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A synopsis of *Euphorbia* subgen. *Chamaesyce* (Euphorbiaceae) in Iran

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This paper is the first taxonomic revision of *Euphorbia* subgenus *Chamaesyce* in Iran since the publication of Flora Iranica in 1964. We provide a key, descriptions, and illustrations for the eight species of the subgenus occurring in Iran. *Euphorbia nutans* is reported as a new record for the flora of Iran, *E. humifusa* is recognized to have two forms, pilose and glabrous; the pilose form is a first report for Flora Iranica, and *E. granulata* var. *turcomanica* is reported as a synonym of *E. granulata*. The following information is given for each species: accepted name, synonymy, habitat, ecology, and geographical distribution.

Introduction

Euphorbia is one of the five most species-rich genera of flowering plants (Frodin 2004) with approximately 2000 species (Govaerts *et al*. 2000) occurring in all temperate and tropical regions, occupying a wide range of habitats and exhibiting a great diversity of growth forms. The subgenus *Chamaesyce* comprises about 250 species, most of which are confined to deserts and littoral regions of tropical America and the Polynesian islands, where woody forms commonly occur (Prokhanov 1974, Benedi & Orell 1992). Species in subgenus *Chamaesyce* are typically small herbs characterized by an early abortion or lack of the apical meristem, resulting in sympodial branching. The loss of monopodial branching and presence of the C4 photosynthetic pathway suggest adaptability of the subgenus *Chamaesyce* to extreme arid habitats.

We recognize eight species occurring in Iran; four are indigenous annuals of dry steppes and deserts, and four are introduced weeds in cultivated areas. The weedy species often spread to countries far from their native range, and thus it is not surprising to find that of the eight Iranian taxa of subgenus *Chamaesyce* only four are indigenous. This work is part of a worldwide initiative to conduct research on the systematics of *Euphorbia* (*see* the *Euphorbia* Planetary Biodiversity Inventory website at www.euphorbiaceae.org), and it is the first taxonomic revision of *Euphorbia* subgenus *Chamaesyce* of Iran since the publication of *Flora Iranica* in 1964.

Subgenus *Chamaesyce* is a well-defined group within *Euphorbia*, yet it has a complicated taxonomic history. Originally classified as genus *Anisophyllum* by Haworth (1812), this group was

later recognized as subgenus *Chamaesyce* by Rafinesque (1817). While some authors followed Rafinesque's concept (Gray 1821, Prokhanov 1974, Radcliffe-Smith 1980, 1982, 1986), other authors continued treating the group as section *Anisophyllum* (Boissier 1879, Rechinger & Schiman-Czeika 1964). Wheeler (1936) provided a taxonomic history of sect. *Anisophyllum*. Several authors have also recognized *Chamaesyce* as a distinct genus (Hurusawa 1954, Croizat 1972, Rao & Prasad 1987, Benedi & Orell 1992). Further, Hurusawa (1954) recognized three sections within the genus *Chamaesyce*: section *Chamaesyce*, section *Hypericifoliae* and section *Sclerophyllae*.

Here we treat *Chamaesyce* at the rank of subgenus following recent molecular phylogenetic studies, which place *Chamaesyce* well nested within *Euphorbia* (Steinmann & Porter 2002, Bruyns *et al*. 2006). We have refrained from subdividing the subgenus *Chamaesyce* into sections and subsections because such a step would only be possible after a comprehensive phylogenetic study of the worldwide species diversity, which is currently underway.

Material and methods

Herbarium specimens of *Euphorbia* subgenus *Chamaesyce* from several Iranian herbaria such as IRAN, TARI (Holmgren & Holmgren 1998) and the private herbarium of Akhani (Hb. Akhani) currently housed at the Department of Plant Sciences, University of Tehran, as well as newly collected specimens from Iran, were studied and identified using the relevant taxonomic literature and floras. Included in the synopsis of each species are the following details: accepted name, synonymy, description, illustration, brief characterizations of ecology, habitat, and geographical distribution. This information was compiled from examination of herbarium specimens, field observation in Iran, and key literature (Muschler 1912, Rechinger & Schiman-Czeika 1964, Rechinger 1964, Radcliffe-Smith & Tutin 1968, Zohary 1972, Prokhanov 1974, Radcliffe-Smith 1980, 1982, 1986, Mouterde 1986, Collenette 1999).

Taxonomic synopsis

Euphorbia L.

Spec. Plant. 450. 1753, Gen. Pl. 1: 157. 1737.
Tithymalus Scop., Fl. Germ. 5: 1. 1849.

Subgenus *Chamaesyce* Raf.

Amer. Monthly Mag. & Crit. Rev. 2: 119. 1817. — TYPE: *E. supina* Raf. (lectotype, designated by Wheeler, Contr. Gray Herb. 127: 51. 1939).

Anisophyllum Haw., Syn. Pl. Succ. 159. 1812, *nom. illeg*., *non* Jacq. 1763. — *Euphorbia* subgen. *Anisophyllum* (Haw.) Gaucher, Ann. Sci. Nat. Bot., Ser. 8, 15: 294. 1902. — *Euphorbia* sect. *Anisophyllum* (Haw.) Webb & Berth., Phyt. Canar. Sect. 3: 236. 1847.

Chamaesyce S.F. Gray, Nat. Arr. Brit. Pl. 2: 260. 1821. — *Euphorbia* subgen. *Chamaesyce* (S.F. Gray) House, Bull. New York State Mus. 254: 470. 1924, *nom. illeg*.

Euphorbia Sect. *Anisophyllum* Roeper *in* Duby, Bot. Gall. 1: 412. 1828.

Aplarina Raf., New Fl. 4: 99. 1838.
Ditritra Raf., Sylva Tellur. 115. 1838.
Xamesike Raf., Fl. Tell. 4: 115. 1838.

Prostrate to ascending annuals with sympodial branching. Leaves opposite, distichous, oblique at base, petiolate, with interpetiolar stipules. Cyathia axillary, not arranged in pseudoumbels; cyathial glands 4, rounded and appendiculate. Fruits trigonous, pilose or glabrous. Seeds ecarunculate.

Key to the species of *Euphorbia* subgenus *Chamaesyce* in Iran

1. Plants usually glabrous (except sometimes in *E. humifusa*); seeds smooth 2
1. Plants usually pubescent (except sometimes in *E. granulata* and rarely in *E. chamaesyce*); seeds grooved or rugulose 3
2. Leaves serrulate at least in upper half, stipules distinct and filiform, plants glabrous or sparingly pubescent .... *E. humifusa*
2. Leaves entire; stipules white, united, triangular, laciniate or fimbriate. Stems almost always rooting at nodes, plants always glabrous ..... *E. serpens*
3. Fruits pilose along keels only, otherwise glabrous. Leaves slightly asymmetrical at the base. Glands with small appendages ..... *E. prostrata*
3. Fruits uniformly pubescent or glabrous. Leaves completely asymmetrical at the base. Glands with large appendages 4
4. Cyathia aggregated together into clusters. Leaves more than 12 mm long, ovate or oblong-elliptic with promi-

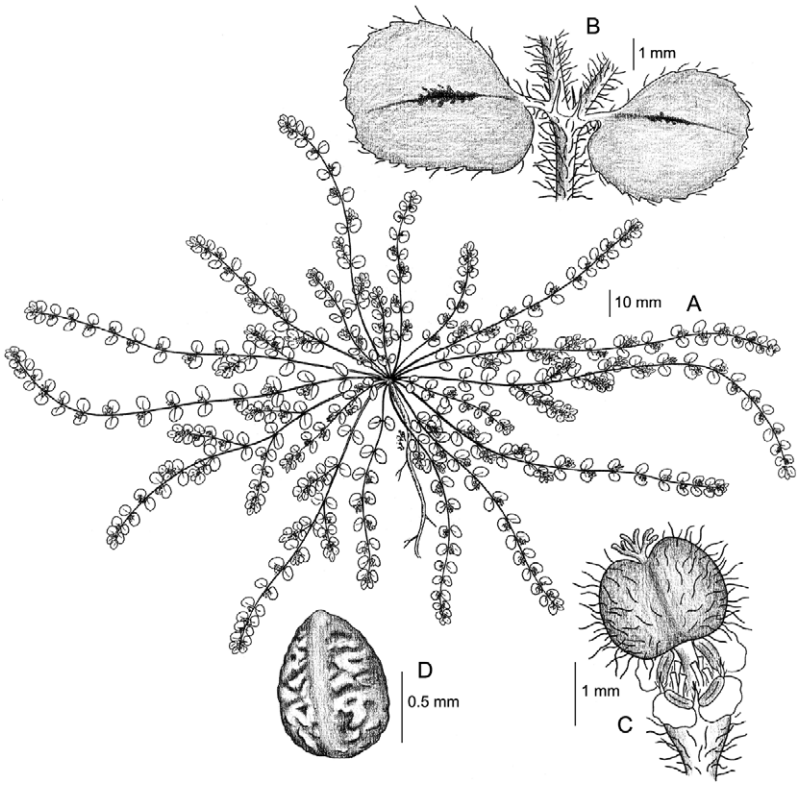

Fig. 1. *Euphorbia chamaesyce*. — **A**: Habit. — **B**: Leaves and stipules. — **C**: Cyathium and fruit. — **D**: Seed. (IRAN 44525).

nent palmate nerves 5
4. Cyathia axilary, solitary, often borne on specialized lateral shoots. Leaves usually not more than 10 mm long (sometimes more than 10 mm in *E. maculata*), orbicular, oblong or ovate, without prominent palmate nerves 6
5. Fruits glabrous. Leaves usually with a red-purple spot on the adaxial side ..... *E. nutans*
5. Fruits pubescent. Leaves without spots ..... *E. indica*
6. Leaves dentate or crenulate all around, usually with a reddish central spot 7
6. Leaves entire or slightly dentate at apex, without a reddish central spot ..... *E. granulata*
7. Plants canescent. Leaves usually orbicular-ovate with a central pale red spot or rarely without it. Capsule with patent hairs or glabrous. Seeds irregularly tuberculate-rugulose ..... *E. chamaesyce*
7. Plants not canescent. Leaves usually oblong-ovate with a prominent reddish central spot. Capsule with closely appressed hairs. Seeds 3–4 times transversely grooved . ..... *E. maculata*

Euphorbia chamaesyce L. (Fig. 1)

Sp. Pl. 1: 455. 1753. — *Tithymalus chamaesyce* (L.) Moench, Methodus: 666. 1794. — *Anisophyllum chamaesyce* (L.) Haw., Syn. Pl. Succ.: 160. 1812.

Euphorbia canescens L., Sp. Pl. ed. 2: 652. 1762. — *Chamaesyce canescens* (L.) Prokh., Consp. Syst. Tithymalus As. Med. 15: 19. 1933.

Euphorbia massiliensis DC., *in* Lam. & DC. Fl. Fr. 6: 357. 1815. — *Euphorbia chamaesyce* var. *massiliensis* (DC.) Thell. *in* Asch. & Graebn., Syn. 7: 455. 1916. — *Chamaesyce massiliensis* (DC.) Galushko, Novosti Sist. Vyssh. Rast. 11: 299. 1974.

Euphorbia pinnulosa Lojac., Fl. Sicul. 2(2): 329. 1907.

Euphorbia vaticana Gand., Nov. Consp. Fl. Eur.: 417. 1910.

Chamaesyce vulgaris Prokh., Tr. Kuibysh. Bot. Sada, 1: 8. 1941.

Procumbent, pilose-villous or subglabrous, glaucous annuals with branches up to 30 cm. Leaves 2–9 × 2–5.5 mm, asymmetrically ovate-suborbicular, obtuse, rarely emarginated, serrulate at least in upper half and sometimes cartilaginous, sometimes with a median purple or red blotch; petiole ca. 1 mm; stipules up to 1 mm, triangular or subulate. Glands suborbicular, with lobate, whitish appendages. Capsules 2 mm diameter, densely patent-pubescent to glabrous. Seeds 1.1–1.5 mm long, ovoid-quadran-

gular, irregularly tuberculate-rugulose, grayish, ecarunculate.

HABITAT: Rocky hillsides, gravel plains, saline and sandy soils, disturbed habitats, fields, gardens and roadsides. Sea level to 2900 m.

GEOGRAPHICAL DISTRIBUTION: S and SW Europe and Mediterranean region (Albania, Hungary, Croatia, Portugal, Spain, France, Italy, Yugoslavia, Romania, Bulgaria, Greece, Turkey, Crimea and S Russia), Asia (Afghanistan, Caucasus, Iran, Iraq, Israel, Kazakhstan, Kyrgyzstan, Lebanon, Pakistan, Saudi Arabia, Syria, Tajikistan, Turkmenistan and Uzbekistan) and North Africa (Algeria, Egypt, Libya, Morocco and Tunisia).

ORIGIN: Old World. Feinbrun and Zohary (as cited in Smith 1980) indicated Mediterranean and Irano–Turanian connections for this ruderal species. Chromosome number 2n = 14 (Benedi & Orell 1991).

FLOWERING AND FRUITING TIME: June–October. In warmer regions (Khuzestan Province of Iran) plants last until November–December.

Some authors have considered *E. chamaesyce* subsp. *massiliensis* a separate taxon (Radcliffe-Smith & Tutin 1968, Benedi & Orell 1992), whereas Govaerts *et al.* (2000) synonymized it with *E. chamaesyce*. After a close examination of herbarium material, newly collected specimens, and study of the literature (Radcliffe-Smith & Tutin 1968, Benedi & Orell 1992), we could not find significant differences to distinguish *E. chamaesyce* subsp. *massiliensis*. Characters such as leaf size, margin and size of appendages are very variable and insufficient to separate the two taxa.

SELECTED SPECIMENS EXAMINED. — **Iran**. Prov. Lorestan, Khorram-abad to Kouh-e Hashtad-pahlu, 20 km Khorramabad, *Delghandi & Tehrani* (IRAN 44525); Prov. W. Azarbaijan, 15 km Makou to Khoy, *Pahlevani & Amini Rad* (IRAN 47792); Urumieh, *Zehzad* (TARI 1269); Prov. Khorasan, Akhlamad, Palang-Darreh, *Iranshahr* (IRAN 18037); Prov. Khuzestan, Dezful, Safi-abad, *Ghanbari* (IRAN 44522); Prov. Zanjan, 35 km S. Soltanieh, Dasht-ei, *Termeh & Mussavi* (IRAN 18036); Alamout-Shirkuh, *Babakhanlou* (TARI 7646); Prov. Golestan, Minou-Dasht, *Sharif* (IRAN 17697); Prov. Fars, Abadeh, Dingizlou, Kouh-e Dena, *Termeh, Delghandi & Tehrani* (IRAN 47964); 13 km from Zarghan towards Band-e Amir, *Zehzad & Taheri* (TARI 66930); Prov. Hamadan, Abbas-abad, Alvand Mt., *Termeh & Mussavi* (IRAN 18035); Prov. Kermanshah, Parow Mt., *Iranshahr & Dezfoulian* (IRAN 17698); 30 km N of Bisotun, Tangeh Ejdaha, *Hamzehee* (TARI 1584); Prov. Ardebil, Moghan, Majid-abad, *Kazemi* (IRAN 47694); Prov. Tehran, Evin, Iranian Research Institute of Plant Protection, *Pahlevani* (IRAN 51693); NE Tehran, Sorkhehesar, *Amin & Bazargan* (TARI 18967); Prov. Ilam, after Saleh-abad, on the road to Mehran, *Assadi & Nikchehreh* (TARI 76333); Prov. Esfahan, Ghameshloo Protected area, Cheshmeh Now, *Yuosefi* (TARI 1876); Prov. Chaharmahal-e Bakhtiari, Lordegan, Sarkhon, Kuh-e Karkonji from Shiasi & Naphon Valleys, *Mozaffarian* (TARI 54942); Prov, Semnan, Damghan, Cheshmeh-Ali, *Mozaffarian* (TARI 45562).

Euphorbia granulata Forssk. (Fig. 2)

Fl. Aegypt.-Arab. 94. 1775.

Tithymalus granulatus (Forssk.) Raf., Fl. Tellur. 4: 115. 1838. — *Euphorbia granulata* var. *glabrata* Boiss., *in* DC. Prodr. 15(2): 34. 1862. — *Anisophyllum granulatum* (Forssk.) Schweinf., Beitr. Fl. Aethiop. 34. 1867. — *Chamaesyce granulata* (Forssk.) Soják, Cas. Nár. Mus., Odd. Prír. 140: 169. 1972.

Euphorbia turcomanica Boiss., Cent. Euph., 13. 1860. — *Euphorbia granulata* var. *turcomanica* (Boiss.) Hadidi, Bull. Jard. Bot. Natl. Belg. 43: 93. 1973.

Prostrate annual or perennial herbs. Stems up to 24 cm. A rather variable densely pubescent to almost glabrous plants. Leaves obovate-oblong or linear-oblong, 2–8 × 0.5–5 mm, rounded or emarginated at the apex, obliquely rounded at the base, entire or almost so, thick and slightly fleshy, rugulose when dry, petioles 0.5 mm; stipules subulate, 0.5 mm long. Cyathia axillary, solitary; glands transversely ovate, yellowish or ochreous, sometimes reddish with unequal, subentire white or pink appendages. Capsules, 1.5–2 mm diameter, trigonous, keels carinate, smooth, either pubescent or glabrous. Seeds, 1–1.4 mm long, narrowly ovoid-cylindric, quadrangular, irregularly foveolate-rugulose, pinkish-gray, ecarunculate.

The species shows great variation in indumentum, leaf-shape and size, life-cycle, and glandular appendages. Some authors such as Boissier (1879), Rechinger and Schiman-Czeika (1964), Rechinger (1964) and El Hadidi (1973) divided the species into two or three taxa (*E. turcomanica, E. granulata* var. *glabrata* and *E. granulata* var. *turcomanica*) but Radcliffe-Smith (1980, 1986) considered it a single species (*E. granulata*). However, Govaerts *et al.* (2000) accepted the two varieties we have synonymized

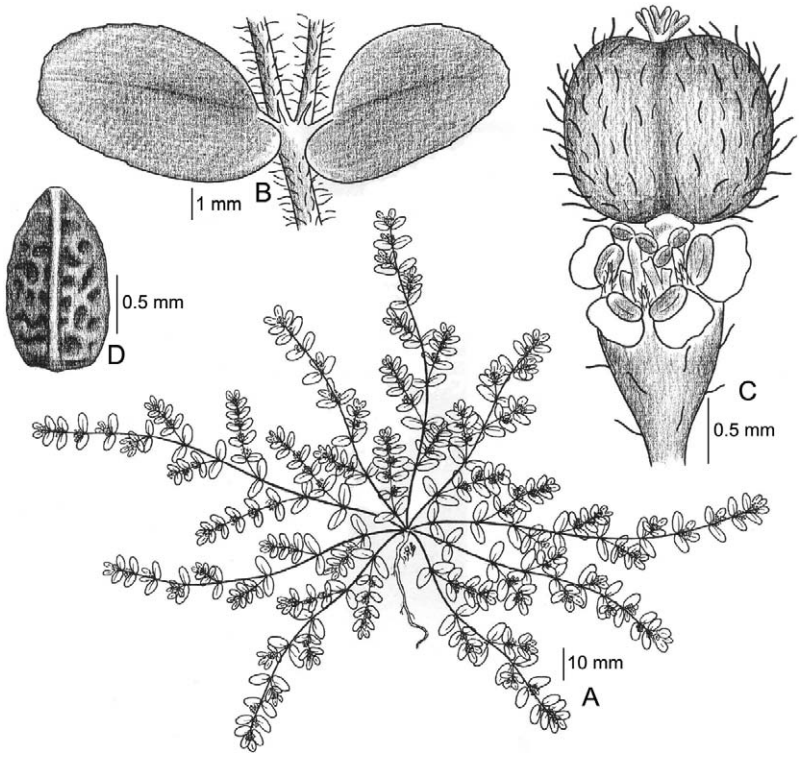

Fig. 2. *Euphorbia granulata*. — **A**: Habit. — **B**: Leaves and stipules. — **C**: Cyathium and fruit. — **D**: Seed. (IRAN 44550).

above (*E. granulata* var. *glabrata* and *E. granulata* var. *turcomanica*). After examination of numerous specimens from throughout Iran, the name *E. granulata* is accepted for Iran following Smith (1980, 1986).

Habitat: Common in deserts and semi-deserts, on sandy or gravel soils, gypsiferous slopes, roadsides and gardens. Sea level to 2300 m.

Geographical distribution: Africa (Algeria, Canaries, Chad, Egypt, Ethiopia, Kenya, Libya, Morocco, Niger, Somalia, Sudan, Tanzania and Tunisia) and Asia (Afghanistan, Bahrain, Caucasus, India, Iran, Israel, Jordan, Kazakhstan, Kuwait, Lebanon, Pakistan, Saudi Arabia, Syria, Tajikistan, Turkmenistan and Uzbekistan).

Origin: Old World.

Flowering and fruiting time: More or less throughout the year (February–November); it is probably a polycarpic plant.

Selected specimens examined. — **Iran**. Prov. Kerman, Djiroft, Ahmad-abad, *Iranshahr & Termeh* (IRAN 18188); 5 km Kahnuj, Djiroft, Kuhe Bardyal, *Termeh & Mussavi* (IRAN 44550); Rafsanjan, *Brown* (IRAN 17923); Baft, *Dini & Bazargan* (TARI 30619); Prov. Khorasan, Sabzevar towards Neishabur, *Termeh* (IRAN 47897); Gon-abad, *Rechinger*, *Esfandiari & Aellen* (IRAN 17916); Mozdavand to Sarakhs, *Djavadi & Sadeghi* (IRAN 47970); Near Mazinan, *Assadi* (TARI 72567); Prov. Yazd, 15 km Chah-malek to Chupanan, *Iranshahr* (IRAN 18184); Prov. Markazi, Arak, Tafresh, Ashtian, *Abaii & Mojib* (IRAN 17920); Prov. Ghom, Roud ghom, *Iranshahr & Mussavi* (IRAN 18070); Prov. Semnan, *Myrzayan* (IRAN 17919); Between Ahmad-abad & Zaman-abad (on the sand hills), *Pahlevani, Amini Rad & Torabi* (IRAN 47353); Touran Protected area, 2 km E of Zaman-abad, *Freitag* (TARI 13628); Prov. Baluchestan, Khash to Iranshahr, *Rechinger*, *Esfandiari & Aellen* (IRAN 17753); Zahedan to Neh, E Dasht-e Lut, *Leonard* (IRAN 17751) Chabahar to Guatr, *Pahlevani, Amini Rad & Torabi* (IRAN 47479); 40 km from Bampour to Nikshahr, *Mozaffarian* (TARI 43048); Hamun-Jazmurian, Zekalat, *Assadi & Mozaffarian* (TARI 25730); Prov. Hormozgan, Bandar-abbas to Minab, 50 km Bandar-abbas, *Termeh*, *Mussavi & Tehrani* (IRAN 47961); Bastak, Anveh, Fariab Sanguye, *Pahlevani*, *Eskandari & Bahramishad* (IRAN 53584); Ghotb-abad, Baghestan, Damtang village, Baz Mt., *Mozaffarian* (TARI 49986); Kish Island, *Termeh & Mussavi* (IRAN 37928); Persian Gulf, Tonb-e Bozorg Island, *Assadi* (TARI 47231); 18 km from Jask to Gabrik, *Mozaffarian*, *Banihashemi & Shahinzadeh* (TARI 44142); Prov. Esfahan, Kashan, Kavir, Kuhe Yakhab, *Termeh & Tehrani* (IRAN 47237); Natanz, 38 km on the road to Kashan, *Foroughi & Assadi* (TARI 15175); Prov. Tahran, Eshtehard, Jafar-abad, *Asefi* (TARI 7647);

Prov. Gilan, E of Rudbar, *Wendelbo & Assadi* (TARI 18304); Prov. Khuzestan, ca. 40 km from Behbahan to Ramhormoz, *Mozaffarian* (TARI 62524).

Euphorbia humifusa Willd. (Fig. 3)

Enum. Pl. Hort. Berol. Suppl. 27. 1814.

Anisophyllum humifusum (Willd.) Klotzsch & Garcke, Phys. Abh. Akad. Berlin 1859: 21. 1860. — *Chamaesyce humifusa* (Willd.) Prokh., Izv. Akad. Nauk S.S.S.R., Ser. 6, 1927: 195. 1927.

Euphorbia pseudochamaesyce Fisch. & C.A. Mey., Ind. Sem. Hort. Petrop. 9: 73. 1842.

Euphorbia polygonisperma Gren. & Godr., Fl. France 3: 75. 1855.

Euphorbia tashiroi Hayata, Icon. Pl. Formosan. 9: 104. 1920.

Euphorbia goeringii Steud. *ex* Boiss. *in* A.P. de Candolle, Prodr. 15(2): 30. 1862. *nom. nud.*

Euphorbia confusa Blume *ex* Boiss. *in* A.P. de Candolle, Prodr. 15(2): 30. 1862. *nom. nud.*

Prostrate to ascending annual plants, usually 4-branched from the base, 7–25 cm long; glabrous or sometimes sparingly hairy on internodes especially near the nodes and stipules. Leaves 1/3 to 1/2 as long as internodes, oblong-ovate or obovate, 5–10 × 2–6 mm, glabrous or sometimes sparingly pilose, short petiolate (0.5–1 mm), asymmetrical at the base, obtuse, serrulate (especially upper half); stipules distinctive, subulate-filiform 1 mm long, sometimes with 2 or more teeth at the base. Cyathia infundibular with triangular slightly tridentate lobes; glands suborbicular, stipitate, purplish, with subequal weakly 2–3-lobed white or purple appendages; styles filiform and deeply bifid. Capsules 1.5–2 mm diameter, trisulcate, obtusely keeled. Seeds 1.1–1.3 mm long, ovoid-quadrangular, smooth, gray or brown-mottled with small papillae when ripe (visible only under magnification), ecarunculate.

From all the herbarium specimens examined, only four specimens corresponded to *E. humifusa*, from the provinces of Mazandaran, Gilan, and Tehran (Karaj).

It is worthy of mention that only the glabrous form is reported in *Flora Iranica*, *Flora Europaea* and Flora of Turkey whereas in the Flora of the USSR and China both the pilose and glabrous forms are reported. This study found that the two forms occur in Iran.

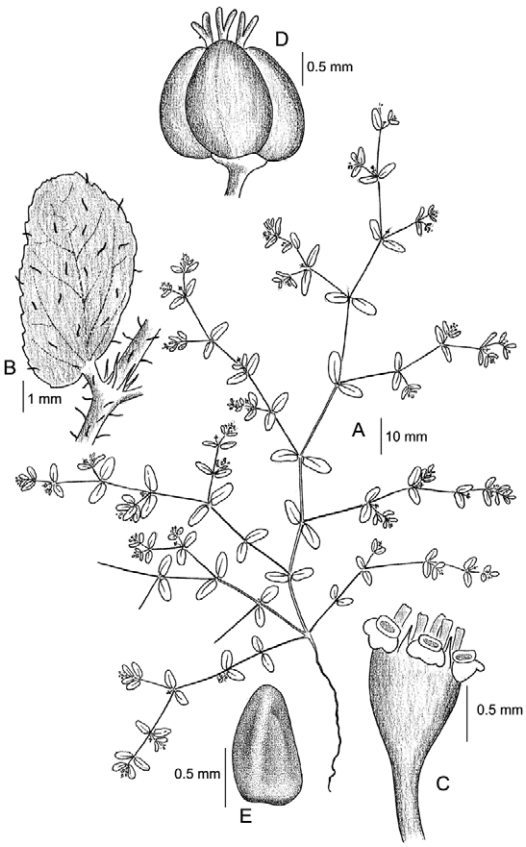

Fig. 3. *Euphorbia humifusa.* — **A**: Habit. — **B**: Leaf and stipules. — **C**: Cyathium. — **D**: Fruit. — **E**: Seed. (IRAN 44562).

Habitat: Weed in ornamental gardens, nurseries and sometimes on the Caspian Sea shores. In other countries it grows on roadsides, stony and disturbed grounds.

Geographical distribution: Widely distributed in temperate regions of Africa, Asia (Iran, Caucasus, China, Japan, Korea, Mongolia, Turkey, and Uzbekistan) and Europe (Austria, Corsica, France, Switzerland, Hungary, Italy, Poland, Romania, Sardinia and Ukraine).

Origin: Old World, native. Chromosome number 2n = 22 (Löve & Löve 1961).

Flowering and fruiting time: July–November.

Selected specimens examined. — **Iran**. Prov. Mazandaran, Now-shahr, Kheiroud, *Iranshahr* (IRAN 17800); Miankaleh protected area, ca. 3 km S of Sasan, *Akhani* (Hb. Akhani 5289); Prov. Gilan, Roudsar, Chalman, *Mirkamali* (IRAN 17799); Prov. Tehran, Karaj, Kalak, *Pahlevani* (IRAN 44562).

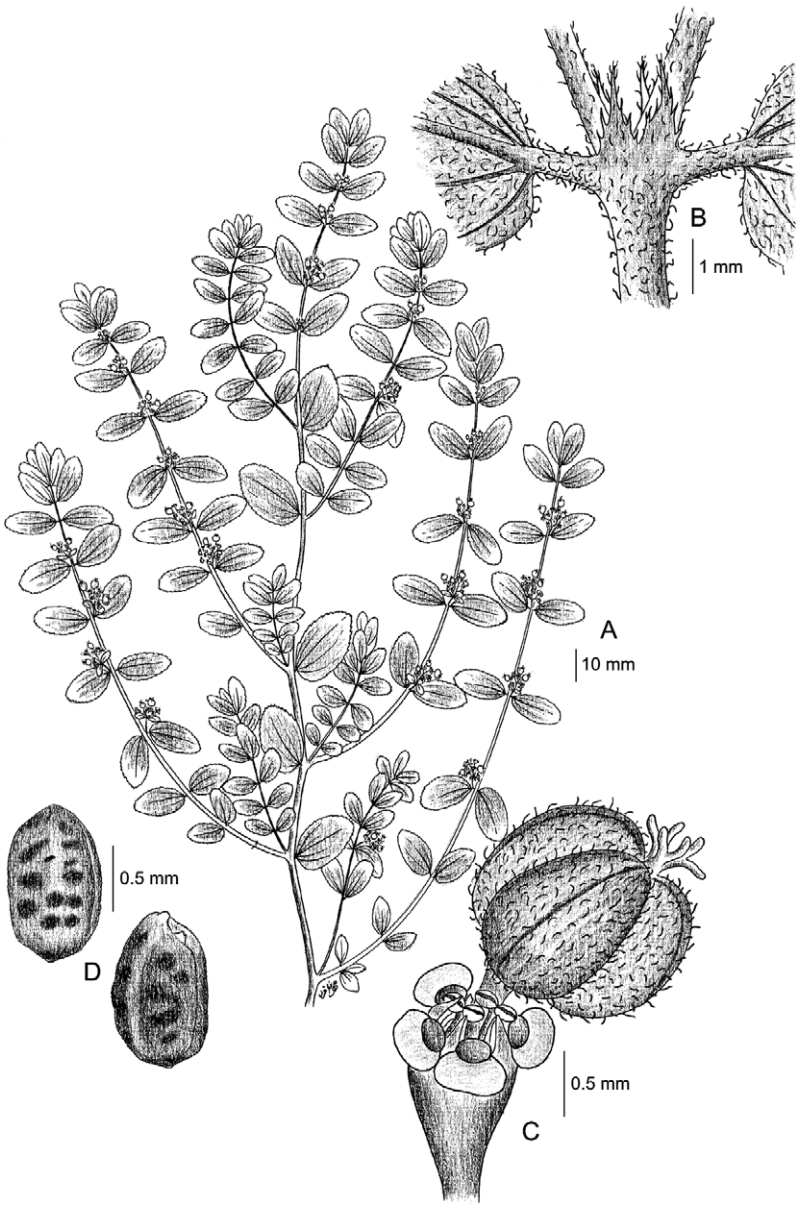

Fig. 4. *Euphorbia indica*. — **A**: Habit. — **B**: Leaves and stipules. — **C**: Cyathium and fruit. — **D**: Seeds. (IRAN 47908).

Euphorbia indica Lam. (Fig. 4)

Encycl. 2: 423. 1786.

Anisophyllum indicum (Lam.) Schweinf., Beitr. Fl. Aethiop.: 34. 1867. — *Chamaesyce indica* (Lam.) Croizat, Lilloa 8: 406. 1942.

Euphorbia decumbens (Forssk.) Willd., Enum. Pl., Suppl.: 27. 1814.

Euphorbia androsaemoides Dennst., Schlüssel Hortus Malab.: 36. 1818.

Euphorbia ovalifolia Kostel., Allg. Med.-Pharm. Fl. 5: 1724. 1836.

Euphorbia cassioides C. Presl, Abh. Königl. Böhm. Ges. Wiss., V, 3: 539. 1845.

A decumbent-ascending, suberect or rarely erect sparingly puberulous or pubescent annual herb up to 50 cm; hairs unicellular, white, sometimes crispate. Leaves ovate to elliptic-oblong, 1.5–3 × 0.7–1.5 cm, obtuse, obliquely rounded at the base, serrulate, especially in the upper half, subtriplinerved, green above, paler beneath; petioles 1–2 mm; stipules triangular, often fimbriate-

laciniate or setaceous, pubescent, especially at the apex, 1.5 mm long. Cyathia aggregated together into loose clusters terminating in short axillary shoots; glands purplish, with white or pinkish petaloid appendages. Capsules 1.8–2.0 mm diameter, trigonous with carinate keels, pubescent. Seeds 1–1.3 mm long, quadrangular, with a few transversal ridges per facet, dark gray, ecarunculate.

HABITAT: Weed in fields and abandoned cultivations.

GEOGRAPHICAL DISTRIBUTION: Africa, Asia (Afghanistan, China, Caucasus, India, S Iran, Sri Lanka, Pakistan, Saudi Arabia, very rare in Iraq and introduced into W Transcaucasus).

ORIGIN: Old World (probably in northern Africa and southwest Asia).

FLOWERING AND FRUITING TIME: February–May in southern Iran (e.g. Hormozgan and Baluchestan Provinces).

SELECTED SPECIMENS EXAMINED. — **Iran**. Prov. Baluchestan, Rask, Sarbaz, *Salavatian* (IRAN 17807); NW of Nikshahr, Gespardeh, *Mozaffarian* (TARI 52735); Prov. Hormozgan, Minab, *Behboudi* (IRAN 17808); Minab, *Iranshahr & Termeh* (IRAN 17806); Minab, Agriculture station, *Iranshahr & Mussavi* (IRAN 47908); Ghotb-abad, Baghestan, Damtang Village, Baz Mt., *Mozaffarian* (TARI 50028); Bandar-Abbas, *Mozaffarian* (TARI 58282).

Euphorbia maculata L. (Fig. 5)

Sp. Pl. 455. 1753.

Tithymalus maculatus (L.) Moench, Methodus: 666. 1794. — *Anisophyllum maculatum* (L.) Haw., Syn. Pl. Succ.: 162. 1812. — *Xamesike maculata* (L.) Raf., Autik. Bot.: 97. 1840. — *Chamaesyce maculata* (L.) Small. Fl. Southeast. U.S. 713. 1903.

Euphorbia supina Raf., Amer. Monthly Mag. & Crit. Rev. 2(1): 119. 1817. — *Chamaesyce supina* (Raf.) H. Hara, J. Jap. Bot. 16: 119. 1940.

Euphorbia depressa Torr. *ex* Spreng., Syst. Veg. 3: 794. 1826.

Euphorbia jovetii Huguet, Botaniste 54: 153. 1971. — *Chamaesyce jovetii* (Huguet) Holub, Folia Geobot. Phytotax. 8: 176. 1973.

Prostrate pubescent annuals, usually much-branched from the base; branches 10–45 cm long. Leaves subfalcately elliptic-oblong to linear-oblong, 4–15 × 1.5–5 mm, obtuse, asymmetrical at the base, serrulate; stipules linear-lanceolate to linear or filiform, sometimes 2-3-partite, laciniate or fimbriate, 1.5 mm long. Glands transversely ovate, reddish-brown, with small, white or pinkish petaloid appendages. Capsules 1.5 mm diameter, sparingly adpressed-pubescent. Seeds 0.8–0.9 mm long, ovoid-quadrangular, transversely grooved, brown, ecarunculate.

HABITAT: Naturalized as a weed in lawns, ornamental gardens, forests and roadsides.

GEOGRAPHICAL DISTRIBUTION: Americas (USA, SE Canada to Belize, Cuba, Bahamas) and introduced to many parts of the Old World such as Europe (Austria, Azores, Bulgaria, France, Germany, Switzerland, Spain, Hungary, Italy) and Asia (Iran, Caucasus, China, Taiwan).

ORIGIN: North America. Chromosome number 2n = 42 (Queiros 1975, Benedi & Orell 1992).

FLOWERING AND FRUITING TIME: July–September.

The species was recorded for flora of Iran from the Mazandaran Province (Nasseh *et al*. 2006); however, the species had already been introduced to Iran about 35 years ago, but was mistakenly identified as *E. turcomanica*.

SELECTED SPECIMENS EXAMINED. — **Iran**. Prov. Gilan, Talesh, Gisoum forest, *Pahlevani & Amini Rad* (IRAN 47770); Bandar-e Anzali, *Mozaffarian* (TARI 65236); Prov. Tehran, Karaj, Kalak, *Pahlevani* (IRAN 43577); Park-e Niavaran, *Kiabi* (IRAN 29515); Pasdaran street (Saltanat-abad), *Termeh* (IRAN 18187); Prov. Mazandaran, Ramsar, Chaboksar, *Sabeti* (TARI 7815); Prov. Golestan, W of Tangerah, *Akhani* (Hb. Akhani 12237).

Euphorbia nutans Lag. (Fig. 6)

Gen. Sp. Pl. 17. 1816.

Chamaesyce nutans (Lag.) Small, Fl. Southeast U. S. 712. 1903. — *Tithymalus nutans* (Lag.) Samp., Anais Fac. Sci. Porto 17: 45. 1931.

Euphorbia preslii Guss. Fl. Sic. Prodr. 1: 539. 1827. — *Chamaesyce preslii* (Guss.) Arthur, Torreya 11: 260. 1911. — *Euphorbia preslii* var. *glaberrima* Boiss. *in* DC., Prodr. 15: 23. 1862 *nom. nud*.

Euphorbia refracta Lowe, Trans. Cambridge Philos. Soc. 6: 11. 1838.

Euphorbia trinervis Bertol., Fl. Ital. 5: 37. 1842.

Euphorbia gibraltarica Wolley-Dod, J. Bot. 52: 13, 1914.

Euphorbia pseudonutans Thell. *in* P.F.A. Ascherson & P. Graebner, Syn. Mitteleur. Fl. 7: 431. 1917.

Euphorbia lansingii (Millsp.) Brühl, Bull. Chicago Acad. Sci. 5(2): 8. 1934.

Procumbent-ascending to almost erect annual, 25–55 cm long, sparingly hirsute to

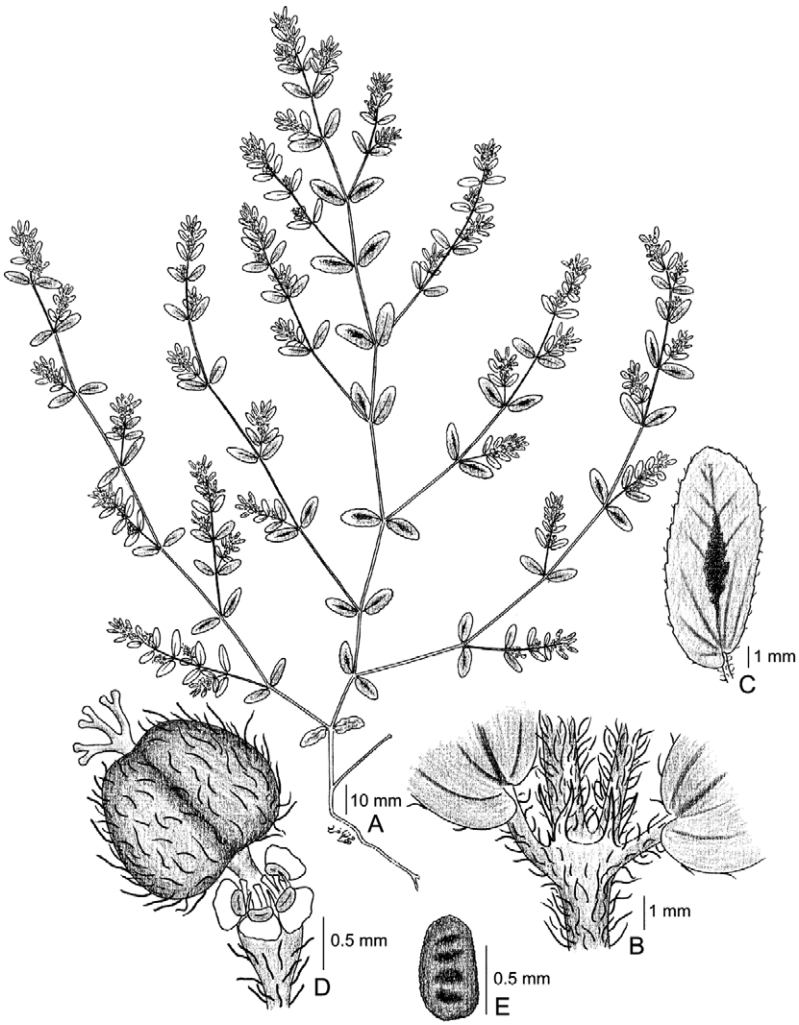

Fig. 5. *Euphorbia maculata*. — **A**: Habit. — **B**: Leaves and stipules. — **C**: Single leaf. — **D**: Cyathium and fruit. — **E**: Seed. (IRAN 47770).

almost glabrescent. Stems forked repeatedly above. Leaves 12–40 × 5–18 mm, elliptic-oblong, occasionally sparsely pubescent above, glabrous beneath, often with a long reddish spot above, obtuse or sometimes subacute, asymmetrical at the base, serrate; petiole 1–2 mm; stipules triangular, fringed, connate or free, 1.5–2 mm long. Cyathia solitary or in monochasial rays, lobes lanceolate; glands white or rarely pale pinkish, transversely ovate to orbicular, with entire or obscurely sinuate appendages. Capsules up to 2 mm diameter, globose, glabrous, rather deeply sulcate. Seeds 1–1.3 mm long, ovoid-quadrangular, blackish, irregularly transversely rugulose, ecarunculate.

Habitat: Cultivated fields and sometimes along seashores.

Geographical distribution: SE Canada to Central America, South America, Caribbean, Asia (Caucasus, Iran, Israel and Lebanon), Europe (Austria, Azores, Bulgaria, France, Switzerland, Spain, Hungary, Italy, Portugal and Romania).

Origin: New World.

Flowering and fruiting time: August–October.

The species is reported as new for Iran. It could be confused with *E. hypericifolia*, but the two species can be distinguished by several features: stipules in *E. hypericifolia* are united into a clearly visible membranous sheath, fruits are not longer than 1.4 mm (Burch 1966) and the plant is completely glabrous (Smith 1980, 1986), while in *E. nutans* stipules are inconspicuous and

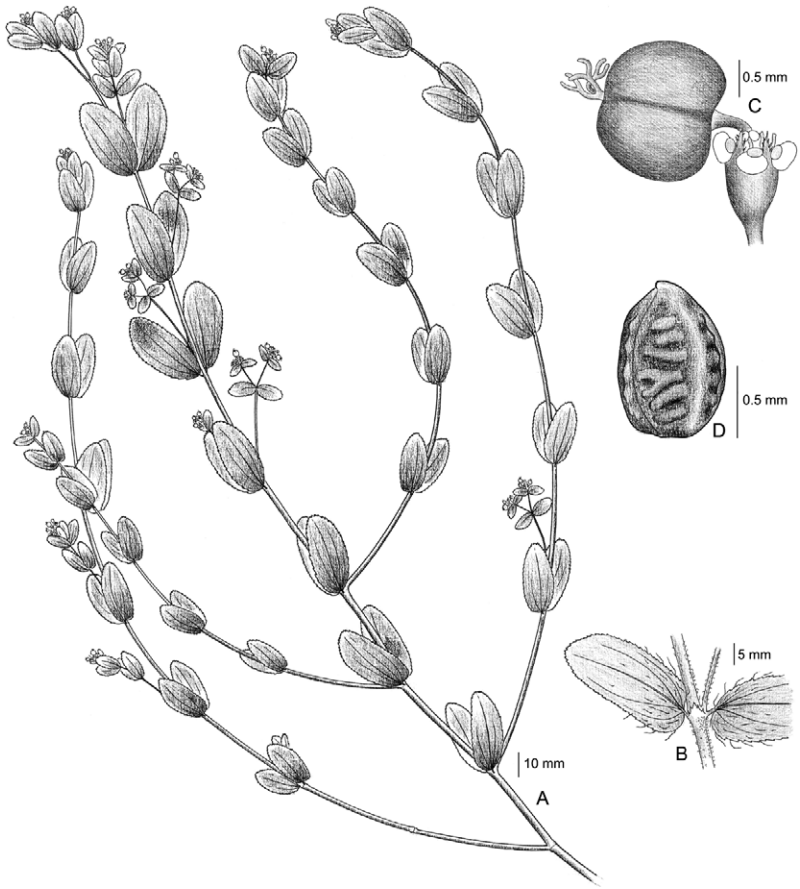

Fig. 6. *Euphorbia nutans*. — **A**: Habit. — **B**: Leaves and stipule. — **C**: Cyathium and fruit. — **D**: Seed. (IRAN 47978).

reddish, fruits are 1.5–2 mm long, the stems are hairy at least on internodes, and hairs could also be present on leaves, especially toward the base.

SELECTED SPECIMENS EXAMINED. — **Iran**. Prov. Gilan, Lahijan, *Mirkamali* (IRAN 47978); Rasht, Gourab, *Mirkamali* (IRAN 17797); Hashtpar, Shafa-rud, Shahrak-e Chouka, *Delghandi* (IRAN 47471); Prov. Mazandaran, Sari towards Dasht-e Naz, near Tajan, Golma, *Termeh*, *Aghabeigi & Ghanbari* (IRAN 29522); Noor, Park-e Jangali, *Akhani* (Hb. Akhani 13720).

Euphorbia prostrata Aiton (Fig. 7)

Hort. Kew. 2: 139. 1789.

Anisophyllum prostratum (Aiton) Haw., Syn. Pl. Succ.: 163. 1812. — *Chamaesyce prostrata* (Aiton) Small, Fl. S.E. U.S. 713. 1903. — *Tithymalus prostratus* (Aiton) Samp., Anais Fac. Sci. Porto 17: 45. 1931.

Euphorbia chamaesyce sensu Wheeler, Rhodora 43: 266. 1941, *non* L., 1753.

Euphorbia callitrichoides Kunth *in* Humb., Bonpl. & Kunth, Nov. Gen. Sp. 2: 52. 1817.

Euphorbia tenella Kunth *in* Humb., Bonpl. & Kunth, Nov. Gen. Sp. 2: 53. 1817.

Euphorbia perforata Guss., Fl. Sicul. Prodr. 1: 540. 1827.

Euphorbia trichogona Bertol., Misc. Bot. 3: 20. 1844.

Euphorbia malaca (Small) Little, Publ. Univ. Oklahoma Biol. Surv. 2(2): 70. 1930.

Procumbent annual, usually branched, 10–25 cm. Stems usually glabrous below, crisp-hairy above. Leaves 4–7 × 2–4 mm, obovate to obovate-oblong, obtuse, asymmetrical at the base, serrulate to subentire, sparsely pubescent to glabrescent on both surfaces; petiole 1 mm; stipules membranous, 1 mm, triangular-subulate, upper part free, often connate at the base. Glands transversely ovate to oblong, purplish, with small, pink appendages. Capsules 2 × 2 mm, 3-sulcate, patulous-bristly along the keels only, usually purplish. Seeds 0.8–0.9 mm, ovoid-quadrangular, deeply transversely furrowed, grayish, ecarunculate.

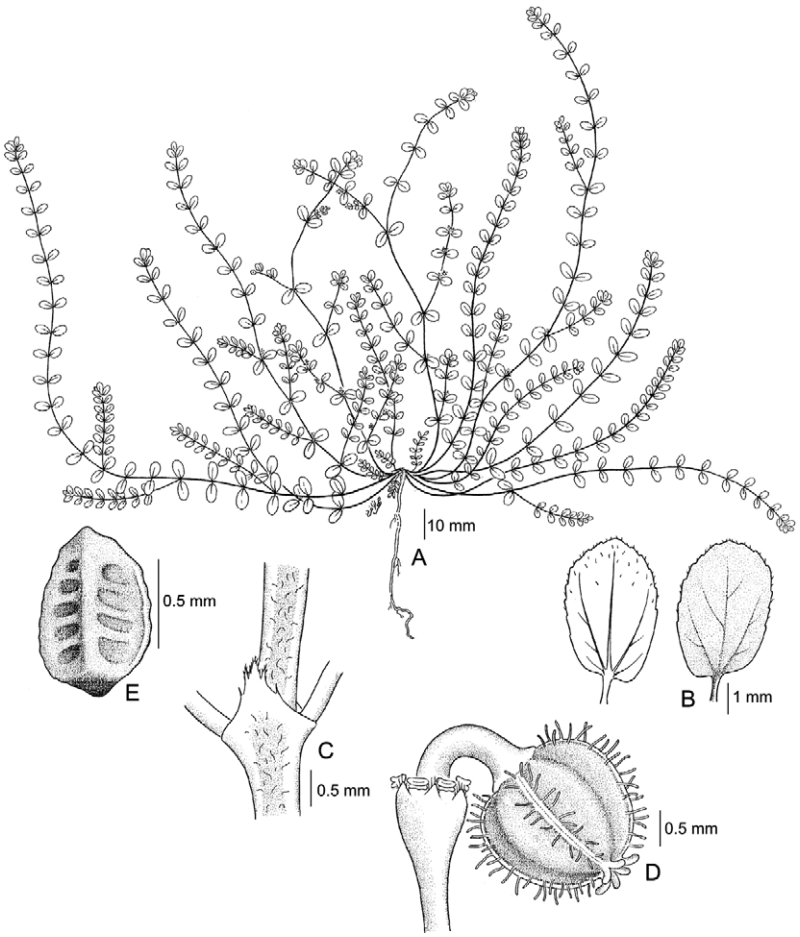

Fig. 7. *Euphorbia prostrata*. — **A**: Habit. — **B**: Leaves. — **C**: Stipule. — **D**: Cyathium and fruit. — **E**: Seed. (IRAN 43773).

HABITAT: In Iran, this species occurs mostly in lawns, ornamental gardens, orchards, and sometimes in fields. In other countries it is reported as a weed in fields, roadsides, scrubs and rarely in sea shores.

GEOGRAPHICAL DISTRIBUTION: Widespread in the New World, central USA to tropical and subtropical America. Introduced in many parts of the Old World.

ORIGIN: Probably North America. Chromosome number 2n = 18 (Benedi & Orell 1992).

FLOWERING AND FRUITING TIME: March–August in tropical and subtropical areas of Iran (Khuzestan Province) and June–October in temperate regions (Tehran Province).

The species was recently recorded for Iran (Pahlevani 2006).

SELECTED SPECIMENS EXAMINED. — **Iran**. Prov. Khuzestan, Dezfoul, Safi-abad, *Ghanbari* (IRAN 44582); Prov. Tehran, Karaj, Kalak, *Pahlevani* (IRAN 43773).

Euphorbia serpens Kunth (Fig. 8)

in Humb., Bonpl. & Kunth, Nov. Gen. Sp. 2: 52. 1817.

Anisophyllum serpens (Kunth) Klotzsch & Garcke, Abh. Königl. Akad. Wiss. Berlin 1859: 23. 1860. — *Euphorbia serpens* var. *radicans* Engelm. *ex* Boiss. *in* DC., Prodr. 15(2): 30. 1862. — *Chamaesyce serpens* (Kunth) Small, Fl. S.E. U.S. 709. 1903.

Euphorbia begoniifolia Lehm., Index Seminum (HBG) 1823: 8. 1824.

Euphorbia flexicaulis Scheele, Linnaea 22: 153. 1849.

Euphorbia pileoides Millsp., Publ. Field Columb. Mus., Bot. Ser. 2: 62. 1900.

Euphorbia minutiflora N.E.Br. *in* D. Oliver & auct. suc. (eds.), Fl. Trop. Afr. 6(1): 1036. 1913.

Euphorbia microclada Urb., Symb. Antill. 9: 215. 1924.

Euphorbia inflexa Urb. & Ekman, Ark. Bot. 22A(8): 64. 1929.

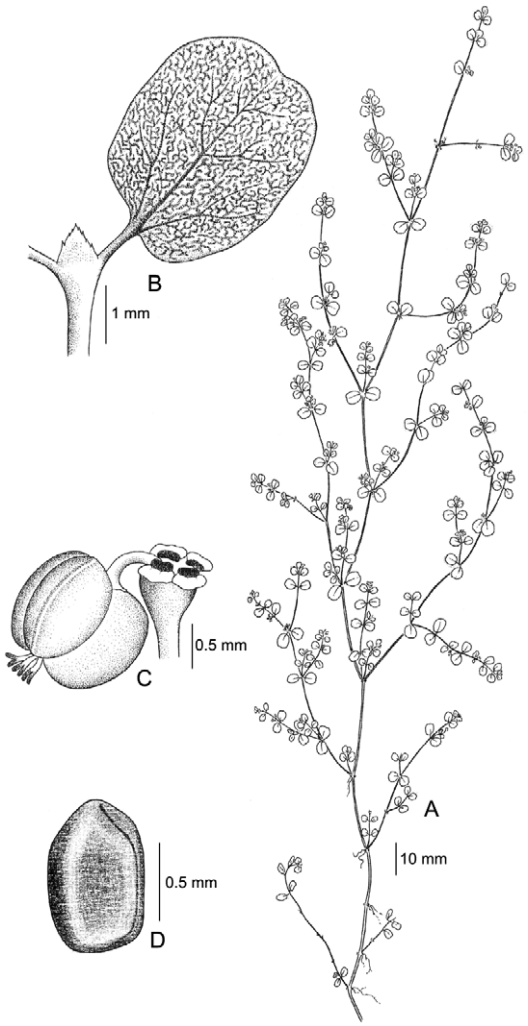

Fig. 8. *Euphorbia serpens*. — **A**: Habit. — **B**: Leaf and stipule. — **C**: Cyathium and fruit. — **D**: Seed. (IRAN 43144).

Euphorbia mangletii Urb., Repert. Spec. Nov. Regni Veg. 28: 233. 1930.

Euphorbia biramensis Urb., Repert. Spec. Nov. Regni Veg. 28: 232. 1930.

Euphorbia orbiculata var. *jawaharii* Rajagopal & Panigrahi, Taxon 17(5): 547. 1968.

Prostrate glabrous annual, usually much branched from the base; branches 15–40 cm and almost always rooting at the nodes. Leaves ovate to suborbicular, 1–5 × 1–4 mm, rounded or emarginated, slightly asymmetrical at the base, entire; petiolate (0.5–1 mm). Stipules united into a triangular laciniate or fimbriate white scale, 0.5–0.75 mm. Glands transversely ovate, purplish, with narrow white petaloid appendages. Capsules 1.5 mm diameter. Seeds 0.8–1 mm, ovoid-quadrangular, smooth and pinkish-brown.

Habitat: Weed in ornamental gardens, lawns and roadsides.

Geographical distribution: Widespread in most parts of tropical and subtropical America, and introduced in many areas of the Old World such as Europe (Mediterranean region), Asia, and Africa.

Origin: New Word. Chromosome number 2n = 22 (Benedi & Orell 1992).

Flowering and fruiting time: March–November in subtropical parts of Iran (Hormozgan and Baluchestan provinces) and July–November in temperate areas (Tehran province).

This species was first recorded in Iran in 2006 (Djavadi *et al*. 2006). It was recollected as a weed in ornamental gardens and lawns in the Tehran, Hormozgan and Kerman provinces. It was probably introduced from the American continent as a weed with infested crop seeds.

Selected specimens examined. — **Iran**. Prov. Tehran, Municipality of district 11, *Khojasteh* (IRAN 43144); Tehran, Iranian Research Institute of Plant Protection, *Pahlevani* (IRAN 43579); Prov. Khuzestan, Hendijan, *Pahlevani*, *Eskandari & Bahramishad* (IRAN 53582); Prov. Hormozgan, Bandar-Abbas, ca. 50 km N of Bandar-Abbas, Sarzeh, *Mozaffarian* (TARI 49786); Persian Gulf, Aboumusa Island, *Assadi & Mozaffarian* (TARI 47185); Bandar-e Khamir, *Mozaffarian* (TARI 63628); Persian Gulf, Siri Island, *Assadi & Mozaffarian* (TARI 47340); Prov. Baluchestan, Pishin, *Mozaffarian* (TARI 52879); SW of Nikshahr, Zarabad, *Mozaffarian* (TARI 52759); Prov. Kerman, Bam, New Arg, *Pahlevani & Bahramishad* (IRAN 53827).

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