MATERIALS FOR A FLORA OF TURKEY: IX

BERBERIDACEAE

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BERBERIS L.

DURING the revision of the Turkish *Berberis* material, we had great difficulty in naming many of the specimens using the most modern revisions—Schneider, C.K., in Bull. Herb. Boiss. sér. 2, 5: 33 et seq. (1905); Ahrendt, L.W.A., *Berberis & Mahonia*, in J. Linn. Soc. Lond. 57, 369: 1–410 (1961). The taxonomic concepts used in these works appear to us excessively narrow; Schneider's account has been constructively criticised by Bornmüller, in Feddes Rep. Beih. 89 (1): 15 (1936), and his strictures could equally apply to Ahrendt's. Unfortunately, Bornmüller does not provide an actual revision, and therefore his work cannot be used for identification.

We have found many specimens among the Turkish material intermediate between the species accepted as occurring in Turkey in the two revisions, which are: *B. vulgaris* L., *B. orientalis* Boiss. ex Schneider, *B. crataegina* DC., (*B. iberica* var. *paphlagonica* Schneider, *B. chinensis* Poir. var. *paphlagonica* (Schn.) Ahrendt; incl. var. *armeniaca* Schn. and var. *lycica* Schn.) *B. integerrima* Bunge (*B. densiflora* Boiss. & Buhse) and *B. cretica* L.

Of these, *B. cretica* presented little difficulty and was omitted from the analysis following.

B. orientalis Schn. has been treated as an infraspecific group under *B. vulgaris* (*B. vulgaris* var. *orientalis* (Schn.) Grossheim). It is said to differ from *B. vulgaris s.s.* in having leaves ± without serrate margins and in having shorter racemes borne on peduncles less than 1 cm long. As regards leaf characters, serrate and entire leaves are frequently found on the same bush, and the raceme characters show continuous variation on the Turkish material. Therefore we have had no hesitation in regarding *B. orientalis* as a synonym of *B. vulgaris*. In this we differ from Schneider, Ahrendt and Slizik (Bot. Mat. 22: 118–121 (1963)).

This leaves *B. vulgaris*, *B. crataegina* and *B. integerrima* for consideration. These species have been distinguished by earlier authors using characters of the bark, leaves (shape, serration, thickness, and the numbers and position of the stomata), spines, racemes, and the shape and colour of the fruit. Of these we have used the bark, the leaf shape, and the fruit colour, while the rest have been largely discarded because each frequently varies even on a single specimen.

B. vulgaris in Europe, *B. integerrima* in Central Asia and *B. crataegina* in Central Anatolia are distinct, and Table 1 is based on specimens seen from those areas. Distinction between the species becomes much more difficult in those areas where they overlap—e.g. Caucasia, North Turkey, Iran and probably adjacent countries.

Table 1

	B. vulgaris	*B. crataegina*	*B. integerrima*
BARK—Young	Yellowish	Dark red	Orange-brown
Old	Greyish, with black lenticels. Grooved.	Dark red, without lenticels. Smooth and glossy.	Orange-brown, without lenticels. Smooth and glossy.
LEAF SHAPE	Usually elliptic, less than 3× longer than broad.	Narrowly elliptic to oblanceolate, more than 3× longer than broad.	Obovate, less than 3× longer than broad.
RIPE FRUIT COLOUR	Red	Black	Red

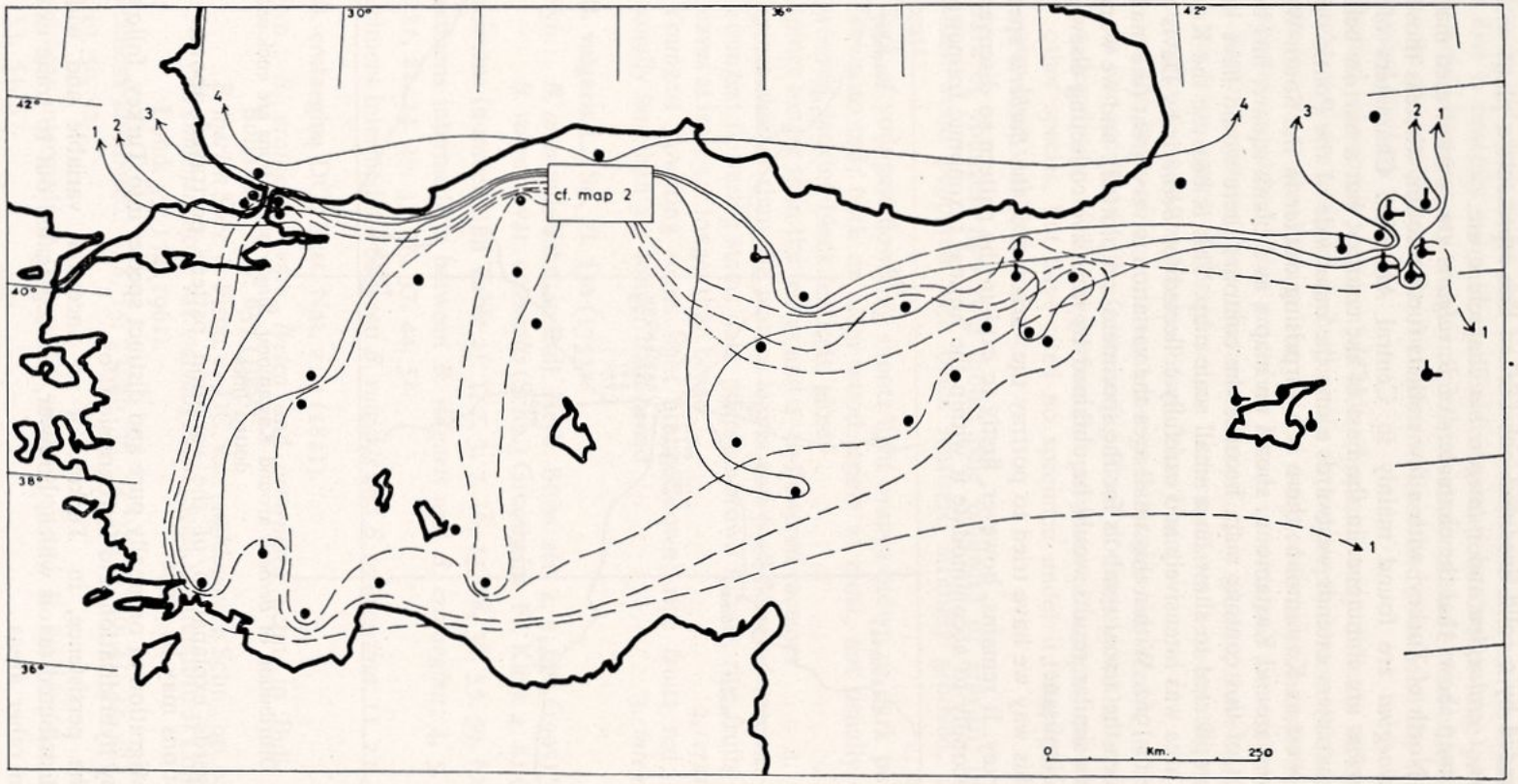
The characters given in Table 1 are not well correlated in the Turkish material, and appear in all combinations. Therefore we have scored each specimen available to us, using the following method:

Each specimen was given a series of 3 numbers. The first figure represented the number of pure *vulgaris* characters present; the second, pure *crataegina* characters; and the third, pure *integerrima*. Thus a score of 121 represents a plant with one *vulgaris*, two *crataegina* and one *integerrima* characters, a total of four characters used. When, as frequently happened (due to inadequate collecting), old bark and/or fruit colour was unknown, that character was not scored. Thus 020 in our scoring represents the information available to us; had the specimen been complete its symbol could have been 121, 130, 220, 022, etc. Also, in deciding whether a red-fruited specimen was to be scored as *vulgaris* or *integerrima* for that character, the other characteristics were taken into account, and if the specimen had only *vulgaris* characters it was scored as *vulgaris* for fruit colour also; if *integerrima* characters were also present it was scored as $\frac{1}{2}$ for *vulgaris* and $\frac{1}{2}$ for *integerrima*. Intermediate conditions were also scored as $\frac{1}{2}$.

This method, although very subjective, appeared to us to be the most simple and useful to use on material which was frequently lacking some important features.

The symbol for each specimen was then plotted on a map, and contour lines were drawn round symbols with 4, 3, 2 and 1 characters of *B. vulgaris* and *B. crataegina* respectively—a modification of the method used by Ehrendorfer (Öst. Bot. Zeitschr. 105: 229–279 (1958)). On map 1, solid lines surround characters of *B. vulgaris* and broken lines those of *B. crataegina*. Next the symbols were erased and dots were substituted, so that the map could be reduced for publication. (The symbols are listed in Table 2). Finally "arms" were drawn on to the relevant dots for characters of *B. integerrima* —the number of "arms" denote the number of characters of *B. integerrima* present, regardless of which.

Thus a dot surrounded by 4 solid lines represents a plant with 4 *vulgaris* characters; a dot surrounded by 3 solid lines a plant with 3 *vulgaris* characters; a dot surrounded by 2 solid and 2 broken lines represents a plant with 2 *vulgaris* and 2 *crataegina* characters; and a dot with 1 "arm"

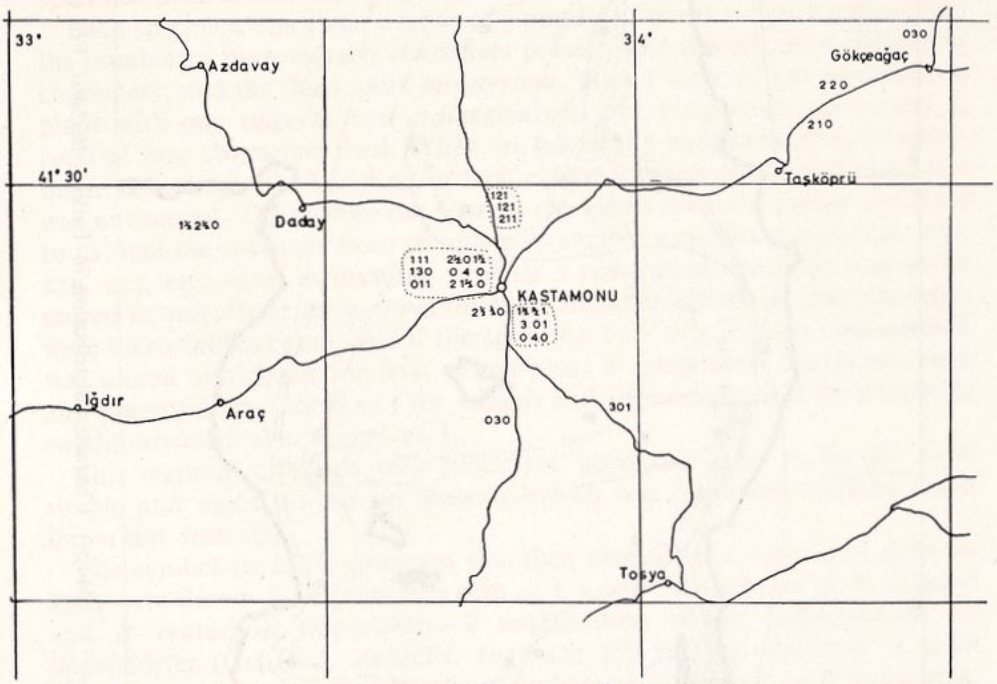


Map 1. Character distribution in Turkish *Berberis*. For explanation, see text.

surrounded by 2 solid lines and one broken line represents a plant with 2 *vulgaris*, 1 *crataegina* and 1 *integerrima* characters, etc.

The map shows that the characters of *B. vulgaris* are concentrated mainly in the North of Turkey, with a few outliers further south, whereas those of *B. crataegina* are found mainly in Central Anatolia. Characters of *B. integerrima* are commoner in the East of the country, but a narrow belt of such characters extends westwards along the inner side of the Pontic range as far west as Kastamonu; there is a surprising outlier in the South-West. The area around Kastamonu, shown on map 1 as a blank square, has been left out of this contour map, because the contours there would have been too complicated to show on a small scale map. This is because the Kastamonu area was intensively and carefully collected for *Berberis* by Davis and Coode in 1962. Within this small area the variation is very great (see map 2, on which the actual symbols for the specimens are plotted), and we wonder whether similar results would be obtained by intensive collecting elsewhere (e.g. Gümüşane).

In this way we have tried to portray the variation of the *Berberis* species in Turkey. It remains, however, firstly to explain the pattern so discovered, and secondly to accommodate it within the normal taxonomic framework.



Map 2. Distribution of *Berberis* around Kastamonu. Single populations are enclosed by dotted lines.

As regards explanation of the variation pattern portrayed above, two suggestions may be made:

a. Migration of originally pure and distinct species into Turkey, followed by hybridisation and introgression; or
b. the persistence, in Turkey, of an ancestral, variable and widely distributed taxon which, however, has segregated out to some extent in other areas.

We do not claim to be able to tell which of these alternatives is true, but the first is possibly more likely. Field observations over a long period of time would be necessary to determine the occurrence and extent of hybridisation; we are unable to make such observations and commend the study to interested Turkish botanists.

Formal taxonomic treatment of this complex is very difficult. After some thought, we have assigned each specimen with a preponderance of characters of one species to that species; the rest are assigned as intermediates between the species concerned. This procedure leaves us with two anomalies:

a. Some specimens show characteristics of all 3 species; these specimens we have simply referred to as "intermediates between *B. vulgaris*, *crataegina* and *integerrima*" (see below), and
b. on the basis of our material, no pure *integerrima* occurs in Turkey. In our account (in the forthcoming Flora of Turkey) we have included a description of *B. integerrima* for purposes of comparison with the other species, but have cited no specimen under it; the species has also been included in the key.

1. Bark of youngest flowering shoots pale yellowish or greyish; bark of older wood peppered with black lenticels, strongly grooved, usually matt . . . . . 1. *vulgaris*
1. Bark of youngest flowering shoots light orange-brown or dark purplish-brown to red; bark or older wood striate at most, not usually deeply grooved, lacking black lenticels, glossy . . . . . 2.
2. Spines longer than the leaves and 4–10-flowered racemes . 4. *cretica*
2. Spines shorter than the mature leaves and 6–18-flowered racemes 3.
3. Youngest flowering stems dark purplish-brown to red; ripe fruits black; leaves at least 3 × longer than broad . . . . 2. *crataegina*
3. Youngest flowering stems light orange-brown; ripe fruits red; leaves usually less than 3 × longer than broad . . . 3. *integerrima*

1. **B. vulgaris** L., Sp. Pl. 330 (1753).

Syn.: *B. orientalis* Schn. in Bull. Herb. Boiss. sér. 2, 5: 666 (1905).
B. vulgaris var. *orientalis* (Schn.) Grossheim, Fl. Kavk 4: 81 (1950).

Specimens (numbered in Table 2): 1, 2, 3, 7, 16, 25, 28, 36, 55, 59, 62.

Specimens intermediate between *B. vulgaris* and *B. crataegina*: 4, 5, 9, 12, 20, 21, 22, 24, 29, 33, 35, 37, 44, 51.

Specimens intermediate between *B. vulgaris* and *B. integerrima*: 11, 27, 56, 58.

2. **B. crataegina** DC., Syst. Nat. 2: 9 (1821).

Syn.: *B. crataegina* vars. *lycica* and *armeniaca* Schn. in Bull. Herb. Boiss. sér. 2, 5: 657 (1905).
B. iberica Stev. & Fisch. ex DC. var. *paphlagonica* Schn., op. cit. 656.
B. chinensis Poir. var. *paphlagonica* (Schn.) Ahrendt in J. Linn. Soc. Lond. 57: 174 (1961).

Specimens numbered: 6, 8, 15, 23, 26, 30, 34, 38, 39, 40, 41, 42, 43, 46, 47, 48, 49, 50, 52.

Specimens intermediate between *B. crataegina* and *B. integerrima:* 13, 32, 45, 53, 54, 57.

We have not recognised the two published varieties of *B. crataegina* (var. *armenica* Schn., with longer, greyish leaves found in the east of Turkey—a few specimens do show this character; and var. *lycica* Schn. which approaches B. *cretica* L. in having shorter leaves and spines relatively longer—this variety is recorded from the extreme South-West of the species' range). We consider that to recognise varieties while the species themselves are so confused would be misleading and inconsistent.

3. **B. integerrima** Bunge in Linnaea 18: 149 (1844).

Syn.: *B. densiflora* Boiss. & Buhse in Aufz. Transk. Pers. t. 32 (1860).

Specimens numbered: 61, 63.

This species has been recorded for Turkey by Bornmüller, *op. cit.* 15, but we have not seen the specimen on which the record is based.

There remain those specimens which we judge intermediate between all three species: 10, 14, 17, 18, 19, 31, 60.

4. **B. cretica** L., Sp. Pl. 331 (1753).

This species is distributed in Greece, Crete and Cyprus, and has been found on Manisa Dağ (Province Izmir), *Bornmüller* 9016!; it is also recorded from Khios and Samos, two of the islands covered by the Flora of Turkey.

Note on Synonymy

We have not seen the type of *B. turcomannica* Ledeb., Fl. Ross. 1: 79 (1842), which was collected "on the eastern shores of the Caspian Sea". This name has been applied to specimens from as far apart as Dzungaria and Armenia; we would identify many of these specimens as *B. integerrima*. Lozinskaya, in Sokolov (ed.) Devreya i R. Kustanriki S.S.S. 3: 62 (1954) records *B. turcomannica* from the Kopet Dagh only, thus suggesting that the name is inapplicable to our plants. If, however, *B. turcomannica* proves to be synonymous with *B. integerrima*, then, being the older name, it must take preference.

Table 2

Specimen citations and scoring of *Berberis*

No.	*Locality and Collector*	*V*	*C*	*I**
TURKEY				
1.	Istanbul, Bebek, *Post*	2	0	0
2.	Istanbul, Bebek, *Robert College*	3	0	0
3.	Istanbul, Tarabya, *Aznavour* Cult. ?	2	0	0
4.	Istanbul, Kadiköy, *Aznavour*	1	1½	0
5.	Istanbul, Maslak, *Aaronsohn*	2	1	0
6.	Zonguldak, Karabük-Safranbolu, *D.* 37934	0	4	0
7.	Kastamonu, N. of Seydiler, *D.* 38502	4	0	0
8.	Kastamonu, W. of Kastamonu, *D.* 38761	0	4	0
9.	,, ,, ,, *D.* 38774	1	3	0
10.	,, ,, ,, *D.* 38775	1	1	1
11.	,, ,, *D.* 38776	2½	0	1½
12.	,, ,, *D.* 38777	2	1½	0
13.	,, ,, ,, *D.* 38778	0	1	1
14.	,, above ,, *D.* 38305A	1½	½	1
15.	,, ,, ,, *D.* 38306A	0	4	0
16.	,, ,, ,, *D.* 38307	3	0	1

No.	Locality and Collector	V	C	I*
TURKEY				
17.	„ N. of Kastamonu *D.* 38517	1	2	1
18.	„ „ „ *D.* 38518	2	1	1
19.	„ „ „ *D.* 38519	1	2	1
20.	„ Daday-Eflani, *D.* 38619	1½	2½	0
21.	„ Taşköprü-Gökçeağaç, *D.* 38047A	2	2	0
22.	„ „ „ *D.* 38047B	2	1	0
23.	„ N. of Gökçeağaç, *D.* 38219	0	3	0
24.	„ Kastamonu, *D.* 25071	2½	½	0
25.	„ Kastamonu-Tosya, *Khan* 642	3	0	1
26.	„ Kastamonu-Ilgaz, *Khan* 655	0	3	0
27.	Amasya, Amasya, *Maniss.* 117	½	0	1½
28.	Tokat, Tokat-Artova, *D.* 24864	3	0	0
29.	Sivas, Zara-Suşehri, *Balls* 1463	1	2	0
30.	Erzincan, Erzincan-Refahiye, *D.* 32679	0	3	0
31.	Gümüşane, Gümüşane, *Balls* 1463B	2½	½	1
32.	„ „ *Stainton* 8334	0	1	1
33.	Erzincan, Cimin, *D.* 31737	1	2	0
34.	Erzincan, Selepur, *D.* 29304	0	2	0
35.	Gümüşane, Bayburt, *Balls* 1463A	1	3	0
36.	Çoruh, Artvin, *D.* 29753	3	0	0
37.	Kütahya, Gediz, *D.* 36943	1	2	0
38.	Kütahya, Murat Dağ, *D.* 36789	0	3	0
39.	Ankara, Nallihan-Mudurnu, *D.* 37068	0	3	0
40.	Ankara, Kizilcahamam, *Khan* 695	0	4	0
41.	Ankara, Ankara, *Fr. d. E.C.*	0	3	0
42.	Yozgat, Akdağmadeni, *Curtis* 161	0	2	0
43.	Erzincan, Kemaliye, *Sint.* 2330	0	2	0
44.	Muğla, Sandras Dağ, *D.* 13600	1	2	0
45.	Denizli, Acipayam-Abbas, *D.* 13466	0	1	1
46.	Antalya, Elmali, *Bourgeau*	0	3	0
47.	Antalya, Gebiz, *D.* 15760	0	2	0
48.	Konya, Beyşehir, *It. Leyd.* 915	0	3	0
49.	Konya, Bozkir, *D.* 16618	0	4	0
50.	Kayseri, Kayseri, *Balls* 235	0	3	0
51.	Maraş, Hacin-Karakilisse, *Post* 607	1	2	0
52.	Malatya, Hekimhan, *D.* 24831	0	3	0
53.	Bitlis, Ahlat, *D.* 24715	0	1	2
54.	Van, Van, *Tchitouny* 249	0	1	1
ARMENIAN S.S.R.				
55.	Kafan region, *Arm. Acad.*	3	0	0
56.	Idzhevan region, *Arm. Acad.*	2½	0	½
57.	*sine loc. & coll.*	0	½	1½
58.	*Szowits*	½	0	1½
59.	collector unreadable	2½	0	½
60.	„ „	1	½	1½
61.	Erevan, *Szowits*	0	0	2
GEORGIAN S.S.R.				
62.	Tiflis, *Schischkin* 11621	2	0	0
IRAN				
63.	Scheheristanek, Elburs, *Bornmüller* 6076	0	0	2

* Scorings for characters of *B. vulgaris*, *B. crataegina* and *B. integerrima*.

LEONTICE L.

Leontice ewersmannii Bunge, and *Leontice armeniaca* Boiv. are frequently treated as specifically distinct from *Leontice leontopetalum* L. When revising the group for the Flora of Turkey we found it more satisfactory to treat it as a polytypic species containing three overlapping subspecies. The characters used to separate the subspecies are rather loosely correlated; the form of the nectary scale (stressed by Boissier) is very variable (even on the same

plant) and is useless for distinguishing the taxa. A key to the subspecies of *Leontice leontopetalum* is given:

1. Plant usually more than 20 cm tall; inflorescence branched; pedicels straight in fruit, spreading or angled upwards 2
1. Plant usually less than 20 cm tall; inflorescence simple with pedicels spreading-recurved . . . . . subsp. *armeniaca*

2. Leaf segments obovate to sub-orbicular; fruiting pedicels usually spreading and ripe capsules over 2 cm long . . . subsp. *leontopetalum*
2. Leaf segments elliptical to lanceolate; fruiting pedicels angled upwards and ripe capsules less than 2 cm long . . subsp. *ewersmannii*

subsp. **leontopetalum**

Found chiefly in the Mediterranean regions of Turkey, it is also recorded from North Africa (Algeria), Egypt, Sinai, Palestine, Lebanon, Syria, Iraq, Iran (*fide* Parsa, Fl. Iran 1: 450 (1951)), Greece and Bulgaria. Largely replaced in Turkmenistan, Afghanistan and Iran by subsp. *ewersmannii*, and in Jordan, Syria, Erevan and Nakhichevan by subsp. *armeniaca*. It is usually a weed of cultivated ground, and belongs to the Mediterranean element.

subsp. **ewersmannii** (Bunge) Coode, **comb. et stat. nov.**

Syn.: *L. ewersmannii* Bunge, in Arb. Naturf. Vereins zu Riga 1, 47: 131 (1847).
L. leontopetalum L. var. *oblongifolia* Post, Fl. Syr. 1: 29 (1932).

The only Turkish specimen of this subspecies seen is *Balls* 714a from Gaziantep. Fl. URSS, 7: 546 (1937) states that this subspecies occurs in Turkish Armenia and Kurdistan, and gives the extra-Turkish distribution as Central Asia, Iran and North Syria. Balls' specimen from Gaziantep, like one from Aleppo, fits the description of the leaf segments, but no fruit is available. The subspecies belongs to the Irano-Turanian element.

subsp. **armeniaca** (Boivin) Coode, **comb. et stat. nov.**

Syn.: *L. armeniaca* Boivin in Bélanger, Voy. Indes Orient. Ic. (s.n.) (1846).
L. minor Boiss., Fl. Or. 1: 100 (1867).

This subspecies has not been seen in Turkey, but is recorded for Transcaucasia, Syria and Jordan. It belongs to the Irano-Turanian element, and in the Syrian desert frequently occurs in association with *Artemisia herba-alba*.

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