Contributions to the taxonomy of the genus *Anticharis* (*Scrophulariaceae*) especially in Namibia and Angola

Received: 14.01.2013 / Accepted: 19.02.2013

B. Nordenstam: Prof., Swedish Museum of Natural History, P.O. Box 50007, SE-104 05 Stockholm, Sweden (bertil.nordenstam@nrm.se)

Abstract

A taxonomic overview of the genus *Anticharis* (*Scrophulariaceae*) especially in Namibia and Angola is presented. Three new species are described, viz. *A. namibensis* B. Nord., *A. kaokoensis* B. Nord. and *A. angolensis* B. Nord. A key to the *Anticharis* species of Namibia and Angola is presented. Some aspects of phytogeography, molecular phylogeny and photosynthetic pathways (C_3-C_4) are briefly discussed.

Keywords: C_4 photosynthetic pathway, *Lamiales*, new species

Introduction

The small angiosperm genus *Anticharis* Endl. (*Scrophulariaceae*) is restricted to arid regions of Africa, Saudi Arabia and SW and S Asia (Iran, Pakistan & India). A majority of the 10 to 12 species now recognized occur in Namibia and adjacent regions of South Africa and Angola. The few taxa in the northern hemisphere are closely related and provide an interesting example of the connections and disjunctions between arid elements of southern Africa and north Africa as well as the Arabian Peninsula and further east into the Indian deserts (cf. Jürgens 1997). The genus may also be an example of the "Cape to Cairo and beyond" evolutionary history in space and time.

The genus *Anticharis* has also attracted attention because of its photosynthetic pathways. It is the only known example of C_4 species in the family *Scrophulariaceae* (Khoshravesh *et al.* 2012). This study demonstrated by carbon isotope ratios, molecular phylogeny (ITS) and leaf (Kranz) anatomy, that the C_4 photosynthesis in *Anticharis* evolved in a clade of four annual taxa, including the new species *A. angolensis*, from the ancestral C_3 species. The other two new species described here have a C_3-C_4 intermediate anatomy and C_3-like carbon isotope (Khoshravesh *et al.* 2012).

During field-work in southern Africa (1962–64, 1974), I became aware that the variation in the genus was not well covered by the current taxonomy and I collected material with a view of revising the genus. With this task still in mind, I now present three new species from the main distribution area and a key to the species of those regions based on own collections and herbarium material mainly in S and M (herbarium abbreviations as in Holmgren *et al.* 1992). A phylogeny based on ITS sequence data was also presented (Fig. 1). The names have already been used in recent literature (Khoshravesh *et al.* 2012).

Key to the species of *Anticharis* in Namibia and Angola

1. Divaricate or squarrose shrubs with small and narrow leaves (15 × 2 mm or less) ……..…….. 2
- Annual or perennial herbs (sometimes suffrutescent); leaves longer or broader …….…….…….. 3
2. Glandular-pubescent. Leaves up to 15 mm long ……..…… *A. scoparia* Hiern ex Benth. & Hook. f.
- Glabrous. Leaves very small ….…….…. *A. juncea* L. Bolus
3. Leaves imbricate, as broad as long, ovate ……... *A. imbricata* Schinz

- Leaves not imbricate, longer than broad …….. 4
4. Peduncles ebracteate, short (1–6 mm long). Seeds warty ……..……5
- Peduncles with a pair of small bracts, usually longer. Seeds winged ……..…… 7
5. Corolla 8–12 mm long, light blue, without distinct dark spots ……..…… *A. namibensis* B. Nord.
- Corolla >12 mm long, deep or purplish blue, striate and with distinct dark spots near throat ……..……. 6
6. Corolla 18–20 mm long. Much-branched, sticky-glandular. Leaves narrowly ovate-lanceolate, 15–25 mm long, petiolate ……..... *A. kaokoensis* B. Nord.
- Corolla 12–16 mm long. Little-branched, more laxly leafy. Leaves 10–15 mm long ……..…… *A. ebracteata* Schinz
7. Leaves narrow, linear to narrowly lanceolate ……..... 8
- Leaves broader, oblanceolate to spathulate or obovate ……..……...……..…… 11
8. Peduncles equalling calyx in length or shorter ……..… *A. linearis* (Benth.) Hochst. ex Asch.
- Peduncles much longer than calyx ……..…..…… 9
9. Corolla rosy-purplish pink-blue, usually 8–12 mm long. Capsule not inflated …..... *A. senegalensis* (Walp.) Bhandari
- Corolla always blue, 15 mm long or more. Capsule inflated …..……..…….……. *A. inflata* Marloth & Engl.
11. Densely glandular-pubescent throughout. Corolla ca. 25 mm long ……..…… *A. angolensis* B. Nord.
- Sparsely glandular (e.g. on capsule and upper part of peduncle). Corolla smaller ….……...… *A. aschersoniana* Schinz

It should be noted that, *Anticharis aschersoniana*, *A. linearis* and *A. senegalensis* (Fig. 4) are closely related and may have to be treated as synonyms under the name *A. senegalensis* as suggested by Bhandari (1964). If this taxonomy is correct, the species has a wide distribution covering the entire range of the genus, i.e. “From Cape to Cairo and beyond”. The variation within this complex is considerable, e.g. in leaf-shape and pubescence, peduncle length and position of bracts, as well as flower colour. It is possible that *A. aschersoniana* is distinct and perhaps restricted to Angola. This problem has to be further investigated and I provisionally kept *A. aschersoniana* separated in the key.

Taxonomy and Descriptions

Anticharis namibensis B. Nord., sp. nov.

Type: Namibia: Lüderitz-Süd distr., 9 km W of Garub, sandy Namib desert, 30.VI.1974, *Nordenstam & Lundgren 380* (S holo., BM, BOL, IRAN, K, LD, M, MO, NBG, PRE, S, WIND iso.). (Figs 2–3)

Densely branched, sometimes little-branched, erect annual 5–25 cm high, glandular-pubescent throughout; branches suberect forming a rather compact and sometimes cushion-shaped plant. Leaves densely set, shortly petiolate or subsessile, entire, elliptic-oblong to narrowly obovate or ovate, 6–17 mm long, 2–6 mm wide, densely glandular-pubescent with long spreading hairs, apically obtuse-rounded. Peduncles 1–3 mm long, ebracteate. Calyx lobes linear, 4–5 mm long, obtuse, glandular-pubescent. Corolla 10–12(–14) mm long; light to purplish blue without distinct darker spots, sparsely glandular or subglabrous. Filaments 2.5 mm long; anthers 2–2.5 mm long, connate below the middle, subglabrous but bearded basally. Style in anthesis 8 mm long, in fruit 10 mm long, shortly glandular. Capsule narrowly ovate, 5–7 mm long, subglabrous or puberulous. Seeds oblong, light brown, 0.5 mm long, 0.4 mm wide, with numerous light-coloured elongate warts.

- Additional examined materials: Namibia: Lüderitz-Süd distr., 6 km W of Garub, sandy Namib desert, 30.VI.1974, *Nordenstam & Lundgren 373* (S); 6 miles W of Gobabeb Research Station, 27.III.1963, *Ihlenfeldt, De Winter & Hardy 3152* (M); Halenberg E of Lüderitz, 24.VIII.1963, *Merxmüller & Giess* 3125 (M); near Ida Mine at Swakop River, 1.II.1963, *L.E. Kers 1845* (S), 12.V.1963, *L.E. Kers 1541* (S).

This is no doubt, close to *Anticharis ebracteata* (Figs 1 & 3), but differs by smaller and broader leaves, shorter peduncles, smaller flowers without distinct throat spots and smaller anthers. Characters in common are the

short ebracteate peduncles and the wingless seeds covered with small warts.

Anticharis namibensis has a restricted distribution in the Namib desert in Namibia. It is dependent on the erratic rainfalls for its survival and reproduction. Probably a seed reserve can remain dormant for many years, until a substantial rainfall occurs, such as in the years 1963 and 1974.

Anticharis kaokoensis B. Nord., sp. nov.

Type: Namibia: Ozomungo, Schieferkopje, 27.I.1958, *H. Merxmüller & W. Giess 1408* (M holo.). (Figs 5–6)

Much-branched erect annual or biennial herb, sometimes suffrutescent, 0.1–0.5 m high, densely leafy and sticky with a glutinous glandular pubescence. Leaves closely set, petiolate, erecto-patent to patent; petiole 5–10 mm long, narrowly linear; leaf-blade narrowly ovate-lanceolate, entire, 15–25 mm long, 6–10 mm wide, herbaceous, green, densely glandular-pubescent, midveined; apex acute to shortly acuminate. Peduncles axillary, short (4–5 mm long), ebracteate. Calyx lobes narrowly linear-lanceolate, acuminate, 6–7 mm long, 0.5 mm wide, white-villous. Corolla 18–20 mm long, basally tubular, distinctly inflated around the middle, dark blue with a paler tube and with distinct dark purple to blackish spots near throat, minutely glandular outside with almost sessile small glands. Anthers connate except basally, pubescent throughout with short glands, apically with distinct tuft of erect hairs. Style shortly glandular throughout. Capsule 7–8 mm long, puberulous. Seeds oblong, 0.5 mm long, 0.3 mm wide, with warts and short interrupted wings.

This species is recognized by the dense sticky and smelly pubescence and the much-branched and sometimes suffruticose habit. In leaf-shape it comes closest perhaps to *Anticharis inflata*, which is however herbaceous and little-branched with longer and bracteate peduncles, larger capsules and distinctly winged seeds. The ITS sequence data (Fig. 1) rather indicate a position as sister to a clade comprising *A. imbricata*, *A. namibensis* and *A. ebracteata.*

- Additional examined materials: Namibia: Kaokoveld, Bed of sandy-stony watercourse in narrower parts of Kapupa Valley, 17°21’ S, 12°34’ E, 19.VIII.1956, *R. Story 5894* (M two sheets); 30 miles S of Kunene on road to Orupembe, 10.V.1957, *B. De Winter & O. Leistner 5797* (M); Ozomungo, Schieferkopje, 27.I.1958, *H. Merxmüller & W. Giess 1408* (M); 23 miles NW of Sesfontein, sandy-gravelly riverbed, 24.VI.1960, *W. Giess 3212* (M); 9 miles W of Oruwanje, on road to Sanitatas, surface limestone at canyon edge, 7.VI.1963, *W. Giess & H. Leippert 7380* (M); Bainesberge at Otjipemba, 17°15’ S, 12°53’ E, 14.VII.1969, *P.G. Meyer 1306* (M).

Anticharis angolensis B. Nord., sp. nov.

Type: Angola: Mocamedes distr., road Sa da Bandeira-Mocamedes, 4 miles E of road to S. Nicolau, 1.V.1968, *L.E. Kers* 3403 (S holo.). (Figs 5 & 7)

Erect branching annual 10–40 cm high, glandular-pubescent throughout. Leaves petiolate, 3–4 cm long, 5–6 mm wide; petiole 1–1.5 cm long, narrowly linear, glandular-pubescent; leaf-blade oblanceolate to narrowly elliptic-oblong, midveined and with fainter lateral-reticulate venation. Peduncle elongate, 12–16 mm long, with a pair of small bracts around the middle, glandular-pubescent. Calyx lobes linear, ca. 4 mm long, glandular-pubescent. Corolla large, 25 mm long, inflated above the tube (5–7 mm long), sparsely to moderately densely glandular, intensely blue with large blackish spots near throat, tube paler and striate, also scattered small speckles on corolla. Anthers 5 mm long, greenish, connate below the middle, subglabrous but apically with a long tuft of straight ciliae. Style slender, 10–15 mm long. Capsule ovoid, acuminate, 7–8 mm long, 3–4 mm wide, villous-glandular. Seeds elliptic-oblong, ca. 0.4 mm long, 0.2 mm wide, light brown with several longitudinal short wings.

- Additional examined materials: Angola: Mocamedes distr., road Mocamedes-San Nicolau, 8 miles NE of railway passage, desert plain, water furrows, 25.IV.1968, *L.E. Kers 3658* (S).

Differs from the *Anticharis senegalensis* species complex (cf. above after key) by the broader leaves, larger flowers, longer styles, smaller seeds (seeds in *A. senegalensis* are 0.6–0.8 mm long, light brown, with short somewhat interrupted wings) etc. (cf. Fig. 4).

The flowers are the largest in the genus and they have striking markings such as stripes, dots and large black throat marks.

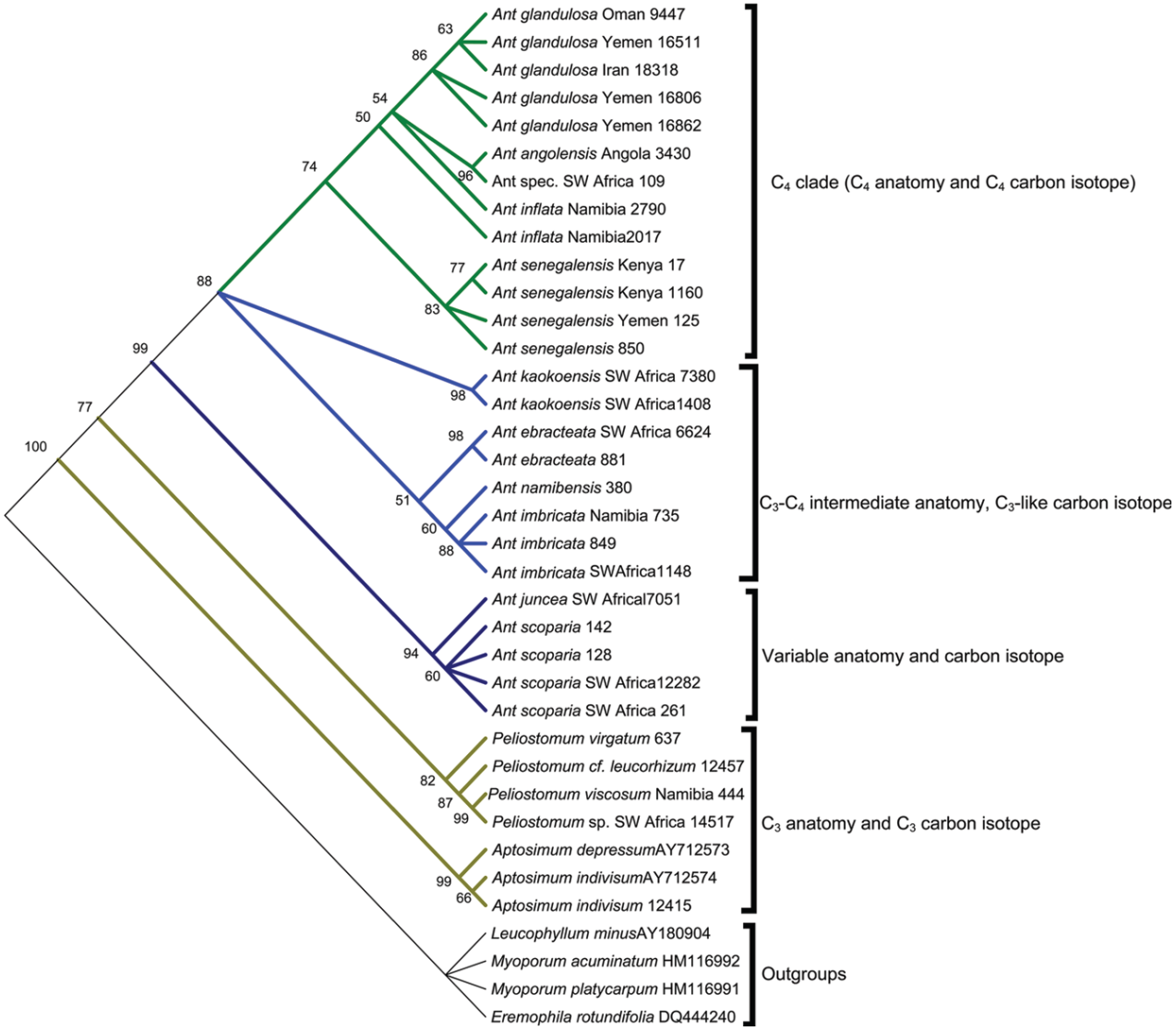

Fig. 1. Phylogeny of *Anticharis* and related taxa based on ITS sequence data. Numbers indicate maximum likelihood bootstrap support. C_3-C_4 anatomy and data on carbon isotopes are added (from Khoshravesh *et al.* 2012, by permission of Oxford University Press).

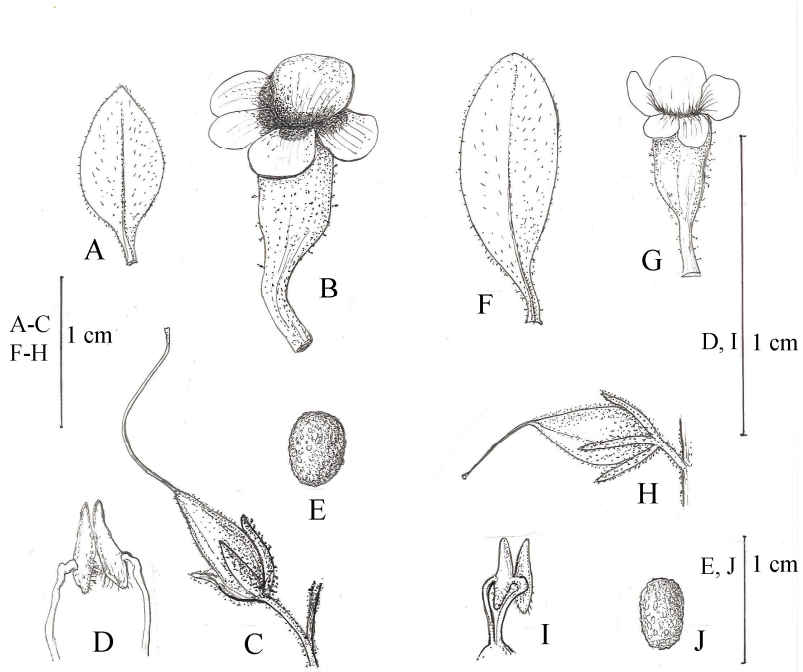

Fig. 2. A–E. *Anticharis ebracteata*: A–B, D. *Nordenstam & Lundgren 881* (S); C, E. *Nordenstam & Lundgren 810*. A. Leaf, B. Flower, C. Capsule, D. Stamens, E. Seed, F–J. *Anticharis namibensis*: (F, G, I. *Nordenstam & Lundgren 380* (S); H, J. *Nordenstam & Lundgren 373* (S); F. Leaf, G. Flower, H. Capsule, I. Stamens, J. Seed (Del. B. Nordenstam).

Fig. 3. *Anticharis namibensis*: Holotype, *Nordenstam & Lundgren 380* (S).

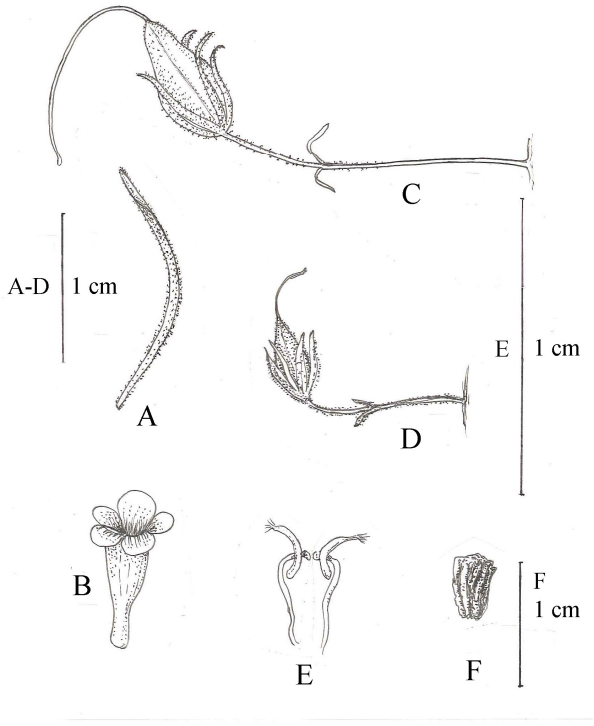

Fig. 4. *Anticharis senegalensis*: A–B, D–F. *Nordenstam & Lundgren 850* (S); C. *Gossweiler 10981* (S). A. Leaf, B. Flower, C, D. Capsule and peduncle, E. Stamens, F. Seed (Del. B. Nordenstam).

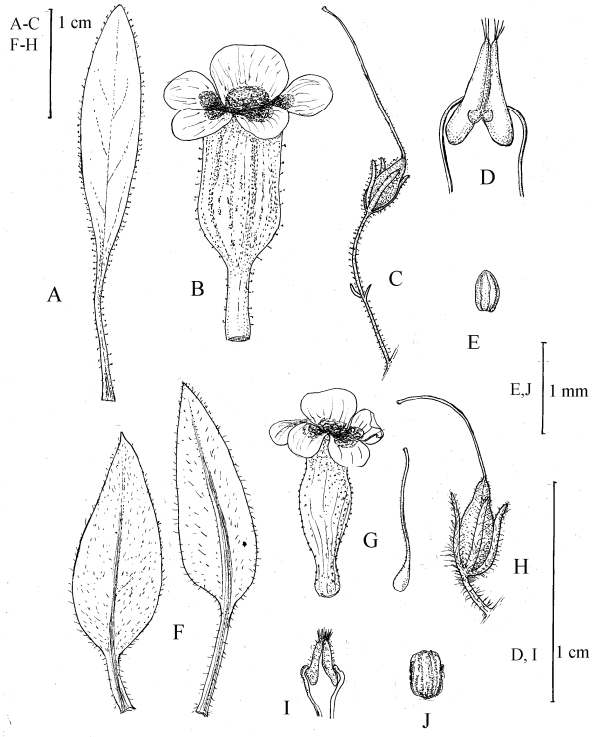

Fig. 5. A–E. *Anticharis angolensis* [*Kers 3403* (S)] and F-J. *Anticharis kaokoensis* [*Merxmüller & Giess 1408* (M)]. A, F. Leaves; B, G. Flower (and style); C, H. Capsule and peduncle; D, I. Stamens. E, J. Seed (Del. B. Nordenstam).

Fig. 6. *Anticharis kaokoensis*: Holotype, *Merxmüller & Giess 1408* (M) (Photo H. Akhani).

Fig. 7. *Anticharis angolensis*: Holotype, *L.E. Kers 3403* (S).

References

Bhandari, M.M. 1964. Notes on Indian desert plants. IV. New names and combinations. Bulletin of Botanical Survey of India 6(2–4): 327–328.

Holmgren, P.K., Holmgren, N.H. & Barnett, L.C. (eds). 1990. Index Herbariorum. Part 1: The Herbaria of the World. ed. 8. Regnum Vegetabile. Vol. 120. New York Botanical Garden, Bronx, New York.

Jürgens, N. 1997. Floristic biodiversity and history of African arid regions. Biodiversity and Conservation 6: 495–514.

Khoshravesh, R., Akhani, H., Sage, T.L., Nordenstam, B. & Sage, R.F. 2012. Phylogeny and photosynthetic pathway distribution in *Anticharis* Endl. (*Scrophulariaceae*). Journal of Experimental Botany 63(15): 5645–5658. doi: 10.1093/jxb/ers218.