

## STUDIES ON THE FLORA AND VEGETATION OF THE GOLESTAN NATIONAL PARK\*, NE IRAN

### III. THREE NEW SPECIES, ONE NEW SUBSPECIES AND FIFTEEN NEW RECORDS FOR IRAN

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*Centaurea golestanica* Akhani & Wagenitz (*Compositae*), *Eriocyclus ghafooriana* Akhani (*Umbelliferae*), *Plantago podlechii* Akhani (*Plantaginaceae*), and *Seseli tortuosum* L. subsp. *kiabii* Akhani (*Umbelliferae*) are described as new from Golestan National Park, NE Iran. The following species are new additions to the Iranian flora from that area: *Allium vavilovii* Popov & Vved., *Alyssum alyssoides* (L.) L., *Atraphaxis seravschanica* Pavlov, *Carex pseudocyperus* L., *Ceratophyllum submersum* L., *Euphorbia humilis* C.A. Mey. ex Ledeb., *Gagea glacialis* K. Koch, *Lactuca georgica* Grossh., *Linosyris vulgaris* Cass. ex Less., *Myosotis alpestris* F.W. Schmidt, *Myosotis arvensis* (L.) Hill, *Myosotis minutiflora* Boiss. & Reuter, *Potamogeton natans* L., *Rumex caucasicus* Rech. f. and *Vicia cassubica* L. Details on the habitat and associated species are given based on field studies and phytosociological relevés. Maps of distribution within the Park of all species and illustrations or photographs are given for some of the taxa concerned.

*Keywords.* Golestan National Park, Iranian flora, new records, new species.

#### INTRODUCTION

In the course of my studies on the flora and vegetation of the Golestan National Park, NE Iran (Akhani, 1996; Akhani & Scholz, 1998), some more taxa new to science have been discovered and several new records from Iran are added. The total number of species known from the Park has now increased to 1302. The vouchers of almost all cited plants are kept in M (Botanische Staatssammlung München), and Herbarium H. Akhani, Tehran (hb. Akh.). Some duplicates are also in the following herbaria: E, GOET, K, LI, W, MMTT and SBUH. The last two herbaria, from Tehran (MMTT acronym for Natural History Museum of Iran and SBUH acronym for Shahid Beheshti University Herbarium), are not yet included in Index Herbariorum (Holmgren *et al.*, 1990). Fig. 1 shows a map of the area and the names of different places referred to in this paper. The local distribution maps of the species were generated by using the computer program FLOREIN (1996), version 4.1, adapted for this project by Mr C. Düring (Regensburg). The tables of associated

\* 'Golestan' means in Persian etymology 'the country of flowers'. This is the older name of the area which replaced the formerly 'Mohammad Reza Shah National Park' after the Iranian Revolution.

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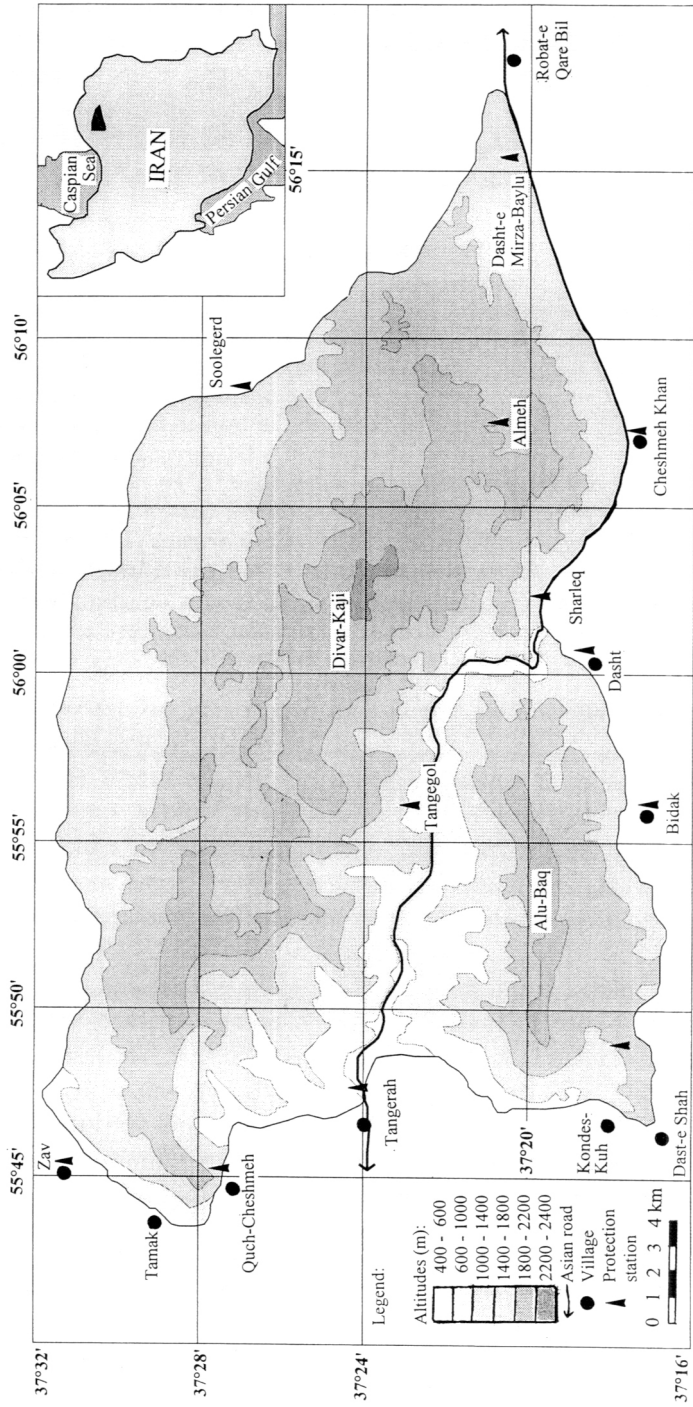


FIG. 1. Map of the Golestan National Park, and position of the Park in NE Iran.

species are a selection of some phytosociological relevés made according to the Braun-Blanquet method (Dierschke, 1994).

## NEW SPECIES AND NEW RECORDS FOR IRAN

### ALLIACEAE

**Allium vavilovii** Popov & Vved. in Bull. Univ. As. Centr. 19: 122 (1934). **Fig. 2.**

*Material examined.* S part of the Park: 7km East of Tangebol, Golzar valley, 37°21'30"N, 56°1'E, 900–1150m, 1 viii 1995, *Akhani* 11854 (M, hb. Akh.).

New for Iran, previously thought to be endemic to Kopetdagh in Turkmenistan. A species closely related to *A. oschaninii* O. Fedtsch., which was already known from Khorasan (NE Iran), Afghanistan, Pamir-Alai and Tian Shan (Wendelbo, 1971: 19). The main distinguishing character between these species is the cylindrical leaves in *A. oschaninii* versus the flat leaves in *A. vavilovii*. The plants cultivated in Munich Botanical Garden (1996 and 1997) demonstrated the flat leaf character of *A. vavilovii* and therefore confirmed its separation from *A. oschaninii*, which had been doubted by Wendelbo (1971: 19). The most peculiar character of *A. vavilovii* is the strongly inflated lower part of the scapes. Furthermore, its habitat restriction to vertical limestone rocks makes the species easily distinguishable among the 18 known *Allium* species of the Park. Furthermore, *A. vavilovii* flowers in August, later than many other *Allium* species growing in that area.

*A. vavilovii* has frequently been observed on S-facing vertical cliffs of Golzar, where it is associated with *Gypsophila aretioides* and several other cliff species (Table 1).

### BORAGINACEAE

Three of the five *Myosotis* species occurring in the Park are new for Iran. They have all been named by Prof. Dr J. Grau (Munich).

**Myosotis alpestris** F.W. Schmidt, Fl. Boëm. 3: 26 (1794). **Fig. 2.**

*Material examined.* NW part of the Park: Chartongi and Besh-Jakhdan area, 37°28'30"N, 55°52'30"E, 1950–2000m, 19 viii 1995, *Akhani* 12011 (M, hb. Akh.).

*M. alpestris* is cited in *Flora Iranica* from only a few localities in Iraq (Riedl, 1967). However, it is mainly distributed in West and Central Europe, Turkey, Caucasia, N Iran, W Himalaya and probably N America. The species was found once in the Park, at the bottom of an alpine karstic gully surrounded by montane forest, where it was collected together with *Fragaria vesca* L., *Urtica dioica* L., *Calamagrostis epigejos* (L.) Roth, *Scrophularia gaubae* Bornm., *Saponaria bodeana* Boiss., *Epilobium montanum* L., *Clinopodium umbrosum* (M. Bieb.) K. Koch, *Erigeron acer* L. subsp.

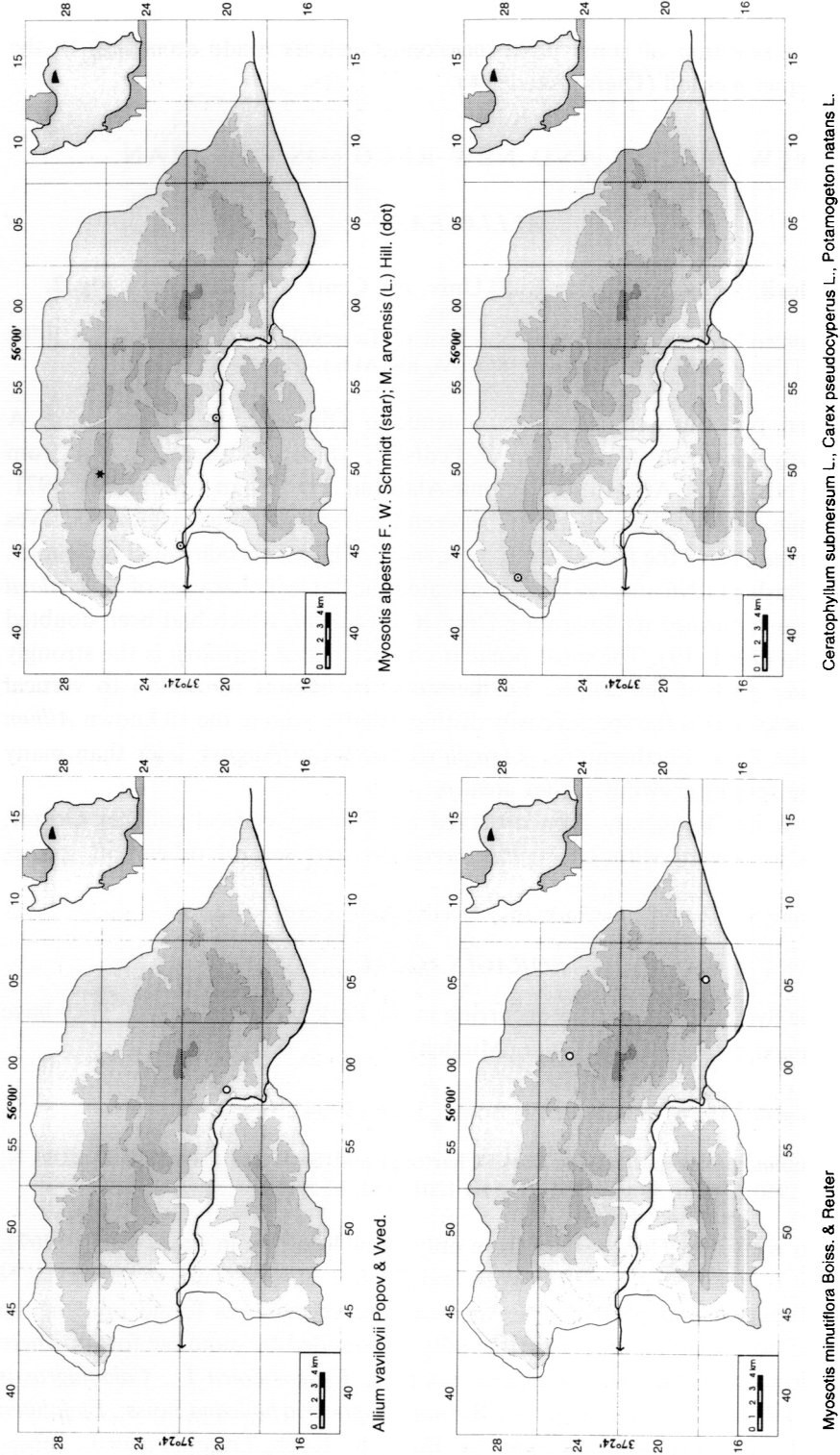


FIG. 2. Distribution of species of the genera *Allium*, *Myosotis*, *Ceratophyllum*, *Carex* and *Potamogeton* in Golestan National Park. ⊕ = +, ○ = 1, cover abundance according to Braun-Blanquet's scales (cf. Dierschke 1994), ⊙ = record based only on herbarium specimen.



TABLE 1. Species associated with *A. vavilovii*, based on a 100m<sup>2</sup> (10 × 10m) sample area: No. 355, Date: 1 viii 1995, Alt.: 1040m, gradient 80–90°, aspect: SW, total cover: 30%.

Species	Cover abundance
<i>Rhamnus pallasii</i> Fisch. & C.A. Mey.	2
<i>Gypsophila aretioides</i> Boiss.	2
<i>Allium vavilovii</i> Popov & Vved.	1
<i>Alyssopsis mollis</i> (Jacq.) O.E. Schulz	1
<i>Asperula gorganica</i> Schönb.-Tem. & Ehrend.	1
<i>Bromus tectorum</i> L.	1
<i>Celtis caucasica</i> Willd.	1
<i>Dianthus orientalis</i> Adams	1
<i>Euphorbia marschalliana</i> Boiss.	1
<i>Kochia prostrata</i> (L.) Schrad.	1
<i>Lappula barbata</i> (Ledeb.) Gürke	1
<i>Melica ciliata</i> L. s. l.	1
<i>Parietaria judaica</i> L.	1
<i>Picris strigosa</i> M. Bieb.	1
<i>Rosularia sempervivum</i> (M. Bieb.) A. Berger	1
<i>Scrophularia variegata</i> M. Bieb.	1
<i>Stipa arabica</i> Trin. & Rupr.	1
<i>Tanacetum parthenicum</i> (L.) Sch.Bip.	1

*arctophilus* (Rech. f.) Rech. f., *Geranium pyrenaicum* Burm. f., *Alchemilla* sp., *Stellaria holostea* L., and a probably new *Potentilla*.

***Myosotis arvensis* (L.) Hill, Veg. Syst. 7: 55 (1764). Fig. 2.**

*Material examined.* Centre of the Park: In quercetis (*Quercus castaneifolia*) apertis ad cascades E Tang-e Gol [Tangegol], substr. calc., 750m, 4 vi 1975, *Rechinger* 52620, 52630 (W); Tangerang, 37°24'N, 55°48'E, near building office, *Quercus castaneifolia-Carpinus betulus* forest, 21 iv 1995, 450–500m, *Akhani* 10389 (LI, M, hb. Akh.)

New for Iran and the *Flora Iranica* area. A species widely distributed in Europe, N Africa and eastwards to N Iran.

***Myosotis minutiflora* Boiss. & Reuter, Pug. Pl. Nov. 80 (1852). Fig. 2.**

*Material examined.* North and South of the Central part of the Park: c.7km W. Soolegerd, 37°26'N, 56°4'E, mixed formation of open *Juniperus excelsa* woodland and *Artemisia* steppe, 1450–1500m, 28 iv 1995, *Akhani* 10530 (LI, M, W, hb. Akh.); Almeh, 37°21'N, 56°8'E, 1700–1900m, mixed formation of grasses and thorn-cushions (*Stipa-Festuca valesiaca-Poa densa-Onobrychis cornuta*), 28 v 1995, *Akhani* 10985 (M, hb. Akh.).

*M. minutiflora* is readily distinguishable by its delicate habit (to 10cm tall) and hooked hairs on stem and leaves. It was not reported from Iran in *Flora Iranica* (Riedl, 1967), however, its presence in Iran as anticipated in *Flora of Turkey* (Grau

1979: 272) can now be confirmed. The species is a Mediterranean/Irano-Turanian element and is distributed from S Spain through the Balkan Peninsula, W, S & C Anatolia and eastwards to N Iran and Afghanistan.

### CERATOPHYLLACEAE

***Ceratophyllum submersum* L.**, Sp. Pl. ed. 2: 1409 (1763). **Fig. 2.**

*Material examined.* NW part of the Park: Sulukli Lake, 37°29'30"N, 55°46'20"E, (pH=6.5, EC=6–11µS/cm), 1380m, 18 xi 1996, *Akhani* 12351 (LI, M, W, hb. Akh.).

New for Iran and the *Flora Iranica* area. The species is easily distinguished from the more common *Ceratophyllum demersum* L. by the absence of basal spines on the fruits and the 3–4-forked leaves. It was found in Sulukli Lake, together with several other rare and interesting species. This species grows in deeper parts of the lake, associated with *Potamogeton natans* L., *Lemna minor* L., *Schoenoplectus lacustris* (L.) Palla and the aquatic liverwort *Ricciocarpos natans* (L.) Corda.

### COMPOSITAE

***Centaurea golestanica* Akhani & Wagenitz, sp. nov. Figs 3, 4 & 9C.**

Planta perennis, e basi multicaulis, ob caules ascendentes vel subprostrati diametrum usque ad 2m attingens. Caules 60–110cm alti, leviter costati, basi straminei, pilis articulatis longis sparse hirsuti, pro parte majore alati et inter costis stramineis virides et araneosi, supra ramosi, capitulis subcorymbose dispositis. Folia basalia et inferiora florendi tempore emarcida, c.8–15cm longa et 1–3cm lata, lanceolata, basi attenuata, sessilia vel petiolata, petiolo usque ad 8cm longo, integra vel denticulata; folia caulina media et superiora lanceolata, 2–10 × 0.5–1.5cm, margine anguste revoluta, nervis subtus prominentibus, laxe araneoso-tomentosa (infra densius) et glandulis sessilibus obsita, apiculata mucrone minuto cartilagineo 0.5–1mm longo. Involucrum 23–28mm longum, 15–18mm latum, subovatum, apicem versus constrictum. Phyllaria tomentulosa vel subglabra, straminea. Appendices phyllariorum mediorum triangulares, 6–10mm longae, in spinam brevem angustatae, utrinque ciliis vel spinulis 3–4, ad 2–3mm longis, saepe prorsus directis provisae. Flores lutei, c.50–60, c.25mm longi. Achaenia 4–5mm longa, compressa, glabra, nitida; pappus usque ad 7–8mm longus, multiseriatus, setis scabris, internus 1–1.5mm longus.

Verosimiliter ad sectionem *Cynaroides* Boiss. ex Walp. pertinens, sed habitu perenne, foliis valde decurrentibus et appendicibus parvis ciliis paucis insignis.

Type: NE Iran: E Mazandaran: Gorgan and Gonbad Area; Northwestern border of the Golestan National Park, c.14km SW of Lohondor, Koilar, 37°30'N, 55°50'E, mixed formation of grasses and shrubs, 1300m, 9.7.1995, *Akhani* 11704 (holo. MMTT; iso. E, M, W, hb. Akh.).

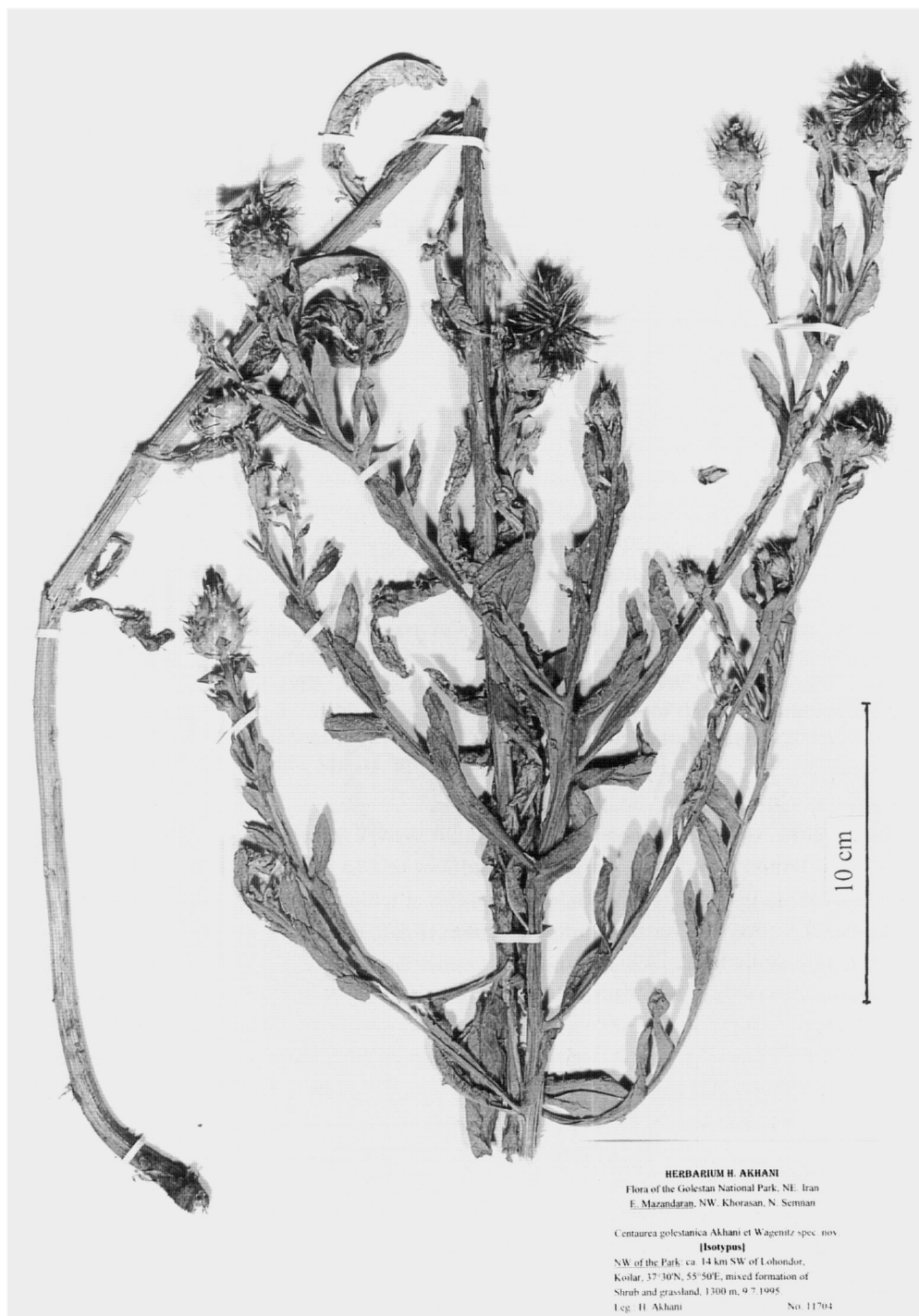


FIG. 3. Isotype of *Centaurea golestanica* Akhani & Wagenitz.

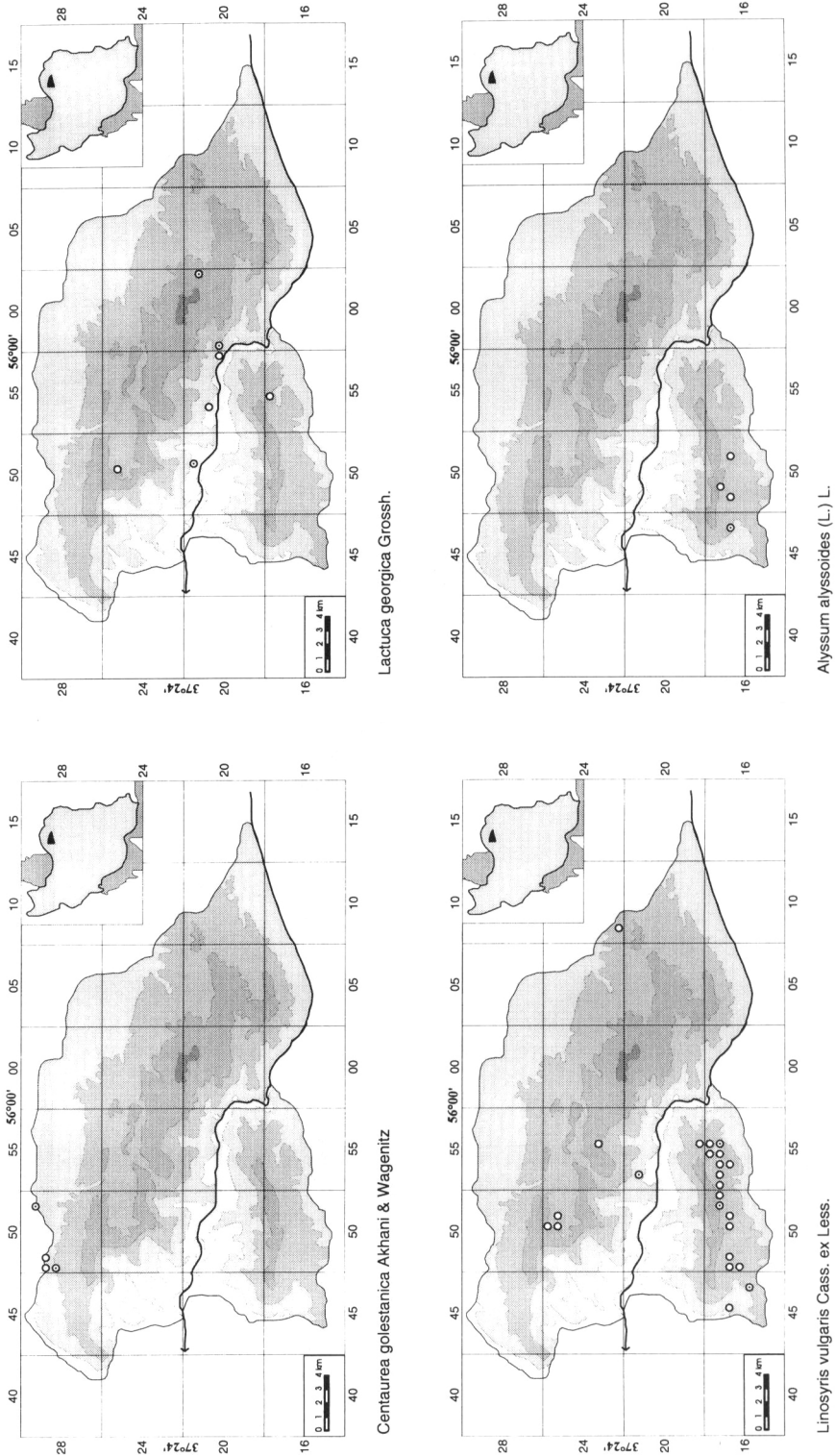


FIG. 4. Distribution of species of the genera *Centaurea*, *Lactuca*, *Linosyris* and *Alyssum* in Golestan National Park (see Fig. 2 for explanation of symbols).

Perennial with several stems from the base, these ascending or nearly prostrate, forming a dense patch up to 2m diam. *Stems* 60–110cm tall, slightly ribbed; lower part straw-coloured, with long multicellular hairs; upper part greenish with straw-coloured ribs, araneose; winged for more than half their length by the strongly decurrent leaves; branched in the upper half or upper third part; capitula mostly subcorymbosely arranged. *Basal and lower cauline leaves* withered at flowering time, 8–15cm long and 1–3cm broad, lanceolate with narrow base, sessile or the lower with petioles up to 8cm long, margin entire or remotely denticulate; middle and upper leaves strongly decurrent, densely arranged, lanceolate, 2–10 × 0.5–1.5cm, apiculate (cartilaginous mucro 0.5–1mm), margins indistinctly revolute, prominently reticulate-veined beneath; with sessile glands and araneose tomentum (denser on the lower side). *Involucre* 23–28mm long and 15–18mm broad, subovoid, constricted towards the top. *Phyllaries* firm and smooth, straw-coloured, finely tomentose or subglabrous; appendage of middle phyllaries triangular, 6–10mm long, narrowed into a short spine, with 2–4 pairs of lateral spinules (c.2–3mm long), often directed towards the tip. *Flowers* yellow, c.50–60 in each capitulum, c.25mm long. *Achenes* 4–5mm long, laterally compressed, glabrous, shiny; pappus up to 7–8mm long, multiseriate, bristles scabrous, the innermost 1–1.5mm long.

*Additional specimens examined.* NW part of the Park, c.14km SW of Lohondor, Koilar, 37°30'N, 55°50'E, mixed formation of grasses and shrubs, 1350m, 2 vi 1995, *Akhani* 11128 (M, hb. Akh.); *ibid.* 3 vii 1988, *Akhani* 4544 (MMTT); c.10km SW of Lohondor, 5km E Gorg-Meydan and Koilar, 37°31'N, 55°54'E, grassland, N border of the Park, margin of the road, 1250m, 9 vii 1995, *Akhani* 11707 (GOET, M); Darreh-ye Gareh-giagh, 1200m, 17 vii 1983, *Zehzad* 83/1377 (GOET, SBUH, hb. Akh.).

The widely decurrent greyish leaves make the new species similar in habit to *C. solstitialis* L. The structure of the involucre, however, is rather different, and so are the large achenes. *C. golestanica* is difficult to place in the existing sections. The closest affinity seems to be with the Iranian perennial species of sect. *Cynaroides* Boiss. ex Walp., such as *C. geluensis* Boiss. & Hausskn. and *C. gudrunensis* Boiss. & Hausskn. Both species, however, have subglabrous or scabrid leaves and the lower ones are lobed or lyrate, the upper shortly decurrent. Moreover, *C. geluensis* from Luristan in W Iran has more numerous lateral spinules, larger achenes (c.7mm) and a shorter pappus (3mm), whereas *C. gudrunensis* from the Iran/Iraq frontier in Kurdistan is distinctive by the longer appendages (8–13mm) and the inner pappus which is long or slightly longer than the other bristles.

*Ecology.* This species was found in a mixed formation of shrubs and grassy patches at the northeastern border of Golestan National Park, in a transition zone of high altitude forest and *Stipa-Artemisia* steppes. The main associated shrubby species are: *Crataegus pentagyna* Willd. subsp. *pentagyna*, *C. pseudoheterophylla* Pojark. subsp. *turkestanica* (Pojark.) K.I. Chr., *Malus orientalis* Uglitzk., *Paliurus spina-christi* Mill., *Cotoneaster ovatus* Pojark., *C. cf. nummularioides* Pojark., *Quercus castaneifolia* C.A.

Mey., *Prunus divaricata* Ledeb. Herbal vegetation included the grasses *Dactylis glomerata* L., *Festuca valesiaca* Gaudin, *Hordeum bulbosum* L., *Stipa lessingiana* Trin. & Rupr., and *Vicia variabilis* Freyn & Sint., *Crucianella sintenisii* Bornm., *Eryngium caucasicum* Trautv., *Haplophyllum acutifolium* (DC.) G. Don. f., *Tragopogon capitatus* S. Nikitin. This last species has newly been reported for Iran from the same locality (cf. Akhani, 1996).

*Distribution and chorology.* Based on our present knowledge, *C. golesstanica* is found only in the northwestern border region of the Golestan National Park. However, its occurrence in similar ecological conditions outside the Park is probable. It is also probable that suitable habitats outside the Park have been greatly reduced or even destroyed, due to overgrazing and agricultural development at the margin of the East Caspian forests. It is rather difficult to determine the phytochorion of *C. golesstanica*, because of its transitional habitat between Caspian forests and NE Iranian steppes. The first author believes that the species can be grouped with several endemic Caspian species inhabiting natural forest margins, as they occur among rocky outcrops that carry an open vegetation mainly made up of low trees, shrubs and grasses.

*Conservation.* As the species grows on the border of the Park, its conservation seems to be rather critical. The habitat of the species is very productive, such that the herbaceous biomass has traditionally been harvested for winter forage for the Park's horses, and for animal forage by the neighbouring Behkadeh village (a village for the rehabilitation of leprosy patients), and by the villages surrounding the Park at the north and northwest. From 1996 onwards, this harvesting has been banned after the author's objection to the Iranian Department of Environment. Other existing threats to the population of *C. golesstanica* are grazing and man-made fires. The author considers that the threats to *C. golesstanica* qualify it to be registered as 'endangered' under the IUCN (1994) categories.

***Lactuca georgica*** Grossh. in Grossh. et Schischk., Sched. ad herb. Pl. or. exsicc. fasc. I–VIII (1924).

Type: Transcaucasia: pr. et dist. Tiflis, prope ruinas Ker-Ogly, 4000ft, in lapidosis, 6 viii 1922, *A. Grossheim* 25 (iso. K). **Fig. 4.**

*Material examined.* C, N-Central and S part of the Park: between Tangerang & Tangebol, c.800m, 37°23'N, 55°53'E, 22 viii 1987, *Ghorbanli & Akhani* 4916 (MMTT); 5km E of Tangebol, 37°22'30"N, 55°59'30"E, 750–900m, 30 vii 1995, *Akhani* 11840 (E, M, hb. Akh.); 6km E of Tangebol, Golzar, in *Zelkova carpiniifolia*-*Carpinus* forest, 37°22'N, 56°00'E, 800–950m, 9 vii 1994, *Akhani* 9624 (hb. Akh.); 6km NE of Almeh, westernmost part of Dagarmanli valley, 37°23'N, 56°05'E, 2000–2050m, transition zone from shrubland to steppe, 11 vii 1995, *Akhani* 11745 (hb. Akh.); SE-facing slopes of Alu-Baq Mountain, Yelaq flats, from 37°19' to 37°20'N and 55°56' to 55°57'E, 1400–1800m, 9 viii 1995, *Akhani* 11926 (K, M, hb. Akh.); westernmost part of Qortoy valley, c.9km NE of Tangerang, 1800m, 37°27'N, 55°52'30"E, in open scrub, associated with grasses, 21 viii 1995, *Akhani* 12054 (M, hb. Akh.); Gulistan [Golestan] forest, 3000 ft alt., dry banks, 20 viii 1966, *P. Furse* 9020 (K).

*Lactuca georgica* was already known from Turkey, Caucasia, and from Kopetdagh in Turkmenistan (Kirpichenkov, 1964: 306–307; Nikitin & Geldykhonov, 1988: 648; Jeffrey, 1975: 778). The last author mentioned its occurrence in N Iran, but Rechinger (1977) did not cite any locality for the *Flora Iranica* area. The material cited above matches well with the type specimen. Kirpichenkov (1964: 306–307) described the achenes as pilose in their upper part. The illustration given in *Flora URSS* (vol. 29: Tab. 18, Fig. 7) also shows some hairs on achenes, but neither the type specimen nor the plants cited above from Iran bear such hairs, except for scabrid ridges visible under high magnification. The length of the involucre both in the type specimen and in Iranian plants is (10–)14–15mm, contrary to 8–11mm long as described in *Flora URSS*.

Rechinger (1977: 193) described *L. azerbaijanica* Rech. f. from a locality in Iranian Azerbaijan: Montes Qareh Dagħ, in declivibus borealibus jugi SW Kaleybar versus Aliabad, in quercetis, 1750m, 19 vii 1971, *J. Lamond* (4862) & *F. Termé* [= *Lamond* in *Rechinger* 44289] (Iso: W). The leaves, inflorescence, involucre and young achenes are very similar to *L. georgica*. However, for a final decision concerning the putative identity of both species, further investigations, particularly of mature achenes are necessary.

***Linosyris vulgaris* Cass. ex Less., Syn. Gen. Comp. 195 (1832).**

Syn.: *Chrysocoma linosyris* L., Sp. Pl. 841 (1753); *Aster linosyris* (L.) Bernh., Syst. Verz. Pfl. 151 (1800); *Crinitaria linosyris* (L.) Less., Syn. Gen. Comp. 195 (1832).

**Figs 4, 9A & B.**

*Material examined.* SW, S & C part of the Park: c.2–3km NE of Dast-e Shah Protection Station, shrubby vegetation in transitional zone between forest and steppe, dominated mainly by *Carpinus orientalis* and *Quercus castaneifolia*, 1500–1700m, 6 vii 1995, *Akhani* 11673 (without flowers, M, hb. Akh.); SE slopes of Alu-Baq Mountain, above Darreh-e Mara ‘valley of snakes’, 37°19’N, 55°54’E, 1650m, 8 viii 1995, *Akhani* 11920 (without flowers, LI, M, hb. Akh.); westernmost part of Qortoy valley, c.9km NE of Tangerang, 37°27’N, 55°52’30”E, 1800m, 21 viii 1995, *Akhani* 12053 (M, W, hb. Akh.); Yelaq flats, 1350m, 16 xi 1996, *Akhani* 12315 (E, M, hb. Akh.); above Tangeqol, Savar-Baqi, 37°23’N, 55°56’E, 21 xi 1996, *Akhani* 12388 (E, M, hb. Akh.).

A very interesting new record for Iran and the *Flora Iranica* area. The species is a Euro-Siberian/Mediterranean element, widely distributed in S, W and C Europe, NW Africa, Balkans, W Turkey, and Caucasia. According to Takhtajan (1995: 629) the distribution of this species in the Caucasia extends to Talish. The wide disjunction could be explained by the lack of good botanical explorations in the South Caspian forest area, particularly for late flowering species. *Linosyris vulgaris* is a very late-flowering plant; its flowering time begins in our area at the end of August, a late time for the collectors of non-chenopod flora. It was seen in abundance on the Yelagh flats located in the South of the Park in November 1996, when the area was totally covered by snow! (Figs 9A & B).

*Linosyris vulgaris* is a component of mixed communities of open shrubland and

grassland in many parts of the Park (see Fig. 4), at altitudes from 1000–1800m. In Table 2 a phytosociological relevé in which the species is associated is given.

### CRUCIFERAE

***Alyssum alyssoides* (L.) L., Syst. Nat. ed. 10, 2: 1130 (1759). Fig. 4.**

Syn: *Clypeola alyssoides* L., Sp. Pl. 2: 652 (1753).

*Material examined.* S part of the Park: c.2km NE & N of Dast-e Shah Protection Station, c.5–6km E of Kondeskuh, S slopes of Shakha Mountain, 37°19'N, 55°49'E, foggy closed forest and open scrub, 1350–1450m, 14 v 1995, *Akhani* 10612-b (M, hb. Akh.); eastern extension of Shakha Mountain, Lateh Tas, 37°19'30"N, 55°51'E, 1850–1900m, 5 vii 1995, *Akhani* 11621 (hb. Akh.).

*Alyssum alyssoides* is a widespread weedy species of W, C and S Europe, Russia and N Africa, and introduced into N and S America. Eastwards, it has been recorded from Crimea, the Caucasus and Azerbaijan (Dudley, 1965: 199). In the *Flora Iranica* area it has been known only from one locality in Afghanistan (Dudley, 1965: 201; Rechinger, 1968b: 153); Kabul: Inter Kabul et Paghman, *Hedge & Wendelbo* 3146. The new collection of the species in Iran links the wide disjunction between Transcaucasia and Afghanistan. It is interesting that Aryavand (1996), in his paper on the numerical taxonomy of Iranian species of *Alyssum*, mentioned the occurrence of *A. alyssoides* in Iran, based on a specimen seen by him in TARI. However, he gave no locality and did not cite any voucher material.

*Alyssum alyssoides* is characterized by entire, non-appendiculate filaments and a persistent calyx. The author found no difference between the Iranian and European plants within the rich material held in M.

The species was collected in the SW part of the Park, in a transition zone between montane scrub and montane steppe. The species associated with *A. alyssoides* are given in Table 2, according to one selected phytosociological relevé.

### CYPERACEAE

***Carex pseudocyperus* L., Sp. Pl. 978 (1753). Fig. 2.**

*Material examined.* NW part of the Park: Sulukli Lake, 37°29'30"N, 55°46'20"E, 1380m, 15 viii 1995, *Akhani* 11988 (E, M, hb. Akh.).

Known previously in the *Flora Iranica* area only from Talish and NE Iraq (Kukkonen, 1987: 29–30). *Carex pseudocyperus* is a helophyte widely distributed in N Africa, Europe, C & S Russia, Siberia, W Syria, Caucasia, N Iran, C & E Asia, New Zealand, N America (Euro-Siberian/Boreo-American element). In the Park it has been found once in Sulukli Lake located in the NW part of the Park, where it is associated with some other rare or new plants for Iran (see Table 3).



TABLE 2. Species associated with *Alyssum alyssoides*, *Euphorbia humilis*, *Linosyris vulgaris* and *Plantago podlechii* based on two phytosociological relevés from southern slopes of the Alu-Baq Mountain (37°19'N, 55°53'30"E): Date: 8 viii 1995; sample area: 36m<sup>2</sup> (6 × 6m); gradient: ±0; alt.: c.1700m; · total cover of both plots: 60–70%. The new records or new species are in **bold face**.

Species	Cover abundance	
	No. 397	No. 398
<i>Stipa lessingiana</i> Trin. & Rupr.	3	·
<i>Stipa pennata</i> L. s. l.	·	2
<i>Festuca valesiaca</i> Gaudin	2	1
<i>Poa bulbosa</i> L.	2	·
<i>Poa densa</i> Troitsky	·	2
<i>Onobrychis cornuta</i> (L.) Desf.	2	1
<i>Acantholimon raddeanum</i> Czerniak.	1	2
<i>Centaurea virgata</i> Lam.	1	2
<i>Koeleria macrantha</i> (Ledeb.) Schult.	·	2
<i>Teucrium chamaedrys</i> L.	1	2
<i>Crupina vulgaris</i> Cass.	1	1
<i>Echinops ritrodes</i> Bunge	1	1
<b><i>Euphorbia humilis</i></b> C.A. Mey. ex Ledeb.	1	1
<i>Hypericum elongatum</i> Ledeb.	1	1
<i>Inula oculus-christi</i> L.	1	1
<i>Linum nervosum</i> Waldst. & Kit.	1	1
<i>Onobrychis sintenisii</i> Bornm.	1	1
<i>Sanguisorba minor</i> Scop.	1	1
<i>Potentilla recta</i> L. s.l.	1	1
<i>Scabiosa columbaria</i> L.	1	1
<i>Silene</i> cf. <i>bupleuroides</i> L.	1	1
<i>Silene cyri</i> Schischk.	1	1
<i>Teucrium polium</i> L.	1	1
<i>Ziziphora clinopodioides</i> Lam.	1	1
<i>Verbascum speciosum</i> Schrad.	1	1
<b><i>Alyssum alyssoides</i></b> (L.) L.	1	·
<i>Asperula gorganica</i> Schönb.-Tem. & Ehrend.	·	1
<i>Convolvulus cantabrica</i> L.	·	1
<i>Cousinia decipiens</i> Boiss. & Buhse	1	·
<i>Fumana procumbens</i> (Dun.) Gren. & Godr.	1	·
<i>Helianthemum nummularium</i> (L.) Miller	1	·
<i>Herniaria incana</i> Lam.	·	+
<i>Hypericum scabrum</i> L.	1	·
<i>Inula salicina</i> L.	1	·
<i>Leontodon asperrimus</i> (Willd.) Boiss. ex Ball	1	·
<i>Leptorhabdos parviflora</i> (Benth.) Benth.	·	1
<b><i>Linosyris vulgaris</i></b> Cass. ex Less.	·	1
<i>Medicago sativa</i> L.	·	1
<i>Minuartia hamata</i> (Hausskn.) Mattf.	·	1
<i>Ononis pusilla</i> L.	+	·
<i>Phlomis herba-venti</i> L.	·	1
<b><i>Plantago podlechii</i></b> Akhani	1	·
<i>Rosa</i> sp.	·	1
<i>Salvia atropatana</i> Bunge	·	1
<i>Scutellaria pinnatifida</i> A. Hamilt.	1	·
<i>Trinia leiogona</i> (C.A. Mey.) B. Fedtsch.	·	1

TABLE 3. Species associated with *Carex pseudocyperus*, *Alopecurus aequalis* and *Potamogeton natans*, based on 7 phytosociological relevés from Sulukli Lake (37°29'30"N, 55°46'20"E): Total cover of all relevés 90–100%, sample area 4m<sup>2</sup> (2 × 2m); pH = 6.5, EC = 6–11µS/cm. New records are in **bold face**.

Species	Relevé number and cover abundance						
	456	429	430	431	432	433	434
<i>Schoenoplectus lacustris</i> (L.) Palla subsp. <i>tabernaemontani</i> (C.C.Gmel.) A. & D. Löve	3	5	5	3	2	1	1
<i>Lemna minor</i> L.	5	3	2	1	1	.	.
<i>Eleocharis mitracarpa</i> Steud.	.	.	2	3	4	3	1
<i>Alisma lanceolatum</i> With.	.	1	1	1	1	1	.
<i>Polygonum minus</i> Hudson	1	.	1	1	1	1	1
<i>Mentha aquatica</i> L.	.	.	.	2	.	3	4
<i>Rumex crispus</i> L.	.	.	.	1	1	1	1
<i>Alopecurus aequalis</i> Sobol.	.	.	.	1	1	2	1
<i>Glyceria arundinacea</i> (M. Bieb.) Kunth	.	.	.	2	1	1	.
<i>Carex melanostachya</i> M. Bieb.	.	.	.	.	.	1	2
<b><i>Carex pseudocyperus</i> L.</b>	.	1	1	.	.	.	.
<i>Lemna trisulca</i> L.	.	1	1	.	.	.	.
<i>Spirodela polyrrhiza</i> (L.) Schleiden	.	1	1	.	.	.	.
<i>Juncus fontanesii</i> J. Gay	.	.	.	.	1	.	1
<i>Juncus effusus</i> L.	.	.	.	.	.	.	2
<i>Ranunculus lingua</i> L.	1	.	.	.	.	.	.
<b><i>Potamogeton natans</i> L.</b>	1	.	.	.	.	.	.

### EUPHORBIACEAE

#### ***Euphorbia humilis* C.A. Mey. ex Ledeb., Icon. Pl. Fl. Ross. 2: 25 (1830). Fig. 5.**

*Material examined.* (partly named by Mr B. Zehzad, Tehran). N, NE, S and SW parts of the Park: 8–10km SW of Lohondor, along Qortoy valley, in *Stipa* steppe, 37°30'N, 55°54'E, 3 vi 1995, *Akhani* 11167 (M, hb. Akh.); 8km from Mirza-Baylu towards Soolegerd, Yakhti-Kalan pass, 37°24'N, 56°12'E, 1600–1700m, 18 iv 1995, mixed *Acer monspessulanum* scrub and *Stipa* steppe, *Akhani* 10235 (M, hb. Akh.); 9km NW of Mirza-Baylu towards Soolegerd, Jakhti-Kalan pass, 37°24'N, 56°11'E, 1540–1850m, 21–22 vi 1995, *Akhani* 11400 (LI, M, W, hb. Akh.); Sharleq, 37°20'N, 56°02'E, 1000–1200m, in *Paliurus spina-christi*-*Acer monspessulanum* scrub, 20 iv 1995, *Akhani* 10348 (M, hb. Akh.); c.2km NE & N of Dast-e Shah Protection Station, c.5–6km E of Kondeskuh, S slopes of Shakha Mountain, 37°19'N, 55°49'E, foggy closed forest and open scrub, 1350–1450m, 14 v 1995, *Akhani* 10608 (M, hb. Akh.); 4–5km NW of Bidak, S-facing slopes of Alu-Baq Mountain, open *Juniperus excelsa* woodland, 37°18'N, 55°53'E, 1300–1500m, 17 v 1995, *Akhani* 10706 (M, hb. Akh.); c.2–3km NE of Dast-e Shah Protection Station, shrubby vegetation in transitional zone between forest and steppe, dominated mainly by *Carpinus orientalis* and *Quercus castaneifolia*, 37°19'N, 55°51'E, 1500–1700, 6 vii 1995, *Akhani* 11692 (M, hb. Akh.).

New for Iran, previously known in the *Flora Iranica* area only from Kopetdagh (Rechinger & Schiman-Czeika, 1964: 33), based on *Flora URSS*. The species is

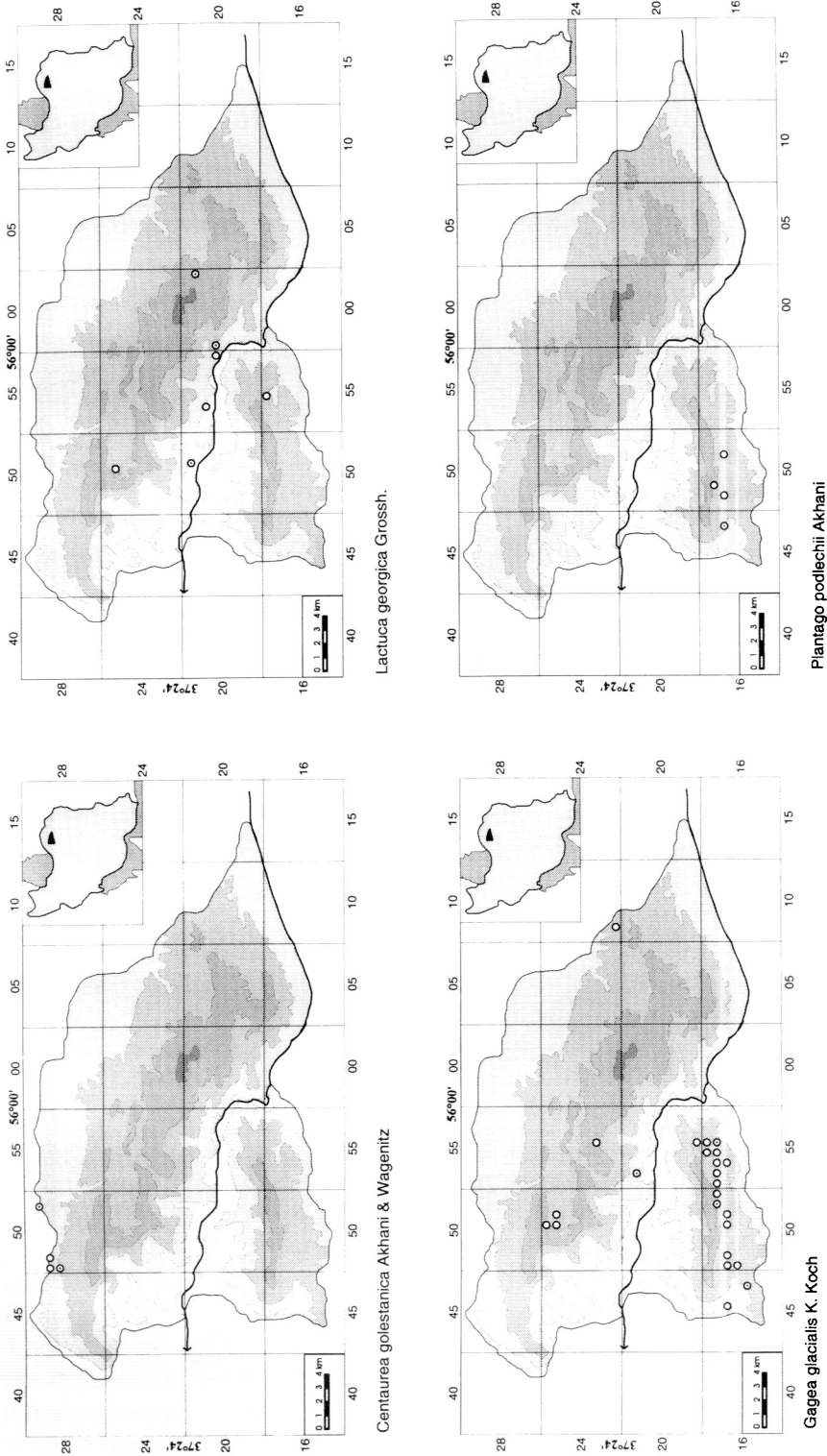


FIG. 5. Distribution of species of the genera *Euphorbia*, *Vicia*, *Gagea* and *Plantago* in Golestan National Park (see Fig. 2 for explanation of symbols).

associated with many steppe and grassland communities in N & NE parts of the Park. The species associated with *E. humilis* in two selected vegetation relevés are shown in Table 2.

### LEGUMINOSAE

***Vicia cassubica* L., Sp. Pl. 735 (1753). Fig. 5.**

*Material examined.* NW part of the Park: Ghoush-Tcheshmeh [Quch-Cheshmeh], 11 vii 1985, Zehzad 85/184 (M, SBUH, hb. Akh.). NC part of the Park: c.11km NE of Tangerang, west of Qortoy valley, 1650–1700m, 37°27'N, 55°53'E, 21 viii 1995. Akhani s. n. (Fragment, hb. Akh.).

A new record for Iran and the *Flora Iranica* area (cf. Chrtková-Zertová, 1979). Davis & Plitman (1970: 280) have already mentioned the Iranian part of Talish under the general distribution of the species in *Flora of Turkey*, but it is not clear what that note was based up. *Vicia cassubica* is a Euro-Siberian element distributed throughout Europe (except for the extreme Northern and Southern parts), the Caucasia, Lebanon, Talish and N Iran.

### LILIACEAE

***Gagea glacialis* K. Koch in Linnaea 22: 228 (1849). Fig. 5.**

*Material examined.* C part of the Park: c.8–10km NNE of Tangegol, W border of Agh-Mazar Mountain, Soltan Hoopi, c.2000m, 9 iv 1989, Akhani & Shasavari 6102 (MMTT, hb. Akh.).

The specimen was collected in an alpine meadow, by melting snow, together with *Crocus almezensis* Brickell & Mathew, *Iris reticulata* M. Bieb., and *Hyacinthus litwinowii* Czerniak. Within the *Flora Iranica* area, *Gagea glacialis* had previously been reported only for Talish (based on *Flora URSS* 4: 87, 1935) (Wendelbo & Rechinger, 1990: 24). Rix (1984: 323), however, quoted Turkey, Caucasia and Iran as parts of the species' area. The specimen matches well with several Turkish plants compared in E.

### PLANTAGINACEAE

***Plantago podlechii* Akhani, sp. nov. Figs 5 & 6.**

Herba perennis caespitosa, usque ad 25cm alta. Caudex lignosus, multiramis, reliquiis foliorum marcidorum brunneis involucreto. Folia lineari-lanceolata, 30–80 × 3–5mm, integra, lamina sericeo-pilosa. Scapus 10–25cm, sulcatus, pilis antrorsis, eis infra spicam densis. Spica ovoidea vel subglobosa, 5–15 × 5–7mm; bractae ovatae, 3–4.5mm longae, apice angustissima, sparse pilosa. Sepala anteriora antica connata, 3mm longa, sparse pilosa vel glabra; sepala posteriora late ovata,

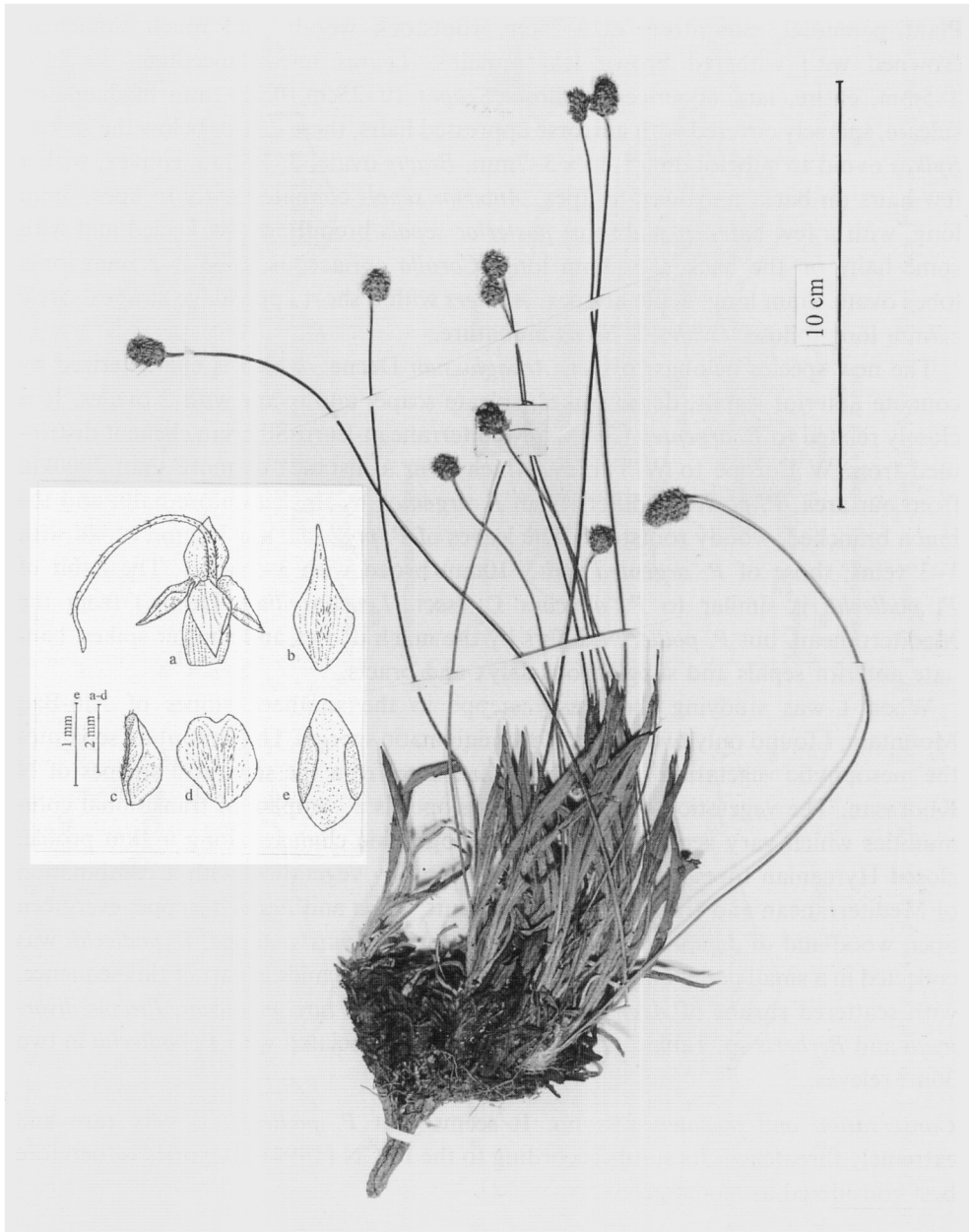


FIG. 6. Holotype of *Plantago podlechii* Akhani: a: corolla and style, b: bract, c: posterior sepal, d: anterior sepals, e: ovary (immature seed).

carinata, sparse ciliata, 2.5–3mm longa. Corolla coriacea, tubo 2–2.5mm longo, lobi ovati acutissimi, 2mm longi. Antherae appendiculatae. Ovula 2. Semina immatura. Type: c.500m E of Alu-Baq spring, 1700m, 37°19'N, 55°53'30"E, 8 viii 1995, *Akhani* 11918 (holo. MMTT, iso. M).

Plant perennial, caespitose, c.20–25cm, rootstock woody and much branched, crowned with withered brown leaf remains. *Leaves* linear-lanceolate, 30–80 × 3–5mm, entire, lamina sericeous-pilose. *Scapes* 10–25cm, 0.75–1mm in diameter, sulcate, sparsely covered with antrorse appressed hairs, these denser below the spikes. *Spikes* ovoid to subglobose, 5–15 × 5–7mm. *Bracts* ovate, 3–4.5mm, convex, with a few hairs on back, narrowed at apex. *Anterior sepals* connate nearly to apex, 3mm long, with a few hairs or glabrous; *posterior sepals* broadly ovate, keeled and with some hairs on the back, 2.5–3mm long. *Corolla* coriaceous, tube 2–2.5mm long; lobes ovate, 2mm long, acute at apex. *Anthers* with a short appendage at apex. *Style* c.7mm long, pilose. *Ovules* 2. *Seeds* immature.

The new species belongs to sect. *Arnoglossum* Decne., which is characterized by connate anterior sepals, dense spikes, sulcate scape, and ovary with 2 ovules. It is closely related to *P. argentea* Chaix, a Mediterranean-Euro-Siberian element distributed from W Europe to W Turkey, which is in a distance of more than 2000km from our area. *P. podlechii* differs from *P. argentea* by the caespitose habit and the much branched, woody rootstock. The leaves of *P. podlechii* are 3–5mm broad with 1–3 veins; those of *P. argentea* are 3–10mm broad with 3–5 veins. The habit of *P. podlechii* is similar to *P. albicans* L. (sect. *Leucopsyllium* Decne.) from the Mediterranean, but *P. podlechii* differs by the much denser and shorter spikes, connate anterior sepals and subglabrous calyx and bracts.

When I was studying the grassy steppe in the southern slopes of Alu-Baq Mountain, I found only two plants of this enigmatic species. This mountain separates the mesophytic vegetation of the Hyrcanian area from the semi-arid steppes of N Khorasan. The vegetation of the southern slopes is a complex of transitional communities which vary according to small topographic changes along a 2km profile: closed Hyrcanian forest; different kinds of shrubby vegetation with a combination of Mediterranean and Irano-Turanian elements; *Stipa* and *Festuca* steppe; evergreen open woodland of *Juniperus excelsa*; rather pure *Artemisia* steppe. *P. podlechii* was collected in a small patch of flat grassland, located in the middle part of this sequence, with scattered shrubs of *Acer monspessulanum* subsp. *turcomanicum*, *Prunus divaricata* and *Berberis* sp. Table 2 presents the species associated with *P. podlechii* in two 36m<sup>2</sup> relevés.

*Conservation and threatened status.* It seems that *P. podlechii* is very rare and extremely threatened. Its status according to the IUCN (1994) categories is therefore best considered as ‘endangered’.

#### POLYGONACEAE

***Atraphaxis seravschanica*** Pavlov, Animadvers. Syst. Herb. Tomsk 5–6: 3 (1933). **Fig. 7.**

*Material examined.* South-Central part of the Park: c.5km E Almehr, N slopes of Almehr valley, 37°21'10"N, 56°11'E, 1500–1700m, 30 v 1995, Akhani 11039 (LI, M, hb. Akh.); Qorkhod Protected Area (bordering the E and NE of the Golestan National Park): In planitie ‘dasht’

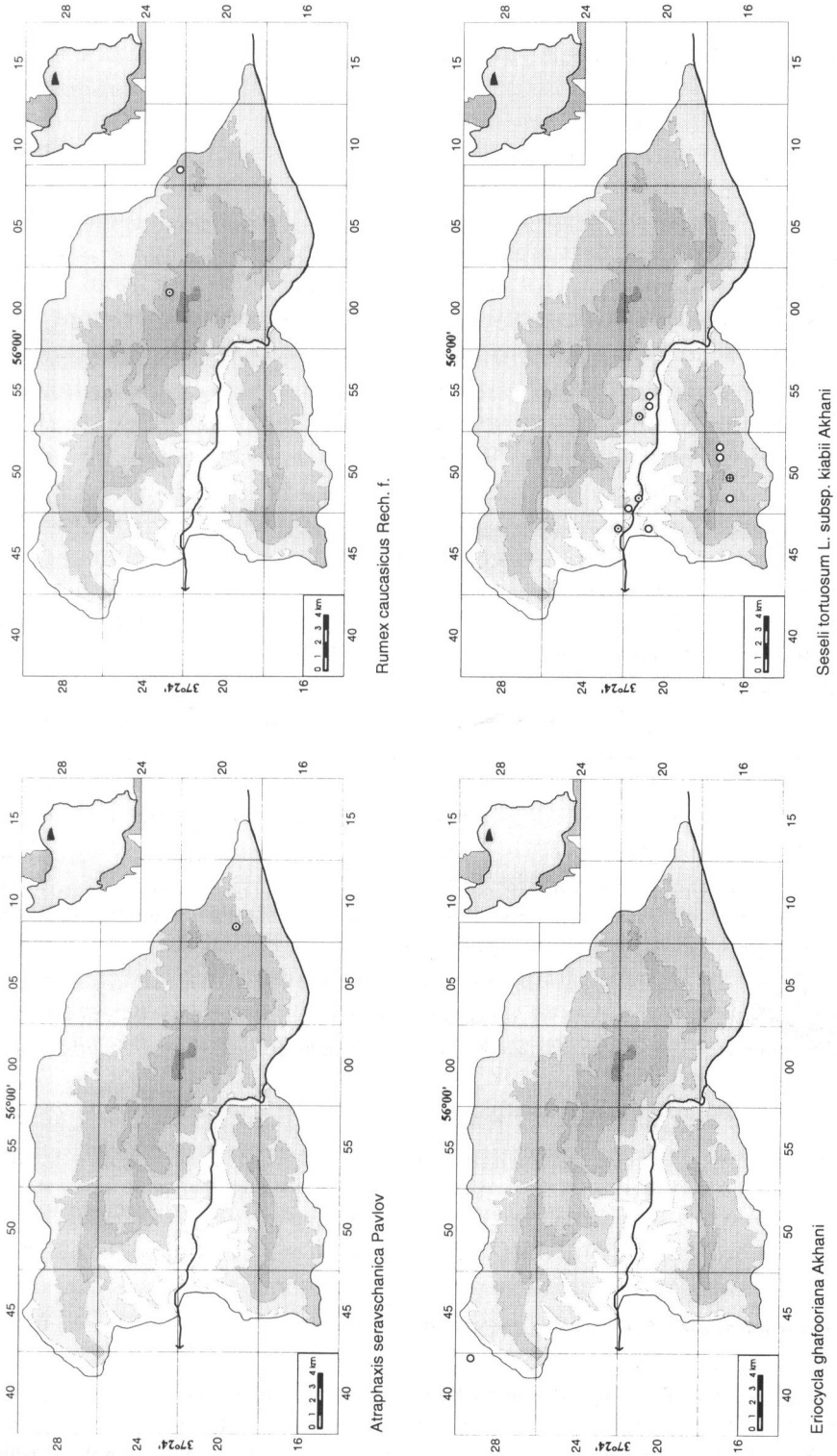


FIG. 7. Distribution of species of the genera *Atraphaxis*, *Rumex*, *Eriocycla* and *Seseli* in Golestan National Park (see Fig. 2 for explanation of symbols).

ad viam versus Almeh ducentem, N Robat-e Qareh Bil, 37°19'N, 56°26'E, 1200m, 5 vi 1975, *Rechinger* 52925 (W).

Also the three following specimens of this species from outside the Park have been seen in W:

Khorasan: 4–6km SE of Moraveh Teppeh, of road to Bojnurd, alt. 500m, lax habit, pale pink flowers with dark pink bracts; a shrub up to 80cm diameter, growing in shallow valleys and on scree, 21 v 1976, *T. F. Hower* H-3824 (W); 30 miles E of Bojnurd, Kopet-Dagh foothills; rocky stony slopes with limestone outcrops and yellow caking earth, 4000 ft alt., bushy pale pink flowers, 17 v 1966, *P. Furse* 7437 (W, as *A. billardieri* var *tournefortii*).

A new record for Iran. It was previously known only from Turkmenistan to Pamir-Alai (*Rechinger & Schiman-Czeika* 1968: 33).

***Rumex caucasicus*** Rech. f., *Feddes Repert.* 31: 262 (1933).

Syn.: *R. aschabadensis* Los., *Fl. URSS.* 5: 715 (1936). **Fig. 7.**

*Material examined.* C part and NE border of the Park: c.12km ENE of Tangebol, N slopes of Divar Kaji Mountain (Agh-Mazar), 37°25'N, 56°03'30"E, 1900–2100m, 19 vi 1995, *Akhani* 11355 (hb. Akh.); 9km NW of Mirza-Baylu towards Soolegerd, Jakhti-Kalan pass, 37°24'N, 56°11'E, 1540–1850m, 21–22 vi 1995, *Akhani* 11397 (M, hb. Akh.).

*Rumex caucasicus* was known in the *Flora Iranica* area (*Rechinger* 1968 a: 12) only from one locality in Turkmenistan: in angustiiis versus mont. Saondak, 15 vi 1897, *Litwinow* 2440 (fragment of isotype of *R. aschabadensis* Los. in W). It is distributed in NE Turkey, Caucasia, Turkmenistan and NE Iran. It differs from the closely related *R. patientia* in having fusiform tubercles on the perianth. I have seen only one specimen of *R. caucasicus* from Turkey (*Davis* 21076, E) and the cited fragment from Turkmenistan. Therefore, further studies and comparison with type or identical specimens from the *locus classicus* are required to check the above identification. No. 11355 was collected under the shade of *Quercus macranthera*, at the margin of *Juniperus excelsa* forest, and No. 11397 was found at the NE border of the Park, along roadsides and in association with open *Acer monspessulanum* subsp. *turcomanicum* scrub.

#### POTAMOGETONACEAE

***Potamogeton natans*** L., *Sp. Pl.* 126 (1753). **Fig. 2.**

NW of the Park: Sulukli Lake, 37°29'30"N, 55°46'20"E, 1380m, 15 viii 1995, *Akhani* 11966 (M, hb. Akh.); *ibid.* 18 xi 1996, *Akhani* 12352 (M, hb. Akh.).

This aquatic species, widely distributed in temperate and arctic Eurasia and N



America, was already known within the *Flora Iranica* area from a few localities in Afghanistan (Dandy 1971: 3).

### UMBELLIFERAE

#### ***Eriocycla ghafooriana* Akhani, sp. nov. Figs 7, 8, 10A–E, 11A–D.**

Suffrutex humilis, pulvinato-caespitosus, 5–15cm altus, 10–20cm diametro, valde aromaticus, odore *Petroselinum crispum* valde simili, glaberrimus, lignosus; rami ad basin multiramiosi, intricati, habitu arbusculam vetustissimam nanam simulanti, caudices crassi, residuis foliorum per annos plures perdurantibus squarrosi, ad basin 1–4cm diametro, cortice valde crassa, rami inflorescentiae 10(–20)cm longi, subprostrati, articulati, 4-angulati, umbellae 2–4 laterales. Folia basalia nitido-viridia, fasciculata, apice veteris rami exorientia, oblonga, 2–9 × 0.7–2.5cm, 1(–2)-pinnata; petiolus 0.5–3.5cm longus, ad basin latus, plusminusve membranaceus; pinnae ovatae, 1–2 × 0.5–1cm, profunde 3–5-lobatae, folia caulina reducta, superiora linearia, 5–10 × c.1mm. Bracteae 2–4(–5), lineares, 2–3(–5)mm longae; bracteolae c.4–5, 1–3mm longae. Umbellae divaricatae vel recurvatae, laterales; umbellae radii (2–)3–4(–5), 5–10(–12)mm longi. Umbellulae radii 5–10, 1–3mm longi. Petala flava, 1mm longa, ovata, supra ad costam alata, apice c.0.5mm angustato-appendiculata, emarginata. Filamenta c.1mm longa. Antherae 0.5mm longae. Stylopodium pileiforme. Calyx triangularis, persistens, c.3mm longus, acutus. Fructus ovatus, 2.5–3mm longus, 2mm latus, leviter lateraliter compressus; mericarpia glabra, juga 5, maturitate arcuata; vittae dorsales 4, commissurales 2.

Type: NE Iran: E Mazandaran: Just outside the NW border of the Golestan National Park, N of Zav village, in crevices of vertical rocks, 37°31'N, 55°45'E, 17 xi 1996, 600–700m, *Akhani* 12322 (holo. MMTT; iso.: E, LI, M, W, hb. Akh.).

*Additional material examined.* Ibid, 700–800m, 17 viii 1995, *Akhani* 12002 (E, LI, M, W, hb. Akh.).

Dwarf pulvinate subshrub, 5–15cm tall, 10–20cm diam., strongly aromatic with a smell similar to parsley, completely glabrous, woody, with much-branched, intricate and 'bonsai-like' habit giving the plant a very 'old' appearance, at base with a short trunk, 1–4cm diam., trunk and old branches covered with very thick bark, upper and younger branches covered by squarrose petiole remains. *Leaves* shiny green, fasciculate, arising from the apex of old woody branches, oblong in outline, 2–9 × 0.7–2.5cm; 1(–2)-pinnate; petiole 0.5–3.5cm long, broadened and more or less membranous at the base; pinnae ovate, 1–2 × 0.5–1cm, deeply 3–5-lobed, rarely pinnate; stem leaves reduced, in upper part of stem linear, 5–10 × c.1mm. *Inflorescence* branches 10(–20)cm long, articulate at nodes, 4-angled, with 2–6 lateral umbels. *Bracts* 2–4(–5), linear, 2–3(–5)mm long, bracteoles c.4–5, 1–2mm long. *Umbels* recurved or divaricate; rays (2–)3–4(–5), 5–10(–12)mm long. *Umbellules* with 5–10 flowers; pedicels 1–3mm long. *Petals* yellow, 1mm long, ovate, upper surface winged along midrib, narrowed to a terminal appendage, c.0.5mm long, emarginate at apex.

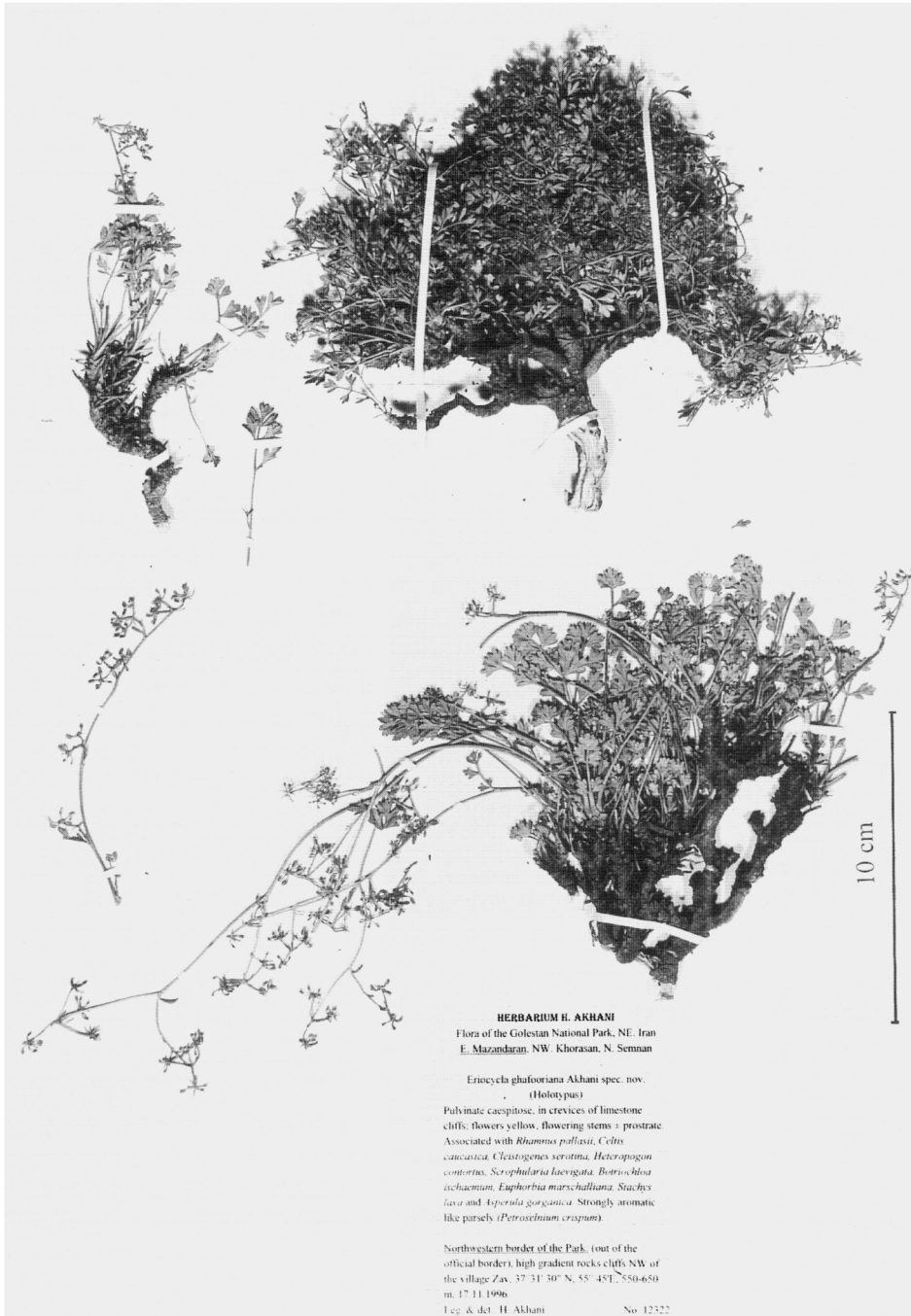


FIG. 8. Holotype of *Eriocyclus ghaffooriana* Akhani.

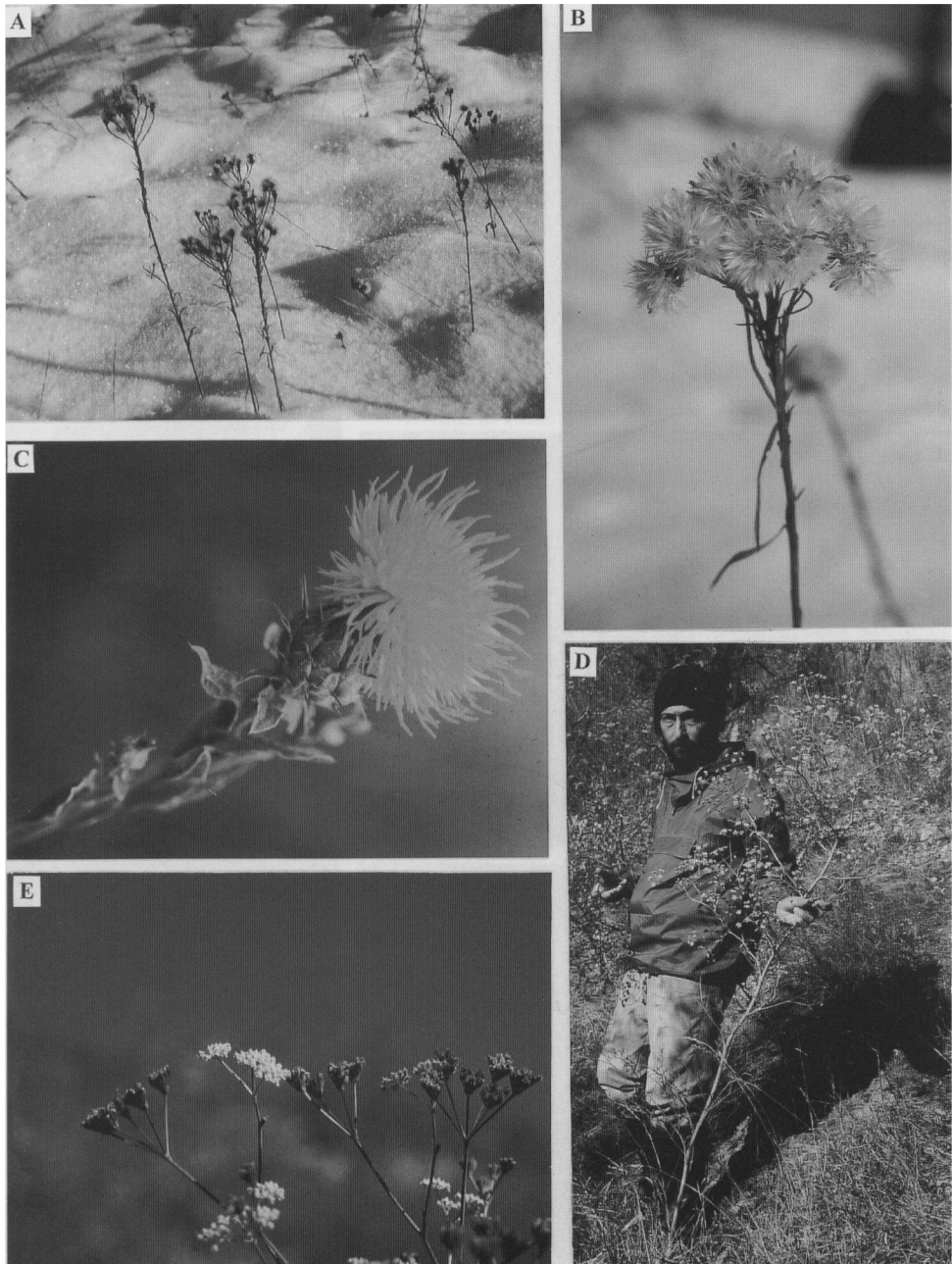


FIG. 9. A–B: Habitat and habit of *Linosyris vulgaris*, note that the habitat is covered by snow. C: *Centaurea golestanica* Akhani & Wagenitz, D–E: *Seseli tortuosum* subsp. *kiabii* Akhani, D: habit with Dr B.H. Kiabi, to whom the subspecific epithet refers, E: inflorescence.

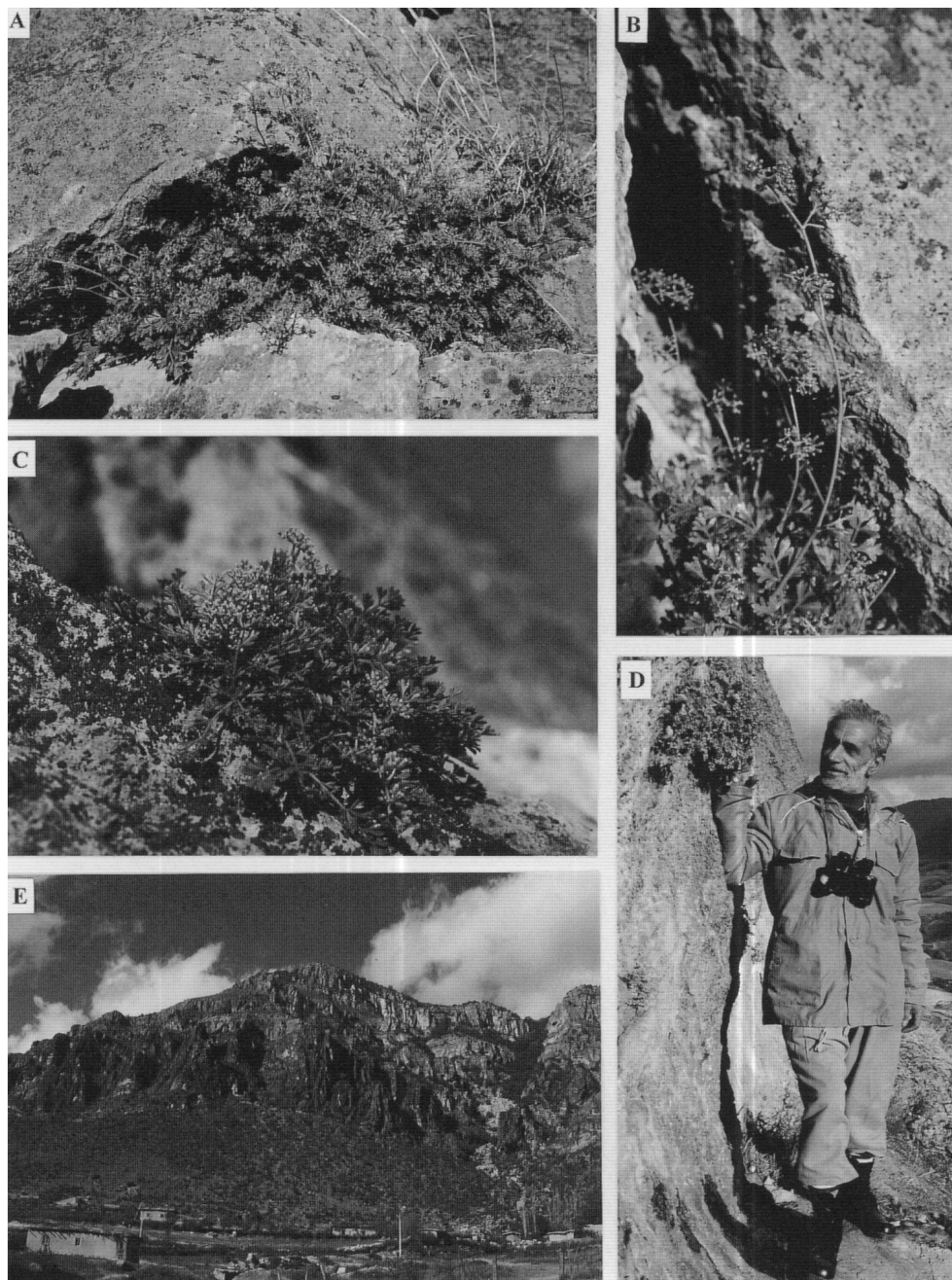


FIG. 10. *Eriocycla ghafooriana* Akhani in natural habitat. A–C: habit, D: habitat in vertical cliffs with Mr Ghafoori, to whom the species is dedicated, E: mountains N Zav, habitat of the species.

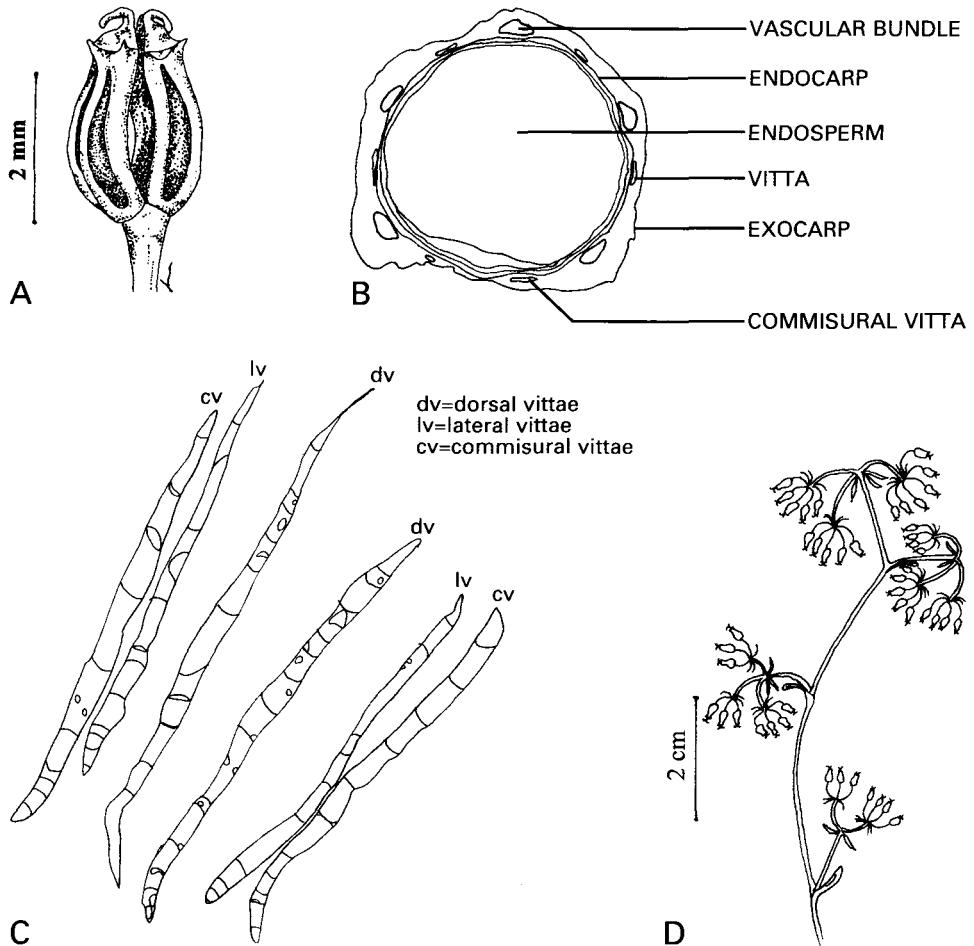


FIG. 11. *Eriocycla ghafooriana* Akhani: A, fruit; B, mericarp in cross section; C, mericarp masceration; D, inflorescence.

*Filaments* c.1mm long; anthers 0.5mm long; stylopodium pileiform. *Calyx teeth* triangular, c.0.3mm, acute, persistent in fruit. *Fruits* ovate, 2.5–3mm long, 2mm broad, slightly laterally compressed; mericarps glabrous, with 5 ribs, arcuate at maturity; dorsal vittae 4, commissural 2.

A very interesting and clearly isolated new species with uncertain generic position. It differs from all other species of *Eriocycla* by the completely glabrous vegetative parts, ovary and fruits. It may be related to *E. olivieri* (Boiss.) Wolff, another cliff species endemic in Alborz Mts. *E. ghafooriana* has an interesting combination of characters that can be compared with several other related genera. The strongly parsley-like aroma, the shiny green leaves, the glabrous fruits, the yellow flowers and solitary dorsal vittae suggest close affinities with *Petroselinum*. However, the habit, the habitat of crevices in cliffs, and the late flowering time is unusual for this

small ditypic genus. The woody caudex, glabrous fruits and leaves have similarities with some *Pimpinella* species, but the solitary dorsal vittae and the very late flowering time do not support such a generic placement. There are some other peculiar characters, for instance the very few rays, laterally arranged umbels and articulation of flowering stem nodes, beside the 'bonsai-like' habit, making this species very isolated and peculiar. The very late flowering and fruiting time is similar to some species of *Seseli*, but the new species does not match this genus in other characters. *E. ghafooriana* has been observed at an early stage of flowering in mid-August, and fruiting in November. Based on field observations, the end of life cycle of this plant is even later, probably in the second half of December!, as was evident from the fresh nature and even flowering umbels at the end of November. These data suggest that *E. ghafooriana* may be an old relic which still exists in special habitats in the East Caspian forest area.

The species is named after Mr Seyed Bagher Ghafoori (Fig. 10D), a diligent park ranger whose interest in nature and conservation of the Park is admirable. Without his generous help during fieldwork, it would not have been possible for me to discover this and several other interesting plants in the Park.

*Ecology.* *E. ghafooriana* grows on vertical cliffs just outside of the Golestan National Park. It is associated with some shrubs such as *Celtis caucasica* Willd., *Rhamnus pallasii* Fisch. & C.A. Mey., *Ficus carica* L., and several late flowering C4 grasses such as *Bothriochloa ischaemum* (L.) Keng, *Pennisetum orientale* Rich., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., and *Cleistogenes serotina* (L.) Keng. Table 4 presents the species associated with *E. ghafooriana*.

*Conservation and threatened status.* As the species is growing outside the National Park area, its habitat is not under protection. The accessible parts of this small mountain are under strong pressure from overgrazing and the cutting of woody species. Fortunately the peculiar habitat, for the time being, offers a kind of natural protection. However, we do not know what will happen if the present impact accelerates. This could lead to a complete destruction of the natural vegetation and a change of the microclimate with adverse consequences for the existence of the species. As the area is located only about 1km outside the official border of the Park, the extension of the park boundary on this mountain is strongly recommended. Alternatively, the area should be included within a buffer zone together with other interesting habitats around the Park.

***Seseli tortuosum* L. subsp. *kiabii* Akhani, subsp. nov. Figs 7 & 9D & E.**

A subsp. *tortuoso* differt planta elatiore usque ad 2m alta (nec 0.5–1m alta), caule ultra medio ramoso (nec e base ramoso), fructis brevioribus 2.5–3.5mm, florifera et fructifera serotina mensibus X–XII (haud VI–X).

Type: NE Iran: E Mazandaran (Gorgan and Gonbad Area); W of the Golestan National Park: 5km E of Tanagerah, 15km W Tangehol, 37°23'20"N, 55°50'E, on

S-facing limestone outcrops, 600–800m, 21 xi 1996, *Akhani* 12370 (holo. MMTT; iso. E, M, W, hb. Akh.).

Differs from subsp. *tortuosum* by the taller habit to 2m (not 0.5–1m), branching from the middle of the stem (not from the base) and the later flowering and fruiting time from October to December (not June to October).

Biennial, stem 1–2m, paniculately branched in the middle of stem, up to 1.5m broad; lateral branches 8–15, 30–80cm long; roots fusiform or branched; stem at base with remnants of dead petioles, but without a distinctly fibrous collar, (0.5–)1–1.5cm diam. at base. *Basal leaves* broadly obovate to orbicular in outline, up to 40cm long and wide, 3–4-pinnate, ultimate segments linear, 3–30mm long, 0.5–1.5(–2)mm broad, scabrid on margin and on midribs of lower surface, acuminate to mucronate at apex; petioles 8–25cm. *Upper leaves* similar but shorter than lower ones. *Inflorescence* divaricately branched, peduncles ribbed, (1–)3–6.5(–7.5)cm. *Bracts* 0–1, lanceolate 2–4mm, membranous at margin, pilose. *Umbels* with 5–8 rays,  $\pm$  equal, 1–15(–35)mm, scabrid or glabrous. *Bracteoles* 9–11, margin membranous, purple-tinged, puberulent. *Umbellules* with 13–19 flowers, pedicels 0.5–3mm, scabrid. *Petals* white. *Fruits* broadly ovoid to orbicular, 2.5–3.5  $\times$  1.5–2.5mm; dorsal vittae 4, commissural 2.

*Additional material examined.* C and W parts of the Park: SE of Tangerang, Khan-dushan, 37°23'N, 55°49'E, 450–550m, *Prunus divaricata-Crataegus pentagyna* scrub, 1 vii 1995, *Akhani* 11563 (M, hb. Akh.); c.6km E of Tangerang, near Golestan Parking, 37°23'N, 55°51'E, limestone outcrops north of the road, open *Carpinus orientalis-Quercus castaneifolia* scrub, 8 ix 1995, *Akhani* 12107 (LI, M, hb. Akh.); c.2km E of Tangerang, N side of road, 650–700m, 37°24'N, 55°49'E, steep limestone outcrops, 14 x 1995, *Akhani* 12230 (E, M, hb. Akh.); 5km E of Tangerang, 37°23'20"N, 55°50'E, 600m, 15 x 1995, *Akhani* 12238 (E, M, hb. Akh., MMTT for distr.); W of Tangegol, S-facing slopes near the road, 37°22'30"N, 55°56'E, 640m, 14 xi 1996, *Akhani* 12274 (E, M, hb. Akh., MMTT for distr.); above Tangegol, Savar-baqi, 37°23'N, 55°56'E, 21.11.1996, *Akhani* 12385 (M, hb. Akh.).

The subspecies is named after Dr B. H. Kiabi (Department of Environmental Protection, Tehran; Fig. 9D) the first Iranian zoologist who performed intensive ecological studies on the wildlife of the Golestan National Park (Hasanzadeh-Kiabi, 1975, 1978). He has supervised several undergraduate and postgraduate theses on the wildlife of the Park and was my first teacher in ecology.

I had first intended to propose this as a new species, but lack of detailed information on the range of variation and distribution of *S. tortuosum*, and the absence of good herbarium material, have led me to give it a lower status. *S. tortuosum* is a widespread Mediterranean and Euxine species distributed in S Europe, NW Africa, Libya, Crimea, and Caucasia to Azerbaijan. Beside the distribution, subsp. *kiabii* differs from *S. tortuosum* subsp. *tortuosum* by its height, branching and shorter fruits. Based on the information gained from herbarium specimens, and personal communications given by some collectors familiar with the Mediterranean flora, it seems that there are remarkable differences between the phenology of subsp. *kiabii* and subsp.

TABLE 4. Species associated with *Cleistogenes serotina*, *Seseli tortuosum* subsp. *kiabii*, *Heteropogon contortus*, and *Eriocyclus ghafooriana* in two selected phytosociological relevés in the Golestan National Park: No. 582: steep cliffs NW of the village of Zav (37°31'30"N, 55°45'E) and No. 583: 5km E of Tangerang (37°23'20"N, 55°50'E), on steep S-facing limestone outcrops.

Relevé No.	582	583
Date	17 xi 96	21 xi 96
Sample area	10 × 10m	15 × 15m
Gradient	75°	c.45°
Altitude	600m	710m
Aspect	SW	S
Total cover (shrub and ground cover)	20%	90%
<b>Shrub layer</b>		
<i>Carpinus orientalis</i> Miller	.	2
<i>Paliurus spina-christi</i> Willd.	.	1
<i>Quercus castaneifolia</i> C.A. Mey.	.	1
<i>Crataegus pentagyna</i> Waldst. & Kit.	.	1
<i>Rhamnus pallasii</i> Fisch. & C.A. Mey.	1	.
<i>Celtis caucasica</i> Willd.	1	.
<b>Ground and herb layer</b>		
<i>Bothriochloa ischaemum</i> (L.) Keng	2	3
<i>Heteropogon contortus</i> (L.) P. Beauv. ex Roem. & Schult.	2	1
<i>Cleistogenes serotina</i> (L.) Keng.	+	2
<i>Dianthus orientalis</i> Adams	+	1
<i>Fumana procumbens</i> (Dun.) Gren. & Godr.	+	1
<i>Bothriochloa bladhii</i> (Retz.) S. T. Blake	.	2
<i>Stachys laxa</i> Boiss. & Buhse	1	.
<i>Stipa bromoides</i> (L.) Dörf.	.	1
<i>Eriocyclus ghafooriana</i> Akhani	1	.
<i>Asperula gorganica</i> Schönb.-Tem. & Ehrend.	1	.
<i>Euphorbia marschalliana</i> Boiss.	+	.
<i>Carex halleriana</i> Asso	1	.
<i>Heteropappus altaicus</i> (Willd.) Novopokr.	.	2
<i>Pennisetum orientale</i> Rich.	1	.
<i>Seseli tortuosum</i> L. subsp. <i>kiabii</i> Akhani	.	1
<i>Origanum vulgare</i> L.	1	1
<i>Convolvulus cantabrica</i> L.	1	1
<i>Fumana arabica</i> (L.) Spach.	.	1
<i>Carex flacca</i> Schreb.	.	1
<i>Onobrychis transcaspica</i> V. Nikitin	.	1
<i>Astragalus jolderensis</i> B.Fedtsch.	.	1
<i>Thesium arvense</i> Horv.	+	.
<i>Teucrium polium</i> L.	+	1
<i>Teucrium chamaedrys</i> L.	+	1
<i>Eryngium caucasicum</i> Tratuv.	.	1



TABLE 4. (Continued).

Relevé No.	582	583
<i>Hypericum perforatum</i> L.	.	+
<i>Linum</i> sp. (sterile)	.	1
<i>Pimpinella affinis</i> Ledeb.	.	+
<i>Dactylis glomerata</i> L.	.	+
<i>Viola alba</i> Bess.	.	+
<i>Sanguisorba minor</i> Scop.	.	+

*tortuosum*. During my field studies I have seen the plant from July to September in vegetative phase, only with basal leaves. However, at that time in the Mediterranean area and in Turkey the species is already in flower and fruit. The stems of subsp. *kiabii* develop at the end of September, flourish in October, and fruits are produced at the end of November and in December. On 21 November I observed many plants still in flowering and early fruiting stage, at a time when surrounding mountainous areas from 1200m onwards were covered by snow! *S. tortuosum* subsp. *kiabii* is a common plant in rocky openings near the main road in lower altitudes of the forested zone of the Park. Further studies may reveal whether this plant may occur also in other parts of the Caspian area.

*Ecology and conservation.* In Table 4 the species associated with *S. tortuosum* subsp. *kiabii* are shown for one sample plot. The species is a very conspicuous component of open scrubs on rocky slopes between Tangerang and Tangegol. For further information on the habitat of the species see notes under *Cleistogenes serotina* in Akhani & Scholz (1998: 446–447).

The species has a large population in the Park and does not appear to be threatened here. Because of lack of information at the moment, it is not possible to evaluate its status outside the Park.

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