

NOTES ON THE GENUS OROBANCHE (OROBANCHACEAE) IN IRAN

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The genus *Orobanche* has 39 species in Iran of which nine taxa are endemic to Flora Iranica area. During preparation of *Orobanchaceae* for the Farsi version of Flora of Iran, *Orobanche owerini* is described and illustrated as a new record to Iran. *O. schultzi* is reported for the second time from Iran. *O. cistanchoides*, *O. stocksii*, *O. caucasica* and *O. bungeana* which have been reported as distinct species by previous authors are revised and accepted. Also, *Orobanche caryophyllacea* is represented as a valid species and it has the priority over *O. vulgaris*. Details on the habitat, ecology and taxonomic remarks of the studied taxa are given.

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Key words. *Orobanche*, Taxonomy, new record, synonymy, Iran.

مطالعاتی روی جنس *Orobanche* (Orobanchaceae) در ایران

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جنس *Orobanche* در ایران دارای ۳۹ گونه است که شش گونه آن انحصاری منطقه "فلور ایرانیکا" است. در راستای تدوین تیره *Orobanchaceae* برای فلور ایران به زبان فارسی گونه *Orobanche owerini* برای اولین بار از ایران گزارش و ترسیم می‌گردد. *O. schultzi* برای دومین بار از ایران گزارش می‌گردد. گونه های *O. cistanchoides*، *O. stocksii*، *O. caucasica* و *O. bungeana* که توسط مؤلفین قبلی به عنوان گونه‌های مستقل گزارش گردیدند بازنگری و پذیرفته شدند. همچنین *O. caryophyllacea* به عنوان گونه معتبر و تقدم نام آن بر *O. vulgaris* ارایه می‌گردد. ویژگیهای تاکسونومیک، رویشگاه. اکولوژی گونه های مورد مطالعه این جنس ارائه می شود.

INTRODUCTION

The genus *Orobanche* L. has 39 species in Iran, of which nine taxa are endemic to Flora Iranica area (Schiman-Czeika 1964). Many species of the genus grow exclusively in the semi-arid and temperate part of northern hemisphere regions (Uhlich & al. 1955). This genus was divided into two sections *Trionychon* Wallr. and *Orobanche* (Beck-Mannagetta 1930). *Orobanche* comprises holoparasitic herbs, with alternative scale-like leaves and flowers arranged in spike. Calyx campanulate, 4(-5)-toothed, or split into two lateral segments, each entire or 2-toothed, shorter than the corolla. The corolla is subzigomorphic bilabiate; upper lip more or less 2-lobed, often erect; lower lip 3-lobed. There is no detailed taxonomic study on *Orobanche* in

Iran except for that presented in Flora Iranica (Schiman-Czeika, 1964), which lacks taxonomic description of the species, but encompasses a diagnostic key and notes on the distribution of the species.

Gilli (1976) considered 33 species of this genus in Iran and also presented notes on geographical distribution of the species.

Forty one species of *Orobanche* were described in Farsi by Iranshahr (2008), but distribution of these species has not been reported from any locality. Two species of *O. androssovii* Novopokr. and *O. rosea* Tzvel. which were reported by Iranshahr (2008), are not present in any Iranian herbaria or nor have Schiman-Czeika (1964) and Gilli (1976) made any mention of these species in Iran.

This paper presents a study of the taxonomy, distribution, and habitat of some species of *Orobanche* in Iran. Appropriate information on the most frequent host plants of *Orobanche* is also included

MATERIAL AND METHODS

This study has been based on numerous specimens in Iranian major herbaria (i.e., IRAN, TARI, TUH) and field observations. In addition, the studied species were compared with type specimens and authentic materials in the herbaria: B, G, K, P and W. Selected localities representing the distribution of seven species of *Orobanche* distributed in Iran are given under the related taxa.

RESULTS AND DISCUSSION

According to Schiman-Czeika (1964), the genus *Orobanche* comprises 36 species in Iran and 47 species in Flora Iranica area. of which nine taxon are endemic to "Flora Iranica area". The studies showed that this genus includes 39 species in Iran.

Orobanche owerini Beck, Feddes Repert. 18: 39 (1922).

Type. Georgia Republic, LE!

Specimen seen. Azerbaijan: East of Bazargan, 1830 m, Forseh & Sireng 31730, (IRAN)!.- Fig. 1!

Description. Stem simple, 20-40 cm long, 10-11 mm thick in the middle part, reddish- brown in dry state, with rather numerous lanceolate scales 15-22 mm long, glandulose. Inflorescence short-cylindrical or oval, 8-10 cm long. Bract scales lanceolate up to 20 mm long, short whitish hairy. Calyx 14-16 mm long, two-toothed, usually shorter than corolla-tube. Corolla 15-30 mm long, bell-shaped, violet-purple from yellowish base to limb. Capsule ovate.

This species belongs to sect. *Orobanche*. Until now, *O. owerini* was only known from near Tbilisi, the capital of Georgia (Novopokrovskii 1958) but now is reported as a new record to Iran. This plant is somewhat similar to, but differs in having segments of calyx (usually shorter than corolla tube vs. as long as the corolla tube), filaments hairy (by 1/3-1/2 of its long from base. vs. not more by 1/3 of its length from base), capsule shape (ovate vs. elliptic) and seeds shape (subglobose vs. subovate). This taxon is parasite on roots of *Trifolium* L., *Vicia* L. and *Lathyrus* L. The flowering and fruiting time of this species is end of March-June.

Orobanche schultzii Mutel, Fl. Franç. 2: 352. (1835) – Fig. 2.

Specimens seen: Mazandaran: Lar valley, 2450 m, Wendelbo & Assadi 13393; Fars: Protected Region of Bambo, 1650-1900 m, Wendelbo & Foroughi 17593; Kermanshah: Rijab to Sarab, Ghandar, 1800 m, Iranshahr & Dezfolian 31742 (IRAN); Tehran; 41 km S. Qom, 1700 m, Amin & Bazargan 18911; Khoraasan: 90 km from Mashhad to Kelat-Naderi, 800 m, Iranshahr & Zarkani 31747 (IRAN).

Type: Algeria, P.

Taxonomic remarks. Calyx teeth lanceolate or linear, longer than the calyx tube. Corolla bluish or violet, glandular pubescent outside. Anthers villous.

Orobanche schultzii was described in 1835 from Algerian coast where it was fairly abundant. In the ensuing one hundred seventy years it was gradually reported from Spain (Sánchez-Gullón, & al. 2005). Recently, it was reported from Turkey by Kandemir & Türkmen (2008). Occurrence of this species has been previously reported in the Flora Iranica area from northeastern Afghanistan (Schiman-Czeika 1964). The first record of *O. schultzii* was based on some collections from North, South and Central Iran (Gilli 1976). From chorological point of view, this species belongs to Mediterranean elements. It is now reported from other localities in western and eastern Iran.

Orobanche angustelaciniata Gilli, Feddes Repert. 63: 312 (1960).

Type. Afghanistan, W!

Taxonomic remarks. Calyx 4-toothed, as long as the corolla tube. Bracts longer than the calyx; bractlets usually free, shorter than the calyx. Corolla violet, shortly glandular hairy. Anthers glabrous at base.

O. angustelaciniata was first reported in the Flora Iranica area only from one locality in eastern Afghanistan by Gilli in 1960 (Schiman-Czeika 1964). The type specimen of this taxon was deposited at Vienna herbarium: (W, Fig.3). Subsequently, Gilli (1976) recorded this species in southern Iran from Dasht-e-Lut, and Jaz Murian based on one specimen Leonard 5656. Likewise, no herbarium specimen of this species was found in the major Iran herbaria during this study. Although our attempts were unsuccessful in 2008 and 2009 to re-collect this species there, nevertheless its occurrence in Iran isn't unlikely. Also, *O. angustelaciniata* is known as an endemic species in Flora Iranica area (Schiman-Czeika 1964). Taxonomically it is closely related to *O. nana* but differs from it by having unequal lips of corolla (lower lip longer than the upper lip in *O. angustelaciniata* vs. equal lips in *O. nana*) and attenuate linear of corolla lobes in *O. angustelaciniata* (vs. elliptic lobes in *O. nana*).

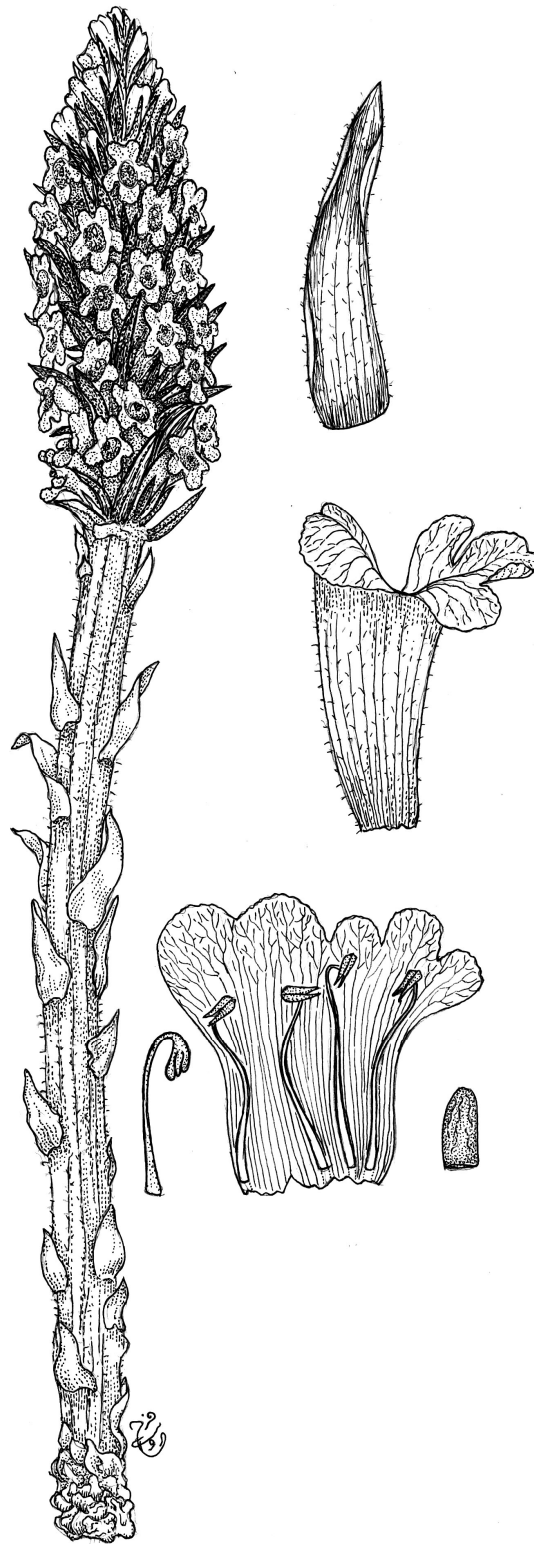


Fig. 1. *Orobanche owerini* ($\times 0.6$); details ($\times 2.2$).



Fig. 2. General view of *Orobanche schultzei*



Fig. 3. Holotype of *O. angustelaciniata*.

Orobanche stocksii Boiss. Fl. Or. 4: 505 (1879).
Specimens seen. Khorassan: 60 km N. of Torbat-Heydarieh, Robat-Sefid, 1750-1900 m, Assadi & Mozaffarian 35856; 20 km from Sabzevar to Nishabour, 1300 m, Assadi & Mozaffarian 35405; Tehran: near Mardabad, S. of Karaj, 1250 m, Wendelbo & Assadi 18147.
Taxonomic remarks. Plants with scales ovate-oblong to oblong. Spikes dense, subcapitate. Calyx length 14-23 mm; segments longer than the calyx tube. Corolla whitish, suberect. Filaments hairy at the base.

Orobanche cistanchoides Beck ex Stapf in Denkschr. Akad. Wiss. Wien Math-Nat. Kl. 50: 26 (1885).
Specimens seen. Azerbaijan: Sahand mountain, 2200-2900 m, Assadi & Mozaffarian 30710; 15 km S. Marand, Mishudagh Mountain, 1800-2250 m, Assadi & Mozaffarian 29922; Arasbaran, Tatar hill, 1300 m, Hamzeh & Asari 81637.

Taxonomic remarks. Plants with scales lanceolate. Spikes rather dense. Calyx length up to 10 mm; segments shorter than the calyx tube. Corolla violet or pinkish, whitish-yellow to base. Filaments villous.

Based on Flora Iranica (Schiman-Czeika 1964), *O. cistanchoides* was regarded as a synonymy of *O. stocksii*, whereas these species were recorded as distinct species by Gilli (1982) and Iranshahr (2008). Based on examined herbarium specimens and observation of the type specimen in Kew (K), we follow the previous taxonomic treatment proposed by Gilli (1982) about separation of these two species. *O. cistanchoides* resembles to *O. stocksii* in having the stamens inserted 5-7 mm above corolla base, elliptic capsule and ovate seeds, but differs from it in length of calyx (up to 10 mm in *O. cistanchoides* vs. 14-23 mm), calyx segments size (shorter than tube in *O. cistanchoides* vs. longer than tube), lateral segments of calyx shape (oblong, in *O. cistanchoides* vs.

lanceolate), filaments indumentum (hairy at the base in *O. cistanchoides* vs. villous). The differences between two species are shown in Table 1.

Orobanche bungeana Beck, Monogr. Orob. 119: 235 (1890).

Specimens seen. Mazandaran: Elika, Mac-Liz, Dehla mountain, 3500-4000 m, Terme 31522 (IRAN); Guilan: Asalem to Khalkhal, 1000 m, Delghandi & al. 31521 (IRAN); Tehran: 91 Km from Karaj to Chalus, The protected station of Pole-Zangouleh, 2400 m, Babakhanlo and Amin 14629.

Type. Iran (Gorgan), LE!

Taxonomic remarks. Corolla bluish-violet, 25 to 35 mm long; lower lobes acute. Calyx teeth as long as or shorter than the calyx tube.

Orobanche caucasica Beck, Repert. Spec. Nov. Regni Veg. 18: 34 (1922).

Specimens seen. Mazandaran: Chalus, Visar, Tepeh-Sabz mountain, 1950 m, Terme & al. 31541 (IRAN); Golestan: between Gonbad and Minoo-Dasht, Mirzayans 31542 (IRAN).

Type. Georgia Republic, WU.

Taxonomic remarks. Corolla violet, 20 to 30 mm long; lower lobes obtuse. Calyx teeth longer than the calyx tube.

O. caucasica is treated as a synonym of *O. bungeana* (In Flora USSR (Novopokrovskii 1958) and Flora Iranica (Schiman-Czeika 1964), whereas these species was recorded as distinct species by Gilli (1982) and Iranshahr (2008). Recently, *O. bungeana* and *O. caucasica* were reported from northeastern and northwestern Turkey by Emiinağaoğlu & Anşiiin (2004). The type specimen of *O. bungeana* collected from Ziarat, located in northern Iran by Bunge in 1859 (Schiman-Czeika 1964) and it was deposited at LE herbarium!. The syntype of *O. caucasica* collected from Isperechan near to Tabriz, by Knapp in 1884 and it was deposited at WU (Gilli 1982). The differences between these two species is indeed very significant as follows: the flowers of *O. bungeana* are mostly longer, with calyx teeth equal or shorter than the tube and also lower lobes of corolla is obtuse (not acute);, the calyx teeth of *O. caucasica* is distinctly longer than the tube.

Orobanche caryophyllacea Sm. Trans. Linn. Soc. London 4: 169 (1797).

Type. Europe, P.

Specimens seen. Azerbaijan: Oromieh, from Khoshkuh to Germi, 2500 m, Mozaffarian 69909; Arasbaran, forests above Kalaleh village, 1200 m, Assadi 73875; Mazandaran: Lar valley, 2450 m, Wendelbo & Assadii

13381; Guilan: Siahkal, Dayleman, 1500 m, Saeidi 16554 (TUH); Hamedan: near to Ganj-Nameh, 2100 m, Mozaffarian & Assadi 36731.

Taxonomic remarks. Plants glandular-pubescent. Scales yellow to purplish or brown. Calyx exceeding or as long as the bract, 2-segmented, each lateral segment ovate-oblong, shortly 2-fid to above the middle. Corolla yellowish or tinged with reddish-brown.

Schiman-Czeika (1964) and Novopokrovskii (1958) treated *Orobanche caryophyllacea* as a synonym under *O. vulgaris*, but several other authors (e.g. Jafri, 1976; Gilli, 1982; Wu & Raven, 1998, and IK: www.ipni.org) reduced *O. vulgaris* under synonymy of *O. caryophyllacea*. Since the publication date of *O. caryophyllacea* is 24 May 1797 and that of *O. vulgaris* is 1 November 1797 (Rumsey & Jury 1991), the former has clear priority over the latter, the valid name for this taxon should be *O. caryophyllacea*. Lectotype of *O. caryophyllacea* which is labelled "Hill behind the inn at Valcimara April 29 1787". was deposited in Smith's herbarium [LINN] (Foley, 2001).

This species is found mainly on *Galium verum*, but we have seen no specimens and suspect confusion with another species. This plant is only found on *Galium mollugo* L. in Britain (Rumsey & Jury 1991).

Orobanche hirtiflora (Reut.) Tzvelev, Fl. Azerbaïdzhana, 7: 569 (1957).

Type. Iran, W!

Specimens seen. Lorestan: Doroud, 22 km from Azna to Mahmoud-Abad, 1740 m, Mahmoudi 32290 (IRAN); Tehran: Ab-Ali, 1350 m, Dini & Arazm 14674 (IRAN).

Taxonomic remarks. Plants glandular-papillose. Calyx 4-toothed. Corolla pale blue; lobes ovate, acute with densely ciliate margins. Stigma retuse.

This species resembles to *O. coelestis* (Reut.) G. Beck. for its bracteoles free from calyx, but it differs markedly from that species in having acute calyx segments (not filiform); it is also similar to *O. orientalis* G. Beck. for its calyx teeth longer than tube or united segment base, but differs from it principally by its longer flowers, bracteoles free, and corolla lobes acute.

O. hirtiflora is distributed in Caucasus, Iran and Pakistan (Jafri 1976). The type specimen of this species collected from southern Iran by Kotschy (No. 408, 920) and was deposited at Geneva and Vienna herbaria (G, W) (Schiman-Czeika, 1964). Also Gilli (1976) reported this species from Lorestan, 60 km western Khorramabad, 1230 m, Archibald 1620. Two specimens of this species were observed in IRAN herbarium These specimens were collected from West and Central Iran.

Notes on the ecology and distribution about other species of *Orobanche*

Most species of *Orobanche* are found in west and northwestern Iran. Some of them e.g. *O. aegyptiaca* Pers. and *O. cernua* Loeffl. have wide range of distribution in Iran, while others such as *O. angustelaciniata*, *O. cypria* Reut., *O. kurdica* Boiss. & Hausskn., *O. hansii* Kerner, *O. penduliflora* and *O. Schwingenschussii* Gilli have very limited distribution. *Orobanche aegyptiaca* and *O. cernua* are widely distributed species occurring in Afghanistan, Africa, Europe, Middle Asia, Saudi Arabia and Turkey. According to Momčilo Kojić & al. (2001), these two species have been reported as predominantly Mediterranean species from Europe.

Orobanche cernua is especially widespread, primarily in sunflower fields. It also grows as a parasite species on tomato, tobacco and some weeds (*Sonchus oleraceus*, *Xanthium strumarium* and *Artemisia* sp.). *Orobanche aegyptiaca* and *O. cernua* from tobacco and tomato did equally well on either host (Musselman and Parker 1982).

The most host plants belong to *Asteraceae*, *Fabaceae*, *Solanaceae* and *Lamiaceae* family, most prominently the species of the following genera: *Artemisia*, *Astragalus*, *Nicotiana* and *Thymus*. Within *Orobanche* species, *O. aegyptiaca* has specialized to parasitize a wide range of crops. A list of host plants of different species of *Orobanche* in Iran is given in Table 2.

Based on studied specimens, *O. cypria* and *O. kurdica* are distinguished as rare species. A collection of *O. cypria* from Kohgiluyeh and Boyer Ahmad Province (Dena mountain, 3200 m, Riazi 7663) and *O. kurdica* from Lorestan Province (Oshtrankuh, Ghaleh of Rostam to Gohar, 2400-2700 m, Iranshahr 31651) is present in TARI and IRAN herbaria, respectively.

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Table 1. Comparison of *Orobanche stocksii* and *O. cistanchooides*.

Characters	<i>O. stocksii</i>	<i>O. cistanchooides</i>
Calyx length	Up to 10 mm	14-23 mm
Calyx teeth	Shorter than tube	Longer than tube
Lateral segments of calyx	Oblong	Lanceolate
Filaments	Hairy	Villous

Table 2. The host plants of different species of *Orobanche*. (Data compiled from: Musselman (1980), Riches and Parker (1995) and Schiman-Czeika (1964)).

Taxon	Host plants
1. <i>O. ramosa</i>	<i>Nicotiana tabacum</i> , <i>Amygdalus</i> , <i>Cannabis</i> .
2. <i>O. nana</i>	<i>Artemisia</i> , <i>Astragalus</i> , <i>Amygdalus scoparia</i> .
3. <i>O. mutelii</i>	<i>Nicotiana tabacum</i> , <i>Amygdalus communis</i> , <i>Parrotia persica</i> , <i>Carpinus</i> , <i>Cousinia multijflora</i> , <i>Armeniaca vulgaris</i> , <i>Salvia</i> , <i>Stachys</i> .
4. <i>O. aegyptiaca</i>	<i>Juniperus excelsa</i> , <i>Dianthus</i> , <i>Cardaria draba</i> , <i>Stachys lavandulifolia</i> , <i>Lilium</i> , <i>Solanum laciniatum</i> , <i>Populus</i> , <i>Quercus brantii</i> , <i>Astragalus</i> , <i>Cucurbita</i> , <i>Cucumis sativus</i> , <i>Nicotiana tabacum</i> , <i>Cucumis melo</i> , <i>Hordeum</i> , <i>Lycoperisicum esculentum</i> , <i>Citrullus vulgaris</i> , <i>Medicago sativa</i> .
5. <i>O. hirtiflora</i>	<i>Astragalus</i> .
6. <i>O. penduliflora</i>	<i>Haloxylon</i> , <i>Calligonum</i> .
7. <i>O. lavandulacea</i>	<i>Fagus</i> , <i>Lycopus eusopaeus</i> , <i>Anthemis</i> .
8. <i>O. oxyloba</i>	<i>Iris</i> , <i>Stachys uniflora</i> , <i>Ferula</i> , <i>Quercus brantii</i> , <i>Rubus</i> , <i>Acer monspessulanum</i> , <i>Amygdalus</i> .
9. <i>O. orientalis</i>	<i>Amygdalus</i> .
10. <i>O. schultzei</i>	<i>Amygdalus scoparia</i> , <i>Cannabis sativus</i> , <i>Alopecurus</i> .
11. <i>O. angutelaciniata</i>	<i>Amygdalus</i> .
12. <i>O. coelestis</i>	<i>Artemisia</i> , <i>Astragalus</i> , <i>Acantholimon</i> , <i>Linum album</i> , <i>Cucurbita</i> , <i>Amygdalus</i> .
13. <i>O. schwingenschussii</i>	?
14. <i>O. eriophora</i>	?
15. <i>O. bungeana</i>	<i>Tanacetum chilophyllum</i> .
16. <i>O. caucasica</i>	<i>Artemisia</i> .
17. <i>O. cilicica</i>	<i>Salvia</i> ., <i>Phlomis</i> .
18. <i>O. caesia</i>	<i>Carpinus</i> .
19. <i>O. pulchra</i>	<i>Thymus balansae</i> .
20. <i>O. purpurea</i>	<i>Artemisia</i> .
21. <i>O. arenaria</i>	<i>Onobrychis cornuta</i> .
22. <i>O. pogonanthera</i>	<i>Artemisia</i> , <i>Achillea santolina</i> , <i>Lycium europaeum</i> .
23. <i>O. cernua</i>	<i>Artemisia</i> , <i>Grantia</i> , <i>Calligonum</i> , <i>Lactuca</i> , <i>Nicotiana tabacum</i> , <i>Helianthus amunus</i> , <i>Lycoperisicum esculentum</i> , <i>Sonchus oleraceus</i> and <i>Xanthium strumarium</i> .
24. <i>O. camptolepis</i>	<i>Polygonum</i> .
25. <i>O. kotschyi</i>	<i>Juniperus sabina</i> , <i>Juniperus communis</i> , <i>Artemisia</i> , <i>Astragalus ascendens</i> , <i>Ferula</i> , <i>Gypsophila</i> .
26. <i>O. hansii</i>	<i>Artemisia</i> .
27. <i>O. amoena</i>	<i>Artemisia</i> .
28. <i>O. stocksii</i>	<i>Lactuca</i> , <i>Salvia</i> , <i>Cousinia</i> , <i>Eryngium</i> .
29. <i>O. cistanchooides</i>	<i>Carpinus</i> , <i>Astragalus</i> , <i>Thymus</i> , <i>Prangos</i> .
30. <i>O. caryophyllacea</i>	<i>Galium verum</i> .
31. <i>O. lutea</i>	<i>Cirsium</i> , <i>Eryngium</i> , <i>Thymus</i> .
32. <i>O. maior</i>	<i>Fagus</i> , <i>Quercus macranthera</i> .
33. <i>O. cypria</i>	<i>Pteroccephalus</i> .
34. <i>O. kurdica</i>	<i>Phlomis</i> , <i>Tanacetum</i> , <i>Cirsium</i> .
35. <i>O. longibracteata</i>	?
36. <i>O. anatolica</i>	<i>Salvia</i> .
37. <i>O. alba</i>	<i>Thymus</i> , <i>Stachys</i> , <i>Medicago</i> , <i>Galium</i> , <i>Rubia</i> .
38. <i>O. crenata</i>	<i>Allium</i> , <i>Centaurea</i> , <i>Verbascum</i> .
39. <i>O. owerini</i>	<i>Trifolium</i> , <i>Lathyrus</i> , <i>Vicia</i> .