

An Account of *Orobanche* L. (Orobanchaceae) in Iraq

Abdulridha A. Al-Mayah* & Widad M. Al-Asadi

Department of Ecology, College of Science, University of Basrah, Basrah, Iraq

*Corresponding author: abdulalwan@yahoo.com

Abstract: Detailed taxonomical study on the genus *Orobanche* L. (Orobanchaceae) in Iraq was carried out based on extensive field surveys and herbarium materials. Seven species of *Orobanche* were confirmed to occur in Iraq. A full taxonomical account for all species of *Orobanche* in Iraq, including key to the species, species description and geographical distribution are presented. Other taxonomical information, such as typification, general distribution, flowering period and species relationships were given. Maps of distribution and species photographs together with their host and floral characteristics were illustrated.

Keywords: *Orobanche*, Broomrapes, Orobanchaceae, Parasitic plants, Iraq.

Introduction

Orobanche and *Phelipanche* are the largest and most important genera of the family Orobanchaceae. *Orobanche* includes about 90 species while *Phelipanche* includes about 50 species. They are a root holoparasitic, widely spread in Iraq, Middle East, Mediterranean, North Africa and Europe. They parasitize on important crops and cause great lost in crop productivity. Taxonomically they possess only few morphological characteristics suitable for species identification and yet their colour is quite changeable at drying. The obvious morphological changes, almost linked to different host plants, are the principal cause for the difficulties in species identification (Kreutz, 1995; Frajman & Schönswitter, 2008).

The number of species of *Orobanche* senso lato (s. l.) listed for Iraq varies. Handle-Mazzetti (1910) listed seven species including *O. major*. Zohary (1946) also listed seven species but included *O. kurdica* instead of *O. major*. Blakelock (1950) listed only four species, one of which was a new species *O. ovata*. Al-Rawi (1964) listed 10 species. Rechinger (1964b) described five species in the Flora of lowlands of Iraq. Salih (2002) presented a systematic study on the *Orobanche* s. l. in provinces of Duhok, Arbil and Sulaimania in Kurdistan of Iraq. All broomrapes have traditionally been put

under the genus *Orobanche* but divided into two sections: *Trionychon* and *Orobanche*.

It is clear that there is no complete account for the genus *Orobanche* in Iraq. The present study is the first complete account of the genus *Orobanche* senso stricto (excluding section *Trionychon*) in Iraq where we followed the generic concept of Holub (1990) and Teryokhin et al. (1993), which was recently supported by cytological data and DNA sequences which lead to final split of the genus *Orobanche* into two distinct genera *Orobanche* and *Phelipanche* (Syn. Section *Trionychon*) (Davis et al., 1982; Schneeweiss et al., 2004; Carlón et al., 2005; Weiss-Schneeweiss et al., 2006; Joel, 2009; Banifa et al., 2011; Al-Asadi & Al-Mayah, 2016).

Materials and Methods

Species identification, description and distribution were based on fresh materials and the herbarium specimens of BAG, BUH, BSRA, BUNH and ASUH. Keys provided by Beck (1930), Novopokrovskii & Tzvelev (1958), Rechinger (1964a), Kreutz, (1995), Pujadaz & Lora González (1996) and Domina et al. (2013) were followed.

Species are alphabetically arranged according to their current accepted names provided by GBC (Card Index of Orobanchaceae) 2016. For each species, place of original description, basionyms and the most relevant synonyms are mentioned. Species description, plant host, habitat, flowering period, local and general distribution, and comment on species relationships are also given.

Results and Discussion

Characters of Taxonomic Importance in the Genus *Orobanche*

Size, colour and pubescence of organs of *Orobanche* species are almost enormously variable. Yet, such details are rarely recorded on the herbarium specimen labels. Therefore, care should be taken not to depend on a single character in species determination.

Other characters that should receive particular attention are the habit and height of plant, colour, density of pubescence of stem; length, shape and pubescence of bracts; length, shape and teeth variation of the calyx; size, shape and pubescence of the lobes of the upper and lower corolla lips, the position of the insertion of the filaments from the corolla tube base, the position and density of the filament pubescence and the colour and connation of the stigma lobes.

The plant host is also considered as a character of taxonomic importance because many of the species of Iraq have a restricted host range and therefore it is necessary to determine and record the host and notice the other surrounding species. Unfortunately, in many cases, an erroneously identified

plant was written on the labels as the host and this has erroneously influenced future identification (Rumsey & Jury, 1991).

Sometimes it is difficult to categorize clearly the habit of some *Orobanche* species that have fleshy aerial portions and underground parts that live for many years in parasitic plants (Masselman & Press, 1995). Other difficulties in species determination is that many of the useful taxonomic characters may have been lost at drying and species which is very distinct in the wild turned into dark brown colour when dried.

***Orobanche* L.**

Orobanche L. Sp. Pl. 632 (1763). Obs. Cardon & al in Documentos Jard. Bot. Atlantico (Gijon) 3: 57, 58, 59 [Phylogenetic relationships] 63 (2005); Docu. Jard. Bot. Atlant. (Gijon) 6: 13f. 2 [Phylogenetic relationships] 2008.

Holoparasitic herb lacking chlorophyll. Stem succulent, often simple, sometimes branched. Inflorescence terminal spike. Flowers with one bract but not subtended with bracteoles. Calyx divided into 2 lateral halves, each half entire or bidentate. Corolla bilabiate, with curved or erect tube; the upper lip with 2 lobes, the lower lip with 3 lobes, variously coloured but rarely blue. Stamens 4 included. Stigma variously coloured. Figure (1) shows the floral characteristics of the *Orobanche* species, while Figure (2) shows their habits.

Lectotype: *O. caryophyllacea* (Syn. *O. major*).

English name: Broomrape or Broom-rape, Orobanche

Arabic name: Haluk هالوك

Key to the species of *Orobanche*

- 1- Filament inserted at the middle of corolla tube, flower blue-violet *O. cernua*
- 1- Filament inserted below the middle of corolla tube, flower not blue-violet 2
 - 2- Corolla concolorous *O. anatolica*
 - 2- Corolla not concolorous 3
 - 3 - Upper lip of corolla deeply bilobed, corolla *O. kurdica*
 - 3 - Upper lip of corolla not deeply bilobed 4
 - 4- Flowers rarely exceeding 15mm *O. minor*
 - 4- Flowers almost exceeding 15mm 5
 - 5- Bracts ovate, much shorter than corolla tube *O. camptolepis*
 - 5- Bracts elongate, equal or longer than corolla tube 6
 - 6- Corolla crenate, white, stamens inserted 2-5 mm above corolla base *O. crenata*
 - 6- Corolla not crenate, brownish, stamens inserted near base of corolla *O. caryophyllacea*

Species Description

1. *Orobanche anatolica* Boiss. & Reut. ex Reut. in DC., Prodr. 11: 17 (1847); Boiss. in Fl. Orient. 4 (2): 504 (1879); Schiman-Czeika in Fl. Iranica, 5: 18 (1964); Al-Rawi in Dept. Agric. Iraq Tech. Bull. 12: 148 (1964); A. Gilli in Fl. Turk., 7: 21 (1982).

Type: Turkey C2 Denizli, monte Cadmo (Honaz Da.) in Cariaemontibus, Boissier G.

Perennial plants, 14-39 cm tall, glandular-white hairy. Stem 8.5-26 cm long, dark red, very thick, middle part 7-15 mm diameter, glabrous. Scales 9.5-15 mm long, brown-reddish, ovate-broadly lanceolate, 0.5-7.5 mm diameter, hairy-pilose. Inflorescence cylindrical, very dense, many flowered (10-46 flowers). Bract 15-25 mm long, equaling or longer than flower, ovate-broadly lanceolate, vary sparsely white pilose. Calyx 10-17 mm long, entire, campanulate, glandular-pilose at margin. Corolla 18-21 mm long, tubular, red-brownish, pink or chestnut, densely glandular-pilose outside and inside, lanate-short hairs on upper lip, dorsal line curved, upper lip curved, undivided, limb long pilose or whitish lanate. Stamens inserted 0.3-1.25 mm above corolla base, subglabrous; Filaments 14-20 mm long, pilose or hairy near base and sparsely glandular below anther. Anther 2-3.25 mm long, glabrous. Style 8-17 mm long, glabrous. Stigma yellow, 3.5-5 mm long. Parasitize on *Salvia*.

Habitat: Mount. Slope, woodland, Mount soil. Alt. 800-3000 m. **Fl. & Fr.** April-August.

Distribution: MAM, Aqra, 1200 m, Al-Rawi, 11434; MAM, Dohuk, 1200 m, Al-Rawi, 8761; MAM, Bakirma, 900 m, Al-Rawi, 8521; MRO, Susa 15 km E. Arbil; MRO, Batas, 900 m, Al-Rawi, 8574; MRO, Shaqlawa, Erbil Liwa, E. Hadac, Lukman & Waleed, 1370; MRO, Shaqlawa, 1400, Gillett, 8060; MAM, Khantur mount. N.E. of Zakho, 1200, Al-Rawi, 23325; MRO, Qandil Range, 800-3000 m, I. Serhang & Al-Rawi, 26762; MRO, Ebsnmansherin valley W.N. of potine Mt. N. of Shirran mount. Erbil Liwa, 4500 ft, A. Agnewi, Hader & Kader, 0019612; MSU, Cara mount., Gasrph Al-Kas, 19515; MSU, Cara mount., Al-Mayah & Al-Asadi, 1457; MSU, Bayara, before Zalan on Shahrabashir-Chawarta road, Al-Mayah, Al-Asadi & Al-Mousawi, 1458; MSU, Delaisher, Sul. 1 km before Pira-Magron road, Al-Mayah & Al-Asadi, 1456; MSU, Pira-Magron, Sul. Al-Mayah & Al-Asadi, 1462; MSU, Pira-Magron, Summer resort Sul. Al-Mayah & Al-Asadi, 15048.

Syria, Lebanon, Iran, Azerbaijan, Turkey, Caucasia, Europe, Russia, Georgia.

Common name: Common broomrape, shotila شوتيله , gurga كوركه

2. *Orobanche cunctipetala* Boiss. & Reut. in Boiss.: Fl. Orient. 4 (2): 515-516 (1879).

= *Orobanche ovata* Blakelock in Kew Bull. 4: 537 f. 5 (1949); Al-Rawi, Wild Plants of Iraq with their distribution. 148 (1964).

Type: Turkey (G), photo!

Parasitic herbs, 7-10 cm tall, glandular pubescent. Stem 3-4 cm long, middle part 3.5-5 mm thick. Scales 8-10 mm long, broadly-ovate, tip attenuated with short, lanceolate cups, hooked when dry. Bract 6-8 mm long, broadly-ovate, glandular-pilose, shorter than corolla tube. Calyx segments free, 9.5-11 mm long, bidentate, segments oblongat base, teeth 2.5-3 mm long. Corolla 10-18 mm long, tubular, blue-violet, whitish base, glandular-pubescent outside. Stamens inserted 3.5-4 mm above corolla base; Filaments 10-12 mm long, glabrous. Anther 2.5-3 mm long, subglabrous. Style 4-6 mm long, sparsely glandular. Stigma purple, 2.5-3 mm long. Parasitize on Polygonaceae.

Habitat: Rocky mount. **Alt.** 1500-2000 m. **Fl. & Fr.** June-August.

Distribution: MRO, Jabal Seri Hassan Beg, 1800 m, E.R. Guest, 2912; MSU, Pira-Magrun mount. E. facing, 1500-2000 m, S.H.S. Miran & Y.S. Faris, 1271.

Syria, Lebanon, Palestine, Iran, Turkey, Afghanistan, China, Armenia, Ukraine.

3. *Orobanche caryophyllacea* Sm. in Trans. Linn. Soc. London 4: 169 (1798).

= *Orobanche major* L., Sp. Pl.: 632 (1753), nom. rej.; A. Gilli in Fl. Turk., 7: 19 (1982).

Lectotype: herb. Smith 1087.23 (Linn.)

Perennial plants, 24-47 cm tall. Stem 14-25.5 cm long, middle part up to 4-11 mm thick, glandular pubescent, slender-sometimes stout, yellow-violet, brown-reddish. Scales 10-25mm long, lanceolate, glandular-pilose. Inflorescence 8-23 cm, spike lax, flowers (12-35 flowers). Bract 15-22 mm long, about as long as corolla, glandular-hairs deflexed in the middle. Calyx segments free, 9.5-16 mm long, bidentate, glandular-piolse, teeth laceolate. Corolla 20-24 mm long, brownish, lilac, usually tinged red, densely glandular pilose, outside, tube broad or campanulate, upper lip very broad, lower lip of corolla deflexed and has three crenate lobes, of equal size. Stamens inserted 1.5-2.5 mm at base of corolla tube. Filaments 12-13 mm long, hairy for third of length from base, glabrous above but glandular-pubescent below anther. Anther 2-2.3 mm long, glabrous or subglabrous. Style 6.5-8.5 mm long, sparsely glandular-hairy. Stigma dark purple to brown-violet, 3-3.5 mm long. Parasitize on *Galium* sp.

Habitat: Mountain Soils, **Fl. & Fr.** May-July.

Distribution: MSU, Pira-Magron, Sul. Al-Mayah & Al-Asadi, 1481; MSU, Cara mount., Al-Mayah & Al-Asadi, 1485; MSU, Pira-Magron, Sul. Al-Mayah & Al-Asadi, 15092.

Iran, Pakistan, Turkey, China, Russia, Armenia, Austria, Franc, England, Germany, Italy, Spain.

Common name: Common broomrape, clove broomrape, glove-scented broomrape, bedstraw broomrape.

4. *Orobanche cernua* L. in Loefl., Iter Hisp.152 (1758): Schiman-Czeika in Fl. Iranica, 5: 13 (1964); Al-Rawi in Dep. Agr. Iraq Tech. Bull. 12: 148 (1964); Rechinger, Fl. Lowland Iraq, 553 (1964); A. Gilli in Fl. Turk., 7: 13 (1982).

Lectotype: Loefling s. n. (Linn. 798. 6).

Annual or biennial plants, 12-65 cm tall. Stem yellowish, 8-39.5 cm long, base slightly thickened, middle part 8-11 mm thick. Scales 7-10 mm long, broadly lanceolate (short)-ovate, glandular-pilose. Inflorescence 4-25.5 cm long, usually cylindrical with numerous flowers (8-83) in a dense spike, later more lax. Bract 6-9 mm long, brownish-yellow, glandular-pubescent, lanceolate with ovate base. Calyx segments free, 7-9 mm long, bifid or bidentate with tow unequal teeth, ovate-lanceolate or subulate, glandular-piolse. Corolla 10-15 mm long, tubular, inflated above the insertion of the stamens, constricted in the middle, inflated again near the upper lip, sparsely glandular-pubescece, white with violet-bluiish near the margin. Stamens inserted 6-7 mm above the base of corolla tube. Filaments 7-10 mm long, glabrous and sparsely glandular-pubescent below anther. Anther 1.75-2 mm long, glabrous. Style 7-9 mm long, subglabrous. Stigma 0.6-1.5 mm long, white-yellowish. Parasitize on *Artemisia scoporia*.

Habitat: In cultivated fields, sand soil, Desert depression, sandy-clay-gravels soil, gravely soil, sandy soil. Summit plateau, salty soil roadside, clay rocky soil, on roadside, loamy soil. **Alt.** 150-550 m. **Fl. & Fr.** March-June.

Distribution: MSU, Spring Pera-Magrun, Hashimi & Waleed, 637; MSU, Siwia-Sulamaniyah, Hashimi & Waleed, 0019609; MSU, 25 km N. Penjawin towards Iranian border, Karzan Omer Kader, 17088; FUJ, 4 km W. of k 2 Al-Jezira Desert, Fred A. Burkley, Elmer A. Palmutier & Jumaa Brahim, 001960; FUJ, Jezira, alt. 350 m, 101511954, G. Gusr, 13411; FUJ, 2 km from Shargat to Mosul, alt. 220 m, Widad & Al-Khagat, 53692; FKI, Jadida W. of Nukhaib, alt. 350 m, Al-Rawi, 31052; FPF, Chlat police station, on Persian border, alt. 150 m, Al-Rawi & Sh. Haddadd, 25707; FPF, Near Chlat about 60 km N.W. Wadi Tib, Al-Mayah & Al-Asadi, 1689; FPF, after 60 km from Tip police station, Al-Mayah & Al-Asadi, 1697; DLJ, Baiji, Al-Hilli, 0025068; DGA, Ghurfa near Injana, alt. 160 m, A.A. Al-Bermani, DGA. Adhaim the third wall at the range management, Widad & Salah, 54399;

DWD, 4 km S. Rutba, Khider Wanni, 7451; **DWD**, 20km E.S.E. of Rutba, alt. 550 m, Al-Rawi, 31297; **DWD**, 40 km S. of Rutba, alt. 510 m, Al-Rawi, 21245; **DSD**, Ruhaba 35 km N. of Najaf, R.W. Haines, K. Hader, Waleed & A. Agnew, 5510; **DSD**, S. Desert Salman, alt. 200 m, G. Guer, Al-Rawi & Sillus, 14078; **DSD**, S. Desert 42 km E. by S. Salman, alt. 180 m, 14110; **LCA**, 20 km N. of Taji comp. Baghdad, A. Agnew, R. Hader & R.W. Haines, 0019611; **LCA**, Baghdad-Hit highway roadside, K. Wanni, M.Y. Sheikh & K.H. Batanouny, 7523; **FUJ**, 4 km west of k 2 in depression in Al-Jazira desert, A. Fred, E. Barkley, A. Pulmatier & J. Brahim, 0019608; **DWD**, Al-Karra-Rutba, Al-Rawi, 23746; **DGA**, Ghurfa Adhaim, 5 km from Baghdad, Al-Shahbaz & Al-Mousawi, 0025444; **DWD**, Bottom of Hawran Wadi, alt. 420 m, 30/3/1962; Chakravarty, Al-Rawi & Hatib Al-Izzi, 31600.

Kuwait, Saudi Arabia, Oman, Jordan, Lebanon, Syria, Palestine, Iran, Turkey, Egypt, Libya, Djibouti, Yemen, Afghanistan, China, India, France, Italy, Russia, Australia, Spain.

Common name: Common broomrape, nodding broomrape.

5. *Orobanche crenata* Forssk., Fl. Egypt.-Arab.: 113 (1775): Schiman-Czeika in Fl. Iranica, 5: 19 (1964); Al-Rawi in Dept. Agric. Iraq Tech. Bull. 12: 148 (1964); A. Gilli in Fl. Turk., 7: 14 (1982).

Type: Egypt, Kahira (Cairo), Forsskal (holo. C.).

Plant usually stout, 14-45 cm tall. Stem 4.5-22 cm long, stout, reddish or brownish, glandular-pubescent. Scales 10-17 mm long, lanceolate, glandular-pilose. Inflorescence 4-23 cm, cylindrical, lax, numerous flowers (11-24 flowers). Bract 15-20 mm long, lanceolate. Calyx segments free, 10-16 mm long, bifid or unequally bidentate, lanceolate-filiform or subulate, almost glabrous. Corolla 19-23 mm long, campanulate, inflated above the insertion of the stamens, white on the entire flower, dorsal line is clearly curved forward at the base, upper lip of corolla consists of three deeply crenate. Stamens inserted 2-5 mm above the base of corolla tube. Filaments 8-10 mm long, pubescent or pilose at base and glandular up to the anther. Anther 1.5-2 mm long, often pubescent. Style 6-7 mm long, glandular-pubescent. Stigma 0.8-1.25 mm long, orange. Parasitize on *Daucus carota*, *Daphne* and *Astragalus*.

Habitat: Stony clay hillside, summit plate, rocky clay soil, rocky valley, **Alt.** 850-1830 m. **Fl. & Fr.** May-July.

Distribution: **MRO**, Potine Mt. N. of Shirwan Mazin, Arbil Liwa, 700-800 ft, A.D.Q. Agnew, E.W. Haines, E. Hader & F. Kadir, 6230a; **MRO**, Haibat Sultan Dagh Mt., N. of Kissanjaq, 850 m, Al-Rawi & Kass, 28175; **MSU**, Avraman Mt. of Halabcha on Persian border, 1500-1800 m, Al-Rawi, 22086; **MSU**, Biging of Khomal-Halabcha road in the direction of Halabcha, Al-Mayah & Al-Asadi, 1504.

Syria, Palestine, Lebanon, Iran, Turkey, Morocco, Tunisia, Libya, France, Germany, Italy, Spain, England, Austria, Armenia, Georgia.

6. *Orobanche kurdica* Boiss. & Hausskn. ex Boiss., Fl. Orient. 4 (2): 505 (1879); Schiman-Czeika in Fl. Iranica, 5: 17 (1964); Al-Rawi in Dept. Agric. Iraq Tech. Bull. 12: 148 (1964); A. Gilli in Fl. Turk., 7: 20 (1982).

Type: W. Iran in montibus Avraman (Kuhe- Owerman) et Schahu Kurdistan. Persica, 2445 m, Haussknecht (holo, G).

Biennial, plant up to 28-32 cm. Stem 11-18 cm long, thick, diameters up to 5-12 mm, glandular-pubescent. Scales 25-28 mm long, lanceolate, few glandular-pilose. Inflorescence 10-16 cm, cylindrical, lax, many flowers (12-34 flowers). Bract 20-27 mm long, lanceolate, glandular-pubescent, as long as corolla or shorter. Calyx segments 20-23 mm long, bidentate or entire, glandular-pilose, lanceolate teeth. Corolla 23-26 mm long, tubular-campanulate, wide, very enlarged towards, inflated above insertion of the stamens, upper lip deeply 2-lobed, yellowish-light brown in dryer, glandular-pilose outside. Stamens inserted 4-6 mm above the base of corolla tube. Filaments 17-20 mm long, pilose from base to middle, glabrous above, but glandular below anther. Anther 2.5-3.25 mm long, glabrous. Style 10-13.5 mm long, sparsely glandular-pilose. Stigma 1.25-1.5 mm long, yellow. Host not confirmed, reported on *Tanacetum*, Cardns (*Carduus*) and *Phlomis*.

Habitat: Near the top of richly-clay land, summit plateau, limestone, hill side, rocky mount. Alt. 1900 m. **Fl. & Fr.** June-July.

Distribution: MRO, Potine mount. of Shirwan Mazin, Erbil Liwa, A.D.Q. Agnew, R.W. Haines, E. Hader & F. Kadir, 0019620; MSU, Avraman mount., 1900 m, Al-Rawi & Hisham, 29355; MSU, Horaman, Tawela, Cumercipr Mont., Weinert & Mousawi, 0027443.

Iran, Turkey, Armenia, Russia.

7. *Orobanche minor* Sm., Engl. Bot. 6: 422 (1796-1797):

Type: K, K000769346 photo!

Plant slender, 6.5-52 cm tall. Stem 12-35 cm long, slender, red-purple, glandular-pubescent, middle part 1.5-4 mm thick. Scales 19-21 mm long, lanceolate, glandular-pilose. Inflorescence 5-17 cm long, flowers (5-32 flowers), lax at base of spike, cylindrical. Bract 10-16 mm long, lanceolate, glandular-pilose. Calyx segments 5-12 mm long, entire or bidentate, glandular-pilose, broadly at base and filiform at tip, about half as long as corolla or shorter. Corolla 10-17 mm long, tubular, inflated near throat, yellowish at base with violaceous or violaceous-reddish near upper lip. Lower lip of corolla consists of three rounded crenate lobes, equal size, glandular-pilose outside. Stamens inserted 3-5 mm above the base of corolla tube. Filaments 7-9 mm long, sparsely pilose at base and glandular up to anther. Anther 1-1.5

mm long, pubescent. Style 5.5-8.5 mm long, sparsely glandular-pilose. Stigma 1-2 mm long, violet-purple, brown or red-violet. Parasitizes on *Vicia* sp.

Habitat: Mount. Soils. **Fl. & Fr.** May-June.

Distribution: MAM, Aqra, Al-Rawi, 11433.

Jordan, Syria, Palestine, Iran, Turkey, India, China, Afghanistan, Yemen, Uzbekistan, Kazakhstan, Egypt, Ethiopia, Sudan, Morocco, Tunisia, Libya, France, Germany, Russia, Italy, Spain, England, Austria, New Zealand, Armenia, Georgia, Serbia, Ukraine, Hungary, Denmark, U.K.

Common name: Common broomrape, small broomrape, lesser broomrape.

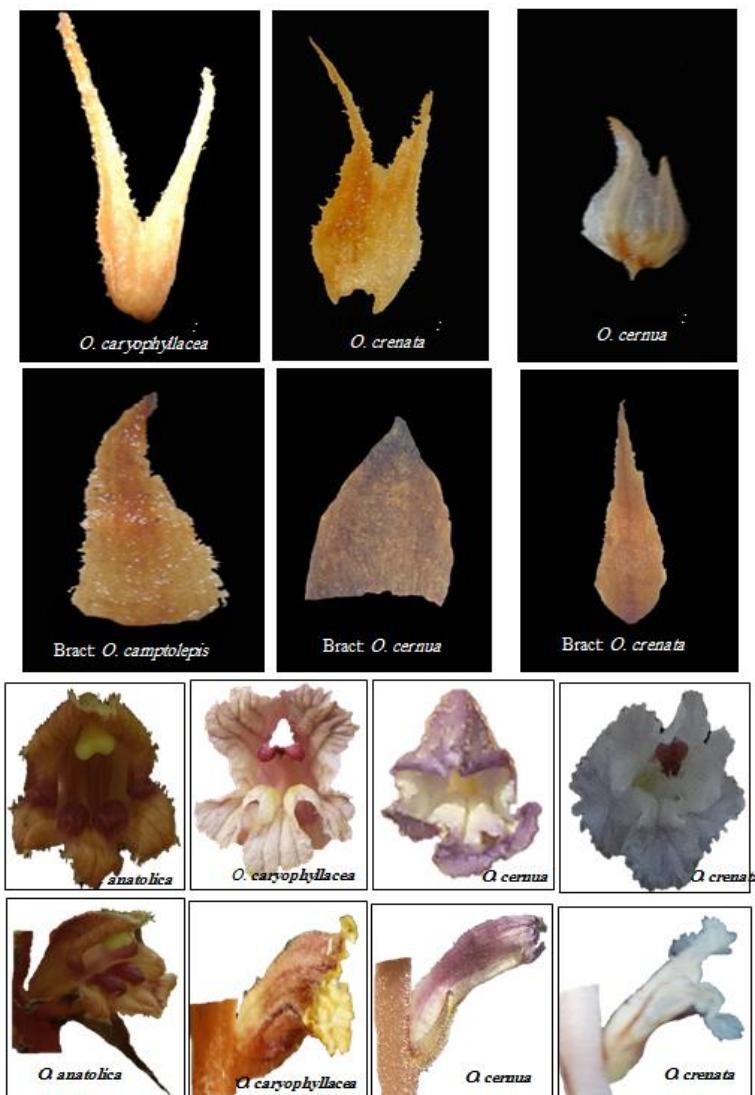


Figure 1: Floral characteristics of the *Orobanche* species.



O. anatolica



O. caryophyllacea



O. cernua



O. crenata

Figure 2: Habit of *Orobanche* species.

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