MATERIALS FOR A FLORA OF TURKEY XXXIII: EUPHRASIA

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ABSTRACT. Various aspects of the taxonomy of *Euphrasia* (Scrophulariaceae) species in Turkey and adjacent regions are discussed. One new subspecies (*E. minima* DC. subsp. *davisii* P.F. Yeo) is described; there are remarks on various misidentifications of Turkish taxa, the hybrid populations on Ulu Dağ, the series *Petiolares*, the phytogeography of the genus in Turkey, and three little-understood Caucasian species.

During the preparation of the account of *Euphrasia* for *Flora of Turkey* vol. 6, various items of general interest came to light. Because many of them cannot be fully dealt with in the Flora, I have taken the opportunity of discussing them here, at the same time as describing one new subspecies. All specimens cited below have been examined, unless otherwise indicated.

A full account of each species recognised for the *Flora of Turkey* (10 in all), and of those Caucasian species of which I have examined adequate material, together with notes on most other Caucasian *Euphrasia*, has been prepared in typescript; copies are available on request.

SOME ERRONEOUS RECORDS

Euphrasia campestris Jord. This was recorded by Handel-Mazzetti (1909) from Trabzon (Kalanema Dere near Aktsche Abad, *Hand.-Mazz.* 402). The taxon is treated in *Flora Europaea* (Yeo, 1972) as a subspecies of *E. rostkoviana* Hayne, but in my opinion the Turkish gathering represents *E. rostkoviana* subsp. *rostkoviana*. There are several other examples of the latter from Trabzon.

E. drosocalyx Freyn. Recorded from two areas: Kayseri and Bursa. Penther & Zederbauer (1907) recorded it (and *E. pectinata*) from B5, Kayseri: Erdschias Da. Their material was determined by Wettstein but I have seen only specimens of *E. pectinata*. Wettstein (1896) also identified specimens at Berlin (B) from Bithynian Olympus as *E. drosocalyx*, but I have not seen these. Later specimens from this area [A2(A) Bursa: Ulu Da., *Davis* 14785 and 14800] were also assigned to this species (Davis, 1952). All these gatherings appear to me to be *E. hirtella* Jord. ex Reut., in a rather atypical form, mixed (in the case of *D.* 14800) with a glandular-hairy state of *E. minima* Jacq. ex DC. (see below). *E. drosocalyx* was described from the European Alps and is a problematical entity (Wettstein, 1896), being similar to *E. minima* but with long glandular hairs on the leaves.

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E. willkommii Freyn. This species was originally described from the Sierra Nevada of S Spain. Wettstein (1896) cited three gatherings of it from Turkey:

Bithynian Olympus—not seen by me but possibly *E. salisburgensis*; Taurus, *Kotschy* (no. 286, Bulgar Da., Bulgar Magara, distributed as *E. minima*, K, M)—I consider this to be a dwarf form of *E. pectinata* Ten.; Ghei Da. 6000 ft, *Heldreich* (K, CGE)—this and other gatherings by Heldreich from the same mountain (Geyik Da.) all represent a dwarf form of *E. pectinata*. No other Turkish specimens that I have seen can be assigned to *E. willkommii*. Some later collections named *E. willkommii* really belong to *E. minima*, q.v. In my unpublished revision of *Euphrasia* in Europe, I have placed *E. willkommii* in series *Petiolares*, which is centred in the Caucasus and discussed below.

E. salisburgensis Funck. Boissier (1879) recorded this species from the Cilician Taurus (*Kotschy*, *Balansa*), Mt Anemas in Lycaonia (*Heldreich*) and Tokat in N Anatolia (*Wiedemann*). None of these records was accepted or recognised by Wettstein (1896) who did not indicate the occurrence of the species in Turkey at all. The Mt Anemas specimens (BM, CGE) are *E. pectinata*, as are Balansa's 1855 specimens (BM, E) from Gülek-Maden in the Taurus. *E. salisburgensis* is now known on Ulu Da. (Bursa) (Davis, 1952).

A NEW SUBSPECIES

Euphrasia minima Jacq. ex DC. was described from the European Alps. It is a dwarf, sparingly branched alpine species with rather broad leaves and capsules and very small corollas. It has been divided into two subspecies (Yeo, 1972): *minima* in the Pyrenees and Alps; and *tatrae* in the Tatra and Carpathian Mountains. In Turkey, Boissier (1879) cited *Kotschy* 286 (mentioned above under *E. willkommii*) as *E. minima*. Wettstein (1896) cited Heldreich's specimens from "Mons Anemas Lycaoniae" as *E. minima* but most of this material is dwarfed *E. pectinata*; however, on a sheet at Edinburgh, *E. minima* is also present. Another collection comprising the same mixture was made on Bulgar Magara by Siehe in 1895 and distributed as *E. minima*. Compared with the plants of *E. pectinata*, the *E. minima* plants in this gathering have blackened more on drying, are more mature, and have a different leaf-shape. Much better-developed specimens of *E. minima* have since been collected in three regions of Turkey, and as they seem rather different from either of the two European subspecies, and are geographically distinct, they are considered to deserve separate subspecific recognition.

E. minima Jacq. ex DC. (Fl. Fr., ed. 3,3:473, 1805) subsp. **davisii** P. F. Yeo, **subsp. nov.**

Ab *E. minima* subsp. *minima* et *tatrae* (Wettst.) Hayek foliis caulinis superioribus et floralibus inferioribus dentium non (nisi rarissime) ultra 4 pares gerentibus atque dentibus foliorum floralium inferiorum incurvatis recedit; insuper ab *E. minima* subsp. *minima* foliis et petiolis validioribus et a subsp. *tatrae* dentibus foliorum superiorum minus acuminatis differt.

Turkey. A2(A) Bursa, Ulu Da.: 1700 m, by stream, granite, 12 ix 1947, *Davis* 14800 (K) [mixed gathering with *E. hirtella*]; 14–15 ix 1957, *Rechinger* 15383 (W); Kirazli Y., 1500 m, 5 ix 1975, *A. Baytop* 33730 (E) [mixed with *E. hirtella* and *E. pectinata*]; old way to Maden, 2000 m, 5 ix 1975, *A. Baytop* 33717 (E) [with one plant *E. hirtella?* or hybrid]. A8 Trabzon: N side of Soğanli Da., above Çaykara, 2000–2200 m, steep lush alpine meadow, flowers white, 4 viii 1957, *Davis & Hedge*, *D.*32158 (BM, E). Rize:Ikizdere, Başkoy (Cimil)—Cermanin Y., 2500 m, pasture, flowers white, 28 viii 1952, *Davis & Dodds*, *D.*21022 (holo. E; iso. BM).C3 Isparta: in pratis humidis reg. alpinae m. Anémas Lycaoniae, alt. 7000 ft., viii 1845, *Heldreich* (E) [mixed with a dwarf form of *E. pectinata*; in some herbaria this collection consists only of *E. pectinata*]. C4 Antalya: Sobitçimen Y. at N foot of Geyik Da., 2000 m, edge of stream, flowers white with yellow throat, 1 ix 1947, *Davis* 14680 (K). C5 Içel: Bulghar Magara, 2700 m, feuchte moorige Orte, viii 1895, *Siehe* 296 (E, K) [mixed with dwarf form of *E. pectinata*].

In addition to the characters given in the diagnosis, *E. minima* subsp. *davisii* is not known to produce yellow corollas, which are common in subsp. *minima*, the first flower is produced at the 3rd to 6th node (2nd–5th in subsp. *minima*), and the leaves are more rounded than in subsp. *minima*. The maximum number of leaf-teeth is normally 3 or 4 pairs, depending on the population (5 is not uncommon in the two European subspecies, and 6 is known in subsp. *tatrae*). However, 5 pairs of teeth have been found in some plants of *Baytop* 33722 from Ulu Da. Whereas European *E. minima* usually has somewhat hairy leaves, these are almost glabrous in the Turkish material except for Ulu Da. specimens, in which they are glandular-hairy.

Two gatherings of *E. minima* subsp. *davisii* from the Taurus have previously been assigned to *E. willkommii*: *Siehe* 1895:296 by Pugsley (K) and *Davis* 14680 by the collector.

E. minima subsp. *davisii* is involved in the complex of hybrids on Ulu Da., as described below.

HYBRIDS ON ULU DAĞ

Because of the problematical nature of the first gatherings I saw from Bithynian Olympus (Ulu Da.), I suggested to Dr P. H. Davis that further careful collecting was needed. He passed the message on to Prof. A. Baytop, who sent me extensive collections made in 1975 from various sites at differing altitudes. These are now at Edinburgh (E) and duplicates, not seen by me, are at Istanbul (ISTE). *E. salisburgensis* Funck, which occurs on the mountain, does not appear to be involved in the hybridization: it occurs from 2200 m to 2500 m. The other Ulu Da. species, ranging from 1450 m to 2050 m, are *E. pectinata*, *E. minima* subsp. *davisii*, and *E. hirtella*. One gathering (*A. Baytop* 33730) includes all three species, without hybrids. Chromosome counts made in Europe (see Yeo, 1970) are n=22 for *E. pectinata* and *E. minima* subsp. *minima*, and n=11 (approx.) for *E. hirtella*.

Some of Prof. Baytop's samples appear to include the hybrid *E. minima* subsp. *davisii* x *E. pectinata* (*A. Baytop* 33685, 33694 and 33722). The plants are small and glandular-hairy, like *E. minima*, but with longer internodes and narrower leaves and leaf-teeth, while some have 3 or 4 pairs of branches arising near the base, unlike either presumed parent.

Any crossing between *E. hirtella* and the other *Euphrasia* species on the mountain would be expected to lead to the production of sterile triploids. However, Yeo (1956) has adduced circumstantial evidence for introgressive hybridization from tetraploid to diploid, sometimes leading to the establishment of new diploid microspecies. The implication of the new Baytop material is that *E. hirtella* has undergone such introgression, probably from the hybrid *E. minima* x *E. pectinata* (*A. Baytop* 33694, p.p.). Whereas in this gathering it is possible to distinguish the apparently introgressed *E. hirtella* from the *E. minima* x *E. pectinata* (and a single plant of *E. pectinata*), in *A. Baytop* 33685 the plants are more uniform, and if the same introgressant and primary hybrid are present they have converged more and cannot be recognised. The possibility cannot be excluded that genes also pass from diploids into tetraploids and this might account for the glandulosity of *E. minima* in this area and the morphological uniformity of no. 33685. However, Yeo (1956) was not able to find clear evidence of introgression in this direction in British *Euphrasiae*.

It may be mentioned that despite its glandular-hairy foliage, *E. minima* subsp. *davisii* on Ulu Da. can be distinguished from *E. hirtella* there in having shorter and less dense glandular hairs, brighter green leaves (in the dried state), shorter upper internodes, shorter calyx in relation to capsule, and differences in leaf-shape.

TURKISH PLANTS RESEMBLING E. NEMOROSA

I have encountered two such plants in herbaria. One is represented by a Balansa specimen labelled "*Euphrasia rigidula* Jord.? (Boiss.). Environs de Rhize (Lazistan). Terrains argillocalcaires. Juillet, Septembre". This gathering was commented on by Wettstein (1896, p. 126), who also furnished the collecting number 799 (absent from specimen in K). Wettstein considered that it was very similar to *E. nemorosa* (Pers.) Wallr. but he could not be certain of its systematic position owing to the absence of fruit. The Kew specimens include a fruiting plant, and were evidently collected on different dates, as indicated by the label. On account of their large corollas, short internodes, and (in some plants) large number of branching nodes, they show a quite remarkable resemblance to *E. pseudokerneri* Pugsl., a calcicolous British endemic closely related to *E. nemorosa*. It seems improbable (but not impossible) that this species could occur at Rize, and it would also be rather surprising if *E. nemorosa* did, since even that is north-west European in distribution, extending to Austria and Bohemia. The node of the first flower ranges in the Kew specimen from 9 to 13 or 14, which alone distinguishes it from any other Turkish species of *Euphrasia*.

There is a remote possibility that Balansa's plant is an aberrant eglandular state of *E. rostkoviana* Hayne, which does occur in this part of Turkey.

A similarly late-flowering specimen is that of *René du Parquet*, Herbarium Byzantinum: Hauteurs du Ichatel Dagh (Çatal Da.?), Anatolie, Mai 1865 (BM). These plants, with the habit of *E. nemorosa* and foliage approaching that of *E. stricta* Lehm., have begun flowering at the 12th or 13th node and have produced up to 10 flowering nodes. This is most unlikely to have been achieved by May and the labelling is therefore suspect.

SERIES PETIOLARES IN TURKEY

I have stated above that I believe *E. willkommii* Freyn to be a member of this series but that it does not occur in Turkey.

Turkish material which can truly be assigned to ser. *Petiolares* Pugsley can be classified into large-flowered and small-flowered, and into round-leaved and angular-leaved (with acute leaf-teeth) groups. The four groups can be equated with five previously described species, four of which have not until now been recorded outside the USSR. The species are *E. petiolaris* Wettst., which is typified by a Turkish specimen; *E. lebardensis* Kem.-Nath., *E. sevanensis* Juz. and *E. juzepczukii* Denis. (both of which also occur in Iran—Yeo, unpublished); and *E. amblyodonta* Juz. *E. lebardensis* is large-flowered and round-leaved, *E. petiolaris* is large-flowered and angular-leaved, *E. sevanensis* and *E. amblyodonta* are both small-flowered and round-leaved, and *E. juzepczukii* is small-flowered and angular-leaved.

The Turkish material amounts to a comparatively small number of gatherings, and some of these represent dwarf or immature states. Further, there is some variation within the groups and some lack of agreement with Soviet material. In this situation it has not been possible to recognise in Turkey any species clearly distinct from the Soviet ones, and the only feasible treatment is to fit them into the latter as far as possible. Accordingly, it is to be borne in mind that further knowledge could lead to a revision of this treatment.

The centre of diversity of ser. *Petiolares* is the Caucasus; NE Turkey and N Iran form the southern border of this centre. Outlying species occur in Spain, the Crimea, and Central Asia. Some of the Caucasian species are discussed below.

PHYTOGEOGRAPHY

The distributions of all the *Euphrasia* species in Turkey fit in with previously known patterns.

On Ulu Da., in NW Turkey, we find *E. salisburgensis*, a mainly S European species. Here also are two European species which are found elsewhere in Turkey, *E. minima* and *E. hirtella*. *E. minima* has a particularly interesting distribution, since it is a European element in the eastern part of the Euro-Siberian region comparable to *Polygala alpestris* mentioned by Davis (1965, p. 18), but is also found in the Taurus. Possibly it will be found to occur on the Anatolian Diagonal. *E. hirtella* presents a case of a distribution gap in Paphlagonia, the occurrence of which is mentioned by Davis (*l.c.*).

Most of the records of *E. hirtella*, and all those of its close ally, *E. rostkoviana*, are from the eastern part of the Euro-Siberian region. The occurrence of both species in this area can be regarded as an extension of their Caucasian ranges, as both are widespread in that area.

The species so far mentioned occur in montane, subalpine or alpine habitats in C Europe, escaping from these levels only in outlying localities in N and W Europe (*E. salisburgensis*) or in certain specialised damp habitats or low-lying Atlantic hill-country (*E. rostkoviana*). This is an expression of the requirement of all species for comparatively cool, moist summers. This preference is also shown by our only other European species, *E. pectinata*.

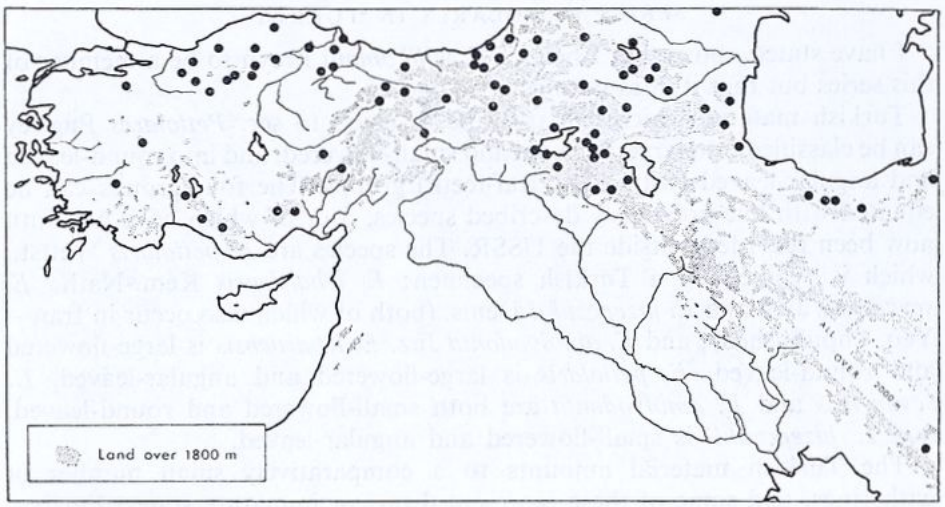

FIG. 1. Distribution of *Euphrasia pectinata* in Turkey, S Transcaucasus and Iran.

The distribution in Turkey and neighbouring areas shows its almost total restriction to mountainous areas (fig. 1) with field notes often indicating a damp habitat. Nevertheless, as a European species *E. pectinata* has a more southerly distribution and an evident tolerance for hotter conditions than most others of the genus. Its chief occurrences are on the southern side of the Alps, and in those mountains that lie at lower latitudes than the Alps, and it is a member of the well-known xerothermic associations near Martigny, in the Rhône valley of Switzerland (Wettstein, 1896, cited as Branson).

NOTES ON SOME CAUCASIAN SPECIES

E. rostkoviana Hayne [Darst. Beschr. Arzn. Gewächse 9: t.7 (1825)] subsp. **rostkoviana**

This taxon does not appear in the 2nd edition of Grossheim's *Flora Kavkaza* (Kemularia-Nathadze, 1967), but I recognise it from the Ciscaucasus (distr. Klukhori), W Transcaucasus (Abchasia) and E Transcaucasus (S Ossetia). The specimens (TBI) had been determined as *E. hirtella* which also occurs in the Caucasus region.

E. macrodonta Juz. in Spis. Rast. Herb. Fl. URSS 11:152 (1949).

Related to *E. petiolaris* (including *E. amblyodonta* Chab.) but differing in its more numerous branches and narrower leaves with deeper and finer, often aristate teeth. The difference is of a kind which can occur ecotypically in *Euphrasia*, and I have seen too few specimens to judge whether *E. macrodonta* is satisfactorily distinct. Juzepczuk himself (1955) expressed doubt thus "Perhaps only a local form of [*E. amblyodonta*], otherwise sufficiently well distinguished from that in the character of the dentation of the floral leaves". One Turkish collection (*Furse* 3940, A8, Trabzon: Soğanli Pass, 1500 m, 16 viii 1962) is late-flowering, with up to 5 pairs of primary branches and small sharply toothed leaves, and thus approaches *E. macrodonta*.

E. ossica Juz. in Spis. Rast. Herb. Fl. URSS 11:152 (1949).

This is very similar to *E. lebardensis* Kem.-Nath., differing mainly in its smaller corollas, 5·5–6·5(–7) mm long instead of (6·5–)7–8·5 mm. It might be appropriate to treat the two as subspecies of *E. ossica*, which is the earlier name. However, it would not be wise to do this without a fuller knowledge than I have of other Caucasian species, namely *E. woronowii* Juz., *E. adenocaulon* Juz., and *E. kemulariae* Juz. In any reconsideration of the taxa related to *E. ossica*, *E. sevanensis* (accepted as occurring in Turkey) would be involved, as its distinctions from *E. ossica* are not very firm.

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