TAXONOMIC REVISION OF EUPHORBIA IN TURKEY

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PREFACE

The following account is extracted from a thesis presented by Dr. M. S. Khan.[1] The emphasis is on the limits, identification and distribution of the Turkish species and their natural relationships. The work incorporates the knowledge of the genus in the field gained by Dr. Khan on his botanical trip to Turkey in 1960. The area covered by the present revision is the whole of modern Turkey together with those east Aegean Greek islands which are botanically closer to Anatolia than to the Greek mainland or the Cyclades and which are to be omitted from the forthcoming *Flora Europaea*. These islands (covered by K. H. Rechinger's *Flora Aegaea*: 1943) include Lésvos (Lesbos, Mytelene), Khios (Chios), Sámos, Foúrnoi, Ikaria (Nikaria), Kalimnos (Calino), Kos (Coo), Nisiros, Tilos (Piscopi), Simi, Rodhos (Rhodes) and smaller islands.

The first comprehensive monographic account of the genus *Euphorbia* L. was published by Boissier in De Candolle's *Prodromus* (1862) where he recognized nearly 700 species. This was followed by Boissier's account of the Near Eastern species in his *Flora Orientalis*, **4** (1879). Since then, Pax & Hoffman in their synopsis of the genus (in Engler & Prantl, *Pflanzenfam.* ed 2, **19c,** 208–221, 1931) have estimated the number of species in the genus to be about 1600. There have been numerous taxonomic revisions of individual groups, mostly from different areas in Europe and North America. Prokhanov's revision of the genus for the Fl. U.R.S.S. (**14,** 1949) has been particularly useful for its treatment of Crimean and Caucasian species allied to Anatolian representatives of the genus.

While workers of the calibre of Boissier and Pax & Hoffman, who made extensive studies of *Euphorbia* throughout its world range, have preferred to retain the genus in its broad sense, treating the cyathium as a generic character, others, notably Haworth (1812), Rafinesque (1838), Klotzsch & Garcke (1860), Croizat (1937) and more recently Löve & Löve (1961) have advocated the division of *Euphorbia* into several smaller genera of various degrees of homogeneity. The distinctions between them have been based on morphological, anatomical and cytological characters, but particularly on differences in vegetative morphology (habit, branching, spines, stipules, etc.). The result of this tendency to fission has been for several of the larger sections—notably *Anisophyllum* and *Tithymalus*—to be sometimes treated as separate genera (*Anisophyllum* under the generic name, *Chamaesyce*).

Croizat (1936, 1937), in his very original papers on the diverse nature of the cyathium, has made out a persuasive case for the polyphyletic

[1] M. S. Khan *Taxonomic Studies in the Genus Euphorbia L.* Ph.D. Thesis, University of Edinburgh, 1962.

origin of the genus *Euphorbia*. He concludes that "the cyathium of *Euphorbia*, correctly appraised, is younger than the tendency to shorten axes that dominates the genus, and younger than the "stipules" at the "petiole" (a characteristic of Sect. *Anisophyllum*). As with *Senecio*, generic and sectional limits in *Euphorbia* certainly require comprehensive revision. But inferences of polyphyletic origin do not automatically necessitate the division of a long-standing genus. This is partly a philosophical problem, involving the place of vegetative characters in generic diagnosis, and considerations of historic usage and generic size. The division of *Euphorbia* may well be desirable, but this can only be done on a world-wide basis, and the very large size of the genus made it impossible for Dr. Khan to attempt it while he was occupied with the detailed revision of the species in the Near East.

One aspect of the problem, however, seems worth considering here. The majority of botanists have preferred to adopt the broad Linnaean view of *Euphorbia*. This unwieldy group, showing great diversity of vegetative structure in addition to detailed differences in the cyathium, was soon divided up into sections and subsections. Within the generally accepted larger subsections (e.g. *Esulae* and *Galarrhaeae*), there is still such a tremendous diversity of form that it would not be difficult to divide them further into several clearly defined groups of species. We find ourselves, however, running out of categories in the taxonomic hierarchy; "series" seems (by general usage) too low a rank to use for such distinctive groups as those centering round *Euphorbia apios* or *E. amygdaloides*. We are suffering from the classification having crystallized downwards from the genus, as it were, instead of being built upwards by the grouping of species into higher units. The solution seems to be either to recognize many of the sections as genera, or, as a conservative compromise, sub-genera, thus gaining at least one extra category to cope with the diversity of species in the classification of the group. When a genus, unsuitably tailored to fit the taxonomic hierarchy, is clearly bursting at the seams, some readjustments obviously need to be made.

Limitations of space have made it necessary to cut out several sections from Dr. Khan's thesis. These include sections on the dynamic biology of the group (pollination, dispersal, etc.), and an analysis of life forms[1] and ecological habitats (with tables). In the taxonomic enumeration of species, the species descriptions have had to be omitted but should appear in the relevant volume of the *Flora of Turkey* in preparation. The synonymy (especially combinations under *Tithymalus*) has been reduced, and the bibliography greatly abbreviated. There has also been some reduction in the presentation of maps and tables.

In conclusion, it should be added that Dr. Khan has published in the Kew Bulletin (**16,** 447, 1963) a new species of *Euphorbia* from Cyprus (*E. veneris*) which came to light during the revision of the Turkish species. A critical paper dealing with *E. chesneyi* and its allies appeared in Notes Roy. Bot. Gard. Edinburgh, **24,** 231 (1963).

[1] Many species of *Euphorbia* cannot be clearly accommodated in Raunkiaer's system of life forms. The problem deserves experimental study which we were unable to give it.

P. H. DAVIS.

Terminology of the Inflorescence

The terminology used by previous workers to describe the different parts of the *cyathium* and the organs associated with it has often been very confusing. In the present work an attempt has been made to standardise the terms applied to various organs of the complex organisation of the "umbel" and the cyathium.

The so-called "flower" or cyathium which *Euphorbia* shares with at least 7 other genera of the tribe *Euphorbieae* is essentially a condensed inflorescence suppressed in a gamophyllous involucre of five bracts. Each bract has its free end (*cyathial lobe*) on the margin of the involucre and it may be entire, cleft or laciniate. The sinuses of the involucre bear thick sessile or stalked nectariferous *glands* which vary in number. (The term "nectarium" was applied to these organs by Croizat, 1936.) Although five seems to be the predominant number of glands, four are found almost as frequently. In the latter case, the fifth sinus serves to lodge the reflexed pedicel of the pistillate flower. The glands may be entire or with two to many horns or in some species provided with a petaloid appendage. Each cyathial lobe subtends a group of monandrous flowers which develop in a centrifugal order. Each monandrous flower is represented by a single stamen joined to a pedicel by an obscure annular articulation. In many species, each staminate flower is borne in the axil of a minute *bracteole* which may enclose the latter entirely at its base, or may appear on two sides of it, or may be vestigial or absent. When present, the distal end of the bracteole may be entire, dissected or finely plumose and intertwined with the staminate flowers.

The main axis of the condensed inflorescence within the involucre is terminated by an achlamydeous, solitary, centrally situated pistillate flower which protrudes, by means of its long pedicel, beyond the upper level of monandrous flowers. The pistil consists of a usually three-carpelled ovary with 3 styles, distinct or connate below, often bifid, stigmas 3–6. Hypogynous disc $\pm$ 3–loped or entire, representing the vestigial perianth. Each loculushas in the inner angle an axile placenta supporting an anatropous descending ovule with ventral raphe and superior exterior micropyle, capped by an obturator.

The cyathia are either situated singly in the pseudo-dichotomies of the vegetative branches (as in *E. chamaesyce*) or aggregated into false *umbels*, the primary axes (*primary umbellate radii*) of which are subtended by a whorl of foliaceous structures, the *involucral leaves*. Each primary radius of the terminal umbel usually divides once or more in a cymose (*pseudo-dichotomous*) manner. The bract leaves in the umbel (*involucellar leaves*) are usually opposite, 2 or 3 being borne at each fork; they may be free or united. The cyathia in the umbels are usually segregated at the tips of ultimate radii and in the terminal or subterminal forks.

Assessment of Taxonomic Characters and Their Variation

An assessment is given here of those characters that are most useful in the taxonomy of the genus, and of character variation. An attempt is made to recognize several evolutionary trends in respect to particular organs. The limitations of such a procedure are fully realised; the views expressed are tentative and subject to alteration.

INDUMENTUM

In many species and groups of species, glabrousness or a particular type of indumentum is a well-established character of distinction, e.g. all species belonging to Subsect. *Myrsiniteae* are glabrous and glaucous; *E. petiolata* is densely woolly; many members of group "*Amygdaloides*" have crisply tomentose or pubescent indumentum; several species belonging to the "*Petrophila* complex", *E. macroclada*, and others have pruinose-hirtelous leaves at least on juvenile shoots. However, the presence or absence of indumentum cannot be stressed too far as a specific criterion due to its notorious variability, partially determined by habitat; glabrous forms occur sporadically in species which are predominantly hairy. Some infraspecific taxa based on this character are, however, recognized, e.g. *E. herniariifolia* var. *glaberrima* and *E. altissima* var. *glabrescens*.

ROOT

Although the root system in annuals is remarkably uniform, the perennating species usually show various modifications of their woody roots, from vertical and cylindrical roots to fusiform or globose tubers. In *E. apios* and its allied species the shape of the root-tuber is of considerable importance as a specific criterion.

AERIAL AND UNDERGROUND STEMS

Being one of the important organs contributing to the general facies of the plant, the aerial stems provide a useful set of characters. In a few perennial species like *E. condylocarpa*, the simple stem is a character of major importance to separate them from their allied species. The presence of scale leaves at the bases of stems is diagnostic of some species or groups of species. In the case of chamaephytes the appearance of juvenile shoots at the bases of stems gives a very distinct facies characterizing a few small groups under some subsections. The bases of the stems when denuded expose the leaf-scars which, by their characteristic patterns, indicate the laxness or denseness of cauline leaves, and an approximate internodal length might prove useful as a taxonomic character. The shape of the main stem itself is important. In *E. fistulosa* the inflated nature of the upper part of its fistular stem is one of its major specific distinctions. The bases of stems may be woody (solid or hollow), fleshy or herbaceous. In either of these cases, the surface may be smooth or longitudinally sulcate.

The underground stems usually take the form of rhizomes, either vertical or creeping. *E. virgata* is distinguished from the allied *E. esula*, apart from the foliar characters, by its vertically descending rhizome instead of a horizontally creeping one. A woody stock and caudiculi are notable features in some species (e.g. the "*Petrophila*" group, *E. herniariifolia*, *E. davisii*).

CAULINE LEAVES

Barring a few cases where the foliage shows extreme polymorphism in a single species, e.g. *E. terracina* L., the leaf characters are among the most obvious and useful taxonomic criteria. Their general size (with length-breadth ratio), shape, density, margin, base, apex, and texture, all contribute towards specific and infraspecific distinctions. Although

the pectinate leaf margin in conjunction with another correlating character can provide a good criterion for species separation (cf. *E. craspedia*, *E. marschalliana*), its value, *per se*, should not be over emphasized. In small groups of allied species where cyathia, capsules or seed characters are of no value for delimiting species, the sessile or petiolate nature of cauline leaves is of major importance, e.g. *E. apios* and *E. dimorphocaulon*.

It is generally recognized that opposite leaves are a derived condition from alternate and spiral phyllotaxy. Section *Anisophyllum* which exhibits peculiar lateral branching, and elaboration of cyathial glands (characters pointing to the specialisation of the group), also has opposite leaves and derived pseudo-stipules. In Section *Tithymalus*, Subsections *Crotonopsideae* and *Decussatae* can be regarded as groups showing an advanced character of phyllotaxy; *E. lathyris* (Subsect. *Decussatae*) further shows a correlated advanced feature in the absence of bracteoles between the male flowers.

The presence of stipules characterizes major groups like Sect. *Anisophyllum*. According to Croizat (1960), the stipules of this section represent the two abortive cauline leaves of the same whorl to which the two well-developed leaves belong. Thus, they are in fact pseudo-stipules and, contrary to the true stipules, represent an advanced character.

In the majority of species, all the cauline leaves are more or less of uniform shape throughout the length of main stem, though differing in size on different parts of the stem. In *E. aleppica* they are heteromorphic, the lower ones being setaceous and the upper linear to broadly linear. In species with juvenile shoots, the leaves on these usually differ from those on the main stem in size and often in shape.

INVOLUCRAL LEAVES

In almost all species belonging to Sect. *Tithymalus*, the involucral leaves could be regarded as representing the terminal members of the stem foliage and are either of the same size and appearance as the cauline leaves or differ from them. Although the number of involucral leaves corresponds usually to that of the umbellate radii, very often there is variation. The number, size and shape of these organs form useful criteria for distinguishing species.

UMBELLATE RADII

The terms "pleiochasium" and "umbellaster" have been proposed by Croizat and others for the "umbel" of radii formed after the termination of the main axis by the production of a cyathium—a general phenomenon seen in Section *Tithymalus*. This "umbel" differs technically from the true umbel in being an aggregate of inflorescences rather than flowers. Further branching of the main radii in this section is dichotomous or trichotomous resulting from the repeated suppression of terminal growth of individual rays due to the formation of cyathia. The number, length, thickness, and the branching and disposition of the umbellate radii characterize some species or groups of species, within reasonable limits. However, one should use caution in recognizing these characters as specific distinctions; they are variable in some cases according to age, general growth and habitat of the plant. Nevertheless, in some critical taxa like the two geographical subspecies of *E. seguieriana*, the number of radii seems to provide the only means of identification.

In Sect. *Anisophyllum*, the terminal "umbels" are absent and the stems show an apparently lateral type of branching. As Roeper interpreted it, the branching is really sympodial, as shown by the position of cyathia in the forks, but often by reduction becomes apparently lateral—a notable phenomenon characterizing this section.

In Sect. *Tithymalus*, there occur in addition to the terminal "umbel" few or many secondary infra-umbellary radii which give a characteristic general facies to some species. In a few species bearing these lateral floriferous branches, the cauline leaves borne in the region of these or just below them are distinct in appearance, being shorter than the lower stem leaves—a character which helps to separate species in critical groups, e.g. *E. amygdaloides*.

It has been seen that although the absence of these axillary branches is more or less a rule in few species, rarely a mechanical injury to the terminal part of the stem, as in case of grazing, activates the lateral vegetative buds in the axils of stem leaves, resulting in the production of secondary radii.

INVOLUCELLAR LEAVES

These organs usually differ in shape from the involucral leaves, and occur in twos, or more rarely, in threes. Their shape (length-breadth ratio), base, margin, apex and, rarely, colour constitute useful taxonomic characters. In exceptional cases, as in *E. ledebourii*, the involucellar leaves are similar to the linear cauline leaves. All the species belonging to group "*Amygdaloides*" are well marked by their united involucellar leaves which form a concave or infundibuliform "plate"—a character which is evidently a derived condition and which emphasizes the naturalness of this group.

CYATHIA

Being a feature of fundamental importance in the genus *Euphorbia*, the cyathium and its various parts provide most valuable criteria for delimiting taxa at different levels.

Cyathial lobes. These are usually 5 in number and of various shapes and measurements in different species. In *E. ispahanica* they are prominently linear and manifestly longer than broad (4 or more times). In all the other species enumerated here, they are usually ovate or oblong and not more than 3 times longer than broad. They are occasionally ciliate and the tip varies from truncate to bifid. The velutinous indumentum on both surfaces of the cyathial lobes marks out *E. macroclada* from the closely allied *E. pannonica*.

Glands. These are by far the most important external characters of the cyathium in the delimitation of sections and subsections. Their number (in the species under consideration) varies from 4–5, and is of no taxonomic significance. In *E. pulcherrima*, belonging to Sect. *Poinsettia*, there is only 1 large gland. The species of Section *Anisophyllum* are provided with broader or narrower petaloid appendages on the margin of their glands, whereas in Section *Tithymalus* glandular appendages are absent. Under the latter section, glands with a rounded margin characterize Subsect. *Galarrhaeae*, while Subsect. *Esulae* is recognized by the truncate or retuse glandular margin.

Although the presence or absence of horns and their number broadly marks out a group of species from others, it is dangerous to recognize this character on its own as of special taxonomic importance. In *E. cheiradenia* a gradual sequence, starting from glands without horns to those with 2 or 3 and finally to the pectinate-margined glands, has been observed during the different stages in the development of the glands. Nevertheless, in some species the pectinate nature of the gland has been stabilised as a good specific criterion, and, in conjunction with other characters, is very useful for distinguishing *E. denticulata* from its related species. The two horns of the gland, when present, show variability in their measurements, tip, and posture (with respect to each other), and might serve to separate allied species or allied groups of species. In most groups of *Tithymalus* the glandular horns, when present, are of the same thickness as the glands, and, being only elongated corners of the gland, appear similar to it in colour. But in a few groups, notably in Subsect. *Myrsiniteae* and *E. petrophila*, the horns are thinner than the glands, usually of a different colour, and apparently originate from the under-surface of the gland—evidently a trend towards elaboration of the gland to form a petaloid appendage.

Bracteoles between the male flowers. Excepting Subsect. *Myrsiniteae* and Subsect. *Decussatae* of Sect. *Tithymalus*, prominent bracteoles occur in the cyathium amongst the male flowers. They are either branched irregularly or plumose, and often are ciliate or hirsute. Although the form of the bracteoles is of no great taxonomic value, their absence certainly forms the most notable feature of Subsections *Myrsiniteae* and *Decussatae*; at least in Section *Tithymalus*, absence of bracteoles is probably a derived condition.

Pistillate flower and monandrous flowers. These do not often provide any useful characters for taxonomy, at least in the species studied in this revision.

CAPSULES

Fruits with seeds provide characters of the utmost importance in this genus for species delimitation. The measurements, shape (including the lobing), keels, wings, warts, spines or other emergences, indumentum or its absence on the cocci—are all very useful as criteria for specific distinction. *E. cybirensis* (typical variety) is unique in having indehiscent fruits with thick walls. *E. peplus* and *E. herniariifolia* are notable for the double wing on the back of the cocci.

Prokhanov (1949) has emphasized the importance of stylar length and depth of stigmatic divisions as a criterion to demarcate certain groups, but the author found this of limited value. In *E. petiolata* the styles are undivided.

SEEDS

Surface. The great diversity in the sculpturing of the seed coat and in the shape and size of the caruncle provide characters of great taxonomic value. The question whether the smooth-seeded species are primitive or derived is debatable. Groups of apparently closely related species include both smooth and sculptured-seeded plants.

The following three sets of closely allied species are taken from three different Subsections of Sect. *Tithymalus*.

Subsection	*Species*	*Seed surface*	*Geograph. distribution*
1. *Galarrhaeae*	(a) *E. guestii*	wrinkled	Turkish Mesopotamia, Amanus, Syria, Anti-Lebanon, Palestine and Iraq.
	(b) *E. gaillardotii*	smooth	Turkish Mesopotamia, Syria, Anti-Lebanon and Transjordan.
2. *Esulae*	(a) *E. petrophila*	pitted	S. Russia, Crimea, Caucasus, Trans-Caucasus, Armenia, central part of N. Anatolia and N. of Cilicia.
	(b) *E. glareosa*	smooth	Crimea, Caucasus, and C. & E. Anatolia.
3. *Myrsiniteae*	(a) *E. myrsinites*	wrinkled	Central Mediterranean as far West as Balearic islands, Balkan peninsula, Crimea and probably N. Iran.
	(b) *E. marschalliana*	± smooth	Turkish Armenia, S. Transcaucasia, Talysch, Azerbaidjan to S. Caspian.
	(c) *E. veneris*	smooth	Cyprus.

In the examples given above, the smooth-seeded species in each subsection show more restricted distribution than the sculptured-seeded ones, indicating that the former may have evolved from the latter. Smooth seeds have apparently been derived from the sculptured ones independently in several different groups.

Caruncle. It appears that the caruncle in *Euphorbia* can be either lost or elaborated during the course of evolution. The following examples of related species chosen from Subsect. *Galarrhaeae* illustrate a probable sequence leading to the loss of caruncle in this group. Deciduous caruncles are found in several species and may represent a transitional stage between the carunculate state and the complete loss of caruncle.

Table of caruncle characters

	persistent	*deciduous*	*absent*	*Geogr. distr.*
microsphaera	+			Anatolia, Cauc., Iran, Iraq, Syria.
guestii		+		S.E. Anatolia, Iraq, Syria, Leb. & Palest.
gaillardotii			+	E. Anatolia, Syria & Transjordan.
cybirensis	+			From Crete to E. Mediterranean.
ancyrensis			+	C. Anatolia.
helioscopia	+			Almost world-wide.
haussknechtii			+	N.W. Mesopotamia.

Species mentioned here with ecarunculate seeds have relatively more restricted distributions than those with carunculate seeds, suggesting that the former may have been derived from the latter. Supporting this view, is the fact that most *Euphorbiaceae* have carunculate seeds. Section *Anisophyllum* (which shows many other advanced features, such as derived stipules, peculiar branching and cyathial glands with petaloid appendages) has seeds which are always ecarunculate. In Subsect. *Myrsiniteae* all the species have lost the bracteoles between the male flowers, but the caruncle is elaborated into a prominent conical structure. *E. ispahanica* (Subsect. *Carunculares*) also has a very large complex caruncle.

The following characters of the seed are of major importance:

Measurements; *shape* (globose, tetragonal, oblong, ovoid, dorsiventrally subcompressed, etc.); *surface* (smooth, shining or not, colour, etc., and if sculptured tubercular, pustular, transversely or longitudinally, reticulately or irregularly grooved, or wrinkled or pitted—the sculpturing often differing on different sides of angular seeds); *caruncle* (its presence or absence, size, shape, transverse or erect posture, presence of longitudinal grooves, apical pore, retuse base, colour, persistent or deciduous, etc.).

Geographical Distribution and Endemism

The distribution of *Euphorbia* in Turkey can be treated in relation to the three phytogeographical regions which meet in Anatolia (cf. Davis in *Notes Roy. Bot. Gard. Edinb.* **24,** 198, 1962).

1. *Euro-Siberian Region* (*Euxine* province): forming a broad belt along the southern coast of the Black Sea—an area of high rainfall and extensive mesophytic deciduous forests, often dominated by *Fagus orientalis* in association with *Rhododendron* species.

2. *Mediterranean Region* (*East Mediterranean* province): western Anatolia and the Taurus mountains, often characterized by *Pinus brutia* forest, *Quercus coccifera* maquis and phrygana.

3. *Irano-Turanian Region:* stretching across the plateau of central and eastern Anatolia, and mainly covered with steppe vegetation or deciduous oak scrub. An arid region with cold winters.

Although these three regions can be recognized in the broad sense, the precise boundaries have not been drawn; transitional areas are quite extensive, especially in W. and N.W. Anatolia, and numerous enclaves occur (e.g. of Mediterranean vegetation along the Black Sea coast below 300 m.). The delimitation of the phytogeographical regions is further complicated by altitude.

The accompanying table summarizes the phytogeographical distribution of the species endemic to Turkey, and gives the distribution of the non-endemic species (names in parenthesis) most closely allied to them. Related species are shown yoked together. A cross opposite a species indicates its presence in that region, a dash its absence; (+) denotes that the species extends only exceptionally into that area. Cases of doubtful occurrence are indicated by a question mark. Additional information about the range of distribution or precise region in Turkish geography is given under the last column. The arrangement of the species in the table follows more or less the linear sequence of the taxonomic enumeration.

Out of the 84 species recorded here, 16 are endemic to Turkey (about 19%), the greatest concentration of endemics being in the Mediterranean region, mostly in the Taurus mountains. The species most closely allied to Turkish endemics belong chiefly to the eastern Mediterranean (including Greece) and the Caucasus; a few are mainly European. About half of the endemics that occur in the Mediterranean part of Turkey are confined to this region alone, while the rest penetrate into the Irano-Turanian and Euxine areas. Only 2 species are restricted to the Irano-Turanian region (*E. grisophylla* and *E. haussknechtii*).

Of the 16 species endemic to Turkey, 13 also have their closest allies growing in Anatolia, although all but one of the latter extend into adjacent

TABLE 1

Distribution of Turkish endemics and their closest allies

Species	C. & W. Eur.	C. & W. Med.	Greece (incl. Aeg. Is.)	Balc. Pen. (excl. Aeg. Is.)	Turkey			Cri-mea	Cauc. & Transc.	Iran	Iraq	Syria (excl. Ant.Leb.)	Lebanon & Ant. Leb.	Pal. & Tr. Jord.	Cyp-rus	N. Afr.	Comments
					Med.	I.T.	Eux.										
rhytidosperma	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	Cilic. Taurus.
(*thamnoides*)	—	—	—	—	+	—	—	—	—	—	—	+	+	+	+	—	
djimilensis	—	—	—	—	+	—	+	—	—	—	—	—	—	—	—	—	disjunct distr. in Pontus and Amanus.
(*macrocarpa*)	—	—	—	—	—	+	—	—	+	+	—	—	—	—	—	—	E. Anatolia.
grisophylla	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	E. Anatolia.
austroanatolica	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	S.W. Anatolia.
(*cassia*)	—	—	—	—	+	—	—	—	—	—	—	+	+	—	+	—	Amanus.
schottiana	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	Cilic. Taurus; perhaps no near relatives.
ancyrensis	—	—	—	—	—	+	(+)	—	—	—	—	—	—	—	—	—	
(*cybirensis*)	—	—	+	+	+	—	—	—	—	(+)	—	+	+	+	+	—	Westwards to Crete.
haussknechtii	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	N.W. Mesopotamia.
(*helioscopia*)	+	+	+	+	+	+	+	+	+	+	+	(+)	—	+	+	+	introduced weed in many parts of the world.
sanasunitensis	—	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	Kurdistan.
(*virgata*)	+	—	—	+	—	+	—	+	+	+	+	—	—	—	—	—	also in Turkmenistan; introd. in Br. Is. & Far East.
pisidica	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	Lycian Taurus.
pestalozzae	—	—	—	—	+	(+)	—	—	—	—	—	—	—	—	—	—	Lycian Taurus, S. Lycaon.
erythrodon	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—	Lycaonia, Pisidia, Lycia.
(*glareosa*)	—	—	—	—	—	+	+	+	+	—	—	—	—	—	—	—	C.&E. part of N. Anatol.
isaurica	—	—	—	—	+	—	—	—	—	—	—	—	—	—	—	—	Isauria.
(*promecocarpa*)	—	—	—	—	—	—	—	—	—	—	—	—	+	—	—	—	Anti-Lebanon.
(*herniariifolia*)	—	—	+	+	+	+	+	—	—	—	—	—	—	—	+	—	western extens. in Crete.
kotschyana	—	—	—	—	+	(+)	—	—	—	—	—	—	—	—	—	—	S. & W. Anatolia.
(*macrostegia*)	—	—	—	—	+	—	+	—	—	+	—	—	+	—	—	—	from Cilicia eastwards.
robbiae	—	—	—	—	?	—	—	—	—	—	—	—	—	—	—	—	prob. near Istanbul.
(*amygdaloides*)	+	+	+	+	(+)	—	+	—	+	+	—	—	—	—	—	—	
davisii	—	—	—	—	+	(+)	—	—	—	—	—	—	—	—	—	—	Isaurian part of Taurus.
anacampseros	—	—	—	—	+	+	—	—	—	—	—	—	—	—	—	—	C. & W. Anatolia.
(*myrsinites*)	—	+	+	+	—	+	+	+	—	(+)	—	—	—	—	—	—	N. Anatolia; westwards to Balearic Is.

countries. The two closely related Lycian endemics, *E. pisidica* and *E. pestalozzae*, seem to have no close affinities with any species outside Turkey; they are broadly sympatric with each other in Anatolia and altitudinally vicarious. No affinity could be decided for *E. schottiana* from Cilicia.

Subsections *Galarrhaeae* (34 species) and *Esulae* (37 species) have about an equal share of the total 16 endemics (7 in the former and 8 in the latter); Subsect. *Myrsiniteae* (7 species) includes only one.

The remaining 68 non-endemic species[1] have rather wide distributions; 50 of them extend from Europe through N. Africa into Orient, and the rest are chiefly centred in Europe. A few, like *E. peplus*, extend from N. America to the Far East.

[1] A table of their distribution (given in the thesis) has had to be omitted here.

Taxonomy

In the following enumeration the divisions of Sect. *Tithymalus* are largely based on the arrangement given in Boissier's monograph (in De Candolle's *Prodromus*, **15** (2), 1–187). For convenience of identification, six additional informal groups (A-F) have also been recognized, and others within these; several of these groups (e.g. the groups "*Apios*" and "*Amygdaloides*") are obviously natural assemblages that deserve taxonomic recognition. All the species annotated are arranged in as natural an order as a linear sequence allows. Section *Anisophyllum* has been treated as a specialized group with a peculiar branching habit and elaboration in glandular morphology; consequently it follows Sect. *Tithymalus*.

In most cases the type locality is cited for each species, exactly as published, and the whereabouts of type material indicated by the usual abbreviations. Lectotypes, however, have usually not been chosen unless the taxonomy necessitates it. Most Linnaean species have not been typified, although Linnaean specimens are cited when they have been seen.

The records are cited according to the grid reference used in the maps; the letter E or A in parenthesis after A1 and A2 means that the localities are from the European or Asiatic side of the Bosphorus, respectively. Usually only one specimen has been cited for each square, but in rare species and in cases where the records are located at two distant points in the square, more than one gathering has been recorded. The east Aegean islands are cited separately, without a grid reference.

All specimens cited, including types, have been examined unless the contrary is indicated (by n.v.—*non vidi*). An exclamation mark after a synonym indicates that the type material of it has been seen. Davis's numbers include all those collections made with his co-collectors, viz. Bilger (Karamanoğlu), Dodds, Hedge, Heywood, O. Polunin, Coode, etc. The collections of Dudley have Davis numbers and accordingly are shown in parenthesis with the letter D. preceding them. "Khan *et al.*" has been used for brevity, referring to collections by Khan, Prance & Ratcliffe.

Species imperfectly known or doubtfully recorded from Turkey are given on p. 152.

Keys

The following keys are based primarily on the more obvious vegetative

and cyathial characters, and when necessary on those of capsules and seeds which could be easily observed. In living plants and in reasonably well-preserved herbarium specimens the bracteoles between the male flowers are quite apparent under the lens simply by cutting open the cyathium. In difficult cases, however, the presence or absence of bracteoles in dried specimens can be determined to the best advantage by boiling up the cyathium and dissecting under the binocular microscope. Measurements for length of seed exclude the caruncle.

In the large Subsections *Galarrhaeae* and *Esulae*, informal groups (designated by capital letters) have been recognized; their species are keyed out separately under each group.

A key based on seed characters alone is given in the Appendix.

Key to Sections, Subsections and Informal Groups

1. Cauline leaves stipulate; leaf base uniauriculate; cyathial glands with a narrow or broad petaloid wing on outer margin; prostrate, much branched annuals . . . . . Sect. *Anisophyllum* (p. 90)
— Cauline leaves exstipulate; leaf base not uniauriculate; cyathial glands without a petaloid wing on outer margin; prostrate to erect, annuals to perennials (Sect. *Tithymalus*) 2

2. Cauline leaves opposite, often decussate 3
— Cauline leaves alternate or spiral, not opposite 4

3. Cauline leaves decussate, glabrous, entire; cyathial glands 2-horned Subsect. *Decussatae* (p. 49)
— Cauline leaves not decussate, densely woolly, spinulose-dentate; cyathial glands deeply pectinate Subsect. *Crotonopsideae* (p. 48)

4. Cyathial lobes linear, at least 4 times longer than broad; caruncle 2 mm. or more long, deeply longitudinally sulcate, excavated on the ventral side . . . . . Subsect. *Carunculares* (p. 90)
— Cyathial lobes not linear, usually not more than 3 times longer than broad; caruncle (if present) not more than 1·5 mm. long, esulcate or only shallowly sulcate, sometimes only retuse at base on ventral side, not excavated 5

5. Rounded shrubs with pseudodichotomous branching; cauline leaves at least 8 times longer than broad Subsect. *Pachycladae* (p. 90)
— Perennial to annual herbs with usually racemose branching, if pseudodichotomous then branches prostrate or ascending; if shrubby, leaves not more than 5 times longer than broad 6

6. Cyathial glands with rounded margin, without horns (Subsect. *Galarrhaeae*) 7
— Cyathial glands with truncate margin, with or without horns, sometimes margin pectinate 9

7. Seeds smooth 8
— Seeds variously sculptured . . . *Group C* (p. 85)

8. Perennials . . . . . *Group A* (p. 83)
— Annuals . . . . . *Group B* (p. 84)

9. Bracteoles between male flowers prominent, usually plumose, often

laciniate or ciliate (Subsect. *Esulae*) 10
— Bracteoles between the male flowers absent
Subsect. *Myrsiniteae* (p. 89)

10. Annuals . . . . . *Group D* (p. 86)
— Perennials 11

11. Involucellar leaves united . *Group E* "*Amygdaloides*" (p. 87)
— Involucellar leaves free . . . . . *Group F* (p. 88)

Group A (subsect. galarrhaeae p.p.)

1. Capsules smooth or only minutely elevate-punctate, never truly warty 2
— Capsules distinctly warty 3

2. Stems erect, robust, up to 90 cm. tall; cauline leaves lanceolate, 6·5–14 × 1–2 cm.; capsules pilose . . . 12. *altissima*
— Stems procumbent, slender, up to 10–15 cm. long; cauline leaves oblong-lanceolate to spathulate, 1·0–2·5 × 0·3–0·5 cm.; capsules glabrous. . . . . 14. *wittmannii*

3. Shrubs up to 1 m. tall 4
— Perennial herbs 5

4. The ultimate dichotomies of umbellate radii persisting as furcate spines in fruiting stage; branches intricate . . . 3. *acanthothamnos*
— Plants unarmed; branches sparse, open . . 4. *thamnoides*

5. Herbs with root-tubers or thick woody roots, never with rhizomes or caudiculi 6
— Herbs with thick woody rhizomes or stems borne on caudiculi; never with root-tubers or woody roots 10

6. Stems slender, not more than 4 mm. thick, never woody; plants with root tubers (Group "*Apios*") 7
— Stems robust, up to 6 mm. thick, woody at base; cauline leaves usually 4–7 × 2·0–2·5 cm., sparsely or densely villose at least on the under surface; plants with usually curved woody tap root 13. *oblongata*

7. Stem solitary, erect, unbranched below; root-tuber ovate-globose, sometimes fusiform; leaves glabrous, cordate-amplexicaul at base 21. *condylocarpa*
— Stems many, prostrate to erect, often branched below; root-tuber napiform or cylindrical, occasionally fusiform; leaves glabrous or hairy 8

8. Lower cauline leaves shortly petiolate; stems dimorphic, flowering stems erect, much longer than the sterile, decumbent stems; autumn flowering . . . . . 18. *dimorphocaulon*
— All leaves sessile; stems monomorphic, all floriferous, prostrate to erect; spring flowering 9

9. Root-tuber napiform, occasionally fusiform; cauline leaves sparsely or densely pilose; leaf-base subattenuate or round 19. *apios*
— Root-tuber cylindrical, vertical; cauline leaves glabrous; leaf base deeply cordate-auriculate . . . . 20. *cardiophylla*

10. Cauline leaves 7–13 × 4–8 mm., ovate; stems filiform, decumbent, many, tufted . . . . . 17. *schottiana*
— Cauline leaves 3–8 × 0·8–2·5 cm.; stems few to many, erect or ascending 11

11. Leaves pellucid-punctate; stems ascending, flexuous 16. *austroanatolica*
— Leaves not pellucid-punctate; stems erect, not flexuous . . 12

12. Stems robust, up to 1·5 cm. thick at the base, with several crowded axillary shoots above . . . . . 10. *palustris*
— Stems slender, not more than 0.7 cm. thick at the base, simple or with few distant axillary floriferous branches 13

13. Bases of stems covered with prominent scale leaves . . 14
— Bases of stems not covered with scale leaves . . . 16

14. Stem with axillary floriferous branches above. Cauline leaves oblong or oblong-lanceolate; capsules 6–10 mm. across; seeds ecarunculate 8. *macrocarpa*
— Stems simple, without axillary floriferous branches . . 15

15. Seeds 3·5–4·0 × 3·0–3·3 mm.; cauline leaves oblong or oblong-lanceolate, greyish green . . . . . 9. *grisophylla*
— Seeds c. 0·3 × 2·5 mm.; cauline leaves elliptic or elliptic-spathulate, dark green . . . . . 6. *djimilensis*

16. Involucellar leaves elliptic or elliptic-rhomboid; cauline leaves sessile, subcoriaceous . . . . . 11. *orientalis*
— Involucellar leaves broadly ovate to semi-orbicular; cauline leaves petiolate, herbaceous . . . . . 7. *squamosa*

GROUP B (SUBSECT. GALARRHAEAE P.P.)

1. Capsules warty or bristly 2
— Capsules smooth or minutely punctate or granular, rarely softly papillose, not truly warty or bristly 6

2. Mature capsules perfectly globose, with rigid or soft bristles . 3
— Mature capsules ± trilobed, covered with warts or bristles . 4

3. Styles 1–2 mm. long; bristles on capsule reduced to scattered soft papillae . . . . . 29. *microsphaera*
— Styles, 2·0–3·5 mm. long; bristles on capsule pointed, rigid or soft . . . . . 28. *cybirensis*

4. Capsules with ± rigid, conical bristles; plants dwarf (4–10 cm. tall); seeds ecarunculate with a fine sticky granular covering, not shining 27. *ancyrensis*
— Capsules warty, not bristly; plants taller, 20–75 cm.; seeds carunculate, shining 5

5. Capsules 2·3–3·0 × 2·7–4·0 mm., obscurely trilobed, with few hemispherical warts; seeds 1·7–2·2 × 1·5–1·7 mm., broadly ovoid; leaves thick, usually yellowish-green; habit robust . 23. *platyphyllos*
— Capsules smaller, 1·7–2·0 mm. long, distinctly trilobed, with several

cylindrical warts; seeds 1·2–1·7 × 0·8–1·2 mm., oblong-ovate; leaves thin, usually pure green; habit slender . . . 24. *stricta*

6. Leaves deeply serrate from base to apex; capsule deeply trilobed; caruncle shortly stipitate, globose . . . . . 33. *arguta*
— Leaves subentire or serrulate only above the middle; capsule globose or deeply trilobed; caruncle sessile or absent 7

7. Capsules globose or rarely only very slightly trilobed; seeds dark brown, shining, sub-compressed ovoid; caruncle transversely ovate, persistent . . . . . 29. *microsphaera*
— Capsules ± deeply trilobed; seeds brown, black or greyish but not shining, ovoid, subquadrangular or ovate-spherical; caruncle absent or minute and deciduous 8

8. Involucellar leaves subcordate to cordate at the base. Stem fistular, gradually thickening towards the top; seeds 3·0–3·5 × 2·5–3·0 mm., ovate . . . . . 34. *fistulosa*
— Involucellar leaves narrowed, rounded or truncate at the base 9

9. Capsules minutely granular, densely pilose. Seeds 2·0–3·0 × 1·5–2·5 mm., ovate-spherical, brown or greyish with brown specks, ecarunculate . . . . . 35. *eriophora*
— Capsules smooth, glabrous 10

10. Mature seeds greyish and irregularly furrowed . . 25. *guestii*
— Mature seeds brown, smooth . . . . 26. *gaillardotii*

GROUP C (SUBSECT. GALARRHAEAE P.P.)

1. Perennials with several rigid stems, or with a single stem, indurated below 2
— Annuals, usually with single or rarely many erect or ascending stems 4

2. Stem single with several axillary branches above. Cauline leaves oblong-lanceolate, villose, base subcordate; seeds 2·0–2·5 × c. 2·0 mm., with ± longitudinally arranged minute tubercles, very rarely tubercles obscure . . . . . 22. *verrucosa*
— Stems many, usually unbranched above, or rarely with a few axillary floriferous branches 3

3. Cauline leaves 2·0–4·0 × 1·2–1·7 cm., oblong-elliptic, pilose; bases of involucellar leaves truncate or subcordate; seeds with many reticulately arranged narrow wrinkles . . . . 5. *rhytidosperma*
— Cauline leaves 1·5–2·5 × 0·2–0·5 cm., oblong-spathulate; bases of involucellar leaves attenuate; seeds with scattered shallow pits 15. *cassia*

4. All leaves entire, always glabrous; seeds obtusely tetragonous, sub-compressed, brown, covered with minute, crowded, white tubercles and with 3–4 narrow, transverse furrows on each face 36. *phymatosperma*
— All leaves serrate, pilose or glabrous; seeds with elevated reticulate wrinkles 5

5. Stems many, prostrate to ascending; caruncle vertical, c. 7 mm.,

subspherical, retuse on inner side . . . 32. *oxyodonta*

— Stem single, erect; caruncle transversely ovate to suborbicular or obscure or absent 6

6. Involucellar leaves each with 10–30 deep serrations; seeds c. 2·0 × 1·5 mm.; caruncle obscure or absent . . . 31. *haussknechtii*

— Involucellar leaves each with 30–60 shallow serrations; seeds 2·0–2·5 × 1·5–1·7 mm.; caruncle transversely ovate or semi-orbicular 30. *helioscopia*

GROUP D (SUBSECT. ESULAE P.P.)

1. Stems with dense setaceous leaves below; upper leaves linear-lanceolate; seeds ecarunculate, tuberculate; bases of stems often denuded, showing leaf-scars . . . . 61. *aleppica*

— Stems with no setaceous leaves below; seeds carunculate, sometimes caruncle deciduous, tuberculate or otherwise . . . 2

2. Seeds with many minute whitish tubercles; stems many, densely leafy . . . . . 60. *exigua*

— Seeds with furrows, pits or wrinkles in various patterns; plant single-stemmed, with or without branches; stems usually laxly leafy . 3

3. Cocci of the capsules with 2 narrow parallel wings on the back; seeds oblong-subhexagonal with 1 longitudinal groove on each of the two inner faces, and with a row of 2–4, rarely 5, pits on each of the four outer faces. Cauline leaves obovate to suborbicular, base long attenuate into a petiole . . . . . 56. *peplus*

— Cocci of the capsules with only one line of dehiscence on the backs; seeds not oblong-hexagonal, pitted, grooved or wrinkled in various patterns 4

4. Seeds with 6 longitudinal parallel grooves; cauline leaves obovate to spathulate, sessile or with short petioles; involucellar leaves ovate-rhomboid, usually broader than long, apex mucronate 57. *aulacosperma*

— Seeds with pits or wrinkles arranged in various patterns; cauline leaves of various shapes, sessile 5

5. Seeds dorsiventrally compressed, with 2 rows of 4 or more transverse grooves on each face, sometimes grooves reduced to pits crowded in a more or less reticulate pattern . . . . . 62. *falcata*

— Seeds not dorsiventrally compressed, variously pitted or wrinkled 6

6. Involucellar leaves linear to elliptic-rhomboid; seeds ovate-tetragonal or oblong-tetragonal 7

— Involucellar leaves shortly or elongatedly deltoid-rhomboid, ovate or ovate-rhomboid; seeds ovoid or ovoid-oblong . . . 8

7. Cocci of the capsules acutely keeled; seeds oblong-tetragonal, each of the four faces concave and with transversely and irregularly arranged wrinkles . . . . . 63. *szovitsii*

— Cocci of the capsules obtuse; seeds ovate-tetragonal, with several unequal, crowded pits . . . . . 64. *ledebourii*

8. Cauline leaves always linear, acute to acuminate; stems densely leafy . . . . . 48. *pinea*

— Cauline leaves obovate-oblong to linear-lanceolate, obtuse, truncate or retuse, scarcely acute; stems laxly leafly 9

9. Seeds irregularly reticulately pitted; glandular horns setaceous, 2 or more times longer than the breadth of gland . 59. *taurinensis*
— Seeds with irregularly reticulate wrinkles enclosing sometimes very small pits; glandular horns not longer than the width of gland 58. *arvalis*

GROUP E, "AMYGDALOIDES" (SUBSECT. ESULAE P.P.)

1. Mature capsules hairy; leaves tomentose, crisply pubescent or hirtellous on both surfaces 2
— Mature capsules glabrous; leaves glabrous, puberulous or pilose, if shortly tomentose, then hairy on the under surface only . . 4

2. Median cauline leaves lanceolate to linear, 8 or more times longer than broad; capsules 5–7 × 5–7 mm., velutinous . 65. *sibthorpii*
— Median cauline leaves obovate or oblanceolate, not more than 6 times longer than broad 3

3. Cauline leaves 4 cm. or more long, hirtellous or tomentose; stems not branched at base . . . . . 66. *thompsonii*
— Cauline leaves not more than 3 cm. long, crisply pubescent; stems woody, branched at base . . . . . 71. *davisii*

4. Cauline leaves with cordate, rounded or rarely truncate bases, never attenuate; lamina ovate-lanceolate or ovate-oblong; sterile shoots absent . . . . . 73. *oblongifolia*
— Cauline leaves with always attenuate bases; lamina elliptic, obovate or oblanceolate; sterile shoots present 5

5. Primary involucellar "plates" usually 1–2 cm. across at the broadest point, rarely up to 2·7 cm.; flowering stems with upper leaves very much smaller than the lower 6
— Primary involucellar "plates" usually 2·5–4·0 cm. across at the broadest point; flowering stems with upper leaves more or less the same size as the lower, or slightly smaller 7

6. Robust habit, with many stems arising from a superficial root system to form wide clumps; mature cauline leaves glabrous on both surfaces, coriaceous; seeds 2·5–3·0 × c. 2·0–2·5 mm. . . 70. *robbiae*
— Slender habit, with few stems arising from a central stock; mature cauline leaves usually puberulous, at least on the lower surface, if glabrous, the leaves not coriaceous; seeds 2·0–2·8 × 2·0–2·2 mm. 69. *amygdaloides*

7. Cauline leaves thin, membranous, dorsal surface not glossy 72. *macroceras*
— Cauline leaves thick, coriaceous, dorsal surface glossy . . 8

8. Capsules 5·0–5·5 × 5·0–6·5 mm.; seeds 3·0–3·5 × 2·5–3·0 mm.; indumentum on the under surfaces of cauline leaves, if present, crisply puberulous; cauline leaves usually linear-oblanceolate 67. *kotschyana*
— Capsules 4·5–5·0 × 4·5–5·5 mm.; seeds 2·3–3·0 × 2·0–2·3 mm.; indumentum on the under surfaces of cauline leaves, if present, pilose; cauline leaves usually obovate-oblanceolate 68. *macrostegia*

GROUP F (SUBSECT. ESULAE P.P.)

1. Stems decumbent, procumbent or ascending, dwarfish (stems usually not longer than 20 cm.), slender (not more than 2 mm. thick at the base), many; habit suffruticose 2
— Stems erect or ascending, taller (usually longer than 20 cm.), more or less robust (usually 3–7 mm. thick at base), few to many . 8

2. Cauline leaves manifestly petiolate, not more than 2 times longer than broad; capsules with cocci 2-winged or 2-lined on the back . 3
— Cauline leaves sessile (if subsessile, leaves linear), 2 or more times longer than broad; capsules with only a single line of dehiscence on the cocci ("*Petrophila*" complex) 4

3. Capsule 3–4 × 2·5–4·0 mm., ovoid to ovoid-oblong; cocci with 2 parallel narrow, ± undulate wings on the back; seeds subtetragonous with 2 parallel grooves on the ventral side and few pits on the dorsal side; caruncle c. 0.5 mm. long, conical . 55. *herniariifolia*
— Capsule 2·5–3·0 × 1·4–1·7 mm., narrowly oblong; cocci with 2 narrow lines on the back; seeds cylindrical, sparsely pitted; caruncle 0·7–1·0 mm. long, oblong or subspherical . . 54. *isaurica*

4. Cauline leaves tomentose, linear, sessile or subsessile; seeds 2·0–2·2 × 1·3–1·7 mm., ovoid, subcompressed and reticulately pitted 50. *pisidica*
— Cauline leaves glabrous or pruinose-hirtellous, always sessile . 5

5. Seeds smooth 6
— Seeds pitted 7

6. Umbellate radii very much condensed to form dense "heads"; young capsules velutinous; stems densely leafy throughout 52. *erythrodon*
— Umbellate radii open, spreading; young capsules glabrous; stems laxly leafy towards the top . . . . . 53. *glareosa*

7. Cauline leaves glabrous, glaucescent; young leaves with involute margins . . . . . 51. *pestalozzae*
— Cauline leaves, at least when young, pruinose-hirtellous; margin of young leaves not involute . . . . 49. *petrophila*

8. Cauline leaves with cordate bases; leaves ovate or ovate-oblong; seeds ovoid, smooth . . . . . 37. *agraria*
— Cauline leaves with rounded, broad or narrow but never cordate bases; seeds of various shapes, smooth or pitted . . 9

9. Cauline leaves with 3–5 nerves from the base, never linear; young leaves usually pruinose-hirtulous 10
— Cauline leaves with a single mid-vein (if 3-nerved, leaves always linear), nerves sometimes obscure; young leaves always glabrous 12

10. Cyathial lobes velutinous outside; leaf apex long-mucronate or acuminate; seeds smooth . . . . . 44. *macroclada*
— Cyathial lobes glabrous outside; leaf apex obtuse or shortly mucronate; seeds smooth or wrinkled 11

11. Capsules 4·5–6·0 mm. long, apex attenuate, always glabrous; seeds with crowded deep vermiform anastomosing wrinkles 46. *cheiradenia*
— Capsules 3·0–4·0 mm. long, apex subcompressed; at least when young usually pilose to velutinous; seeds smooth . . 45. *pannonica*

12. Leaves on the main stem densely imbricate 13
— Leaves on the main stem usually lax 14

13. Leaves thick, coriaceous; seeds ovate-globose, smooth, greyish, often with darker spots . . . . . 43. *paralias*
— Leaves thin; seeds ovoid, irregularly reticulate-pitted 48. *pinea*

14. Cyathial glands ecornute; leaves on main branches always linear, long-mucronate. Capsules 2–4 mm. long; seeds 1·5–2·5 × 1·0–1·5 mm., ovoid . . . . . 42. *seguieriana*
— Cyathial glands always 2-horned; leaves on main branches linear or otherwise, leaf-tip various 15

15. Capsules 5–6 × 6–7 mm.; upper cauline leaves gradually tapering from the middle into an acuminate apex, thick and firm, always shining on the dorsal surface . . . . . 38. *lucida*
— Capsules not more than 4 × 5 mm.; upper cauline leaves acute, acuminate or obtuse; usually not shining on the dorsal surfaces 16

16. Leaves on sterile branches similar to those on the main stem; oblanceolate to obovate, truncate or retuse. Seeds 2·0–2·5 × 1·5–1·8 mm., oblong-cylindric, grey; caruncle stipitate, projecting and beaked on one side . . . . . 47. *terracina*
— Leaves on sterile branches (if present) narrower than those on main stems, acute, mucronate or acuminate 17

17. Leaves on main stems ovate to ovate-lanceolate, secondary nerves always prominent on the lower surface. Seeds 2·5–3·0 × 1·7–2·0 mm., ovoid-oblong, caruncle almost discoid, slightly retuse on the ventral side . . . . . 39. *iberica*
— Leaves on main stems elliptic-lanceolate to rhomboid-lanceolate or linear-lanceolate to elliptic-oblong, secondary nerves obscure on the lower surface 18

18. Leaves on main stems elliptic-lanceolate to rhomboid-lanceolate; seeds c. 2 × 1·5 mm., ovoid-subtetragonal . . 41. *sanasunitensis*
— Leaves on main stems linear-lanceolate to elliptic-oblong; seeds c. 2·5 × 2·0 mm., ovoid . . . . . 40. *virgata*

SUBSECT. MYRSINITEAE

1. Involucral glands without horns, glandular margin pectinate . 2
— Involucral glands distinctly 2-horned, glandular margin entire 3

2. Primary umbellate radii usually not more than 5, rarely up to 8, no secondary infra-umbellar radii; seeds 4·0–4·5 × 2·0–2·8 mm., with irregular vermiform wrinkles; leaf margin usually entire, sometimes scabrid . . . . . 74. *denticulata*
— Primary umbellate radii usually 8–15, often more, with usually several secondary infra-umbellar radii; seeds 4·5–5·5 × 3–3·5 mm., with more or less longitudinally arranged discontinuous pustules; leaf margin usually cartilaginous-denticulate, often pink 75. *craspedia*

3. Leaves lanceolate, 4 or more times longer than broad; leaf apex acuminate-spinose; cocci of the capsule acutely keeled; seeds smooth . . . . . 80. *rigida*

— Leaves not lanceolate, not more than 2 times longer than broad (rarely 4 times longer); leaf apex obtuse or mucronate, rarely acute or acuminate; seeds smooth or vermiculate-rugose . . . 4

4. Primary umbellate radii 8–20 5
— Primary umbellate radii 3–6, rarely 7 6

5. Seeds smooth or obscurely rugose; caruncle conical, acute at the apex; cauline leaves prominently pectinate-margined 78. *marschalliana*
— Seeds distinctly vermiculate-rugose; caruncle conical but concave at the apex; cauline leaves subentire or scabrid . 77. *myrsinites*

6. Seeds vermiculate-rugose; caruncle stipitate; cauline leaves rhomboid or rhomboid-orbiculate . . . . 76. *anacampseros*
— Seeds smooth, rarely obscurely rugose; caruncle sessile; cauline leaves broadly elliptic or elliptic-rhomboid . . . . 79. *armena*

SECT. ANISOPHYLLUM

1. Leaves membranous: stems filiform; capsules c. 1·5 × 2 mm.; seeds c. 1·3 × 0·8 mm., ovate-tetragonous, with many irregular, sometimes anastomosing wrinkles . . . . . 84. *chamaesyce*
— Leaves thick; stems up to 3 cm. thick; capsules c. 4 × 4 mm.; seeds c. 2·5 × 1·5 mm., subtetragonous-ovate, smooth . . 83. *peplis*

Enumeration of Species

Sect. Tithymalus ([Tourn. ex] Hill) Duby & Roeper, Bot. Gall. **1,** 412 (1828).

Type species: Euphorbia peplus L. (cf. Millspaugh: 1909).

Subsect. Pachycladae Boiss. in DC., Prodr. **15** (2), 107 (1862).

Lectotype: E. mellifera Ait.

1. **E. dendroides** L., Sp. Pl. 462 (1753).

Syn.: *E. divaricata* Jacq., Ic. Pl. Rar. **1,** 9, t. 87 (1784)!
E. laeta Aiton, Hort. Kew. ed. 1. **2,** 141 (1789).

Described from Italy, Crete and Stoechades island (Iles d'Hyères) (Herb. Linn. No. 89—sterile).

C2: prov. Muğla, dist. Fethiye, Kalkan, 10 m., 29 Mar. 1956, *Davis* 25448. Antiphellus [Fethiye], *Forbes*, Travels in Lycia **2,** 135 (1847), n.v.

Two species from Atlantic islands, *E. piscatoria* Ait. and *E. regisjubae* Webb, resemble *E. dendroides* L. in general facies, but the latter is always recognizable by its smooth seeds and usually fewer umbellate radii.

Distributed throughout the Mediterranean, though rare in the East, often in scrub on south limestone slopes.

Subsect. Carunculares Boiss. in DC., Prodr. **15** (2), 111 (1862).

Lectotype: E. cornuta Pers.

2. **E. ispahanica** Boiss., Diagn., **1** (7), 91 (1846).

Syn.: *E. megalantha* Boiss., in DC., Prodr. **15** (2), 111 (1862) and Fl. Or.

4, 1093 (1879), pro parte—non Boiss., Diagn. **1** (7), 95 (1846).
E. vanensis Azn. in exsicc. G. & B. Post, Eastern Turkey trip, no. 720 (1906) (nomen)!
E. megalantha Boiss. var. *brevicaulis* Nábělek, in Publ. Fac. Sc. Univ. Masaryk, **105,** 17 (1929)!
E. froedinii Rech. fil. in Symb. Bot. Upps. **21** (5), 48. fig. 24 (1952)!

Type: [Iran]: prope Ispahan, *Aucher* 5287 (G).

A9: prov. Kars, Iğdir—Tuzluca, 18 Apr. 1957, *E. Sauer* 291/57. B9: prov. Karaköse, Armenia Turcica, Sandz. Bajazed (Doğubayazit), 5 May 1916, *B. Schischkin*; prov. Bitlis, Nemrut dağ, below Soğurt, 1710 m., 3 July 1954, *Davis* 23561; 2 km. from Ahlat, 17 July 1956, *Birand & Karamanoğlu* 385; prov. Van, Gevaş—Edremit, 9 July 1954, *Davis* 22604.

A weed of disturbed steppe and fallow fields, reaching an altitude of 2000 m.

Although Boissier described *E. ispahanica* in 1846, he later regarded it as conspecific with the closely related *E. megalantha* Boiss. However, morphologically and geographically *E. ispahanica* is quite distinct; it has larger capsules (6·0–7·5 mm. × 4·5–6·0 mm., instead of 4·5–5·0 mm. × c. 5 mm.), larger seeds (3·5–4·0 mm. × 2·8–3·0 mm., instead of c. 3 mm. × c. 2·8 mm.), taller more robust stature, usually thicker more rigid umbellate radii, and usually thicker broader involucral leaves. *E. ispahanica* is more northerly and westerly in distribution, being found on the Caucasus, S. Transcaucasia, Armenia, Azerbaidjan, Kurdistan, Iraq, with its eastern limit near Isfahan in Iran. *E. megalantha* is almost confined in Iran to east of Isfahan.

The caruncles in *E. froedinii* were described by Rechinger as "valde depressa non prominente", but the isotype at Vienna shows the large ovate-conical caruncles and the linear cyathial lobes of *E. ispahanica; E. froedinii* can be regarded as only a depauperate form of the latter and evidently conspecific with it.

Despite certain variation in the size and shape of cauline, involucral, and involucellar leaves, *E. ispahanica* is always recognizable by the long linear cyathial lobes and the characteristic large caruncles. *E. ispahanica* Boiss. var. *brevicaulis* Nábělek cannot be regarded as more than an aberrant form with shorter stems and much longer and divaricate umbellate radii.

Endemic to the areas cited above.

Subsect. **Galarrhaeae** Boiss. in DC. Prodr. **15** (2), 113 (1862).

Type species: E. helioscopia L. (cf. Wheeler, 1943).

3. **E. acanthothamnos** Heldr. et Sart. in Boiss., Diagn. **2** (4), 86 (1859). *Syntypes:* In regione sempervirenti totius Greciae, Bithynia et Hoemo, *Grisebach* (G—non vidi); insulis Leucadia et Corcyra, *Mazziari* (G—non vidi).

C1/C2: prov. Muğla, 20 km. from Emecik, towards Marmaris, 7 June 1962, *Dudley* (D.35454). C2: prov. Muğla, Marmaris, 30 m., 24 Mar. 1956, *Davis* 25236; *ibid.*, Nimara ada, 16 July 1960, *Khan et al*, 71—Aeg. Is. Rodos (Rodhos): ad Embona, 15 May 1935, *K. H. & F. Rechinger* 7310, regio. Med. Rhodus, *Aucher-Eloy* 2016; Kalimnos, 5–7 Apr. 1887,

Forsyth Major 16; Samos, ad monasterium Zoodochous pigi, c. 300 m., 4 Apr. 1934, *K. H. & F. Rechinger* 3701.

On rocky slopes, in *Pinus brutia* forests on serpentine and limestone (Marmaris), forming one of the elements of the Mediterranean maquis and phrygana from sea level to 300 m.

This species has been often confused previously with another closely related species, *E. spinosa* L. (distributed mainly in the C. and W. Mediterranean, and N. Balkan peninsula), but differs chiefly in its shorter, narrower, bifurcate spines which originate from the radii of the umbel, instead of the longer wider simple "spines" of the latter which represent the blunt persistent fertile branches. In habit *E. acanthothamnos* resembles *Poterium spinosum* and, like the latter, in Greece often affords unarmed herbs protection against grazing (Davis, obs.).

In Turkey, *E. acanthothamnos* has been reported only from the Carian coast near Marmaris. Outside Turkey, it extends from the Dalmatian coast through Greece (including Aegean islands) to Crete and the Dodecanese, being more eastern in its distribution than *E. spinosa*.

4. **E. thamnoides** Boiss., Cent. Euph., 33 (1860).

Syntypes: In collibus regiones calidioris Syriae ad Berythium et Tripolin, *Boissier* (G; K—type of *E. dumosa* Boiss.); Sidonem, *Gaillardot* (W—n.v.); [Turkey (C3)], in Lycia prope Adalia [Antalya], *Pestalozza* (G); *ibid*, *Bourgeau* (K; E); [Turkey (C1)] circa Ephesum, *Aucher* 837 (P?); Cypri, *Labillardière* in h. Deless. (G—missing).

B1: Smyrna [Izmir], *E. Whittall.* C2: prov. Muğla, Fethiye, 30m., 27 Mar. 1956, *Davis* 25413. C3: prov. Antalya, Konya alti, 10 m., 24 Jan. 1936, *Tengwall* 66; Antalya, 5 m., 5 Apr. 1956, *Davis* 25636; Atbükü, 5 km. N. of Çirali, 26 May 1950, *Huber-Morath* 9965.

On limestone rocks, in Mediterranean communities near the coast (0–30 m.).

E. thamnoides shows affinities with *E. bivonae* Steud. ex Boiss. (Sicily, Malta and N. Africa), but is distinguished by its elliptic or elliptic-spathulate leaves (instead of linear-lanceolate), and by its obovate, obtuse involucellar leaves (instead of elliptic and mucronate). It is probably also related to *E. rhytidosperma* Boiss. et Bal.; see under the latter for differences.

E. thamnoides is an East Mediterranean species, extending from W. and S. Anatolia to Cyprus, Syria, Lebanon, and Palestine.

5. **E. rhytidosperma** Boiss. et Bal., Diagn. **2** (4), 84 (1859).

Type: [Turkey (C5)]: in fauce Guzel Dere Ciliciae littoralis supra Sedichig non procul a Mersina, floret fine Maii, fructus maturat Junio, *Balansa* (G; K; BM). Cilicia: Kagiraki, Apr. 1896, *Siehe* 178—as *E. dulcis* L.

E. rhytidosperma is probably allied to the shrubby E. Mediterranean *E. thamnoides* Boiss. which it chiefly resembles in leaf-shape and capsule, but is readily distinguished by its herbaceous habit, pilose (instead of glabrous and glaucescent) leaves, broadly ovate or suborbicular involucellar leaves with truncate or subcordate base (instead of elliptic or obovate), and its rugose (instead of smooth) seeds. *E. rhytidosperma* is endemic to the Cilician Taurus.

6. **E. djimilensis** Boiss., Fl. Or. **4,** 1104 (1879).

Type: [Turkey (A8)]: in regione alpina Ponti Lazici prope Djimil [Cimil above Rize], 1980 m., Jul. [1866], *Balansa* (*holo.* G; *iso.* K).

A8: prov. Trabzon, N. side of Soğanli dağ above Çaykara, 2000–2200 m., 4 Aug. 1957, *Davis* 32156; prov. Gümüşane, Bayburt—Of, 3 km. N. of pass top, 2400 m., 11 July 1960, *Stainton & Henderson* 6189. C6: prov. Hatay, Amanus, mont. de Dümanly, 700–1200 m., July 1911, *Haradjian* 3739.

On mountain slopes reaching 2400 m., often in alpine or subalpine meadows.

E. djimilensis resembles *E. macrocarpa* Boiss. et Buhse in its erect, simple stems with scale leaves and in the prominent mid-vein of its leaves, but can be easily separated by the elliptic or elliptic-spathulate leaves, by the lack of axillary floriferous branches and by its smaller capsules and smaller, carunculate seeds.

Although *E. djimilensis* is mainly centred in the eastern part of the Euxine province, it has been collected from the Amanus, a disjunct distribution shared w ith several other predominantly Euxine species like *Prunus laurocerasus*, *Fagus orientalis*, *Lathyrus aureus*, *Cardamine lazica*, etc.

7. **E. squamosa** Willd., Sp. Pl. ed. 4, **2** (2), 918 (1800).

Syn.: *E. aspera* M. B., Fl. Taur.-Cauc. **1,** 377 (1808).
E. muricata M. B., Fl. Taur.-Cauc. **1,** 378 (1808).

Holotype: [Turkey]: In Cappadocia, *Tournefort* (P—n.v.; photo. E).

A7: prov. Trabzon, dist. Maçka, 2 km. from Hamsiköy, 1320 m., 10 July 1958, *Huber-Morath* 16082, S. of Trabzon, 200 m., 19 May 1931, *R. Görz* 286. A8: prov. Rize, dist. Hemşin, Ortaköy—Çat, 1700 m., 2 Sept. 1952, *Davis* 21263; prov. Çoruh, Hopa, 50 m., 7 July 1931, *R. Görz* 736.

On rocky slopes in hazel scrub and bushes, and in both evergreen and deciduous forests, reaching 1700 m.

E. squamosa Willd. was described from Cappadocia and *E. aspera* M. B. from the Caucasus. Boissier rejected (Fl. Or. & in DC., Prodr.) *E. squamosa* as an unsuitable epithet, and cited the type of *E. squamosa* as one of the specimens representing *E. aspera* M. B. A photograph of the type of *E. squamosa* examined at Edinburgh shows only a scrappy upper part of a stem with two axillary floriferous branches and a few separate radii of the umbel. However, the presence of slender infra-umbellary radii, the general appearance of the capsule with cylindrical-filiform warts and the shape of the involucellar leaves is conclusive enough to equate this plant with Colchic specimens. The type locality "in Cappadocia" may well be erroneous; Tournefort also visited Georgia and might have collected it from there.

E. squamosa, in its habit, looks like *E. macroceras* (a species with connate involucellar leaves) with which it overlaps in its distribution, but is easily separated by its free involucellar leaves and warty capsules.

Probably endemic to the easternmost Euxine area in Turkey, Caucasus, Transcaucasia, and N. Iran (Hyrcanian province).

8. **E. macrocarpa** Boiss. et Buhse, in Nouv. Mém. Soc. Nat. Mosc. **12,** 197 (1860).

Type: [N. Persia]: Ssamamgebirge, an einem grasigen buschigen Abhange, 1 Jun. 1848, *Buhse* (*holo.* G; *iso.* W, photo. E).

B6: prov. Maraş, Berit dağ—Elbistan, 1800 m., 16 June 1960, *Stainton & Henderson* 5617. B7: prov. Tunceli, Hozat—Ovacik, 14 July 1957, *Davis* 31100. B9: prov. Bitlis, Karz dağ above Kotum, 1980 m., 28 June 1954, *Davis* 22273; Nemrut dağ, 2315 m., 3 July 1954, *Davis* 23552.

Among rocks and between oak scrub, often on open slopes and in hollows, reaching 1980 m.

E. macrocarpa is allied to *E. grisophylla* M. S. Khan; see the description of the latter for differences.

Apparently confined to E. Anatolia, N. Iran and Talysch.

9. **E. grisophylla** M. S. Khan, **spec. nov.** Pl. 5.

Affinis *E. macrocarpae* Boiss. et Buhse sed foliis caulinis subsessilibus, radiis secundariis infra umbellam plerumque nullis, capsulis et seminibus multo minoribus, seminibus ovoideis differt.

Perennis, glabra vel pubescenti-hirtella. *Radix* ignota. *Caules* floriferi plures, erecti ad 80 cm. alti, plus minus fistulosi, striati, parce foliosi, saepe superne ramosi, basi ad 7 mm. crassi squamis imbricatis provisi. *Folia caulina* mediana 30–70 mm. × 13–30 mm., subsessilia (petiolo non plus quam 2 mm. longo), oblonga vel oblongo-lanceolata vel ovata, integra, subrepanda, acuta vel mucronata, membranacea, griseo-viridia. *Folia involucri* 4–5, elliptica vel elliptico-rhomboidea vel late ovata, 25–45 mm. × 20–35 mm., acuta vel acuminata. *Radii primarii umbellae* 4–5, 25–75 mm. semel vel bis bifidi. *Folia involucellae* 10–27 mm. × 15–30 mm., late ovata, suborbiculata, flavescenti-viridia, basi plerumque subcordata. *Cyathia* campanulata, 3–4 mm. longa, lobis oblongis obtusis ciliatis extus glabris intus velutinis, glandulis subreniformibus ecornutis flavescentibus vel fuscis (in sicco). *Bracteolae* inter flores masculos latae, laciniatae et ciliatae. *Capsula* 4·5–7·0 mm. × 5·0–6·5 mm., ovoidea, trilobata, coccis rotundatis verrucis pluribus cylindrico-filiformibus provisis, stylis 2·0–2·5 mm. longis, a medio coalitis, apicem versus bifidis. *Semen* c. 4 mm. × c. 3 mm., late ovoideum, griseum, laeve, caruncula minutissima munitum.

Holotype: C10: prov. Hakâri, Cilo dağ, in gorge between Cilo yayla & Diz deresi, 2400 m., rocky slope, 10 Aug. 1954, *Davis & Polunin* (*Davis* 24250: E).

A9: prov. Erzerum, about 10 km. east of Kosor between Göle and Oltu, 27 Apr. 1957, *E. Sauer* 319. B8: prov. Bitlis, dist. Setek, Kambos dağ above Hurmuz, 2100 m., 31 June 1954, *Davis* 23456; Feuchter Mischwald 3 km. südlich Tatvan, 1700–1720 m. ü. m., 5 Juli 1951, *Huber-Morath* 11490. B9: prov. Van, dist. Gevaş, Artos dağ, 3080 m., 16 July 1954, *Davis* 22745; dist. Çatak, Kavuşşahap dağ, 3100 m., 23 July 1954, *Davis* 23212.

In its general habit, presence of scale leaves, and in the characters of cyathial glands, capsules and seeds, *E. grisophylla* shows affinities with *E. macrocarpa* Boiss., but differs by its much smaller capsules and seeds

PLATE 5. *Euphorbia grisophylla* M. S. Khan (holotype).

PLATE 6. *Euphorbia austroanatolica* Hub.-Mor. & M. S. Khan (holotype).

(the latter being broadly ovoid), subsessile cauline leaves and usually by its lack of infra-umbellary secondary radii. Although overlapping in its distribution with *E. macrocarpa* in E. Anatolia, *E. grisophylla* does not extend beyond Armenia in the north; it is probably a geophyte on mountain slopes and screes, reaching an altitude of 3100 m.

10. **E. palustris** Linn., Sp. Pl., 462 (1753).

Syn.: ?*Euphorbia sauliana* Boreau ex Boiss. in DC., Prodr. **15** (2), 1266 (1866)!

Described from southern Sweden, Germany and Belgium (Hort. Cliff.; Herb. Linn. no. 69).

A3: prov. Adapazari, Sakarya, 800–900 m., 30 Mar. 1957, *Davis* 26269; Bolu, 20–30 May [a. 1835?], *Wiedemann.*

Usually associated with damp marshy places, swamps, moist places near ponds and in the areas of streams and rivers, up to 900 m.

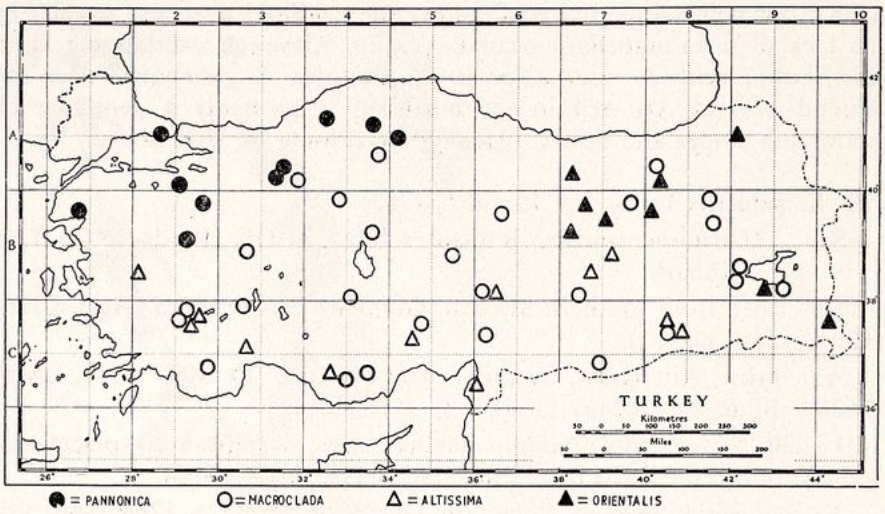
E. sauliana Boreau ex Boiss. (in DC. Prodr. **15** (2), 1266:1866) was described from Lydia "prope Magnesiam Meandri" [Prov. Aydin]. Boissier claims that although *E. sauliana* shows close affinities with *E. palustris*, it was reported by Boreau to have retained its diagnostic characters in cultivation for a period of several years. *E. sauliana* is said to differ from *E. palustris* in its more elongated and thinner axillary shoots, much narrower leaves, narrower involucellar leaves and much smaller and shorter warts on the capsules. The type of *E. sauliana* at Geneva has narrower (5–8 mm.), more pointed leaves. However, plants evidently belonging to *E. palustris*, collected from two localities (viz. Prov. Konya, *Siehe* 153—as *E. virgata* var. *orientalis* Boiss.; and Prov. Hatay, Balik gölü, *Haradjian* 4223) show that the breadth of cauline and involucellar leaves and the thickness and length of axillary shoots varies quite considerably in this species. The three areas in Turkey where *E. palustris* has so far been collected are Bithynia, Lycaonia, and Hatay. More material might throw light on the nature of the taxon, *E. sauliana*, and the validity of the size and width criteria of young axillary shoots, cauline and involucellar leaves.

E. palustris is very similar in habit to a Caucasian species, *E. eugeniae* Prokh. (in Komarov, Fl. U.R.S.S. **14,** 735: 1949). There is a photograph at Edinburgh of the type (in Leningrad) of this species. *E. eugeniae* is said to differ chiefly in its smaller capsules (not more than 3·5 mm. long) with pectinate processes on the upper dorsal parts of coccae, and in its shorter stature (not more than 65 cm.) with stems only 4–6 mm. thick at base.

E. palustris is mainly a European species with a distribution extending from southern Spain through Central Europe to most parts of N. Europe, and eastwards to the Urals, Siberia and the Altai. Towards the south, it reaches Greece; in Turkey it has so far been known from the three isolated areas mentioned above.

11. **E. orientalis** Linn., Sp. Pl., 460 (1753). Map 1.

Syn.: *E. notadenia* Boiss. et Hohen. ex Boiss., Diagn. **1** (12), 111 (1853)!
E. artvinensis Bornm. et Woronow, Monitor Jard. Bot. Tif. **26,** 3 (1913).



Map 1. Distribution of *Euphorbia* in Turkey.

Described from the Orient (Herb. Linn., no. 60—only the right hand specimen of this sheet named as *E. orientalis* could be referred to this species; the other plant on this sheet probably belongs to *E. palustris* L.).

A7: prov. Giresun, Sebenkarahisar, 5 Aug. 1952, *Davis* 20462. A8: prov. Gümüşane, Bayburt—Aşkale, 33 km. S. of Bayburt, 1820 m., 5 July 1955, *Huber-Morath* 14262. A9: prov. Çoruh (Artvin), Ardanuç, 650 m., 27 June 1957, *Davis* 30180—depauperate. B7: prov. Erzincan, Egin [Kemaliye], Ekrek-dere, 25 June 1890, *Sintenis* 2760; Erzincan—Refahiye, 17 km. N.W. of Erzincan, 1450 m., 6 July 1955, *Huber-Morath* 14260; prov. Tunceli, Munzur dağ, in Aksu Dere above Ovacik, 1700 m., 21 July 1957, *Davis* 31466. B8: prov. Erzincan, Selepür—Tercan, 1400 m., 8 June 1957, *Davis* 29307. B9: prov. Siirt, at Müküs, a. 1860, *Kotschy* 783. C9: prov. Hakâri, Zab gorge, near Dize, 1560 m., 6 Aug. 1954, *Davis* 23914.

Common by the side of rivers, on rocky metamorphic, igneous or limestone slopes, eroded bare clay hills, dried up river beds and moist valley floors, reaching 2900 m.

E. artvinensis Bornm. et Woron. was distinguished by its authors from *E. orientalis* chiefly by the shorter umbellate radii bearing solitary cyathia on each radius and by its narrower stems. But it has been observed that plants collected from river sides and moist places are usually robust with normally developed umbels, whereas gatherings from dry situations like eroded clay hills, etc. exhibit the characters described for *E. artvinensis*. The leaf-width also seems to vary within rather wide limits. *E. artvinensis* probably represents variant of *E. orientalis* adapted to dry and unfavourable conditions; similar variants may occasionally result from grazing.

Sterile specimens of *E. orientalis* can be easily mistaken for *E. altissima* Boiss. which, however, is more southern and western in distribution; see the discussion under the latter for differences.

E. orientalis is confined in Turkey to the Eastern provinces. Outside Turkey, it extends to the Caucasus and Azerbaidjan, reaching N. Iraq towards the South.

12. **E. altissima** Boiss., Diagn. **1** (5), 52 (1844). Map 1.

Key to varieties

Cauline leaves tomentose on both surfaces, or pilose at least on veins or margins . . . . . a. var. *altissima*
Cauline leaves glabrous on both surfaces . b. var. *glabrescens*

a. var. **altissima**

Syntypes: [Turkey (C2)]: ad rivuloso circa Denisleh [Denizli], *Boissier* (G); Laodiceam [Denizli] in Phrygia australi, June, 1842, *Boissier* (G, K).

B2: prov. Manisa, Tayten [Tatan], 3 km. from Salihli, 31 May 1938, *Huber-Morath* 5276. B7: prov. Elaziğ, Kharput [Harput], Erzuruk [Erzülük], 20 Apr. 1889, *Sintenis* 809; prov. Malatya, Malatya—Elaziğ, 21 km. E. of Malatya, 880 m., 16 June 1949, *Huber-Morath* 9400. C2: Denizli-Çardak, 15 miles. from Denizli, 700 m., 10 June 1962, *Dudley* (D.35579). C3: prov. Antalya, dist. Gebiz (Pisidia), Sinni Çay (Nenni Çay) between Gebiz and Pinargözü yayla on Bozburun dağ, 22 July 1949, *Davis* 15479. C5: prov. Adana, Bozanti [Pozanti], 700 m., a. 1896 *Siehe* 360. C8: Mardin, 13 June 1888, *Sintenis* 990.

b. var. **glabrescens** Boiss. ex M. S. Khan, **var. nov.**

A typo foliis caulinorum utrinque glabris differt.

Holotype: [Turkey (Lydia)]: plaine de Sardes, Septembre [1854], *Balansa* 185 (G).

B6: prov. Seyhan, Saimbeyli, 1100 m., 11 July 1952, *Davis* 19879. C4: prov. Konya, près Ermenek, July 1872, *A. Péronin* 200. C6: prov. Hatay, Mont. Amanus, Hasan Veyli, 900 m., a. 1908, *Haradjian* 2194. C8: prov. Mardin, Rischemil, 23 July 1888, *Sintenis* 1360.

The species is common along the edges of streams and in humid places, with an altitudinal range from 700 m.–1100m.

E. altissima is related to the European *E. villosa* Waldst. & Kit. (*E. pilosa* auct. incl. Boiss., Fl. Or., non L.; *E. procera* M. B.) which, however, differs by its glabrous capsules and broader shorter cauline leaves. A specimen from Marienfeld (Transcaucasia), distributed by Hohenacker under the name *E. procera* M. B. and mistakenly referred to *E. altissima* by Boissier (Fl. Or.), does, in fact, represent *E. villosa* Waldst. & Kit. which evidently reaches Caucasia; *E. altissima* is absent from there. When not in fruit, *E. altissima* is easily confused with *E. orientalis* L. which it resembles in leaf-shape and size of umbellate radii. The latter, however, is more northerly and easterly in distribution, extending from Armenia and the Pontus through Azerbaidjan into the Elburz Mts. and N. Iraq. *E. altissima* differs from *E. orientalis* in its thinner serrulate leaves (instead of subcoriaceous and almost entire), and capsule with verrucose cocci.

Outside Turkey, *E. altissima* is restricted to Syria, Iraq, Anti-Lebanon and Cyprus; in Turkey it is absent from the Euxine province.

Some hairy Iraqi specimens (no seeds available, e.g. dist. Mosul, supra Sirsank, 1300–1400 m., 10–12 July 1957, *K. H. Rechinger* 11649) have more slender stems and much narrower and smaller cauline leaves than *E. altissima*, and appear to represent a distinct taxon allied to that species.

13. **E. oblongata** Grisebach, Spicil. Fl. Rumel. Bithyn. **1,** 136 (1843).

Syn.: *E. erioclada* Boiss. et Heldr., Diagn. **1** (7), 88 (1846)!

Type: [Greece]: In peninsula Hajion-Oros: in umbrosis fruticum semper-virentium pr. Pandocratoras sparsim, alt. 0–360 m. (substr. micasch), Fl. Maj.—Jun., *Grisebach* (*holo.* B—n.v.; *iso.* K).

A1(E): prov. Istanbul, Çilingöz, fide *Hermann* in Fedd. Rep. Beih. 87, 73 (1936), n.v. A2(A): prov. Istanbul, Adampol, *Aznavour*; prov. Çanakkale, Bayramiç, Kazdağı—Çeşme Sirti, 1100–1200 m., 16 Aug. 1951, *Ismail Akbas.*

Aeg. Is.: Lesvos, prope Dip (Ntip) ad sinum Kolpos Jeras, 18–24 May 1934, *K. H. & F. Rechinger* 5657, in monte Olympos ad pagum Ajassos, ca. 400–700 m., 19 May 1934, *K. H. & F. Rechinger* 5623.

Usually in shady, moist places, from sea level to 700 m.

E. sessiliflora Boiss. et Sprun. (Diagn. **1** (5), 52: 1844), which was described from Mt. Delphi in Euboea and later reduced to a variety of *E. oblongata* by Boissier himself (in DC., Prodr. **15** (2), 126: 1862) and regarded by Nyman as a subspecies (Consp. Fl. Europ. **1,** 649: 1881), was distinguished by its shorter stature, smaller, more obtuse leaves with greyish tomentum and obsoletely serrate margin, and short "capituliform" umbellate radii. I have not seen the type specimen but examined some plants from Aznavour's Herbarium, Geneva (e.g. Constantinople, bord du chemin, 3 Juin 1894, *Aznavour*) labelled as var. *sessiliflora* Boiss. which show several stems and very much condensed umbellate radii. However, the possibility that it might represent only a depauperate form growing in unfavourable situations cannot be ruled out. More material (including the type) needs to be examined before deciding on the status of this taxon.

The relationships of *E. oblongata* are rather obscure. In general facies, it approaches more or less *E. verrucosa* Linn. (*E. pubescens* Vahl) which, however, has tuberculate seeds and is further distinguished by its oblong-lanceolate cauline leaves. *E. oblongata* was mistakenly described by Grisebach as an annual; in fact, it is a perennial with a thick lignified root.

Each of the 2 sheets under the name *E. pilosa* in Sibthorp's herbarium at Oxford consists of a mixed gathering of *E. oblongata* Griseb. and *E. verrucosa* L. (*E. pubescens* Vahl).

E. oblongata is mainly centred in Greece, Crete and Thrace, but reaches Troas and the Bosphorus in its eastern extension; it is also recorded from the Euxine province of European Turkey.

14. **E. wittmannii** Boiss., Cent. Euph., 31 (1860).

Type: In saxosis Transcaucasiae ad Atskur et Usurgeti, *Wittmann* (LE—n.v., G).

A8: prov. Çoruh, Murgul 300 m., 17 Apr. 1960, *Stainton* 8196; prov. Erzerum, about 15 km. S. of Tortum gölü, 23 Apr. 1957, *E. Sauer* 336/57. A9: prov. Kars, Oltu—fide *Sosnowsky*, Phytog. invest. Kars. pp. 49 & 88 (1915), n.v.

Probably endemic to Georgia and N.E. Anatolia (Lazistan, and N.E. Armenia), growing in mountain steppe and rocky ledges.

E. wittmannii is perhaps allied to a Cyprian endemic, *E. cypria* Boiss., but is easily distinguished by its larger, broader, spreading leaves, larger involucral leaves, and smooth seeds.

15. **E. cassia** Boiss., Diagn. **1** (12), 108 (1853). Boiss., Ic. Euph. t. 88 (1866).

Syn.: *E. rigoi* Boiss. ex Freyn in Bull. Herb. Boiss. **6,** 987 (1898).
E. troodii Post in Mém. Herb. Boiss. **18,** 100 (1900).
E. cassia Boiss. ssp. *rigoi* (Boiss. ex Freyn) Holmboe, Studies Veg. Cyprus, 120 (1914).

Type: [Turkey (D5)]: in jugis umbrosis Cassii in regione inferiori secus viam qua a Laodicea ad Suadieh itur circa pagum Cassab [Kasab, S. of Antakya], *Boissier* (*holo.* G; *iso.* K).

C6: prov. Hatay, Mt. Amanus, a. 1906, *Haradjian* 293; *ibid.*, 900 m., a. 1906, *Haradjian* 487; prope Beilan [Belen], 1050 m., May–June 1862, *Kotschy* 173.

On mountains and in valleys up to 1050 m.

E. rigoi Boiss. ex Freyn was distinguished from the typical plants of *E. cassia* by its decumbent or ascending habit and the stunted umbellate radii (not longer than the involucral leaves). Holmboe, who regarded *E. rigoi* as a subspecies, claimed that these characters described by Freyn are preserved in cultivation and that this taxon is confined to Cyprus. Post differentiated his *E. troodi* chiefly on its obovate-rotund and mucronate involucellar leaves. However, material from the Amanus also shows the decumbent habit, and the length of umbellate radii varies independently of habit and the shape of the involucellar leaves which themselves show considerable variation in their length/breadth ratio.

E. cassia resembles a Cyprian endemic, *E. cypria* Boiss., in habit and seed characters, but is distinguished by its oblong-spathulate (instead of linear) leaves and by the stems which are branched below. It is an East Mediterranean species confined to Cyprus, the Amanus, W. Syria and Lebanon.

E. cassia is allied to *E. austroanatolica* Huber-Morath & M. S. Khan; for differences see under the latter.

16. **E. austroanatolica** Huber-Morath et M. S. Khan, **spec. nov.** Pl. 6.

Affinis *E. cassiae* Boiss. sed capsulis molliter verrucosis, seminibus laevibus, foliis caulinis membranaceis et pellucido-punctatis differt.

Perennis, herbacea, glabra et glaucescens vel pilosa. *Caules* ex rhizomate plures, ad 30 cm. longi, ad basin 1–2 mm. crassi et caudiculosi, graciles, fragiles, flexuosi, ascendentes, plerumque simplices, raro ramosi, sparsim foliosi, inferne demum denudati. *Folia caulina* mediana 15–25 mm. × 3–6 mm., breviter petiolata (petiolo c. 0·5 mm. longo), anguste elliptica vel oblanceolata, membranacea, pellucido-punctata, anguste cartilagineo-marginata, folia juvenilia saepe induplicata et falcata, purpureo- et serrulato-marginata. *Folia involucri* 4–5, elliptica vel lanceolata, 10–20 mm. × (–2) 5–8 mm., minute serrulata, mucronata, pellucido-punctata. *Radii primarii umbellae* 4–5, 1–4 cm. longi, semel vel bis bifidi. *Folia involucellae* (primariae) 8–13 mm. × 4–8 mm., elliptica, mucronata, pellucido-punctata. *Cyathia* 2–3 mm. longa, campanulata, lobis oblongis truncatis

vel retusis utrinque glabris sed ciliato-marginatis, glandulis (in sicco) flavescentibus, breviter stipitatis, transverse late oblongis vel subreniformibus, marginibus rotundatis ecornutis. Bracteolae inter flores masculos paucae, ciliatae. *Capsula* 3·0–4·5 mm. longa, coccis glabris verrucis conico-cylindricis purpureis mollibus provisis. *Semen* 2·5–2·7 mm. × 1·7–1·9 mm., ovoideo-oblongum, laeve, fuscescens, caruncula c. 0·5 mm. longa globosa. Fl. Apr.-Jun.

C2: prov. Muğla dist. Köyceğiz, Muğla—Fethiye, Macchie 141 km. sudöstlich Muğla, 7 Juni 1938, *Huber-Morath* 5281 (*holo.* Hb. Hub.-Mor.; *iso.* E), dist. Fethiye, Kizildere, between Fethiye & Köyceğiz, 50 m., 1 Apr. 1956, *Davis* 25540 (K), Muğla—Fethiye, 27 miles from Muğla, 70 m., 29 May 1962, *Dudley* (D.35141-E).

E. austroanatolica is probably related to an East Mediterranean species, *E. cassia* Boiss., which it resembles in general facies and in the characters of the cyathial glands, but is really distinguished by its verrucose capsules, smooth seeds, and membranous, pellucid-punctate leaves.

This slender, tufted species has been collected only from the province of Muğla where it grows near sea level in *Pinus brutia* forest on serpentine and in maquis; it is probably endemic to S.W. Anatolia (Caria).

17. **E. schottiana** Boiss., Diagn. **2** (4), 85 (1859).

Syn.: *E. densa* Schott et Ky. in Kotschy, Reise Cilic. Taur., 396 (1858), nomen solum, non Schrenk (1845).

Type: [Turkey (C5)]: in summa valle Metdesis [Mededsiz, prov. Niğde] Tauri Cilici alt. 3080 m., floret Julio, Aug. [1853 ?], *Kotschy* 147 (G; K; BM).

C5: Karli Boghas [Külek boğhas ?], 1800 m., and Kizil Deps, [Kizil tepe near Bulgar Maden], 2800 m., a. 1896, *Siehe* 299.

E. schottiana, endemic to the Cilician Taurus, apparently has no near relatives. The only species which it approaches in general appearance is *E. capitulata* Reichenb. (from Greece, Dalmatia and the Balkan peninsula), but can be easily separated by its laxly leaved stems, thick woody vertical rhizome and long-stalked capsules.

The "Apios" Group

Group "*Apios*", including *E. dimorphocaulon*, *E. apios*, *E. cardiophylla*, and *E. condylocarpa*, forms a distinct natural unit. All four members have tuberous roots and are scarcely distinguishable by characters of capsules and seeds. However, they are geographically separate and show differences in their vegetative characters and flowering habit.

The following table summarizes the distinctive features of the four species.

dimorphocaulon	*apios*	*cardiophylla*	*condylocarpa*
Root napiform, rarely bifurcate	napiform, occasionally ± fusiform	cylindrical, vertical	ovate-globose, sometimes fusiform
Stems dimorphic; sterile decumbent, branched from the base, densely leafy; floriferous erect, sparsely leafy	monomorphic; 1–many, prostrate to erect, branched below	monomorphic: many, sub-erect, often branched below	solitary; stem erect, unbranched

Leaves sparsely hirtellous, on sterile branches up to 6 mm. × 4 mm. and shortly petiolate; on floriferous branches not more than 3 mm. long and subsessile; leaf-base subattenuate or round	sparsely or densely pilose, (–5) 10–17 mm. × (–2)3-7mm., sessile; leaf-base subattenuate or round	glabrous, 18–35 mm. × 6–20 mm., sessile; leaf-base deeply cordate-auriculate	glabrous, 15–20 mm. × 3–6 (–13) mm., sessile; leaf-base cordate-amplexicaul
Autumn flowering	spring flowering	spring flowering	spring flowering
Crete, Cyprus, and S. Turkey	S. Italy, Greece, Balkan Peninsula, Anatolia (chiefly in the Medit. region), Anti-Lebanon & Syria.	Turkey (Bithynia, Lycia, N. Isauria) and N. Iraq.	Caucasia and N. Iran.

18. **E. dimorphocaulon** P. H. Davis in Phyton **1,** 196 (1949).

Syn.: *E. apios* sensu Sieber, Reise nach Creta **2,** 321, t. 9 (1823), non Linn. (1753).

Holotype: Crete: Hierapetra, Aphendi Kavusi, in Phrygana von 0 bis 800 m., *Davis* 1065 (K).

C4: prov. Antalya, between Gazipaşa and Kaldiran çay, 300 m., 12 Apr. 1956, *Davis* 25922—sterile.

E. dimorphocaulon is very closely related to *E. apios* L., with which it has been confused before. The Turkish gathering is sterile (being collected in the spring) but its petiolate leaves distinguish it from *E. apios.*

E. dimorphocaulon is apparently confined to Crete, Cyprus and Isauria in S. Turkey where it is the only autumn-flowering species of Euphorbia, a habit made possible by its tuberous root. In Crete and Cyprus it replaces *E. apios* L. and grows from sea level to 750 m., especially on metamorphic slopes among *Quercus coccifera* and *Poterium spinosum.*

19. **E. apios** Linn., Sp. Pl., 457 (1753).

Syn.: *E. apios* L. var. *lamprocarpa* Boiss., in DC. Prodr. **15** (2), 126 (1862)!

Type: Clusius's illustration (Rar. Plant. Hist., Lib. **6,** 190: 1601).

A3: prov. Bolu, 2 km. S. of Seben, 800 m., 8 May 1958, *Kühne* 2039. A4: prov. Ankara, Çubuk baraj, 1000 m., May 1958, *F. Markgraf*; A5: Amasya, 16 May 1889, 4–600 m., *J. Bornmüller* 814—as var. *lamprocarpa.* A7: Gümüşane, 1100 m., 10 May 1960, *Stainton* 8381. B4: prov. Ankara, Dikmentepe, 8 June 1933, *W. Kotte* 1089. B7: prov. Erzincan, Egin [Kemaliye], 13 May 1890, *Sintenis* 2231. C2: prov. Muğla, Marmaris —Emecik, 300 m., 25 Mar. 1956, *Davis* 25324. C3: prov. Antalya, Korkuteli—Gülük dağ, 600 m., 7 Apr. 1956, *Davis* 25753. C4: prov. Içel, Gülnar, 1000 m., 14 Apr. 1956, *Davis* 26054. C5: prov. Seyhan, Kurttepe, 150 m., 9 Apr. 1935, *E. K. Balls* 2089, dist. Pozanti, Bürücek, 1300 m., 3 Apr. 1957, *Davis* 26349; prov. Içel, village d'Alla Dagh, à 7 lieues au NO. de Mersina, 6 June 1855, *Balansa* 783. C6: prov. Hatay, dist. Belen, Soğuk Oluk, 700 m., 23 Apr. 1957, *Davis* 27023.—*Aeg. Is.:* Khios, Kardhamigla, 6 Mar. 1940, *J. W. O. Platt* 416; Samos, prope Tigani, c. 250 m., 2 Apr. 1934, *K. H. Rechinger* 3620.

On rocky slopes and screes of limestone, schist or metamorphic sub-

strate, mountain steppe, amongst maquis on serpentine and in pine and oak forests, reaching 1650 m., mainly in the Mediterranean region.

E. apios is very closely related to *E. dimorphocaulon* P. H. Davis which, however, can be distinguished by its dimorphic stems, short-petioled leaves and autumn-flowering habit. Whereas *E. dimorphocaulon* is known, so far, only from Crete, Cyprus and Isauria, *E. apios* extends from S. Italy and Greece through the Balkan peninsula and Anatolia (mainly in the Mediterranean region) into the Anti-Lebanon and Syria, but is absent from Crete and Cyprus where it is replaced by *E. dimorphocaulon*.

The diagnosis of *E. apios* L. in *Species Plantarum* can be traced back to the figure in Clusius's *Rar. Plant. Hist., Lib.* **6,** 190 (1601), a work which Linnaeus cites in synonymy. Clusius mentions Apulia (S. Italy) and the kingdom of Naples as localities for this plant. Both the provenance cited and the illustration are quite consistent with *E. apios* in the generally accepted sense, but are not applicable to *E. dimorphocaulon* which has not been collected west of Crete. The habitat "in Creta" cited by Linnaeus for *E. apios* appears to be erroneus, apparently based on Clusius's information that the plant in question was seen by Bellonius in Crete—a record that probably refers to *E. dimorphocaulon*. One of the two specimens labelled as *E. apios* in the Linnaean Herbarium has since been identified as *E. tuberosa* L.; the other might represent *E. barellieri* Savi (*E. baselicis* Ten.). Neither specimen fits Linnaeus's diagnosis of *E. apios* and it therefore seems necessary to typify the name by the illustration in Clusius.

E. apios var. *lamprocarpa* was based on its subentire leaves, larger, sparser hemispherical warts on the capsules, and slightly larger seeds. These characters vary independently of each other and throughout the whole range of the species, so that "*lamprocarpa*" does not deserve varietal rank.

20. **E. cardiophylla** Boiss. et Heldr., Diagn. **1** (12), 107 (1853).

Holotype: [Turkey (C3)]: In fructicetis regionis inferioris montis Solyma [Bey dağlari] Lyciae infra Kartsibahir, *Heldreich* (G).

A2: Bithynia, pr. Brussam [Bursa], May 1874, *Pichler*. C3: prov. Konya, Beyşehir—Akseki, 36 km. from Beyşehir, 1300 m., 19 June 1948, *Huber-Morath* 9972.

Often on calcareous rock up to 1300 m.

Described from Lycia and recorded from Bithynia and northern Isauria, *E. cardiophylla* has also been collected from N. Iraq (e.g. Rowanduz gorge, *Guest*—as *E. condylocarpa*, K!; Sulaimaniya, *Rechinger* fil. 10380, W!). Further collecting may show this little-known species to have a less disjunct distribution than it appears to have on present evidence.

E. cardiophylla is related to *E. condylocarpa* M. B.; for differences, see the discussion under the latter.

21. **E. condylocarpa** M. B., Fl. Taur.-Cauc. **1,** 377 (1808).

Holotype: in Montosis Caucasi, circa acidulam Narzana, *Marschall von Bieberstein* (LE—n.v.).

Armenia, *Tournefort* (Berlin, fide Boiss. Fl. Or., n.v.).

E. condylocarpa is allied to *E. cardiophylla* Boiss. et Heldr. but is distinguished by its ovate-globose or fusiform (instead of cylindrical) root, solitary stem unbranched below, and by its much slenderer stem and umbellate radii.

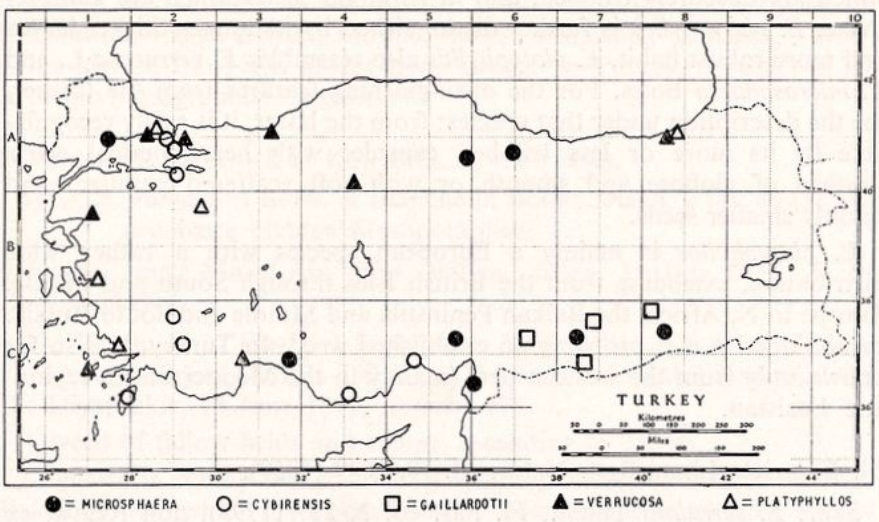
Probably endemic to Armenia (Turkish?), Caucasia and N. Iran. Its reported occurrence in Ankara province by Krause (Ankaranin Floru, 101: 1937) appears to be erroneous; one of the two specimens cited in his work (i.e. Çankaya, *Lindsay*) is in the Kew Herbarium and represents *E. apios* L.

22. **E. verrucosa** Linn., Sp. Pl., 459 (1753). Fiori & Paol., Ic. Fl. It. **2,** t. 305, f. 2589 (1901)—sub *E. pubescens* Vahl; Bonnier, Fl. Compl. Fr. Suisse & Belg. **10,** t. 545, f. 2469 (1929). Map 2.

Syn.: *E. pubescens* Vahl, Symb. Bot. **2,** 55 (1791)!
E. platyphylla L. var. *pubescens* (Vahl) Roep. ex Webb & Berthelot, Phyt. Can. **3** (3), 245 (1846–1847)!
E. platyphylla L. subsp. *pubescens* (Vahl) Knoche, Fl. Balear. **2,** 148 (1922)!

Described from S. France and Switzerland. (Herb. *Linn.* no. 51; in Herb. *Cliff.* the specimen labelled as "Tithymalus sylvaticus flore lunato" could be referred to *E. verrucosa* L.).

A2 (E): prov. Istanbul, Kücük Çekmece, 2 Aug. 1891, *Aznavour.* A2 (A): Istanbul, Dragos—Kartal, 29 Aug. 1898 & 14 Aug. 1898, *Aznavour.* A3: prov. Bolu, 10–15 km. east of Akçakoca, sea level, 14 July 1962, *Davis* 37494. A4: Ankara, Idris dağı—Hasanoğlan deresi, c. 1400 m., 6 June 1945, *Kamil Bilger* 295—sterile. A8: Rize, 27 Sept. 1866, *Balansa* 385. B1: prov. Balikeşir, between Seitinly [Zeytinli] and Ak çay, 11 June 1883, *Sintenis* 446. C3: Antalya, 30 m., 23 June 1935, *T. A. Tengwall* 27.—*Aeg. Is.:* Kos, Istranköy, *Aucher-Eloy* 2021.



Map 2. Distribution of *Euphorbia* in Turkey.

In fields in plains, and on the mountains up to 1400 m., often in moist places and near salt marshes.

The two specimens labelled as *E. verrucosa* in Herb. Linn. represent the two species later described as *E. pubescens* Vahl and *E. cybirensis* Boiss. The Linnaean phrase name and the synonymy, however, evidently refer to the former species, so that there seems good reason to adopt *E. verrucosa* L. (1753) as the correct name for *E. pubescens* Vahl. The plant described by Lamarck as *E. verrucosa* (Encyc. Bot. **2,** 434: 1788) is a different species, but as he cites *E. verrucosa* L. as a synonym, "*E. verrucosa Lam.*" is nomenclaturally synonymous with *E. verrucosa* L. The correct name for Lamarck's species may be *E. brittangeri* Opiz (fide A. R. Smith, in litt.).

E. verrucosa L. resembles, in general facies, *E. platyphyllos* L., but can be readily separated by its cyathial glands which are hirsute on the under surface, by its perennial habit and usually tuberculate seeds.

23. **E. platyphyllos** Linn., Sp. Pl., 460 (1753). Map 2.

Syn.: *E. literata* Jacq., Coll. **2,** 340 (1789) & Ic. Rar., t. 482 (1789).
E. lanuginosa Thuill., Fl. Par. ed. **2,** 238 (1799).
E. platyphylla L. var. *literata* (Jacq.) Koch, Syn. Fl. Germ. Helv. ed. 2 (1), 723 (1843).

Described from France, British Isles and Germany (Herb. Linn. no. 55).

A2 (E): Istanbul, Safra köy—Yarimbourgas, 19 June 1898, *Aznavour* (as v. *literata* Koch). A3: prov. Adapazari, Arifiye, 30 m., 1 July 1962, *Davis* 36285. A8: Rize, 24 June 1866, *Balansa* 1441. B1: Smyrna [Izmir], 23 July 1854, *Balansa*. B2: Kütahya—Tavşanli, 30 km. before Tavşanli, 800 m., 23 June 1962, *Dudley* (D.36118). C1: prov. Muğla, Bodrum Milaş, 6 km. from Milaş, 50 m., 26 May 1962, *Dudley* (D.35015a). Cilicia Trachaea, 1600 m., a. 1912, *Siehe* 350—fide Hayek in Ann. Nat. Hofm. Wien, **28,** 178 (1914), n.v.

In damp places.

Differs from its nearest relative, *E. stricta* L., in its larger capsules which are obscurely trilobed, and in its larger seeds which are globose-ovate. *E. platyphyllos* is further distinguished by its longer thicker leaves and more robust habit. *E. platyphyllos* also resembles *E. verrucosa* L. and *E. microsphaera* Boiss. For the distinguishing features from the former, see the description under that species; from the latter, it is easily recognizable by its more or less trilobed capsules with hemispherical warts (instead of globose and smooth or with soft scattered papillae) and slightly smaller seeds.

E. platyphyllos is mainly a European species with a rather wide distribution, extending from the British Isles through South and Middle Europe to N. Africa, the Balkan Peninsula and Middle and South Russia. In N. America it is probably an established weed. In Turkey, it is so far known only from the western part (mainly in the Mediterranean region and Lazistan.

24. **E. stricta** Linn., Syst. Natur. ed. 10, 1049 (1759).

Syn.: *E. serrulata* Thuill., Fl. Par. ed. **2,** 237 (1799), non Reinw. ex Blume (1826).

E. micrantha M. B., Fl. Taur.-Cauc. **1,** 376 (1808).

Type locality not given by Linnaeus (Herb. Linn. no. 54).

A1 (E): prov. Tekirdağ, dist. Malkara, Sariyar, 22 June 1891, *Aznavour*. A2 (E): prov. Istanbul, Belgrad forest, 18 Mar. 1960, *F. Yaltirik*. A2 (A): prov. Istanbul, Ermeniköy, Alemdağ, 9 May 1892, *Aznavour*. A3: prov. Bolu, distr. Ala dağ, Kartal Kaya Tepe, 2000 m., 11 Aug. 1960, *Khan et al.* 461. A4: prov. Kastamonu, Ilgaz dağlari, Kastamonu—Ilgaz, 1400 m., 11 Aug. 1960, *Khan et al.* 681; prov. Ankara, Kizilcahamam, Güdül, 3 Aug. 1957, *Kühne* 1317. A5: prov. Sinop, Çangal dağ, above Ayancik, 1100 m., 27 July 1962, *Davis* 38252. A6: Tokat, *Wiedemann* 357. A7: prov. Trabzon, Yomra, 8 Apr. 1957, *Sauer* 229/57. A8: Rize (Lazistan), 2 June 1866, *Balansa* 1442; Artvin, 1800 m., 1 July 1960, *Stainton & Henderson* 5939. B2: prov. Izmir, distr. Ödemis, Bozdağ, 1300 m., 16 Aug. 1950, *Davis* 18237; prov. Balikeşir, dist. Dursunbey, Alaçam dağı, 1170 m., 27 July 1951, *Najmi Saylu*. B4: prov. Ankara, Beynam, 5 July 1947, *Davis* 13031. B5: prov. Niğde, Masmeneu Dagh [Masmutli dağ] à 25 lieues au SSO de Césarée, 9 Aug. 1855, *Balansa* 739; prov. Yozgat, Sakarya valley, Yarimca çayir, June 1960, *E. W. Curtis* 198. C1: prov. Aydin, Samsun dağı, 30 km. S. of Davutlar Köy, 240 m., 24 May 1962, *Dudley* (D.34944). C2: prov. Muğla, Köyceğiz, 5 m., 1 Apr. 1956, *Davis* 25549; prov. Antalya, Elmali, 16 July 1860, *Bourgeau* 259 and 599. C3: prov. Konya, distr. Beyşehir (Isauria), Hoyran—Kurucaova, 1100–1200 m., 4 Aug. 1949, *Davis* 16084. C5: prov. Içel, Cilicia Trachea, June 1912, *Siehe* 350.

E. stricta prefers shady wet places by streams, springs, ditches on road sides, salt marshes and among rocks in forest, reaching 1800 m.

Although *E. stricta* looks very much like its closest ally *E. platyphyllos* L. in general facies, it can be readily separated by its smaller capsules which are deeply trilobed and by its smaller seeds which are narrower and ovoid-oblong. The habit of *E. stricta* is also much more slender and the leaves thinner than in *E. platyphyllos*.

Like *E. platyphyllos*, *E. stricta* is also mainly a European species extending as far west as the British Isles, but more northerly in its distribution, viz. in Central Europe, Balkan Peninsula, Caucasia, Turcomania and N. Iran; it is absent from Greece. In Turkey, it occurs in all three phytogeographical regions.

25. **E. guestii** Blakelock in Kew Bull. **3,** 452 (1950).

Syn.: *E. gaillardoti* Boiss. & Blanche in Boiss., Diagn. **2** (4), 84 (1859), pro parte plantae Mesopotamiae!

Holotype: Iraq: Mosul-Ain Sifni, 360 m., fields, 11 July 1933, *E. R. Guest* 4034 (K).

B7: 70 km. E. of Elaziğ, 1 Sept. 1954, *Davis* 24815. C6: prov. Hatay, Iskenderun—Soğuk Oluk, c. 750 m., c. 25 June 1944, [*Baki*] *Kasapliğil* 40. C8: Diyarbakir, 13 June 1841, *Kotschy* 179.

A weed of fallow fields and steppe, ascending to 750 m.

E. guestii is closely related to *E. gaillardotii* Boiss. & Blanche emend. Blakelock with which it was confused by Boissier due to its close resemblance in habit, but the former can be easily separated by its seeds which

are grey and irregularly furrowed (instead of brown and smooth). The involucellar leaves, which in *E. guestii* are usually longer than broad, and the usually corymbose appearance of the umbels, may provide additional differential characters, though their constancy is not to be relied on. Plants evidently belonging to *E. gaillardotii* (e.g. Diyarbakir, *Davis* 22143) with brown, smooth seeds have involucellar leaves longer than broad.

Confined to Turkish and Iraqi Mesopotamia, Amanus, Syria, Anti-Lebanon and Palestine.

26. **E. gaillardotii** Boiss. et Blanche in Boiss., Diagn. **2** (4), 84 (1859), emend. Blakelock in Kew Bull. **3,** 453 (1950). Map 2.

Lectotype: [Syria]: prope Rascheya, alt. 1350 m., *Kotschy* (G, W, K).

C6: Aintab [Gaziantep], 27 July 1907, *Manissadjian* 1221 (Herb. B. V. D. Post)—as *E. microsphaera* Boiss. C7: Urfa—Akçakale, 32 km. from Urfa, 450 m., 17 May 1957, *Davis* 28166; between Urfa and Siverek, Sept. 1865, *Haussknecht*. C8: Diyarbakir, 23 June 1954, *Davis* 22143.

A weed, often in fallow fields, reaching an altitude of 1350 m.

In the absence of seeds *E. gaillardotii* can be easily mistaken for *E. guestii* Blakelock which it greatly resembles in general habit and capsule characters. Kotschy's plant with seeds has to be chosen as the lectotype; another syntype, viz. "in agris versus Ouadi Barrada Antilibani, *Gaillardot*" lacks capsules. The third syntype of *E. gaillardotii* cited by Boissier (prope trajectum Tigridis, *Kotschy*) represents *E. guestii* Blakelock.

E. gaillardotii is endemic to Turkish Mesopotamia, Syria, Anti-Lebanon, and Transjordan; it is also reported from Isfahan and near Teheran (cf. Parsa, Fl. Iran).

27. **E. ancyrensis** Aznavour ex M. S. Khan, **spec. nov.**

Affinis *E. cybirensi* Boiss. sed statura valde humiliore, capsulis trilobatis; basibus aculeorum latioribus, seminibus minoribus ecarunculatis albo-pulverulentibus distinguitur.

Planta annua, glabra, humilis, 4–10 cm. alta. *Radix* tenuis ad 12 mm. alta. *Caulis* inferne non plusquam 2 mm. crassus, saepe ramis floriferis infra umbellam provisus. *Folia caulina* oblanceolata, 8–20 mm. × 4–7 mm., uninervia, ultra medium serrulata, acuta vel breviter acuminata, raro obtusa, basi in petiolum 2–4 mm. longum attenuata. *Folia involucri* 3–4, oblongo-oblanceolata vel oblonga, 10–16 mm. × 4–6 mm., apicem versus serrulata, acuta. *Radii primarii umbellae* 3–4, 10–20 mm. longae, 2- vel 3-fidi, ad ter divisi. *Folia involucellae* 5–10 mm. × 5–8 mm., ovata vel rhomboideo-ovata, vel late vel valde late ovata, ultra medium serrulata, mucronata vel breviter acuminata, basi rotunda vel subcordata. *Cyathia* campanulata, 1·5–2·0 mm. longa, lobis breviter oblongis, truncatis vel bifidis, ciliatis, glandulis transverse ellipticis vel depresse transverse ovatis ecornutis flavescento-brunneis (in sicco). *Bracteolae* inter flores masculos latae, hirsutae. *Capsula* 2·0–2·5 mm. × 2·5–3·0 mm., trilobata, glabra, coccis subacutis, dorso aculeis plus minus rigidis 0·4–0·7 mm. longis saepe basi latis provisis. *Styli* 1·5–2·0 mm. longi, basi coaliti, ad apicem bifidi. *Semen* c. 1·6 mm. × c. 1·3 mm., ovoideum, brunneum vel nigrum, saepe sub lente albo-pulverulentum, ecarunculatum.

A/B4: [Ankara]: au dela du tumulus éventié (inculter), coll. Frères E. C., Herb. *Aznavour* (*holotypus*, G). A5: prov. Kastamonu, Koesen [Kösen, 5 km. ESE of Tosya], 10 May 1892, *Sintenis* 3700 (G).

The fruiting specimens of this plant simulate a much dwarfed *E. cybirensis* but the trilobed capsules provided with conical emergences usually with broader bases, and ecarunculate seeds with a fine sticky granular covering characterize this very distinct species. As Aznavour named this plant on the herbarium sheet as *E. ancyrensis*, the type gathering presumably came from near Ankara. It is probably a rare species which may be restricted to Galatia and Paphlagonia.

28. **E. cybirensis** Boiss., Diagn. **1** (7), 89 (1846) et (12), 109 (1853). Map 2.

Key to varieties

1. Capsules dehiscent, capsule-wall thin with slender, softer bristles . . . . . b. var. *dehiscens*
1. Capsules indehiscent, capsule-wall thick, with ± stiff, pointed bristles 2
2. Capsules 2·5–3·5 mm. across . . . . c. var. *microcarpa*
2. Capsules 3·6–4·5 mm. across . . . . a. var. *cybirensis*

(a) var. **cybirensis**

Holotype: [Turkey (C2)]: In planitie Cybirensi near Cameli Cariae, June 1842, *Boissier* (G).

In monte Tauro, a. 1836, *Kotschy* 481.—*Aeg. Is.*, Rhodes: Bastida, 21 May 1870, *Bourgeau* 289.

(b) var. **dehiscens** Boiss., in DC., Prodr. **15** (2), 119 (1862).

Syntypes: [Greece]: in Zacyntho, *Margot* (G ?); [Turkey (C3)]: Pamphylia ad Kourmalu, *Heldreich* (G, K); Creta, *Sieber* (G, K).

A2 (A): prov. Istanbul: Prinkipo [Büyük Ada], 26 May 1901, *Aznavour*. C5: prov. Içel, Gülnar—Gilindire, 12–13 km., S. of Gülnar, 600–700 m., 8 June 1950, *Huber-Morath* 11614.

(c) var. **microcarpa** Boiss., in DC., Prodr. **15** (2), 119 (1862).

Holotype: [Turkey (C5)]: in Cilicia ad Mersina, a. 1855, *Balansa* 738 (G).

A2 (E): prov. Istanbul, Constantinople, Zeker Köy, June 1896, *Aznavour* A2 (A): Bursa—Mudanya, 23 Aug. 1960, *Karamanöğlu* 8. C2: prov. Denizli, Aker Tavaş—Kale Tavaş, 13 km. from Tavaş, 950 m., 5 June 1938, *Huber-Morath* 5289.

This species grows, often as a weed, on rocky limestone slopes, clayey soils, cultivated fields and among maquis, ascending to 900 m.

E. cybirensis var. *acutifolia* Boiss., Diagn. **1** (12), 109 (1853), mainly distinguished by its oblong-lanceolate cauline and involucral leaves with attenuate and acute apex and by its taller habit, has been seen only from Cyprus (*Sintenis & Rigo* 662) and Syria (plants raised from seed collected by *Colin*—examined in Herb. Boiss.).

E. cybirensis shows affinities with a western Mediterranean species, *E. akenocarpa* Guss., and with the mainly eastern Mediterranean *E. microsphaera* Boiss. From the former it is distinguished chiefly by its echinate (instead of smooth) capsules with longer stalks (2–3 mm. instead of 0·5 mm.). The distinctions from *E. microsphaera* are given under that species. *E. cybirensis* is also allied to *E. ancyrensis* Azn. ex M. S. Khan which is known so far only from near Ankara and prov. Kastamonu. *E. cybirensis*, however, is distinguished by its taller stature, spherical capsules provided with emergences narrower at base, and larger, caruncculate seeds.

E. zahnii Heldr., described from the Peloponnese, is a taxon of doubtful status which may not be specifically distinct from *E. cybirensis*; it resembles var. *dehiscens* in the filiform outgrowths on its capsules. Specimens labelled as *E. zahnii* have been seen from Chios (*Guiol* 1814 and *Fr. Denis* 82 in Herb. B. V. D. Post).

E. cybirensis is mainly eastern Mediterranean in its distribution, with its western limit in Crete. In Turkey it reaches the Bosphorus in the north. It might be an introduced weed in S.W. Iran (cf. Parsa, Fl. Iran 4, 1234: 1949).

29. **E. microsphaera** Boiss., Diagn. **1,** (7), 87 (1846). Map 2.

Syn.: *E. mohammarensis* Boiss. in Pl. Nöe exs. no. 39 (1850)!
E. unilateralis Blakelock in Kew Bull. **3,** 453 (1950)!

Type: [Iran]: In humidis ad radices montis Sabst Buschom prope Schiraz, 31 Maj. 1842, *Kotschy* 448 (G; K; E; BM).

A1 (E): prov. Tekirdağ, Marmara Ereğlesi, c. 45 km. from Tekirdağ, sea level, 8 Aug. 1962, *Davis* 39192. A5: prov. Amasya, near river Yesilirmak, 14 Feb. 1889, *J. Bornmüller* 951. A6: prov. Tokat, Niksar, 350 m., 4 Sept. 1954, *Davis* 24848. C3: prov. Antalya, Manavgat—Akseki, 1 km. from Manavgat, sea-level, 14 June 1962, *Dudley* (D.35749), Antalya, 2 m., 26 June 1958, *D. E. S. Truman* 241. C5: Adana—Sis [Kozan], 2 July 1906, *B. V. D. Post* 484 (as *E. platyphyllos* L. var. *bertramii* Azn.). C6: prov. Hatay, Iskenderun—Antakya, west of Amik Gölu, 150 m., 30 Apr. 1957, *Davis* 27267—sterile. C7: prov. Urfa, Suverek [Siverek] to Biredjik [Birecik], 15 Aug. 1888, *Sintenis* 1392. C8: prov. Mardin, Rischemil [Rişmil], 23 July 1888, *Sintenis* 1362 (type of *E. unilateralis* Blakelock).

A weed of plains, cultivated fields and vineyards, often occurring near rivers and marshy places, ascending up to 600 m.

E. unilateralis Blakelock, which was based mainly on the unilateral branching of its umbels, was further distinguished from *E. gaillardotii* by its globose capsules and larger shining seeds with persistent caruncles. However, the description and type of *E. unilateralis* agree in every detail, including the mode of umbel branching, so closely with *E. microsphaera* Boiss. that one is bound to regard Blakelock's species as synonymous with the latter.

E. microsphaera stands between *E. gaillardotii* and *E. cybirensis* Boiss., resembling the former in its habit, and the latter in capsule shape and seed characters. From the former it can be separated by its globose capsules (not 3–lobed), and by its larger, shining subcompressed seed with

a persistent caruncle (not c. 1·5 mm. long, subquadrangular with deciduous caruncle); from the latter it is easily distinguished by its shorter styles (1–2 mm.; not 2–3·5 mm.), and by its usually smooth or papillose capsule (not bristly).

When not in fruit, *E. microsphaera* can be easily mistaken for a predominantly European species, *E. platyphyllos* L. which in the Orient, however, is confined to the Caucasus and N. & W. Turkey; see the discussion under the latter for differences.

E. subtuberculata C. A. M. ex Boiss. (in DC. Prodr. **15** (2), 118: 1862) described from Azerbaidjan (!) and reported from Tashkent, Central Asia (Herb. Fl. As. Med. no. 305) may not be specifically distinct from *E. microsphaera*; it is impossible to separate the two except by the minutely tuberculate capsules of the former.

E. microsphaera, which occurs in Iraq and Syria, and in Iran as far south as Shiraz, has a rather disjunct distribution in Anatolia. Although its occurrence in the southern provinces is more or less a continuation of its main geographical area, it has also been recorded from the central part of N. Anatolia, and the Mediterranean coast of European Turkey.

30. **E. helioscopia** Linn., Sp. Pl., 459 (1753). Griseb., Spic. Fl. Rum. Bith. **1,** 135 (1843).

A1 (E): prov. Tekirdağ, Eski Heracli [Ereğli], fide *Grisebach* (*op. cit.*), n.v. A2 (A): prov. Istanbul, Çamlica, 19 Apr. 1891, *Aznavour*—dwarf form; prov. Kocaeli, Gebze, 20 m., 30 Mar. 1957, *Davis* 26245—dwarf form; prov. Bursa, Ulu dağ, road to Soğukpinar, 500–1000 m., 16 May 1962, *Dudley* (D.34743). A2 (E): prov. Istanbul, Rumeli Hissar, 22 May 1905, Herb. *B. V. D.* Post—a large form with stems up to 40 cm. tall. A3: prov. Bolu, 2 km. South of Akçakoca, 7 May 1957, *Kühne* 98. A4: Zonguldak—Bartin, 22 Feb. 1945, *Yasar* 130. A6: east of Samsun, a. 1858, *Tchihatcheff*. B3: prov. Eskişehir, Sivrihisar, 1200–1300 m., 22 June 1962, *Dudley* (D.36036). B4: Ankara, 9 May 1933, *W. Kotte* 1017. C2: prov. Muğla, Marmaris, 5 m., 24 Mar. 1956, *Davis* 25815; dist. Fethiye, Xanthus, 50 m., 31 Mar. 1956, *Davis* 25530; prov. Burdur; Tefenni ovasi nr. Karataş göl, 1100 m., 4 Apr. 1956, *Davis* 25624—dwarf form. C3: Antalya, 30 m., 27 Feb. 1936, *T. A. Tengwall* 140. C4: Konya, 28 Apr. 1913, Post Herbarium no. B.49. C5: prov. Içel, Kuyuluk, 10 km. W. of Mersin, 2 m., 7 Apr. 1957, *Davis* 26516. C6: prov. Urfa, Fort William, Mar. 1836, *Chesney* 41.—*Aeg. Is.:* Khios, the Kampos, 7 Feb. 1939, *J. W. O. Platt* 17; Samos, between Malagari and Kokkari, 8 Apr. 1934, *K. H. & F. Rechinger* 3826.

A common weed of cultivated fields and in steppe; occasionally also found on rocky limestone slopes on terra-rossa, amongst *Quercus* maquis and by streams and marshes, reaching up to 1300 m.

E. helioscopia is nearly related to *E. oxyodonta* Boiss. et Hausskn. and *E. haussknechtii* Boiss., but is always readily recognized by its very characteristic transversely ovate or semiorbicular caruncle (instead of a vertical one in the former, or obsolete or none in the latter). The habit of the plant and leaf measurements show a considerable variation throughout its range of distribution, but the seed characters are always consistent and dependable as specific criteria. A closely related species, *E. physocaulos* Mouterde (Fl. Djebel Druze, 146: 1953), has been described from

Syria which differs in its swollen stems and much larger capsules and seeds; specimens have not been seen.

First described from Europe, *E. helioscopia* shows a very wide distribution. In Europe it extends from the Arctic in the North to Spain and Greece in the South. In N. and E. Africa, in Asia up to Japan, in Australia, New Zealand and N. America, it is probably an introduced weed.

31. **E. haussknechtii** Boiss. in DC., Prodr. **15** (2), 1267 (1866).

Syn.: *E. helioscopia* L. var. *haussknechtii* Boiss., Fl. Or. **4,** 1107 (1879), pro parte excl. pl. Aleppica.

Glabrous, erect, annual up to 35 cm. tall. *Stem* up to the base of umbel 2–15 cm. tall and up to 1 cm. thick, with only a few leaf scars at base. Cauline leaves not seen. *Involucral leaves* spathulate, serrate towards the apex. *Umbellate radii* usually 5, several times branched. *Involucellar leaves* oblong, ovate-oblong or obovate, rarely subrotund, deeply serrate, serrations few (10–30 per involucellar leaf), apex acutish or obtuse. Capsules 3·2–3·5 mm. across, globose-trilobed, glabrous, smooth; cocci rounded. Seeds c. 2·0 mm. × c. 1·5 mm. ovoid, brown, with honeycomb-like elevated reticulations, apex acute; caruncle obscure or absent. Fl. May.

Lectotype: [Turkey (C6)]: inter Aintab [Gaziantep] et Nisib [Nizip], *Haussknecht* (G, photo. E).

C7: prov. Urfa, Akçakale—Urfa, about halfway, 17 May 1957, *Davis* 28115.

Out of the two syntypes cited by Boissier for this species, only the Turkish gathering of Haussknecht's matches the seed characters described by him. The other syntype (pr. Aleppo, *Kotschy* 115) represents a distinct species differing from *E. haussknechtii* in several characters including the smooth seeds, and has been described in the present work as a new species, *E. fistulosa* M. S. Khan, allied to *E. arguta* Boiss. In the type description of *E. haussknechtii* (the lectotype of which lacks cauline leaves), Boissier obviously included the leaf characters of the Aleppo plant ("foliis oblongis basi attenuatis acutiusculis serrulatis") and the seed characters of Haussknecht's plant. An emended description is given here.

E. haussknechtii differs from *E. helioscopia* L., to which it is very closely related, chiefly in its seeds which are shorter (only c. 2·0 mm. long; not 2·0–2·5 mm.) and ecarunculate (or seeds with only an obsolescent caruncle), and usually in its comparatively narrower, oblong, acutish involucellar leaves with deeper and fewer serrations (10–30; in *E. helioscopia* 40–60 serrations per involucellar leaf).

The nearly related species *E. helioscopia*, which has a very extensive geographical distribution, shows a strikingly uniform constancy in its seed characters (with a persistent, transversely ovoid or suborbicular caruncle), although a certain degree of variation is seen in habit, leaf-shape, length of umbellate radii and the shape of the involucellar leaves. The correlation of the seed characters with the number and depth of serrations of the involucellar leaves seems to justify provisionally maintaining *E. haussknechtii* Boiss. as a separate species. It is probably endemic to N.W. Mesopotamia, in the Irano-Turanian region.

32. **E. oxyodonta** Boiss. et Hausskn. in DC., Prodr. **15** (2), 1267 (1866).

Holotype: [Syria]: in fissuris rupium et calcareis Djebel Muhassan et Turmanin prope Aleppum, *Haussknecht* (G).

C7: prov. Adiyaman, Nimruddag supra Orfam [a hill near Kâhta] et in Djebel Taktak [between Urfa and Viranşehir] 600 m., Mar. 1865, *Haussknecht*—sterile.

Usually found on calcareous rock up to 600 m.

E. oxyodonta is apparently allied to *E. sintenisii* Boiss. ex Freyn which it resembles in leaf and seed characters, but is distinguished by its dwarfer, prostrate or ascending (instead of erect) stems and smaller seeds (2·0–2·2 mm. × 1·5–1·7 mm. instead of 2·5–3·3 mm. × 2·0–2·6 mm.). While *E. oxyodonta* is confined to Mesopotamia, Syria, Transjordan, and probably Palestine, *E. sintenisii* extends from N. Africa to the E. Mediterranean, reaching its eastern limit in Mesopotamia.

33. **E. arguta** Banks & Solander in Russell, Nat. Hist. Aleppo, ed. 2, **2,** 253 (1794). Eig in Jour. Bot. (London) **75,** 188 (1937).

Syn.: *E. calendulaefolia* Del., Fl. Egypt., 89, t. 30, fig. 1 (1813).

Holotype: Syria: Aleppo, *Russell* (BM).

C5: prov. Içel, Kuyuluk, 10 km. W. of Mersin, alt. 2 m., 7 Apr. 1957, *Davis* 26511; Mersina (Cilicia), 19 May 1855, *Balansa* (as *E. calendulaefolia*).—*Aeg. Is.*: Chios, 9 May 1912, *Frère Denis* 17 (Herb. B. V. D. *Post*).

E. arguta is allied to *E. fistulosa* M. S. Khan described below; see the discussion of the latter for differences.

E. arguta also bears a remarkable resemblance in habit to *E. sintenisii* Boiss. ex Freyn which belongs to the group with reticulate-rugose seeds, and it is not easy to distinguish one from the other in the absence of fruiting material. The former has smaller capsules and smaller seeds which are always smooth when mature, with smaller depressed orbicular caruncles. The latter species, on the other hand, has larger capsules (3–4 mm. × 4·0–5·5 mm.) and larger seeds (2·5–3·3 mm. × 2·0–2·6 mm.) which are distinctly wrinkled in an irregularly reticulate manner (even the immature ones showing faint whitish reticulations), with larger whitish hemispherical caruncles (0·5–0·8 mm. across). There is considerable overlapping of the two species in their range of distribution, viz. in Egypt, Cyprus, Syria and Palestine.

Another species which is more or less similar in general facies to *E. arguta* is *E. oxyodonta* Boiss. (from Mesopotamia, Syria and Transjordan) which can be separated by its dwarf stature, ascending stems, and reticulate seeds.

E. sintenisii, which has not so far been collected in Turkey, extends as far west as Libya (cf. Sandwith & Simpson in Jour. Bot. Mar. **71,** 41, 1941), and through the E. Mediterranean to Mesopotamia, whereas *E. arguta*, which is known in Turkey only from Cilicia, occurs throughout the E. Mediterranean and Egypt.

34. **E. fistulosa** M. S. Khan, **spec. nov.** Pl. 7.

Syn.: *E. haussknechtii* Boiss. in DC., Prodr. **15** (2), 1267 (1866), p.p. pl. alepp.

E. helioscopia L. var. *haussknechtii* (Boiss.) Boiss., Fl. Or. **4,** 1107 (1879), p.p. pl. alepp.

Affinis *E. argutae* Banks & Sol. sed foliis caulinis minute et remote serrulatis vel denticulatis, capsulis et seminibus majoribus, statura robustiore recedit.

Annua, erecta, molliter et parce pilosa. *Radix* verticalis ad 10 cm. longa vel ultra, superne ad 5 mm. crassa. *Caulis* 14–45 cm. altus et ad basin 2–5 mm. crassus, fistulosus, superne sensim dilatatus, tenuiter striatus, plerumque flaveo-virens, parce foliosus, saepe ad basin ramis sterilibus et superne ramis floriferis provisus. *Folia caulina* (mediana) 30–60 mm. × 8–25 mm., sessilia, oblongo-lanceolata vel elliptico-lanceolata, integra, a medio plerumque minute et remote serrulata vel denticulata, acuta, membranacea, subtus glaucescentia. *Folia involucri* 4–5, 25–60 mm. × 10–25 mm., oblongo-lanceolata vel late elliptica, apicem versus serrulata, acuta. *Radii primarii umbellae* 3–5, 4–9 cm. longi, bis vel ter bi- vel trifidi, fistulosi. *Folia involucellae* (primariae) bina vel terna 10–30 mm. × 12–33 mm., late ovata vel ovato-deltoidea, apicem versus serrulata vel denticulata, acuta, basibus plerumque subcordatis saepe obliquis. *Cyathia* late campanulata, 2·5–3·0 mm. longa, lobis late ovatis, erosulis, glandulis transverse oblongis, marginibus rotundatis, ecornutis, flavescentibus vel fuscis (in sicco). *Bracteolae* inter flores masculos multae, apicem versus longe ciliatae. *Capsula* 3·0–5·0 × 4·5–6·0 mm., subgloboso-triloba, coccis obtusis, glabris, laevibus, stylis fere ad basin liberis, apicem versus bifidis. *Semen* 3·0–3·5 mm. × 2·5–3·0 mm., ovoideum, laeve, caruncula ignota. Fl. Apr.–Jun.

Type: [Syria]: in agris pr. Aleppum, 17 Apr. 1841, *Kotschy* 115 (*holo.* G; *iso.* BM, K, photo. E).

C7: prov. Urfa, Urfa—Hilvan, 5 km. from Hilvan, 750 m., 18 May 1957, *Davis* 28230, Tel Pinar [between Kâhta and Siverek], 23 May 1888, *Sintenis* 860—as *E. cybirensis* Boiss. C8: Diyarbakir—Ergani, 10 km. from Diyarbakir, 750 m., 1 June 1957, *Davis* 28806.

The type gathering (*Kotschy* 115) was confused by Boissier (*op. cit.*) with *E. haussknechtii* Boiss. and cited as a syntype of the latter. *E. fistulosa* is, in fact, more nearly related to *E. arguta* Banks & Solander which it resembles in its smooth seeds, but is readily separated by its minutely and remotely serrulate or denticulate cauline leaves, larger capsules and seeds, and more robust habit. The stem is almost always swollen and fistular towards the top. In habit the new species resembles *E. physocaulos* Mouterde (n.v.) recently described from the Djebel Druze, but differs in its much smaller capsules and smooth seeds.

E. fistulosa is an annual weed of cultivated fields, reaching an altitude of 750 m.; it is probably restricted to S.E. Anatolia and Syria and belongs to the Irano-Turanian element.

35. **E. eriophora** Boiss., Diagn. **1** (5), 51 (1844).

Holotype: [Turkey (C2)]: In agris Cariae interioris segetes, specimen unicum, Jun. 1842, in planitie ad meridiem Cadmi [Honaz dağ], *Boissier* (G ?—type missing).

A4: prov. Zonguldak, pr. Safranbolu, *Wiedemann.* A8: prov. Gümüşane,

Baibout [Bayburt], July 1862, *Bourgeau* 460. B2: prov. Uşak, between Ouchak [Uşak] and Boulgas Köy, 20 June 1857, *Balansa* 1259. B4: prov. Ankara, Şerefli Koçhisar—Aksaray, 35 km. south of Ş.K., 930 m., 27 June 1959, *Huber-Morath* 16086. B6: prov. Malatya, Darende to Kavak Aghatch, 14 July 1906, *B. V. D. Post* 31. B7: prov. Malatya, Malatya—Arapkir, 30 km. N. of Malatya, 750 m., 22 June 1949, *Huber-Morath* 9401. B8: prov. Erzurum, Horasan—Pasinler, 1600 m., 24 June 1957, *Davis* 32615; Muş, c. 1280 m., *Birand & Karamanöğlu* 360. B9: prov. Van, W. foot of Erek dağ, 1800 m., 18 July 1954, *Davis* 22940. C2: prov. Burdur, from Tefenni to Yeşilova, 9 miles beyond Tefenni, 1 June 1962, *Dudley* (D.35294). C3: prov. Konya, Sariköy near Beyşehir, 5 Sept. 1949, *Davis* 16123; prov. Isparta, Eğridir, June 1845, *Heldreich*. C6: Aintab [Gaziantep], 900 m., May 1906, *Haradjian* 13; prov. Maraş, Akher Dagh [Ahir dağ], near Maraş, 840 m., July 1907, *Haradjian* 1549. C7: Urfa—Hilvan, 5 km. from Hilvan, 750 m., 18 May 1957, *Davis* 28227. C8: Diyarbakir, 23 June 1954, *Davis* 22138; Mardin—Nusaybin, 15–20 km. from Nusaybin, 650–700 m., 22 May 1957, *Davis* 28462.

A weed of cultivated fields and steppe from 650 m.–1800 m.

E. eriophora is nearly related to a W. Mediterranean species, *E. lagascae* Spreng. from which, however, it is recognizable by its pilose (instead of glabrous) indumon-tum, globose capsule with rounded cocci (instead of glabrous and oblong with carinate cocci), and by its ovate-spherical, ecarunculate seeds (instead of oblong and carunculate).

E. eriophora is rare in W. Anatolia. Outside Turkey, it occurs in Transcaucasia, N.W. Iran and probably in Iraq and N. Syria.

36. **E. phymatosperma** Boiss. et Gaill. in Boiss., Diagn. **2** (4), 83 (1859).

Holotype: [Syria]: In monte Djebel Khailoun ad septentrionem Damasci, medio Aprili, *Gaillardot* (G).

B7: [prov. Erzincan], Egin [Kemaliye], 20 May 1890, *Sintenis* 2378. C6: Gaziantep—Nizip, 15 km. from Gaziantep, 850 m., 14 May 1957, *Davis* 27886; 10 km. S. of Maraş, 550 m., 1 May 1957, *Davis* 27359. C7: prov. Adiyaman, Nimruddagh prope Orfam [a hill near Kâhta] 600 m., Mar. 1867, *Haussknecht*. C8: prov. Mardin, Terek [Derik], Mar. 1867, *Haussknecht* 865 a, Mardin—Diyarbakir, 24 km. from Mardin, 1000 m., 27 May 1957, *Davis* 28843.

In disturbed steppe and on calcareous rock, often mixed with oak-scrub, reaching up to 1000 m.

E. phymatosperma bears a superficial resemblance to *E. taurinensis* All. in the general appearance of its umbels and in the shape of the involucellar leaves, but is easily separated by its very characteristic tuberculate and transversely sulcate seeds, and ecornate cyathial glands.

Probably confined to E. Anatolia, N. Iraq, W. Iran, Syria and Lebanon.

Subsect. **Esulae** (Haworth) Boiss. in DC., Prodr. **15** (2), 138 (1862).

Type species: E. esula L. (cf. Wheeler: 1943).

37. **E. agraria** M. B., Fl. Taur.-Cauc. **1,** 375 (1808) & **3,** 326 (1819).

Holotype: [Crimea]: In Tauriae meridionalis declivibus siccis mari nigro imminentibus, *Marschall von Bieberstein* (LE—n.v.).

A2 (A): prov. Kocaeli, Pendik, 31 Mar. 1896, *Aznavour*. A2 (E): prov. Istanbul, San Stefano—Florya, 21 May 1900, *Aznavour*. C2: Mesogis [Aydin dağl.], June 1842, *Boissier*.

E. agraria has a distributional range from Roumania and the Balkan Peninsula to W. Anatolia, the Crimea and probably Transcaucasia, but has not been reported so far from the central part of N. Anatolia (i.e. opposite the Crimea).

38. **E. lucida** Waldst. & Kit., Pl. Rar. Hung. **1,** 54, t. 54 (1802).

Type: [Hungary]: in fossis aliisque locis humidis Comitatus Pesthinensis, Albensis, Tolnensis, Bekensiensis & Bihariensis, nec non in Banatu inter Orsonam & Ogradinum ad Danubium, *Waldstein* (PR, photo. E).

A2 (E): prov. Istanbul, near the river Kila, 2 July 1901 and 21 July 1901, *Aznavour*. Asia minor, a. 1858, *Tchihatcheff*.

E. lucida is similar to *E. virgata* Waldst. & Kit. differing, however, in its thicker shining leaves, larger capsules and seeds, and in its creeping rhizome. It is mainly a central and eastern European species extending through the Balkan Peninsula into N. Anatolia.

This species is known to interbreed with *E. virgata* Waldst. & Kit. and *E. esula* L. in Austria and Transsylvania; the hybrid with the former has been described under the name *E.* × *pseudo-lucida* Schur (in Verh. Sieb. Ver. Naturw, 3, 124: 1852), and the one with the latter has been mentioned as *E.* × *wagneri* Soó by its author in Bot. Közl. **22,** 67 (1924/25).

39. **E. iberica** Boiss., Cent. Euph., 38 (1860).

Syntypes: in herbidis humidiusculis Georgiae Caucasicae circa Helendorf, *Hohenacker* (LE—n.v., K, G); Persia bor., *Buhse* (LE—n.v., G).

A8: Rize, July 1866, *Balansa* 387—as *E. iberica* var. *intermedia*. A9: prov. Kars, Sarikamiş—Selim, 1900 m., 13 June 1957, *Davis* 29545; Ardahan—Yalnizçam, 1900 m., 16 June 1957, *Davis* 29593. B6: prov. Maraş, dist. Çardak, Kandil dağ, 1700–1900 m., 24 July 1952, *Davis* 20233. B7: prov. Tunceli, Ovacik—Hozat, 2050 m., 22 July 1957, *Davis* 31573 and 2000 m., 14 July 1957, *Davis* 31075. B8: prov. Bitlis, Kambos dağ, above Hurmuz [dist. Setek], 2100 m., 31 June 1954, *Davis* 23455. B9: prov. Karaköse (Ağri), 54 km. E. Horassan, between Zidikan [Eleskirt] and Velibaba, c. 2500 m., 4–5 Sept. 1957, *K. H. Rechinger* 15058 (as *E. orientalis* L.). C9: prov. Hakâri, Kara dağ, 3450 m., 16 Aug. 1954, *Davis* 24497—plants dwarf, young leaves puberulous. C10: prov. Hakâri, Cilo tepe, 3060 m., 8 Aug. 1954, *Davis* 24081—rather untypical, sterile branches sometimes absent, umbels condensed.

On rocky slopes, earthy igneous screes, and in deciduous oak-scrub from 1700–3450 m.

E. iberica is probably allied to *E. latifolia* C. A. Meyer ex Ledeb. (Siberia and Central Asia) from which it differs chiefly by its firm subcoriaceous leaves (not thin and membranous) and smaller umbels.

Boissier described a var. *intermedia* with narrower, oblong-lanceolate leaves (in DC. Prodr. **15** (2), 163: 1862) from Caucasia. I have seen one of the two syntypes (Chaschmi, *Hohenacker*) but not enough material referable to this taxon to decide its status. *Balansa's* plant from Rize and

PLATE 7. *Euphorbia fistulosa* M. S. Khan (holotype).

PLATE 8. *Euphorbia pisidica* Hub.-Mor. & M. S. Khan (holotype).

Davis 31075 from prov. Tunceli have leaves up to 4 times longer than broad.

E. iberica is restricted to the Caucasus, E. Anatolia, N. Iraq and N. Iran.

40. **E. virgata** Waldst. et Kit., Pl. Rar. Hung. **2,** 176, t. 162 (1805).

Syn.: *E. virgata* Waldst. et Kit. var. *orientalis* Boiss. in DC., Prodr. **15** (2), 160 (1862)!

E. virgata Waldst. et Kit. var. *uralensis* (Fisch. ex Link) Boiss. in DC., Prodr. **15** (2), 160 (1862), pro parte.

E. virgata Waldst. et Kit. subsp. *orientalis* (Boiss.) Velenovsky in Fl. Bulg., 507 (1891)!

Tithymalus boissierianus Woronow, Herb. Fl. Cauc. no. 479 (1931, in sched.)!

E. boissieriana (Woronow) Prokh. in Komarov, Fl. U.R.S.S., **14,** 445 (1949)!

Type: si altiora loca montosa demas, per omnem fere Hungariam, Croatiam & Sclavoniam locis siccis, *Waldstein* (PR, photo. E).

A4: prov. Kastamonu, above Küre, 1200 m., 7 June 1954, *Davis* 21635. A5: prov. Kastamonu, Tosya, 4 Aug. 1892, *Sintenis* 4890. A6: Tokat, June 1852, Nöe 1087 (as *E. esula*). A7: Gümüşane, 30 May 1862, *Bourgeau* 243. A9: prov. Kars, S.W. side of Kisir dağ, 2300 m., 3 July 1957, *Davis* 30511. B6: prov. Sivas, Gürün, 1050 m., 19 June 1954, *Davis* 21894. B7: prov. Tunceli, Pülümür—Selepur, 1850 m., 23 July 1957, *Davis* 31582. B8: prov. Muş, Bingol dağl. near Gümgüm [Varto], 1380 m., 16 Aug. 1859, *Kotschy* 303; near Erzurum, July 1853, *Huet du Pavillon* (syntype of var. *orientalis* Boiss.). B9: prov. Bitlis, Tatvan, 1750 m., 27 June 1954, *Davis* 22210. C4: prov. Içel, Mut—Kirobaşi, Cümelek, 40 km. from Mut, 1100 m., 14 June 1950, *Huber-Morath* 9961.

In meadows and arable land, usually near rivers and ditches, and on igneous N. slopes, reaching 2300 m.

E. virgata W. & K. var. *orientalis* Boiss., which was later raised to the rank of a subspecies by Velenovsky and treated as a distinct species by Prokhanov, was chiefly based on the longer and broader cauline leaves, slightly bigger capsules and more branched habit. Considerable variation in leaf size and capsule size has been seen from the material examined from Europe and the Orient, and plants with broader leaves and many sterile branches occur in Swedish, Serbian and Austrian localities. The Turkish material shows every transition in the length and breadth of the cauline leaves and in the number of infra-umbellar sterile branches, so that there seems no justification for recognizing this taxon even at varietal rank.

E. uralensis Fisch. ex Link, which according to Prokhanov (Fl. U.R.S.S.) is endemic to the regions near the Volga-Don, Altai mountains, Urals and Russian Black Sea coast, is said to differ from *E. virgata* mainly in its narrower linear cauline leaves and more branched habit. I have not examined sufficient material of this taxon to assess its value, but all the specimens from Caucasia and Asia Minor under this name at Kew are referable to *E. virgata.*

E. virgata is closely allied to another widespread species, *E. esula* L. (Europe and temperate Asia), from which it is chiefly distinguished by its vertical descending root (instead of horizontal and stoloniferous) and by its oblong subsessile leaves with a rounded or cuneate base (instead of linear-oblanceolate, gradually tapering from the middle towards the base into a short narrow petiole). *E. virgata* is also related to *E. sanasunitensis* Hand.-Mazz.; see the discussion under the latter for differences. The Iranian *E. hebecarpa* Boiss. resembles *E. virgata* very closely in general facies but can be separated by its pubescent cyathia and capsules. The unbranched narrow-leaved forms of *E. virgata* can be easily confused with *E. seguieriana* Necker, but are readily recognizable by the presence of horns on the glands. In fruiting condition, the former is also easily distinguished by its larger capsules.

This species is known to hybridise with at least 3 allied ones, viz. *E. lucida*, *E. cyparissias*, and *E. salicifolia*. The hybrids, all from Austria and Hungary, have been described as *E.* × *pseudo-lucida* Schur, *E.* × *gayeri* Boros et Soó ex Soó (in Bot. Közl. **22,** 66: 1924/25) and *E.* × *angustata* Rochel (Pl. Banat. rar. **43,** t. 7: 1831) respectively.

E. virgata is common in central and eastern Europe but penetrates through the Caucasus and Asia Minor (chiefly in Armenia and Kurdistan) into the mountains of Elburz and Turkmenistan. In the British Isles and in the Far East it is probably an introduced plant.

41. **E. sanasunitensis** Handel-Mazzetti in Annal. Naturh. Hofmus. Wien **26,** 139, text fig. 1 and tab. II, f. 4 (1912).

Holotype: [B8]: Meleto dagh im Sassun (armenischer Taurus, Wilajet Bitlis), auf üppigen Humus in der Nivalzone bis gegen den Gipfel oft in grosser Menge und weiter abwarts an Quellen; Kalk, 2200–3100 m., 10–11/VIII 1910 *Handel-Mazzetti* Nr. 2789 (WU, photo. E).

B8: prov. Bitlis, Kambos dağ above Hurmuz, 2100 m., 31 June 1954, *Davis* 23455 (K). C9/10: prov. Hakâri, Cilo Tepe, 3140 m., 8 Aug. 1954, *Davis* 24081 (K).

On rocky slopes often on limestone, on humus, and near springs, from 2100–3140 m.

E. sanasunitensis is very closely related to *E. virgata* Waldst. & Kit. from which it seems to differ chiefly by its elliptic-lanceolate to rhomboid-lanceolate cauline leaves (instead of narrowly or broadly oblong). It is probably endemic to Kurdistan.

42. **E. seguieriana** Necker in Acta. Akad. Theod. Pal. **2,** 493 (1770). Rechinger fil. in Ann. Nat. Mus. Wien **43,** 330 (1929).

Key to subspecies

Umbellate radii usually 5–14 . . .	a. subsp. *seguieriana*
Umbellate radii usually 15 or more . .	b. subsp. *niciciana*

a. subsp. **seguieriana**

Reichenb., Ic. Fl. Germ. Helv. **5,** t, 147, f. 4794 (1841)—sub *E. gerardiana.*

Syn.: *E. linariaefolia* Lam., Encyc. **2,** 437 (1788 or 1789).
E. gerardiana Jacq., Fl. Austr. **5,** 17, t. 436 (1778); sensu M. B., Fl. Taur. Cauc. 1, 379 (1808), Ledeb., Fl. Ross. **3,** 569 (1850), Boiss. in DC. Prodr. **15** (2), 166 (1862), pro parte.

Holotype: in Palatinatu Rheni [Central Europe], a. 1768–1769, *Necker* (Mannheim—destroyed).

A2 (A): prov. Kocaeli, Gebze, 50 m., 30 Mar. 1957, *Davis* 26259. A2 (E): prov. Istanbul, Halkali, 21 June 1896, *Aznavour*. A3: prov. Bolu, Ala dağ, 700 m., 12 Aug. 1960, *Khan et al.* 529. A9: prov. Erzurum, Horassan, 1600 m., 13 June 1957, *Davis* 29384. B1: prov. Çanakkale, in Dumbrek valley, 8 May 1883, *Sintenis* 153. B4: prov. Ankara, Çankaya near Ankara, 15–31 May 1926, *Lindsay* 46. B9: prov. Kara Köse, foothills of Ağri dağ, c. 1500 m., 10 Sept. 1960, *K. M. Guichard* T/150/60; prov. Van, Gevaş—Edremit, 9 July 1954, *Davis* 22606. B10: prov. Ağri, Doğubayazit, c. 2000 m., 4–5 Sept. 1957, *K. H. Rechinger* 14958.

b. subsp. **niciciana** (Borbas ex Novak) Rech. fil. in Ann. Naturh. Mus. Wien. **56,** 211 (1948).

Syn.: ?*E. esuloides* Velenovsky in Abh. Kön. böhm. Gessel. Wissen. **7** (1), 39 (1886), non Ten. (1831).
E. gerardiana sensu Boiss. in DC., Prodr. **15** (2), 166 (1862), p.p.: Halácsy, Consp. Fl. Gr. **3,** 105 (1904), non Jacq. (1778).
E. seguieriana sensu Hayek, Prodr. Fl. Balc., **1,** 128 (1924) p.p.: non Necker (1770).
E. niciciana Borbas ex Novak in Preslia, **5,** 76 (1927).

Syntypes: [Yugoslavia]: Serbia austro-occidentalis, in herbidis et pratis supra fluminis Ibar ripam dextram apud vicum Mataruge (alluvium, arena, 220 m.s.m.), copiose [19 May 1926], *Novák* 1223 (PRC—n.v.) et copiose in herbidis ad declivia arenosa apud vicum Gotovac, 225 m.s.m., non procul ab oppido Kraljevo [20 May 1926], *Novák* 1229 (PRC—n.v.); Stolovi planina, in serpentinicis, solitarie ad declivia ad septentriones spectantia montis Ostra Čuka apud vicum Mataruge, 250–260 m.s.m. [19 May 1926], *Novák* 1279 (PRC—n.v.); in herbidis ad declivia ad septentriones spectantia montis Cava supra vicum Metikos, meridiem versus ab oppido Kraljevo, 520–550 m.s.m. [18 May 1926], *Novák* 1187 (PRC—n.v.).

A1 (E): prov. Kirklareli, Istranca dağ, Demirköy—Iğneada, 23 June 1960, *H. Kayacik* 38. A1 (A): prov. Çanakkale, Erenköy, *Kirk.* A2 (A): prov. Istanbul, dist. Beyköz, between Hüseyinli and Bozhane, 11 June 1893, *Aznavour*. A3: near Bolu, c. 27 km. SE. 13 Sept. 1957, *K. H. Rechinger* 15314; prov. Zonguldak, S.W. of Alapli, 10 km., 14 July 1962, *Davis* 37452. A4: prov. Zonguldak, Balikisik, near Yenice, 150 m., 22 July 1962, *Davis* 37989. A5: Kastamonu—Tosya, 1200 m., 13 Aug. 1960, *Khan et al.* 648; Boyabat to Sinop, 1150 m., 24 July 1962, *Davis* 38072.

In fallow fields, disturbed steppe, oak forests, river valleys and on mountains, often amongst volcanic rock, and on marly or soft loamy substratum, from sea level to 2000 m.

E. seguieriana Necker was distinguished from *E. niciciana* (Borbas ex Novak) Rech. fil. by Hayek and Rechinger on various characters. Hayek

(*op. cit.*) separated them on capsule size (3 mm. in *E. seguieriana* and 2 mm. in *E. niciciana*), and seed-shape (oblong-prismatic in the former; briefly cylindric in the latter). Rechinger (*op. cit.*: 1929) pointed out that the cauline leaves in the former are upwardly inclined and in the latter, spreading. The distinction on the above-mentioned characters, however, breaks down due to the variability of these features and their lack of correlation with the number of umbellate radii; hence, it is impossible to maintain *E. niciciana* at specific rank. The umbellate radii in this taxon, however, are found usually at a fairly constant range (15–26)—a criterion which serves to separate it from the typical *E. seguieriana* which has usually 5–14 radii. As Rechinger (*op. cit.*: 1948) had already emphasized, *E. niciciana* Necker could be better treated as a geographical subspecies confined mainly to Greece (where it replaces subsp. *seguieriana*), the Balkan peninsula and Turkey where it is recorded from Thrace, Bithynia, and Paphlagonia; in N.W. Turkey it overlaps with subsp. *seguieriana*. Two gatherings made near Beyşehir in prov. Konya (viz. 1100 m., 15 June 1962, *Dudley* (D.35828); and a. 1845, *Heldreich*) show, in the same populations, plants with the number of umbellate radii ranging from 9–21. Rechinger (*op. cit.*: 1929) also mentioned similar doubtful specimens from the Balkan peninsula with 13–20 umbellate radii, and placed them as transitional forms.

Subsp. *seguieriana* is distributed almost all over Europe, extending through the Crimea and Caucasus into the Aralo-Caspian region. In Turkey, the typical specimens of this have been collected so far only from W. Anatolia and from Armenia and Kurdistan. The plants in the easterly range usually show longer and much-branched umbellate radii. A third subspecies, subsp. *hohenackeri* (Hochst. & Steud. ex Boiss.) Rech. fil., distinguished by elongate-lanceolate involucellar leaves, is restricted to Caucasia.

E. seguieriana resembles a European species, *E. cyparissias* L., in habit and leaf-shape; the latter, however, has many sterile branches and semi-lunar cyathial glands.

43. **E. paralias** Linn., Sp. Pl., 458 (1753).

Described from sand dunes of Europe (*Herb. Linn.* nos. 44 & 45; the specimen labelled in *Herb. Cliff.* as *E. paralias* is *E. aleppica* L.).

A1 (E): Kirklareli—Demirköy, 1 July 1953, *Halis Benli*; prov. Tekirdağ, Marmara Ereğlessi, c. 45 km. from Tekirdağ, sea level, 12 Aug. 1962, *Davis* 39196; Gallipoli [Gelibolu], Kara Kova-Dere, *C. M. Ingoldby* 524—fide Rech., Fl. Aeg., n.v. A2 (E): prov. Istanbul, Florya, 11 May 1890, *Aznavour*. A2 (A): prov. Bursa, Bithynia prope Nicaem [Iznik], 14 Oct. 1867, *J. Ball*. A3: prov. Bolu, Akçakoca, E. of Ayazli, 6 May 1957, *Kühne* 93; prov. Zonguldak, Kilimli—Çatalağzi, 25 Aug. 1960, *Khan et al.* 820. A5: west of Sinop, 1 m., 25 July 1962, *Davis* 38119. A6: near Samsun, *Wiedemann*; prov. Ordu, Ünye—Terme, 5 Sept. 1954, *Davis* 24951. A7: Trabzon, 5 Aug. 1957, *Davis* 32032. B1: prov. Balikeşir, dist. Edremit, Seitinly [Zeytinli], 4 Aug. 1883, *Sintenis* 445; Izmir, May 1854, *Balansa*. C3: prov. Antalya, mouth of Aksu Çay, 29 July 1949, *Davis* 15470. C5: prov. Seyhan, Çiçek Ada near Ayvalik, 24 Aug. 1932, *W. Kotte* 298. —*Aeg. Is.*: Khios, Kondari, 19 July 1939, *J. W. O. Platt* 317; Rodhos,

between Triandra and Kromasto, 22 June 1935, *K. H. & F. Rechinger* 8352; Kos, near Kephalos, 8 June 1935, *K. H. & F. Rechinger* 8056; Lesvos, Argala, Kampos, Sigrion Eressi—fide *Candargy* (in Bull. Soc. Bot. Fr. 45 (5), 182: 1898)—n.v.

Limited chiefly to coastal sandy places.

E. paralias is similar to a W. Mediterranean species, *E. pithyusa* L. which, however, has narrower lanceolate, more pointed leaves, smaller capsules and smaller, rugulose-pustulose seeds.

E. paralias is distributed along the coast from the British Isles and western Europe throughout the Mediterranean; in Turkey it also extends along the Black Sea coast and reaches the Crimea and W. Caucasus.

44. **E. macroclada** Boiss., Diagn. **1** (5), 54 (1844). Map 1.

Syn.: *E. tinctoria* Boiss. et Huet ex Boiss. in DC. Prodr. **15** (2), 166 (1862)!

E. tinctoria Boiss. et Huet ex Boiss. var. *schizoceras* (Boiss. et Hohen.) Boiss. in DC. Prodr. **15** (2), 166 (1862)!

E. macroclada Boiss. var. *aceras* Handel-Mazzetti in Ann. Naturh. Hofmus. Wien. **26,** 140 (1912)!

E. macroclada Boiss. var. *schizoceras* (Boiss. et Hohen.) Dinsm. in Post, Fl. Syr. Pal. Sin. **2,** 504 (1933)!

Holotype: [Turkey (C2)]: in collibus argillosis ad orientem urbis Denisleh [Denizli], June 1842, *Boissier* (G).

A3: prov. Ankara, Beypazari, 700 m., 1 June 1957, *Kühne* 495 & 497. A4: near Çankiri, 800 m., 6 June 1929, *J.* et *F. Bornmüller* 14608. A5: prov. Kastamonu, Tosya, July 1892, *Sintenis* 4281. A8: prov. Gümüşane, Bayburt, 20 June, 30 July 1862, *Bourgeau.* B3: Afyonkarahisar, 29 June 1907, *Saint-Lager.* B4: prov. Ankara, above Tuz Gölü, 25 km. north of Koçhisar, c. 925 m., 29 July 1956, *McNeill* 334. B5: near Kayseri, 1300 m., 24 July 1856, *Balansa* 269. B6: Sivas—Şarkişla, 1500 km., 28 Aug. 1957, *Davis* 32722; prov. Seyhan, dist. Saimbeyli, Doğanbeyli—Akçal, 1300 m., 12 July 1952, *Davis* 19905. B7: prov. Erzincan, Keşiş dağ above Cimin, 1800 m., 26 July 1957, *Davis* 31723. B8: prov. Muş, foothills, Bingöl dağl. in dist. Varto, 1440 m., 17 Aug. 1859, *Kotschy* 320; near Erzurum, July 1853, *Huet du Pavillon* (syntype of *E. tinctoria*). B9: near Bitlis, 1380 m., 15 Sept. 1859, *Kotschy* 531; prov. Van, Gevaş—Edremit, 9 July 1954, *Davis* 22605. B/C7: prov. Adiyaman/Malatya, between Malatya and Kâhta, 1200–1900 m., 19 July 1910, *Handel-Mazzetti* 2492 (type of *E. macroclada* var. *aceras* Hand.-Mazz.). C2: prov. Antalya, Elmali, 9 July 1860, *Bourgeau* (syntype of *E. tinctoria*); prov. Denizli, Denizli-Çardak, 10 miles from Denizli, 250 m., 10 June 1962, *Dudley* (D.35569). C3: prov. Isparta, dist. Eğridir, Atabe, 1200 m., 2 Aug. 1960, *Khan et al.* 424 (glandular horns obsolete). C4: prov. Içel, Mut—Kirobaşi, Cümelek, 40 km. from Mut, 1100 m., 14 June 1950, *Huber-Morath* 9967; Konya—Sultanhani, 18 miles from Konya, 1050 m., 17 June 1962, *Dudley* (D.35914). C5: prov. Niğde, Bulgar Maaden, 1400 m., June 1896, *Siehe* 486. C6: prov. Seyhan/Maraş, Osmaniye—Maraş, May 1950, *Ismail Akbaş.* C7: Urfa—Akçakale, 10 km. from Urfa, 500 m., 17 May 1957, *Davis* 28147. C8: Mardin, 1 June 1888, *Sintenis* 1320.

In mountain steppe, fallow fields, forestry plantations, on calcareous and metamorphic hill slopes and sandy flats near lakes, reaching 1900 m.

E. macroclada is closely related to *E. pannonica*. However, the former is distinguished by its larger capsules and seeds, usually velutinous cyathial lobes, usually more pointed leaves and a horizontal rhizome. Both species are also geographically distinct: *E. macroclada* is easterly in distribution, extending from Lycia to Kurdistan and reaching N.W. Iran and Caucasus towards the east and Palestine towards the south; *E. pannonica*, which in Turkey is restricted to W. & N. Anatolia, extends through the Balkan peninsula into C. Europe.

Like *E. cheiradenia* Boiss., *E. macroclada* shows great diversity in the morphology of the glands which, in some species, do not provide satisfactory diagnostic characters.

A unique specimen collected from Keşiş dağı in prov. Erzincan (a. 1834, Orient. Herb. *Montbret* 2460, W!), though approaching *E. macroclada* in leaf and seed characters, is distinct in its flexuose decumbent stems arising from caudiculi, trapeziform ecornate cyathial glands, much shorter umbellate radii and a vertical rhizome. It may represent an undescribed taxon.

45. **E. pannonica** Host, Fl. Austr. **2,** 566 (1831). Map 1.

Syn.: *E. glareosa* Pall. ex M. B. var. *lasiocarpa* Boiss., in DC. Prodr. **15** (2), 166 (1862)!

Holotype: in Hungaria et finitima Austria in pratis, campis, ad agrorum margines; in agro Vindobonensi copiose circa Lanzendorf, Himberg, *Host* (Herb. Endlicher, W).

A2 (A): Bithynian Olympus [Ulu dağ], *Nöe* (sterile). A2 (E): prov. Istanbul, between Makriköy and San Stefano, 8 June 1890, *Aznavour* 1941 bis. A3: prov. Bolu, 15 km. E. of Müdürnü, 1150 m., 1 Aug. 1958, *Kühne* 3392. A4: Kastamonu—Ilgaz, 900 m., 14 Aug. 1960, *Khan et al.* 639; prov. Zonguldak, Kel Tepe above Karabük, 800–900 m., 4 Aug. 1962, *Davis* 39008. B2: prov. Kütahya, Murat dağ (above Gediz) below Hamam, 1300 m., 5 July 1962, *Davis* 36849; Domaniç, 900 m., 2 July 1962, *Davis* 36427.

In plains or on mountains, from sea level to 1150 m.

The nearest ally to *E. pannonica* is *E. nicaeensis* All. from which the former seems to differ in its smaller capsules with rounded coccae (in the latter, capsules are 4–5 mm. long and the coccae carinate on the back), broader, longer leaves and more robust habit. There is also a geographical separation between the two species; *E. pannonica* extends from C. Europe through the Balkan peninsula into W. & N. Anatolia, while *E. nicaeensis* All. has its distributional range from Spain to Dalmatia, mostly within the Mediterranean region.

E. pseudoglareosa Klokov (Fl. RSS. UCR, **7,** 630, t. 27: 1955), described from the Ukraine, was distinguished by its author chiefly by the often elliptic, acute leaves with a manifestly denticulate margin. But the examination of an authentically determined specimen from Herb. Inst. Bot. Ac. Sc. RRS. Ucr. Kiew, Ukraine, and the description and illustration of the species, suggest that *E. pseudoglareosa* may not be specifically different from *E. pannonica* Host.

E. pannonica could be mistaken for *E. macroclada* Boiss. whose distributional range it overlaps in the central part of N. Anatolia (cf. Map 1). See the discussion under *E. macroclada* for differences.

46. **E. cheiradenia** Boiss. et Hohen., Boiss. Diagn. **1** (12), 112 (1853).

Syn.: *E. bothriosperma* Boiss. et Kotschy ex Boiss., Cent. Euph., 36 (1860)!

Syntypes: in monte Elbrus Persiae borealis prope Passgala, *Kotschy* 182 (G; K; BM); [Turkey (C8)], in Mesopotamia circa Diarbekir, *Kotschy* Pl. Mus. Imp. Vindob. no. 232 (W; G; K; BM).

A6: Sivas, Mt. Yildiz dağ, 1200 m., 6 June 1890, *J. Bornmüller* 2513. B6: prov. Sivas, dist. Kangal, Tecer—Gürün, 1 km. from Böğindelik, near Behramcali, 1800 m., 28 June 1955, *Huber-Morath* 14261. B7: prov. Elaziğ, Harput, 30 July 1889, *Sintenis* 161. B8: prov. Muş, Bingöl dağl., near Varto, 1380 m., 16 Aug. 1859, *Kotschy* 305 (type of *E. bothriosperma* Boiss. et Kotschy). B9: prov. Bitlis, Reşadiye—Pelli, 1900 m., 6 July 1954, *Davis* 22369; prov. Van, dist. Başkale, Ispiriz dağ, 2700 m., 31 July 1954, *Davis* 23670. C8: Mardin, 23 June 1888, *Sintenis* 1181.

Among calcareous, igneous, marly or serpentine rocks, in fallow fields and steppe and on gravelly river banks, reaching 3000 m.

E. bothriosperma Boiss. et Kotschy ex Boiss. treated here as a synonym of *E. cheiradenia*, was based chiefly on the non-pectinate cyathial glands —a character that has been seen to be extremely variable; young glands have only 2 simple horns which later on in development become bifid at the tips, while on the glandular margin itself appear one to several accessory horns.

E. cheiradenia is perhaps allied to *E. petrophila* C. A. Meyer, but is a much larger plant with the seeds densely and irregularly vermiform-wrinkled instead of shallowly pitted. *E. cheiradenia*, which is chiefly centred in the Irano-Turanian region, reaches the Elburz mountains (Iran) towards the east, and extends southwards to Jordan.

Kotschy 232 from Diyarbakir (a syntype of *E. cheiradenia* Boiss. et Hohen.) and *Kotschy* 532 from Anti-Lebanon which also represents this species were mistakenly cited by Boissier (Fl. Or.) under *E. chesneyii* (Kl. & Gr.) Boiss.—a species which has not so far been reliably reported from Turkey.

47. **E. terracina** Linn., Sp. Pl. ed. **2,** 654 (1762).

Syn.: *E. alexandrina* Del., Fl. Egypt. Expl. Planch., 90 (1813).
E. leiosperma Sibth., Fl. Gr. **5,** 51, t. 465 (1825)!
E. terracina L. var. *prostrata* Boiss., Fl. Or. **4,** 1123 (1879)!

Described from Spain (Herb. Linn. no. 33).

A2 (A): prov. Istanbul, near Pendik, 6 July 1891, *Aznavour*. In monte Tauro [a. 1836?], *Kotschy* 484.—*Aeg. Is.:* Rodhos, Kremasto, 10 May 1935, *K. H. & F. Rechinger* 7107.

This polymorphic species has a much more exhaustive synonymy than is given here; extreme variability is found in habit and the shape of cauline and involucellar leaves. Although originally described as an annual, *E. terracina* perennates by the help of its thick lignified root.

E. terracina has a great resemblance to *E. taurinensis* All. in leaf shape and general facies, but is easily separated by its smooth (not pitted) seeds and more robust perennial habit.

E. terracina is distributed throughout the Mediterranean. From the mainland of Turkey, it is known so far only from near Istanbul and the Taurus mountains.

48. **E. pinea** Linn., Syst. ed. **12,** 333 (1767).

Boissier (Fl. Or.) recorded *E. pinea* from N.W. Anatolia, viz. in rupestribus saepius maritimus, Bithynia, *Wiedemann* in herb. Petrop. (LE—n.v.). I have not seen any plant from Turkey that could be referred to this taxon. The European material examined shows great variation in habit and leaf-shape. *E. pinea* has been treated as a subspecies of an annual species, *E. segetalis* L., by Hayek (Prodr. Fl. Pen. Balc. **1,** 135: 1927) and Vindt (Mongr. Euph. Maroc. **1,** 140: 1953).

E. pinea is distributed throughout the C. & W. Mediterranean region.

49. **E. petrophila** C. A. Meyer, Kleine Beitr. Russ., 9 (1850).

Key to varieties

Leaves 6–15 mm. long; primary umbellate radii 5–20 mm. long; stems usually dwarf (3–10 cm.) . . . . a. var. *petrophila*

Leaves 10–25 mm. long; primary umbellate radii 15–30 mm. long; stems usually long (15–25 cm.) . . . . . b. var. *armena*

a. var. **petrophila**

Syntypes: from Crimea, Ukraine and Caucasus (LE—n.v.).

A4: prov. Kastamonu, Ilgaz dağ, Kücük Ilgaz dağ, 2050 m., 30 June 1958, *E. Markgraf* 10618, 5 km. N. of Kastamonu, 900 m., 7 June 1954, *Davis* 21641, Kastamonu et Safranbolu, *Wiedemann*; prov. Ankara, Ayaş (50 km. W. of Ankara) 1000 m., 1 June 1958, *F. Markgraf* 11279. A5: prov. Amasya, Akdağ, 13–1900 m., 23 May 1890, *J. Bornmüller* 1815. C5: prov. Niğde, Bulgar Maaden, N. Taurus, 1700 m., July 1913, *Siehe* 446.

b. var. **armena** Boiss. in DC. Prodr. **15** (2), 1268 (1866).

Type: [Turkey (A8)]: in rupibus pr. Baibout [Bayburt], Armeniae, 20 June 1862, *Bourgeau* 242 (*holo.* G; *iso.* E, K).

A8: prov. Gümüşane, Bayburt, 20 June—10 July 1862, *Bourgeau* 636 (as *E. armeniaca*).

The species occurs on calcareous rock and on dry slopes of mountains, often on alpine meadows growing with *Juniperus nana*, reaching 2050 m.

E. petrophila is closely allied to *E. mesopotamica* M. S. Khan described from N. Iraq and N.E. Syria but differs chiefly in its ascending instead of procumbent stems, thinner involucellar leaves with entire or eroded margin (instead of coriaceous and cartilaginous-denticulate) and shorter seeds (1·7–2·5 mm. instead of 2·0–2·7 mm.).

Another closely allied W. Caucasian taxon, *E. panjutinii* Grossheim (Not. Syst. Herb. Inst. Bot. Ac. Sc. U.R.S.S., **13,** 18: 1950), was dis-

tinguished from *E. petrophila* by its dwarfer stems which are densely foliate, smaller leaves, and by its greatly abbreviated umbellate radii. I have not seen the type of *E. panjutinii* but examined a photograph of it at Edinburgh; by its general facies it appears that it may represent a depauperate form of *E. petrophila*.

E. petrophila is probably confined to S. Russia, the Crimea, the Caucasus, Transcaucasia, and Anatolia where it occurs mainly in the central-northern part, but also extends to the N. side of the Cilician Taurus. Samuelsson's plant (S. 3382–S!) from central Syria, referred by Rechinger (in Arkiv für Bot. ii. 5 (1), 284: 1959) to *E. petrophila*, is, in fact, *E. cheiradenia* Boiss. et Hohen.

50. **E. pisidica** Huber-Morath et M. S. Khan, **spec. nov.** Pl. 8.

Affinis *E. pestalozzae* Boiss. sed indumento breviter tomentoso, foliis caulinis semper linearibus angustioribus, radiis umbellae longioribus plerumque semel bifidis recedit.

Planta perennis. *Radix* (caudice incluso) indurata verticalis ad 20 cm. longa vel ultra, superne ad 1 cm. crassa, caudiculosa. *Indumentum* caulium (in parte superiore) et foliorum caulinorum et involucri dense et breviter tomentosum. *Caules* floriferi plures, ad 20 cm. longi et 1–2 mm. lati, fragiles, ascendentes, simplices, raro superne ramis floriferis, inferne demum denudati cicatricosi, surculosis hornotinis sterilibus brevibus commixti. *Folia caulina* mediana 10–25 mm. × 1–2 mm., sessilia, linearia, integra, late mucronata, crassa, inferiora et ea surculorum sterilium dense imbricata, superiora laxa. *Folia involucri* 4–5, linearia vel oblongo-lanceolata, mucronata, 10–15 mm. × 2–5 mm. *Radii primarii umbellae* 2–5, 15–40 mm. longi, graciles, glabri, plerumque semel bifidi. *Folia involucellae* (primariae) 5–8 mm. × 8–12 mm., transverse late elliptica, mucronata, glabra virenti-flava. *Cyathia* 2·5–3·5 mm. longa, campanulata, glabra, lobis ovato-oblongis extus glabris intus pubescento-hirtis, plerumque retusis, glandulis (in sicco) fuscis, semilunato-deltoideis bicornutis, cornubus angustis obtusis glandulae latitudini aequilongis. *Bracteolae* inter flores masculos multae plumosae. *Capsula* 3·5–4·0 mm. × 2·5–3·0 mm., ovoidea, trilobata, fuscescentia, coccis rotundatis, laevibus, obscure punctatis; styli 1·0–1·5 mm. longi, apicem versus semel bifidi, ad basin coaliti. *Semen* 2·0–2·2 mm. × 1·3–1·7 mm., ovoideum, subcompressum, griseum, leviter et irregulariter reticulato-foveolatum; caruncula c. 0·5 mm. longa, conico-pyramidalis, basi intus retusa. Fl. Jun.

C2: prov. Burdur, dist. Tefenni, Passhöhe südlich ob Dirmil, Eruptivgestein, 1500 m., 28 Juni 1948, *Huber-Morath* 8593 (*holotypus*, Hub.-Mor.; *iso.* E); Triften der Passhöhe 7 km. südlich Dirmil, 1500 m., 9 Juni 1938, *Huber-Morath* 5667; Katara pass [near Gölhisar, 12 May 1842], *Prof. Forbes* 563 (K).

E. pisidica is closely allied to *E. pestalozzae* Boiss. to which it is similar in general habit and in the characters of cyathial glands, capsules and seeds, but is specifically distinct in its shortly tomentose indumentum, always linear cauline and involucral leaves, and longer and usually at least once-divided umbellate radii.

E. pisidica has not been found, so far, outside Pisidia and the adjacent Lycian Taurus, and is probably endemic to that region; it is a chamaephyte

on pasture land and volcanic rocks near high mountain passes at an altitude of about 1500 m.

51. **E. pestalozzae** Boiss., Diagn. **1** (12), 114 (1853).

Syn.: *E. akdaghensis* Stapf in Denskr. Akad. Wien **51** (2), 368 (1886)!

Holotype: [Turkey (C4)]: prov. Konya, in Caramania [Karaman], *Pestalozza* (G).

C2: prov. Antalya, Akdağ, 17 July 1882, *Luschan* (type of *E. akdaghensis*), *ibid.*, 5 July 1860, *Bourgeau* 600, dist. Elmali, Beydağ, 2500 m., 28 July 1960, *Khan et al.* 292. C3: prov. Antalya, Çalbalidağ, 2000 m., 14 July 1949, *Davis* 15408.

On high plateaus and on mountain screes, from 2000–2500 m.

E. pestalozzae is allied to *E. pisidica* Huber-Morath & M. S. Khan; the latter, however, has narrower (not more than 2 mm. wide) leaves that are pubescent, and longer (15–40 mm.) divided umbellate radii. *E. pestalozzae* is probably endemic to the Lycian Taurus and S. Lycaonia.

52. **E. erythrodon** Boiss. et Heldr., Boiss. Diagn. **1** (12), 114 (1853).

Seeds 2·0–2·3 mm. × 1·3–1·5 mm., ovoid-oblong, greyish, smooth; caruncle small, conical. Fl. May–July.

Type: [Turkey (C3): prov. Isparta], in rupestribus regionis superioris montis Davros Pisidiae, alt. 1650 m., May, *Heldreich* (*holo.* G; *iso.* K, BM).

B3: prov. Konya, Akşehir, Sultandağ, 1800 m., 21 June 1899, *J. Bornmüller* 5551, *ibid.* 1900 m., 3 July 1948, *Huber-Morath* 8150. C3: prov. Antalya, Bozburundağ, 2200–2300 m., 25 July 1949, *Davis* 15663.

On mountain ridges, often on limestone, up to 2300 m.

Boissier, who did not know the seeds of *E. erythrodon*, placed it provisionally with the species with pitted seeds. In fact, it is allied to the smooth-seeded *E. glareosa* Pall ex M. B. (*E. glareosa* Pall ex M. B. var. *minor* Boiss.) from which it is distinguished by its condensed "capitulate" umbels and by the densely imbricate cauline leaves.

E. erythrodon is apparently endemic to Anatolia, being known only from Lycaonia, Pisidia, and Lycia.

53. **E. glareosa** Pall. ex M. B., Fl. Taur.-Cauc. **1,** 373 (1808) & 3, 324 (1819).

Syn.: *E. glareosa* M. B. var. *minor* Boiss., Fl. Or. **4,** 1129 (1879)!

Holotype: [Crimea]: provenit in Tauriae et Caucasi sterilibus lapidosis, [*Pallas*], Floret Majo, Junio (LE—n.v.).

A5: Amasya, Mont. Logman, 500–514 m., 17 May 1889 *J. Bornmüller* 819. B6: Gürün—Sivas, 20 km. from Gürün, 1400 m., 20 June 1960, *Stainton* & *Henderson* 5740 (with many prostrate stems from a much branched woody stock). B8: Erzurum, a. 1853, *Calvert* 990, and a. 1854, *Calvert* 111.

E. glareosa is allied to *E. erythrodon*, but distinguished by its longer spreading umbellate radii and laxly arranged cauline leaves. *E. glareosa*

can also be easily mistaken for *E. petrophila* C. A. Mey., whose distribution it overlaps, due to a striking similarity in habit, but in the fruiting state is easily separated by its smooth seeds.

E. glareosa var. *elatior* M. B. (Fl. Taur. Cauc. **3,** 325: 1819) has been described as *E. stepposa* Zoz (in Komarov, Fl. U.R.S.S. **14,** 738: 1949) from Ukraine. This plant is said to be allied to *E. pannonica* Host and *E. glareosa* M. B., differing from the former (*fide* Zoz) in its taller stems, glabrous leaves and divaricate umbels, and from the latter in its robust stature, glabrous entire leaves and multi-radiate umbels. The type of *E. stepposa* has not been seen, and its status requires confirmation.

E. glareosa is restricted to the Crimea, Caucasus, and the central and eastern part of N. Anatolia.

54. **E. isaurica** M. S. Khan, **spec. nov.** Pl. 9.

Affinis *E. promecocarpae* P. H. Davis et *E. herniariifolia* Willd. sed ab ambabus indumento tomentoso distinguitur; insuper a priore foliis majoribus crassioribus, statura majore, capsulis et seminibus majoribus recedit; ab altera capsulis oblongis, coccis dorso rotundatis (haud bialatis), caruncula majore subglobosa differt.

Perennis, planta tota breviter tomentosa. *Caules* plures, procumbentes vel penduli, fragiles, basi caudiculosi, iterum iterumque acute ramosi, ad 30 cm. longi, inferne 1–4 mm. lati. *Folia caulina* mediana 4–9 mm. × 4–9 mm., breviter petiolata (petiolus 0·5–1·5 mm. longus), orbiculata vel late elliptica, crassa, integra, obtusa raro emarginata, nervis obscuris. *Folia involucri* (–2) 3–4, 4–12 mm. × 4–12 mm., late elliptica vel late elliptico-rhomboidea vel orbiculata, obtusa vel acutiuscula, breviter petiolata (petiolo 0·5–1·0 mm. longo). *Radii primarii umbellae* 2–4, 5–30 mm. longi, bis vel iterum iterumque bifidi. *Folia involucellae* (primariae) 5–10 mm. × 5–11 mm., late elliptica vel late elliptico-rhomboidea raro orbiculata, acuta vel obtusa. *Cyathia* turbinata, 1–2 mm. longa, lobis oblongis truncatis ciliatis, glandulis transverse oblongis vel semilunatis flavescento-fuscis vel atrofuscis (in sicco), bicornutis, cornubus setaceis, glandulae latitudini aequilongis vel longioribus. *Bracteolae* inter flores masculos ciliatae. *Capsula* 2·5–3·0 mm. × 1·4–1·7 mm., anguste oblongo-trilobata, apici et basi plus minus depressa, coccis rotundatis, dorso bilineatis; styli 0·7–1·0 mm. longi basin versus coaliti, apicem versus bifidi. *Semen* 1·2–2·0 mm. × 0·7–1·0 mm., cylindricum, griseum vel griseo-virens, foveolis paucis levibus provisum; caruncula 0·7–1·0 mm. longa circa dimidio semine brevior, oblonga vel subsphaerica, substipitata, albescens vel flavescens. Fl. Jun.–Aug.

C4: prov. Konya, dist. Ermenek (Isauria), Kamiş Dere (between Ermenek & Oyuklu dağ), alt. 1400–1500 m., 14 Aug. 1949, hanging from roofs of caverns, *Davis* 16189 (*holo.* E; *iso.* K); Ermenek—Karaman, 24 km. nach Ermenek, 1550 m., 9 Jun. 1948, *Huber-Morath* 8661.

Although very similar to *E. promecocarpa* P. H. Davis (Syria) in its habit and the characters of capsules and seeds, *E. isaurica* is specifically distinct in its larger thicker leaves, larger stature, larger capsules and seeds, and by its short tomentose indumentum. From its other ally, *E. herniariifolia* Willd., it differs by its narrowly oblong capsules whose carpels are not dorsally winged, cylindrical seeds with larger, oblong or subspherical caruncles, and by its characteristic indumentum.

The type of *E. isaurica* was collected in a relict community found on overhanging rocks at the mouths of limestone caverns in Isauria where it was associated with *Arenaria speluncarum* McNeill, *Teucrium cavernarum* P. H. Davis, *Tracheliopsis myrtifolia* (Boiss. & Heldr.) O. Schwarz & P. H. Davis, *Campanula leucosiphon* Boiss. & Heldr., *Erodium pelargoniiflorum* Boiss. & Heldr., *Galium dumosum* Boiss. and *Valeriana speluncaria* Boiss.; it is probably endemic to Isauria. *Huber-Morath* 8661 was collected from calcareous rock. The allied *E. promecocarpa* is confined to dry vertical overhanging rocks in the Anti-Lebanon.

A puzzling gathering made by Huber-Morath from near the type locality (Ermenek—Mut, sendrechte Kalkfelsen 20 km. nach Ermenek, 1340 m., 13 June 1950, *Huber-Morath* 9962) includes both tomentose plants resembling *E. isaurica* and glabrous ones which at first sight might be referred to *E. herniariifolia* Willd. var. *glabrescens* Halácsy. The hairy plant has a short ovoid capsule but the glabrous specimens have oblong capsules like *E. isaurica*. However, neither of the plants have capsules mature enough to show the seed characters. It seems possible that this gathering might represent the product of hybridisation between *E. isaurica* and *E. herniariifolia* var. *glabrescens*.

55. **E. herniariifolia** Willd., Sp. Pl. **2** (2), 902 (1800).

Key to varieties

Stems, leaves, and capsules, at least when young, puberulous to velutinous . . . . . a. var. *herniariifolia*

Stems, leaves and capsules always glabrous . . . . b. var. *glaberrima*

a. var. **herniariifolia**

Syn.: *E. pumila* Sibth. & Sm., Fl. Gr. Prodr. **1,** 324 (1809) & Fl. Gr. **5,** 47, t. 460 (1825)!

E. herniariifolia Willd. var. *hebecarpa* Boiss. in DC., Prodr. **15** (2), 155 (1862)!

Holotype: in Creta, *Willdenow* (B—n.v.; *photo.* E).

A4: Çankiri, 1200 m., 29 June 1958, *F. Markgraf* 10562. A5: Amasya, 4–900 m., Mar.–May, 1889, *J. Bornmüller* 814. B2: Gediz to Kütahya, 18 km. S. of Kütahya, 1000 m., 7 July 1962, *Davis* 36926. B3: prov. Konya, dist. Akşehir, Sultan dağı, 1750 m., 3 July 1948, *Huber-Morath* 16089. B5: prov. Seyhan, dist. Feke, Bakir dağ, near top of Sencan dere, 1900 m., 30 June 1952, *Davis* 19407; prov. Niğde, Hasan dağ above Taşpinar yayla, 2200 m., 16 June 1952, *Davis*, 18936. B6: prov. Maraş, Nurihak dağ—Elbistan, 2800 m., 17 June 1960, *Stainton & Henderson* 5634. B7: Elaziğ, *Forbes* 554. C2: prov. Denizli, Cadmus (Honaz dağ), 1500 m., 3 June 1938, *Huber-Morath* 5284. C3: prov. Antalya, Çalbali dağ at Fesliken yayla, 1800 m., 14 July 1949, *Davis* 15348; Burdur—Antalya, 20 km. from Burdur, 1100 m., 11 June 1938, *Huber-Morath* 5733. C4: prov. Antalya, N. foot of Akdağ (S. of Geyik dağ), 1800 m., 30 Aug. 1947, *Davis* 14655. C5: Cilicia, Bolkar dağl., 1800 m., July 1853, *Kotschy*. C6: prov. Maraş, Koyunoluk dağ between Maraş and Göksun, 1200 m., 4 May 1957, *Davis* 27560.—*Aeg. Is.:* Khios, summit of Pelmaion, a. 1939, *J. W. O. Platt* 224a.

b. var. **glaberrima** Halácsy, Consp. Fl. Gr. **3,** 109 (1904).

Syntypes: [Greece], Mt. Malevo, *Orphanides* herb. n. 2898 (W—n.v.); Epirus, *Baldacci*, It. Alb. a. 1892, n. 163 (K).

A2 (A): prov. Bursa, Ulu dağ, 2490 m., 13 Sept. 1947, *Davis* 14857. A4: prov. Zonguldak, Kel Tepe above Yenice, above Sorgun yayla, 1700 m., 20 July 1962, *Davis* 37894. A7: prov. Giresun, Eğribel, 50 km. from Giresun, 2400 m., 7 July 1958, *F. Markgraf* 10790. A8: prov. Rize, Cimil valley [near Rize], 2000 m., July 1866, *Balansa* 1439. B1: prov. Izmir, Bozdağ, 25 July 1854, *Balansa* 346 (as *E. pumila* Sibth.). B6: prov. Maraş, dist. Göksun, Binboğa dağ, on Işik dağ, above Karli yayla, 2700 m., 15 July 1952, *Davis* 19982. B7: prov. Tunceli, Munzur dağ above Ovacik, 2800 m., 17 July 1957, *Davis* 31282. C2: prov. Antalya, Elmali, 26 May 1860, *Bourgeau* 290. C3: prov. Antalya, dist. Kemer, Tahtali dağ, 2100 m., 10 July 1949, *Davis* 15102. C4: prov. Antalya, Geyik dağ, 2286 m., 31 Aug. 1947, *Davis* 14577. C6: prov. Hatay, Mont. Amanus, near Dülül [?], 2100 m., July 1908, *Haradjian* 2437.—*Aeg. Is.:* Sámos, Mt. Ambelos, c. 1000 m., 10 Apr. 1934, *K. H. & F. Rechinger* 3689.

E. herniariifolia grows on calcareous, serpentine or metamorphic rocky slopes and ledges, often on north-facing screes and overhanging rock crevices, reaching an altitude of 2900 m.

In addition to the presence or absence of indumentum, the species shows considerable variation in size, shape and texture of the leaves, length of petioles, the colour of the cyathial glands (from red to yellow), and the size of capsules and seeds; plants growing in shady situations have usually thinner leaves with longer petioles. The two varieties recognized here are, admittedly, single-character variants and have widely overlapping distributions. The pattern of variation found in this polymorphic species requires further study.

E. herniariifolia is allied to *E. isaurica* M. S. Khan—probably endemic to Isauria—from which it can be separated by its ovoid to ovoid-oblong capsules (instead of narrowly oblong),, seeds with smaller, conical caruncles (instead of larger, globose) and glabrous or puberulous leaves (instead of tomentose). It occurs in all the phytogeographical regions of Turkey, with its western and southern extension through the Balkan peninsula and Greece (including the Aegean islands) up to Crete and Cyprus. Eastwards it does not extend beyond Turkey; in Syria and Lebanon it is replaced by *E. caudiculosa* Boiss. and *E. promecocarpa* P. H. Davis, both of which resemble it rather closely in general facies.

56. **E. peplus** Linn., Sp. Pl., 456 (1753).

Key to varieties

Plants tall with erect stems with only few branches at the base; leaves usually longer than broad, obovate; seeds (–1·3) 1·4–1·6 mm. long
a. var. *peplus*

Plants dwarf with many decumbent branches at the base; leaves usually as broad as long, ± orbicular; seeds 1·0–1·3 (–1·4) mm. long
b. var. *peploides*

a. var. **peplus**

Described from Europe (Herb. Linn. no. 25—var. *peplus*; Herb. Cliff.—var. *peplus*).

A2 (E): prov. Istanbul, Yeni köy, 12 June 1894, *Aznavour*. A2 (A): prov. Istanbul, Pachabagtche, 8 May 1899, *Aznavour*. A4: prov. Zonguldak, dist. Bartin, sea level, 25 Aug. 1960, *Khan, et al.* 783a. C2: prov. Muğla, dist. Fethiye, Xanthus, 50 m., 31 Mar. 1956, *Davis* 25529. C5: prov. Içel, Kuyuluk, 10 km. W. of Mersin, alt. 2 m., 7 Apr. 1957, *Davis* 26517. C2: prov. Muğla, Marmaris, 30 m., 24 Mar. 1956, *Davis* 25278. C3: east of Antalya, 40 m., 23 Feb. 1936, *T. A. Tengwall* 89. C5: Mersin—Silifke, 7 Mar. 1957, *E. Sauer* 57/50.—*Aeg. Is.*: Lésvos, fide Candargy in Bull. Soc. Bot. Fr. 45, 181 (1898), n.v.; Candargy also describes a var. *acerata* from this island (n.v.).

b. var. **peploides** (Goüan) Visiani, Fl. Dalm. **3,** 229 (1852).

Syn.: *E. peploides* Goüan, Fl. Monsp., 174 (1765).
E. peplus L. var. *maritima* Boiss. in DC., Prodr. **15** (2), 141 (1862)!
E. peplus L. subsp. *peploides* (Goüan) Rouy, Fl. Fr. **12,** 175 (1910).
E. peplus L. f. *peploides* (Goüan) Knoche, Fl. Balear. **2,** 157 (1922).

Type: Montpellier (S. France), *Goüan* (?K).

A2 (E): prov. Istanbul, Eyup, 12 May 1901, *Aznavour*. A8: prov. Gümüşane, Bayburt, July 1862, *Bourgeau*. B1: prov. Çanakkale, Thymbra [near Troy], in valle Scamandri [K. Menderes], 19 Apr. 1883, *Sintenis* 294.

E. peplus is a weed of cultivated fields and waste places, often on limestone rocks at low altitudes from sea level to 50 m.

It is with some hesitation that var. *peploides* is provisionally maintained here. Goüan differentiated *E. peploides* from *E. peplus* L. chiefly by its 2–fid umbellate radii (a very variable character), in contrast to the 3–fid umbels of the latter. Boissier maintained *E. peploides* as a distinct species distinguished by its more rounded leaves, obsolete styles and by its twice smaller seeds with fewer pits—characters claimed to have been preserved in cultivation. Careful examination of material from Europe and the Orient revealed that the number of pits in each row on seeds varies a great deal. However, there seems to be a fair degree of correlation between the decumbent habit and the smaller seeds in plants which have their cauline leaves usually suborbicular. The possibility of this taxon being treated as a subspecies can be ruled out as it has no separate geographical area; decumbent plants with orbicular leaves are not confined to the Mediterranean, but also occur in the British Isles and N. Iran. The relationship of *E. peploides* to *E. peplus* cannot be understood without cultivation experiments. To what extent are its diagnostic characters environmentally induced? In the meantime it seems advisable to draw attention to the problem by recognizing *E. peploides* as a variety of *E. peplus*.

E. peplus is closely related to *E. chamaepeplus* Boiss. et Gaill. (from Iraq, Syria, Palestine, Arabia and Egypt) from which, however, it differs by its capsules with bicarinate cocci (instead of a single keel) and by its seeds with 4 distinct rows of longitudinally arranged pits on the outer faces (instead of pits in crowded and irregularly arranged rows). *E.*

chamaepeplus is always a dwarf plant with petioles usually not more than 1·5 mm. long.

E. peplus is mainly a European species occurring almost throughout the Continent (including the Mediterranean) and the British Isles but also extending to N. Africa, E. Mediterranean, Arabia Petrea and N. Iran. In Turkey it is distributed mainly in the Mediterranean region and the Euxine province. In other parts of the world, viz. N. America, Canaries, India, etc., it is probably an introduced weed.

57. **E. aulacosperma** Boiss., Diagn. **1** (12), 117 (1853).

Syn.: *E. fossulata* Boiss., Diagn. **2** (4), 87 (1859)!
E. aulacosperma Boiss. var. *fossulata* (Boiss.) Boiss. in DC., Prodr. **15** (2), 141 (1862)!

Holotype: [Palestine]: in cultis prope Hierosolymam, fl. Apr., *Boissier* (G).

C4: c. 15 km. S. of Konya, 5 June 1937, *H. Reese*. C5: prov. Içel, village d'Alla-Dagh, à 7 lieues au NO. de Mersina, 16 May 1855, *Balansa* 784, Guzeldere, près de Kechlik (environs de Mersina), 30 May 1855, *Balansa* 743; Namrun, 1500 m., June 1895, *Siehe* 180.

On mountains up to 1500 m.

In its general habit, *E. aulacosperma* resembles very closely the eastern Mediterranean *E. arvalis* Boiss. et Heldr., and in seed characters the western Mediterranean species, *E. sulcata* De Lens ex Loisel. From the former, it is recognized by its longitudinally grooved seeds instead of irregularly reticulate-rugose; from the latter it differs in its obovate to spathulate cauline leaves (instead of linear), and in its usually taller stature.

Probably endemic to Cilicia and Lycaonia, Syria, Anti-Lebanon, Lebanon, and Palestine.

58. **E. arvalis** Boiss. et Heldr., Boiss. Diagn. **1** (12), 116 (1853).

Syn.: *E. punctata* sensu Ledeb., Pl. Ross. **3** (2), 571 (1850); sensu Boiss. in DC., Prodr. **15** (2), 143 (1862), pro parte—non Delile (1813).

Holotype: [Turkey (C3)]: in arvis Pisidiae inter Isbarta [Isparta] et Eğridir, *Heldreich* (G).

A8: [prov. Rize], Cimil valley (Lazistan), 2000 m., July 1866, *Balansa* 383 (as *E. punctata*). B4: prov. Ankara, dist. Şerefli Koçhisar, Ş.K.—Aksaray, 35 km. S. of Ş.K., 930 m., 27 June 1959, *Huber-Morath* 16085. B5: Talasse [Talas], near Kayseri, 1255 m., July 1856, *Balansa* 272. B8: Erzurum, a. 1853, *Calvert* 167 (as *E. punctata* Delile). C3: Antalya, Apr. 1845, *Heldreich*; prov. Konya: Beyşehir, 6 June 1957, *H. Reese*.

A weed of fields, reaching 2000 m.

E. arvalis had been erroneously treated previously by Boissier (in DC., Prodr.) as conspecific with an allied Egyptian species, *E. punctata* Del.; the latter, however, is a much dwarfer plant with smaller (1·0–1·2 mm. long), ecarunculate seeds sculptured with irregularly arranged pits instead of wrinkles.

In Turkey *E. arvalis* is confined chiefly to S. and E. Anatolia, extending northwards and eastwards to the Caucasus and N. Iran.

59. **E. taurinensis** Allioni, Fl. Ped. **1,** 287 & **3,** t. 83, f. 2 (1785). Rössler-Hüber in Berichte Schweiz. Bot. Ges. **56**, 271 (1946).

Syn.: *E. graeca* Boiss. et Sprun., Boiss. Diagn. **1** (5), 53 (1844)!
E. graeca Boiss. et Sprun. var. *isophylla* (K. Maly) Hayek, Prodr. Fl. Balc. **1,** 136 (1924).

Type: [N. Italy]: Nascitur circa Lusengo non procul ab Augusta Taurinorum, *Allioni* (TO, photo. E).

A2 (A): prov. Istanbul, Antigoni, Kocaeli, *Aznavour*; prov. Kocaeli, Pendik, *Aznavour*; Bilecik, 300 m., 2 July 1962, *Davis* 36506. A2 (E): prov. Istanbul, Flamour [Ihlamur], 10 June 1893, *Aznavour*. A4: prov. Ankara, dist. Kizilcahamam, Akdere, 1100–1400 m., 16 Aug. 1960, *Khan et al.* 704. B1: prov. Çanakkale, Assus, a. 1883, *Sintenis* 317; prov. Izmir, Smyrne, 5 May 1854, *Balansa* 347. B2: prov. Kütahya, Gediz, 850 m., 7 July 1962, *Davis* 36971. C1: prov. Muğla, Marmaris—Emecik, 200 m., 25 Mar. 1956, *Davis* 25327. C2: prov. Muğla, Muğla—Fethiye, 40 miles from Muğla, 29 May 1962, *Dudley* (D.35155b). C3: prov. Antalya, dist. Manavgat, Akseki, above Fersinuluni, 700 m., 8 Apr. 1956, *Davis* 25771; Çarma dağ, 210 m., 17 June 1958, *E. R. B. Little* 38. C5: prov. Seyhan, Sis [Kozan], Apr. 1896, *Siehe* 132. Cilicia: Bulgar dagh [Bolkar dağl.], a. 1853, *Kotschy.—Aeg. Is.:* Khios, Apr. 1931, *F. Guiol*; Lésvos, Stratonikos, Malea, *Candargi* (cf. Bull. Soc. Bot. Fr. 45 (5), 182: 1898) as var. *brachyceras*—n.v.

On serpentine, igneous and calcareous rocks, often in pine forests, from sea level to 1450 m.

Boissier (Fl. Or. **4,** 1115: 1879) differentiated *E. graeca* Boiss. et Sprun. from *E. taurinensis* by its shorter stature, deeply bifid styles and long-horned cyathial glands, but these characters, along with the form and measurements of the cauline and involucellar leaves, show such a degree of variability, sometimes even on the same plant, that it is impossible to separate one species from the other. *Rössler-Hüber* (*op. cit.*) regards *E. reuteriana* Boiss. (Syria, Lebanon, and Palestine)—a taxon closely related to *E. taurinensis*—as a geographical race of the latter.

Although resembling *E. terracina* L. (smooth-seeded) and *E. exigua* L. (tubercular-seeded) in its habit and shape of cauline leaves, *E. taurinensis* is, in fact, closer to *E. segetalis* L. (Europe and N. Africa) in its capsules with warty cocci and reticulately-pitted seeds, but differs in its laxer cauline leaves which are oblong-ovate to linear-lanceolate (instead of crowded and narrowly linear), and by its more deeply pitted seeds.

Rössler-Hüber (*op. cit.*) designated Allioni's figure as the type of *E. taurinensis* without giving reasons for such a choice. An authentic specimen from Allioni's Herbarium (lacking a number and information about the locality) agrees in all characters with the type description, and might be regarded as the type of Allioni's species although not identical with Allioni's figure.

Described from N. Italy, *E. taurinensis* is chiefly a N. Mediterranean species centred in the Balkan peninsula and Greece, but also extends to the Crimea and Caucasus. In Anatolia it is mostly found in the Mediterranean region.

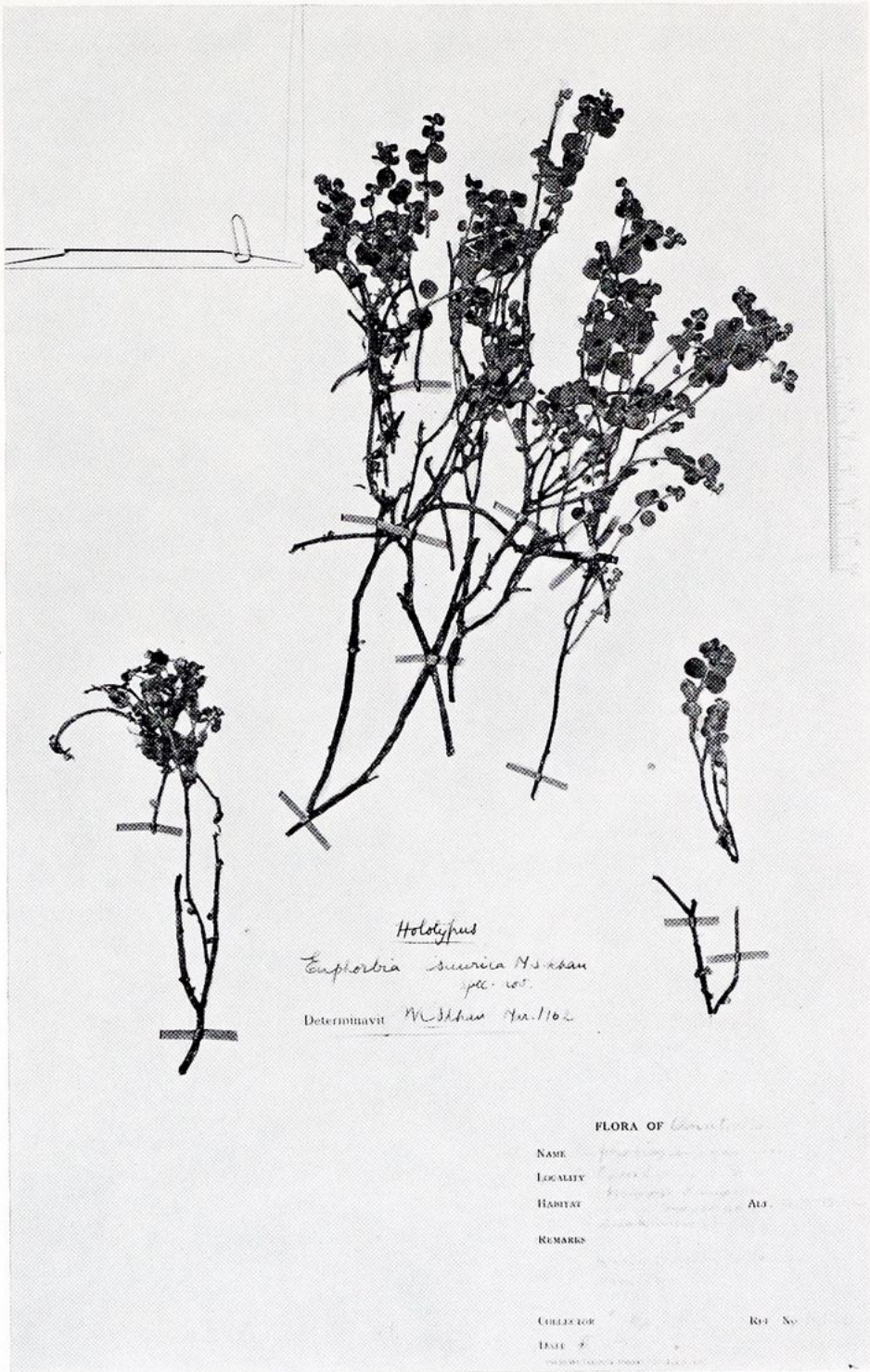


PLATE 9. *Euphorbia isaurica* M. S. Khan (holotype).

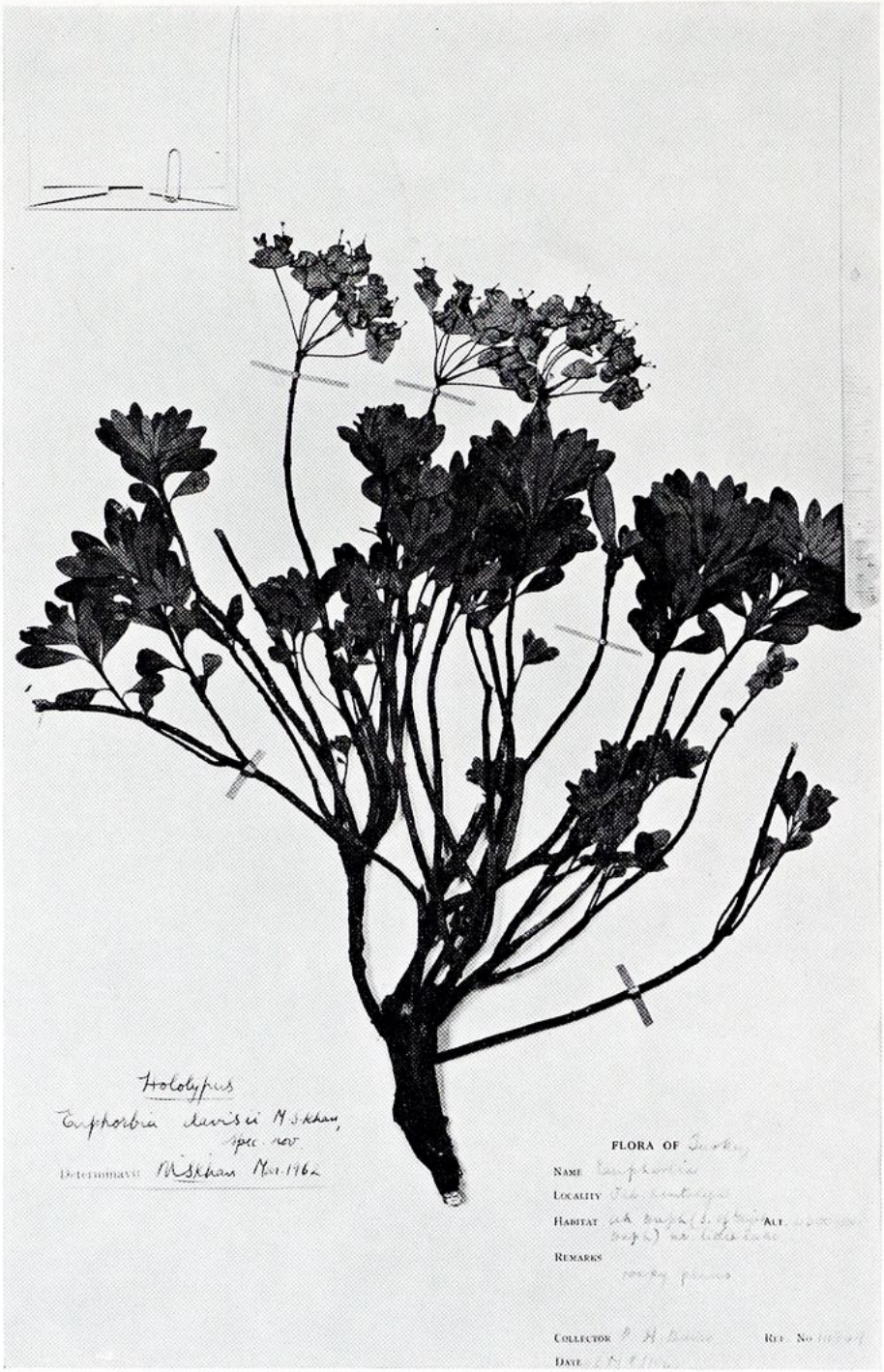


PLATE 10. *Euphorbia davisii* M. S. Khan (holotype).

60. **E. exigua** Linn., Sp. Pl., 456 (1753).

The cytological studies of this species investigated on material from different countries yielded conflicting chromosome numbers. As given by Darlington and Wylie (1955) and Löve and Löve (1961), they are as follows:

Source of material	*2n*	*Reference*
Sweden	16	Wulff (1939).
Britain	24	Rutland (1941).
Italy	24–26	D'Amato (1946).
Portugal and France	28	Perry (1943, Shimoyama 1958).
Europe and Temp. Asia	64	Reese (1952).
Britain	56	Shimoyama (1958).

Fresh material from Turkey could not be investigated cytologically; the seeds collected from Anatolia and sown at Edinburgh did not germinate.

Key to varieties

All the cauline leaves acute . . . . . a. var. *exigua*

At least the lower cauline leaves with truncate, retuse or tricuspidate apex . . . . . b. var. *retusa*

a. var. **exigua**

Syn.: *Euphorbia exigua* L. var. *acuta* L., Sp. Pl. 456 (1753).

Described from Spain, N.E. Germany, France and Switzerland (Herb. Linn. nos. 28 & 30).

A2 (E): prov. Istanbul, San Stefano, 21 May 1900, *Aznavour*. A2 (A): prov. Istanbul, Pendik—Kartal, 3 May 1903, *Aznavour*.

b. var. **retusa** Linn., Sp. Pl., 456 (1753).

Syn.: *E. tricuspidata* La Peyr., Hist. Abr. Pyr., 271 (1813).
E. rubra sensu DC., Fl. Fr. **5**, 359 (1815), non Cavan. (1791).
E. exigua L. var. *truncata* D. J. Koch, Syn. Fl. Germ. Helv. **1**, 731 (1843).
E. exigua L. var. *tricuspidata* (La Peyr.) D. J. Koch, loc. cit., 731 (1843).

Described from Montpellier, S. France—(*Herb. Linn.* nos. 27 & 29; no. 28 from "Monsp." has all leaves acute. *Herb. Cliff.*).

A1 (A): prov. Çanakkale, Dardanelles near Nagram, 24 May 1883, *Sintenis* 154. A2 (A): prov. Istanbul, Prinkipo, Langre, 22 May 1904, *Aznavour*. A2 (E): prov. Istanbul, Safra köy—Nakace farm, 10 May 1903, *Aznavour*. A6: Samsun, *Tchihatcheff*. C5: Mersin. 19 May 1855, *Balansa* 741.

The species is a weed of arable land.

E. exigua is related to *E. parvula* Delile described from Egypt, but is distinct in its linear instead of obovate-spathulate cauline leaves, and in its seeds which are longer (1·2–1·4 mm. long, instead of c. 1 mm.), and

ovate-tetragonal (instead of ovate-globose). Out of seed, the larger forms of *E. exigua* can be easily mistaken for the smaller versions of *E. taurinensis* All. due to the close resemblance in habit. However, the latter can be separated by its much longer gland-horns (2 or more times longer than the width of the gland) and usually broader cauline leaves (more than 2 mm.).

E. exigua is a widely distributed species extending from the British Isles eastwards through almost all Europe, Canaries, N. Africa, and E. Mediterranean up to Caucasus. It has also been reported from N. Iran (Rudbar de Hamadan, *Polak & Stapf*); cf. Parsa, *Flore de l'Iran*, **4,** 1244 (1949). In Turkey it occurs chiefly in the Mediterranean region, or in Mediterranean enclaves in the Euxine.

61. **E. aleppica** Linn., Sp. Pl., 458 (1753).

Syn.: *Euphorbia condensata* Fisch. ex M. B., Fl. Taur. Cauc. **3,** 322 (1819)!

Described from Crete and Aleppo (Herb. Linn. no. 46; Herb. Cliff.—as *E. paralias*).

A1 (A): Dardanelli [Çanakkale], 9 Aug. 1883, *Sintenis* 697. A2 (E): prov. Istanbul, Makri köy, 23 Aug. 1890, *Aznavour*. A2 (A): prov. Istanbul, Kartal beach, 22 Aug. 1897, *Aznavour*; prov. Bursa, between Mudanya and Bursa, June 1862, Herb. *John Stuart Mill*. A3: prov. Bolu, dist. Ala dağ, 700 m., 12 Aug. 1960, *Khan et al.* 532. A5: Amasya, 5–700 m., 14 Aug. 1889, *J. Bornmüller* 1269. A6: Tokat, *Wiedemann* 261. A7: prov. Sivas; 25 km. E. of Suşehri towards Refahiye, 7 Sept. 1957, *K. H. Rechinger* 15212. B1: prov. Çanakkale, Thymbra, in valley of Scamandri, 19 Apr. 1883, *Sintenis* 294—as *E. peploides* Goüan; prov. Izmir, Smyrna, 24 June 1854, *Balansa* 348. B2: prov. Kütahya, Gediz, 850 m., 5 July 1962, *Davis* 36893. B4: Ankara, 21 June 1932, *W. Kotte* 293. B7: 70 km. E. of Elaziğ, 1 Sept. 1954, *Davis* 24816. C2: Denizli, July 1905, *Saint-Lager*. C3: prov. Isparta, dist. Eğridir, Barla, 30 July 1960, *Khan et al.* 350; prov. Konya, Beyşehir, Aug. 1849, *Heldreich*. C4: prov. Konya, Karaman, Jan. 1845, *Heldreich*. C5: prov. Niğde, Bolkar dağl., Bulgar Maaden, 1500 m., 3 Aug. 1853, *Kotschy* 99e; prov. Içel, Külek pass, 3 Aug. 1855, *Balansa* 740. C6: Maraş, 600 m., 21 Aug. 1865, *Haussknecht*. C8: Diyarbakir, 23 June 1954, *Davis* 22140.—*Aeg. Is.:* Lésvos, *Candargy* (fide Rech. fil., Fl. Aeg., n.v.); Kos between Pili and Kardamena, 6 June 1935, *K. H. & F. Rechinger* 7975; Chios, the Kampos, 27 June 1939; *J. W. O. Platt* 296; Rodhos, Salakos, 11 June 1870, *Bourgeau* 291.

A common weed of cultivated fields and amongst rocks, reaching 1500 m.

A linear-leaved spurge described by Aiton (Hort. Kew. **2,** 142: 1789) as *E. juncea* from the island of Porto Santo near Madeira, and illustrated under the same name by Jacquin (Schoenbr. **1,** t. 107: 1797), has been given as a synonym of *E. aleppica* L. in *Index Kewensis*. Although the description of vegetative characters of *E. juncea* and the illustration (excepting the cyathia) agree very closely with those of *E. aleppica* L., the occurrence of the reported sexual dimorphism in the cyathia has not been observed either in the European or the Orient material of *E. aleppica*

examined so far. None of the Floras of the Atlantic islands includes *E. aleppica* L. or *E. juncea* Aiton, nor was a type specimen found at Kew.

E. aleppica has no near relatives, and is unique in its setaceous basal cauline leaves. It is distributed throughout the Mediterranean Europe east of the Tyrrhenian islands and in the eastern Mediterranean, N. Iran (chiefly Azerbaidjan) and Transcaucasia. In Turkey, it occurs in all three phytogeographical regions.

62. **E. falcata** Linn., Sp. Pl., 456 (1753).

Key to subspecies and varieties

1. Seeds usually with transverse grooves shorter, crowded, and often with irregular reticulate pattern; involucellar leaves as broad as or broader than long, suborbicular, always densely imbricate, mucro usually longer, 2–3 mm., recurved . . subsp. *macrostegia*

1. Seeds with transverse grooves longer and usually in regular transverse pattern, rarely shorter and crowded; involucellar leaves as long as or longer than broad, usually ovate or elliptic-rhomboid, mucro shorter, 1·0–1·5 mm., usually straight, rarely recurved subsp. *falcata*: 2.

2. Seeds smaller, 1·0–1·3 mm. long, transverse grooves shallow and obscure, often reduced to pits, not more than 6 on each side; upper umbellate radii elongated . . . . var. *galilaea*

2. Seeds larger, 1·4–2·0 mm. long, transverse grooves deep and distinct; upper umbellate radii very short . . . var. *falcata*

subsp. **macrostegia** (Bornm.) O. Schwarz in Fedde, Rep. **36** (4), 129 (1934).

Syn.: ?*E. falcata* L. var. *aeolica* Candargy in Bull. Soc. Bot. Fr. **45,** 181 (1898).

E. falcata L. var. *macrostegia* Bornm. in Mitt. Thür. Bot. Ver. NF. **24,** 111 (1908).

Syntypes: [Turkey (B1)]: Sinus Smyrnaeus in valle supra Hidja (aquas Agamemnonis), 29 May 1899, *Bornmüller* 9961 (B—n.v.; K; BM); [Turkey (C3)], in monte Taktali dagh, 26 May 1899, *Bornmüller* 9960 (B—n.v.); [Turkey (B3)]; Phrygiae monte Sultan dağ, 28 June 1899, *Bornmüller* 5550 (B—n.v.).

A3: prov. Ankara, Nallihan, 650 m., 9 July 1962, *Davis* 37045. B1: prov. Izmir, Smyrna, Apr. 1827, *Fleischer*—as *E. alexandrina* Del.; Seitinly [Zeytinli in dist. Edremit], 26 June 1883, *Sintenis* 766. C2: Kale Tavaş—Muğla, 35 km. from Kale Tavaş, 5 June 1938, *Huber-Morath* 5238; 40 miles from Muğla, 29 May 1962, *Dudley* 35155a; prov. Denizli, Abbas at foot of Boz dağ, 14 July, 1947, *Davis* 13297; Petra Mahali near Acipayam, 14 July 1947, *Davis* 13286.—*Aeg. Is.:* Lésvos, in Petakas, Gaidarantiphoros, *Candargy* (*loc. cit.*)—type of var. *aeolica* Cand., n.v.

This subspecies is characterized by its much imbricate involucellar leaves which are suborbicular and with long recurved mucros, and by its seeds which have the transverse grooves usually reduced to pits that show transitions to a reticulate pattern. It is confined to western Anatolia and probably the east Aegean islands.

subsp. **falcata**

var. **falcata**

Described from southern Europe (Herb. Linn. no. 26; the other plant (no. 25) named as *E. falcata* is *E. terracina* L.).

A2 (A): prov. Bursa, Yenişeher, 13 Oct. 1867, *J. Ball*; prov. Kocaeli, Pendik, 6 July 1891, *Aznavour*. A2 (E): Istanbul, Makri köy—San Stefano, 18 June 1893, *Aznavour*. A3: S.W. Bolu, Çepni, 30 June 1957, *Kühne* 1040. A4: Kastamonu—Inebolu, 900 m., 12 Aug. 1960, *Khan et al.* 609. A8: prov. Gümüşane, Bayburt, July 1862, *Bourgeau*. C2: prov. Antalya, Elmali—Avlan gölü, 23 July 1960, *Khan et al.* 169. B4: prov. Ankara, 10 km. N. of Koçhisar [Şerefli Koçhisar], 12 Sept. 1957, *K. H. Rechinger* 15271. B5: prov. Nevşehir, Göreme, c. 10 km. W. of Ürgüp, c. 1000 m., 3 Aug. 1956, *McNeill* 401. B8: Erzurum, a. 1943, *Hikmet Birand* 202. B9: prov. Van: 5 km. N. of Çatak, 25 July 1954, *Davis* 23267b. C1: prov. Muğla: dist. Marmaris, Knidas, sea level, 18 July 1960, *Khan et al.* 119 and 119a. C2: Tefenni—Burdur, 18 km. from Tefenni, 1100 m., 10 June 1938, *Huber-Morath* 5282. C3: prov. Isparta, Ağlasun—Isparta, 1600 m., 29 July 1960, *Khan et al.* 333. C4: prov. Konya, Ermenek, July 1872, *A. Péronin*. C5: prov. Seyhan, dist. Feke, Göksu gorge below Himmetli, 700–800 m., 9 July 1952, *Davis* 19803. C6: Maraş—Göksun, near Yemiş dağ, 600 m., 2 May 1957, *Davis* 27497; prov. Gaziantep, Nisib—Birecik, c. 5 km. from the Euphrates, 400 m., 14 May 1957, *Davis* 27966; prov. Hatay, Mont. Cassius, 1–1200 m., June 1909, *Haradjian* 3040.—*Aeg. Is.*: Rodhos near Bastida, May 1870, *Bourgeau* 288.

var. **galilaea** (Boiss.) Boiss. in DC., Prodr. **15** (2), 140 (1862).

Syn.: ?*E. falcata* L. var. *falciformis* Griseb., Spic. Fl. Rum. Bithyn. **1**, 139 (1843).
E. galilaea Boiss., Diagn. **1** (12), 116 (1853)!

Holotype: [Jordan] in Planitie Esdraelon [valley of Jezreel], May 1846, *Boissier* (G).

A2 (E): prov. Istanbul, Makri Köy, 6 July, 1891, *Aznavour*. A3: prov. Adapazari, Süğütlü, 50 m., 7 Aug. 1962, *Davis* 39139. A5: prov. Kastamonu, Tosya, 6 July 1892, *Sintenis* 5298. A6: Tokat, *Wiedemann*. B7: Diyarbakir—Ergani, 15 km. from Ergani, 750 m., 31 June 1957, *Davis* 28796. C5: prov. Içel, Tchaousli [Çavuslu] near Mersin, 27 Apr. 1855, *Balansa*; prov. Seyhan, Kozan (Anti-Taurus), 150 m., 12 Apr. 1957, *Davis* 26599. C7: Urfa—Akçakale, 10 km. from Urfa, 500 m., 17 May 1957, *Davis* 28152.

Var. *galilaea* is characterized by smaller seeds with shallow obscure grooves almost reduced to pits, and a distinct general facies with lax involucellar leaves and elongated upper umbellate radii.

E. falcata is a common weed of fallow fields, vineyards, stony places in pine forests and often by rivers and amongst calcareous rocky knolls, from sea level to 1600 m.

This species shows considerable variation in habit, colour of foliage and the cyathial glands, and presence or absence of glandular horns; the first two characters in most cases are probably determined by soil con-

ditions. The plant is often infected with an *Erysiphe* sp. whose external mycelium gives a false impression of arachnoid indumentum.

E. acuminata Lam. (Encycl. 2, 427: 1788 or 1789), whose type I have not seen, was described from Switzerland and is distinguished from *E. falcata* chiefly by the dark-green colour of its foliage (in contrast to bluish or pale green). Later, Hegi (Ill. Fl. Mittel-Eur. 5, 185, t. 1706: 1924) further emphasized its specific difference from *E. falcata* by its red instead of yellowish cyathial glands and the softly cartilaginous instead of sharply pointed tip of the involucellar leaves. Prokhanov, who also maintains *E. acuminata* as a distinct species (in Komarov, Fl. U.R.S.S. **14**, 465: 1949), separates it from *E. falcata* chiefly on the characters of shorter, straight tips of involucellar leaves, laxer foliage, and smaller seeds with only 3–4 transverse grooves—the features diagnostic of *E. falcata* var. *galilaea* which was cited by Prokhanov under synonymy. According to Löve & Löve (1961), D'Amato (1939) found the diploid chromosome number of *E. acuminata* Lam. to be 36, while Pólya (1950) reported 16 as the somatic number for *E. falcata* L. I have not seen enough European material referable to *E. acuminata* to decide its taxonomic status. However, following Boissier, the plants with the characters of *E. acuminata* (sensu Prokhanov) are provisionally recognized here as representing var. *galilaea* (Boiss.) Boiss.

E. falcata is related to a Caucasian endemic, *E. normannii* Schmalh. ex Lipsky, but differs in its compressed seeds with transverse grooves or pits (instead of ovate-quadrangular with irregularly arranged pits), and longer capsules (more than 2 mm.). In vegetative characters, *E. falcata* also resembles two Algerian species, *E. hieroglyphica* Coss. et Durieu ex Boiss. and *E. bupleuroides* Desf., but is always recognizable by its seed characters.

E. falcata has a wide geographical distribution, extending throughout the Mediterranean and C. & E. Europe, and through Turkey, Caucasia, C. Asia, Iraq and N. Iran up to Beluchistan. In Turkey, it is represented in all three phytogeographical regions.

63. **E. szovitsii** Fisch. & Mey., Index seminum Petrop. **1**, 27 (1835).

Key to varieties

Primary involucellar leaves linear-oblong, usually falcate, 6–17 mm. × 1–3 mm., 3 or more times longer than broad . . . a. var. *szovitsii*

Primary involucellar leaves elliptic-rhomboid, 5–13 mm. × 3–7 mm., usually not more than 3 times longer than broad . b. var. *kharputensis*

a. var. **szovitsii**.—Boiss., Ic. Euph., t. 96 (1866).

Syntypes: In Persia boreali, *Szovits* (LE—n.v.; photo. E); in Armenia, *Szovits* (LE—n.v.); [Caucasus] in Montibus Talüsch, *Fischer & Meyer* (LE—n.v.; G).

A3: prov. Ankara, N.W. Beypazari, 1 June 1957, *Kühne* 538 & 542. A4: prov. Ankara, 2 km. from Kizilcahamam, 1060–1120 m., 19 June 1955, *Huber-Morath* 14257. A5: Amasya, montis Logman, 600 m., 25 May 1890, *J. Bornmüller* 2849. A7: Gümüşane, 26 May 1862, *Bourgeau*. B3: prov. Konya, Akşehir, 1000 m., 22 June 1899, *J. Bornmüller* 5548.

B4: prov. Ankara, Beynam, c. 300 m., 5 July 1947, *Davis* 13064. B7: prov. Erzincan, Egin [Kemaliye], 13 May 1890, *Sintenis* 2230. C3: prov. Isparta, dist. Sütcüler (Isauria), Dedeğöl dağ between Daribükü & Selköşe, 900–1100 m., 30 July 1949, *Davis* 15863. C4: 4 km. N. of Konya, near Sille 1040 m., 5 June 1948, *Huber-Morath* 8659. C6: Kizilhisar dere between Gaziantep & Kilis, 25 km. S. of Gaziantep, 750 m., 13 May 1957, *Davis* 28007; prov. Urfa, Birecik, 12 May 1888, *Sintenis* 614. C7: Urfa—Akçakale, 10 km. from Urfa, 500 m., 17 May 1957, *Davis* 28151. C8: prov. Mardin, Savur, 900 m., 24 May 1957, *Davis* 28546; Diyarbakir, a. 1857, *Holmes*.

b. var. **kharputensis** Aznavour ex M. S. Khan, **var. nov.**

A typo foliis involucellae primariae elliptico-rhomboideis plerumque latitudine non plus longioribus recedit.
Holotype: [B7]: prov. Elaziğ: Harput to Khan Kezzin, ridge above lake, July 26, 1906, *B. V. D. Post* 349 (G; photo. E)—as *E. kharputensis* Azn. (nomen).

B7: prov. Diyarbakir, Maden—Ergani, 1000 m., 2 June 1957, *Davis* 29071; prov. Tunceli, Ovacik, 1400 m., 21 July 1957, *Davis* 31458; prov. Elaziğ, between Gölcük and Maden, 5–7 km. from the lake, 1180–1210 m., 2 July 1951, *Huber-Morath* 11494. B9: prov. Van, Erek dağ [Mt. Varak between Gevaş and Van], 18 July 1954, *Davis* 22959. C2: prov. Antalya, Elmali, 1 July 1860, *Bourgeau*. C5: prov. Seyhan, dist. Feke, Sencan dere between Süphandere and Belanköy, 1000 m., 2 July 1952, *Davis* 19574. C6: foothills of Akher dağ [Ahir dağ], near Maraş, 750 m., July 1907, *Haradjian* 1522. C8: prov. Mardin, Kiziltepe, 600 m., 26 May 1957, *Davis* 28666.

E. szovotsii is a weed of fallow fields, vineyards, dried up river beds, and steppe; it also grows on metamorphic and igneous slopes, and schistose screes, reaching 1740 m. It is related to *E. ledebourii* F. & M.; see the description of the latter for differences.

Chiefly an Irano-Turanian species, *E. szovitsii* penetrates into the Mediterranean region of Anatolia. Outside Turkey, var. *szovitsii* extends from the Caucasus southwards and eastwards up to Afghanistan; var. *kharputensis* is apparently restricted to Anatolia and Iraq.

64. **E. ledebourii** Boiss., Cent. Euph., 35 (1860).

Syntypes: [Crimea], in Tauria ad Sudak, *Pallas* in Herb. *Fischer* (LE—n.v.); *ibid.*, *Steven* (H—n.v.); prope Elizabethpol in prov. Transcauc., *Kolenati* pl. exs. no. 1445 (LE, photo. E).

A4: Çankiri, 800 m., 5 June 1954, *Davis* 21517. A5: prov. Kastamonu, Tosya, 13 June 1892, *Sintenis* 4227; Amasya, 16–500 m., 16 May 1890, *J. Bornmüller* 2866. B4: Ankara, 2 June 1933, *W. Kotte* 1057a—as *E. szovitsii; ibid.*, a. 1892, *J. Bornmüller* 3194.

In mountain steppe, often on gypsum rock, up to 800 m.

E. ledebourii is allied to *E. szovitsii* Fisch. & Mey. from which, however, it differs in its narrowly linear involucellar leaves (instead of linear-oblong or elliptic-rhomboid and often falcate) and by its irregularly foveolate seeds (instead of transversely and irregularly wrinkled).

E. ledebourii, which was described from the Crimea and Transcaucasia, is so far known in Turkey only from Galatia and Paphlagonia. Its disjunct distribution might perhaps be explained by the theory supported by Czeczott (1937) that the middle part of N. Anatolia, in the Upper Pliocene, was connected by a broad land bridge to the Crimea.

Candargy described a new variety, var. *insularis*, from *Mytilene* (Lésvos); cf. Bull. Soc. Bot. Fr. **45** (5), 181 (1898). Although the description, in general, agrees with the characters of *E. ledebourii*, the geographical distribution appears rather unlikely. The type gathering could not be traced, nor has any specimen of this taxon been seen from Lésvos; it needs further investigation.

65. **E. sibthorpii** Boiss., Cent. Euph., 39 (1860).

Syn.: *E. lycia* Boiss. in DC., Prodr. **15** (2), 172 (1862)!
E. veneta Willd. var. *sibthorpii* (Boiss.) Hayek, Prodr. Fl. Balc. **1,** 129 (1924)!

Syntypes: in declivibus montanis et ad ripas rivulorum in Graecia vulgaris. circa Athenas, *Spruner* (G), *Sartori* (G); in Peloponneso, *Bory* (?G—n.v.),

C2: prov. Muğla, Fethiye, 30 m., 27 Mar. 1956, *Davis* 25432, Xanthus. 50 m., 31 Mar. 1956, *Davis* 25528, Makri [Fethiye], Feb. 1872 (?), Prof, *Forbes*, Muğla—Fethiye, 15 miles from Muğla, 510 m., 29 May 1962, *Dudley* 35134. Lycia, *Bourgeau* 1860 (holotype of *E. lycia* Boiss.); *ibid.* Mar. 1874, *N. J. Elwes* (as *E. characias*).—*Aeg. Is.:* Chios, a. 1939–40, *J. W. O. Platt*; Samos, below Zoodochous Pigi monastery, c. 200 m., 4 Apr. 1934, *K. H. Rechinger* 3727; Rohdos, Mont Akramiti, c. 600 m., 19 May 1935, *K. H. & F. Rechinger* 7458.

On rocky slopes, often on limestone, reaching 600 m.; also in shady damp places.

Boissier differentiated *E. lycia* from *E. sibthorpii* by its less dense, more obtuse cauline leaves which are verticillate above, and by the longer, convergent horns of its cyathial glands. The leaf characters show considerable variation, and the cyathial glands of the two specimens collected from the same area (e.g. *Davis* 25432 & 25528) show short or obsolete horns on one gathering, and narrow, pointed and divergent ones on the other. The Anatolian plants could be regarded as representing the eastern limit of one continuous distribution pattern of *E. sibthorpii*, extending from Greece (mainland) through the Aegean islands to Lycia.

E. sibthorpii is nearly allied to *E. veneta* Willd. (1809) from which it appears to differ chiefly in its narrower cauline leaves and larger involucellar leaves; the material of the latter species examined is too inadequate for reliable measurements. Geographically also, *E. sibthorpii* is separate, being confined to Greece (mainland), Peloponnese, Malta, Aegean islands and Lycia, whereas *E. veneta* is more northerly in its distribution, extending from Venice eastwards to the Balkan peninsula (W. & S. Yugoslavia, Albania and Greece).

It is possible that *E. sibthorpii* might be better treated as a subspecies of *E. veneta* (the earlier name), but sufficient material of the latter has not been seen on which to base a decision.

66. **E. thompsonii** Holmboe, Studies on the Vegetation of Cyprus, 121, fig. 36 (1914).

Type: Cyprus: Pissuri, a. 1905, *Jens Holmboe* 712 (G).

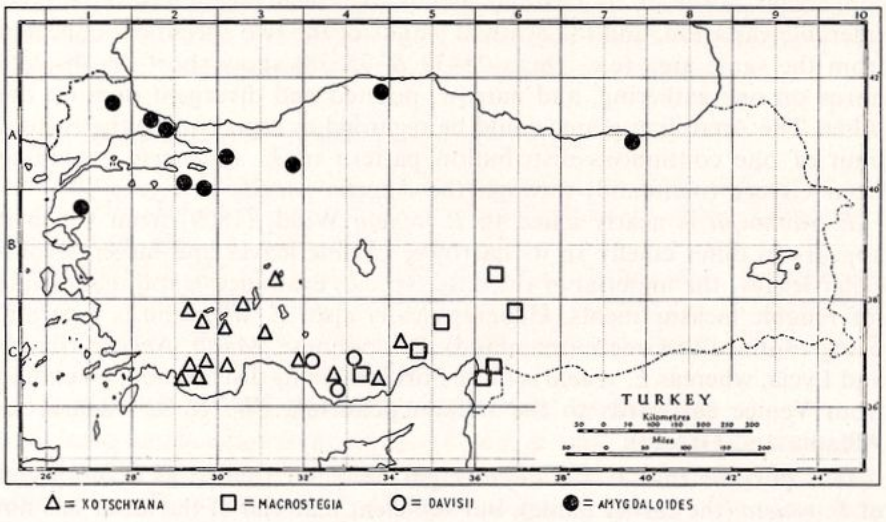
C4: prov. Içel, Findik Pinari above Mersin, 1200 m., 7 Apr. 1957, *Davis* 26498; Cilicia, a. 1895, *Siehe* 40 (as *E. amygdaloides*).

This little known species, growing on igneous slopes in *Quercus coccifera* maquis and reaching 1200 m., is related to *E. sibthorpii* Boiss. but distinct from it in its cauline leaves which are broader towards the apex and usually obtuse, and (*fide* Holmboe) by the shape of its cyathial glands which are "protracted into long subulate appendices". The Cilician specimens could be equated with *E. thompsonii* in all characters excepting the cyathial glands which are semilunar with short converging horns, and hardly agree with the description given by Holmboe; in some allied species (e.g. *E. sibthorpii* Boiss.), however, the horns show considerable variation, so that this character may well not be diagnostic for *E. thompsonii*. None of the specimens examined has capsules. *E. thompsonii* is probably restricted to Cyprus and Cilicia.

67. **E. kotschyana** Fenzl, Pugil. Plant. Nov. Syr. Taur. **1,** 7 (1842). Map 3.

Type: [Turkey]: in montosis Tauri occidentalis, *Kotschy* 480 (G; K; BM).

B2: prov. Denizli, Boz dağ, 2100 m., 16 July 1947, *Davis* 13367; Kale—Tavaş, 1150 m., 6 June 1938, *Huber-Morath* 5695. B3: prov. Isparta, Sultan dağ, above Yasian, 16–1800 m., 1 July 1899, *J. Bornmüller* 5545. C2: prov. Muğla, Girdev dağ, above Duğa, 1600 m., 6 Aug. 1947, *Davis* 14015; prov. Antalya, Kaş—Elmali, 27 July 1960, *Khan et al.* 222. C3: prov. Burdur, Tcheltickchi [Çeltikçi], May 1845, *Heldreich*; prov. Antalya, between Tepedeler yayla & Soğut Cumasi yayla near Çalbali dağ, 13 July 1949, *Davis* 15263; dist. Gebiz, Bozburun dağ at Taşli yayla, 27 July 1949, *Davis* 15774. C4: prov. Konya, Bozdağ near Ermenek, July 1872, *Péronin* 201; prov. Içel, Selefka [Silifke], Alaya mts., July 1930, *B. A. Byles* no. H1 1793.



Map 3. Distribution of *Euphorbia* in Turkey.

Common on screes and rocky knolls, often on limestone, from 1150–2100 m.

E. kotschyana is allied to *E. macrostegia* Boiss., but is easily separated by its larger capsules and seeds, thicker stems and taller stature. Whereas *E. macrostegia* is easterly in its distribution, extending from Cilicia to Lebanon and S. Iran, *E. kotschyana* is restricted to S.W. Anatolia and the Cilician Taurus.

68. **E. macrostegia** Boiss. in DC., Prodr. **15** (2), 171 (1862). Map 3.

Syn.: *E. erubescens* Boiss., Diagn. **1** (7), 90 (1846), non Meyer ex Boiss. (1862)!

E. macrostegia Boiss. var. *pauciradiata* Bornm. in Notizbl. Kön. Bot. Gart. Berlin **63** (7), 39 (1917).

Syntypes: in declivibus montis Kuh Delu [Kuh-e-Dil] Persiae australis, *Kotschy* no. 533 (G; K; BM)—type of *E. erubescens* Boiss.; [C5: near Mersin], in valle Guzeldere Ciliciae, *Balansa* 780 (G; K; BM); supra Eden [Ehden, near Bsherri] Libani, *Kotschy* n. 582 (G).

B6: prov. Maraş, dist. Göksun, Binboğa dağ, N.E. side of Işik dağ, 1900 m., 16 July 1952, *Davis* 20076. C4: prov. Içel, 1–2 km. N.E. and N. of Gülnar, 950–980 m., 7 June 1950, *Huber-Morath* 9963. C5: prov. Seyhan, dist. Karaisali, Asmancik yayla N.W. of Pozanti, 1450–1500 m., 28 June 1959, *Huber-Morath* 16083. C6: prov. Maraş, Ahir dağı, 1800–2100 m., July 1907, *Haradjian* 1688; prov. Hatay (Amanus), Soğuk Oluk near Belen, 700 m., 23 Apr. 1957, *Davis* 27026.

In ravines on limestone, in mixed deciduous oak or *Pinus brutia* forests, often in *Quercus* maquis, with an altitudinal range of 700–2100 m.

Var. *pauciradiata* Bornm. was based on its biradiate umbels—a character seen to be extremely variable. Specimens from the same gathering (*Davis* 27026) show the number of radii ranging from 2–5, so that this character does not seem to merit varietal status.

The two species closely allied to *E. macrostegia* are *E. kotschyana* and *E. amygdaloides*. From the former, *E. macrostegia* differs by its smaller capsules and seeds, thinner stems and shorter stature; from the latter, it can be distinguished by the shortly conical caruncles of its seeds, stems woodier and shrubby at the base, usually thicker cauline leaves and larger involucellar "plates" (2·5–4·0 mm. across at the broadest point). Geographically the three species are largely separate, although *E. kotschyana* overlaps with *E. macrostegia* in Cilicia; see distribution Map 3.

69. **E. amygdaloides** Linn., Sp. Pl. 463 (1753). Map 3.

Described from southern France and Germany (Herb. Linn. No. 71).

A1 (E): prov. Kirklareli, Istranca dağ, by Velika bridge, 25 June 1960, *H. Kayacik* 88. A1 (A): prov. Çanakkale, Ulu dağ, 24 Apr. 1883, *Sintenis* 84 (or 89 ?)—leaves glabrous and narrower, stature short. A2 (E): prov. Istanbul, Belgrad forest, 26 May 1960, *F. Yaltirik*. A3: prov. Bolu, dist. Ala dağ, Kartal kaya (Mt.), 2000 m., 11 Aug. 1960, *Khan et al.* 462; prov. Adapazari, Sapanca, 100 m., 30 Mar. 1957, *Davis* 26271—large form. A4: prov. Kastamonu, Küre—Inebolu, 720 m., 7 June 1954, *Davis* 21621.

A7: Trabzon, 50 m., 31 Mar. 1960, *Stainton* 8130—large form. B1: prov. Balikeşir, M. Ida [Kaz dağı], Kareikos, 23 June 1883, *Sintenis* 89. B2: prov. Kütahya/Bursa, 30 miles from Tavşanli towards Inegöl, 1200–1400 m., 23 June 1962, *Dudley* (D.36158a).

In pine forests, Euxine scrub and on woody shady hillsides, from sea level to 2000 m.

E. amygdaloides is closely related to *E. robbiae* Turrill and *E. davisii* M. S. Khan, and less so to *E. macrostegia* Boiss.; see under the respective species for differences.

Although the cauline leaves of *E. amygdaloides* are usually crisply puberulous on the under surface, variants with glabrous leaves have been seen in W. Anatolia (e.g. Trojan Ida, *Sintenis* 89). Glabrous plants from Aude and Pyrénées Orientales in France have been described as *E. chaixiana* Timb.-Lag. (in Mém. Acad. Toul. Sér. **4** (6), 152: 1856)—later reduced to a variety of *E. amygdaloides* by Boissier (in DC. Prodr. **15** (2), 170: 1862)—and this name has been attached to the glabrous variants from the Balkan peninsula by Hayek (Prodr. Fl. Pen. Balc. **1,** 130: 1924). Another glabrous variety described from Montenegro is var. *pachyphylla* Pant. in Ver. Ver. Naturk. N.F. **2,** 112 (1874). I have not seen enough material of the glabrous plants to form an opinion about the status of these taxa. It seems likely that glabrous variants are of polytopic origin.

The geographical distribution of *E. amygdaloides* extends from Ireland towards the east through Portugal and France to Middle and South Europe (as far south as Sicily). Northwards and eastwards it extends from the Balkan peninsula through W. and N. Anatolia into the Caucasus, S. Russia, N. Iran, and Turkestan. It is an introduced plant in N. America.

70. **E. robbiae** Turrill in Curtis, Bot. Mag. (London) **169,** t. 208 (1952–53).

Type: in Herb. Kew., cult. Herbarium Experimental ground, Kew, 13 April 1949.

E. robbiae differs from its closest ally *E. amygdaloides* L. in its greener, thicker cauline leaves which are glabrous on both surfaces when mature, larger capsules and seeds and more robust habit with many stems arising from a spreading superficial root system to form wide clumps. The cytological investigations by Janaki Ammal (as reported by Turrill) on the cultivated plants of *E. robbiae* revealed a large number of "pro-chromosomes" in the resting cells, and the somatic chromosome number of 42, instead of 18 as in European material of *E. amygdaloides*.

This species, whose seeds are said to have come originally from near Istanbul, has been in cultivation for several years at Kew, where (as claimed by Turrill) the plants have retained the characters distinguishing them from *E. amygdaloides*. However, *E. robbiae* has not been collected again from any wild locality, and its origin remains something of a mystery.

71. **E. davisii** M. S. Khan, **spec. nov.** Pl. 10. Map 3.

Affinis *E. amygdaloidi* Linn. sed indumento crispe pubescenti, statura humiliore, caulibus inferne lignosis ramosis, foliis caulinis minoribus recedit.

Herba perennis, suffruticosa, inferne in caudiculos ad 5 mm. crassos lignosos demum denudatos cicatricosos ramosa. *Indumentum* caulium et foliorum caulinorum et capsularum crispe pubescens. *Caules* floriferi plures ad 35 cm. longi, erecti, dense foliosi, infra umbellam ramis floriferis provisis; caules hornotini steriles, dense foliosi. *Folia caulina* (mediana) 20–30 mm. × 6–10 mm., obovata vel oblanceolata, petiolata (petiolo gracili, 2–7 mm. longo), integra, obtusa vel acutiora saepe breviter mucronata, raro retusa, superiora infra umbellam minora (7–10 mm. × 3–6 mm.), obovata vel obovato-oblonga, obtusa vel retusa. *Folia involucri* 6–10 mm. × 4–6 mm., obovata vel obovato-oblonga. *Radii primarii umbellae* 6–10, 2·0–4·5 cm. longi, graciles, plerumque semel bifidi. *Folia involucellae* in patellam plerumque usque medium connata (sinubis angustis separata), late oblonga vel suborbiculata, 10–20 mm. longa et 10–16 mm. lata. *Cyathia* 1·5–2·0 mm. longa, campanulata, parce hirtella, lobis ovato-oblongis, ciliatis, truncato-retusis, intus velutinis, glandulis semilunatis flavescentibus vel atrofuscis (in sicco), cornubus glandulae latitudini aequilongis vel longioribus latissimis obtusis. *Bracteolae* inter flores masculos multae apicem versus ciliatae. *Capsula* 4·0–5·0 mm. × 4·5–5·0 mm., trilobata, apice et basi depressa, coccis subcarinatis elevatim punctatis, stylis c. 2 mm. longis, apicem versus semel bifidis, ad basin coalitis. *Semen* 2·5–3·0 mm. × 2·0–2·3 mm., ovoideo-oblongum, laeve, nigrum; caruncula c. 1 mm. longa, substipitata, breviter conica, basi intus retusa, apice saepe rostrata. Fl. Jun.–Aug.

C4: prov. Antalya, Akdağ (S. of Geyik dağı), near little lake, rocky places, 2300 m., 28 Aug. 1947, *P. H. Davis* 14349 (*holotypus*, E) & 14384; prov. Içel, dist. Anamur (Cilicia Trachea) near Çamurlu yayla, 2100 m., 15 Aug. 1949, *Davis* 16256; prov. Konya, Yelibel dağ, Karaman—Ermenek, 2020 m., 10 June 1948, *Huber-Morath* 9405 (as *E. lycia* Boiss.).

This rather attractive alpine species is nearly allied to *E. amygdaloides* L.—a widely distributed Euro-Siberian species that occurs in N. & W. Anatolia but has not been reported from Cilicia. The new species differs in its crisply pubescent indumentum, smaller leaves, shorter stature and branched suffruticose base.

E. davisii is known from an altitudinal range of 2020–2300 m., growing on calcareous rocky ground, often on north slopes; it is probably endemic to the central (Isaurian) part of the Taurus where it has been found growing with *E. kotschyana* Fenzl in the same group.

72. **E. macroceras** Fischer et Meyer, Ind. Sem. Hort. Petrop. **4,** 36 (1837).

Holotype: [Caucasus] in montibus sylvaticis Cartiliniae et Karabagh, *Fischer & Meyer* (LE—n.v.).

B8: Erzurum, *M. Zohrab* 413.[1]

This species is closely allied to *E. oblongifolia* C. Koch with which it is often confused, but the cauline leaves with cuneate bases, and lax, much branched spreading umbellate radii easily distinguish it from the latter. *E. macroceras* also has a superficial resemblance to *E. squamosa* Willd.—another species from the Caucasus and Lazistan—but is readily distinguished by its connate involucellar leaves and smooth or punctate (instead of warty) capsules.

[1] Probably from between Erzurum and Trabzon.

E. macroceras is probably endemic to the Caucasus, Transcaucasia (incl. Armenia) and Lazistan. The only specimen seen from Turkey is Zohrab's scrappy gathering at Kew. Huet du Pavillon's plant from Köprübaşi (prov. Trabzon, BM!) labelled as *E. macroceras* is in fact *E. oblongifolia* C. Koch (*E. rumicifolia* Boiss.).

73. **E. oblongifolia** (C. Koch) C. Koch in Linnaea **21,** 726 (1848). Boiss. Ic. Euph., t. 115 (1866)—sub *E. rumicifolia* Boiss.

Syn.: *E. amygdaloides* L. var. *oblongifolia* C. Koch in Linnaea **19**, 17 (1846).
E. rumicifolia Boiss., Cent. Euph. 39 (1860)!

Holotype: [A2 (A)]: aus der Umgegend von Brussa [Bursa], *Dr. Thirke* (B—n.v.).

A2 (E): Constantinople, *Aucher-Eloy* 2040. A2 (A): prov. Bursa, Ulu dağ, 9 June 1889, *Emile Burnat*; Keles—Inegöl, 20 km. from Keles, 1500–2000 m., 18 May 1962, *Dudley* (D.34775); Taktaköprü forest (*Fagus*) between Inegöl and Domaniç, 1400 m., 2 July 1962, *Davis* 36406. A7: Trabzon, a. 1862, *Bourgeau*; prov. Gümüşane, Ligana [Zigana, dist. Torul], 1500–1800 m., 20 July 1889, *Sintenis* 1388; prov. Giresun, east of Tamdere, 1620–1700 m., 7 July 1958, *Huber-Morath* 16084; Sumila [in valley of Meryamana], 3 Aug. 1889, *Sintenis* 1532. A8: prov. Trabzon, Koeprubachu [Köprübaşi], between Trabzon and Bayburt, 4–500 m., May 1853, *Huet du Pavillon* (syntype of *E. rumicifolia* Boiss.); prov. Rize, dist. Ikizdere, Baltaş Tepe, 2800 m., 26 Aug. 1952, *Davis* 20949. B9: prov. Siirt, Müküş, *Kotschy* (syntype of *E. rumicifolia* Boiss.).

In rocky clearings in *Picea orientalis* and *Fagus orientalis* forests and on igneous rocky slopes, reaching 2800 m.

Boissier (Fl. Or.) erroneously cites *E. oblongifolia* (C. Koch) C. Koch as a synonym of *E. amygdaloides* L. In fact, *E. oblongifolia* is specifically distinct and has priority over *E. rumicifolia* Boiss. (1860) which must be treated as a synonym of Koch's species.

E. oblongifolia differs from its nearly allied species, *E. macroceras* Fisch. et Mey., in its cauline leaves with cordate, rounded or truncate bases (not attenuate) and by the abbreviated, less branched umbellate radii.

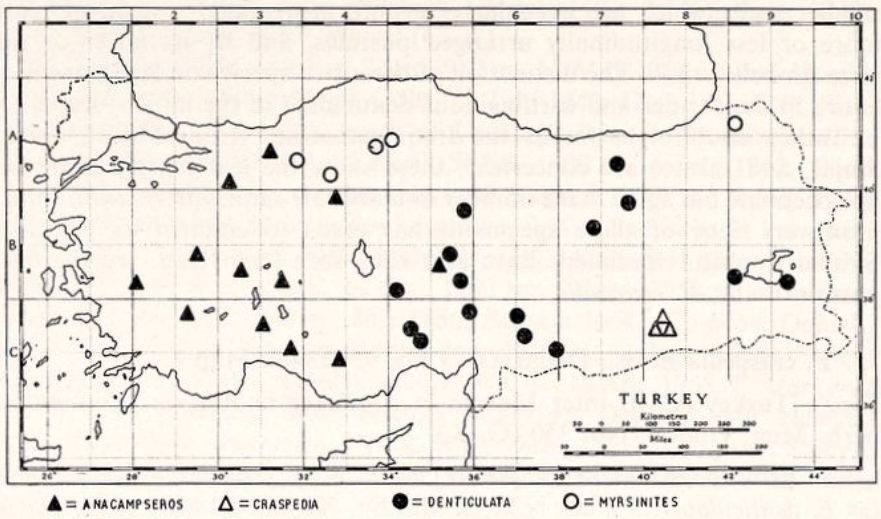
Although *E. oblongifolia* mainly belongs to the Euxine province (including W. Caucasus), it penetrates into Kurdistan. Aucher-Eloy's plant from Istanbul marks the westernmost point of its Black Sea range. It may be absent from the central part of North Anatolia—a type of distribution correlated by Czeczott (1937) with the existence of an arid Tertiary land bridge between this part of Anatolia and the Crimea.

Subsect. **Myrsiniteae** Boiss. in DC. Prodr. **15** (2), 173 (1862).

Type species: *E. myrsinites* L.

74. **E. denticulata** Lam., Encycl. Bot. **2,** 435 (1788 or 1789?) Map 4.

Syn.: *E. rotundata* Hochst. in Lorent, Wander. Morgenl., 344 (1845).
E. cilicica Boiss., Diagn. Or. **2** (4), 88 (1859)!



Map 4. Distribution of *Euphorbia* in Turkey.

Type: Aubriet's illustration in Paris.

A7: Gumusch-khane [Gümüşane], 4 June 1862, *Bourgeau* 241 and 632. B5: prov. Kayseri, Plaine de Césarée (Cappadoce) [Kayseri], 1200 m., July 1856, *Balansa* 270—as *E. anacampseros* (type of *E. cilicica* Boiss.); Bakir dağ, nr. Akoluk yayla above Kisge, 1800–2000 m., 30 June 1952, *Davis* 19354; prov. Niğde: Hasan dağ above Taşpinar, 1800 m., 16 June 1952, *Davis* 18986; prov. Yozgat: Akdağmadeni, Sofular Deresi, June 1960, *E. W. Curtis* 164. B7: prov. Tunceli, Munzur dağ above Ovacik, 2500 m., 16 July 1957, *Davis* 31199. B9: prov. Bitlis, Karz dağ above Kotum, 1950 m., 28 June 1954, *Davis* 22221; prov. Van, Hakâri—Van, 126 km. from Hakâri, ca. 2600 m., 19 July 1956, *Birand & Karamanöğlu* 475 (sterile). C5: prov. Içel, Gulek-Boghas [Külek], à 10 lieues au norde de Tarsous, 22 July 1855, *Balansa* 731 (as *E. anacampseros*); prov. Seyhan, Montibus Kassan Oghlu Gorumse [Gürümze, dist. Feke], 1620 m., 15 May 1859, *Kotschy* 97. C6: prov. Maraş: Ahir dağ above Maraş, 1300–1500 m., *Davis* 27392; prov. Urfa: Biredjik [Birecik], 11 Apr. 1888, *Sintenis* 277.

Endemic to Cilicia, eastern Anatolia and probably N. Iraq, growing usually on dry limestone slopes and igneous rocks, ascending to 2400 m.

E. pectinata Alboff (in Bull. Herb. Boiss. **2,** 640: 1894) has been treated as synonymous with *E. denticulata* Lam. by Prokhanov (cf.: Fl. U.R.S.S., **14,** 412: 1949), but the type material of the former species, "Artwin, a. 1893, Dr. *Radde* Exs. N.2", examined in Herb. Delessert at Geneva, shows the cauline leaves elliptic-oblong and the segments of the deeply incised cyathial glands broader and much lobed at the tips. Only more material from the Artvin region can decide whether *E. pectinata* Alboff is a taxon worthy of specific rank or merely an aberrant form of *E. denticulata* Lam. at the northernmost limit of the latter's geographical range.

E. denticulata is closely allied to *E. craspedia* Boiss. from which it can be separated by its fewer umbellate radii (not more than 5, rarely up to 8),

smaller seeds which are irregularly vermiform-wrinkled instead of with more or less longitudinally arranged pustules, and by its fewer or no infra-umbellar radii. The distinction of these two species on leaf margin—entire in the former and cartilaginous-denticulate in the latter—seems to be rather doubtful as far as the Iraqi gatherings (from Mosul, Erbil, Sinjar, and Jarmo) are concerned; these show the leaf margin more or less pectinate but agree in the number of umbellate radii with *E. denticulata*. However, none of these specimens has seeds to confirm its identity. Similar doubtful specimens have also been seen from Iran; see the discussion under *E. craspedia*.

75. **E. craspedia** Boiss., Diagn. Or. **1** (7), 95 (1846). Map 4.

Type: [Turkey (C8)]: inter Mardin et Assuaner in Assyria, *Kotschy* ex herb. Mus. Vindob. No. 350 (G, K).

C8: prov. Mardin: Terek [Derik] Mar.–May 1867, *Haussknecht* 868 (as *E. denticulata*); 3 miles N.E. of Mardin, 700 m., 26 May 1957, *Davis* 28618; Mardin—Diyarbakir, 24 km. from Mardin, 1000 m., 27 May 1957, *Davis* 28822.

Probably endemic to northern Mesopotamia and Iraqi Kurdistan, preferring limestone slopes and ascending to 1000 m.

The following plants from near Luristan in West Iran, examined at Kew and Edinburgh, (viz. Luristan, Aug. 1884, *Mark Bell*; Southern Kurdistan, 11 Mar. 1958, *L. F. Merton* 3241; 6 m. E. of Khurramabad, 11 Apr. 1929, *Cowan & Darlington*; Damavar, Bakhtiari, 3600 m., 5 May 1940, *Walter Koeltz* 15164; 40 km. from Kermanshah, inter Kermanshah et Shahabad, 14 May 1960, *A. Bent & H. E. Wright* 514–110), are unique in that they have leaves with a distinctly pectinate margin like *E. craspedia*, but as in *E. denticulata* the umbellate radii are not more than 7 and the infra-umbellar radii are absent. The fruiting material of these specimens is, however, inadequate to decide whether these plants from Luristan—an area rather far from the southern limit of both *E. craspedia* and *E. denticulata*—constitute a new taxon intermediate between these two species.

76. **E. anacampseros** Boiss., Diagn. **1** (5), 55 (1844). Map 4.

Key to varieties

Stems 5–28 cm. long, decumbent; median cauline leaves 10–22 mm. × 7–15 mm., subcoriaceous, leaf-margin usually scabrid or cartilaginous denticulate . . . . . a. var. *anacampseros*

Stems 28–45 cm. long, suberect; median cauline leaves 30–38 × 22–40 mm., usually thinner, leaf-margin ± entire . . . . b. var. *tmolea*

a. var. **anacampseros**

Syn.: *Euphorbia anacampseros* Boiss. var. *minor* Boiss. in DC., Prodr. **15** (2), 174 (1862)!

Syntypes: [Turkey (C2)]: in regione alpina montium Cariae, *Boissier* (G?—n.v.); Cadmi occidentalis [prov. Denizli, Honaz dağ] supra Gheyra, *Boissier* (G); orientem supra Colossam [Honaz], *Boissier* (G?—n.v.);

[Turkey (B2)], Tmoli circa Bozdagh, *Boissier* (G, E. K), June 1842; Caria interiori, aest. 1843, *Pinard* (G, K).

A2: Bilecik, 15 km. south of Söğut, 950 m., 13 May 1954, *Huber-Morath* 14265. A3: prov. Bolu, Abant Gölü, 17 July 1940, Herb. *B. V. D. Post.* B2: prov. Uşak, Elma dağ, north of Uşak, 10 June (a. ?) *Balansa* 186; prov. Kütahya, Murat dağ, at Kesik Söğüt, 1400 m., 5 July 1962, *Davis* 36700. B3: prov. Konya, Sultan dağ near Akşehir, 1750 m., 3 July 1948, *Huber-Morath* 9404; prov. Afyonkarahisar, A.K.—Sandikli, 31 km. from A.K., 1220 m., 12 May 1956, *Huber-Morath* 14266. B4: prov. Ankara, Beynam forest, 50 km. S.E. of city, 1200 m., 9 May 1958, *F. Markgraf* 10539. B5: Kayseri, 1200 m., July 1856, *Balansa* 1064. C2: prov. Denizli, 6 km. from Çukur Köy on Honas dağ, 1050 m., 2 June 1938, *Huber-Morath* 5278. C3: prov. Antalya, Akseki, 900 m., 18 Apr. 1958, *F. Markgraf* 11273; prov. Isparta, dist. Sütçüler (Isauria), Dedegöl dağ between Selköşe and Oruz Gaz yayla, 1 Aug. 1949, *Davis* 15913. C4: prov. Konya, Karaman—Ermenek, 53 km. from Ermenek, 1480–1580 m., 12 June, 1948, *Huber-Morath* 9403.

b. var. **tmolea** M. S. Khan, **var. nov.**

A typo caulibus longioribus ad 45 cm. longis suberectis, foliis caulinis majoribus (30–38 mm. × 22–40 mm.) plus minus integerrimis differt.

B1: prov. Izmir, dist. Ödemiş, collines entourant l'yaila de Bozdagh, 25 July 1854, *Balansa* (*holo.* G); Bozdağ, 16 Aug. 1950, *Davis* 18221.

E. anacampseros Boiss. is easily confused with *E. myrsinites* L. due to resemblances in seed characters and general facies, but the former species has only 3–5 umbellate radii instead of more than five, and rhomboid, ovate-rhomboid or rhomboid-orbicular cauline leaves.

E. anacampseros is endemic to the Irano-Turanian and the Mediterranean regions of C. & W. Anatolia, occurring in plains, cornfields, pine forests, brush-wood, steppe and also on calcareous and marly slopes of mountains up to 1750 m. Its ally *E. myrsinites*, which is a widely distributed species, is restricted in Turkey to the mountains in the North. The much larger var. *tmolea* is only known from Bozdağ (Tmolus) where it has been collected twice. As the typical form of the species grows on the same mountain, its status needs further investigation.

77. **E. myrsinites** Linn., Sp. Pl., 461 (1753). Map 4.

Syn.: *Euphorbia curtifolia* Chaubard in Bory & Chaubard, Exped. Morée **3,** 135 (1832)!

Described from Calabria [South Italy] and Monspelius [Montpellier, S. France], *Herb. Linn.* no. 69. In Clifford's herbarium there is only a plant with narrow erect stems and narrow lanceolate leaves, apparently distinct from *E. myrsinites* and obviously representing var. *angustifolius* of *Hort. Cliff.*

A1 (E): Tekirdağ, fide Stoyanov in Jahrb. Univ. Sofia **8–9,** 28 (1914)—n.v. A3: prov. Bolu, dist. Ala dağ, Kartal kaya (Mt.), 2000 m., 11 Aug. 1960, *Khan et al.* 463. A4: prov. Çankiri, dist. Ilgaz, Yaylacik, 1000 m., 5 June 1954, *Davis* 21531; prov. Ankara, Ankara—Kizilcahamam, Çamlidere orman, 7 June 1944, *Baki Kasapliğil* 293; A5: prov. Kastamonu,

Tosya, Elmalu dağ, 24 May 1892, *Sintenis* 3935. A8: prov. Çoruh (Artvin), Kordevan dağ (Yalnizcaın dağlari) near Kütül yayla, 2200 m., 28 June 1957, *Davis* 30217. B1: prov. Balikeşir, M. Ida [Kaz dağı], mont Kapu dağ, 12 June 1883, *Sintenis* 767.

Common on the mountains of N. Anatolia, often on igneous rocks up to 2700 m. Mainly central Mediterranean, occurring as far west as the Balearic islands and extending in the north through the Balkan peninsula into the Crimea; also reported from N. Iran (cf. Parsa, *Flore de l'Iran* **4,** 1273: 1949).

A Cyprian endemic (described elsewhere as *E. veneris* M. S. Khan) resembles *E. myrsinites* very closely in habit and has been previously confused with it. However, the latter, which does not grow in Cyprus, is distinguished by its wrinkled seeds and by its cauline leaves which are only twice as long as broad and with a usually scabrid margin. *E. myrsinites* is also closely related to a western Irano-Turanian species, *E. anacampseros* Boiss.; see the description of the latter for differences.

E. pontica Prokhanov (*type*, LE!), a new species said to be allied to *E. myrsinites*, has been described (in Fl. U.R.S.S. **14,** 740, t. 21, f. 2: 1949) from the mountains near Ardanuç in Prov. Artvin (N.E. Turkey). Prokhanov distinguishes *E. pontica* from *E. myrsinites* by the following characters: cauline leaves oblong-oblanceolate, more than twice as long as broad, more or less acuminate but not mucronate, almost entire; involucellar leaves not cordate at the base, the lower ones more or less reniform, slightly broader than long, the upper ones, suborbiculate often reddish; and also by the colour of the whole plant—greyish-green, not glaucous. (Sic).

These characters do not seem to be sufficiently valid to be taken as specific criteria due to their homologous variation in the related species, *E. myrsinites*. However, Andronaki's Artvin plant (Herb. Florae Caucasicae no. 484) which Prokhanov cites (*op. cit.* p. 408), and Stainton's gathering from the same locality (Artvin, 500 m. 14 Apr. 1960, no. 8177) do show the cordate base of the involucellar leaves and a slightly different shape of the cyathial glands. They are narrower and transversely oblong with the extreme ends drawn into short usually lobed horns which are more or less horizontally disposed (as shown in the illustration of *E. pontica* in Fl. U.R.S.S.; the glands on the type specimen are too inadequate for satisfactory examination). On the other hand, *E. myrsinites*, whose involucellar leaves are usually rounded at the base, has its cyathial glands transversely ovate with the horns arising from the under surface of the gland and more or less arranged parallel to or only slightly divergent from each other. Another specimen from Artvin (*Davis* 30217) has the glandular characters of *E. myrsinites* and thus does not approach *E. pontica*. More material of *E. pontica* is needed to assess the status of this seemingly very local plant; it may represent an aberrant peripheral population of *E. myrsinites*.

78. **E. marschalliana** Boiss., Diagn. Or. **1,** (7), 94 (1946) (excl. syn. *E. myrsinites* sensu M. B.). Prokh., in Fl. U.R.S.S. **14,** 410 (1949).

Syn.: *E. myrsinites* sensu Ledeb., Fl. Ross. **3,** 579 (1850), p.p. excl. specimina e Tauria, Boiss., Fl. Or. **4,** 1135 (1879) p.p., non L. (1753).

Syntypes: in tractu Suwant Prov. Talysch [Caucasia], *Hohenacker* (LE—n.v., K, G. W); Armenia, *Aucher* 5310 (P—n.v., K, G, BM).

B8: Erzurum, *M. Zohrab* 416.

Due to its close resemblance with *E. myrsinites* in general facies, *E. marschalliana* has been previously confused by Ledebour and Boissier (*loc. cit.*) with Crimean plants of the former species. *E. marschalliana*, however, is easily recognizable by its more or less smooth seeds (instead of vermiculate rugose) and smaller cauline leaves which are always prominently pectinate-margined. Another species from S. Transcaucasia and N. Iran, described as *E. woronowii* Grossheim, seems to differ from *E. marschalliana* only by its distinctly rugose seeds.

Whereas *E. myrsinites* extends as far north as the Crimea, *E. marschalliana* is absent from the Crimea (fide Prokh., *loc. cit.*) and is more easterly in geographical range. It extends from Turkish Armenia through S. Transcaucasia, Talysch, and Azerbaidjan to the south side of the Caspian.

79. **E. armena** Prokhanov in Komarov, Fl. U.R.S.S. **14,** 741 (1949).

Type: Armenia, Etchmiadsin prope Erevan, 8 Mar. (25 Apl.), 1910, *A. Grossheim* (LE—n.v., photo. E).

A9: prov. Kars: between Kağizman and Tuzluca, 16 Apr. 1957, *E. Sauer* 274/57. B9: prov. Karaköse: Aralykh to Takjalla [Takalty (?)], Aras plain, 9 Aug. 1910, *B. V. D. Post* 2037 (as *E. marschalliana* Boiss.).

E. armena is very closely related to *E. marschalliana* Boiss. with which it overlaps in Russian Armenia, but is easily distinguished by its fewer umbellate radii (5–7, not 8–20), broadly ovate involucellar leaves with a subcordate (instead of usually rounded) base. It is endemic to southern Transcaucasia and the adjacent part of Turkish Armenia.

80. **E. rigida** M. Bieb., Fl. Taur.-Cauc. **1,** 375 (Jan. 1808). Eig, Journ. Bot. (London) **75,** 187 (1937).

Syn.: *E. pungens* Banks & Sol. in Russell, Nat. Hist. Aleppo, ed. 2, 268 (1794), non Lam. (1788)!
E. biglandulosa Desf. in Ann. Mus. Par. **12,** 114, t. 14 (1808).
E. phlomos Candargy in Bull. Soc. Bot. Fr. **44** (4), 156 (1897).

Type: [Crimea]: in Tauriae meridionalis declivibus siccis mari nigro imminentibus, *Marschall von Bieberstein* (LE—n.v.).

A1 (E): prov. Çanakkale, Gallipoli, Kilia, *Ingoldby* 454—fide Rech. fil. *Fl. Aeg.*, n.v.; prov. Tekirdağ, Tekirdağ—Malkara above town of Kumbağ, 30–50 m., 11 May 1962, *Dudley* (D.34667). A1 (A): prov. Çanakkale, Renkoei [Erenköy], a. 1883, *Sintenis* 97. A2 (A): prov. Istanbul, Canlidja [Kanlica]—Tchibouki [Çubuklu], 3 May 1899, *Aznavour*; prov. Kocaeli, Taş Köprü, 18 Apr. 1932, *W. Kotte* 296. A5: Amasya, 4–600 m., 16 Apr. 1889, *Bornmüller* 818. B1: prov. Izmir, Smyrna, a. (?), *E. Whittall* 679. C1: prov. Muğla, Milâs—Ören, 29 km. from Milâş, 220 m., 27 May 1962, *Dudley* (D.35038). C2: prov. Denizli, nr. Çukurköy, 1000 m., 4 Apr. 1956, *Davis* 25609; prov. Muğla, dist. Fethiye, Kemer—Kestep, 50 m., 29 Mar. 1956, *Davis* 25468; prov. Antalya, Plain of Macri, a. 1842, Prof. *Forbes* 560. C4: prov. Içel, Silifke,

7 Mar. 1957, *E. Sauer* 57/38. C5: prov. Içel, dist. Tarsus, Körlüköy, 300 m., 5 Feb. 1958, *F. Markgraf* 11102; prov. Niğde, Ulukişla to Pozanti, 1080 m., 6 Apr. 1934, *E. K. Balls & W. B. Gourlay* 651.—*Aeg. Is.:* Samos, inter Hag. Konstantinos et Awlakia, 6 Apr. 1934, *K. H. Rechinger* 3766; Kos, montis Dikius supra Asphendin, 21 Apr. 1887, *Forsyth-Major* 433; Mytilini (Lésbos), in monte Olympos ad pagum Agassos, c. 940 m., 19 May 1934, *K. H. Rechinger* 4545; Chios, *F. Guiol.*

A plant of limestone rocks, deciduous forests and arable fields, often forming dominant saxatile populations on clayey sea-cliffs, reaching an altitude of 1200 m.

E. rigida M. B. was known by Boissier as *E. biglandulosa* Desf. (1808), and was later regarded by Eig (*op. cit.*) as synonymous with *E. pungens* Banks & Solander (1794). The latter, however, is a later homonym of *E. pungens* Lam. (1788) and therefore cannot be used. Both *E. rigida* M. B. and *E. biglandulosa* Desf. were described in the year 1808. Dr. W. T. Stearn informs me that according to a note inserted by C. D. Sherborn in the British Museum (Nat. Hist.) copy of Ann. Mus. Hist. Nat. Paris, vol. 12, the part of this volume containing the description of *E. biglandulosa* was published in August, 1808. As the preface of M. Bieberstein's Fl. Taur. Cauc. vol. 1 is dated "mense Januario a. MDCCCVII", it is reasonable to assume that this volume was published not long after January 1808, which would establish the priority of *E. rigida* M. B. over *E. biglandulosa* Desf.

E. rigida has been previously confused by various authors with a closely related Cyprian endemic now described elsewhere as *E. veneris* M. S. Khan, sharing with it the characters of lanceolate leaves and smooth seeds. However, the leaves in *E. rigida* are 4 or more times longer than broad (instead of 2·5–4 times as long as broad), the habit usually erect (instead of decumbent), and the involucellar leaves larger and yellowish.

The distributional range of *E. rigida*, which is absent from Cyprus, extends from Sicily through Greece to the Crimea, Turkey (mainly in the Mediterranean region), W. Caucasus, Anti-Lebanon, Jordan and Palestine.

Subsect. **Crotonopsideae** Boiss. in DC. Prodr. **15** (2), 101 (1862).

The only representative, *E. petiolata*, must be regarded as the type species. Allied to Subsection *Oppositifoliae*.

81. **E. petiolata** Banks & Solander, in Russell, Nat. Hist. Aleppo, ed. 2, **2,** 253 (1794).

Syn.: *Croton denticulatus* Geiseler, Crotonis monogr., 72 (1807).
E. malacophylla Clarke, Travels, **2,** 354 (1812).
E. lanata Sieb. ex Spreng., Syst. **3,** 792 (1826).
E. syriaca Spreng., Syst. **3,** 792 (1826).
E. lanata Sieb. ex Spreng. var. *microphylla* Post, Pl. Post. **2,** 22 (1891)!
Chrozophora warionis Cosson ex Battandier et Trabut, Fl. Alg. **2,** 804 (1895)!
E. petiolata Banks & Sol. var. *microphylla* (Post) Eig in Jour. Bot. (London) **75,** 192 (1937)!

Holotype: [Syria] Aleppo, *Russell* (BM).

B7: prov. Malatya, Elazığ—Malatya, Euphrates bridge, 1 Sept. 1954, *Davis* 24805.

A weed of vineyards, fallow fields and steppe.

E. petiolata is characterized by its deeply pectinate-margined glands and undivided styles; allied to Subsect. *Oppositifoliae* but easily distinguished by its petiolate woolly leaves, pectinate glands and quadrangular pustular seeds.

Mainly Eastern Mediterranean but penetrating into Iraq and Iran. Prokhanov (Fl. U.R.S.S. 14: 476) records it from Mountain Turkmenia in Central Asia. It presumably occurs spontaneously in Algeria (cf. Battandier et Trabut, *op. cit.*) where it was described as *Chrozophora warionis*.

Subsect. **Decussatae** Boiss. in DC., Prodr. **15** (2), 99 (1862).

Type species: E. lathyris Linn. (The only species in the Subsection.)

82. **E. lathyris** Linn., Sp. Pl., 457 (1753).

Described from S. France and Italy. (Herb. Linn. no. 32).

A4: prov. Kastamonu, Inebolu, 45 km. from Kastamonu, 13 July 1962, *Davis* 38546.

This solitary gathering from Turkey came from gravel and sand on the shore near *Platanus* trees, where it was growing with *Oxalis corniculata* L. (s.l.). *E. lathyris* is common in S. Europe but also extends westwards to the British Isles and Atlantic islands. It has also been reported as occurring in Mexico, Peru, Abyssinia, E. Europe, Caucasus, C. Mediterranean, China, etc.—in many areas as a spontaneous weed. It is probably an alien on the Black Sea coast.

Sect. **Anisophyllum** (Haworth) Roeper ex Duby in A. P. de Candolle, Bot. Gall., 412 (1828?)

Type species: E. peplis L. (cf. Wheeler: 1941).

83. **E. peplis** Linn., Sp. Pl. 455 (1753).

Described from the coast of Narbonia [Southern France] and Spain (Herb. Linn. no. 18).

A1 (E): prov. Tekirdağ, Marmara Ereğlesi, c. 45 km. from Tekirdağ, 8 Aug. 1962, *Davis* 39194. A1 (A): prov. Çanakkale, Dardanelles, 4 Sept. 1883, *Sintenis* 765. A2 (A): prov. Istanbul, Kilia, 29 July 1891, *Aznavour*. A3: prov. Bolu, 10 km. east of Akçakoca, sea level, 14 July 1962, *Davis* 37463. A6: prov. Ordu, Ünye—Terme, 5 Sept. 1954, *Davis* 24950; prov. Samsun, Bafra—Samsun, 10 km. N.W. of Samsun, 2 July 1958, *Huber-Morath* 16088. A7: Gumusch-Khane [Gümüşane], 2 June 1862, *Bourgeau*; prov. Trabzon, coastal land, 5 Aug. 1957, *Davis* 32023. B1: prov. Izmir, Smyrne, 4 July 1854, *Balansa*; prov. Çanakkale, Assos, 17 June 1883, *Sintenis* 705. B4: prov. Ankara, shore of Tuz Gölü, 25 km. north of Koçhisar, c. 900 m., 28 July 1956, *McNeill* 294. B8: Erzurum, a. (?),

M. Zohrab 414. C1: prov. Izmir, north of Kuşadasi, 16 km. from Selçuk, 22 June 1954, *Demiriz* (*Huber-Morath* 14267). C2: prov. Muğla, dist. Marmaris, Kizil Cortmen, 19 July 1960, *Khan et al.* 126. C3: prov. Antalya, Lara, 8 km. E. of Antalya, 23 May 1950, *Huber-Morath* 9957. C5: prov. Seyhan, Adana—Karataş, 4 July 1944, *Baki Kasapliğil* 38.—*Aeg. Is.:* Kos, Kephalo, 8 June 1935, *K. H. & F. Rechinger* 8060; Chios, Amadhes, 10 July 1939, *J. W. O. Platt* 335; Rodhos, 28 June 1870, *Bourgeau.*

Common on the sandy beaches round the coast but also penetrating inland into Armenia and on the shores of salt lakes in the Central Anatolian plateau, reaching an altitude of at least 900 m. Outside Turkey, it is found throughout the Mediterranean littoral and extends as far as the British Isles; in the east and the north it extends through eastern Europe to the Crimea, Caucasus, and the Ural mountains.

E. peplis is probably related to *E. chamaesyce* L. with which it shares, among other characters, the general leaf shape, appendaged glands and the ecarunculate seeds, but is easily separated by its thicker glaucescent leaves, larger smooth seeds and more robust habit.

84. **E. chamaesyce** Linn., Sp. Pl., 455 (1753).

Syn.: *E. canescens* Linn., Sp. Pl. ed. 2, 652 (1762).
E. chamaesyce L. var. *canescens* (L.) Roep., in Duby, Bot. Gall. (ed. 2) **1,** 412 (1828).
E. chamaesyce L. subsp. *canescens* (L.) Holmboe, Studies Veg. Cyprus, 118 (1914).

Lectotype: Löffling's specimen from Spain (Herb. Linn. no. 15)—see below.

A1 (A): prov. Çanakkale, Dardanelles, 19 May, 1883, *Sintenis* 1005. A2: prov. Istanbul, Constantinople, Aug. 1845, *Nöe* 215. A4: prov. Zonguldak, S. of Karabük, 250–300 m., 6 Aug. 1962, *Davis* 39045. B1: prov. Izmir, Smyrna, 21 Sept. 1860, *J. D. Hooker & D. Hanbury*—as *E. massiliensis.* B4: Ankara, 26 June 1932, *W. Kotte* 297. B7: prov. Tunceli, Ovacik, 1400 m., 21 July 1957, *Davis* (D.31489). C2: prov. Antalya, dist. Kaş, Demre gorge, 26 July 1960, *Khan et al.* 200; Denizli, 9 July 1904, *Saint-Lager*; prov. Muğla, dist. Marmaris, Armelli Bükü, 19 July 1960, *Khan et al.* 135. C3: prov. Isparta, dist. Eğridir, Barla, 30 July 1960, *Khan et al.* 347. C4: prov. Konya, Sille, 1000 m., 14 Aug. 1958, *F. Markgraf.* C6: prov. Hatay, Mont. Amanus, 240–900 m., Sept. 1913, *Haradjian* 4661. C8: Diyarbakir, 680 m., 29 June 1949, *Huber-Morath* 9397—*Aeg. Is.:* Lésbos, fide Candargy in Bull. Soc. Bot. Fr. **45,** 181 (1898), as new varieties *exappendiculata* and *grandifolia*—n.v.

On calcareous soil and dry gravelly plains, often a very common weed in fallow fields, ascending up to 1400 m.

E. canescens L. was described from Spain, being separated from *E. chamaesyce* L. by its denser ("white-villose") indumentum and obsoletely emarginate and obsoletely crenate leaves. Although completely glabrous forms occur sporadically in Europe, every transition from sparsely hairy to densely canescent has been seen in both the European and Orient material. Similarly leaf margin and leaf apex also vary as observed in both

glabrous and hairy forms. *E. canescens* L. has been maintained as a distinct species by Prokhanov, and in the illustration (Fl. U.R.S.S. **14,** t. xxv, f. 1: 1949) the presence of dark central markings on the leaves and the rather prominent crenate leaf margin have been shown as further distinguishing characters. Holmboe treats this taxon as a subspecies, considering that the canescent forms have a separate area of distribution in the Near East.

Several races, forms and subforms of *E. chamaesyce* have been recognized by Thellung in Ascherson & Graebner, Synop. Mittel-Europ. Fl. **7,** 450 (1917). However, none of the varying characters of the leaf, viz. indumentum, margin, apex and dark central markings, is constant enough to be taken as a criterion even for varietal rank, nor is the supposed separate geographical area well enough marked to warrant recognition of *E. canescens* as a subspecies.

E. chamaesyce is nearly allied to *E. humifusa* Willd. (Central and N. European) from which it differs by its rugose seeds (instead of smooth or minutely pustulose) and by its more or less hairy, broader leaves (instead of glaucescent and narrow). Other species which approach *E. chamaesyce* are *E. granulata* (entire leaves, narrower seeds—from Egypt, Arabia, and India) and *E. sanguinea* (narrower, longer leaves, and obscurely rugose seeds—from Arabia, Africa and India).

A very common invasive weed found throughout the Mediterranean and in most parts of Europe and the Near East. It has also been reported as a sporadic weed in North America.

Wheeler (1941) typified *E. chamaesyce* L. by Patrick Brown's Jamaican plant in the Linnaean herbarium, basing his decision on the photograph and some fragments of this specimen which he examined at the Field Museum, Chicago (U.S.A.), and on the description and localities given in *Hort. Cliff.* cited among the earlier references by Linnaeus. Wheeler regarded the plant commonly known as *E. prostrata* Aiton (1789)—native of the New World but now widely introduced in the other tropical and subtropical regions—as conspecific with *E. chamaesyce* L.

In the Linnaean herbarium there are two specimens labelled as *E. chamaesyce* (nos. 15 & 17), and a third as *E. canescens* (no. 16). There are also 3 plants (2 glabrous, 1 hairy) in *Herb. Cliff.* named as one or the other.

Although Linnaeus in his *Species Plantarum* cites *Hort. Cliff.* under synonymy, he altered considerably the description and evidently also the concept of *E. chamaesyce*. Accordingly the species should be typified by a specimen in the Linnaean herbarium. As the type localities cited for this species in the *Species Plantarum* are S. Europe and Siberia, the name of this entity is applicable to the plant native to the Mediterranean region and Orient.

According to Savage's catalogue (1945), plant no. 15 of the Linnaean herbarium was collected by Löffling who was in Spain in 1752 and sent material and notes to Linnaeus (cf. Stearn in Introduction to Linn., Sp. Pl.: 1753, vol. 1, facs. ed., p. 136: 1957). Specimen no. 16 came from Alströmer during his travels in Spain and the South of Europe from 1760–1764 (cf. Savage's *Catalogue*; Jackson's *Index to Linn. Herb.*: 1912), and the third was evidently collected in Jamaica by Patrick Brown whose herbarium was bought by Linnaeus in 1758.

The two plants of Löffling and Alströmer (both hairy forms) conform to the diagnosis in *Species Plantarum*. The Jamaican plant has more or less entire and glaucescent leaves. The only plant apparently in the possession of Linnaeus before the publication of his *Species Plantarum* (1753) was Löffling's gathering from Spain (1752) which should therefore be taken as the lectotype of *E. chamaesyce*.

E. prostrata Aiton is evidently a distinct species and has been typified by Fawcett & Rendle (Fl. Jamaica **4** (2), 341: 1920) by a specimen in the British Museum (Herb. Cliff.). In this work, they drew attention to Brown's specimen from Jamaica representing this species but named as *E. chamaesyce* in the Linnaean herbarium.

SPECIES IMPERFECTLY KNOWN OR DOUBTFULLY RECORDED FROM TURKEY

1. **E. belgradica** Forskahl, Fl. Egypt. Arab., 211 (1775).

"Caule erecto, ramis alternis, dichotomis; foliis oppositis: caulinis oblongis, serrulatis, superioribus semicircularibus, omnibus sessilibus; capsulis solitaris, axillaribus, tuberculatis."

—ad pagum Belgrad prope Constantinop. rarium in sylvis, *Forskahl.*

According to Christenson in Dansk. Bot. Arkiv **4** (3), 34 (1922), it seems that no botanist has seen the type specimen. Boissier maintains that this plant is probably a spring form of *E. pubescens* Vahl (i.e. *E. verrucosa* L.) or *E. platyphyllos* L.

2. **E. cornuta** Pers., Syn. **2,** 17 (1807).

This chiefly N. African species was enumerated under its synonym *E. retusa* Forsk. in Tchihatcheff's *Asie Mineure* (Bot.) **1,** 163 (1860). The specimen cited was "Bithyniae Olympo, *Dominique Sestini*". I have not seen this nor any plant representing this species from Anatolia, but for phytogeographical reasons the record seems highly unlikely to be correct.

3. **E. dulcis** L., Sp. Pl., 457 (1753).

This controversial entity was mentioned by Tchihatcheff (*op. cit.* p. 159) as occurring at Trabzon ("Sylvis circa Trapezunt, *D'Urv.*, *Enum.*) and in Russian Armenia ("prov. Erivan, alt. c. 1460 m., *C. Koch*"). The species (in the sense of Jacquin) is not recorded for Transcaucasia in the Fl. U.R.S.S.

4. **E. epithymoides** Jacq., Fl. Austr. **4,** 23, t. 344 (1776).

Reported by Boissier (Fl. Or.) from Alem dağ on the Asiatic side of the Bosphorus ("in monte Alemdagh Anatolia borealis, *Nöe*"). I have not seen this specimen nor any plant referable to this C. & E. European species from Turkey.

5. **E. erythradenia** Boiss., Diagn. **1** (7), 92 (1846).

Hayek in Ann. Naturh. Hofmus. Wien. **28,** 178 (1914) reported this species from the Taurus mountains—"Südtaurus: Sonnige Abhänge bei Maaden, 2000 m. [*Siehe*]"—n.v. Hayek may have mistaken the Cilician endemic *E. schottiana* Boiss. for *E. erythradenia* which it resembles in habit; the latter is restricted to S.W. Iran.

6. **E. humifusa** Willd., Enum. Hort. Berol. Suppl., 13 (1814).

Recorded by Handel-Mazzetti (in Ann. Naturh. Hofmus. Wien. **23,** 148: 1909) and by Rechinger fil. (Enum. Fl. Const. in Fedde Rep. Beih. **98,** 9: 1938) from near Istanbul. In both cases, the specimen cited wa "Prinkipo, *Handel-Mazzetti*"—specimen not seen. Hayek records this North American species as adventive in Croatia.

7. **E. lagascae** Sprengel, Neue Entdeck. **2,** 115 (1821).

This species, native of Spain and Canaries, was collected only once near Istanbul ("a. 1845, *Nöe* 226"—G; K)—probably growing as a casual weed.

8. **E. mucronata** Clarke, Travels, **2,** 260 (1812).

"Euphorbia fruticosa, glabra; foliis ovato-lanceolatis mucronatis integerrimis; foliolis involucri ovalibus; involucelli obovatis, integerrimis, petalis dentatis; capsulis verrucosis glabris."—Makri bay [near Fethiye], *Clarke* (BM?).

Clarke refers to this plant as a shrubby "Daphne" with slender flexuose shoots, pointed leaves and "petals toothed nearly wedge-shaped". There is no species reliably recorded from the Lycian coast which matches this description.

9. **E. nicaeensis** All., Fl. Pedem. **1,** 285, t. 69, fig. 1 (1785).

This S. European plant was recorded twice; by Tchihatcheff (*op. cit.* p. 163), who cites his own gatherings from Lycaonia, Galatia, and Cappadocia; and by Wettstein in Sitzm. Kaiserl. Akad. Wissen. **98** (4), 386 (1889), from "Buldur-See" [Burdur gölü in prov. Burdur] as collected by *Heider*. These specimens cited (probably in Algiers) could not be examined; they probably represent either *E. pannonica* Host or *E. macroclada* Boiss. which are very similar to *E. nicaeensis* in vegetative characters.

10. **E. pusillima** Post in Bull. Herb. Boiss. **3,** 162 (1895).

Type: habitat in glareosis rupium vulcanicorum ad basin montis Kurd Dagh ad orientem pagi Tcheftalik; floret aprili [*Post*] no. 389 (K; BM; G).

The type specimen, which has no capsules, is similar to *E. aucheri* Boiss. from Iran. Most of Kurt dağ is in Syria and it seems unlikely that the plant was collected on the Turkish side of the mountain. Its taxonomic status remains in doubt.

11. **E. scopoliana** Steudel ex Boiss. in DC. Prodr. **15** (2), 87 (1862).

Syn.: *E. scopoliana* Steudel, Nomencl. Bot. (ed. 2) **1,** 615 (1840), nomen nudum.
E. fimbriata Scopoli, Delic. Insubri. **3,** 8, t. 4 (1788), non alior.

The locality cited by Steudel and Scopoli was Aleppo. Boissier (*loc. cit.*) observed that the original locality of this cactoid *Euphorbia* was not known and that it was certainly not spontaneous at Aleppo. This species, similar to *E. mamillaris* L. (tropical African) in habit, might have been

cultivated at Aleppo. In *Index Kewensis*, *E. scopoliana* has been given as a native of Cilicia, but no dendroid succulent *Euphorbia* has so far been reported from Anatolia and the natural occurrence of one seems highly unlikely.

12. **E. segetalis** L., Sp. Pl., 458 (1753).

Mainly S. European. Reported by Tchihatcheff (*op. cit.* p. 164) from near Istanbul ("circa Byzantium, *Rigler*"—n.v.).

13. **E. spinosa** L., Sp. Pl., 457 (1753).

A species centred in the N. Mediterranean (from Dalmatia westwards). It was enumerated by Tchihatcheff (*op. cit.*) as occurring on the islands of Leros and Samos (quoted from D'Urv., Enum.) and in Armenia ("valle fl. Tchoruk [Çoruh], alt. 478–975 m., *C. Koch*"—n.v.). Although its occurrence on the east Aegean islands is a possibility, its Armenian locality is highly improbable. It is not mentioned in Rechinger's *Flora Aegaea*.

13. **E. thyrsoidea** Boiss. in DC. Prodr. **15** (2), 164 (1862).

A Himalayan plant. Tchihatcheff (*op. cit.* p. 167) erroneously cites an Anatolian specimen ("Karamania"—n.v.) as representing this species, still undescribed at the time.

Key To Turkish Euphorbias Based On Seed Characters Alone

This key is an attempt to see how far the seed characters allow one to run down the species. Such a key may prove useful, especially to the departments of forestry and agriculture in Turkey. Previously seed keys for Euphorbias have been published, e.g. for European species by Rössler (1943); for the species in Iowa, U.S.A. by Murley (1945); for the Moroccan species by Vindt (1953).

The seed lengths given in this key are taken without the caruncle and by measuring the dorsal side of the seed. The greatest breadth of the seed is measured. The instrument used for all measurements was a Leitz mounted lens with a built-in micrometer which allowed the measurements to be made up to 1/10 of a millimetre. In many species, the caruncle is deciduous; hence one should examine enough material, preferably of younger seeds, before deciding whether the seed is carunculate or not.

In some cases of smooth seeds it is impossible to distinguish the species of certain groups, e.g. Subsect. *Myrsiniteae*, group "*Amygdaloides*" and the "*Petrophila* complex". Although this shows that closely related species have similar seeds, a number of apparently unrelated species belonging to Subsect. *Galarrhaeae* (e.g. *E. apios*, *E. cybirensis*, and *E. acanthothamnos*) have seeds resembling each other so closely that they are virtually indistinguishable. It appears that smooth seeds have been derived independently of other characters in several different evolutionary lines within the genus.

1.	Seed sculptured	2
—	Seed smooth	34

2. (1) Seed more than 3 mm. long 3
— Seed not more than 3 mm. long 9

3. (2) Apex rounded or pointed in the centre . . . 4
— Apex obliquely truncate 8

4. (3) Surface with distinct vermiform wrinkles . . . 5
— Surface with obscure wrinkles, almost smooth *marschalliana*

5. (4) Caruncle with margin curved outwards, undulate, base equal to breadth of seed apex. Seed 3·0–3·5 mm. . *anacampseros*
— Caruncle with margin curved inwards, not undulate, often only longitudinally sulcate 6

6. (5) Seed not more than 3·5 mm. long . . *myrsinites*
— Seed 4·0 mm. or more long 7

7. (6) Seed 2·0–2·8 mm. broad at base; 4·0–4·5 mm. long *denticulata*
— Seed 3·0–3·5 mm. broad at base; 4·5–5·5 mm. long *craspedia*

8. (3) Seed tetragonal, c. 3·5 mm. long; surface with scattered pustules *petiolata*
— Seed ovoid, c. 6 mm. long; surface with narrow irregular wrinkles *lathyris*

9. (2) Seed surface with minute tubercles 10
— Seed surface without tubercles 13

10. (9) Seed with 3 or more transverse grooves on each face; base truncate; caruncle persistent, stipitate. (Seeds 2·0–2·5 (–3·0) mm. long) . . . . . *phymatosperma*
— Seed without transverse grooves on any face; base rounded; caruncle persistent, deciduous or absent, if persistent then flat, not stipitate 11

11. (10) Seed oblong-tetragonal; tubercles scattered, whitish on darker surface 12
— Seed ovoid-subcompressed; tubercles arranged in ± longitudinal lines, brown, of the same colour as the surface. (Caruncle flat, persistent) . . . . . *verrucosa*

12. (11) Seed c. 1·5 × c. 1·0 mm.; ecarunculate . . *aleppica*
— Seed 1·0–1·2 × 0·6–0·8 mm.; caruncle deciduous *exigua*

13. (9) Seed surface with usually 6 parallel longitudinal grooves *aulacosperma*
— Seed surface not as above 14

14. (13) Seed surface with 3 or more transverse grooves on each face, manifestly dorsiventrally compressed. (Seed 1·0–2·0 mm. long) *falcata*
— Seed surface with pits or wrinkles in various patterns, not transversely grooved; ovoid, tetragonal or only subcompressed 15

15. (14) Each of the 2 ventral faces with a longitudinal groove; each of the lateral and dorsal faces with a longitudinal row of rounded pits 16
— Ventral faces (if well marked) without longitudinal grooves; pits, if present, not in longitudinal rows 17

16. (15) Seed 1·0–1·6 mm. long; caruncle depressed, retuse at base; pits deep . . . . . *peplus*
— Seed 1·7–2·5 mm. long; caruncle conical or conico-pyramidal, not retuse at base; pits shallow . . . *herniariifolia*

17. (15) Caruncle almost half the length of seed, globose-oblong; seed oblong-cylindrical, with few scattered shallow pits. (Seed 1·5–2·0 mm. long) . . . . . *isaurica*
— Caruncle (if present) less than half the length of seed, not globose-oblong; seed not oblong-cylindrical; pitted or wrinkled 18

18. (17) Seed surface with deep or shallow pits, not wrinkled . 19
— Seed surface wrinkled, not pitted 25

19. (18) Seed ovoid; sides rounded 20
— Seed ovoid-tetragonal or ovoid-oblong; often dorsiventrally subcompressed 21

20. (19) Pits deep, rounded . . . . . *taurinensis*
— Pits shallow, irregular . . . . . *pinea*

21. (19) Caruncle obscure; seed brown with shallow scattered pits; ovoid-oblong. (Seed 2·0–2·2 × c. 1·5 mm.) . . . . *cassia*
— Caruncle prominent; seed usually greyish with shallow or deep pits; ovoid-tetragonal or dorsiventrally subcompressed . 22

22. (21) Seed ovoid-tetragonal, sides straight, 1·8–2·3 × 1·3–1·5 mm. *ledebourii*
— Seed dorsiventrally subcompressed, back curved outwards 23

23. (22) Seed apex nearly as wide as the base. (Seed 1·7–2·5 × 1·0–1·8 mm.) *petrophila*
— Seed apex distinctly narrower than the base . . . 24

24. (23) Pits narrow, deep, crowded; seed 2·0–2·2 × 1·3–1·7 mm. *pisidica*
— Pits broad, shallow, scattered; seed 2·0–2·5 × 1·5–1·8 mm. *pestalozzae*

25. (24) Wrinkles discontinuous and in ± linear series *rhytidosperma*
— Wrinkles continuous, not in a linear series . . . 26

26. (25) Seed narrowly or broadly ovoid with ± rounded base . 27
— Seed oblong-tetragonal or ovoid-tetragonal with truncate or rounded base 31

27. (26) Caruncle transversely ovate or semicircular; wrinkles in a regular honeycomb-like pattern. (Seed 2·0–2·5 × 1·5–1·7 mm.) *helioscopia*
— Caruncle rudimentary or absent, if present then transversely ovate; wrinkles in various irregular patterns . . . 28

28. (27) Seed dark-brown; wrinkles in ± honeycomb-like pattern 29
— Seed greyish; wrinkles vermiform or irregularly reticulate 30

29. (28) Caruncle erect, hemispherical, retuse at the base on the ventral side; seed 2·0–2·2 × 1·5–1·7 mm. . . . *oxyodonta*
— Caruncle rudimentary or absent; seed c. 2 × c. 1·5 mm. *haussknechtii*

30. (28) Seed 2·5–3·0 × c. 1·8 mm. with ± longitudinally arranged vermiform wrinkles; caruncle pyramidal, c. 1 mm. long *cheiradenia*
— Seeds c. 2·0 × c. 1·5 mm. with ± irregularly reticulate wrinkles; caruncle shortly conical, c. 0·5 mm. long . . *pinea*

31. (26) Seed greyish with wrinkles of the same colour . . 32
— Seed brown with greyish wrinkles . . . *guestii*

32. (31) Base truncate; seed 1·3 × 0·7 mm.; wrinkles ± transverse 33
— Base ± rounded; seed 1·5 or more × 1·0 mm. or more; wrinkles irregular . . . . . *arvalis*

33. (32) Seed carunculate; oblong-tetragonal with short thick interrupted transverse wrinkles on each face . . . *szovitsii*
— Seed ecarunculate; narrowly ovoid-tetragonal with narrow, faint, continuous wrinkles on each face . . *chamaesyce*

34. (1) Seed ± globose; apex rounded; ecarunculate; seed colour greyish or light brown, often with lighter specks . . . 35
— Seed not globose; apex pointed, obliquely truncate or rarely rounded; caruncle present or absent; seed colour greyish to dark brown 36

35. (34) Seed c. 4–5 mm. across . . . . *macrocarpa*
— Seed 1·5–2·5 mm. across . . . . . *eriophora*

36. (34) Seed ± oblong-tetragonal; apex rounded but with a small abrupt elevation in the centre; base truncate; caruncle conical. (Seed 3·0–3·5 × 0·7–2·3 mm. Subsect. *Myrsiniteae*, p.p.) *marschalliana*, *armena*, *rigida*
— Seed not oblong-tetragonal; apex obliquely truncate, pointed, or rounded but not elevated in the centre; base truncate or rounded, caruncle present or absent 37

37. (36) Seed ± turbinate; apex pointed; caruncle absent . . 38
— Seed not turbinate; apex obliquely truncate or rounded; caruncle present or absent 39

38. (37) Seed c. 2·5 × c. 1·5 mm.; surface with whitish covering swelling to form a mucilaginous envelope when moistened *peplis*
— Seed 3·0–3·5 × 2·5–2·8 mm.; surface greyish, often with darker spots, not swelling to form a mucilaginous covering when moistened . . . . . *paralias*

39. (37) Base ± truncate; seed oblong or ovoid-oblong; caruncle present, ±persistent 40
— Base ± rounded (if truncate, then seeds dorsiventrally compressed); seeds of various shapes; caruncle present, often deciduous 44

40. (39) Seed subcarinate on back and sides 41
— Seed with back and sides rounded, not subcarinate . . 42

41. (40) Seed 2·5–3·5 × 2·0–2·3 mm.; caruncle c. 1 mm. long, pyramidal *macroclada*
— Seed 2·0–2·5 × 1·5–1·7 mm.; caruncle c. 0·5 mm. long, shortly conical . . . . . *pannonica*

42. (40) Caruncle 2 mm. or more long, pyramidal, deeply longitudinally sulcate, excavated on its ventral side, sessile; seed apex transversely truncate; seed 3·5–4·0 × 2·8–3·0 mm. *ispahanica*
— Caruncle not more than 1 mm. long, peltate or depressed and projected towards the raphal side; stipitate or subsessile; seed apex obliquely truncate; seed 2·5–3·5 × 1·8–3·0 mm. . 43

43. (42) Caruncle stipitate, often peltate; seed usually larger, 2·5–3·5 × 2·0–3·0 mm. (Group "*Amygdaloides*", p.p.) *sibthorpii*, *kotschyana*, *macrostegia*
— Caruncle sessile or subsessile, depressed, often projected towards the raphal side; seed usually smaller, 2·0–3·0 (–3·5) × 2·0–2·5 mm. (Group "*Amygdaloides*", p.p.) . . . *amygdaloides*, *robbiae*, *davisii*, *macroceras*, *oblongifolia*

44. (39) Seed laterally compressed, 2·0–3·3 × 2·0–2·5 mm. (Caruncle c. 0·7 mm. long, crested) . . . . . *dendroides*
— Seed not laterally compressed 45

45. (44) Seed 4 mm. or more long; broadly ovoid; caruncle obscure *grisophylla*
— Seed less than 4 mm. long; seed shape various; caruncle present or absent. 46

46. (45) Seed ± dorsiventrally compressed; often brown . . 47
— Seed not dorsiventrally compressed; greyish to dark brown 53

47. (46) Caruncle absent; seed surface with fine sticky granular covering; seed c. 1·6 × c. 1·3 mm., ovoid . . . *ancyrensis*
— Caruncle present, ± persistent; seed surface not with fine sticky granular covering (if greyish, then 2·0 mm. or more long) 48

48. (47) Seed surface shining, brown or yellowish . . . 49
— Seed surface not shining, yellowish to light brown . . 52

49. (48) Caruncle globose, minute; seed yellowish; c. 2·5 × c. 1·7 mm.; oblong-ovoid . . . . . *austroanatolica*
— Caruncle discoid or reniform, base ± retuse; seed brown to dark brown 50

50. (49) Seed 3 mm. or more long, and more than 2 mm. broad *squamosa*, *cardiophylla*
— Seed 1·8–2·2 (–2·5) mm. long and not more than 2 mm. broad 51

51. (50) Seed not more than 1 mm. broad; ovoid-oblong . . *stricta*
— Seed 1–2 mm. broad; ovoid to broadly ovoid *acanthothamnos*, *oblongata*, *wittmannii* *dimorphocaulon*, *apios*, *platyphyllos* *cybirensis*, *microsphaera*

52. (48) Caruncle subglobose, ± beaked; seed c. 3·0 × c. 2·5 mm. *djimilensis*
— Caruncle pyramidal or conical; seed 2·0–2·5 × 1·3–1·5 mm. ("*Petrophila*" complex, p.p.) . . *erythrodon*, *glareosa*

53. (46) Seed ovoid- or oblong-subtetragonal 54
— Seed not ovoid- or oblong-subtetragonal . . . 55

54. (53) Seed c. 2×c. 1·5 mm.; caruncle stipitate, projected towards the raphal side . . . . . *sanasunitensis*
— Seed c. 1·5×c. 1 mm.; caruncle minute, deciduous *gaillardotii*

55. (53) Seed 1·0–1·5 mm. broad; ovoid; 1·5–2·5 mm. long *seguieriana*
— Seed more than 1·5 mm. broad; ovoid, ovoid-globose, or subcylindrical 56

56. (55) Seed subcylindrical; caruncle beaked, not retuse at base. (Seed size 2·0–2·5×1·5–1·8 mm.) . . . . *terracina*
— Seed ovoid, ovoid-oblong, or ovoid-globose; caruncle depressed, discoid, or shortly conical, usually retuse at base, rarely slightly beaked, often deciduous 57

57. (56) Seed ovoid-globose 58
— Seed ovoid or ovoid-oblong 60

58. (57) Seed c. 3×c. 2·7 mm.; caruncle slightly beaked *lucida*
— Seed 1·5–2·5 (3·0)×1·5–2·0 (–2·5) mm.; caruncle not slightly beaked 59

59. (58) Raphe deep and prominent; seed surface dirty brown, rough *altissima*
— Raphe obscure; seed surface yellowish to light brown, not rough . . . . . *arguta*

60. (57) Caruncle slightly beaked. (Seed 3×2·7 mm.) . . *lucida*
— Caruncle shortly conical or discoid, not slightly beaked . 61

61. (60) Caruncle flat 62
— Caruncle shortly conical, suborbicular or subglobose, not flat. (Seed ovoid) 64

62. (61) Seed 2·5–3·0×1·7–2·0 mm. . . . . *iberica*
— Seed 3·0–3·5×2·5–3·0 mm. 63

63. (62) Seed ovoid-oblong . . . . . *palustris*
— Seed ovoid . . . . . *fistulosa*

64. (61) Seed 3·5–4·0 mm. long . . . . . *orientalis*
— Seed 2·5–2·8 mm. long 65

65. (64) Seed surface greyish or brown, not shining . . *virgata*
— Seed surface often shining, brown or reddish-brown *thamnoides*

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