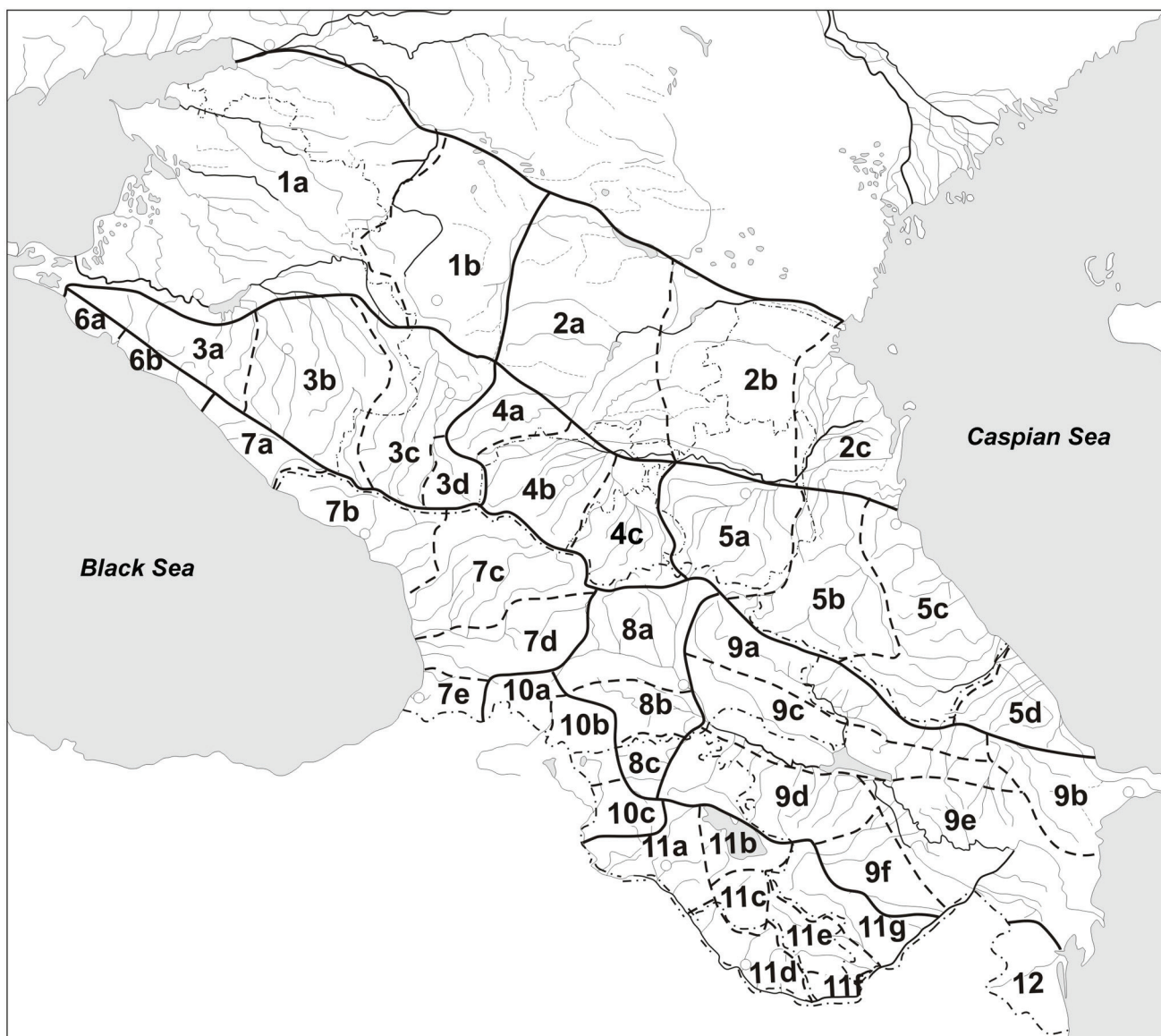


Fig. 1. Scheme for indicating the geographical distribution (according to Menitsky (1991) and Takhtajan (2003)).

1. WCC – Western Ciscaucasia: 1a. *Az.-Kub.* – Azov-Kuban, 1b. *W. Stav.* – Western Stavropol; **2. ECC** – Eastern Ciscaucasia: 2a. *E. Stav.* – Eastern Stavropol, 2b. *Ter.-Kuma* – Terek-Kuma, 2c. *Ter.-Sul.* – Terek-Sulak; **3. WC** – Western Caucasus: 3a. *Adag.-Pshish* – Adagum-Pshish, 3b. *Bel.-Laba* – Belaja-Laba, 3c. *Urup-Teb.* – Urup-Teberda, 3d. *U. Kub.* – Upper Kuban; **4. CC** – Central Caucasus: 4a. *U. Kuma* – Upper Kuma, 4b. *Malka* – Malka, 4c. *U. Ter.* – Upper Terek; **5. EC** – Eastern Caucasus: 5a. *Assa-Arg.* – Assa-Argun, 5b. *U. Sulak* – Upper Sulak, 5c. *Man.-Samur* – Manas-Samur, 5d. *Kubin.* – Kubinsky; **6. NWTC** – North-Western Transcaucasia: 6a. *Anapa-Gel.* – Anapa-Gelendzhik, 6b. *Pshada-Dzhubga* – Pshada-Dzhubga; **7. WTC** – Western Transcaucasia: 7a. *Tuap.-Adl.* – Tuapse-Adler, 7b. *Abkh.* – Abkhazia, 7c. *Ing.-Rioni* – Inguri-Rioni, 7d. *Rioni-Kvir.* – Rioni-Kvirili, 7e. *Adzh.* – Adzharia; **8. CTC** – Central Transcaucasia: 8a. *Kart.-S. Oss.* – Karthalinia-South Ossetia, 8b. *Triat.-L. Kart.* – Trialetia-Lower Karthalinia, 8c. *Lori* – Lori; **9. ETC** – Eastern Transcaucasia: 9a. *Alaz.-Agrich.* – Alazan-Agrichay, 9b. *Shirv.* – Shirvan, 9c. *Iori-Sheki* – Iori-Sheki, 9d. *Murgh.-Murovd.* – Murghuz-Murovdagh, 9e. *L. Kura* – Lower Kura, 9f. *Karab.* – Karabagh; **10. SWTC** – South-Western Transcaucasia: 10a. *Meskh.* – Meskheta, 10b. *Dzhav.-U. Akh.* – Dzhavachetia-Upper Akhurjan, 10c. *Arag.* – Aragatz; **11. STC** – Southern Transcaucasia: 11a. *Erev.* – Erevan, 11b. *Sevan* – Sevan, 11c. *Dar.* – Daraleghiz, 11d. *Nakh.* – Nakhitshevan, 11e. *Zang.* – Zangezur, 11f. *Megri-Zan.* – Megri-Zangelan, 11g. *S. Karab.* – Southern Karabagh; **12. T** – Talysch.

according to the scheme adopted in the “Caucasian flora conspectus” (Takhtajan, 2003) (Fig. 1)¹ followed by indication of the level 3 units of “World geographical scheme for recording plant distribution” (Brummitt, 2001)² and for indigenous species — indication of their geographical element according to Geltman (2015a); and finally, any pertinent taxonomic or geographical notes. All photos of the plants are made by the author.

Determination key of Caucasian *Euphorbia* species

1. Upper stem, ray and raylet leaves with wide white margin 80. *E. marginata*.
- + Upper stem, ray and raylet leaves concolorous, without white margin 2.
2. Cyathia with a single gland 79. *E. davidii*.
- + Cyathia with 4–5 glands 3.
3. Stem leaves without stipules, usually alternate, rarely opposite. Cyathia in prominent rays, forming apical pseudumbel (rarely reduced to a single cyathium), surrounded by ray leaves, and also located in axils of stem leaves. Cyathial glands with or without horn-like appendages 4.
- + Leaves opposite, with stipules, cyathia axillary or in short axillary sprouts, cyathial glands with petaloid appendages 76.
4. Stem leaves opposite; capsules indehiscent, with spongy mesocarp 1. *E. lathyris*.
- + Stem leaves alternate; capsules dehiscent, mesocarp not spongy 5.
5. Perennials or small shrubs 6.
- + Annuals or biennials 55.
6. Caruncle at least $\frac{2}{5}$ total length of seed 43. *E. heteradena*.
- + Caruncle small, less than $\frac{2}{5}$ total length of seed 7.
7. Cyathial glands semilunate, always with more or less prominent horn-like appendages 8.
- + Cyathial glands elliptic, oblong-elliptic, reniform or trap-ezoid, sometimes with or without horn-like appendages 25.
8. Raylet leaves free 9.
- + Raylet leaves connate in pairs 22.
9. Stem leaves 5 or more times as long as wide, linear, oblong-linear, narrow oblanceolate or narrow elliptic ... 10.
- + Stem leaves 2.5–5(8) times as long as wide, ovate, elliptic, oblong, oblanceolate, oblong-linear 14.
10. Stems (15)20–60 cm tall, 2–6 mm thick. Stem leaves light-green, raylet leaves yellow or green-yellow when plants are in flower, different in colour from stem leaves 62. *E. virgata*.
- + Stems (3)5–40 cm tall, up to 2 (2.5) mm thick. Stem leaves grey-green, raylet leaves concolorous with stem leaves when plants are in flower 11.
11. Plants with axillary vegetative sprouts and/or numerous, long axillary rays 12.
- + Plants without axillary vegetative sprouts, sometimes with few, short axillary rays 13.
12. Stems (8)10–20(30) cm tall and (1)1.5–2 mm thick. Apical rays (4)5–10. Axillary sprouts without rays. Root more or less horizontal, nearly the same thickness as stem at bottom. Plants of mountain areas 66. *E. daghestanica*.
- + Stems 5–15 cm tall and 1–1.5(2.5) mm thick. Apical rays 3(4). Axillary sprouts often with their own axillary and apical rays. Root vertical, noticeably thicker than stem at bottom. Plants of lowlands of Ciscaucasia 68. *E. astrachanica*.
- 13 (11). Stem leaves linear or linear-subulate, shortly acute at apex, (3)4–7 cm long, 1–2(3) mm wide, (12)15–30(40) times as long as wide 67. *E. leptocaula*.
- + Stem leaves linear, narrow elliptic or narrow oblanceolate, shortly acute or rounded at apex, 2.5–4 cm long, 2–4 mm wide, 6–15 times as long as wide 65. *E. subtilis*.
- 14 (9). Stems (15)20–120 cm tall, 2–12 mm thick. Stem leaves 2–12 cm long, bright-green or grey-green, raylet leaves yellow, green-yellow or grey-green when plants are in flower, concolorous or not concolorous with stem leaves 15.
- + Stems (3)5–20 cm tall, up to 2 mm thick. Stem leaves 0.5–3 cm long, grey-green, raylet leaves concolorous with stem leaves when plants are in flower 19.
15. Stems 70–120 cm tall, 5–12 mm thick, often lignescent at base. Stem leaves more or less coriaceous, shiny, closely spaced, elliptic or ovate-elliptic, rounded or truncate at base, 5–15 cm long and 1–3.5 cm wide, 4–8 times as long as wide. Wetland and coastal plants 61. *E. lucida*.
- + Stems 15–80 cm tall, usually not lignescent at base. Stem leaves not shiny, more sparse, elliptic or oblong-elliptic, usually rounded or cordate at base, 3.5–5.5(6.5) cm long and 1–1.8 cm wide, 2.5–5(7) times as long as wide. Steppe, meadow, forest or rock plants 16.
16. Stem leaves cordate at base, sometimes almost amplexicaul 60. *E. agraria*.
- + Stem leaves rounded at base 17.
17. Stem leaves greyish, raylet leaves greyish or yellow-greyish, more or less concolorous with stem leaves when plant are in flower 63. *E. pseudagraria*.
- + Stem leaves green, raylet leaves yellow or greenish-yellow, different in colour from stem leaves when plant are in flower 18.
18. Plants glabrous 58. *E. iberica*.
- + Plants at least partly pilose 59. *E. dubovikiae*.
- 19 (14). Plants with numerous comparatively long axillary vegetative sprouts, often exceeding length of stem and apical rays 20.

¹ This scheme was developed by Menitsky (1991) with consultations from A. L. Takhtajan. It was an attempt to combine a natural division of the Caucasus (first of all, mountain systems and river basins) with existing administrative borders. Initially it was based on the administrative divisions of the former Soviet Union. For its adaptation to modern administrative divisions and relation to other systems used for the recording of plant distribution in the Caucasus, see <https://www.binran.ru/resursy/informatsionnyye-resursy/tekuschie-proekty/caucasian-flora/contentkav/departments.php>

² NCS — Northern Caucasus (territory of the Russian Federation in the Caucasus); TCS — Transcaucasia (all other countries).

- + Plants without axillary vegetative sprouts 21.
- 20. Stems ascendent, stem leaves oblong-ovate or oblong-elliptic, 0.7–0.8 cm long and 0.3–0.7 cm wide 70. *E. buschiana*.
- + Stems usually erect, stem leaves linear or oblong-linear, 1.2–2.5 cm long and 0.1–0.5 cm wide 65. *E. daghestanica*.
- 21 (19). Stems up to 10 cm tall. Stem leaves oblong-elliptic, undulate at margin, rounded at apex 69. *E. undulata*.
- + Stems 8–25 cm tall. Stem leaves obovate or elliptic, not undulate at margin, often emarginated at apex 64. *E. sareptana*.
- 22 (8). Flowering stem annual, without a pseudorosette of leaves 23.
- + Flowering stem biennial, first year leaves in a pseudorosette or at least with very short internodes 24.
- 23. Stem leaves elliptic or obovate-elliptic, attenuate or cuneate at base, with petioles 4–10 mm long. Mostly forest plants 45. *E. macroceras*.
- + Stem leaves oblong or oblong-ovate, base truncate, rounded or cordate, sessile or with petiole up to 3 mm long. Mostly plants of subalpine meadows 46. *E. oblongifolia*.
- 24 (22). Plants glabrous, leaves of pseudorosette caducous, leaving noticeable leaf scars 47. *E. glaberrima*.
- + Plants at least partly pubescent, leaves of pseudorosette persistent, wintering 48. *E. amygdaloides*.
- 25 (7). Cyathial glands oblong-elliptic, always without appendages. Capsules mostly verrucose or tuberculate, sometimes cristate. Leaves usually serrulate or dentate in upper part, venation pinnate, prominent 26.
- + Cyathial glands trapezoid or reniform, sometimes with appendages. Capsules smooth. Leaves entire, venation obscurely palmate 42.
- 26. Shrub with lignescent branches 12. *E. hierosolimitana*.
- + Perennials 27.
- 27. Cyathia solitary or few 20. *E. ardonensis*.
- + Cyathia in apical or axillary rays 28.
- 28. Raylet leaves 2 29.
- + Raylet leaves 3–4 (sometimes 2 on axillary rays) 37.
- 29. Rootstock tuberous. Stem leaves cordate or amplexicaul at base 8. *E. condylocarpa*.
- + Rootstock not tuberous. Stem leaves rounded or cuneate at base 30.
- 30. Stems and leaves glabrous 31.
- + Stems and leaves pubescent, at least partly 32.
- 31. Plants 10–30 cm tall. Stem leaves usually oblong, 1.4–3.7 cm long. Stigma sessile, style absent. Plants of Lesser Caucasus 13. *E. wittmannii*.
- + Plants 40–60 cm tall. Stem leaves elliptic, (3.5)4–6 cm long. Style ca. 1.5 mm. Plants of Western Transcaucasia 25. *E. eugeniae*.
- 32 (30). Plants densely covered with hairs ca. 1 mm long, occurring on littoral and coastal habitats 7. *E. hirsuta*.
- + Plants covered by hairs less than ca. 0.5 mm long, occurring in forests, montane meadows and steppes 33.
- 33. Rays up to 1 cm long, always non-branched, usually equal to ray leaves 34.
- + Rays (2)3–10(15) cm long, branched or non-branched, usually longer than ray leaves 35.
- 34. Capsules with more or less long warts (ca. 1.5 mm high), seeds 2.2–2.6 × 1.8–2 mm 19. *E. scripta*.
- + Capsules with very short, punctate warts (0.1–0.2 mm high), seeds (2.3)2.8–3 × (2)2.3–2.5 mm 18. *E. djimilensis*.
- 35 (33). Capsules ca. 4 mm diam., seeds 2.2–2.8 mm long 16. *E. squamosa*.
- + Capsules 7–10 mm diam., seeds 3–4 mm long 36.
- 36. Capsules subglobose, stem leaves at base cuneate. Plants of forests 17. *E. czerepanovii*.
- + Capsules trilobate, stem leaves at base truncate or rounded, seldom subcuneate. Plants of open habitats 15. *E. macrocarpa*.
- 37 (28). Stems and leaves pubescent, at least partly 38.
- + Stems and leaves always glabrous 39.
- 38. Capsules at least partly cristate, (3.5)4–5.5 mm long, seeds (2.5)2.9–3.2 mm long. Stems glabrous or pubescent. Stem leaves (6)6.5–8.5 cm long, (3.5)4–7 times as long as wide. Plants occurring throughout the Caucasus 23. *E. procera*.
- + Capsules verrucose, usually not cristate, 3.5–4 mm long. Seeds 2.5–2.8 mm long. Stems always glabrous. Stem leaves 4–6(7) cm long, 2–4(4.5) times as long as wide. Plants of North-West Transcaucasia 24. *E. tauricola*.
- 39 (37). Plants always without axillary vegetative sprouts 14. *E. orientalis*.
- + Plants with axillary vegetative sprouts 40.
- 40. Capsules without warts. Stem leaves usually shortly aristate at apex 22. *E. aristata*.
- + Capsules warty. Stem leaves usually rounded at apex, at least not aristate 41.
- 41. Wetland plants (60)80–170(200) cm tall. Capsules 3.5–5 × 5–6 mm, with warts 0.15–0.25 mm high, seeds 3–4 mm long 21. *E. palustris*.
- + High mountain plants 40–60 cm tall. Capsules 2.5–3 × 3–4 mm, with warts 0.5–1 mm high, seeds 2.5–2.6 mm long 25. *E. eugeniae*.
- 42 (25). Glands without appendages 43.
- + Glands with appendages (at least very short) 46.
- 43. Cyathia more or less broadly campanulate, their length equal to width in upper part or slightly shorter, usually with triangular, often bifid lobes. Stems thin, 1.5–2 mm diam., virgate, leaves glaucous, usually linear and oblong-linear, sometimes linear-elliptic, (3)4–14 times as long as wide 33. *E. seguieriana*.
- + Cyathia narrowly campanulate, 1.4–2 times as long as wide in upper part, with obtuse, irregular, usually entire lobes. Stems 1–5 mm diam., leaves yellowish-green, usually elliptic, broad elliptic, obovate, 2–6 times as long as wide .. 44.
- 44. Stems 10–20 cm tall, 1.5–2(2.2) mm diam., apical pseudumbel of 3–6 rays 37. *E. glareosa*.
- + Stems (20)25–70 cm tall, (2.3)2.5–4 mm diam., apical pseudumbel of (5)7–16 rays 45.
- 45. Ovary and capsule usually pilose. Stems and leaves at least partly with minutely papillose (“glareose”) indumentum (usually visible on magnification) 35. *E. pannonica*.
- + Ovary and capsule glabrous. Stems and leaves without minutely papillose (“glareose”) indumentum, only leaf margins sometimes glareose-dentate 36. *E. stepposa*.

- 46 (42). Capsule deeply trisulcate, wider than long. Seeds almost rounded in cross-section, with a small complanate caruncle. Plants of sandy sea shores 52. *E. paralias*.
- + Capsule weakly sulcate, longer than wide. Seeds quadrangular or subquadrangular (two-faceted from ventral side and almost rounded from dorsal side) in cross-section, with a noticeable conical or cylindrical caruncle 47.
47. Capsule conical; male flowers with bracteoles; seeds subquadrangular in cross-section 48.
- + Capsule resembling a truncated tetrahedron; male flowers without bracteoles; seeds quadrangular in cross-section 52.
48. Ovary and capsule pilose. Seeds smooth. Plants 20–70 cm tall 34. *E. macroclada*.
- + Ovary and capsule glabrous. Seeds foveolate or smooth. Plant small, 10–15 cm tall 49.
49. Seeds usually 2.5–2.6 mm long. Stem leaves (1.5)2–3 cm long 38. *E. smirnovii*.
- + Seeds usually 2.2–2.4 mm long. Stem leaves 0.5–2 cm long 50.
50. Apical rays 10–80 mm, usually longer than ray leaves, if shorter, stem in upper part sparsely leaved. Seeds always foveolate 39. *E. petrophila*.
- + Apical rays 0.5–5(7) mm, usually equal or shorter than ray leaves, stem in upper part densely leaved. Seeds foveolate or smooth 51.
51. Perennial herb (sometimes with lignescent stem base), annual shoots dying after flowering 40. *E. erythron*.
- + Small semishrublet, annual shoots lignescent and continuing growth after flowering 41. *E. panjutinii*.
- 52 (47). Stem leaves linear, rarely linear-obovate, long acute at apex, (2.5)3–5 times as long as wide 27. *E. rigida*.
- + Stem leaves oblong-elliptic, obovate, sometimes almost rounded, shortly acute at apex, (1.2)1.5–2.5 times as long as wide 53.
53. Seeds always rugulose, caruncle truncate-conical or almost spherical, obtuse 30. *E. myrsinites*.
- + Seeds rugulose or smooth, caruncle acute-conical 54.
54. Apical pseudoubel of 2–6(7) rays 28. *E. armena*.
- + Apical pseudoubel of (7)8–20 rays 29. *E. marschalliana*.
- 55 (6). Ovary and capsule with warts 56.
- + Ovary and capsule smooth, sometimes with minute scattered warts (*E. microsphaera*) 58.
56. Plants up to 14 cm tall, glabrous. Stem usually equal or shorter than apical and axillary rays. Seeds ecarunculate 3. *E. coniosperma*.
- + Plants 10–40 cm tall, at least partly pubescent. Stem usually longer than apical and axillary rays. Seeds carunculate 57.
57. Capsule prominently trisulcate, 1.6–2 × 2–2.2 mm, with warts located mainly in median part of the lobes. Seeds 1.3–1.7 × 1–1.2 mm. Apical pseudoubel of 3, rarely 5 rays 9. *E. stricta*.
- + Capsule obscurely trisulcate or subspherical, 2.3–3 × 3–3.5 mm with warts located more or less sparsely. Seeds 1.9–2.2 × 1.6–1.9 mm. Apical pseudoubel of 5, rarely 3 rays 10. *E. platyphyllos*.
- 58 (55). Seeds smooth 59.
- + Seeds ornamented 62.
59. Caruncle large, equal or longer than seed itself 42. *E. grossheimii*.
- + Caruncle much smaller than seed itself or absent 60.
60. Glands with long horn-like appendages 50. *E. terracina*.
- + Glands without appendages 61.
61. Plants moderately pilose. Capsule spherical, seeds carunculate 11. *E. microsphaera*.
- + Plants densely pilose. Capsule clearly trilobate, seeds ecarunculate 4. *E. eriophora*.
- 62 (58). Plants at least partly pilose. Stem leaves, ray and raylet leaves serrate near apex 63.
- + Plants usually glabrous. Stem leaves, ray and raylet leaves entire 64.
63. Seeds foveolate 6. *E. helioscopia*.
- + Seeds striate-rugulose 5. *E. rhabdotosperma*.
- 64 (62). Raylet leaves linear, oblong-linear, narrowly elliptic or ovate, at least 3 times longer than wide 65.
- + Raylet leaves ovate, rhombic-ovate, elliptic or almost rounded, 1.5–2(2.5) times longer than wide 68.
65. Seeds hexagonal in cross-section, longitudinally narrowly sulcate and transversely plicate-rugulose on the facets 49. *E. aserbajdzhanica*.
- + Seeds quadrangular or subquadrangular (two-faceted from ventral side and almost rounded from dorsal side) in cross-section, foveolate, minutely tuberculate or pustulate-rugulose 66.
66. Stem leaves narrowly oblong-obovate, early deciduous. Seeds tetrahedral with more or less equal facets, transversely pustulate-rugulose 44. *E. szovitsii*.
- + Stem leaves linear, persistent. Seeds quadrangular with irregular facets or subquadrangular, foveolate or tuberculate 67.
67. Stem leaves, ray and raylet leaves linear, not enlarged at base. Seeds foveolate, subquadrangular in cross-section 54. *E. ledebourii*.
- + Stem leaves linear, ray and raylet leaves narrowly triangular, slightly enlarged at base. Seeds tuberculate, quadrangular in cross-section, with unequal facets: those adjacent to raphe concave, other slightly convex 51. *E. exigua*.
- 68 (64). Seeds hexangular or quadrangular in cross-section, with prominent edges and flat facets 69.
- + Seeds subquadrangular in cross-section, only the facets adjacent to raphe flat 73.
69. Seeds hexangular in cross-section 70.
- + Seeds quadrangular in cross-section 71.
70. Capsule alate. Seeds 1.2–1.5 mm long, longitudinally sulcate on facets adjacent to raphe, foveolate on other ones 55. *E. pephus*.
- + Capsule not alate. Seeds 1.6–1.7 mm long, on all facets longitudinally sulcate 57. *E. aulacosperma*.
- 71 (69). Stem leaves almost rounded. Glands minute, narrowly elliptic, without appendages. Seeds ca. 2.5 mm long. Endemic to Talysh 2. *E. hyrcana*.
- + Stem leaves elliptic or spatulate. Glands more or less prominent, semilunate or trapezoid, with or without appendages. Seeds 1–2 mm long. More widely distributed plants 72.

72. Capsule conical. Seeds dorsiventrally compressed, shallowly quadrangular in cross-section, transversely sulcate on facets 31. *E. falcata*.
 + Capsule subovoid. Seeds regularly quadrangular in cross-section, transversely pustulate-rugulose on facets 44. *E. szovitsii*.
 73 (68). Seeds foveolate or minutely tuberculate 74.
 + Seeds tuberculate-rugulose or longitudinally rugulose 75.
 74. Stem leaves filiform, numerous, imbricate, 0.5–1.5 mm wide, usually early caudicous. Seeds tuberculate, 1.3–1.7 mm long 26. *E. aleppica*.
 + Stem leaves obovate or oblong, not imbricate, more or less persistent, 2–3 mm wide. Seeds foveolate, 1.6–2 mm long 53. *E. taurinensis*.
 75. Raylet leaves ovate or ovate-elliptic. Seeds irregularly rugulose or tuberculate-rugulose, 1.6–1.7 mm long, caruncle prominent, more or less persistent. Plants of Transcaucasia and Talysh 56. *E. arvalis*.
 + Raylet leaves elliptic or oblong. Seeds longitudinally sulcate-rugulose, 1.3–1.4 mm long, caruncle minute, early caudicous. Endemic to Stavropol Heights 32. *E. normannii*.
 76 (3). Stems erect or ascendent, leaves 1–4 cm long, with hairs 0.7–1.5 mm long 71. *E. nutans*.
 + Stems prostrate, leaves 0.3–1 cm long, with hairs 0.2–0.7 mm long or glabrous 77.
 77. Capsules appressedly pilose 78.
 + Capsules glabrous or squarrosely pilose 79.
 78. Stems in upper part usually squarrosely pilose. Seeds 0.8–0.9 mm long 77. *E. maculata*.
 + Stems in upper part usually crispate pilose. Seeds 1–1.2 mm long 78. *E. forskalii*.
 79. Leaves entire or subentire 80.
 + Leaves dentate or crenulate 81.
 80. Seeds ovate-conical, smooth, ripe ones sometimes papillate, 2–3.5 mm long. Plants of sea shores 72. *E. peplis*.
 + Seeds narrowly ovoid-cylindric, quadrangular, irregularly foveolate-rugulose, 1–1.4 mm long. Plants of steppes and semideserts 76. *E. granulata*.
 81. Seeds ovoid-quadrangular, smooth, sometimes papillate when ripe 73. *E. humifusa*.
 + Seeds transversely rugulose or cristate 82.
 82. Seeds irregularly transversely rugulose on facets. Style 0.3–0.5 mm long, stigma not sessile 74. *E. chamaesyce*.
 + Seeds with 3–5 transverse almost regular ribs on facets. Style 0.1–0.2 mm long, stigma subsessile 75. *E. glyptosperma*.

Taxonomic treatment

Euphorbia L.

Subgen. 1. *Esula* Pers.

Sect. 1. *Lathyris* Dumort.

1. *E. lathyris* L. 1753, Sp. Pl.: 457. = *Tithymalus lathyris* (L.) Hill, 1768, Hort. Kew.: 172.3. — Lectotype (Geltman, 2015b: 129): “Herb. Linn. № 630.32” (LINN!).

Roadsides, sea shores, human settlements; alien.

WTC: 7b, 7c, 7d, 7e; **ETC:** 9d. — TCS.

The origin of *E. lathyris* is not yet clear. It is now found in both the Mediterranean and neighboring areas as well as in Eastern Asia. Most of the available herbarium specimens from the Caucasus were collected in the 19th or early 20th centuries. Pasta and Troia (2019) stated that this species was much more frequent and commonly used as a medicinal plant in southern Italy and Sicily until 2–3 centuries ago, as well as in the classical ages.

Euphorbia lathyris was included in the “Cultivated flora of the USSR” as an oil-producing plant (Sharapov, 1941). Sinskaya (1969: 246) believed that *E. lathyris* occurred wild in the mountains of Western China and was cultivated in Eastern Asia as an oil plant; she also mentioned that its culture in Japan has now entirely ceased.

Sect. 2. *Lagascae* Lázaro

2. *E. hyrcana* Grossh. 1920, Trudy Tiflissk. Bot. Sada, 2 (1): 7. — Lectotype (Geltman, 1991a: 112): “Prov. Baku, dist. Lenkoran (Talysh), Lerik, in faucibus fl. Jataganovtshaj, in fruticetis, 21 IV 1915, A. Grossheim” (TBI!).

Stony montane slopes, bush thickets.

T. — TCS. — Irano-Turanian element.

Known only from the vicinity of the village Lerik near Lenkoran by a few gatherings. Morphologically is very similar to *E. phymatosperma* Boiss. et Gaill. Prokhanov (1949) treated this species as a synonym of *E. peplus*, but his opinion was based on misinterpretation of the original material of *E. hyrcana* — see details in Geltman (1991a). Unfortunately, such misinterpretation was recently repeated by Pahlevani et al. (2020) that led to wrong sectional attribution.

Sect. 3. *Helioscopia* Dumort.

3. *E. coniosperma* Boiss. et Buhse, 1860, Nouv. Mém. Soc. Nat. Moscou, 12: 196. — Lectotype (Rechinger, Schiman-Czeika, 1964: 26): “Persia, 1847, Buhse” (G!; isoelectotype — LE 01070910!).

= *E. ancylensis* Azn. ex M. S. Khan, 1964, Notes Roy. Bot. Gard. Edinburgh, 25: 106. = *Tithymalus ancylensis* (Azn. ex M. S. Khan) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 170. — Holotype: “Pl. de Turquie, coll. Frères, in Hb Aznavour” (G!; isotype — E 00362396!).

Dry steppes on clayey soils.

ETC: 9c; **SWTC:** 10a; **STC:** 11a, 11c, 11d. — TCS. — Irano-Turanian element.

The lectotype of *E. coniosperma* has a standard printed label “Persia, Buhse”, although in fact the plant

was collected in present-day Armenia. The isolectotype (LE) has two labels: the original “Gamarlu” and the later “In der Araxesebene bei Erevan u. Gamarlu, April 1847, Buhse” (similar to the text from the protologue). There is little doubt that the G and LE sheets are parts of a single gathering, because there is a record in the protologue that the species was known by a single specimen (Boissier, Buhse, 1860: 196).

4. *E. eriophora* Boiss. 1844, Diagn. Pl. Orient., sér. 1, 5: 51. ≡ *Tithymalus eriophorus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin, 1859: 65. — Type unknown.

= *E. lasiocarpa* K. Koch, 1849, Linnaea, 21: 721, nom. illeg., non Klotzsch, 1843. — Type: “in herb. Gundelsheimer” (Koch, 1849: 721).

Clayey steppes, fallow lands and cultivated grounds.

STC: 11a, 11c, 11d. — TCS. — Irano-Turanian element.

Regarding the record for NWTC: 6a (Zernov, 2000, 2006) — see comment under *E. hirsuta*.

The holotype of *E. eriophora* is likely missing (Khan, 1964).

5. *E. rhabdotosperma* Radcl.-Sm. 1975, Notes Roy. Bot. Gard. Edinb. 34, 1: 129. ≡ *Tithymalus rhabdotospermus* (Radcl.-Sm.) Holub, 1977, Folia Geobot. Phytotax. 12: 428. — Holotype: “Elmali-Korkuteli, 8 km from Elmali, in dry steppe, 1120 m, 31 III 1962, Dudley (Davis 35223)” (E 00359917; isotype — K 001080014!).

Stream banks, especially on gravel substrate, pastures and agricultural lands, roadsides.

ECC: 2c; **CC:** 4c; **EC:** 5a (vicinity of Grozny), 5b (north), 5c, 5d; **CTC:** 8a; **ETC:** 9b, 9c, 9d, 9e; **SWTC:** 10a, 10b; **STC:** 11a, 11b, 11d, 11f, 11g; **T:** — NSC, TCS. — Submediterranean element.

6. *E. helioscopia* L. 1753, Sp. Pl.: 459. ≡ *Tithymalus helioscopius* (L.) Hill, 1768, Hort. Kew.: 172.3. — Lectotype (Jafri, El-Gadi, 1982: 33): “Herb. Linn. № 630.49” (LINN!).

Cultivated grounds, roadsides, stream banks and beds, forest margins.

WCC: 1a; **WC:** 3c; **EC:** 5c, 5d; **NWTC:** 6a; **WTC:** 7a, 7b, 7c, 7e; **CTC:** 8a, 8b; **ETC:** 9b, 9c, 9d, 9e; **STC:** 11d, 11e, 11f, 11g; **T:** — NCS, TCS. — European-Pantethyan element.

Two subspecies are accepted here. Their distribution in the Caucasus is almost identical, although in more northern areas only the type subspecies is found. Subsp. *helioscopioides* is restricted to more natural habitats and usually has an autumn — spring life cycle. Both subspecies are evidently undercollected in the area.

Key to the subspecies

1. Stems solitary, erect, rarely ascendent .. subsp. *helioscopia*.
- + Stems numerous, ascendent at the base subsp. *helioscopioides*.

6a. *E. helioscopia* L. subsp. *helioscopia*.

Cultivated grounds, roadsides, sometimes by stream banks.

WCC: 1a; **WC:** 3c; **EC:** 5c, 5d; **NWTC:** 6a; **WTC:** 7a, 7b, 7c, 7e; **CTC:** 8a, 8b; **ETC:** 9b, 9c, 9d, 9e; **STC:** 11d, 11e, 11f, 11g; **T:** — NCS, TCS.

6b. *E. helioscopia* L. subsp. *helioscopioides* (Loscos et J. Pardo) Nyman, 1881, Consp. Fl. Europ. 3: 651. ≡ *E. helioscopioides* Loscos et J. Pardo, 1863, in H. M. Willkomm (ed.), Ser. Inconf. Pl. Aragon.: 93. ≡ *Tithymalus helioscopius* (L.) Hill subsp. *helioscopioides* (Loscos et J. Pardo) Soják, 1972, Čas. Nár. Mus., Odd. Přír. 140: 173. ≡ *T. helioscopioides* (Loscos et J. Pardo) Holub, 1977, Folia Geobot. Phytotax. 12: 428. — Syn type (?): “Castelseras in Aragonia, ex herb. Loscos” (MPU 014450 — image!).

= *E. helioscopia* L. subsp. *hiemalis* A. P. Khokhr. 1989, Byull. Moskovsk. Obshch. Isp. Přír., Otd. Biol. 94, 6: 96. — Holotype: “Аджарская АССР, Хелвачаурский р-н, Эрге, осыпь под скалами, 1 III 1988, А. П. Хохряков [Adjara ASSR, Khelvachauri district, Erge, scree under the rocks, 1 III 1988, A. P. Khokhryakov]” (MW 0593507!).

Stream banks and beds, forest margins, less often as a weed in cultivated grounds.

WCC: 1a; **EC:** 5c, 5d; **WTC:** 7a, 7b, 7c, 7e; **CTC:** 8a; **ETC:** 9b, 9c, 9d, 9e; **STC:** 11e, 11f, 11g; **T:** — NCS, TCS.

7. *E. hirsuta* L. 1759, Amoen. Acad. 4: 483. — Type not designated.

= *E. pubescens* Vahl, 1791, Symb. Bot. 2: 55. ≡ *Tithymalus pubescens* (Vahl) Samp. 1931, Anais Fac. Sci. Porto, 17: 46. — Lectotype (Radcliffe-Smith, 1982): “circa Zowan, herb. Vahl [2201/28]” (C 10000684 — image!).

— *E. verrucosa* auct. non L.: M. S. Khan, 1964, Notes Royal Bot. Gard. Edinb. 25 (2): 103.

Gravel beaches and wetlands near seashore.

?**NWTC:** 6a; **WTC:** 7b, 7c, 7e. — ?NCS, TCS. — Macaronesian-Mediterranean element.

Zernov (2000, 2006) collected in NWTC: 6a (Краснодарский край, Анапа, песчаный пляж, 22 VIII 1998, А. С. Зернов, № 311 [Krasnodar Territory, Anapa, sand beach, 22 VIII 1998, Zernov 311] (MW 0690215!)) a small undeveloped densely pubescent *Euphorbia* plant which he identified as *E. eriophora*. However this specimen could belong to *E. hirsuta* as well and its habitat is more typical for the latter than for the for-

mer. Until now there is no reliable records of the occurrence of normally developed *E. hirsuta* in this area, although it is quite probable because this species recently was found in Crimea (Geltman, Shatko, 2012).

8. *E. condylocarpa* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 377. ≡ *Tithymalus condylocarpus* (M. Bieb.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 78. — **H o l o t y p e**: “Ex Caucaso cabardinico, circa Narzana lecta, 1800 [Bieberstein]” (LE 01070909!).

= *E. amplexicaulis* Ledeb. 1850, Fl. Ross. 3 (2): 567, nom. illeg., non Hook. f. 1847. ≡ *Tithymalus amplexicaulis* Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 80. — **H o l o t y p e**: “Schuscha, herb. Ledebour, 830.35” (LE 01057260!).

= *E. cardiophylla* Boiss. et Heldr. 1853, in Boiss., Diagn. Pl. Orient., sér. 1, 12: 107. ≡ *Tithymalus cardiophyllus* (Boiss. et Heldr.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 78. — **H o l o t y p e**: “Mt. Solima reg. infer. en montant a Kartsibahir, in fruticeti, 1 V 1845 [Heldreich], № 1058” (G-BOISS!).

Steppes and meadows, sometimes shrub thickets or sparse forests, usually on clacareous soils or rocks; 300–2400 m.

WCC: 1b; **WC**: 3a, 3b, 3c; **CC**; **EC**; **NWTC**: 6a; **WTC**: 7c, 7d, 7e; **CTC**; **ETC**; **SWTC**: 10b, 10c; **STC**; **T**. — NCS, TCS. — Submediterranean element.

9. *E. stricta* L. 1759, Syst. Nat., ed. 10, 2: 1049. ≡ *Tithymalus strictus* (L.) Klotzsch et Garcke, 1858, Fl. N. Mitt.-Deutschland, ed. 4: 290. ≡ *Euphorbia platyphyllos* L. var. *stricta* (L.) Fiori, 1901, Fl. Italia, 2: 281. — **L e c t o t y p e** (Radcliffe-Smith, 1982: 593): “Herb. Linn. № 630.54” (LINN!).

= *E. serrulata* Thuill. 1799, Fl. Env. Paris, ed. 2: 237. ≡ *E. platyphyllos* L. var. *serrulata* (Thuill.) Pers. 1806, Syn. Pl. 2: 18. ≡ *Tithymalus serrulatus* (Thuill.) Holub, 1970, Preslia, 42: 94. — Type unknown.

= *E. micrantha* Stephan ex Willd. 1799, Sp. Pl. 2: 905. ≡ *Tithymalus micranthus* (Stephan ex Willd.) Raf. 1838, Fl. Tellur. 4: 115. ≡ *Euphorbia stricta* L. subsp. *micrantha* (Stephan ex Willd.) Nyman, 1881, Consp. Fl. Eur.: 651. — **L e c t o t y p e** (Geltman, 2015b: 130): “Habitat in Persia, Stephan” (B-W 09318!).

= *E. densifolia* K. Koch, 1849, Linnaea, 21: 722. — **L e c t o t y p e** (Geltman, 2011: 120): “Caucasus, Wilhelms” (LE 01070914!).

Meadows, forest glades and margins, pastures, sand and gravel river banks and sea shores, roadsides, cultivated grounds; very common; 0–2100 m.

WCC; **ECC**; **WC**; **CC**; **EC**; **NWTC**; **WTC**; **CTC**; **ETC**; **SWTC**: 10a, 10b; **STC**: 11e, 11f; 11g; **T**. — NCS, TCS. — European-Pantethyan element.

10. *E. platyphyllos* L. 1753, Sp. Pl.: 460. ≡ *Tithymalus platyphyllos* (L.) Hill, 1768, Hort. Kew.: 172.4. — **L e c t o t y p e** (Geltman, designated here): “Herb. Linn. № 630.61” (LINN!).

Naturalized in botanical gardens.

?**CC**: 4a (Zheleznovodsk); **STC**: 11a (Yerevan botanical garden). — ?NCS, TCS. — Euro-Siberian element.

The only reliable record of this species for the Caucasus is one from the Yerevan Botanical Garden where it is evidently alien and naturalized. There is also a specimen: “Железноводск [Zheleznovodsk], 17 V 1887, Herb. Akinfiewi” (TBI) which could be referred to this species. Most probably this specimen was wrongly labeled, especially taking into account that another species with dubious presence in the Caucasus (*E. agraria*) also is known only from Zheleznovodsk according to Akinfiev’s gatherings. Chintibidze and Gvinianidze (1983: 160) mention *E. platyphyllos* for WTC: 7b but the voucher herbarium specimens (SUKH) in my opinion belong to *E. stricta*. At the same time it is impossible to exclude that *E. platyphyllos* could be found as native in the Caucasus since it also occurs in Crimea.

11. *E. microsphaera* Boiss. 1846, Diagn. Pl. Orient., sér. 1, 7: 87. ≡ *Tithymalus microsphaerus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 74. — **L e c t o t y p e** (I: Rechinger, Schiman-Czeika, 1964: 26; II: Geltman, designated here): “In humidis ad rad. m. Sabst-Buschom prope Schiraz, 31 V 1842, Kotschy, № 448” (W 0031040!; isolectotypes: A 00277273 — image!, BM 000951541!, CAS 00123963 — image!, FI 011590 — image!, G-DC 00311672!, G 00441434!, G-BOISS!, GOET 003734 — image!, JE 00002899, 00002900 — image!, K001080030!, L 0150814 — image!, LE 01071213!, MO-260133–260135!, P 00702735!, 00702737–00702740 — images!, WAG0004311 — image!, W 0031041, 0031042, 1889-0154945, 1889-0159509!, WU 0069098!).

= *E. subtuberculata* C. A. Mey. ex Boiss. 1862, in DC., Prodr. 15, 2: 118. — **L e c t o t y p e** (Geltman, 2015b: 131): “Rarior ad vias circa Khoi prov. Aderbaidzhan, 15 VI 1828, Szovits” (LE 01071317!).

Coastal cliffs.

T. — TCS. — Submediterranean element.

Known for the area from a single specimen: “Ленкорань, близ сел. Н. Ньюады, береговой обрыв, 11 VI 1931, Н. Шипчинский, № 147 [Lenkoran, near Nizhniye Nyuady, 11 VI 1931, N. Schipczinsky, № 147]” (LE 01071326!).

Rechinger and Schiman-Czeika (1964) unintentionally designated a specimen kept in W as the lectotype of *E. microsphaera*. However, there are several suitable

specimens in W, so the next step of lectotype selection is done here. The selection of the lectotype of this name done by me (Geltman, 2012: 501) now appears to be superfluous.

12. *E. hierosolymitana* Boiss. 1853, Diagn. Pl. Orient., sér. 1, 12: 110. = *E. thamnoides* Boiss. var. *hierosolymitana* (Boiss.) Boiss. 1862, in DC., Prodr. 15, 2: 131. — Lectotype: (Geltman, 2008: 150): “Palaestina, Eirusalem, IV–V 1846, E. Boissier” (G-BOISS!, isolecotypes: G-DC 00312179!, G 00441419!).

= *E. dumosa* Boiss. 1853, Diagn. Pl. Orient., sér. 1, 12: 110, nom. illeg., non A. Rich. 1850. = *E. thamnoides* Boiss. 1860, Cent. Euphorb.: 33. = *Tithymalus thamnoides* (Boiss.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 177. — Lectotype (Geltman, 2006b: 163): “Syria, Tripoli, V–VII 1846, E. Boissier” (G-BOISS!, isolecotypes: G-DC!, K 001080021!, LE 01071250!, 01071251!).

Rocks.

WTC: 7e (Chorokh valley, Erge). — TCS. — Mediterranean element.

This Mediterranean species is known only from a single specimen in the Caucasus: “Аджария, Батумский р-н, Эпре, 15 XI 1969, А. Дмитриева [Adjara, Batumi district, forest rocks of Chorokh gorge, 15 XI 1969, A. Dmitrieva]” (LE 01071325!). This specimen has part of certainly lignescent shoot, which is characteristic of *E. hierosolimitana*. This locality is very disjunct from the main part of the species distribution area.

13. *E. wittmannii* Boiss. 1860, Cent. Euphorb.: 3. — Lectotype (Radcliffe-Smith, 1982: 590): “Südrussland (Atskur, Osurgeti, etc.), Wittmann” (LE 01070961!).

Stony slopes and rocks.

WTC: 7d (Osurgeti); **CTC:** 8a (Borjomi, Bakuriani); **STC:** 10a. — TCS. — Euro-Siberian (Caucasian) element.

There are some morphological characters, especially a very short style, which this species has in common with European species of the *E. verrucosa* L. group (*E. flavicoma* DC., *E. polygalifolia* Boiss. et Reut., *E. spinosa* L., etc.).

The lectotype selection done by me (Geltman, 2008: 122) appears to be superfluous.

14. *E. orientalis* L. 1753, Sp. Pl.: 460. = *Tithymalus orientalis* (L.) Hill, 1768, Hort. Kew.: 172.3. — Lectotype (Croizat, 1938: 98): “Herb. Linn. № 630.60” (LINN!).

= *E. notadenia* Boiss. et Hohen. 1853, in Boiss., Diagn. Pl. Orient., sér. 1, 12: 111. = *Tithymalus notadenius*

(Boiss. et Hohen.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 78. — Lectotype (Geltman, designated here): “In monte Elbrus [Elburs] pr. Derbend, 30 VI 1843, Th. Kotschy, № 420 (Pl. Pers. bor. Ed. R. F. Hohenacker, 1846)” (G-BOISS!, isolecotypes: FI 011589 — image!, G!, LE 01071139!, 01071310!, P 00606917!).

= *E. artvinensis* Bornm. et Woronow, 1912, Vestn. Tiflissk. Bot. Sada, 26: 3. — Lectotype (Geltman, 2015b: 127): “Артвинский окр., долина Аргамуг-су близ уроч. Горгота-ханч, 12 VII 1911, Ю. Воронов, № 5681 [Artvin district, valley of the river Arganuchsu near Gorgota-khanch terrain feature, 12 VII 1911, Woronow, № 5681]” (TBI 28701!).

Stony slopes, wadies, eroded sandy and clayey places; 1300–2100 m.

SWTC: 10c; **STC:** 11a, 11b, 11c, 11d, 11e, 11f. — TCS. — Irano-Turanian element.

15. *E. macrocarpa* Boiss. et Buhse, 1860, Nouv. Mém. Soc. Nat. Moscou, 12: 197. = *Tithymalus macrocarpus* (Boiss. et Buhse) Prokh. 1949, Fl. URSS, 14: 350, nom. illeg., non (Bentham) Croizat, 1937. = *T. notabilis* Soják, 1972, Čas. Nar. Mus., Odd. Prír. 140: 174. — Lectotype (Khan, 1964: 94): “Persia, Ssamam [1 VI 1848], Buhse” (G-BOISS!, isolecotypes: BR 0000005106370 — image!, LE 01071134!, W 1889-0080953, 1963-0023445!).

Clayey steppes, sparse forests on rocks.

ETC: 9b (Gobustan area); **STC:** 11f (between Karchavan and Agarak). — TCS. — Irano-Turanian element.

16. *E. squamosa* Willd. 1799, Sp. Pl. 2, 2: 918. = *Tithymalus squamosus* (Willd.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 78. — Holotype: “Herb. Willd. № 9358” (B-W 09358-010!). — Fig. 2: A–C.

= *E. aspera* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 377. = *Tithymalus asper* (M. Bieb.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 78. — Lectotype (Geltman, 2006: 162): “Ex Caucaso demissiore ruthenico, 1800, [Bieberstein]” (LE-Bieb.: LE 01070983!).

= *E. muricata* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 378. — Lectotype (Geltman, 2006: 163): “Ex Iberia, 1806, Steven” (LE-Bieb.: LE 01071029!).

= *E. muricata* M. Bieb. var. *wilhelmsiana* K. Koch, 1849, Linnaea, 21: 725. = *E. squamosa* Willd. var. *wilhelmsiana* (K. Koch) Oudejans, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 188. — Lectotype (Geltman, 2015b: 130): “Caucasus, Wilhelms” (LE 01070940!).

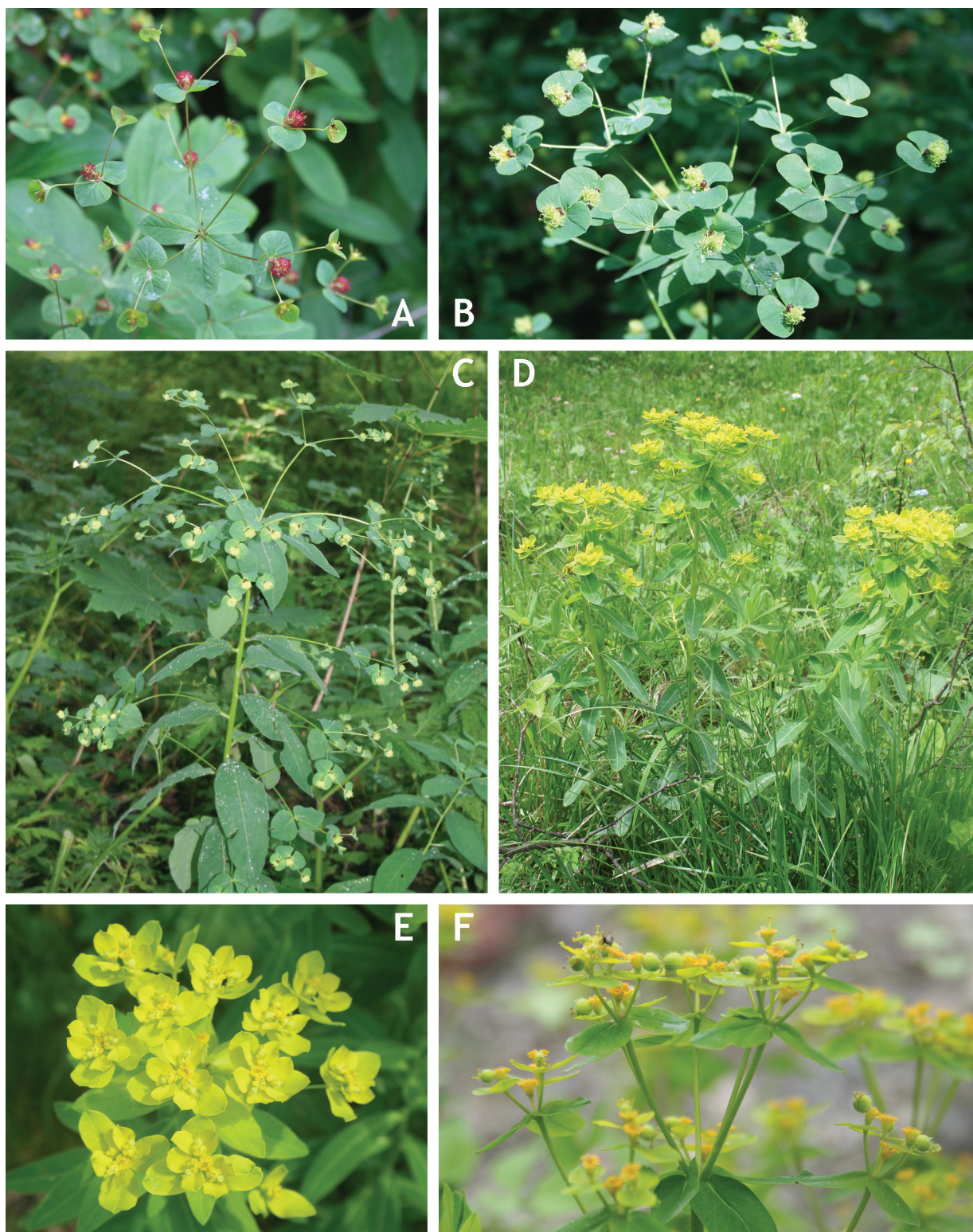


Fig. 2. Caucasian species of *Euphorbia* section *Helioscopia*.

Euphorbia squamosa: A, B — apical synflorescences, C — habit; *E. procera*: D — habit, E, F — apical synflorescences.

= *E. aspera* M. Bieb. var. *serrata* Boiss. 1862, in DC., Prodr. 15, 2: 124. — **H o l o t y p e**: “Imeretien, Eichwald (Herb. Ledebour)” (LE 01057264!).

= *E. talyschensis* Boiss. et Buhse, 1860, Nouv. Mém. Soc. Nat. Moscou, 12: 196. ≡ *E. aspera* M. Bieb. var. *oligadenia* Boiss. 1862, in DC., Prodr. 15, 2: 124 (1862). — **L e c t o t y p e** (Geltman, 2015b: 131): “Massula, IV 1848, Buhse” (LE 01070957!, isoelectotype: G-BOISS).

= *E. abchazica* Woronow, 1912, Vestn. Tiflissk. Bot. Sada, 22: 3. — **L e c t o t y p e** (I: Chinthibidze, Gvinianidze, 1983: 157; II: Geltman, designated here): “Abchazia occid., locus Mombeschta inter mm. Mamdzyschcha et Kutysch, pascua alpina, 6500', 28 VII / 10 VIII 1905, G. Woronow, № 356” (TBI 1025054!, isoelectotype: LE 01057259!).

Forests, rarely subalpine meadows and krummholz; 50–2400 m.

WCC: 1a (Stavropol Heigth); **WC**; **CC**; **EC**: 5a, 5b, 5c, [?5d]; **NWTC**; **WTC**; **CTC**: 8a, 8c [?8b]; **ETC**: 9a, 9c, 9d, 9e, [?9f]; **SWTC**: 10a; **STC**: 11a, 11b, 11f, 11g; **T**. — NCS, TCS. — Euro-Siberian (Caucasian-Euxinian-Hyrcanian) element.

Typical element of broadleaved (sometimes mixed) forests, also penetrates into the subalpine belt. Variable, especially in the length of warts on capsules, but this variation does not correlate with geographical distribution or habitat preferences.

17. *E. czerepanovii* Geltman, 1997, Bot. Zhurn. 82 (3): 122. — **H o l o t y p e**: “Дагестанская АССР, Гумбетовский р-н, между сел. Буртанай и перевалом к сел. Данух; опушка букового леса по склону к речке, 17 VI 1961, Н. Н. Цвелёв, С. К. Черепанов, Г. Н. Непли, А. Е. Бобров, № 1220 [Daghestan ASSR, Gumbetovsky district, between village Burtanai and pass to village Danukh, margin of beech forest on the slope to the stream, 17 VI 1961, Tzvelev et al., № 1220]” (LE 01070911!).

Forests.

EC: 5b (Salatau range); **ETC**: 9a (Lagodekhi, Khochaldagh mountain). — NCS, TCS. — Euro-Siberian (Caucasian) element.

Very similar to *E. squamosa*, but differs in larger seeds (ca. 3 mm long). The type specimen also differs by its larger raylet leaves. The second known specimen was collected on the south slope of Mt. Khochaldagh located just at the border between Russia and Georgia (Georgia, Kachetia, pr. pag. Lagodechi, m. Choczaldag, 6 VIII 1935, W. Kozłowski (TBI)). This species is likely a relict restricted to the Eastern Caucasus. Probably, it gradually disappears due to hybridization with *E. squamosa*.

18. *E. djimilensis* Boiss. 1879, Fl. Or. 4: 1104. ≡ *Tithymalus djimilensis* (Boiss.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 171. — **L e c t o t y p e** (I: Khan, 1964: 93; II: Geltman, designated here): “Environs de Djimil (Lazistan), vers 2200 metres d'altitude, VII 1866, Balansa, № 1440” (G-BOISS; isoelectotypes: F 0056676F — image!, G 00441427!, GOET 003712 — image!, JE 00004090 — image!, K 001080026!, LE 0107128!, 01071283!, P 00606718–00606720!, US 00109333!, W 1889-0042024!, 0031053!).

Rhododendron caucasicum Pall. and *Juniperus hemisphaerica* C. Presl subalpine krummholz; 2000–2300 m.

WTC: 7b, 7e. — TCS. — Euro-Siberian (Euxinian) element.

Khan (1964) selected the “type” specimen from G. However, there are more than one specimens in G, so additional selection is necessary. In the Caucasus *E. djimilensis* mostly occurs in Adjara, but one specimen is also known from Abkhazia.

19. *E. scripta* Sommier et Levier, 1892, Trudy Imp. S.-Peterburgsk. Bot. Sada, 12 (5): 159. ≡ *Tithymalus scriptus* (Sommier et Levier) Prokh. 1949, Fl. URSS, 14: 348, nom. altern. — **L e c t o t y p e** (Geltman, 2015b: 131): “Svanetia libera, in jugo Utviri inter flumina Nakra et Nenskra, 2500 m, 19 VIII 1890, Sommier et Levier, № 1186” (FI, sheet with handwritten species — image!, isoelectotype: FI — image!).

Grass communities in subalpine and alpine belt; 1800–2300 m.

WC: 3b (Mt. Bolshoi Bambak); 3c (vicinity of Dombai, the Gonachkhir River); **WTC**: 7a, 7b, 7c. — NCS, TCS. — Euro-Siberian (Euxinian) element.

Similar to *E. djimilensis*, but differs in the length of processes on the capsule and in seed size, as well as slightly different habitat preferences. See more in Geltman (1991b).

20. *E. ardonensis* Galushko, 1976, Novosti Sist. Vyssh. Rast. 13: 210. ≡ *Tithymalus ardonensis* (Galushko) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **L e c t o t y p e** (Geltman, 2002a: 122): illustration in Galushko, 1976, Novosti Sist. Vyssh. Rast. 13: 211.

Rocks; 1200 m.

CC: 4c (valley of the Ardon River). — NCS. — Euro-Siberian (Caucasian) element.

Although Galushko (1976) mentioned that the type of *E. ardonensis* should be in LE, it was not found there despite careful search, so the illustration was designated as lectotype.

Very rare species known from a single locality — the valley of the Ardon River in the area of Skalistyi Range (Terekbaev, 1991). The apical synflorescence is reduced

to a single cluster of few cyathia (similar to *E. capitulata* Rchb.).

21. *E. palustris* L. 1753, Sp. Pl.: 462. — *Lectotype* (Polyatschek, 1971: 190): “Herb. Linn. № 630.69” (LINN!).

Wetlands, river banks.

WCC: 1a; **NWTC:** 6a; **WTC:** 7b, 7c. — NCS, TCS. — Euro-Siberian element.

Galushko (1980) recorded this species for ETC, but without precise localities. It is quite probable taking into account habitat preferences of the species, although there are no herbarium specimens from this area.

22. *E. aristata* Schmalh. 1892, Ber. Deutsch. Bot. Ges. 10: 292. ≡ *Tithymalus aristatus* (Schmalh.) Prokh. 1933, Sist. Obzor Moloch. Sredn. Azii: 108. ≡ *Euphorbia soongarica* Boiss. subsp. *aristata* (Schmalh.) Prokh. et Kuzm. 1961, Izv. Bot. Inst. (Sofia), 8: 148. ≡ *Tithymalus soongaricus* (Boiss.) Prokh. subsp. *aristatus* (Schmalh.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 176. — *Lectotype* (Geltman, 2008: 139): “Auf steinigen Böden in Полковничий яр, 20 VI 1878, 20 V 1879, A. Normann [Auf steinigen Böden in Polkovnichy Yar, 20 VI 1878, 20 V 1879, A. Normann]” (KW 147557!).

Wet saline places on slopes of ravines.

WCC: 1b (Stavropol Heights). — NSC. — Euro-Siberian (Caucasian) element.

This species is a member of the complex of closely related species (*E. aggr. soongarica* — see Geltman, 2008) which includes also Central Asian *E. soongarica* Boiss., *E. lamprocarpa* (Prokh.) Prokh. and *E. velenowskyi* Bornm. from the Balkans. *E. aristata* differs from the others by its long-aristate leaf apex (especially leaves of axillary vegetative shoots), but this character is not very stable. The complex definitely needs careful revision and phylogeographic studies.

23. *E. procera* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 378. ≡ *Tithymalus procerus* (M. Bieb.) Klotzsch et Garcke, 1858, Fl. N. Mitt.-Deutschland, ed. 4: 291. ≡ *Euphorbia pilosa* L. var. *procera* (M. Bieb.) Nyman, 1881, Consp. Fl. Eur.: 650. — *Lectotype* (Geltman, 2006: 163): “Ex Tauria et Caucaso demissiora” (LE-Bieb.: LE 01071040!). — Fig. 2: D–F.

= *Euphorbia caucasica* Dubovik, 1977, Novosti Sist. Vyssh. Nizsh. Rast. (Kiev), 1976: 96. — *Holotype*: “Краснодарский край, Геленджикский горсовет, Архипо-Осиповка, в сосновом лесу из *Pinus pithyusa*, 27 V 1975, О. Дубовик [Krasnodar Region, Gelendzhik city area, Arkhipo-Osipovka, in pine forest of *Pinus pithyusa*, 27 V 1975, Dubovik]” (KW 02226!, isotype: KW 02225!).

— *E. villosa* auct. non Waldst. et Kit.: Prokh. 1949, Fl. URSS, 14: 359; Khalilov, 1955, Fl. Azerb. 6: 114; Ter.-Chatsch. et Tamamsch. 1973, Fl. Armenii, 6: 102; Chint. et Gvinian. 1983, Fl. Georgiae, ed. 2, 8: 158.

Forest glades and margins, meadows in forest belt; 300–2200 m.

WCC: 1a; **WC:** 3a, 3b, 3c; **CC:** **EC;** **NWTC;** **CTC;** **ETC:** 9c, 9e, 9f; **SWTC:** 10b, 10c; **STC:** 11a, 11b. — NCS, TCS. — Euro-Siberian (Caucasian) element.

Very similar to European *E. illirica* Lam. (= *E. villosa* Waldst. et Kit.), but differs by generally larger seeds ((2.5)2.9–3.2 mm vs. 2.2–2.9 mm in *E. illirica*) and fruits often with cristate plicae.

24. *E. tauricola* Prokh. 1949, Fl. URSS, 14: 736. ≡ *Tithymalus tauricola* (Prokh.) Prokh. 1949, l. c.: 736, nom. altern. ≡ *E. austriaca* A. Kern. subsp. *tauricola* (Prokh.) Chrtek et Křisa, 1970, Preslia, 42: 263. — *Holotype*: “Крым, Бельбек, на опушке леса, 14 V 1898, К. Л. Гольде [Crimea, Belbek, forest margin, 14 V 1898, Golde]” (LE 01071096!, isotype: LE 01071101).

Forests; 300–800 m.

NWTC: 6a. — NCS. — Euro-Siberian element.

25. *E. eugeniae* Prokh. 1949, Fl. URSS, 14: 735. ≡ *Tithymalus eugeniae* (Prokh.) Prokh. 1949, l. c.: 735, nom. altern. — *Holotype*: “Красная Поляна, субальпийский луг при подъеме на г. Ачишхо, 10 VIII 1946, Е. Победимова [Krasnaya Polyana, subalpine meadow on the slope of Achishkho mountain, 10 VIII 1946, E. Pobedimova]” (LE 01070915!). — Fig. 3.

Subalpine and alpine meadows, gravel screes on acid substrate, can be dominant in the plant cover; 1900–2100 m, sometimes at lower elevation near streams.

WC: 3b (upper reaches of the Bolshaya Laba River basin); **WTC:** 7a, 7b. — NCS, TCS. — Euro-Siberian (Euxinian) element.

Subendemic to Abkhazia.

Sect. 4. **Myrsiniteae** (Boiss.) Lojac.

26. *E. aleppica* L. 1753, Sp. Pl.: 458. ≡ *Tithymalus aleppicus* (L.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 84. — *Lectotype* (Turland, 1995: 136): “Herb. Linn. № 630.46” (LINN!).

= *E. condensata* Fisch. ex M. Bieb. 1819, Fl. Taur.-Cauc. 3: 322. ≡ *E. aleppica* L. var. *condensata* (M. Bieb.) K. Koch, 1848, Linnaea, 21: 729. — *Lectotype* (Geltman, 2015b: 128): “Ex Iberia, circa Tiflis, comm. Fischer [Wilhelms]” (LE-Bieb.: LE 01070990!; isolectotypes: LE 01071361–01071363!).

Roadsides, fields, fallow lands, dry montane slopes.

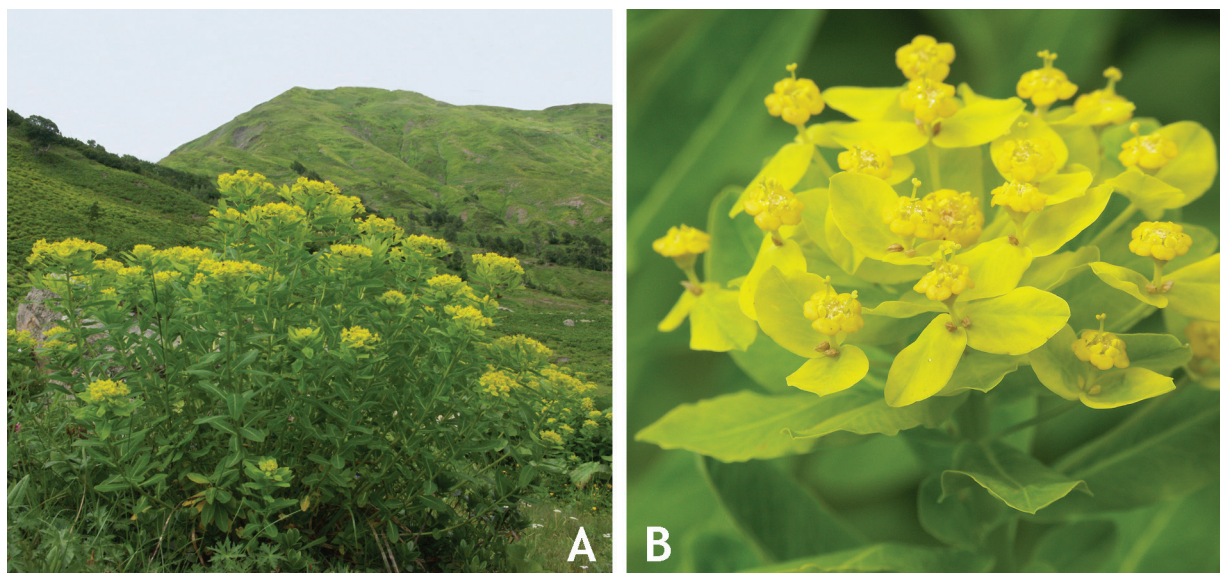


Fig. 3. *Euphorbia eugeniae*.

A — habit; yellow aspect of plant cover is formed by this species; B — apical synflorescence.

CTC: 8a; **ETC:** 9a, 9b, 9c, 9e; **STC:** 11a, 11g; **T.** — TCS. — Mediterranean element.

27. *E. rigida* M. Bieb. I 1808, Fl. Taur.-Cauc. 1: 375. $\equiv$ *Tithymalus rigidus* (M. Bieb.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 176. — **Lectotype** (I: Khan, 1964: 147; II: Geltman, 2004: 162): “Ex Tauria meridionali [Marschall Bieberstein]” (LE-Bieb.: LE 01071047!). — Fig. 4: A.

= *E. biglandulosa* Desf. VIII 1808, Ann. Mus. Hist. Nat. (Paris), 12: 114. $\equiv$ *Tithymalus biglandulosus* (Desf.) Haw. 1812, Syn. Pl. Succ.: 141. — **Lectotype** (Geltman, 2009: 188): icon in Desf., 1808, Ann. Mus. Paris, 12, tab. 14; **epitype** (Geltman, 2009: 188): “Herb. Tournefort, № 122” (P!).

Coastal cliffs.

NWTC; WTC: 7a (Sochi, vicinity of Razdolnoye). — NCS, TCS. — Submediterranean element.

The species locality in 7a could be an escape from cultivation (Portenier, Solodko, 2006).

28. *E. armena* Prokh. 1949, Fl. URSS, 14: 741. $\equiv$ *Tithymalus armenus* Prokh. 1949, l. c.: 741, nom. altern. $\equiv$ *Euphorbia marschalliana* Boiss. subsp. *armena* (Prokh.) Oudejans, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 186. — **Holotype**: “Закавказье, Эчмиадзин, 25 IV 1910, A. A. Гроссгейм [Transcaucasia, Echmiadzin, 25 IV 1910, A. A. Grossheim]” (LE 01057262!).

Sparse forests, stony or clayey steppes and semideserts.

STC: 11a, 11c, 11d. — TCS. — Irano-Turanian element.

Closely related to *E. marschalliana* and recently regarded as its subspecies (Pahlevani et al., 2011). The record for CTC: 8a (Chinthibidze, Gvinianidze, 1983) belongs to *E. marschalliana*.

29. *E. marschalliana* Boiss. 1846, Diagn. Pl. Orient., ser. 1, 7: 94. $\equiv$ *Tithymalus marschallianus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 86. — **Lectotype** (I: Rechinger, Schiman-Czeika, 1964: 45; II: Geltman, 2004: 164): “in aridis arenosis prope Tatuni ditionis Swant, Georg. cauc., VI 1836, R. F. Hohenacker” (G-BOISS!; isolectotypes: G 00441442, K 001080049!, P 00606900!, 00606901!).

= *E. woronowii* Grossh. 1916, Trudy Tiflissk. Bot. Sada, 14: 26. $\equiv$ *E. marschalliana* Boiss. subsp. *woronowii* (Grossh.) Prokh. 1964, Novosti Sist. Vyssh. Rast. 1964 [1]: 232. — **Holotype**: “Prov. et distr. Erivan, Arasda, an mons Dagna, 10 V 1914, A. Grossheim” (TBI 1025067!).

Stony slopes, steppes and semideserts; 500–2400 m.

CTC: 8c; **STC:** 11a, 11b, 11c, 11d, 11f; **T.** — TCS. — Irano-Turanian element.

30. *E. myrsinites* L. 1753, Sp. Pl.: 461. $\equiv$ *Tithymalus myrsinites* (L.) Hill, 1768, Hort. Kew.: 172.4 (“*myrsinitis*”). — **Lectotype** (Pahlevani et al., 2011: 490): “Herb. Linn. № 630.68” (LINN!).

= *E. pontica* Prokh. 1949, Fl. URSS, 1949, 14: 740. $\equiv$ *Tithymalus ponticus* Prokh. 1949, l. c.: 740, nom. al-

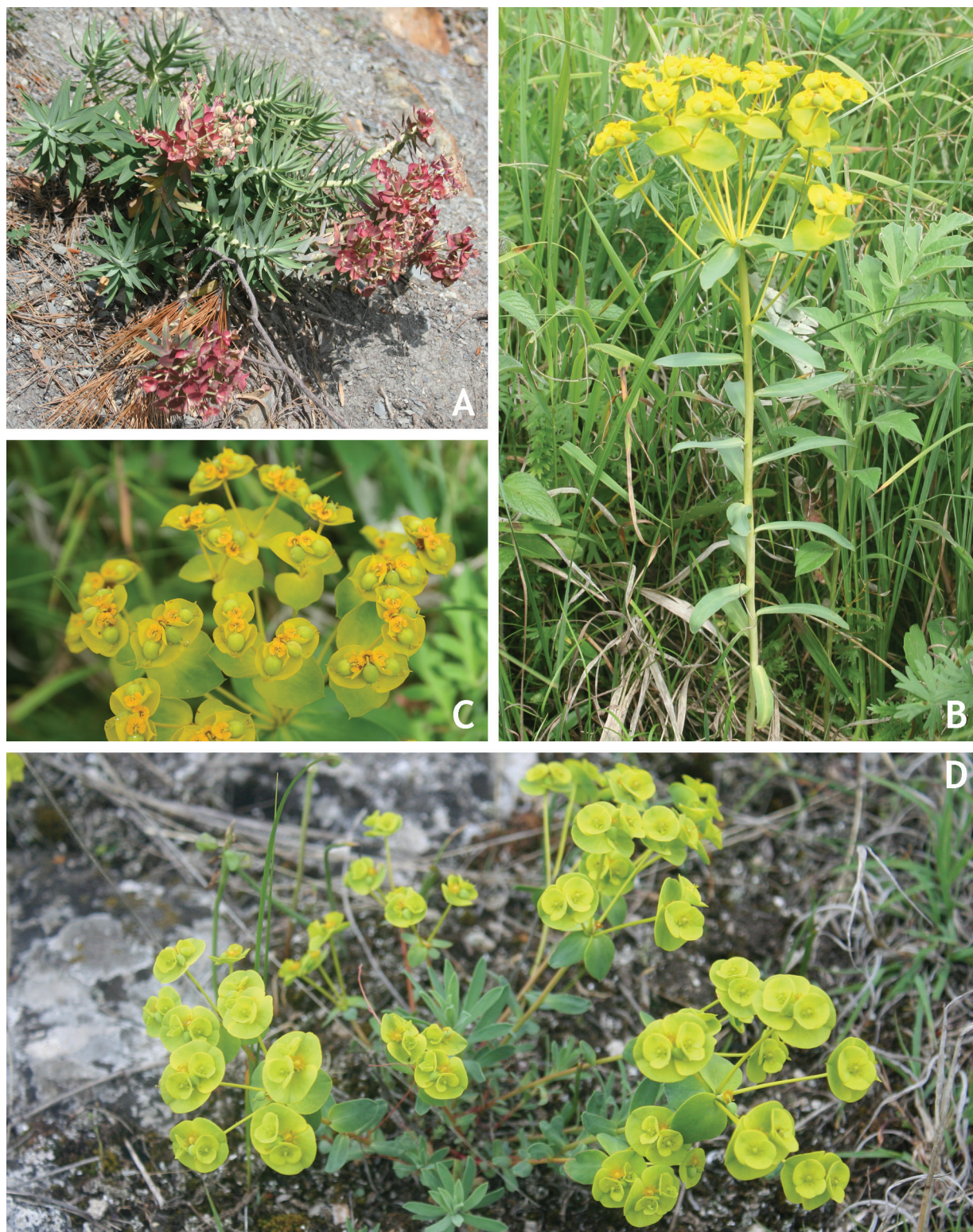


Fig. 4. Caucasian species of *Euphorbia* sections *Myrsiniteae* and *Pithyusa*.
A — *Euphorbia rigida*, habit; *E. stepposa*: B — habit, C — apical synflorescence; D — *E. petrophila*, habit.

tern. $\equiv$ *Euphorbia myrsinites* L. subsp. *pontica* (Prokh.) R. Turner, 1995, Europ. Gard. Guide: 136. — **H o l o t y p e**: “Батумская обл., Артвинский окр., Ардаун, каменистые склоны горы Варцхет, 26 V 1914, С. Туркевич, № 452 [Batum region, Artvin district, Ardaung, stony slopes of Vartskhet mountain, 26 V 1914, S. Turkevich, № 452]” (LE 01070946!).

= *E. pectinata* Albov, 1894, Bull. Herb. Boiss. 2: 640. — **L e c t o t y p e** (Geltman, 2009: 189): “Artwin, 12/25 V 1893, G. R[adde]” (TGM 29031!).

Stony places, montane steppes and pastures, sparse forests; 300–1100 m.

WTC; CTC: 8a; **SWTC:** 10a, 10b. — NCS, TCS. — Submediterranean element.

Prokhanov (1949) recorded *E. myrsinites* for Crimea, and *E. pontica* for the Black Sea coast (mainly Turkey). I failed to find any significant morphological differences between the Black Sea coast populations from Crimea and from the Caucasus, especially having in mind the diversity of *E. myrsinites* throughout its entire distribution area. However, Falch et al. (2019) discovered genetic differences between Adriatic and some Caucasian populations of *E. myrsinites* (the Crimean plants were not studied), but did not propose any taxonomic changes. In light of these data, the independent status of *E. pontica* could be re-evaluated.

Sect. 5. *Pithyusa* (Raf.) Lazaro

31. *E. falcata* L. 1753, Sp. Pl.: 456, nom. cons. $\equiv$ *Tithymalus falcatus* (L.) Klotzsch et Garcke, 1858, Fl. N. Mitt.-Deutschland, ed. 4: 292. — **L e c t o t y p e** (Molero, 1992: 715): “Arduino, Herb. Linn. № 630.26”, right specimen (LINN!).

= *E. acuminata* Lam. 1788, Encycl. 2: 427. $\equiv$ *E. falcata* L. var. *acuminata* (Lam.) St.-Amans, 1818, Fl. Agen.: 189. $\equiv$ *Tithymalus falcatus* (L.) Klotzsch et Garcke subsp. *acuminatus* (Lam.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 172. — **H o l o t y p e**: “Herb. Lamarck” (P-LA 00381891!).

= *E. galilaea* Boiss. 1853, Diagn. Pl. Orient. 12: 116. $\equiv$ *Tithymalus galilaeus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 83. $\equiv$ *Euphorbia falcata* L. var. *galilaea* (Boiss.) Boiss. 1862, in DC., Prodr. 15, 2: 140. — **H o l o t y p e**: “Palaestina, Planitie Esdraelon, IV–V 1846, E. Boissier” (G-BOISS!).

= *E. falcata* L. var. *ecornuta* Boiss. 1879, Fl. Orient. 4: 1111. — **L e c t o t y p e** (Geltman, 2015b: 128): “In deserto fl. Chabur, V 1867, Haussknecht, № 863” (G-BOISS!).

= *E. falcata* L. var. *macrostegia* Bornm. 1908, Mitth. Thüring. Bot. Vereins, n. f., 24: 111. $\equiv$ *E. falcata* L. subsp. *macrostegia* (Bornm.) O. Schwartz, 1934,

Repert. Spec. Nov. Regni Veg. 36: 129. $\equiv$ *Tithymalus falcatus* (L.) Klotzsch et Garcke subsp. *macrostegius* (Bornm.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 172. — **L e c t o t y p e** (Geltman, 2015b: 128): “Lydia: Sinus Smyrnaeus, Ilidja, ad rivulum, 29 V 1906, J. Bornmüller, № 9961” (B 10 0367965!; isolectotypes: HBG 516252 — image!, LE 01071316!).

Open stony slopes, river banks, dry meadows, steppes, semideserts and open woodlands, agricultural and fallow lands, roadsides, human settlements.

WCC; WC: 3a, 3d; **CC; EC; NWTC; WTC; CTC; ETC; SWTC; STC; T.** — NCS, TCS. — European-Pan-tethyan element.

Plants known as *E. falcata* subsp. *macrostegia* can be found throughout the species distribution area, so in my opinion they do not merit subspecies rank.

This species is probably expanding its distribution in the Caucasus, because only recently it was found in the vicinity of Pyatigorsk (EC: 4a), which is a very well studied area.

32. *E. normannii* Schmalh. ex Lipsky, 1891, Zap. Kievsk. Obshch. Estestvoisp. 11 (2): 57. $\equiv$ *Tithymalus normannii* (Schmalh. ex Lipsky) Prokh. 1949, Fl. URSS, 14: 466, nom. altern. — **L e c t o t y p e** (Geltman, 2000: 103): “Auf salzigem, sandigem Lehm Boden, beim armenischem Friedhofe um Sengileyevschen See (Рыбное озеро), 17 V 1879, 6 VI 1883, A. Normann [Auf salzigem, sandigem Lehm Boden, beim armenischem Friedhofe um Sengileyevschen See (Rybnoye Lake), 17 V 1879, 6 VI 1883, A. Normann]” (KW 147556!).

Steppes.

WCC: 1b. — NCS. — Euro-Siberian (Caucasian) element.

Local endemic, restricted to Stavropol Heights. Galushko (1980) listed this species for ECC, but without precise locality.

Recent molecular studies (Frajman, Geltman, in review) have shown that *E. normannii* is likely an inter-sectional hybrid, because according to nuclear markers it is nested in section *Myrsiniteae*, but according to chloroplast markers it falls into section *Pithyusa*. It is proposed to place it in the latter because of its morphological similarity to *E. falcata*.

33. *E. seguieriana* Necker, 1770, Hist. Commentat. Acad. Elect. Sci. Theod.-Palat. 2: 493. $\equiv$ *Tithymalus seguierianus* (Necker) Prokh. 1933, Sist. Obzor Moloch. Sr. Azii: 163. — **L e c t o t y p e** (Geltman, 2006a: 1099): icon in Séguier, 1745, Pl. Veron. 1, tab. 3, f. 1; **e p i t y p e** (Frajman et al., 2019: 248): “Germany, Rheinland-Pfalz, Rheintal: Sandhausener Dünen, W of the village Sandhausen; 111 m, sand dunes; 8°38'16"E,

49°21'8"N", 13 VIII 2015, B. Frajman, P. Kirschner" (WU0098407).

= *E. gerardiana* Jacq. 1778, Fl. Austriac. 5: 17. ≡ *Tithymalus gerardianus* (Jacq.) Steud. 1841, Nomencl. Bot., ed. 2, 2: 689. ≡ *Euphorbia seguieriana* Necker var. *gerardiana* (Jacq.) Fiori, 1901, Fl. Italia, 2: 286. — **Lectotype** (Geltman, 2015b: 129): "Crescit in pratis Danubialibus passim et in locis arenosis hinc inde, N. J. Jacquin" (W-Jacq. 0049519!).

= *E. firma* Ledeb. 1850, Fl. Ross. 3: 563. ≡ *Tithymalus firmus* (Ledeb.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 73. ≡ *Euphorbia gerardiana* Jacq. var. *firma* (Ledeb.) Boiss. 1862, in DC., Prodr. 15, 2: 167. ≡ *E. seguieriana* Necker var. *firma* (Ledeb.) Oudejans, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 187. — **Lectotype** (Geltman, 2015b: 129): "Djup Karagan, Eichwald, № 447, Herb. Ledebour" (LE 01071114!, isoelectotypes: LE 01071115!, 01071116!).

= *E. gerardiana* Jacq. var. *hohenackeri* Boiss. 1862, in DC., Prodr. 15, 2: 167. ≡ *E. seguieriana* Necker subsp. *hohenackeri* (Boiss.) Rech. f. 1948, Ann. Naturhist. Mus. Wien, 56: 212. — **Lectotype** (Geltman, 2006: 163): "Ad margines Georg. Cauc. VI 1836, R. F. Hohenacker" (G-BOISS 00418676!, isoelectotypes: HBG 516246 — image!, LE 01071364!, NY 00263339!, P00606937–00606939!, HAL 118608 — image!).

= *E. seguieriana* Necker var. *petrogena* Tamamsch. 1944, Dokl. Akad. Nauk Armyanskoi SSR, 1: 46. — **Lectotype** (Geltman, 2015b: 131): "Armenia, pr. et distr. Erivan, 1 VI 1922, S. Tamamschan" (ERE 8672!).

= *E. seguieriana* Necker subsp. *armeniaca* Frajman, 2019, Mol. Phylogen. Evol. 134: 249. — **Holotype**: "Flora of Armenia: Vajots'dzor, along the street between villages Gnishik and Agarakadzor (S of Jeghegnadzor), 2127 m; mountain steppe, limestone, 45°18'24" E, 39°40'32" N, 28 VII 2012, P. Schönschwetter, B. Frajman" (WU 0098408, isotype: IB 93171).

Sandy and stony steppes and semideserts, pastures, rocks, sandy and coquina sea shores, river beds, fallow lands and agricultural fields.

WCC; ECC; CC: 4a, 4b; **EC; NWTC:** 6a; **WTC:** 7c (Poti); **CTC:** 8a, 8b; **ETC; SWTC; STC; T.** — NCS, TCS. — West-Palearctic element.

A very variable species, especially in leaf shape and ploidy level (Frajman et al., 2019). It is very likely could be split into several taxa of varietal, subspecies or even species rank, although until now no convincing variants of such splitting have been proposed. The plants recently described from Armenia as *E. seguieriana* subsp. *armeniaca* Frajman do have some differences according RAPD analysis (Frajman et al., 2019) and can be found in other parts of the *E. seguieriana* distribution area, at least in its eastern part.

E. seguieriana subsp. *hohenackeri* (Boiss.) Rech. f. was described from the Caucasus and is accepted by Govaerts et al. (2020), and Frajman et al. (2019) distinguished it by elliptic raylet leaves. This character is likely an abnormality and can be found in plants from various parts of the species distribution area. This abnormality is occasionally found in other species of the section as well (e. g. *E. nicaeënsis* All.).

The closely related species *E. niciciana* Borbás (= *E. seguieriana* subsp. *niciciana* (Borbás) Rech. f.) occurs in the Balkans and West Anatolia and is not present in the Caucasus (Frajman et al., 2019).

34. ***E. macroclada*** Boiss. 1844, Diagn. Pl. Orient., sér. 1, 5: 54. ≡ *Tithymalus macrocladus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 97. — **Lectotype** (Khan, 1964: 119): "Caria, Denisleh, ad collibus argillosis [Boissier], VI 1842" (G-BOISS).

= *E. schizoceras* Boiss. 1844, Diagn. Pl. Orient., sér. 1, 5: 54. ≡ *Tithymalus schizoceras* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 98. ≡ *Euphorbia tinctoria* Boiss. et Huet var. *schizoceras* (Boiss.) Boiss. 1862, in DC., Prodr. 15, 2: 166. — **Lectotype** (Geltman, 2015b: 130): "Kurdistan, Berg Gara, 3 VIII [1841], Th. Kotschy, № 570" (G-BOISS!, isoelectotypes: BM 000951553!, G-DC!, K 001080072!, LE 01071163!, 01071180!).

= *E. syspirensis* K. Koch, 1849, Linnaea, 21: 727. ≡ *Tithymalus syspirensis* (K. Koch) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 97. — Type unknown.

= *E. damascena* Boiss. 1853, Diagn. Pl. Orient., sér. 1, 12: 113. ≡ *Tithymalus damascenus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 96. — **Lectotype** (Geltman, designated here): "Syria, Damasci collis, E. Boissier, V–VII 1846" (G-BOISS).

= *E. tinctoria* Boiss. et Huet, 1862, in DC., Prodr. 15, 2: 166. — **Lectotype** (Geltman, 2006b: 164): "Elmali, Gémichem quine dans les ravins [Bourgeau], № 598, 9 VII 1860" (G-BOISS!, isoelectotypes: G-DC 00313297!, MPU014638 — image!).

Rocks, stony steppes and semideserts.

STC: 11a. — TCS. — Irano-Turanian element.

Ter-Chatschaturova and Tamamschjan (1973) mentioned this species also for SWTC: 10b and STC: 11c, but these records are not supported by herbarium materials.

35. ***E. pannonica*** Host, 1831, Fl. Austriac. 2: 566. ≡ *E. glareosa* Pall. ex M. Bieb. var. *pannonica* (Host) Nyman, 1881, Consp. Fl. Eur.: 653. ≡ *Tithymalus pan-*

nonicus (Host) Á. Löve et D. Löve, 1961, Bot. Not. 114: 40. ≡ *Tithymalus nicaeënsis* All. subsp. *pannonicus* (Host) Soják, 1983, Čas. Nár. Mus., Odd. Prír. 152: 22. — Lectotype (Geltman, 2015b: 130): “Schwechat, 1817, Host” (W 0495171!).

= *E. glareosa* Pall. ex M. Bieb. var. *lasiocarpa* Boiss. 1862, in DC., Prodr. 15, 2: 166. ≡ *E. nicaeënsis* All. var. *lasiocarpa* (Boiss.) Radcl.-Sm. et Govaerts, 1996, Kew Bull. 51: 542. — Lectotype (Geltman, 2009: 178): “In campis arenosis Banatue, Heuffel” (G-DC 00313307!).

= *E. novorossica* Dubovik, 1976, Novosti Sist. Vyssh. Nizsh. Rast. (Kiev), 1975: 111. — Holotype: “Краснодарский край, Анапский р-н, Натухаевское лесничество, Лысая гора, опушка, 10 VI 1973, О. Дубовик, А. Краснова [Krasnodar Territory, Natukhaevskoye forestry, Lysaya mountain, forest margin, 10 VI 1973, O. Dubovik, A. Krasnova]” (KW 022214!).

Open steppe slopes and forest margins.

NWTC: 6a. — NCS. — Euro-Siberian element.

E. pannonica and the next species, *E. stepposa*, are undoubtedly very closely related. *E. pannonica* is characterized by the presence of a pubescent ovary (capsule surface) and/or pubescence with short papillary (“cartilaginous”) hairs, at least on some parts of the plant. It occurs in the Pannonian Plain, the Balkans, the north of Asia Minor; in the Caucasus, the only known location is the vicinity of Anapa, from where it was described as *E. novorossica* Dubovik.

E. stepposa always has a glabrous ovary, and the leaves and stems without short papillary pubescence. However, sometimes similar plants can also be found within the distribution area of *E. pannonica*. This gives some reason for considering these taxa as subspecies of the same species, which in this case would receive the priority name *E. pannonica*.

In a number of publications ([Radcliffe]-Smith, Tutin, 1964; Radcliffe-Smith, 1982) *E. pannonica*, *E. stepposa*, as well as *E. glareosa* Pall. ex M. Bieb. are considered subspecies, varieties or even synonyms of the western Mediterranean *E. nicaeënsis* All. In my opinion, this point of view is not sufficiently substantiated, since *E. nicaeënsis* is well differentiated from the types mentioned above by the presence of horn-like appendages on the glands, and it also has a very distinct geographical distribution.

36. *E. stepposa* Zoz ex Prokh. 1949, Fl. URSS, 14: 738. ≡ *Tithymalus stepposus* (Zoz ex Prokh.) Prokh. 1949, l. c.: 738, nom. altern. ≡ *Euphorbia glareosa* Pall. ex M. Bieb. subsp. *stepposa* (Zoz ex Prokh.) Kuzm. 1963, Izv. Bot. Inst. (Sofia), 12: 126. — *E. nicaeënsis* All.

subsp. *stepposa* (Zoz ex Prokh.) Greuter et Burdet, 1981, Willdenowia, 11: 278. ≡ *Tithymalus nicaeënsis* Klotzsch et Garcke subsp. *stepposus* (Zoz ex Prokh.) Soják, 1983, Čas. Nár. Mus., Odd. Prír. 152: 23. — Neotype (Geltman, 1998a: 200): “Харьковская губерния, близ г. Старобельска, на меловых горах, 6 VII 1904, И. Шираевский [Kharkov governance, near Starobelsk, on chalk hills, 6 VII 1904, I. Shiraevsky]” (LE 01071100!, isoneotype: LE 01071096!). — Fig. 4: B, C.

= *E. klokoviana* Railjan, 1973, Bot. Zhurn. 58 (7): 1019. ≡ *E. bessarabica* Klokov, 1955, Fl. URSS, 7: 629, nom. illeg., non *E. basarabica* Prod. 1930. ≡ *Tithymalus klokovianus* (Railjan) Holub, 1974, Folia Geobot. Phytotax. 9: 273. — Holotype: “Бессарабия, Кринички, 11 VI 1886, В. Липский [Bessarabia, Kri-nichki, 11 VI 1886, V. Lipsky]” (KW 022206!).

Steppes and steppified meadows, rarely fallow lands; 0–1200 m.

WCC; ECC: 2a; **WC:** 3c; **CC; NWTC:** 6a. — NCS. — Euro-Siberian element.

Records of this species for Daghestan (EC) (Murtazaliev, 2009) likely belong to *E. glareosa*.

37. *E. glareosa* Pall. ex M. Bieb. 1808, Fl. Taur.-Cauc. 1: 373. ≡ *Tithymalus glareosus* (Pall. ex M. Bieb.) Prokh. 1949, Fl. URSS, 14: 402, nom. altern. ≡ *Euphorbia nicaeënsis* All. subsp. *glareosa* (Pall. ex M. Bieb.) Radcl.-Sm. 1968, Feddes Repert. 79, 1–2: 55. — Lectotype (Geltman, 1998a: 199): “in rupestribus ad Tschorgun, Pallas” (LE 01071068!); epitype (Geltman, 1998a: 199): “ex Tauria et Caucaso [Bieberstein]” (LE 10070917!).

= *E. glareosa* Pall. ex M. Bieb. var. *minor* Boiss. 1879, Fl. Orient. 4: 1129. — Lectotype (Geltman, 2009: 180): “Georg. cauc., R. F. Hohenacker, V 1838” (G-BOISS!).

= *E. volgensis* Krysht. 1929, Izv. Glavn. Bot. Sada SSSR, 28: 375. ≡ *Tithymalus volgensis* (Krysht.) Prokh. 1949, Fl. URSS, 14: 403, nom. altern. ≡ *Euphorbia nicaeënsis* All. subsp. *volgensis* (Krysht.) Oudejans, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 186. — Lectotype (Geltman, 1998a: 201): “Саратовская губ., Камышинский у., меловой холм, версты полторы к югу от с. Чухонастовки, 27 VI 1926, Ю. Григорьев, № 1040 [Saratov Governance, Kamyshin district, chalk hill, ca. 1.5 versts south of Chukhonastovka, 27 VI 1926, Yu. Grigoryev, № 1040]” (LE 01071111!, isoelectotype: LE 01071112!).

= *E. maleevii* Tamamsch. 1944, Dokl. Akad. Nauk. Armyanskoi SSR, 1 (1–2): 45. ≡ *E. glareosa* Pall. ex M. Bieb. subsp. *maleevii* (Tamamsch.) Tamamsch. 1973, Fl. Armenii, 6: 108. — Lectotype (Geltman, 2015b: 130): “Distr. Akhty, prope pag. Solak, ad rip.

dextr. fl. Zanga, in vallecule, schist. et sabulosis, 30 VIII 1942, S. Tamamschan" (ERE 29421!).

Stony slopes, outcrops and rocks, both acid and limestone, rarely steppes; 400–2000 m.

WCC: 1b; **WC:** 3d (vicinity of Kichibalyk); **EC:** 5b, 5c; **CTC:** 8a, 8b; **ETC:** 9b, 9c, 9d; **SWTC:** 10c; **STC:** 11a, 11b, 11c, 11d. — NCS, TCS. — Submediterranean element.

In my opinion, to *E. glareosa* belong only plants with stems 9–15(19) cm tall and 1.5–2(2.2) mm thick, with only 3–6 rays of apical synflorescens. It is a strict petrophyte generally avoiding true steppe communities.

38. *E. smirnovii* Geltman, 1996, Bot. Zhurn. 81 (11): 102. — *E. petrophila* C. A. Mey. var. *armena* Boiss. 1866, in DC., Prodr. 15, 2: 1268. — **Lectotype** (Khan, 1964: 122): "In ruperstribus vallicum pr. Baidurt, 20 VI 1862, E. Bourgeau, № 242" (G!; isoelectotypes: BR 0000005106028 — image!, E 00202633!, LD1677755 — image!, LE 01071337!, MPU 014224 — image!).

Gravelly slopes.

SWTC: 11a (Arzakan). — TCS. — Irano-Turanian element.

A rare species, restricted mainly to the periphery of the Armenian Highlands. From this area it is known from a single specimen: "Окрестности оз. Гокча, Арзакенд, щебнистый склон по берегу р. Занги, 9 VIII 1929, П. Смирнов, № 703 [vicinity of the lake Gokcha [Sevan], Arzakend, gravelly slopes by the bank of the Zanga river, 9 VIII 1929, P. Smirnov, № 703]" (MW 0690596!).

39. *E. petrophila* C. A. Mey. 1850, Kleine Beitr.: 9. ≡ *Tithymalus petrophilus* (C. A. Mey.) Soják, 1972, Čas. Nár. Mus., Odd. Přír. 140: 175. — **Lectotype** (Geltman, 1998a: 199): "legi in montib. Tauriae, Eski-Krym et Tschatyrdagh, 1818, Meyer" (LE 01071082!). — Fig. 4: D.

= *E. petrophila* C. A. Mey. var. *colchica* Litv. 1898, Trudy Imp. S.-Peterburgsk. Bot. Sada, 14 (2): 299. ≡ *E. colchica* (Litv.) Geltman, 1995, in Czerepanov, Vasc. Pl. Russia Adj. States: 224. — **Lectotype** (Geltman, 2006c: 163): "Черноморский окр., нижнее течение р. Псеуапсе, на каменистом склоне, 21 VI 1895, Д. Литвинов [Chernomorsky district, lower reaches of river Pseuapse, on rocky slope, 21 VI 1895, D. Litvinov]" (LE 01070907!, isoelectotypes: JE00002890 — image!, LE 01070908!).

= *E. cretrophila* Klokov, 1955, Fl. URSS, 7: 629. — **Holotype**: "Сталинская обл., Славянский р-н, горы Артема, правый берег р. Донца, на опушке дубового леса, на меловых обнажениях, часто, 23 VI

1938, 3. Сова [Stalino [Donetsk] region, Slavyansk district, Artem hills, right bank of the Donets river, margin of oak forest, on chalk outcrops, numerous, 23 VI 1938, Z. Sova]" (KW 022209!).

= *E. subhastifolia* Klokov, 1977, Novosti Sist. Vyssh. Nizsh. Rast. (Kiev), 1976: 99. — **Holotype**: "Краснодарский край, хр. Маркотх, на каменистых известняковых склонах, на высоте 500 м, 19 V 1951, А. Колаковский (Список растений Гербария флоры СССР, № 3688) [Krasnodar Territory, Markotkh range, on rocky limestone slopes, 500 m, 19 V 1951, A. Kolakovsky]" (KW 022234!; isotypes: A00277321 — image!, BM000751480!, G 00441493!, H 1298173!, K 000911992!, LE 01070951!, 01070952!).

Limestone rocks, stony steppes; 300–800 m.

WC (mainly the Skalisty range); **CC:** 4a; **NWTC:** **WTC:** 7a, 7b. — NCS, TCS. — Submediterranean element.

Galushko (1980: 200) records this species for WCC: 1b, but this record most probably belongs to *E. glareosa*.

40. *E. erythrodon* Boiss. et Heldr. 1853, Diagn. Pl. Orient., ser. 1, 12 : 112. ≡ *Tithymalus erythrodon* (Boiss. et Heldr.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 87. — **Lectotype** (I: Khan, 1964: 124; II: Geltman, 2005: 144): "in rupes-tribus du Davros-Dagh, 5500', 29 V 1845 [Heldreich], № 759" (G-BOISS!, isoelectotypes: BM 000951547!, G 00441424!, G-DC 00312951!, K 000911990!, LE 01071243!, 01071244!, P 00568286!, 00568287, W 1889-0159589, 0031049!).

= *Euphorbia oschtenica* Galushko, 1973, Novosti Sist. Vyssh. Rast. 10: 325. ≡ *Tithymalus oschtenicus* (Galushko) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **Holotype**: "Западный Кавказ, юго-западный склон г. Оштена, 1 VIII 1963, А. Галушко [West Caucasus, south-west slope of Mt. Oshten, 1 VIII 1963, A. Galushko]" (LE 01070942!, isotype: LE 01070941!).

= *Euphorbia kotovii* Klokov, 1977, Novosti Sist. Vyssh. Nizsh. Rast. (Kiev), 1976: 102. — **Holotype**: "Крымский государственный заповедник, Бабуган-яйла, гора Роман-кош, осыпи известняков на высоте 1400 м, 19 VII 1955, М. Котов, А. Евзеров, В. Романов [Crimean state reserve, Babugan-yayla, Mt. Roman-kosh, limestone screes, 1400 m, 19 VII 1955, M. Kotov, A. Evzerov, V. Romanov]" (KW!).

Montane limestone slopes and screes; (700)1200–2500 m. — Submediterranean element.

WC: 3b (Mt. Oshten); **NWTC:** 6a; **WTC:** 7a. — NCS.

The montane race of *E. petrophila* probably deserving subspecies rank only.

41. *E. panjutinii* Grossh. 1950, Bot. Mat. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR, 13: 18. — **H o l o t y p e**: “Предзыбский [Бзыбский] хребет, вершина г. Напра [Накра], 2400 м, альпийский луг, 28 VII 1936, П. Панютин, № 1246 [Predbzybsky [Bzybsky] range, top of Napra [Nakra] mountain, 2400 m, alpine meadow, 28 VII 1936, P. Panyutin, № 1246]” (LE 01070943!, isotype: LE 01070944!).

Alpine meadows on limestone rocks; ca. 2400 m.

WTC: 7b. — TCS. — Submediterranean element.

An enigmatic species known only from the type specimen. It was not found in the *locus classicus* during a special search in 1991.

Sect. 6. *Sclerocyathium* (Prokh.) Prokh.

42. *E. grossheimii* Prokh. 1930, Izv. Glavn. Bot. Sada SSSR, 29: 551. — **H o l o t y p e**: “Nachitschevan, 13 V 1929, A. Grossheim” (LE 01070918!).

= *E. isthmia* Täckh. 1932, Sv. Bot. Tidskr. 26: 374. ≡ *Tithymalus isthmus* (Täckh.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 173. — **H o l o t y p e**: “Sinai: 3–4 km S of Bir Lehfen S of el Arish, 21 III 1928, Täckholm” (S G-2570 — image!).

= *E. mariae* Tamamsch. 1944, Dokl. Akad. Nauk Armyanskoi SSR, 1 (1–2): 43. — **L e c t o t y p e** (Geltman, 2015b: 130): “Prope Nachičevan, in steppa, 6 VI 1929, A. Shelkovnikov, E. Kara-Murza” (ERE 8663!).

= *Euphorbia cheirolepioides* Rech. f. 1955, Dansk Bot. Ark. 15 (4): 48. ≡ *Tithymalus cheirolepioides* (Rech. f.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 171. — **H o l o t y p e**: “Buschir [Bushehr], 27 II 1937, M. E. Kōie, № 162” (C10011230 — image!, isotypes: C10011229 — image!, W1951-0011260!).

Dry stony slopes, gravelly river banks.

STC: 11a (near Kaghtsrashen), 11d. — TCS. — Irano-Turanian element.

Sect. 7. *Chylogala* (Fourr.) Prokh.

43. *E. heteradena* Jaub. et Spach, 1845, Ill. Pl. Orient. 2: 42. ≡ *Tithymalus heteradenus* (Jaub. et Spach) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 173. ≡ *Euphorbia megalantha* Boiss. var. *gracilis* Boiss. 1862, in DC., Prodr. 15, 2: 112. — **L e c t o t y p e** (Rechinger, Schiman-Czeika, 1964: 22): “Ispahan, Aucher № 5313” (P 00702303!, isoelectotypes: W 0031063!, 1889-0077529!).

= *E. ispahanica* Boiss. 1846, Diagn. Pl. Orient. 7: 91. ≡ *Tithymalus ispahanicus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 89. — **L e c t o t y p e** (Khan, 1964: 91): “Ispahan, Aucher, № 5287” (G-BOISS!).

= *E. megalantha* Boiss. 1846, Diagn. Pl. Orient. 7: 95. ≡ *Tithymalus megalanthus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 91. — **L e c t o t y p e** (Geltman, 2013: 8): “in virtutis prope ruinas u. Persepolis sparsim, 20 IV 1842, Kotschy, № 270” (G-BOISS!, isoelectotypes: BM 000951565!, E 00362390!, 00362391!, FI 011592 — image!, FR 0031292 — image!, G 00441441!, G-DC 00311615!, H 1297808 — image!, HAL 0118586 — image!, JE 00001691 — image!, K 000911928!, LE 01071217!, 01071219!, MA 205865!, US 00095363!, W 0031043!).

= *E. megalantha* Boiss. var. *denticulata* Boiss. 1862, in DC., Prodr. 15, 2: 112. — **L e c t o t y p e** (Geltman, 2013: 8): “inter Feisabad et Dirachtanschan (inter Chabbi et Kerman), 1 IV 1859 [Bunge] 24” (G-BOISS!, isoelectotype: LE 01071220!).

= *E. megalantha* Boiss. var. *hirtiflora* Boiss. 1862, in DC., Prodr. 15, 2: 112. — **H o l o t y p e**: “Assyria, 1836, Aucher, № 1823” (G-DC: G00311613!).

= *E. coriacea* K. Koch, 1849, Linnaea, 21: 730. — **L e c t o t y p e** (Geltman, 2013: 8): “trans amnem Araxen, 1837, Koch, № 867” (LE 01071327!).

= *E. froedinii* Rech. f. 1952, Symb. Bot. Upsal. 11 (5): 48. — **H o l o t y p e**: “Sarik Sifla vid Vansjön, 28 VI 1939, Frödin, № 202” (UPS).

Montane rocky slopes, steppes, semideserts, river banks, sometimes roadsides and field margins; 1000–2300 m.

STC: 11a, 11c, 11d, 11g. — TCS. — Irano-Turanian element.

My previous records for SWTC: 10c and STC: 11f (Geltman, 2012) were not confirmed by herbarium specimens, although the occurrence of this species there is not impossible.

Sect. 8. *Szovitsiae* Geltman

44. *E. szovitsii* Fisch. et C. A. Mey. 1835, Index Sem. Hort. Bot. Petropol. [1]: 27. ≡ *Tithymalus szovitsii* (Fisch. et C. A. Mey.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 65. — **L e c t o t y p e** (Geltman, 2000: 102): “Nakitschevan, 1829, Szovits” (LE 01070953!).

Open rocky and clayey slopes and outcrops, river banks and beds; 400–2200 m.

EC; **WTC**: 7e; **CTC**: 8a, 8c; **ETC**: 9c; **SWTC**: 10a, 10c; **STC**; **T**. — NCS, TCS. — Irano-Turanian element.

Key to the varieties

1. Raylet leaves linear-oblongate, 1–3 mm wide, 3 or more times longer than wide *E. szovitsii* var. *szovitsii*.

- + Raylet leaves, at least upper ones, ovate-rhombic, 3–8 mm wide, usually not more than 3 times longer than wide
..... *E. szovitsii* var. *kharputensis*.

Var. **szovitsii**.

Open rocky and clayey slopes and outcrops, river banks and beds; 400–2200 m. — Throughout the whole area of the species.

Var. **kharputensis** Azn. ex M. S. Khan, 1964, Notes Roy. Bot. Gard. Edinburgh, 25: 136. — **H o l o t y p e**: “Harput to Khan Kezzin, 26 VII 1906, B. Post, № 349” (G!).

Open rocky slopes.

T. — TCS.

The lectotype of *E. szovitsii* has two labels with information on locality: (1) “Prope Naktshevan, 1829, Szovits” and (2) “in lapidosis montium ad latena saxorum ad Seichaizi ditio Khoi prov. Aderbeidhan, 19 May 1828, Szovits, № 290” as well as the text of the original species description. There are 6 individuals which provisionally could be separated into 2 sets, but it is impossible to determine to which locality they belong.

Ivanov (1997: 81) recorded *E. szovitsii* for ECC: 2a, but this record is not supported by herbarium material.

Sect. 9. **Patellares** (Prokh.) Frajman

45. ***E. macroceras*** Fisch. et C. A. Mey. 1837 (publ. 1838), Index Seminum (LE), 4: 36. ≡ *Tithymalus macroceras* (Fisch. et C. A. Mey.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 95. — **L e c t o t y p e** (Geltman, 1998: 199): “In locis altioribus umbrosis Cartilinae prope Malitzki, 10 V 1830, Szovits, № 40” (LE 01070936!, isoelectotypes: LE 01070931–01070935!). — Fig. 5: A.

= *E. macroceras* Fisch. et C. A. Mey. var. *spectabilis* K. Koch, 1849, Linnaea, 21: 726. — Type unknown.

Forests, usually beech or with beech; 700–2150 m.

WC: 3b, 3c; **CC**: 4a, 4c; **EC**: 5a, 5b; **WTC**; **CTC**: 8a, 8c; **ETC**: 9a, 9c, 9d, 9e; **SWTC**: 10a, **STC**: 11a; **T.** — NCS, TCS. — Euro-Siberian (Caucasian-Euxinian-Hyrcanian) element.

46. ***E. oblongifolia*** (K. Koch) K. Koch, 1849, Linnaea, 21: 726. ≡ *E. amygdaloides* L. var. *oblongifolia* K. Koch, 1846, Linnaea, 19: 17. ≡ *Tithymalus oblongifolius* (K. Koch) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 96. — Type unknown. — Fig. 5: B, C.

= *Euphorbia rumicifolia* Boiss. 1860, Cent. Euphorb.: 39. — **L e c t o t y p e** (Geltman, 2002b: 21): “supra Koeprubachu, V 1853, A. Huet de Pavillon” (G-BOISS!; isoelectotypes: BM001050481!, K 001080062!, 001080063!).

Subalpine meadows and krummholz, sometimes near streams or on open slopes in forest belt, 1600–2800 m.

WC: 3b, 3c; 3d; **CC**: 4c; **WTC**; **CTC**: 8a, 8c; **ETC**: 9a, 9d; **SWTC**: 10a; **T.** — NCS, TCS. — Euro-Siberian (Caucasian-Euxinian-Hyrcanian) element.

47. ***E. glaberrima*** K. Koch, 1849, Linnaea, 21: 726. ≡ *Tithymalus glaberrimus* (K. Koch) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 95. — **L e c t o t y p e** (Geltman, 2002a: 106): “In Lori (parte provinciae Bambaki), 1837, Koch, № 870, herb. C. A. Meyer” (LE 01070916!).

= *E. iteophylla* Boiss. 1860, Cent. Euphorb.: 39. — **L e c t o t y p e** (Geltman, 2002b: 22): “In Grusia am Aragwi-fluß bei [Gutgore], Sept., Hohenacker, № 3811” (LE 01070927!).

Subalpine meadows and krummholz, sometimes on rocks, usually on calcareous substrate.

WC: 3b, 3c; **CC**: 4c; **EC**: 5c; **WTC**: 7a, 7b, 7c, 7d; **CTC**; **ETC**: 9a, 9d; **SWTC**: 10b; **STC**: 11a, 11b, 11e. — NCS, TCS. — Euro-Siberian (Caucasian-Euxinian) element.

48. ***E. amygdaloides*** L. 1753, Sp. Pl.: 463. — **L e c t o t y p e** (Geltman, 2002a: 106): “Herb. Linn. № 630.71” (LINN!).

= *E. sylvatica* L. 1753, Sp. Pl.: 463. ≡ *Tithymalus sylvaticus* (L.) Hill, 1768, Hort. Kew.: 172.4. — **L e c t o t y p e** (Geltman, 2002a: 23): “Herb. Linn. № 630.72” (LINN!).

Forests; 100–1000 m.

EC: 5c, 5d; **NWTC**: 6b (vicinity of Agoy); **WTC**; **T.** — NCS, TCS. — Euro-Siberian element.

Record for CC: 4a (Galushko, 1980: 224) is likely erroneous.

Sect. 10. **Herpetorrhizae** (Prokh.) Prokh.

Subsect. **Oppositifoliae** Boiss.

49. ***E. aserbajdzhanica*** Bordz. 1928, Izv. Kievsk. Bot. Sada, 7–8: 19. — **H o l o t y p e**: “Transcaucasia, Aserbajdzhan, in decliviis lapidosis aridis haud procul ab oppido Nachiczewan, 6 VII 1927, E. Bordzilowski” (KW 022205!).

= *Tithymalus pseudosororius* Prokh. 1930, Izv. Glavn. Bot. Sada SSSR, 29: 556. — **H o l o t y p e**: “Нахичевань, 30 VI 1893, В. Липский [Nakhichevan, 30 VI 1893, V. Lipsky]” (LE 01070969!).

Open stony, gypsum or clayey places; 600–1000 m.

SWTC: 10c (Artik); **STC**: 11a, 11d. — TCS. — Irano-Turanian element.

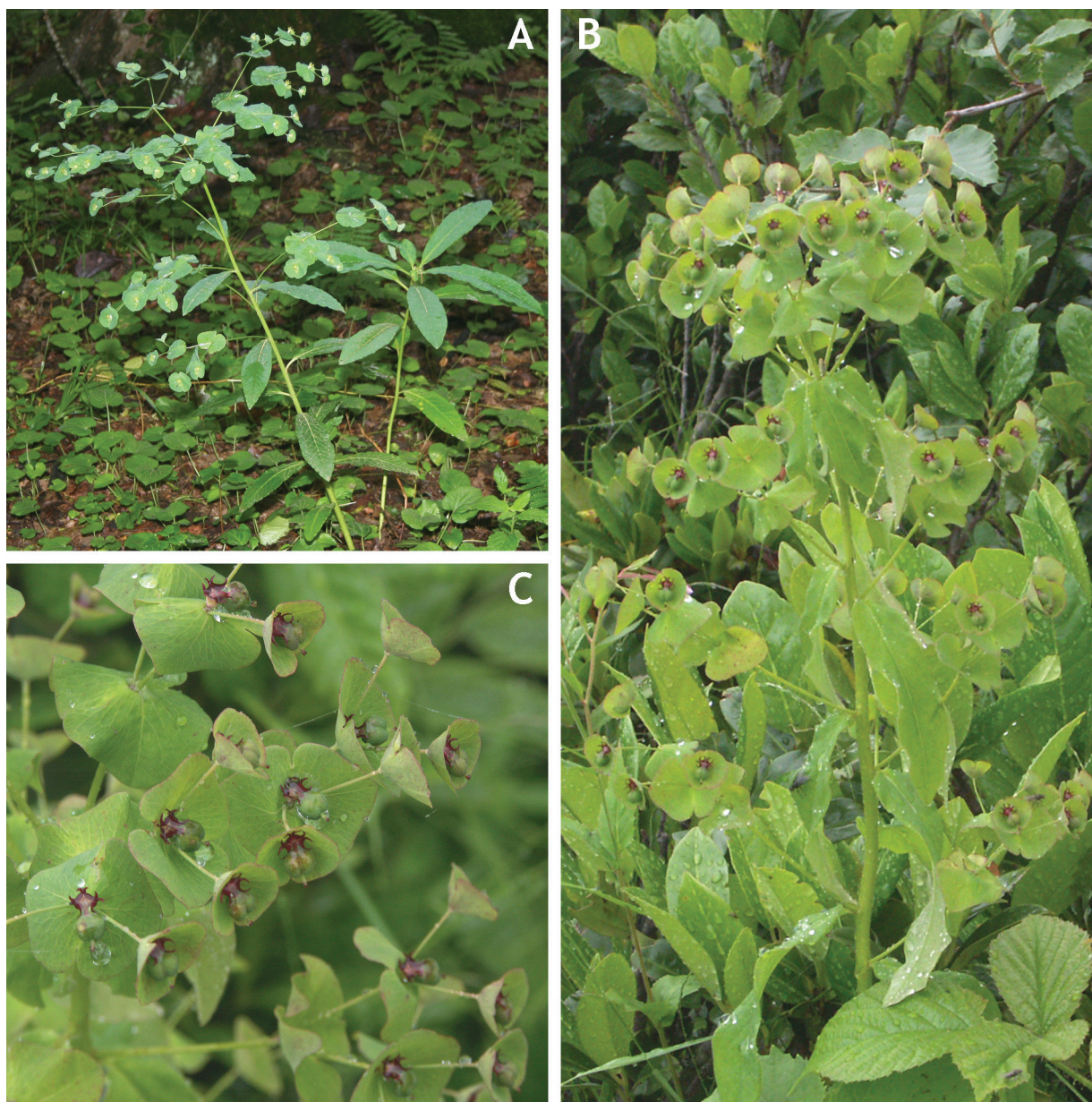


Fig. 5. Caucasian species of *Euphorbia* section *Patellares*. A — *Euphorbia macroceras*, habit; *E. oblongifolia*: B — habit, C — apical synflorescence.

Sect. 11. ***Pachycladae*** (Boiss.) Tutin

50. ***E. terracina*** L. 1762, Sp. Pl., ed. 2: 654. ≡ *Tithymalus terracinus* (L.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 90. — Lectotype (El Hadidi, Fayed, 1978: 50): “Herb. Linn. № 630.33” (LINN).

— *E. boissieriana* auct. non (Woronow) Prokh.: Kolakovsky, 1982, Fl. Abkhazii, ed. 2, 2: 192.

Sandy sea shore.

WTC: 7b (vicinity of Sukhumi). — TCS. — Macaronesian-Mediterranean element.

The record for ETC: 9b (Baku Botanical Garden) (Musaev, 1988: 69) is not supported by herbarium specimens.

E. terracina is likely an alien in the Caucasus, although it may have the easternmost limit of its natural distribution area there.

Sect. 12. *Exiguae* (Geltman) Riina et Molero

51. *E. exigua* L. 1753, Sp. Pl.: 456. $\equiv$ *Tithymalus exiguus* (L.) Hill, 1768, Hort. Kew.: 172.3. — *Lectotype* (Jafri, El-Gadi, 1982: 39): “Herb. Linn. № 630.27” (LINN!).

Habitats unknown.

NWTC: 6a (Novorossiisk). — NCS. — European-Pantethyan element.

E. exigua is known in the Caucasus from two specimens collected in 1892 near Novorossiisk. It is likely alien there, although may have the easternmost limit of its natural distribution area there.

Sect. 13. *Paralias* Dumort.

52. *E. paralias* L. 1753, Sp. Pl.: 458. $\equiv$ *Tithymalus paralias* (L.) Hill, 1768, Hort. Kew.: 172.3. — *Lectotype* (Geltman, designated here): “Herb. Linn. № 199.15” (S 09-28594). — Fig. 6.

Sandy sea shores.

NWTC; WTC. — NCS, TCS. — European-Pantethyan element.

53. *E. taurinensis* All. 1785, Fl. Pedem. 1: 287; 3: tab. 83, fig. 2. $\equiv$ *Tithymalus taurinensis* (All.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin, 1859: 83. — *Lectotype* (Khan, 1964: 130): Herb. Allioni (TO, photo!).

= *E. graeca* Boiss. et Spruner, 1844, in Boiss., Diagn. Pl. Orient., sér. 1, 5: 53. $\equiv$ *Tithymalus graecus* (Boiss. et Spruner) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin, 1859: 84. — *Lectotype* (Geltman, 2006: 163): “Hymetto, Spruner” (G-BOISS).

Open stony slopes, steppes, open forests (especially *Juniperus*), roadsides.

TWTC: 6a. — NCS. — European-Pantethyan element.

54. *E. ledebourii* Boiss. 1860, Cent. Euphorb.: 35. $\equiv$ *Tithymalus ledebourii* (Boiss.) Prokh. 1949, Fl. URSS, 14: 462, nom. altern. — *Lectotype* (Geltman, 2000: 104): “In planitie territorii Elisabethopoleos, flora Transcauc., 21 V 1844, Kolenati, № 1445” (LE 01071318!, isolectotypes: LE 01071319–01071321!).

Open stony places.

ETC: 9d (Ganja), 9f (Shusha); **STC:** 11f. — TCS. — Submediterranean element.

Sect. 14. *Tithymalus* (Gaertn.) Roep.

55. *E. peplus* L. 1753, Sp. Pl.: 456. $\equiv$ *Tithymalus pep- lus* (L.) Hill, 1768, Hort. Kew.: 172.3. — *Lectotype*



Fig. 6. *Euphorbia paralias*.

(El Hadidi, Fayed, 1978: 46): “Herb. Linn. № 630.24” (LINN!).

Rocks and screes, littoral sands, forest margins, as a weed in settlements and roadsides.

WCC: 1b; **CC:** 4a; **NWTC:** 6a; **WTC:** 7a, 7b, 7c, 7e; **ETC:** 9b (Baku); **T.** — NCS, TCS. — European-Pantethyan element.

Sect. 15. *Arvalis* (Geltman) Geltman

56. *E. arvalis* Boiss. et Heldr. 1853, in Boiss., Diagn. Pl. Orient., sér. 1, 12: 116. $\equiv$ *Tithymalus arvalis* (Boiss. et Heldr.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 82. — *Lectotype* (Geltman, designated here): “Plaines d’Isbartha — a 2 lieuer d’Isbartha sur la route d’Egdir, 31 V 1845 [Heldreich], № 769” (G!, isolectotypes: BM 001050444!, GOET 03704 — image!, LE 01071140!, 01071141!, P 0552400!, US 01050201!).

= *E. ruderalis* Scheele, 1843, Linnaea, 17: 343, nom. illeg., non Dumort. 1827. — *Lectotype* (Geltman,

designated here): “In agris incultis et ruderalis prope Gredück in ditone Swant Georg. Cauc. VI 1836, alt. 4000–5000', R. F. Hohenacker” (K 000911915 – image!; isolectotypes: LE 01071365–01071367!).

= *E. parvula* K. Koch, 1849, Linnaea, 21: 731, nom. illeg., non Delile, 1813. ≡ *Tithymalus parvulus* Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 93. — Type: “Im russischen Armenien” (?B, destroyed).

— *E. punctata* auct. non Delile: Ledeb. 1850, Fl. Ross. 3, 2: 571.

Stony places, montane steppes; 1500–2000 m.

SWTC: 10c; **STC:** 11a, 11b, 11d; **T:** — TCS. — Irano-Turanian element.

57. *E. aulacosperma* Boiss. 1853, Diagn. Pl. Orient., sér. 1, 12: 117. ≡ *Tithymalus aulacospermus* (Boiss.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 82. — Holotype: “Palaestina, Eirusalem, IV–V 1846, E. Boissier” (G-BOISS!).

= *E. fossulata* Boiss. et Gaill. 1859, in Boiss., Diagn. Pl. Orient., sér. 2, 4: 87. ≡ *E. aulacosperma* Boiss. var. *fossulata* (Boiss. et Gaill.) Boiss. 1862, in DC., Prodr. 15, 2: 140. — Lectotype (Geltman, designated here): “Talus pierreux au jard Djebel Khailoun nord du Damascus, 12 IV 1856, C. Gaillardot, № 2220” (G-BOISS!, isolectotype: JE 00002431 – image!).

Montane steppes and open forests, especially with *Juniperus*; 400–800 m.

NWTC: 6a (vicinity of Novorossiisk). — NCS. — Submediterranean element.

Sect. 16. *Esula* (Pers.) Dumort.

58. *E. iberica* Boiss. 1860, Cent. Euphorb.: 38. ≡ *Tithymalus ibericus* (Boiss.) Prokh. 1933, Sist. Obzor Moloch. Sr. Azii: 183. — Lectotype (Geltman, 2002a: 110): “In demissis herbis humidiusculis prope Helenendorf, V 1835, R. F. Hohenacker” (G-BOISS!, isolectotypes: G 00441417!, 00441418!, G-DC 00313261!, K 001096700!, 001080075!, LE 01070919–01070923!). — Fig. 7: A, B.

= *E. iberica* Boiss. var. *intermedia* Boiss. 1862, in DC., Prodr. 15, 2: 163. ≡ *E. intermedia* (Boiss.) Fisch. et C. A. Mey. ex Trautv. 1844, Trudy Imp. Peterb. Bot. Sada, 9 (1): 159 (Incrim. Fl. Fanerogam. Ross. 3). — Lectotype (Geltman, designated here): “Caucasus, Hohenacker” (LE 01070924!).

= *E. sanasunitensis* Hand.-Mazz. 1912, Ann. K. K. Naturhist. Hofmus. (Wien), 26: 139. ≡ *Tithymalus sanasunitensis* (Hand.-Mazz.) Soják, 1972, Čas. Nár. Mus., Odd. Prír. 140: 176. — Lectotype (Khan, 1964: 116): “Kurdistania media, Taurus Armenius, in monte

Meleto (Meretug) Dag districtus Bitlis, in humosis opimis copiose, 10–11 VIII 1911, Handel-Mazetti, № 2789” (WU 0046584!, isolectotype: W 1913-0015644!).

= *E. kemulariae* Ter-Chatsch. 1963, Zametki Sist. Geogr. Rast. (Tbilisi), 23: 92. — Lectotype (Geltman, designated here): “Мамисон, субнивальный пояс, 9 VIII 1958, А. Харадзе, Л. Хинтибидзе [Mamisson, subnival belt, 9 VIII 1958, A. Kharadze, L. Chinthibidze]” (TBI 1025062!, isolectotype: LE 01070928!).

= *E. vedica* Ter-Chatsch. 1965, Zametki Sist. Geogr. Rast. (Tbilisi), 24: 24 (1965). — Holotype: “АрмССР, Вединский р-н, Зинджириу × Биралу, 28 V 1960, А. Тахтаджян и др. [Armenian SSR, Vedi district, between Zindzhiriu and Biralu, 28 V 1960, A. Takhtajan et al.]” (ERE 68547, isotype: TBI 1025066!).

Steppes, meadows, open forests, rarely a weed in agricultural fields, fallow lands and ruderal habitats; 10–2500(3000) m.

WCC; ECC; WC; CC; EC; NWTC: 6a; **WTC** (alien): 7c, 7d; **CTC; ETC; SWTC; STC.** — NCS, TCS. — Euro-Siberian element.

Very common in most areas of the Caucasus. The species is very variable, especially in the shape of stem leaves. There are some individuals of *E. iberica* with very scarce indumentum in WCC: 1a (Taman Peninsula) and NWTC: 6a, which can be a result of introgressive hybridization with *E. dubovikiae*.

59. *E. dubovikiae* Oudejans, 1969, Phytologia, 67 (1): 45. ≡ *E. pinetorum* Dubovik, 1977, Novosti Sist. Vyssh. Nizsh. Rast. (Kiev) 1976: 105, nom. illeg., non (Small) G. L. Webster, 1967. — Holotype: “Краснодарский край, Геленджинский р-н, Архипо-Осиповка, лес из *Pinus pityusa* Stev., 27 V 1975, О. Дубовик [Krasnodar Territory, Gelendzik district, Arkhipo-Osipovka, forest of *Pinus pityusa* Stev., 27 V 1975, O. Dubovik]” (KW 022223; isotype: KW 022224!).

Pine, deciduous and mixed forests.

NWTC: 6b. — TCS. — Euro-Siberian (Crimean-Novorossiisk) element.

E. dubovikiae is similar to *E. iberica*, but differs in leaves with an indumentum and habitat preference: it occurs in forests, while *E. iberica* is mainly confined to meadows and steppes.

60. *E. agraria* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 375. ≡ *Tithymalus agrarius* (M. Bieb.) Klotzsch et Garcke, 1860, Abh. Königl. Akad. Wiss. Berlin 1859: 89. — Lectotype (I: Khan, 1964: 113; II: Geltman, desig-



Fig. 7. Caucasian species of *Euphorbia* section *Esula*.

Euphorbia iberica: A — habit, B — fragment of apical synflorescence; C — *E. virgata*, habit.

nated here): “Ex Tauria, 1794 [Marschall Bieberstein]” (LE-Bieb.: LE 01070980!).

?**CC**: 4a (Zheleznovodsk — ?alien); ?**WTC**: 7b. — ?NCS, ?TCS. — Euro-Siberian element.

Steppes and meadows.

I do not know of any current reliable record of *E. agraria* for the Caucasus. There are herbarium specimens from the vicinity of Zheleznovodsk (“Zheleznovodsk, 22 VI 1884, Akinfiyev” (KW!)), from Abkhazia (“Чедым, альпийские луга, Н. Альбов [Chedym, alpine meadows, N. Albov] (TBI!)) and one without precise locality (“Caucasus, G. S. Karelin, Herbarium proprium” (LE 01071329!)). These data are not confirmed by later gatherings, and the record for Abkhazia (in habitat atypical for this species) could be the result of mislabeling.

E. agraria is common in Crimea and can occur as native in WCC: 1a, especially on the Taman Peninsula, although it has not been found there yet.

61. *E. lucida* Waldst. et Kit. 1802, Pl. Rar. Hung. 1: 54, tab. 54. ≡ *Tithymalus lucidus* (Waldst. et Kit.) Klotzsch ex Garcke, 1858, Fl. N. Mitt.-Deutschland, ed. 4: 292. — **L e c t o t y p e** (Chrtek, Skočdoplová, 1982: 212): “Waldstein” (PR 155814/781!).

Wetlands, especially in Colchis lowlands, often near sea shore.

NTWC: 6a (Novorossiisk); **WTC**: 7b, 7c, 7d (Lake Paleostomi). — NCS, TCS. — Euro-Siberian element.

Records for WC: 5c (Zernov, Onipchenko, 2011) and CTC: 8a (Chinthibidze, Gvinianidze, 1983) belong to *E. iberica*.

62. *E. virgata* Waldst. et Kit. 1803–1804, Pl. Rar. Hung. 2: 176, tab. 162. ≡ *Tithymalus waldsteinii* Soják, 1972, Čas. Nár. Mus., Odd. Přír. 140, 3–4: 177. ≡ *Euphorbia waldsteinii* (Soják) Czer. II 1981, Sosud. Rast. SSSR: 216. ≡ *E. waldsteinii* (Soják) Radcl.-Sm. XI 1981, Kew Bull. 36 (2): 216, isonym. — **L e c t o t y p e** (Chrtek, Skočdoplová, 1982: 224): “in Hungarn” (PR 155811/782, al). — Fig. 7: C.

= *E. repens* K. Koch, 1849, Linnaea, 21: 728. — **N e o t y p e** (Geltman, 2011: 120): “Арапатский район, травянистые склоны в окрестностях оз. Карахач, 1750–1950 м, северный склон, 18 VI 1977, В. Манакян [Ararat district, grassy slopes in the vicinity of Karakhar Lake, 1750–1950 m, northern slope, 18 VI 1977, B. Manakyan]” (LE 01070947!, isoneotype: ERE!).

= *E. virgata* Waldst. et Kit. var. *orientalis* Boiss. 1862, in DC., Prodr. 15, 2: 160. ≡ *E. virgata* Waldst. et Kit. subsp. *orientalis* (Boiss.) Velen. 1891, Fl. Bulg.: 507. ≡ *Tithymalus boissierianus* Woronow, 1931, Sched.

Herb. Fl. Cauc. 10, № 479. ≡ *Euphorbia boissieriana* (Woronow) Prokh. 1949, Fl. URSS, 14: 445. ≡ *E. esula* L. subsp. *orientalis* (Boiss.) Molero et Rovira, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 163. — **L e c t o t y p e** (Geltman, 2015b: 132): “Ad margines hortorum circa Badalan distr. Khoi prov. Aderbeidzhan, 8 VI 1828, Szovits, № 399” (LE 01070958!).

= *E. saratoi* Ardoino, 1867, Fl. Anal. Alpes-Mar.: 335. ≡ *E. esula* L. var. *saratoi* (Ardoino) Fiori, 1901, in A. Fiori et al., Fl. Italia, 2: 288. ≡ *E. esula* L. subsp. *saratoi* (Ardoino) P. Fourn. 1936, Quatre Fl. France: 274. ≡ *E. waldsteinii* (Soják) Czer. subsp. *saratoi* (Ardoino) Oudejans, 1992 (publ. 1993), Collect. Bot. (Barcelona), 21: 189. — **L e c t o t y p e** (Molero, Rovira, 1992: 163): “L'Ariane, sur rive droite dupaillon, VI 1864–65, C. Sarato” (FI).

= *Tithymalus hypoleucus* Prokh. 1933, Sist. Obzor Moloch. Sredn. Azii: 199. ≡ *Euphorbia hypoleuca* (Prokh.) Rech. f. 1948, Ann. Naturhist. Mus. Wien 56: 212. — **L e c t o t y p e** (Geltman, 2015b: 132): “Turcomania, ad fl. Dajne-ssu, 30 VII 1898, D. Litwinow, № 1985” (LE 01071117!, isoelectotype: LE 01071118!).

= *E. virgultosa* Klovov, 1955, Fl. URSR, 7: 631. ≡ *Tithymalus virgultosus* (Klovov) Holub, 1973, Folia Geobot. Phytotax. 8: 175. ≡ *Tithymalus tommasinianus* (Bertol.) Soják subsp. *virgultosus* (Klovov) Soják, 1979 (publ. 1980), Čas. Nár. Mus., Odd. Přír. 148: 79. — **H o l o t y p e**: “Kiovia, in decliviis ad Borysthemen in horto urbica, 15 VI 1950, Klovov, Anfilava” (KW 022239!).

Roadsides, human settlements, forest belts, weed in agricultural lands, fallow lands, steppes, slopes and cliffs by sea shores and river banks; 0–1750 m.

WCC; ECC; WC: 3a, 3b, 3c; **CC; EC; NWTC; WTC**: 7a; **CTC**: 8a, 8c; **ETC; SWTC**: 10c; **STC**: 11a, 11b, 11d, 11e, 11f, 11g; **T**. — NCS, TCS. — West-Palearctic element.

E. virgata is one of the most problematic taxa of the genus. In some publications it was accepted as a subspecies of *E. esula* ([Radcliffe-Smith, Tutin, 1968; Molero, Rovira, 1992; etc.) or even synonymized with it (e. g. Hämet-Ahti et al., 1984). In my opinion, there are no grounds for such decision (Geltman, 1998b) and this point of view was recently shared by Molero et al. (2012) and Reichert et al. (2017).

However, *E. virgata* (described from Central Europe) itself is very variable, so there were several attempts to split it into several more natural taxa. Boissier described *E. virgata* var. *orientalis*, which differed from the typical variety by branching stems and elongated leaves. Klovov (1955) believed that true *E. virgata* occurs in Central Europe and described the closely related *E. virgultosa* from Kyiv. Recently Reichert et al.

(2017) proposed a similar approach based on karyological and morphological data. According to their opinion, the name *E. virgata* s. str. belongs to non-branched plants with narrow leaves and $2n = 20$ occurring in Central Europe only; while for branched plants with wider leaves and $2n = 60$ (presumably native to Eastern Europe, but widely introduced, including North America) the name *E. saratoi* should be applied.

Here I prefer to accept a very variable *E. virgata* with several ploidy levels as a single species. It is quite probable that the *E. virgata* s. l. complex was initially represented by several geographical races of subspecies or even species level. However, with the development of agriculture a polyploid weedy form appeared; it was widely introduced and now apparently has almost completely absorbed local races as a result of hybridization. “Traces” of such races could be found with very careful analysis and good experience.

E. virgata definitely needs careful studies throughout its whole distribution area.

Records of *E. esula* for ECC: 2a and CC: 4a (Tanfilyev, Kononov, 1987: 68; Ivanov, 1997: 81, Mikheev, 2009: 31) most likely belong to *E. virgata*.

63. *E. pseudagraria* P. Smirn. 1940, Byull. Moskovsk. Obshch. Isp. Prir., Otd. Biol. 49, 2: 85. — **Holotype**: “Верховья р. Голубой, мел, по днущу балки, среди *Juniperus sabina*, близ хут. Голубинского, 15 V 1938, П. Смирнов [Upper reaches of the river Golubaya, chalk, bottom of ravine, among *Juniperus sabina*, near Golubinsky, 15 V 1938, P. Smirnov]” (MW 0593520!, isotypes: LE 01071084–01071087!).

Steppes on calcareous substrate.

ECC: 2a. — **NCS**. — Euro-Siberian element.

64. *E. sareptana* Becker, 1858, Bull. Soc. Nat. Moscou, 31 (1): 13. ≡ *Tithymalus sareptanus* (Becker) Prokh. 1949, Fl. URSS, 14: 426, nom. altern. — **Lectotype**: (Geltman, 1998a: 39): “Sarepta, 27 V 1851, A. Becker” (LE 01071089!).

= *E. tanaitica* Pacz. 1891, Mat. Fl. Step. Donskoi Obl.: 78. ≡ *Tithymalus tanaiticus* (Pacz.) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **Lectotype** (Geltman, 2015b: 131): “In steppis pr. stat. Kagalnickaja, Terra Cosacorum Tanaicens, 3 V 1889, I. Paczowski” (KW 022235!, isoelectotype: LE 01071102!).

= *E. chimaera* Lipsky, 1899, Trudy Tiflissk. Bot. Sada, 4: 444. ≡ *Tithymalus chimaerus* (Lipsky) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **Lectotype** (Geltman, 1998a: 198): “Черноморский округ, Новороссийск, [11] V 1892, Липский [Cherno-

morsky District, Novorossiisk, [11] V 1892, V. Lipsky” (LE 01057270!).

= *E. chimaera* Lipsky var. *kimmerica* Lipsky, 1899, Trudy Tifl. Bot. Sada, 4: 444. ≡ *E. kimmerica* (Lipsky) Grossh. 1932, Fl. Kavkaza, 3: 39. — **Lectotype** (Geltman, 2011: 120): “Черноморский округ, Новороссийск, 11 V 1892, Липский [Chernomorsky District, Novorossiisk, 11 V 1892, V. Lipsky]” (LE 01070905, isoelectotype: LE 01070906!).

Steppes.

WCC; **WC**: 3a; **NWTC**: 6a. — **NCS**. — Euro-Siberian element.

An enigmatic species occasionally found in steppes of Eastern Europe and the Northern Caucasus, sometimes together with *E. subtilis*.

65. *E. subtilis* (Prokh.) Prokh. 1949, Fl. URSS, 14: 421. — *E. gracilis* M. Bieb. 1819, Fl. Taur.-Cauc. 3: 324, nom. illeg., non Loisel. 1807. ≡ *Galarhoeus subtilis* Prokh. 1941, Trudy Kuibyshevsk. Bot. Sada, 1: 48. ≡ *Tithymalus subtilis* (Prokh.) Prokh. 1949, l. c.: 421, nom. altern. — **Lectotype** (Geltman, 1998a: 200): “Kursk — Belgorod, 1812 [Marschall Bieberstein]” (LE-Bieb.: LE 01071009!). — Fig. 8.

= *E. baxanica* Galushko, 1970, Novosti Sist. Vyssh. Rast. 6: 216. ≡ *Tithymalus baxanicus* (Galushko) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **Neotype** (Geltman, 2015b: 127): “Кабардино-Балкария, Баксан, р. Гижгит, в 4 км выше устья, на скалах, 5 VI 1960, А. Галущко [Kabardino-Balkaria, Baksan, Gizhgit River, 4 km above its mouth, on rocks, 5 VI 1960, A. Galushko]” (LE 01057265!).

= *E. meyeriana* Galushko, 1970, Novosti Sist. Vyssh. Rast. 6: 216. ≡ *Tithymalus meyerianus* (Galushko) Galushko, 1979, Fl. Severn. Kavkaza Vopr. Ist. 3: 56. — **Holotype**: “In rupestribus versus fluv. Kashaut, 5000–6000 ped., 3 VII [1834] [Meyer]” (LE 01070938!).

Steppes, steppified meadows, rocks; 300–1600 m.

WCC; **WC**: 3c, 3d; **CC**: 4b; **EC**: 5b; **NWTC**; **CTC**: 8a (Borjomi). — **NCS**, **TCS**. — Euro-Siberian element.

This species is common in steppes of Eastern Europe and the Northern Caucasus, but also penetrates into arid montane areas.

66. *E. daghestanica* Geltman, 1997, Bot. Zhurn. 82 (3): 122. — **Holotype**: “Дагестанская АССР, Левашинский р-н, окр. с. Цуда[к]хар, h — 1200 м, в трещинах скал, 10 VII 1961, Н. Н. Цвелев и др., № 3215 [Daghestan ASSR, Levashi district, vicinity of Tsudakhar, h — 1200 m, in rock crevices, 10 VII 1961, Tzvelev et al., № 3215]” (LE 01070912!).

Rocks and dry stony slopes; 900–3700 m.



Fig. 8. *Euphorbia subtilis*.

CC: 4c; **EC:** 5a, 5b, 5c; **STC:** 11e, 11g. — NCS, TCS. — Euro-Siberian (Caucasian) element.

67. *E. leptocaula* Boiss. 1862, in DC., Prodr. 15, 2: 159. ≡ *Tithymalus leptocaulus* (Boiss.) Prokh. 1949, Fl. URSS, 14 : 443, nom altern. — **L e c t o t y p e** (Geltman, 2002a: 118): “Taur[ia], Steven” (G!, isolectotypes: LE-Bieb.: LE 01071025!, LE 01071078!, 01071079!).

Steppes, dry stony slopes; 0–550 m.

WCC; ECC; WC: 3a; **NWTC:** 6a. — NCS. — Euro-Siberian element.

The record for West Transcaucasia (Gouria) (Ledebour, 1850: 572) appeared by mistake (see Geltman, 2002a: 118). The record for WC: 3c (Zernov, Onipchenko, 2011: 133) in fact refers to *E. subtilis*.

68. *E. astrachanica* C. A. Mey. ex Trautv. 1844, Trudy Imp. Peterb. Bot. Sada, 9 (1): 156 (Inc. Fl. Fanerogam. Ross. 3). ≡ *E. leptocaula* Boiss. var. *praecox* Boiss. 1862, in DC., Prodr. 15, 2: 159. — *E. praecox* (Boiss.) B. Fedtsch. et Flerow, 1909, Fl. Evrop. Rossii: 614. — **L e c t o t y p e** (Geltman, 2002a: 119): “Pl. Wolga infer., locis salsis argillosis, Maio, A. Becker” (G!, isolectotypes: LE 01071063!, 01071064!).

— *E. praecox* M. Bieb. ex Fisch. 1808, Cat. Jard. Pl. Gorenk.: 120, nom. inval.

— *E. astrachanica* C. A. Mey. ex Claus, 1851, Beitr. Pfl. Russ. Reich. 8: 254, nom. inval.

Steppes, usually on clayey substrates.

WCC. — NCS. — Irano-Turanian element.

Recorded for ECC: 2a, 2b (Galushko, 1980: 201; Terekbaev, 1991: 94), but herbarium material is not available. My previous record for EC: 5b (Geltman, 1996: 100) is erroneous and belongs to *E. daghestanica*.

69. *E. undulata* M. Bieb. 1808, Fl. Taur.-Cauc. 1: 371. ≡ *Tithymalus undulatus* (M. Bieb.) Klotzsch et Garcke, 1860, Abh. Akad. Wiss. Berlin 1859: 92. — **L e c t o t y p e** (Geltman, 1998a: 201): “Ex dit. Wolgicis: inter Astrachan et Zarizyn, 1800 [Marschall Bieberstein]” (LE-Bieb.: LE 01071058!).

Semideserts and dry steppes.

Can be found in **ECC.** — NCS — Euro-Siberian element.

I know of a single specimen without indication of the precise locality: “Caucasus, herb. Fischer” (LE 01071328!). Grossheim (1932: 37) mentioned this species for “North Caucasus” and Tamamschyan (1962: 95, map 107) recorded on his map a single locality in ECC: 2b. Galushko (1980: 201) believed that this species occurs in several places of the central part of Pre-Caucasia, but herbarium materials are not known. Having in mind the distribution of this species and

its habitat preferences, its occurrence in ECC is very probable.

70. *E. buschiana* Grossh. 1940, Bot. Zhurn. 25 (4–5): 330. ≡ *Tithymalus buschianus* (Grossh.) Soják, 1972, Čas. Nar. Mus., Odd. Přír. 140: 170. — Holotype: “р. Сукан, верховья, урочище Сукан-баша-цифи, 2400 м, лев. борт Сукана, 29 VII 1931, Е. и Н. Бунш [River Sukan, upper reaches, Sukan-bashi-tsifi terrain feature, 2400 m, left bank of Sukan, 29 VII 1931, E. and N. Busch]” (LE 01057266!, isotype: LE 01057267!).

Rocks in subalpine and alpine belt; 1400–2700 m.

CC: 4b, 4c; **EC:** 5b (Botlikh district, vicinity of Alak). — NCS. — Euro-Siberian (Caucasian) element.

Subgen. 2. *Chamaesyce* Raf.

Sect. 1. *Anisophyllum* Roep.

71. *E. nutans* Lag. 1816, Gen. Sp. Pl.: 17. ≡ *Chamaesyce nutans* (Lag.) Small, 1903, Fl. S. E. U.S.: 712. — Lectotype (Wheeler, 1941: 144: “Habit. in N[ova] H[ispania], J. D. Rodriguez” (MA 250449 — image!)).

Roadsides, human settlements, agricultural fields, pastures, sea shores and river banks, alien; 0–700 m.

WC: 3b; **CC:** 4a; **EC:** 5b; **NWTC:** 6a; **WTC:** 7a, 7b, 7c, 7d; **CTC:** 8a; **ETC:** 9a, 9b; **STC:** 11d. — NCS, TCS.

Grossheim (1949) mentioned *E. indica* Lam. for the Apsheron Peninsula (ETC: 9b) and Talysh. Re-examination of corresponding herbarium material from the Apsheron Peninsula (BAK) showed that in fact they belong to *E. nutans*.

72. *E. peplis* L. 1753, Sp. Pl.: 455. ≡ *Chamaesyce peplis* (L.) Prokh. 1933, Sist. Obzor Moloch. Sr. Azii: 15. — Type not designated.

Sea shores.

WCC: 1a; **NWTC:** 7a, 7b, 7c, 7d. — NCS, TCS. — Macaronesian-Mediterranean element.

73. *E. humifusa* Willd. 1813, Enum. Pl. Horti Berol., suppl.: 27. ≡ *Chamaesyce humifusa* (Willd.) Prokh. 1927, Izv. Akad. Nauk SSSR, 3–4: 195. — Type not designated.

= *E. pseudochamaesyce* C. A. Mey. 1842 (publ. 1843), Index Seminum (LE), 9: 73. ≡ *Chamaesyce humifusa* (Willd.) Prokh. var. *pseudochamaesyce* (Fisch. et C. A. Mey.) Hurus. 1954, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 6: 288. ≡ *Euphorbia humifusa* Willd. var. *pseudochamaesyce* (Fisch. et C. A. Mey.) Murata, 1962, Acta Phytotax. Geobot. 20: 198. — Lectotype (Baikov, 2007: 107): “In rupestribus inter Bu-

chtarminsk et Woronenskoi, 1840, Karelin et Kirilloff” (LE 01071324!).

River banks, pastures and fallow lands, roadsides, agricultural lands; ?alien.

ECC: 3c; **CC:** 4a, 4c; **EC:** 7b, 7c; **CTC:** 8a; **ETC:** 9e, 9f. — NCS, TCS. — South-Palearctic element.

The lectotype selection of *E. pseudochamaesyce* proposed by Baikov (2007) cannot be regarded as fully suitable. One cannot be sure that this specimen was definitely seen by the author of the name, and, hence, may not represent a part of the original material.

E. humifusa is a species of Asian origin, but was introduced to Europe long ago. In the north and north-eastern parts of the Caucasus it could be native, but in other areas it is most probably alien.

74. *E. chamaesyce* L. 1753, Sp. Pl.: 455. ≡ *Chamaesyce vulgaris* Prokh. 1941, Trudy Kuibyshevsk. Bot. Sada, 1: 8. — Lectotype (Khan, 1964: 152): “Löfling, № 373, Herb. Linn. № 630.15” (LINN!).

= *E. canescens* L. 1762, Sp. Pl., ed. 2: 652. ≡ *Chamaesyce canescens* (L.) Prokh. 1933, Sist. Obzor Moloch. Sr. Azii: 19. ≡ *E. chamaesyce* L. subsp. *canescens* (L.) Prokh. 1964, Novosti Sist. Vyssh. Rast. [1]: 237. — Lectotype (Benedí González, Orell, 1993: 149): “Alströmer, № 146a, Herb. Linn. № 630.16” (LINN!).

= *E. massiliensis* DC. 1815, in DC. et Lam., Fl. Fr., ed. 2, 5: 357. ≡ *E. chamaesyce* L. var. *massiliensis* (DC.) Thell. 1917, in Ascherson u. Graebner, Syn. Mitteleur. Fl. 7: 457. ≡ *Chamaesyce canescens* (L.) Prokh. subsp. *massiliensis* (DC.) Soják, 1972, Čas. Nár. Mus., Odd. Přír. 140: 169. ≡ *Chamaesyce massiliensis* (DC.) Galushko, 1974, Novosti Sist. Vyssh. Rast. 11: 299.

River banks and sea shores, steppes and semideserts, agricultural and fallow lands, human settlements; 5–550 m.

WCC: 1a; **EC:** 7a; **NWTC:** 6a; **WTC:** 8a; **ETC:** 9b, 9e; **STC:** 11. — NCS, TCS. — European-Pantethyan element.

E. chamaesyce varies in the presence and density of the indumentum. Prokhanov (1949, 1964) treated glabrous and semigrabrous forms as *E. chamaesyce* s. str. (or *E. chamaesyce* subsp. *chamaesyce*) and pilose forms as *E. canescens* (or *E. chamaesyce* subsp. *canescens*). There are some grounds for this point of view: e. g. in the southeast of European Russia mainly glabrous forms are found. However, in other areas both forms are usually present in the same local populations.

Here I follow Pahlevani, Riina (2011) and accept *E. chamaesyce* in the broad sense. At the same time careful revision of this group in all its vast distribution area is absolutely necessary.

75. *E. glyptosperma* Engelm. 1858, in W. H. Emory, Rep. U.S. Mex. Bound. 2(1): 186. ≡ *Chamaesyce glyptosperma* (Engelm.) Small, 1903, Fl. S.E. U.S.: 712. — Lectotype (Wheeler, 1937: 496): “Fort Kearney on the Platte, VII 1856, Engellmann” (MO 144635 — image!).

= *E. glyptosperma* Engelm. var. *tenerrima* Engelm. 1858, in W. H. Emory, Rep. U.S. Mex. Bound. 2 (1): 187. — Lectotype (Wheeler, 1941: 235): “[pebbly bars of the Nueces River, Texas, 25 V 1851] C. Wright, № 1853” (MO 144673/2196682 — image!; isolectotypes: F 0056275F — image!, GH 00047685!, 00047686 — image!, K 001080336!, 001080340 — image!, NY 00263120 — image!).

= *E. glyptosperma* Engelm. var. *pubescens* Boiss. 1862, in DC., Prodr. 15, 2: 48. ≡ *Chamaesyce glyptosperma* (Engelm.) Small var. *pubescens* (Boiss.) Millsp. 1913, Living Fl. W. Va, 5A (1): 294. — Lectotype (Wheeler, 1941: 235): “Bords du Mississippi en Illinois, VIII 1846, Riehl, № 472” (G!).

Steppes and semideserts, alien.

WCC: 1b; **ECC:** 2b.

This North American plant was collected for the first time in the Caucasus in 1987–1988, but it has only recently been properly named (Geltman, Medvedeva, 2017). It could also be found in other steppe areas of the Caucasus.

76. *E. granulata* Forssk. 1775, Fl. Aegypt.-Arab.: 94. ≡ *Chamaesyce granulata* (Forssk.) Soják, 1972, Čas. Nár. Mus., Odd. Přír. 140: 169. — Type not designated.

= *E. turcomanica* Boiss. 1860, Cent. Euphorb.: 13. ≡ *Chamaesyce turcomanica* (Boiss.) Prokh. 1933, Sist. Obzor Moloch. Sr. Azii: 21. ≡ *Euphorbia granulata* Forssk. var. *turcomanica* (Boiss.) Hadidi, 1973, Bull. Jard. Bot. Natl. Belg. 43: 93. — Lectotype: (Rechinger, Schiman-Czeika, 1964): “In littore orientali maris Caspii, 1834, D. Karelin” (G-DC!).

Steppes and semideserts.

ETC: 9e (Mugan steppe); **STC:** 11d, 11f. — TCS.

I follow Radcliffe-Smith (1980) and Pahlevani, Riina (2011) and treat *E. turcomanica* Boiss. as a synonym of *E. granulata* Forssk.

77. *E. maculata* L. 1753, Sp. Pl.: 455. ≡ *Chamaesyce maculata* (L.) Small, 1903, Fl. S.E. U.S.: 713. — Lectotype (Croizat, 1962: 191): “21. maculata; Herb. Linn. № 630.11” (LINN!).

Riverbanks and seashores, pastures, roadsides, human settlements; alien; 0–1500 m.

WCC: 1a; **CC:** 4a, 4c; **NWTC:** 6a; **WTC:** **CTC:** 8a; **ETC:** 9a, 9b, 9d; **STC:** 11a, 11f, 11g; **T:** — NCS, TCS.



Fig. 9. *Euphorbia davidii*.

78. *E. forskaolii* J. Gay, 1847, in Webb et Berthelot, Phytogr. Canar. 2 (3): 240. ≡ *Chamaesyce forsskaolii* (J. Gay) Prokh. 1949, Fl. URSS, 14: 493, “forsskalii”. — Type not designated.

Agricultural lands; alien.

WTC: 7c; **ETC:** 9e; **T:** — TCS.

Sect. 2. *Poinsettia* (Graham) Baill.

79. *E. davidii* Subils, 1984, Kurtziana, 17: 125. — Holotype: “Argentina: Córdoba: Depto. Río Cuarto, Alpa Corral, Arroyo Las Moras, cerca de la unión con Arr[oyo] el Talita, 19 Nov 1982, Subils & Moscone 3115” (CORD). — Fig. 9.

Roadsides, human settlements, agricultural lands; alien; 300–680 m.

WCC: 1a; **ECC:** 2b; **EC:** 3a, 3c; **CC:** 4a, 4c; **EC:** 5a; **WTC:** 7a, 7b. — NCS.

First collected in 1968 in Pyatigorsk and named *E. dentata* Michx. (Mikheev, 1971). The record of *E. geniculata* Ortega for the same locality (Dorofeyev, 2011) refers to *E. davidii* as well.

Sect. 3. *Alectorroctonum* (Schltdl.) Baill.

80. *E. marginata* Pursh, 1814, Fl. Amer. Sept. 2: 607. ≡ *Tithymalus marginatus* (Pursh) Cockerell, 1909, Torreyia, 9: 119. ≡ *Agaloma marginata* (Pursh) Á. Löve et D. Löve, 1961, Bot. Not. 114: 40. — Type not designated.

Cultivated as an ornamental plant. Known as escaping from cultivation wild in CC: 4a, 4c, could be found in other regions.

Discussion

The current *Euphorbia* treatment for the Caucasus contains 80 species. From this number, 73 species are highly likely indigenous and/or archaeophytes (including *E. agraria*, *E. platyphyllos* and *E. undulata* which could be found in the area although currently there are no reliable records). There are also 7 alien species, most of them (5) of New World origin.

The geographical analysis of the indigenous component of Caucasian *Euphorbia* (see Table) shows that the majority of species belong to Euro-Siberian, Irano-Turanian and Submediterranean elements. The Euro-Siberian geographical element evidently dominates (41.10 %). However, if we apply a narrower approach to the definition of geographical elements for the Caucasus (e. g. according to Portenier (2000) and Geltman (2010)), one can see that 7 species of Euro-Siberian element in the “broad sense” could be characterized as Caucasian (*E. ardonensis*, *E. aristata*, *E. czerepanovii*, *E. daghestanica*, *E. normannii*, *E. procera*, *E. wittmannii*), 3 – Euxinian (*E. djimilensis*, *E. eugeniae* and *E. scripta*), 1 – Caucasian-Euxinian (*E. oblongifolia*) and 2 – Caucasian-Euxinian-Hyrcanian (*E. macroceras* and *E. squamosa*). So, about 43 % of Euro-Siberian Caucasian *Euphorbia* species are restricted to three main floristic provinces of the Caucasus (Caucasian, Euxinian and Hyrcanian).

The Irano-Turanian element is the second largest one by number of species (15, or 20.54 %); these species occur mainly in Transcaucasia. An important number of species come from the Submediterranean element (15.07 %) which includes (Geltman, 2016): (a) species occurring in the Mediterranean region itself (usually at higher elevations) and also in neighboring areas (*E. myrsinites*, *E. rigida*); (b) species found in the Mediterranean and/or at the western edge of the Irano-Turanian region and at the same time in southern parts of the Circumboreal region, where such plants are usually restricted to “Mediterranean-like” habitats (*E. aulacosperma*, *E. condylocarpa*, *E. glareosa*, *E. ledebourii*, *E. microspheara*, *E. petrophila*, *E. rhabdotosperma*); (c) species endemic to the mountain systems located at the northern border of the Mediterranean, or local endemics to the areas adjoining the Mediterranean (*E. erythrodon* and *E. panjutinii*).

Eight species (10.96 %) belong to the European-Pantethyan element. These plants are mostly weeds of Mediterranean origin, but they also occur in Europe and/or the Irano-Turanian region.

Table. Geographical elements of indigenous fraction of Caucasian *Euphorbia*

Geographical element	Number of species	Percentage of total number of indigenous species
Palearctic	1	1.37
West Palearctic	2	2.74
Euro-Siberian	30	41.10
Pantethyan	1	1.37
European-Pantethyan	8	10.96
Mediterranean	2	2.74
Macaronesian-Mediterranean	3	4.11
Submediterranean	11	15.07
Irano-Turanian	15	20.54
TOTAL	73	

Mediterranean and Macaronesian-Mediterranean species are poorly represented in the Caucasus and include species restricted to sea shores (*E. hirsuta*, *E. peplis*, *E. terracina*), and possible archaeophytes (*E. aleppica*). The data on *Euphorbia* shows that there are no true enclaves of Mediterranean flora in the Caucasus.

Taxonomically most of Caucasian *Euphorbia* species (70, or 87.5 %) belong to subgen. *Esula*, which is perfectly expected for temperate floras of Eurasia. These species belong to 16 sections of the 21 currently accepted sections in the subgenus (Riina et al., 2013). By the number of species, section *Helioscopia* is the largest (23 species) followed by sections *Esula* (13 species) and *Pithyusa* (11 species). The representatives of these 3 sections comprise about 67 % of the number of species in the subgenus. Other sections contain 5 or less species, and 9 sections are represented by a single species. Subgen. *Chamaesyce* is represented by 10 species (of 3 sections) and only 3 of them are indigenous.

Conclusion

The taxonomy and geography of Caucasian *Euphorbia* species are of great interest because of high biodiversity significance of the area. The following directions for future studies are the most notable.

1. Careful investigation of critical taxa, first of all *E. virgata* s. l. and *E. chamaesyce* s. l. Such studies should include several techniques (including molecular and karyological) and employ material from the entire distribution area; data from the Caucasus are critical to produce adequate results.

2. Although the distribution patterns of most native Caucasian *Euphorbia* are more or less clear, some new important data could be obtained. Special attention

should be paid to lowland areas of Ciscaucasia, especially still unknown but preserved spots of native steppe vegetation; regarding Transcaucasia, there are also some underinvestigated areas, especially in Azerbaijan and southern and southwestern Georgia (Ajara and Samtskhe-Javakheti).

3. It is important to clarify the current status of some wetland species (*E. hirsuta*, *E. lucida*, *E. palustris*) known from specimens that are 60 or more years old.

4. The distribution dynamic of alien species, especially *E. davidii* and *E. nutans*, needs careful studies; it would also be important to trace the current status of *E. forskalii*, known only from old gatherings. A special search for possible new aliens is also very important.

5. According to my calculations at the moment at least some molecular data are available for 59 *Euphorbia* species occurring in the Caucasus and data for 21 species were received using the material collected in the Caucasus. So, additional new sample collecting and analyses are necessary. Besides, molecular techniques could be used for phylogeographic research which could clarify the history of the distributions of some species (e. g. *E. amygdaloides*, *E. macroceras* or *E. squamosa*), as well the affinity of Caucasian species with those occurring in neighboring areas.

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