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Orobanchaceae of the Arabian Peninsula

M. J. Y. FOLEY

ABSTRACT

FOLEY, M. J. Y. (2004). Orobanchaceae of the Arabian Peninsula. *Candollea* 59: 231-254. In English, English and French abstracts.

Based mainly upon preserved herbarium material collected from within the Arabian peninsula, the taxonomy, ecology and distribution of members of the *Orobanchaceae* are described; this includes two new species: *Orobanche perangustata* M. J. Y. Foley and *O. muteliformis* M. J. Y. Foley. Three species of *Cistanche* and eleven other species of *Orobanche* have been recognized.

RÉSUMÉ

FOLEY, M. J. Y. (2004). Les Orobanchacées de la Péninsule arabe. *Candollea* 59: 231-254. En anglais, résumés anglais et français.

Basées principalement sur le matériel conservé en herbier, la taxonomie, l'écologie et la distribution des Orobanchacées de la Péninsule arabe sont présentées. Sont incluses deux nouvelles espèces: *Orobanche perangustata* M. J. Y. Foley et *O. muteliformis* M. J. Y. Foley. Trois espèces du genre *Cistanche* et onze espèces du genre *Orobanche* sont reconnues.

KEY-WORDS: OROBANCHACEAE – Arabian Peninsula

The family *Orobanchaceae* has been poorly studied in the Arabian peninsula. This is mainly due to a general lack of preserved specimens from what is a vast, often inhospitable, and rarely visited terrain, covering an area of approximately three million square kilometres. However, material is relatively well represented in a few herbaria and especially so in K, BM and E and this, together with that in ON, SQUH and elsewhere, has been examined. Collections made by individual field botanists figure regularly within this family and have been the basis upon which much of the following account has been prepared. Of these I. S. Collenette, J. P. Mandaville, A. G. Miller and J. R. I. Wood merit special mention.

There is still a great deal of investigative work to be carried out into the taxonomy of members of the *Orobanchaceae* of the Arabian peninsula; no doubt, other taxa will be recorded as botanical exploration is extended. Also, future molecular phylogenetic studies on the lines of that carried out elsewhere by SCHNEEWEISS & al. (2004) should help to clarify the taxonomy further. It is hoped that this account will, at least, act as a basis for future work.

Orobanchaceae

Annual, biennial or perennial herbs, lacking chlorophyll and completely parasitic upon the roots of a wide range of (usually) dicotyledonous plants. *Stems* erect, fleshy, simple or branched. *Leaves* scale-like, alternate, numerous. *Inflorescence* consisting of a usually many-flowered terminal raceme or rarely single-flowered, the flowers subtended by a single bract, with or without two lateral bracteoles. *Calyx* tubular or campanulate or \pm divided into two lateral segments, the segments either further divided into (usually) two teeth, or entire. *Corolla* tubular, infundibuliform, campanulate or obconical, comprising five \pm equal and regularly distributed lobes or else distinctly two-lipped with two upper and three lower lobes. *Stamens* four, didynamous, with a fifth reduced to a staminode or absent; filaments usually inserted towards the base of the corolla. Ovary superior comprising (usually) two fused carpels and a single locule; placentation axile; ovules numerous; style single, stigma two-lobed. Fruit a loculicidal capsule dehiscing by two valves. Seed numerous, very small; testa rugose or reticulate-foveolate.

The family is traditionally maintained separately from the *Scrophulariaceae* but such a delimitation is questionable. There are about 14 genera world-wide, distributed mainly in the temperate regions of the northern hemisphere where *Orobanche* is the largest genus.

Notes:

This is a taxonomically difficult family of obligate root parasites. Members of the genera *Cistanche* and *Orobanche*, because of their fleshy, succulent and achlorophyllous nature, preserve poorly so that important taxonomic characters, including colour, are often lost. As with many parasitic plant genera, morphological reduction has meant that useful diagnostic characters are limited. Of these, the most important include inflorescence morphology (density, corolla attitude etc.), calyx shape, corolla colour, shape and size, corolla lobe denticulation and ciliation, distribution and type of pilosity on the filaments, height of insertion of the filaments above the base of the corolla, and the colour and degree of separation of stigma lobes. Frequently, a combination of these characters is necessary to satisfactorily separate closely related taxa. Since the colour of the corolla and stigma lobes are most useful diagnostic characters, the importance of recording these when collecting cannot be over-emphasised. Unfortunately, up to present such information is lacking on many herbarium collections although most of those collected by Collenette are well documented in this way.

The range of dimensions given below are those typical of most plants. However, even within a single population, plants may vary appreciably in respect to these characters. Dimensions for stem width are measured immediately below the inflorescence whilst those for corolla length are taken in a direct line from the corolla base to the tip of the upper lip. There is sometimes uncertainty as to whether individual taxa are annual, biennial or perennial and it is possible that in certain cases all these conditions may variously apply depending upon the host or on environmental influence. However, those species which parasitise annuals such as crop plants may reasonably be assumed to also be annual.

Specimens of members of this family, when preserved for the herbarium, frequently become embrittled and damage easily; they also lose many important characters after pressing. Due to this, their value is often reduced and can cause a problem in identification. For these reasons, it is important that a full description of the plant should be recorded when making new collections and should include the shape and colour of the corolla, the height of insertion of the filaments above the corolla base, the type and distribution of filament pilosity and the colour of the stigma lobes. All this information should be noted on the label. Failure to do so will, in many cases, mean that the specimen is undeterminable and therefore its worth greatly diminished. The addition to the herbarium sheet of a good colour photograph can also be helpful. Wherever possible, the physical attachment between the parasite and the roots of the host should be established by careful excavation.

Suggested modern floristic literature
(References cited in the text are at the end of this article)

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Key to genera

1. Corolla \pm actinomorphic, subequally 5-lobed **1. Cistanche**
- 1a. Corolla zygomorphic, 2-lipped, the upper lip bilobed, the lower 3-lobed **2. Orobanche**

1. Cistanche Hoffmanns. & Link

Parasitic, usually perennial herbs to 100 cm high. *Stem* robust, simple. *Leaves* numerous, usually imbricate below. *Inflorescence*, a dense terminal spike, many-flowered, each flower with a single bract and (in our species) two lateral bracteoles adnate to the campanulate, usually 5-lobed calyx; calyx lobes obtuse, rounded. *Corolla* \pm regular, tubular, campanulate or \pm obconical with five subequal, patent lobes, and often with two prominent bosses in the throat of the corolla. *Stamens* included; style curved near apex, stigma robust, subentire. *Capsule* ovoid, seeds subglobose, very small.

Note: At least 20 species have been described. These are frequent in north Africa and western and central Asia but only occasional in southern Europe. All are plants of sandy, usually saline habitats, either coastal or else inland in steppe or desert terrain and are parasitic on various hosts. However, the taxonomy of the genus is poorly understood and in urgent need of further investigation. Difficulties in the study of the genus arise because of the difficulty in determining meaningful taxonomic characters in plants which preserve so poorly, so that much of the currently available herbarium material is undeterminable. Remoteness of many populations, their presence in a hot, arid environment, and possible morphological variation across the geographical range of some individual species, are additional facts which compound the problem of their study.

Key to species

1. Plant pinkish ± throughout, corolla usually 20-30 mm long, narrowly infundibuliform **2. *C. rosea***
- 1a. Plant not pinkish throughout, corolla usually 30-50 mm long, ± campanulate 2
2. Corolla rarely exceeding 40 mm in length, white with strongly recurved violet lips **3. *C. violacea***
- 2a. Corolla often exceeding 40 mm in length, basically yellow, but often strongly flushed violet, pink or purple **1. *C. phelypaea***

1. *Cistanche phelypaea* (L.) Cout., Fl. Portugal: 571. 1913.

≡ *Lathraea phelypaea* L., Sp. Pl.: 606. 1753.

= *Orobanche tinctoria* Forssk., Fl. Aegypt.-Arab.: 112. 1775.

≡ *Cistanche tinctoria* (Forssk.) Beck in Bull. Herb. Boissier ser. 2, 4: 685. 1904.

= *Phelypaea tubulosa* Schrenk, Pl. Spec. Aegypt.-Arab.: 23. 1840.

≡ *Cistanche tubulosa* (Schrenk) Hook. f., Fl. Brit. Ind. 4: 324. 1884.

Type locality: «in Lusitaniae umbrosis».

Type: «Orobanche elegantissima verna flores luteo virid. Lusit. Grisley», *Tournefort 6443* (neo-: P-TRF, photo!), see FOLEY (2001: 229).

lc.: JAFRI (1978: 2).

Apparently perennial, 20-50(-120) cm tall, often robust. *Stem* unbranched, (5-)7-15(-20) mm diameter below the inflorescence, often swollen towards the base, glabrous, yellow to grey-violet. *Leaves* (15-)20-30 × 5-12 mm, ovate-lanceolate or sometimes ± lanceolate, obtuse at the apex, glabrous with scarious margins, usually brownish, glabrous. *Inflorescence* (10-)15-30(-35) cm long, dense or sometimes rather lax, ± cylindrical. *Bracts* 15-20 mm long, ovate-lanceolate, crenulate, glabrous; bracteoles 12-15 mm long, oblong-lanceolate. *Calyx* 12-18 mm long, campanulate, divided into five subequal, oblong-suborbicular lobes, glabrous. *Corolla* 30-50 mm long, broadly campanulate-obconical, curved, often strongly genuflexed, bright yellow, often flushed violet, pink or purple, occasionally all white, glabrous; lobes suborbicular, erecto-patent. *Filaments* inserted towards base of corolla, glabrous above, hairy below. *Anthers* villous. *Stigma* lobes white. Sometimes sweetly scented.

Parasitic on various hosts, especially members of the *Chenopodiaceae*, *Polygonaceae* and *Tamaricaceae*.

Habitat.— Fine soft sand, both on sandy flats and dunes, as well as in hard sand over limestone, in stony ground, and in saline, occasionally flooded swampy areas. It also occurs in fertile irrigated soils on field margins.

Local distribution.— Widespread within the Arabian peninsula, often a coastal plant but also recorded inland.

Flowering.— (November-)December-April but also recorded in September and October.

Altitudinal range.— 0-2400 metres.

Overall geographical range.— Widespread in sandy, desert regions from the west coast of Africa and southern Spain, through north Africa, the southern Mediterranean and the Middle East, to India and Pakistan.

Selected typical specimens.— **Bahrain:** vicinity of stone quarries near east coast, 18.XII.1983, *Cornes 97* (E). **Kuwait:** near Kathma, 12.III.1981, *Rawi & al. 10218* (E); near the Salmi road, 16.III.1981, *Armer 122* (E); 9 km south of Dubaiya, 20.II.1973, *Boulos s. n.* (BM). **Oman:** Salalah to Nazwa, 21.I.1993, *McLeish 1490* (E); Dhofar, Raha beach, 13.I.1989, *McLeish 966* (E); Dhofar, Kuria Muria islands, 16.X.1979, *Miller 2767* (E); Beach near Muscat Intercontinental Hotel, 15.I.1982, *Maconochie 3096* (E); Duqm beach, 11.XI.1993, *McLeish 3071* (E); Dhofar, Miji, 18.IX.1989, *Miller & Nyberg M9431* (E). **Saudi Arabia:** Thaniyat Camp, 24.III.1982, *Collenette 3469* (E); Eastern province, north of Damman, 7.II.1982, *Naylor 6* (E); 30 km west of Dhahran, 23.III.1981, *Frey & Kürschner VO 6557* (E); off the Medina-Qassim road, 20.IV.1981, *Collenette 2458* (E); Eastern Province, Juaymah, 14.II.1983, *Naylor 172* (E). **Yemen:** Wadi ad Dahab, 11.III.1984, *Miller & King 5082* (E); above Bahal, 13.X.1978, *Miller 509* (E); east of Hamman Ali, 30.III.1979, *Wood Y1132* (E); Hadda, 15.X.1978, *Miller 581* (E).

Note: This taxon is still poorly understood and shows considerable variation within and across its geographical range. This is especially so in flower colour, inflorescence density, corolla shape, and overall stature. Some authors have chosen to separate it into two species *C. phelypaea* and *C. tubulosa* (Schrenk) Hook. f. based mainly on flower colour but occasionally on slight differences in the shape of the anther lobes. *Cistanche phelypaea* with plain yellow flowers and acute anther lobes, *C. tubulosa* with the flowers basically yellow but tinged red or purple and with obtuse anther lobes. However, corolla colour and anther lobes shape is poorly correlated and is very difficult to assess in preserved specimens, so that until further work indicates otherwise, it would appear best to consider it as the single variable taxon: *C. phelypaea*. It is a most attractive, showy desert plant.

2. *Cistanche rosea* Oliver in Hooker's Icon. Pl.: sub tab. 2363. 1895.

Type locality: «Hadramaut, near Mokalla [Arabia]».

Type: *Lunt 62* (BM!).

!c.: Hooker's Icon. Pl.: tab. 2363 (1895); WOOD (1997: tab. 28).

Probably perennial, (10-)20-30 cm tall, whole plant mostly pinkish-red. *Stem* unbranched, often robust, 1-3 cm diameter measured just below the inflorescence, often swollen towards the base, glabrous, fleshy, pink. *Leaves* imbricate, 10-20 x c.10 mm, ovate to ovate-oblong, obtuse at the apex, glabrous. *Inflorescence* 8-20 cm long, dense, ± cylindrical. *Bracts* obovate-oblong, obtuse, shorter than the flowers; bracteoles narrow. *Calyx* ovate-elliptic, obtuse, 12-15 mm long. *Corolla* 20-30 mm long, narrowly infundibuliform, curved or straight, rose-pink or white-pale pink proximally, tipped pink; lobes ovate-rounded, pink or white on the inside, erose. *Filaments* inserted towards the middle of the corolla tube, glabrous but pilose at the base. *Stigmas* orange-red. *Anthers* cream-white, lanate.

Parasitic upon *Pluchea dioscoridis*, and often growing in association with *Acacia* (including *A. ethbaica*), *Boswellia* and *Commiphora* spp. and under *Zizyphus spina-christi*, upon all of which it may be parasitic.

Habitat.— Bottom and sides of wadis, rocky slopes, earth banks, margins of cultivated land, etc.

Local distribution.— Although some recorded localities are difficult to trace, it appears to be limited to the south of the peninsula, possibly just to Oman and Yemen.

Flowering.— February to March and September to November, and probably also at other times.

Altitudinal range.— 0-1800 metres.

Overall geographical range.— Possibly endemic to southern Oman and Yemen.

Selected typical specimens.— «**Arabia**»: s. loc., 1893-94, *Lunt 62* (BM); East road near Raidat el Maara (Mile 100), 14.XI.1950, *Guichard KG/HAD/419* (BM); Wadi Lubaat, Dahal Well, 5.IV.1947, *Thesiger s. n.* (BM). «**South Arabia**»: Hasar Johar, 9.XI.1934, *Ingrams 62* (BM); Dahmah, 10.XI.1934, *Ingrams 63* (BM). **Oman**: Dhofar, 2 km east of Ayn Wadi, 23.IX.1993, *McLeish 2597* (E); Dhofar, Wadi Mughsayl, 4.III.1994, *McLeish 3434* (E) & photo!; Dhofar, Wadi Adownib, 3.X.1979, *Miller 2491* (E); Dhofar, Salalah to Samrait road, 4.X.1979, *Miller 2521* (E); Dhofar, route de Ayun vers la route principale Salalah-Thamrait, 15.XII.1981, *Barbier 1320* (BM); towards Jebel Qara, 11.III.1978, *Lawton 2012* (BM). **Yemen**: Wadi Hajr, 100 km west of Mukalla, 13.II.1989, *Miller & al. M8168*; Wadi Hedhraan, near Taiz, 26.XII.1975, *Wood Y/75/1002* (BM); Wadi Hedrahaan, near Taiz, 15.XI.1978, *Wood 2641* (E).

Note: A interesting but little studied plant. First collected by W. Lunt on J. Theodore Bent's Hadramaut [part of Yemen] expedition of 1893-94. An illustration of a plant from Farasan island under the title of *Cistanche tubulosa* in COLLENETTE (1999: 586) may in fact be *C. rosea*, and, if so, would represent an extension of its range. The plant is known locally as fetukh. More collections are needed.

3. *Cistanche violacea* (Desf.) Hoffmanns. & Link, Fl. Portug. 1: 320. 1813.

≡ *Phelipaea violacea* Desf., Fl. Atlant. 2: 60. 1798.

Type locality: «in arenis deserti prope Tozzer» [Tunisia].

Ic.: DESFONTAINES (1798: tab. 145); JAFRI (1978: 6).

Apparently perennial, 15-35 cm tall. *Stem* usually unbranched, 20-30(-50) mm diameter, often swollen towards the base. *Leaves* scale-like, ± deltoid to ovate-lanceolate and imbricate below, longer, narrower and more free above, apex somewhat acute, pale grey. *Inflorescence* 10-20 cm long, broad and dense-flowered, ± cylindrical. *Bracts* ovate-oblong, obtuse, shorter than the corolla; bracteoles linear-oblong. *Calyx* campanulate, divided into five oblong lobes with margins scarious. *Corolla* (25-)30-40 mm long, ± campanulate, curved, tube white-very pale violet, lobes ± equal, rounded, usually strongly recurved, deep violet; inside of corolla with two pronounced yellow bosses at the folds between the lowermost central and the adjacent two lateral lobes. *Filaments* inserted towards the base of the corolla, pilose towards the base. *Anthems* villous. *Stigma* lobes white to very pale violet.

Parasitic on members of the *Chenopodiaceae* as well other plants, possibly including *Astragalus spinosus*.

Habitat.— Recorded from hard sand near Turayf, Saudi Arabia. Otherwise habitat not known. (In North Africa it occurs in saline areas on the coast as well as inland and in deserts).

Local distribution.— Northern Saudi Arabia?

Flowering.— (Probably) January to April.

Altitudinal range.— Not known.

Overall geographical range.— North Africa, from Morocco (and possibly southern Spain) eastwards through Tunisia and Egypt to south-west Asia, including the northern part of Saudi Arabia.

Selected typical specimens.— None located (see below).

Note: To date, no preserved specimens of this plant have been located. Its inclusion here is based upon a photograph of what is undoubtedly this taxon illustrated in COLLENETTE (1999: 587) where it is stated to be «occasional locally» near Turayf in the north of Saudi Arabia and

on information supplied by L. J. Musselman regarding its occurrence also in the north. Colour variants of *C. phelypaea* which have led to erroneous records for *C. violacea* in southern Spain should not similarly be confused with the true plant here. More populations of *C. violacea* should be searched for in northern areas.

2. *Orobanche* L.

Parasitic, perennial (possibly short-lived) or sometimes annual herbs up to c. 70cm tall but occasionally more. *Stems* erect, sometimes swollen at the base, branched or not, often glandular-pilose. *Leaves* numerous, sometimes imbricate near the stem base. *Inflorescence* a terminal spike or raceme, few- to many-flowered. *Bracts* present, usually \pm linear-lanceolate, bracteoles when present \pm linear and adnate to the calyx. *Calyx* tubular or campanulate, usually 4-lobed or divided into two entire or bifid lateral segments. *Corolla* tubular, campanulate or infundibuliform, variously coloured, usually glandular-pilose externally, distinctly 2-lipped, with two upper and three lower lobes. *Stamens* four, variously pilose, glandular-pilose or glabrous along their length, included and inserted towards the base of the corolla tube. *Anthers* glabrous or pilose. *Style* usually curved at the apex, moderately glandular-pilose or glabrous. *Stigma* bilobed (occasionally 4-lobed) often distinctively coloured. *Capsule* ovoid, seeds subglobose, minute.

About 150 species, its centre of distribution is from southern Europe through to south west Asia. Elsewhere it occurs much more rarely, including the New World and in the southern hemisphere. Parasitises a wide range of hosts species; for some individual taxa the host range may be very restricted.

The genus has been traditionally divided into two Sections based mainly upon the presence (Sect. *Trionychon* Wallr.) or absence (Sect. *Orobanche* (= Sect. *Osproleon* Wallr.)) of bracteoles. Section *Orobanche* has been subsequently divided into a series of *Greges* by BECK (1890, 1930).

Note: Some species of *Orobanche* are able to parasitise a wide range of host species and it is quite possible that because of this their morphology will be appreciably influenced. It is known that discrete races exist in some taxa and that these are physiologically adapted to certain hosts. It is quite possible, therefore, that incipient speciation may occur in this way. If largely inbreeding, a population or race which preferentially parasitises a host species of narrow ecological requirements may itself, in consequence, also become isolated so that a new taxon might evolve as a result. However, the morphological differentiation accompanying such speciation may be very slight and difficult to quantify by traditional means. This, together with the general lack of useful morphological characters present in the genus and the practical problems in its study, illustrates the difficulties encountered by the taxonomist.

Key to species

1. Stem sometimes branched, bracteoles present adnate to the calyx, flowers blue (but often very pale, almost white) (Sect. *Trionychon*) 2
- 1a. Stem never branched, bracteoles absent, flowers not blue (sometimes in *O. cernua*) (Sect. *Orobanche*)..... 9
2. Corollas 25-35 mm long 3
- 2a. Corollas less than 25 mm long 4
3. Stem branched, inflorescence many-flowered..... **1. *O. aegyptiaca***
- 3a. Stem unbranched, inflorescence few-flowered..... **6. *O. bungeana***
4. Stem always unbranched, inflorescence very few-flowered..... **7. *O. eriophora***
- 4a. Stem usually branched..... 5

5. Plant glandular-pilose 6
 5a. Plant arachnoid-tomentose **8. *O. hypertomentosa***
 6. Inflorescence elongated, slender, ± remote-flowered 7
 6a. Inflorescence compact, ±cylindrical, not remote-flowered 8
 7. Corolla narrow, usually only 2-3mm wide, ± straight, anthers glabrous
 **3. *O. perangustata***
 7a. Corolla exceeding 4 mm wide, often curved, anthers lanuginous-villous
 **5. *O. schultzei***
 8. Inflorescence dense, flowers suberect, white to grey-white **4. *O. muteliformis***
 8a. Inflorescence lax, flowers suberect to patent, blue at least distally **2. *O. ramosa***
 9. Margins of the corolla lobes markedly erose, or denticulate..... 10
 9a. Margins of corolla lobes entire or almost so 11
 10. Plant robust, inflorescence densely-flowered throughout **10. *O. crenata***
 10a. Plant slender, inflorescence lax at least below 12
 11. Inflorescence dense-flowered, corollas usually strongly curved, lobes bluish
 **9. *O. cernua***
 11a. Inflorescence fairly lax, corollas not usually strongly curved, white, cream-yellow
 to lilac with violet-mauve veins..... **11. *O. minor***
 12. Inflorescence very lax and remote-flowered throughout, corollas 12-14 mm long
 **12. *O. dhofarensis***
 12a. Inflorescence dense-flowered above, corollas 16-20 mm long..... **13. *O. abyssinica***

1. *Orobanche aegyptiaca* Pers., Syn. Pl. 2: 181. 1806.

Type: «*in Aegypto*» [Egypt] (G-DC, photo!).

Plant (15-)25-35(-50) cm tall. *Stem* usually branched (may be unbranched in small less robust plants), branches when present, 2-4 and to 20 cm long, often forming low on the stem, moderately glandular-pilose. *Leaves* lanceolate (10-)15-20 mm long, ± lanceolate, glandular pilose; bracts to 10 mm long, broadly lanceolate, glandular-pubescent; bracteoles two, 8-10 mm long, ± linear, glandular pilose, pale cream. *Calyx* to 12 mm long, ± campanulate, the lateral lobes divided into two subequal teeth, pale cream, distinctly glandular pilose. *Inflorescence* moderately dense to lax, many-flowered; *corollas* (25-)30-35(-40) mm long, somewhat constricted above the ovary, then broadly tubular and gradually widening, ± straight or slightly curved, pale blue to violet but cream proximally. *Filaments* hairy at the base otherwise glabrous. *Anthers* with long villous hairs. *Stigma* lobes cream-white.

A parasite of cultivated plants, especially tomatoes, but also recorded as growing in the *Rhanterium* and amongst *Haloxylon salicornicum*.

Local distribution.— Records in the peninsula are so far from Saudi Arabia, especially the east.

Habitat.— Mainly a parasite of cultivation and waste areas.

Flowering.— Dated collections show it as flowering in March but no doubt also a little outside this period as well.

Altitudinal range.— There is no record for its altitudinal range.

Overall geographical distribution.— From the eastern Mediterranean eastwards to central Asia.

Selected typical specimens.— **Saudi Arabia:** NE of Riyadh, 20.III.1969, *Mandaville 2397* (BM); Al Kharj, 1.III.1970, *Parker S.A. 67* (BM); Onaiza, 5.III.1970, *Parker S.A. 112* (BM); Summan Plateau, 17.III.1983, *Mandaville 7930* (herb. Mandaville); NE Arabia, WNW of Nariya, 20.III.1968, *Mandaville 1474* (BM); E of Abraq al-Kabrit, 22.III.1968, *Mandaville 1717* (BM).

Note: Throughout much of the eastern Mediterranean, Egypt and western Asia, this is a pest of cultivated crop plants.

2. *Orobanche ramosa* L., Sp. Pl.: 633. 1753.

Type locality: «in Europae siccis».

Type: herb. Clifford: 321, *Orobanche 2* (BM!), see FOLEY (2001: 231).

Ic.: HEGI (1974); HESS & al. (1980); JAFRI (1978: 10); KREUTZ (1995: 45-47); UHLICH & al. (1995: 39, 62, 109).

Annual, probably also perennial, very variable in height and habit, 5-50 cm tall. *Stem* simple or branched, often much-branched from near the base, stems 2-6 mm wide below the inflorescence, cream to grey-mauve, glandular-pubescent. *Leaves* 3-8 mm long, ovate-lanceolate, cream-grey, glandular-pubescent. *Inflorescence* 3-20(-25) cm long usually lax, few to many-flowered, sometimes with pedicellate lower flowers. *Bracts* 5-10 mm, ovate-lanceolate, cream-grey, glandular-pubescent; bracteoles linear-lanceolate. *Calyx* 5-10 mm long, the shape rather variable, segments divided into tapering teeth, greyish-blue, glandular-pubescent. *Corolla* 10-13(-17) mm long, suberect to patent, slightly inflated proximally then somewhat constricted at about $\frac{1}{3}$ of length, widening and becoming tubular-subinfundibuliform distally, slightly curved, almost white at the base, but pale whitish-blue to deep blue distally with white bosses inside the throat, glandular-pubescent; upper lip slightly bilobed, lobes of lower lip with margins \pm entire. *Filaments* inserted 4-6 mm above the base of the corolla, \pm glabrous throughout their length. *Anthers* \pm glabrous. *Stigma* lobes cream-white or occasionally very pale blue. *Style* slightly glandular-pilose, whitish.

Thought to be parasitic upon *Rumex nervosus*, as well as on *Pulicaria crispa*, *Ferula communis*, and *Ebenus* sp., and also on cultivated crops, such as sorghum, tomato and lucerne.

Habitat.— A plant of open stony areas, rocky hillsides, wadi banks, roadsides, as well as gardens and cultivated areas. Fairly frequent throughout suitable habitat in the peninsula.

Local distribution.— Widespread in the peninsula.

Flowering.— Especially March to April but possibly also throughout most of the year.

Altitudinal range.— Recorded to an altitude of 2600 metres.

Overall geographical range.— Throughout much of the world although probably introduced in many areas.

Selected typical specimens.— **Kuwait:** Al-Sharq, Kuwait City, 31.III.1985, *Al-Nimer s. n.* (E) -new to Kuwait-. **Saudi Arabia:** Al Habu, 6.IV.1995, *Collenette 9332* (E); near Abha, 21.XI.1981, *Collenette 3177* (E, K); Hema Figra, 5.IV.1989, *Collenette 7091* (E, K); Jabal Ibrahim, 18.IX.1982, *Collenette 3553* (E); W of Arat, Turayf road, 8.IV.1988, *Collenette 6684* (E). **Oman:** Sayq plateau, 16.IV.1980, *Whitcombe 853* (E); Wadi Mistal, Wakkan, 26.III.1992, *Ghazanfar 1774* (SQUH); Jebel Shams, 28.IV.1989, *Ghazanfar & al. 983* (SQUH). **Yemen:** Dafrd, 8.IX.1982, *Bisset 182a* (K); SSW of Dhulma Jebel Hubaysh, 5.VIII.1977, *Radcliffe-Smith & al. 4496* (K); W of Ibb, 10.VII.1983, *Spellenberg 7227* (K); Ibb, 21.VII.1983, *Spellenberg 7440* (K); Mahwit, 2.III.1972, *Wood 72/41* (BM); Hajja, 7.III.1973, *Wood 73/32* (BM); Jibla, 26.X.1975, *Hepper 6090* (K); Jibla, 27.X.1975, *Hepper 6315* (K); near Dhulma, 6.VIII.1977, *Wood 1774* (K).

Note: This is an extremely polymorphic taxon within which several additional specific, and many infra-specific, taxa have been described. Whilst some plants can be readily referred to them, others possess an intermediate morphology and are difficult to place with accuracy. Further work may show that these taxa merit a rank lower than subspecies. *Orobanche ramosa* is a very widespread plant of southern Europe, Asia, Africa and north America, and is often introduced. It is a considerable pest of cultivation but also occupies a wide range of other, especially anthropogenic habitats, such as waste ground and roadsides.

3. *Orobanche perangustata* M. J. Y. Foley, *spec. nova* (Plate 1)

– *Orobanche ramosa* Arabian auct.

Type: [Oman] An Nid, 2500', «in cultivations of Lucerne &c.», 21.III.1976, *Radcliffe-Smith* 3979 (holo-: K; iso-: ON).

Planta gracilis sparsim pilosa; caulis angustissimus, ramosus vel simplex, sub inflorescentia 1-2 mm latus; inflorescentia angusta, laxa, pauciflora; corolla 12-16 x 2-3 mm, perangusta plus minusve tubulosa.

Plant slender, graceful, sparsely hairy; *stem* very narrow, 1-2 mm wide below the inflorescence, branched or unbranched; *inflorescence* narrow, lax, few-flowered; *corolla* 12-16 x 2-3 mm, very narrow, ± tubular.

A slender, graceful plant, annual or possibly perennial, 15-25 cm tall. *Stem* pale yellow-brown, simple or loosely branched, the branches narrow, sometimes flexuous; stems very narrow 1-2(-2.5) mm wide immediately below the inflorescence, slightly glandular-pubescent. *Leaves* rather few, 3-7 mm long, lanceolate, glandular-pubescent. *Inflorescence* 6-12(-15) cm long, narrow, graceful, usually lax, relatively few-flowered, sometimes with pedicellate lower flowers. *Bracts* 6-9 mm long, lanceolate, somewhat glandular-pubescent; bracteoles linear, 4-5 mm long. *Calyx* 5-7 mm long, ± campanulate, divided into two sets of narrow, tapering teeth ± equalling the tube, sparsely pilose to subglabrous. *Corolla* 12-16 mm long, very narrow, 2-3(-4) mm wide, suberect to patent, inflated proximally, constricted immediately above, then ± tubular, widening only slightly towards the limb, straight or angled above the constriction, mauve to blue, subglabrous; lobes of lower lip rounded, occasionally acute, margins ± entire. *Filaments* inserted 3-4 mm from the base of the corolla, glabrous except for a few hairs at the base. *Anthers* white, glabrous. *Stigma* lobe colour not recorded.

Thought to be parasitic on *Medicago* sp. (i.e. lucerne) and *Flaveria* sp.

Habitat.– Recorded from rocky slopes and from a wadi, as well as from areas of cultivation.

Local distribution.– So far only known from Oman.

Flowering.– February to April.

Altitudinal range.– 600-1900 metres.

Overall geographical range.– Possibly endemic to Oman.

Selected typical specimens.– **Oman:** Nizwa, 12.II.1973, *Parker* 0.50 (BM); Jabal al Harim, 27.II.1979, *Mandaville* 7313 (BM); As Siy, Musandam Range, 14.IV.1983, *Gallagher* 6716/4 (E); An Nid, 21.III.1976, *Radcliffe-Smith* 3979 (K, holotype; ON, isotype).

Note: So far known from only four collections all of which are restricted to Oman and to where it may be endemic. However, what may be a more robust variant was collected in Saudi Arabia (Jabl Fayfa, 6.III.1979, *Chaudhary* E420 (E)). When branched, *O. perangustata* shows superficial similarities to *O. ramosa* but is readily distinguished by its much more slender graceful habit, its narrow stem, relatively long, narrow, sparsely-flowered inflorescence, and narrow corollas. A rather inconspicuous plant, it is possibly overlooked and therefore under-collected.

4. *Orobanche muteliformis* M. J. Y. Foley, *spec. nova* (Plate 2)

– *Orobanche mutelii* sensu MANDAVILLE (1990: 280)

Type: Dawadini Camp II [Saudi Arabia], 24.46N; 44.38E. Low limestone scarp near camp. Head of gully, 2900', 6.III.1983, *Collenette 4088* (holo-: E).

lc.: MANDAVILLE (1990: tab. 195).

Planta 12-27 mm alta; caulis plerumque simplex interdum ad basim fastigiatus; inflorescentia cylindracea, densiflora, flores alba, in alabastro flavida; corolla 14-18 mm longa, pallida ravidus alba, curvata, sursum ampliata, supra ovarium valde constricta; stamina infra medium corollae inserta, c. 4-6 mm e basi; filamenta ubique glabra.

Plant 12-27 mm tall; *stem* usually simple, occasionally fastigiate-branched below; *inflorescence* cylindrical, dense-flowered, flowers white, yellowish in bud; *corolla* 14-18 mm long, pale greyish-white, curved, inflated proximally, strongly constricted immediately above the ovary; *filaments* inserted 4-6 mm above the corolla base, glabrous throughout.

Annual, probably also perennial, (9-)12-27(-35) cm tall, rather variable in height. *Stem* usually simple, occasionally ± fastigiate branched at the base, stems 3-5(-7) mm wide below the inflorescence, pinkish-cream to pale fawn, glandular-pilose. *Leaves* (5-)8-12 mm long, broadly lanceolate, acute, brownish, subglabrous. *Inflorescence* (4-)7-10 cm long, a dense, ± cylindrical, many-flowered spike, sometimes with pedicellate lower flowers. *Bracts* 8-11 mm, ovate-lanceolate, creamish to pale brown, glandular-pilose; bracteoles ± linear. *Calyx* 8-12 mm long, divided into four ± equal, tapering teeth which subequal or exceed the tube, pale fawn, distinctly glandular-pilose; flowers ± white, yellowish in bud. *Corolla* (12-)14-18(-20) mm long, usually suberect, rarely becoming more patent, inflated at the ovary, distinctly constricted above then ± tubular, curved, white to greyish-white throughout, sometimes with a tinge of very pale violet, with scattered glandular hairs; lobes variably obtuse or acute. *Filaments* inserted 4-6 mm above the base of the corolla, ± glabrous throughout their length. *Anthers* glabrous. *Stigma* lobes darkening with age. *Style* glabrous.

It appears to be limited to *Rhanterium epapposum* (arfaj) for its host.

Habitat.— An occasional plant of sands, silts and limestone substrates, found in ravines and wadi beds and on limestone scarps.

Local distribution.— All records to date are from Saudi Arabia.

Flowering.— March-April.

Altitudinal range.— From 50-900 metres.

Overall geographical distribution.— Apparently endemic to Saudi Arabia.

Selected typical specimens.— **Saudi Arabia:** NE Arabia, Jabal al-'Amudah, 22.III.1968, *Mandaville 1738* (BM); NE Arabia, Abu Hadriyah, 23.III.1968, *Mandaville 1760* (BM); Eastern Province, W of al-Lahy al-'Atshan, 3.IV.1986, *Mandaville 8595* (herb. Mandaville); Eastern Province, al-Malsuniyah, 27.III.1986, *Mandaville 8561* (herb. Mandaville); Eastern Province, Summam Plateau, 17.III.1983, *Mandaville 7924* (herb. Mandaville); Eastern Province, Summam Plateau, 18.III.1983, *Mandaville 7937* (herb. Mandaville); Eastern Province, Wadi-as-Sahba, 27.III.1983, *Mandaville 8067* (herb. Mandaville); Eastern Province, S of Thaj village, 10.III.1983, *Mandaville 7899* (herb. Mandaville); Dawadini Camp II, 6.III.1983, *Collenette 4088* (E, holotype); 100 km N of Buraydah, 23.IV.1981, *Collenette 2520* (E, K); Dhahran Aerodrome, 15.IV.1950, *Dickson 653* (K).

Note: This plant has often been erroneously assigned to the distinctly variable *O. mutelii* F. W. Schultz by authors and collectors, but differs essentially in its much denser inflorescence comprising rather shorter, suberect, white to grey-white, subglabrous flowers. It may be geographically restricted since most collections to date have been from the eastern part of the peninsula. Dried specimens are of a white to pale yellowish coloration and are especially typical.

5. *Orobanche schultzei* Mutel, Fl. Franç. 2: 429. 1835.

Type locality: «Bone» [Algeria].

Type: «au bord de la mer à Bone [Algeria]», *Mutel s. n.* (lecto-: GRM, photo !), see FOLEY (2001: 232).

lc.: JAFRI (1978: 16).

Plant, 15-30 cm tall. *Stem* usually simple but sometimes branched towards the base, somewhat glandular-furfuraceous. *Leaves* 7-12 mm, ovate-lanceolate, glandular pilose. *Bracts* broadly lanceolate, 8-10 mm long, glandular-pilose, bracteoles two, ± linear, 6-8 mm long. *Inflorescence* 15-25 cm long, many-flowered, narrow-cylindrical, elegantly tapering, fairly lax, flowers suberect, some of the lower ones pedicellate. *Calyx* ± campanulate, 8-12 mm long, each lobe ± equally divided into two teeth, the latter usually longer than the tube, glandular-pilose. *Corolla* 13-15(-20) mm long, whitish to mauve or deeper, narrow, constricted below the middle, curved, often strongly so, glandular-pilose, lobes of lower lip, elliptical, acute or acuminate. *Filaments* inserted 4-5 mm above the base of the corolla, ± glabrous. *Anthers* lanuginous-villous. *Stigma* lobes pale, whitish.

Host not known.

Habitat.— Information is sparse. Recorded in a ditch by a road cutting within the juniper zone, on a lush rock ledge, and on a terrace growing with *Catha edulis*.

Local distribution.— Probably mainly from the south of the peninsula.

Flowering.— November to May.

Altitudinal range.— 1500-2100 metres.

Overall geographical distribution.— Southern Europe, north Africa, the Middle East and western Asia.

Selected typical specimens.— **Saudi Arabia:** Jabal Fayfa, 2.IV.1982, *Baierle & al.* 82-1060 (E); N of Mindak, Ibrahim road, 16.III.1995, *Collenette* 9312 (E); Asir, Tumniha, 19.V.1982, *Vincett s. n.* (BM). **Yemen:** Dar an Nasr, Jebel Sabir, Taiz, 7.XI.1974, *Wood* Y/74/229 (BM).

Note: Originally described from Algeria as a parasite of a *Scorpiurus* sp., the tall, elegant, spire-shaped spikes are especially typical.

6. *Orobanche bungeana* Beck in Biblioth. Bot. 19: 119. 1890.

Type: «prope Siarat [Iran] in 1859» (LE) – image!

Plant (10-)12-17(-30) cm tall. *Stem* usually unbranched, occasionally sparsely branched, glandular-pilose. *Leaves* broadly lanceolate 8-12 mm long, glandular pilose. *Bracts* (8-)10-12 mm long, broadly lanceolate, glandular-pubescent; bracteoles two, 10-12 mm long, ± linear, glandular lanate, cream-fawn. *Calyx* to 15 mm long, ± campanulate, the lateral lobes divided into two, long, narrow, ± equal teeth, the latter equalling, or slightly exceeding the tube, cream-fawn, glandular lanate. *Inflorescence* capitate to subcapitate, fairly lax, few-flowered, lower flowers sometimes pedicellate. *Corollas* 25-35 mm long, somewhat constricted above the ovary, then widening rapidly and becoming ± campanulate to infundibuliform, ± straight but sometimes articulating above the ovary, blue to violet with a white throat, paler proximally, glandular pilose, the lower lip relatively large and prominent. *Filaments* shortly pilose at the base, otherwise glabrous. *Anthers* villous. *Stigma* lobes pale.

Host not confirmed but *Zilla spinosa* and *Horwoodia dicksoniae* have been noted in close association.

Habitat.— Recorded from sands and gravels, in runnels and on wadi sides.

Local distribution.— Restricted to Saudi Arabia.

Flowering.— February to March.

Altitudinal range.— Known records are from between 200 and 550 metres.

Overall geographical range.— Iran and neighbouring parts of western Asia.

Selected typical specimens.— **Saudi Arabia:** Nejd, Buwaib, 19.III.1945, *Vesey-Fitzgerald 14654/1* (BM); Arafjan, S of Kuwait, III.1933, *Dickson 123* (K); Arafjan, 1935, *Dickson 123A* (K); Al A'aqla, N of Riyadh, 14.III.1981, *Hillcoat 226* (BM); near Zabirah, 24.II.1985, *Collenette 5081* (E); Eastern Province, Jibal adh-Dhubabat, 21.III.1986, *Mandaville 8560* (herb. Mandaville).

Notes:

Orobanche bungeana was first described from plants discovered in 1859 by von Bunge at Siarat, Iran. It has also been recorded from elsewhere in Iran as well as from the Caucasus; there is a single doubtful European record based on a collection of Sintenis in 1896 from the Pindus mountains of Greece. However, this is almost certainly the Balkan endemic, *O. nowackiana* Markr., to which *O. bungeana* shows some affinity.

It differs from another local Arabian, large flowered species of Sect. *Trionychon* (*O. aegyptiaca*) by its usually smaller stature, its less tendency to branching, by the longer calyx teeth, sometimes exceeding the tube, its rapidly broadening, sometimes almost infundibuliform corollas, and in its \pm capitate, usually few-flowered inflorescence. Collections of the plant from within the Arabian peninsula are scarce.

7. *Orobanche eriophora* Bornm. & Gauba in Repert. Spec. Nov. Regni Veg. 51: 200. 1942.

Type locality: «Elburs: Bei Pole Zangulé [Iran] am Kandavan-Pass im Buschwald, 2300 m.»

Type: Elburz, Pole Zangulé, 21.VII.1938, *Gauba 1672* (holo-: B!).

Plant small, 7-15 cm tall, tomentose. *Stem* unbranched, slender, glandular-pubescent above. *Leaves* lanceolate, 7-10 mm long. *Bracts* broadly lanceolate to ovate, 8-10 mm long, tomentose; bracteoles to 6 mm long, \pm linear, densely pilose especially along the margins. *Calyx* to 8-10(-15) mm long, tomentose, sometimes \pm hyaline, lobes shortly divided. *Inflorescence* fairly dense but very few-flowered. *Corolla* 18-20 mm long, curved, slightly constricted above the ovary then broadly tubular and gradually widening, light blue to amethyst, darker at the limb, \pm glabrous. *Filaments* inserted towards the corolla base, glabrous. *Anthers* lanate. *Style* \pm glabrous.

Host details are lacking.

Habitat.— The type specimen [from Iran] was collected in scrub but this is unlikely to be the case for Arabian peninsula plant.

Local distribution.— North-east Saudi Arabia.

Flowering.— March, probably at relatively low altitude.

Altitudinal range.— Not known.

Overall geographical range.— Iran to north-east Saudi Arabia.

Selected typical specimens.— **Saudi Arabia** (north-east): 2 km S of Kuwait border, 22.III.1968, *Mandaville 1677* (BM); NE of Khursaniyah, 23.III.1968, *Mandaville 1800* (BM).

Note: Known from only two collections, this plant appears to be very local in the north-east of the peninsula. Outside the area it is apparently known only from the type collection in Iran to where it was thought to be endemic (SCHIMAN-CZEIKA, 1964: 10). There it flowered in July at an altitude of 2300 metres on the Kandavan Pass. More collections of this plant are required.

8. *Orobanche hypertomentosa* M. J. Y. Foley in Edinburgh J. Bot. 55: 232. 1998.

Type: Saudi Arabia, south-west of Zabirah, 200 km north of Buraydah, red sand dunes, 22.IV.1981, *Collenette 2506* (holo-: E; iso-: K).

Ic.: COLLENETTE (1985: 383, top left photograph as *O. caucasica*); FOLEY (1998: 233).

A relatively robust plant of modest stature to 25 cm tall, exceedingly arachnoid-tomentose with glandular and eglandular hairs on stems, calyxes and bracteoles, rather less so on the bracts. *Stem* simple, unbranched. *Inflorescence* not very dense-flowered, tapering. *Bracts* lanceolate; bracteoles linear-lanceolate. *Calyx* ± campanulate with segments usually bifid which bear lanceolate teeth. *Corollas*, ± patent, initially narrowly tubular and restricted in width proximally, then deflexed, spreading distally, 20-25 mm long, pale blue-lavender with prominent white bosses in throat and bearing moderately arachnoid, white, glandular hairs; lips of corollas prominent. *Filaments* glabrous throughout their length, inserted 7-8 mm above the corolla base. *Anthers* with scattered long white hairs. *Stigma* lobes white. Apparently sweetly scented.

Possibly parasitic upon *Calligonum comosum*.

Habitat.— A plant of the «red» sand dunes in desert localities but also occurring in coastal stabilized dunes. Recorded also as an agricultural casual.

Local distribution.— Recorded only from Bahrain and Saudi Arabia.

Flowering.— March to April.

Altitudinal range.— 0-550 metres.

Overall geographical range.— Endemic to the Arabian peninsula.

Selected typical specimens.— **Bahrain:** sandy desert, SW of J. Dubhan, 21.III.1950, *Good 243* (BM). **Saudi Arabia:** SW of Zabirah, 200 km N of Buraydah, 22.IV.1981, *Collenette 2506* (holotype: E, isotype: K); 2 km S of Al Hufuf, 5.III.1970, *Mandaville 2739* (BM); 65 km ESE of Umm 'Ushar, Eastern Province, 26.III.1981, *Hillcoat 335* (BM); Ras Al-Ghar, Eastern Province, 22.IV.1982, *Mandaville 7711* (E).

Note: *Orobanche hypertomentosa* is readily separated from related taxa by the presence of a highly arachnoid-tomentose glandular/eglandular indumentum on the stems, bracteoles and calyces, in combination with characters which include a fairly lax, tapering inflorescence, a distinctively shaped corolla which is narrow and restricted proximally but which then markedly expands distally and possesses prominent upper and lower lips. Present records suggest that *O. hypertomentosa* is endemic to Saudi Arabia and Bahrain.

9. *Orobanche cernua* Loeffl., Iter. Hispan.: 152. 1758.

Type locality: «ad Aranjuez [Spain] supra radices Artemisiae campestris erectae, odore Carlinae; in campis sterilissimis».

Type: *Loeffling s. n.* (lecto-: LINN 798.6, microfiche!), see FOLEY (2001: 230).

Ic.: JAFRI (1978: 18).

Annual or perennial, (5-)10-30(-40) cm tall. *Stem* simple (3-)5-8(-10) mm wide below the inflorescence, yellow to pale violet, somewhat glandular-pubescent. *Leaves* 5-10 × c.5 mm, ovate-lanceolate, yellowish, with sparse glandular hairs. *Inflorescence* 3-8(-20) cm long, dense- or very dense-flowered, ± cylindrical. *Bracts* fairly short, 8-10(-14) mm long, ovate, yellow, glandular-pubescent. *Calyx* 7-12 mm long, segments usually divided into two acuminate teeth, pale yellow-blue, with glandular hairs. *Corolla* 12-15(-20) mm long, erecto-patent, ± tubular but distinctly inflated proximally, the dorsal line slightly to very strongly curved, genuflexed, the tube cream-white (sometimes yellowish at first or even cream-white throughout), weakly to strongly

tinged blue-mauve to purple, sparingly glandular-pubescent. *Lobes* blue-purple or paler, the upper lip \pm bilobed, those of the lower lip usually rounded, \pm evenly spaced, the margins glabrous, slightly erosulate. *Filaments* inserted c. 6 mm above the base of the corolla, \pm glabrous above, slightly pubescent below. *Anthers* glabrous or hairy. *Stigma* lobes pale white-yellow. *Style* slightly glandular-pilose.

Parasitic on a wide range of hosts but *Lycium shawii*, cultivated tomato, and other members of the *Solanaceae* appear to be especially favoured. Recorded also on *Anvillea garcinii*, *Artemisia monosperma*, *A. sieberi*, *Barleria bispinosa*, *Francoeria crispa*, *Pulicaria glutinosa* and *Withania somnifera*, as well as leguminous annuals.

Habitat.— Occurs in the beds of wadis, on disturbed rocky slopes, and in silty soils, gravels, red sands and barren earth, sometimes in the absence of any obvious host. Also in cultivated areas.

Local distribution.— Apparently widespread in the peninsula and especially so amongst cultivation.

Flowering.— More or less all the year round but especially between February and May and September to October.

Altitudinal range.— From sea-level up to 3000 metres.

Overall geographical range.— Widespread in southern Europe, also Africa, much of Asia and Australia. It is probably introduced in many areas.

Selected typical specimens.— **Saudi Arabia:** near Qfeyah, 21.III.1962, *Zeller 6804* (BM); Al Qaha, 2.II.1986, *Collenette 5581* (E, K); S.W. of Zabirah, 22.IV.1981, *Collenette 2505* (E, K); Wadi Qaraqir, 5.III.1979, *Collenette 951* (K); Eastgern Province, N.E. of Harad, 24.III.1983, *Mandaville 8002* (herb. Mandaville); Eastern Province, Dhahran, 7.III.1983, *Mandaville 7893* (herb. Mandaville); Eastern Province, Na'lat Shadqam, 14.III.1983, *Mandaville 7901* (herb. Mandaville); Eastern Province, Umm a-Jamajlin, 21.III.1981, *Hillcoat 326* (BM). **Kuwait:** Al-Khيران, 21.IV.1983, *Halwagy 17/83* (KTUH); Failaka island, 25.IV.1972, *Halwagy 1231* (KTUH); NE of Jahra, 30.III.1995, *Modhi Al-Dosari 1533* (KTUH); Al-Db'a'iyah, 15.IV.1986, *Halwagy 5/86* (KTUH). **Oman:** near Birkal, 11.IV.1982, *Lawton 2348* (BM); Kaharat to Rahba, 14.III.1980, *Edmondson E 3401* (E); Qarabi, 7.IV.1978, *Whitcombe 180* (E, K); between Hagayf & Ayun, 18.IX.1993, *Collenette 8839* (ON). **Yemen:** Qa Bakil, 2.XI.1975, *Hepper 6212* (K); Dafod, 4.VI.1982, *Bisset 105* (K); San'a, 17.II.1938, *Scott & Britton 526* (BM); Taiz, 4.III.1976, *Wood 1555* (BM). **Aden:** Lodar Audhilla range, 17.X.1962, *Popov P35/11* (BM).

Notes:

This is a very variable taxon to which several infra-specific taxa have been described, some of which exhibit a morphology which may result from the influence of the host. Also, the differences between them are often dimensional rather than otherwise morphological and so it is doubtful whether they should be considered even at varietal level. Some also show considerable inter-gradation one to another which again makes separate taxonomic recognition questionable.

However, there appear to be at least two more readily separable taxa:

(a) *Orobanche cernua* var. *nepalensis* Reut. (syn. *O. pogonanthera* Reut.; *O. cernua* var. *desertorum* Beck) when compared to var. *cernua* is found to be a more robust, taller (to 40 cm) plant with a broader stem (to 10 mm diameter), a very dense inflorescence of much less curved, larger corollas (to 18-20 mm) and often paler flowers. As *O. pogonanthera* it was originally described from Iran based on collection *Kotschy 949* (erroneously numbered 849 in the protologue). A photograph of this has been examined (G!) and the following Arabian peninsula collections appear to be the same taxon: **Saudi Arabia:** Jabal al-Amudah, *Mandaville 1726* (BM); az-Zulayfayn, *Mandaville 4068* (BM); Al Jouf, *Wood W224 & W246* (BM). **Yemen:** Hadde, *Rathjens s. n.* (BM); Taiz, *Wood 1555* (K). The collection *Mandaville 4068* was identified as being parasitic on *Lycium arabicum* and growing in open sand.

Beck's reduction in rank to var. *desertorum* seems to be much more appropriate than the specific status granted by Reuter. The epithet «*pogonantha*» refers to the hairy apex of the anthers although, from the diagnosis, this appears to be an inconstant character.

(b) *Orobanche cernua* var. *latebracteata* Beck possesses broad, ovate bracts and small (10-14 mm long) corollas with small lobes. Collections possibly referable to this have been noted from Birkah (*Popov 69/121* (BM)), near Abha (*Collenette 2094* (E)), and from Dhofar (*Miller & Nyberg M. 9143* (E)).

Outside the Arabian peninsula, *O. cernua* is a widespread plant of western Asia and the drier, warmer latitudes of southern Europe. As var. *cumana* (Wallr.) Beck it can be a persistent agricultural pest in the latter area, especially amongst crops of *Helianthus annuus*. This differs from the type in its taller stature, its less dense, elongated inflorescence of more remotely spaced, slightly longer, paler-coloured flowers. However, it has not been recorded from the area so far. It has been suggested that it may merely represent another host-determined form of the type but work carried out on material from Israel has shown that genetic differences do in fact exist (see KATZIR & al., 1996). Similar work on other closely related taxa from the Arabian peninsula might also be illuminating. *Orobanche cernua* s. l. is wide ranging, found from Spain eastwards into western Asia.

Orobanche camptolepis Boiss. & Reut. (syn. *O. ovata* Blakelock) is another species which shows affinities to *O. cernua*. Although so far not recorded from the Arabian peninsula with any certainty, it may nevertheless occur there. It is a small plant with a dense inflorescence of small pinkish flowers with tubular corollas, 10-15mm long. The bracts and leaves are short, the latter often strongly recurved, the filaments are glabrous and inserted towards the middle portion of the corolla and the stigma lobes pale pink. *Orobanche camptolepis* was first described from Turkey «ad ruinas Pompeiopolis in Ciliciâ» based on the collection *Balansa 764* (G photo!); it is quite widespread in western Asia. Poorly preserved specimens which may represent this taxon are *Ritchie 77* (E) from Yemen and *McLeish 335* (E) from Oman but others have not been located.

10. *Orobanche crenata* Forssk., Fl. Aegypt.-Arab.: 113. 1775.

Type locality: [Egypt: Cairo] «Kâhira».

Type: *Forsskål 358, 1534, 1535* (C! photo).

lc.: JAFRI (1978: 20); KREUTZ (1995: 85-87); UHLICH & al. (1995: 109, 163).

Plants 15-50(-100) cm high. *Stem* simple 4-8(-10) mm wide below inflorescence, sometimes yellowish but often strongly flushed purple, appreciably glandular-pubescent. *Leaves* 12-25 x 3-5 mm, frequent especially below, linear-lanceolate. *Inflorescence* typically 20-40 cm long, fairly dense, many-flowered. *Bracts* 15-25 mm, linear-lanceolate, glandular-pubescent. *Calyx* 10-20 mm long, lateral segments unequally bifid. *Corolla* (15-)20-25(-30) mm, erecto-patent, ± campanulate with some glandular hairs, dorsal line slightly curved, usually cream-white with lilac-purple veins, often quite heavily veined but can also appear almost white and unveined; there is much variation between these states even within a single population. Upper lip usually bilobed, lobes of lower lip broad and rounded, margins distinctly crenulate-dentate. *Filaments* inserted 2-5 mm above the base of the corolla, glandular pilose above, appreciably pilose below. *Anthers* ± glabrous. *Stigma* lobes just separate, white or very pale violet-pink. *Styles* glandular pubescent.

So far only definitely recorded as a parasite of *Centaurea pseudosinaica* but it may also possibly parasitise *Melilotus indica*.

Habitat.— Occurs as a roadside weed and in addition it is also thought to be a ruderal of gardens and farms (see MANDAVILLE, 1990: 280).

Local distribution.— Apparently a rare plant of eastern Saudi Arabia.

Flowering.— Records suggest March-April, but probably also outside this period.

Altitudinal range.— Not known.

Overall geographical range.— Widespread from southern Europe, north Africa, Middle East and into Asia. Probably introduced in some parts.

Selected typical specimens.— **Saudi Arabia:** Hanidh, 1.IV.1983, *Mandaville 8104* (herb. Mandaville); Eastern Province, al-Khubar, 4.III.1983, *Mandaville 7887* (herb. Mandaville).

Note: This is a very widespread plant of southern Europe, north Africa, and south-west Asia, also sometimes introduced outside this area. In the Mediterranean region it is a pest of cultivated crops, especially members of the Fabaceae such as broad bean. From its frequency elsewhere, it is surprising that it appears to be so rare in the peninsula. Other than the Mandaville collections given above, the only other reference to its presence is for «Arabia Petraea» given by BLATTER (1921: 352). Fairly constant in its morphology and often a tall plant, *O. crenata* is easily recognised by its neat dense, cylindrical inflorescence of patent, distinctly crenulate-lobed, cream-white, purplish veined flowers. Elsewhere the flowers are known to omit a pleasant odour but information on plants from the Arabian area is lacking.

11. *Orobanche minor* Sm., Engl. Bot. 6: tab. 422. 1797.

Type locality: [England] «near Sheringham».

Type: specimen 1087.13 no.1, herb. Smith (LINN!).

lc.: ROSS-CRAIG (1966, 23: tab. 28); KREUTZ (1995: 121-123).

Probably annual, usually fairly small and slender but sometimes much taller, 12-30(-40) cm high. *Stem* simple, 4-8 mm wide below the inflorescence, pink to purple-violet. *Leaves* 14-22 x 3-5 mm, broadly lanceolate, dark, moderately glandular-pubescent. *Inflorescence* 5-30(-50) cm long, fairly lax, tapering. *Bracts* 10-20 mm long, ± lanceolate, dark mauve, glandular-pubescent. *Calyx* 8-15 mm long, unequally divided into tapering teeth or else entire, mauve, with some glandular hairs. *Corolla* (10-)13-18 mm long, ± patent, tubular, slightly curved, whitish, cream-yellow to lilac with violet-mauve veins especially distally, but colour variable, with glandular hairs.

Upper lip slightly bilobed, lobes of lower lip rounded, margins slightly denticulate. *Filaments* inserted 2-3 mm above the base of the corolla, glabrous above, slightly pilose below. *Anthers* glabrous. *Stigma* lobes usually mauve or purple, sometimes pinkish or even pale yellow. *Style* pink with some glandular hairs.

Parasitic on a wide range of hosts but these are rarely, if ever, recorded with any accuracy.

Habitat.— Includes overgrazed grassy and rocky slopes, clearings in thickets, roadside banks and tracksides, and in wadi beds.

Local distribution.— From the collections examined, it appears to be especially frequent in the south west of the peninsula, especially in Yemen.

Flowering.— Almost all the year round but especially between February and May and between September and October.

Altitudinal range.— Recorded from 600 metres up to an altitude of 2900 metres, although it is probably to be found at lower levels also.

Overall geographical range.— Very widespread and probably introduced in many places. Europe, Asia, Africa, North America, some southern hemisphere countries.

Selected typical specimens.— **Saudi Arabia:** NE of Jizan, 25.IV.1982, *Collenette* 3590 (E); Jabal Shada, 24.II.1990, *Collenette* 7330 (E); SE of Abha, 27.IV.1978, *Nasher* P23 (BM). **Yemen:** Naqd al Ahmar, 25.IX.1977, *Lavranos & Newton* 15980 (E); Mahwit, 31.III.1981, *Miller & Long* 3356 (E); Al Mejsin, 6.II.1979, *Wood* Y1044 (E); near Turba, 29.X.1976, *Wood* 1430 (E); Karkaban and Shibam, 1.VI.1977, *Wood* 1672 (E, K); Jebel Sumarra, 16.IX.1976, *Wood* 1238 (E); Mahwit, 29.II.1972, *Wood* 72/13 (BM); Sumara Pass, 16.IX.1982, *Bisset* 190 (K); N of Ibb, 16.IX.1977, *Wood* 1981 (K); Ibb, 27.IX.1976, *Wood* 1318 (K). **Socotra:** Jebel Rughid, 8.II.1990, *Miller & al. M.* 10336 (E); Reiged plateau, 21.II.1989, *Miller & al. M.* 8332 (E); «Socotra», 1898-1899, *Ogilvie-Grant-Forbes Expedition* (E).

Notes:

Another variable taxon, within which several varieties and forms have been described. Some of these may exist as distinct races, their morphology being determined by the host upon which they grow. It is quite possible that other taxa are present within the current concept of *O. minor* and more investigation is required before its taxonomy, and that of its close relatives, is fully understood. To achieve this a genetic approach will be necessary.

More robust plants with distinctly glandular-pilose stems, bracts and calyces and longer (to 20 mm), corollas have sometimes been referred to *O. pubescens* D'Urv. (syn.: *O. versicolor* F. W. Schultz, *O. fragrans* Griseb. non Koch). This is a plant which is frequent in the eastern Mediterranean, North Africa and western Asia parasitising members of the *Apiaceae*. It was first described from a collection made in Greece by Spruner at «Nauplia» (P) and the species could also be present in the Arabian peninsula. Two collections, one from Saudi Arabia (Jabal Shada, north of Mikhua, 10.II.1995, *Collenette* 9238) the other from Yemen (Jebel Qar'ad, 13.VIII.1975, *Wood* Y/75/521 (BM)) may well be this plant. It should be searched for in similar habitats to those of *O. minor*.

12. *Orobanche dhofarensis* M. J. Y. Foley in Edinburgh J. Bot. 55: 230. 1998.

— *Orobanche minor* auct. non Sm.

Type: Oman, Dhofar, near lip of scarp west of Ashinhaib, 22.IX.1993, *Collenette* 8887 (holo-: ON, central specimen, a colour photograph accompanies the holotype; iso-: E).

Ic.: FOLEY (1998: 231).

Stem simple, unbranched; slender, delicate, moderately glandular-pilose plants, (10-)15-25 (-35) cm tall. *Inflorescence* very lax and remote-flowered. *Bracts* lanceolate. *Calyx segments* relatively broad-based, usually bidentate with lanceolate teeth. *Corollas* ± campanulate, c.12-4 mm long and 4-5 mm wide, white, often tinged with cream, pink or violet, with prominent erose-denticulate margins to the lobes, dorsal line slightly curved. *Filaments* eglandular, pilose at the base and to about 1/3 height, glabrous above, inserted 2.5-3 mm above the corolla base. *Stigma* lobes just separate, pale coloured, often pink or white.

Host not definitely identified but *Plectranthus* spp. strongly suspected; also possibly *Impatiens balsamifera* as well as other taxa.

Habitat.— Occurs at woodland edges and on wooded escarpment slopes dominated by *Anogeissus dhofarica*, sometimes in proximity to wet localities; also in light scrub and on, and amongst, boulders.

Local distribution.— Thought to be endemic to Dhofar.

Flowering.— Recorded as between September and October.

Altitudinal range.— Occurs from 200-1000 metres.

Overall geographical range.— Endemic to Dhofar (Oman).

Selected typical specimens.— **Oman** (Dhofar): west of Ashinhaib, 22.IX.1993, *Collenette* 8887 (ON, E); Khadrafi, Sarfait area, 27.IX.1976, *Mandaville* 6970 (BM); Khadrafi, 29.IX.1977, *Radcliffe-Smith* 5289 (K); Jebal Qara, Wadi Darbat, W of Salalah, 8.X.1979, *Miller* 2604 (K); Jebal Qara, Wadi Ayn Arzat, 23.IX.1979, *Miller* 2163 (E); Jebal Qara, Salalah to Thamrait road, 10.X.1985, *Miller* 7568 (ON); Jebal Qara, Salalah to Thamrait road, 22.IX.1985, *Miller* 7745 (E); Jebel Qamar, below Sarfait, 11.IX.1989, *Miller & Nyberg* 9306 (E); near Umbaraaf, 1.X.1992, *Collenette* 8368 (ON).

Notes:

Orobanche dhofarensis is readily separated from related taxa by its delicate habit and very lax, remote-flowered inflorescence with conspicuous erose-denticulate margined corolla lobes. Whilst the corollas are basically white in colour, the plant can also occur in a range of pale forms due to veining or flushing with pink, lilac or violet, whilst the colour of the stigma lobes can vary similarly. Such colour variation may be due to the influence of differing hosts or to varying ecological conditions. From *O. abyssinica* A. Rich., a member of the *O. minor* group originally described from north-east Africa (Abyssinia), it differs in its much less robust habit, its less dense, fewer flowered inflorescence of shorter, rather \pm campanulate corollas, and its shorter, more broad based calyxes. In addition the filaments are less pilose.

At present *O. dhofarensis* is only definitely recorded from Dhofar (Oman) where it is frequent in the higher wet woodland areas along the upper edges of the main escarpment apparently parasitic upon *Impatiens balsamifera* (COLLENETTE, *pers. comm.*). It also grows further inland in the drier, less wooded areas bordering the true desert; here it is apparently to be restricted to *Plectranthus* spp. as host.

Two collections from Jabal Shada in south-west Saudi Arabia: *Collenette* 6955 and 7316 (both E) may be this or a closely related taxon but are much more densely glandular-pilose than the Dhofar plant and flower in February rather than in the autumn. They also occur at a higher altitude on well-vegetated granite slopes apparently parasitic upon *Barleria bispinosa* and further investigations are required to ascertain their true status. Up to the present time *O. dhofarensis* has been recorded only from the area indicated above and is possibly endemic. However, inadequate specimens suggest that it may also occur on Socotra and perhaps elsewhere within this general geographical area.

13. *Orobanche abyssinica* A. Rich., Tent. Fl. Abyss. 2: 137. 1850.

— *Orobanche minor* mult. auct. non Sm.

Type locality: «parasitica in radicibus Guizotiae oleiferae, in diversis Abyssiniae [Ethiopia] partibus». **Type:** «Choa, Abyssinie, legerunt Quartin Dillon et Petit» (lecto-: P!), see FOLEY (1998: 230).

Probably annual, (20-)30-40(-60) cm tall. *Stem* simple, fairly slender, 4-6 mm wide below the inflorescence, mauve-purple, moderately glandular-pilose. *Leaves* (7-)10-14 x 3-5 mm, broadly lanceolate, glandular-pubescent. *Inflorescence* 20-30(-50) cm long, fairly dense above but with the flowers becoming markedly remote by 2-3x their own length below. *Bracts* 8-12 mm long, \pm lanceolate, glandular-pubescent. *Calyx* 8-12 mm long, unequally divided into tapering teeth, the longer \pm equal in length to the tube, slightly glandular-pilose. *Corolla* (14-)16-20 mm long, \pm patent, tubular-campanulate, slightly curved, white-cream to yellow, becoming faintly mauve distally and with prominent mauve veins, slightly glandular-pilose; upper lip slightly bilobed, lobes of lower lip with crenulate margins. *Filaments* inserted towards the base of the corolla, glabrous above, slightly pilose below. *Anthers* glabrous. *Style* pale. *Stigma* lobes mauve.

Recorded as parasitic on *Flaveria trinerva* but, no doubt, on other hosts also.

Habitat.— Ruderal areas, roadside verges, sorghum terraces, field borders and stream sides.

Local distribution.— Restricted to Yemen and Socotra.

Flowering.— July-February.

Altitudinal range.— Recorded from 300 up to 2440 metres altitude.

Overall geographical range.— From north-east Africa to the southern parts of the Arabian peninsula.

Selected typical specimens.— **Yemen:** Ibb Governate, 25.VII.1983, *Spellenberg* 7492 (K); Sayyani (Taiz-Ibb), 4.IX.1976, *Wood* 1139 (K); Menzil Sumara, 2.I.1938, *Scott & Britton* 396 (BM); San'a district, Wadi Dhahr, 21.I.1938, *Scott & Britton* 425 (BM). **Aden:** Jebel Jihaf, Dhala Highlands, 9.X.1937, *Scott & Britton* 173 (BM). **Socotra:** Hamaderoh, Homhil Plateau, 1.II.1990, *Miller & al.* M10211 (E).

Notes:

This plant is closely related to *O. minor*. As the name suggests, it was first described from Abyssinia (Ethiopia) by Achille Richard based on specimens originally collected on the Lefèbre expedition by the two unfortunate French naturalists Richard Quartin Dillon and Antoine Petit. These were both to die soon afterwards – the former from a fever, the latter devoured by a crocodile when attempting to cross the Blue Nile. The plant appears to be restricted to this part of north-east Africa and to the far south-west of the Arabian peninsula, including Socotra.

BALFOUR (1888: 207-208) acknowledged that Socotran plants seen by him matched Richard's description as well as specimens of Abyssinian plants in the Kew herbarium but questioned whether *O. abyssinica* warranted specific status. However, its much taller stature, the markedly remotely-flowered lower section of the inflorescence, the somewhat crenulate and distinctly tubular-campanulate corollas, and the low point of filament insertion, separate it from *O. minor*. *Orobanche abyssinica* also shows affinities to *O. dhofarenis* but differs in the characters indicated under that species (above); the latter appears to be limited the Dhofar area of Oman whilst, in the Arabian peninsula, *O. abyssinica* is restricted to the extreme south west; *O. minor* itself is widespread throughout much of the peninsula. It is apparently known locally as «halouk».

Orobanche lavandulacea Rehb., a possible additional taxon

Another taxon which is likely to occur in the area is *O. lavandulacea* Rehb. although no material definitely assignable to this has been seen. It is a plant, widespread in the southern Mediterranean where it parasitises *Bituminaria bituminosa* and grows at the margins of cultivated and waste land, along road sides, and in garrigue, usually at low altitudes. Its occurrence in the Arabian peninsula is a distinct possibility and it should be looked for there.

Annual or perennial (20-)25-45(-50) cm tall, with a prominent main stem bearing a tapering, fairly dense inflorescence and in larger, possibly more mature plants, being ± asymmetrically branched below into several subsidiary stems each with smaller, tapering, inflorescences; lower flowers often long pedicellate and sometimes apparently cleistogamous (smaller plants may have unbranched stems but similarly pedicellate lower flowers). *Stems* cream-fawn, shortly glandular-pubescent as well as with longer eglandular, semi-arachnoid hairs. *Leaves* broadly lanceolate; bracteoles present. *Bracts* broadly lanceolate, cream or darker. *Calyx* ± campanulate with broadly lanceolate, tapering teeth, slightly longer than the tube, cream-lilac, glandular. *Corolla* 16-22 mm long, ± patent, rather narrow proximally, deflexed at about 1/3 length, then becoming slightly subcampanulate, slightly curved, lavender to dark grey-blue with rather inconspicuous darker longitudinal veins, whitish on the underside and with two white areas inside the throat, glandular-pubescent, lobes of lower lip obtuse. *Filaments* inserted 5-6 mm above the base of the corolla, glabrous throughout their length. *Anthers* distinctly hairy. *Stigma* lobes white, just separate. *Style* very pale violet, ± glabrous.

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Orobanche perangustata sp. nov.
det. M J Y Foley, 26.iii.2003

Holotype

SULTANATE OF OMAN

Orobanche ramosa

An Nid 2500'. In cultivations of lucerne &c.

Much-branched parasite. Stems pale yellow-brown. Corolla mauve. Anthers white. Fruit off-white, or greyish-white.

21.3.76 A. Radcliffe-Smith 3979

EX HERBARIO KEWENSI

Orobanche ramosa L.

OMAN

A. RADCLIFFE - SMITH NO 3979

1976

H 1808/94
36

Plate 1. – Holotype of *Orobanche perangustata* M. J. Y. Foley [Radcliffe-Smith 3979, K].



Holotype

Orobanche muteliformis sp. nov.

det. M J Y Foley, 26.iii.2003

OLD DOMINION UNIVERSITY HERBARIUM

Orobanche cernua Loefl.

Lytton J Musselman July 1985

COUNTRY, PROVINCE, ETC. SAUDI ARABIA		
Dawadimi Camp II 24.46N. 44.38E		
NAME <i>Orobanche</i> sp. nov. <small>cernua var. brevistoma</small>		
LOCALITY, ALTITUDE, VEGETATION/SOIL TYPE		
Low limestone scarp near camp. head of gully. 2.900ft		
DESCRIPTION OF PLANT. USES		
Short spike to 10cm tall, sometimes branching. Small white flowers 1 cm long by 5mm wide, not wide-opening. Always on <i>Phantherium eppaporum</i> , over limestone.		
DATE	COLLECTOR	NUMBER
6/3/83	J S Collenette	4088

Plate 2. – Holotype of *Orobanche muteliformis* M. J. Y. Foley [Collenette 4088, E].

