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EBERHARD FISCHER[1*], WOLFRAM LOBIN[2] & JENS MUTKE[3]

Striga barthlottii (Orobanchaceae), a new parasitic species from Morocco

Dedicated to Professor Wilhelm Barthlott on the occasion of his 65th birthday.

Abstract

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Striga barthlottii, a species of the broomrape family *(Orobanchaceae)* endemic to Morocco and parasitising exclusively on succulent *Euphorbia* species, is described as new to science and compared with the widespread, polymorphic *S. gesnerioides,* for which it was previously mistaken.

Additional key words: *Striga gesnerioides, Euphorbia,* witchweeds, taxonomy, holoparasitism, succulents

Introduction

The genus *Striga* Lour. comprises about 40 species with the highest diversity in tropical Africa, where 28 taxa have been recorded (Mohamed & al. 2001) of which 22 are rather narrow endemics. Only few taxa extend to the Arabian Peninsula and further into Asia. *S. lutea* Lour. and *S. gesnerioides* (Willd.) Vatke have been introduced to North America, the latter species to Florida only in 1978, where it attacks mainly indigo (*Indigofera hirsuta* L.) (Musselman & Parker 1981).

All species are parasitic and have a greater impact on human welfare than other parasitic angiosperms, because their hosts comprise subsistence crops in areas marginal for agriculture.

The parasitism of *Striga gesnerioides* s.l., a plant lacking green leaves and being the most widespread and polymorphic species of the genus, is controversially discussed in the available literature. Botanga & Timko (2005) and Hibberd & al. (1996) state that all *Striga* species are obligate root hemiparasites. In contrast, dePamphilis & al. (1997: 7371) emphasise that "*Alectra orobanchoides* and *Striga gesnerioides* are the sole holoparasitic species in otherwise hemiparasitic genera".

Most species of *Striga* are parasitising on *Poaceae,* whereas *S. gesnerioides* grows on a variety of hosts from *Fabaceae, Convolvulaceae, Solanaceae, Vitaceae* and, according to Mohamed & al. (2001), also on *Euphorbiaceae*. This variety of hosts led Mohamed & al. (2001) to distinguish eight different strains, which have each evolved a strong host specificity. Mohamed & al. (2001) stated, however, that these strains could not be correlated with morphological features as far as observable on herbarium specimens. One of these is the *Euphorbia* strain, which is parasitic on cactiform *Euphorbia* species (Mohamed & al. 2001). Musselman & Hepper (1988) wrote that *S. gesnerioides* in the Arabian Peninsula is apparently restricted to the succulent arborescent *E. abyssinica* Gmel. except for a population found on *Cissus quadrangularis* L. *(Vitaceae)*. They described their morphology as similar to that of *S. gesnerioides* parasitising succulent *Euphorbia* in Sudan (Musselman & Hepper 1986), while plants growing on weedy *Fabaceae* or *Convolvulaceae* are characteristically much-branched. More detailed investigations on the morphology, delimitation, phylogeny and taxonomic status of the various strains are still missing.

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Since 1970, W. Barthlott repeatedly observed a species of *Striga* on cactiform *Euphorbia* species in Morocco. According to Jahandiez & Maire (1934), Emberger & Maire (1941), Mohamed & al. (2001) and Ibn Tattou (2007: 549) only *S. gesnerioides* occurs in Morocco. The plants observed on cactiform *Euphorbia,* however, differ considerably and consistently from typical *S. gesnerioides* in the shape and colour of their corolla and in their basally usually unbranched stem. In 2005, during an excursion to Morocco, two of the authors (WL, JM), together with Klaus Lewejohann, studied these plants on *E. officinarum* subsp. *echinus* (Hook. f.) Vindt and collected material. Careful comparison with herbarium specimens of *S. gesnerioides,* including the strain growing on succulent *Euphorbia* species, revealed that the Moroccan plants represent a hitherto neglected species, which is described as new to science below.

Materials and methods

The study is based on the observation of living plants in Morocco in the course of two excursions of the Nees Institute for Biodiversity of Plants on 22.3.–5.4.2005 and 6.3.–23.3.2010, as well as on the investigation of herbarium material obtained from the herbaria B, BM, GOET, K and M (abbreviations according to Thiers 2008+).

Striga barthlottii Eb. Fisch., Lobin & Mutke, **sp. nov.**
Holotype: Morocco, road Gourizim–Sidi Ifni, c. 20 km NE of Sidi Ifni, 29.5083°N, 10.0616°W, on *Euphorbia officinarum* subsp. *echinus,* 3.4.2005, *Lewejohann Mc-05-139* (B; isotype: GOET).

Striga barthlottii cum corolla pallide rosea vel albida, lobis obtusis caule non-ramoso vel ramoso in parte basale inflorescentiae, species parasitica in *Euphorbiis* succulentis cactiformibus. Species proxima *S. gesnerioides* corolla violacea maculis albidis et lobis longis angustibus instructa et caule e basi ramoso differt.

Perennial, tufted, succulent herbs, 11.5–36(–55) cm tall, leaves and stems minutely puberulent with upward-pointing hairs. *Single primary haustorium* c. 1.8–2 × 2.6–3(–5) cm in diameter, usually present. *Stems* erect, quadrangular, usually simple at least in lower half, much more rarely also branched near base, above middle simple or with 5–7(–15) branches at the inflorescence. *Leaves* scale-like, appressed to the stem, opposite to alternate, sessile, 5–12 mm long and 1–2 mm wide. *Flowers* opposite or alternate, sessile or subsessile, bracts usually as long as or longer than the calyx, 7–10 × 1–2 mm, bracteoles minute, shorter than the calyx. *Calyx* 5-ribbed, 6–7 mm long, calyx teeth linear, acute, 1.8–2 mm long. *Corolla* pale pink to whitish, tube 8–10 mm long, narrow, bent just below the limb, upper lip bilobed, 2.5–3 mm long, lobes up to 1.5 mm wide, slightly recurved, lower lip tripartite, spreading, lobes 4–5 mm long and (2.5–) 3–4 mm wide. *Stamens* 4, inserted in the upper tube just below the throat, filaments 2 mm long, anthers 1 mm long. *Ovary* 3–4 mm long, with an up to 6 mm long style. *Capsule* ovate, up to 6 × 3 mm, shorter than the calyx.

Etymology. — The new species is named in honour of Professor Wilhelm Barthlott, who observed the new species during many excursions in Morocco and drew our attention to it.

Additional specimens investigated. — Morocco: Agadir, 1.–2. 1936, *Islethew*[? collector illegible] *52* (K); Agadir, 11.5.1924, *Lynes 53* (K); Agadir, parasite sur *Euphorbia beaumieriana* [actually either *E. officinarum* subsp. *echinus* or *E. resinifera*], 3.4.1923, *Jahandiez 214* (BM); 10 km N of Agadir, Imouzzer valley, 8 km ENE from Aorire, 30°30'N, 9°37'W, 25R 441531 3374322, 240 m, in *Argania spinosa* woodland, parasitic on *Euphorbia officinarum,* 17.3.1994, *Jury & al. 14243* (BM); 6 km östl. Aourir (12 km NNW Agadir), an der Straße nach Imozzer-Ida-Outanen, 100 m, 30°31'N, 9°39'W, 16.4.1997, *D. Podlech 53718* (M); Agadir, sur *Euphorbia beaumierana* Coss. [actually either *E. officinarum* subsp. *echinus* or *E. resinifera*], 13.4.1931, *Maire 2575* (BM); bei Sidi R'bat, am Binnensee, südl. Agadir, 25.5.1984, *MR 25* (B); N from Agadir along coast road, c. 2 km S of Cap Rhir, 30°37'33"N, 9°51'29"W; 29R 417579E 3388253N, 25 m, on *Euphorbia officinarum,* 7.6.2002, *Jury & al. 19619* (BM); Cap Rhir, 55 km NW Agadir, 30°40'N, 9°53'W, 10–100 m, 8.4.1986, *D. Podlech 40184* (M); Cap Rhir, NW Agadir, 150 m, 12.4.1967, *Merxmüller & F. Oberwinkler 22421* (M); between Cap Ghir and Agadir, 26.3.1972, *Bramwell & al. 252* (K); SW Tamri to Cap Ghir, 50 m, on spiny *Euphorbia,* 19.3.1969, *P. & J. Davis 48448* (BM); Oued Massa, between Agadir and Tiznit, c. 10 m, on *Euphorbia officinarum,* 19.3.1972, *Davis 53515* (BM); Oued Massa, nahe der Straße von Agadir nach Tiznit (P 30), 30 m, 29°55'N, 9°37'W, 8.4.1986, *D. Podlech 40237* (M), ibid., auf *Euphorbia beaumeriana* [actually either *E. officinarum* subsp. *echinus* or *E. resinifera*], 25.3.1990, *D. Podlech 49177* (M); ibid., 25.3.1990, *B. Summet (F. Schuwerk 90/185)* (M); ibid., 8.4.1990, *F. Schuwerk 90/707* (M); 2 km hinter Massa Richtung Sidi R'bat, N-Seite des Oued Massa, c. 50–100 m, 27.4.1994, *N. Kilian 3398* (B); Tabla[?], Rhorm-el-Alkhem[?], 600 m, parasite sur *Euphorbia resinifera,* 14.5.1927, *Jahandiez 202* (BM); Anti-Atlas, above Ait Baha, 1200 m, 30°5'N, 9°20'W, 4.6.1974, *Reading Univ./BM Exped. 292* (BM); Imini Fri, W Demnat, 4800 ft, on *Euphorbia,* 9.7.1936, *Balls 3022* (BM, K); 5 km of Demnat, M. Atlas, 5600 ft, on *Euphorbia resinifera,* 18.7.1966, *Lambert & Thorp 210* (BM); Moyen Atlas, Quaouizert, vers le Tizi Rnim, 1350 m, sur *Euphorbia resinifera,* 21.5.1927, *Jahandiez 149b* (BM); Beni Mellal, prope Bine al Quidane, 800 m, 29SQR35, 5.5.1992, *Fernández Casas & Molero 13746*

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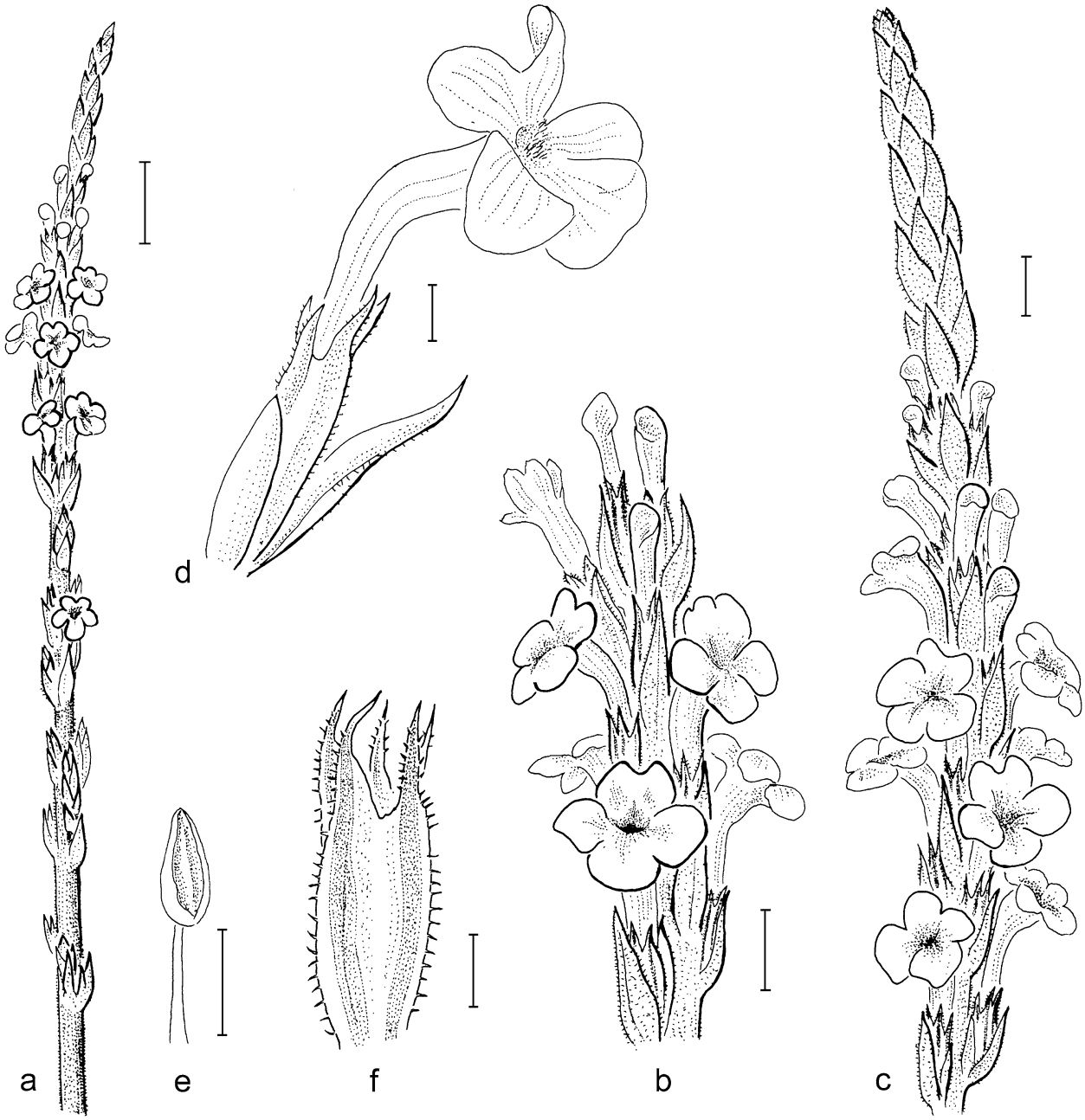


Fig. 1. *Striga barthlottii* – a–c: inflorescence, habit and details; d: flower; e: stamen; f: calyx. – Scale bars: a = 1 cm, b–c = 5 mm, d–f = 1 mm; drawing by E. Fischer from the holotype.

(BM); Beni Mellal, Kesbeh, 800 m, sur Euphorbe cactiforme, 22.3.1983, *Lewalle 10634* (BM, M); Beni Mellal, between Zaouia Ahanesal and Tilougguite near "Cathedral rock", 1850 m, parasitic on *Euphorbia gummifera* [actually either *E. officinarum* subsp. *echinus* or *E. resinifera*], 15.7.1973, *Davis 55245* (BM, M); Grand Atlas, Bin-el-Ouisdane, *Euphorbia resinifera,* 750 m, 24.5.1927, *E. Jahandiez 256b* (M).

The following specimen from Morocco did not bear flowers but safely can also be referred to the new species: Anti-Atlas, 1 km E of Tirhmi, between Tiznit and Tafraoute, 29.6°N, 9.5°W, on *Euphorbia officinarum,* 3.4.1974, *Miller & al. 615* (BM).

Distribution and ecology. — *Striga barthlottii* is confined in its distribution (Fig. 3) to the centralwestern and southwestern part of Morocco, where it is currently known from the Beni Mellal area of the southernmost Moyen Atlas in the Northeast (c. 32.4°N) to the Sidi Ifni area in the Southwest (c. 29.5°N).

Apparently, *Striga barthlottii* has a strict host specificity for succulent *Euphorbia* species. We observed the species on four occasions: on two sites around Sidi Ifni, on a third site in the Anti-Atlas E of Tiznit (Djebel Imai) and near the Pont Naturel in Imi-n Ifri, c. 4 km SE of Demnate. At Cap Rhir, where in 2005 and 2010 no plants could be found, W. Barthlott observed the taxon

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Fig. 2. A, B, D, E: *Striga barthlottii,* habit and habitat with its host *Euphorbia officinarum* subsp. *echinus* (A, B, D), corolla in detail (E); A from Cap Rhir, photograph April 2006 by W. Barthlott, B, D, E from Djebel Izmi N of Et Tnine, photographs 2.4.2005 by J. Mutke. – C+F: *S. gesnerioides,* habit (C) and corolla in detail (F), from Zimbabwe; photograph February 1994 by R. Seine.

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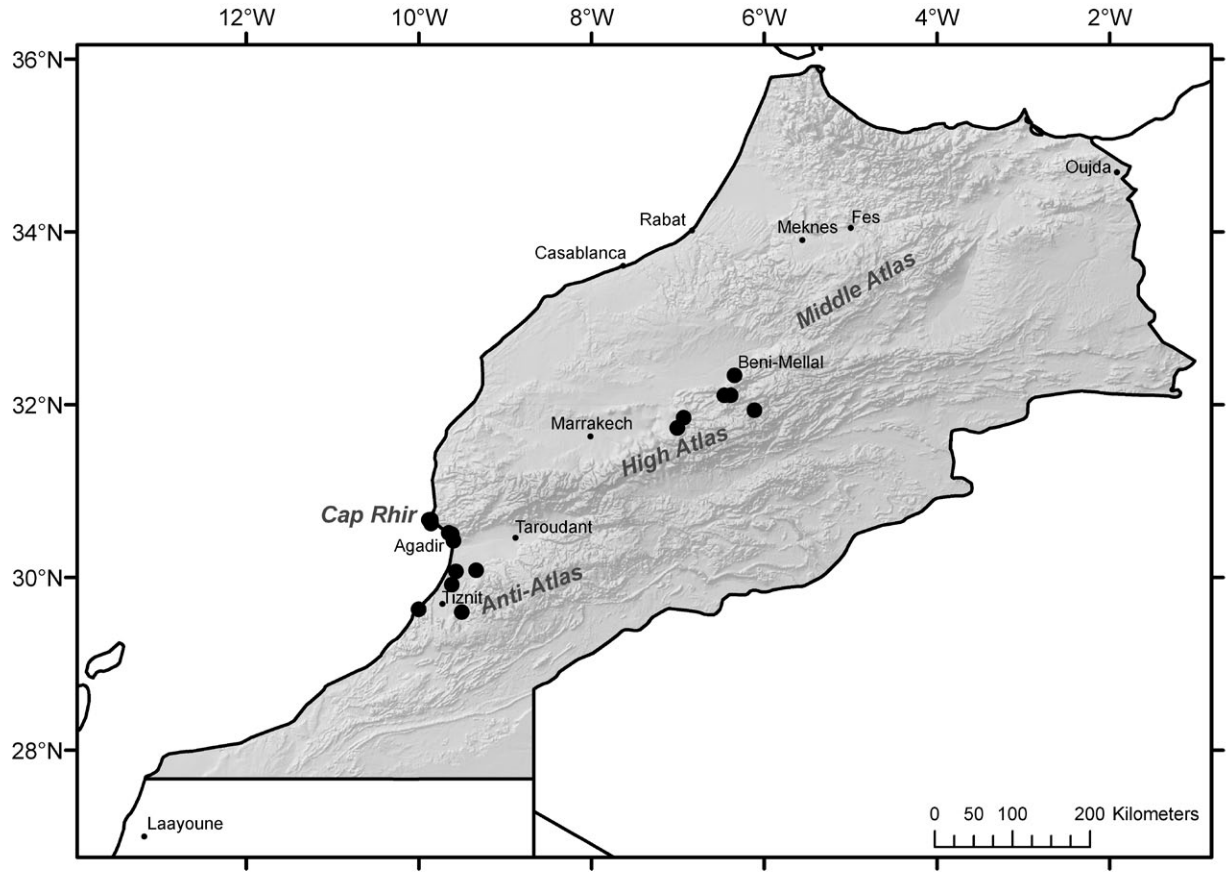


Fig. 3. Distribution of *Striga barthlottii* based on the specimens seen.

at 15 m above sea level. Near Sidi Ifni, *S. barthlottii* is part of the succulent bush at an elevation between 90 and 290 m above sea level with the following succulent and woody species: *Acacia gummifera* Willd., *Argania spinosa* (L.) Skeels, *Caralluma* sp., *Convolvulus trabutianus* Schweinf. & Muschl., *Ephedra altissima* Desf., *Euphorbia officinarum* subsp. *echinus* (Hook.f. & Coss.) Vindt (Fig. 2A–B), *E. regis-jubae* J. Gay, *Kleinia anteuphorbium* (L.) Haw., *Launaea arborescens* (Batt.) Murb., *Periploca laevigata* subsp. *angustifolia* (Labill.) Markgr. and *Warionia saharae* Benth. & Coss. This succulent bush belongs to typical "*Euphorbia echinus* succulent shrubland" as is described by White (1983) and which is phytosociologically classified by Médail & Quézel (1999) as Euphorbia echini-Arganietum spinosae, a vegetation type widespread throughout the South of the Souss and in the Anti-Atlas in an arid bioclimate. It is characterised by a high number of endemic species. Le Houérou (2001) describes it as "succulent glycophytic steppes".

The identification of the *Euphorbia* host species mentioned on the herbarium labels is not in all cases possible to verify. Three succulent *Euphorbia* taxa occur in Morocco according to Carter (2004), Fennane (2007) and Govaerts & al. (2000: 792–793): *E. officinarum* subsp. *echinus* (Fig. 2A–B), *E. officinarum* subsp. *officinarum* and *E. resinifera* O. Berg. On the majority of herbarium specimens, no distinction between the subspecies of *E. officinarum* is made and their identity must remain unsolved. *E. resinifera* is cited as host plant three times. Besides these, two other taxa are recorded as host plants: *E. beaumieriana* Hook.f. & Coss. is mentioned twice on labels and is today regarded as a subspecies of *E. officinarum* occurring only in Yemen (Govaerts & al. 2000: 792–793). *E. gummifera* Boiss. is given once on the label. This species is restricted to S Africa (Govaerts & al. 2000: 792–793) and is thus wrongly identified. In these three cases the host taxon can be assumed to be either *E. officinarum* subsp. *echinus* or *E. resinifera*.

***Delimitation.* —** *Striga barthlottii* differs morphologically from *S. gesnerioides* mainly in the corolla shape and colour and, less so, in the branching of the stem.

The corolla lobes of *Striga barthlottii* are characteristically rounded and about as long as wide (Fig. 1B, 2E), while *S. gesnerioides* has long and narrow corolla lobes, which are at least 2 times longer than wide in the lower lip (Fig. 2F). The corolla of *S. barthlottii* is usually pale pink to whitish, while in *S. gesnerioides* it is violet with whitish marks (Fig. 2F).

The stem of *Striga barthlottii* is typically unbranched, and if lateral branches occur, they are usually inserted in

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the upper half (Fig. 1A, 2A, D), very rarely it has few basal branches, while *S. gesnerioides* is generally richly branched from the base (Fig. 2C).

Striga barthlottii is distributionally distinctly isolated from *S. gesnerioides,* since all the specimens from Morocco cited by Mohamed & al. (2001) under this species represent the new species and the true *S. gesnerioides* is definitely absent from Morocco. It is interesting to note that apart from *S. barthlottii* even no other species of the genus has a native occurrence in Africa N of 15° latitude. The presence of *S. asiatica* and *S. hermonthica* in Egypt is considered by Mohamed & al. (2001: 67, 85) as likely anthropogenous.

Striga gesnerioides in its present circumscription still remains a polymorphic complex and more field work and studies of living plants are necessary to assess the variation and perhaps divide it into morphologically, ecologically and geographically distinct taxa. In particular, further studies are required to elucidate the relationships to *S. gesnerioides* and *S. barthlottii* of the *Striga* plants in Sudan, Ethiopia and the Arabian Peninsula that have been indicated by Musselman & Hepper (1988), Wood (1987) and Mohamed & al. (2001) to parasitise succulent *Euphorbia* species. The material we investigated of *S. gesnerioides* s.l. parasitising on *Euphorbia* species, especially from the Arabian Peninsula, probably includes another cryptic species of the *S. gesnerioides* complex. However, without fresh plants the material was too scanty to make a taxonomic revision.

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