Jaca, T.P. et al. Taxonomic studies of the genus Rhynchosia Lour. (Phaseoleae, Fabaceae) in South Africa: A review of section Chrysoscias.
South African Journal of Botany, 117: 119 – 133.
http://dx.doi.org/10.1016/j.sajb.2018.05.012

Taxonomic studies of the genus Rhynchosia Lour. (Phaseoleae, Fabaceae) in South Africa: A review of section Chrysoscias

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Abstract

Background: A taxonomic study of the genus Rhynchosia section Chrysoscias is presented. The section (as classified by Baker) comprises five taxa (four species and one variety). Previous revisions of the section by various botanists placed emphasis on leaflet shape and number of flowers as the primary characters to distinguish the species, however, these characters were found to be highly variable even within species. In addition, species distribution overlaps and therefore no conclusions can be made based on distribution patterns.

Objectives: The aim of this paper is to provide diagnostic features of the four species of the section recognised in the current study, a key to the species, correct nomenclature, complete synonymy, typification, description, distribution maps as well as habitat notes.

Methodology: We studied herbarium specimens housed at BOL, JRAU, PRE, and those loaned from NBG (including SAM) supplemented by extensive field work. Morphological features were studied; measurements of characters recorded and illustrations were drawn using a camera lucida attachment. Anatomical and scanning electron microscopy studies were also carried out.

Results: The current study revealed that there are four species in this section: Rhynchosia angustifolia, R. chrysoscias, R. leucoscias and R. microscias. The distribution and type of trichomes, degree of fusion in the uppermost calyx lobes and size of the standard petal are important taxonomic characters for distinguishing between the species. Leaflet shape can only be used in distinguishing R. angustifolia from the other species. The section is restricted to the Core Cape Subregion of the Greater Cape Region of South Africa.

Conclusion: Four species are recognised, Rhynchosia angustifolia, R. chrysoscias, R. leucoscias and R. microscias. R. leucoscias var. angustifolia is here synonymised with R. angustifolia and the latter name is preserved to take Jacquin's earlier name of Glycine angustifolia referring to the narrow leaflets. The distributions and types of trichomes are reported here for the first time.

1. Introduction

The genus Rhynchosia Lour. (commonly known as snout bean) belongs to the subtribe Cajaninae, tribe Phaseoleae, in the family Fabaceae. The genus is the

largest in the subtribe, comprising about 232 species distributed throughout the tropics and subtropics, and extending to North America from Mexico to some parts of the United States as well as Africa and Madagascar where it is most diverse (Schrire, 2005; Turner, 2011). About 73 species are native to southern Africa, with one species [R. phaseoloides (Sw.) Kuntze] cultivated in the region (Germishuizen et al., 2006; Glen, 2002; Schrire, 2005; Moteetee and Le Roux, 2016). Within Cajaninae, Rhynchosia is closely related to the genus Eriosema (DC.) G.Don. (Moteetee et al., 2012), sharing mostly pinnately trifoliolate leaves which are prominently-veined underneath, yellow flowers, and generally 2-seeded fruits. The mode of funicular attachment of the seed in relation to the hilum is the only distinguishing character between these two genera (Grear and Dengler, 1976; Moteetee and Van Wyk, 2006). In Eriosema the funicular attachment is at the end of the hilum whereas in Rhynchosia the attachment is centric or subcentric (Ramcharan et al., 1973). Rhynchosia is also closely related to Bolusafra Kuntze and Flemingia Roxb. ex W.T.Aiton (Lackey, 1981; Verdcourt, 2001; Moteetee and Van Wyk, 2006). Rhynchosia is similar to Bolusafra in that they both have similar growth habit (twining), pinnately trifoliolate leaves with conspicuous veins generally covered with glands beneath and yellow flowers. Rhynchosia is also similar to Flemingia in growth form, leaves covered with glands beneath, yellow flowers and two-seeded fruits. Rhynchosia differs from Bolusafra in that the latter has prominent seed arils and turgid fruits as opposed to obsolete or almost absent seed arils in the South African species of Rhynchosia and laterally compressed fruits (with the exception of Rhynchosia section Chrysoscias where fruits can be slightly turgid) which are often falcate (Verdcourt, 2001; Moteetee and Van Wyk, 2006). Flemingia may be distinguished from Rhynchosia by its digitately trifoliolate leaves and the very turgid fruits (Verdcourt, 2001).

De Candolle (1825) described a number (21) of South African species of Rhynchosia, followed by Ecklon and Zeyher (1836) who described 11 species. Thereafter, sectional classification of South(ern) African species was introduced by various authors, in most cases with little overlap (summarised in Table 1). Meyer (1836) distributed his 19 species in sections Orthodanum E. Mey. (2 spp.) and Copisma E. Mey. (17 spp.). Harvey (1862) divided the South African species into four sections: Chrysoscias Benth. (4 spp.), Polytropia (Presl.) Harv. (2 spp.), Orthodanum E. Mey. (5 spp.) and Copisma E. Mey. (20 spp.). In their classification, Bentham and Hooker (1865) placed the southern African species into five of their eleven sections: Orthodanum (3 spp. – Harvey's section Chrysoscias), Chrysoscias (2 spp. – Harvey's section Polytropia), Cyanospermum (Wight and Arnott) Benth. (1 sp.), Polytropia (2 spp.), and Copisma (4 spp.). Baker (1871) divided the southern African species into three sections: Cyanospermum (2 spp.), Copisma (3 spp.) and Arcyphyllum Torrey and Gray (1 sp.). Baker (1923) recognised 59 species in the genus; he based his classification mainly on Harvey (1862) and Baker (1871) in preserving Arcyphyllum, Cyanospermum, Chrysoscias, and Polytropia, but then lumped all of Orthodanum and Copisma into his type section Eurhynchosia (correctly known as section

Rhynchosia). A revised sectional classification will be finalised once molecular studies have been completed (Manyelo, 2014). Based on the ongoing studies of the South African species of the genus, sect. Cyanospermum remains with one species (Moteetee et al., 2012) while one new species has been added to sect. Polytropia (Moteetee et al., 2014). Sect. Chrysoscias is the subject of the current study.

Table 1
History of sectional classification of *Rhynchosia* (synonyms are indicated in brackets).

Author	No of sections and species	Sections in southern Africa	Species in southern Africa
Meyer (1836)	2 sections, 19 species	*Orthodanum* E.Mey. *Copisma* E.Mey.	*R. argentea* (E.Mey. Harv. (=*R. argenteum* E.Mey.), *R. sordida* (E.Mey.) Schinz. (=*R. sordidum* E.Mey) *R. adenodes* Eckl. & Zeyh. (=*R. effusum* (E. Mey.) Druce), *R. capensis* (Burm. f.) Schinz. (=*R. glandulosum* (Thunb.) DC.), *R. caribaea* (Jacq.) DC. (=*R. gibbum* E.Mey.), *R. falcatum* E.Mey. (=*R. minima* var. *falcata*), *R. glabra* (Spreng.) DC. (=*R. glabrum* E. Mey.), *R. grandifolia* Steud. (=*R. grandifolium* E. Mey.), *R. hirsuta* Eckl. & Zeyh. (=*R. diversifolium* E.Mey.), *R. nitida* (E.Mey.) Harv. (=*R. nitidum* E.Mey.), *R. picta* (E.Mey.) Burtt-Davy, (=*R. pictum* E. Mey.), *R. simplicifolia*, E. Mey. (=*R. simplicifolium* E.Mey.), *R. tenuis* Steud. (=*R. tenue* E.Mey.), *R. totta* (Thunb.) DC. (=*R. pilosum* E. Mey.), *R. totta* (Thunb.) DC. (=*R. tottum* DC.), *R. totta* var. *longicalyx* A.Moteetee & M.M.le Roux (=*R. paniculatum* E.Mey.), *R. trichodes* (E.Mey.) Harv., *R. rotundifolia* (E. Mey.) Walp. (=*R. rotundifolium* E.Mey.), *R. viscidula* (E. Mey.) Steud. (=*R. viscidulum* E.Mey.)
Harvey (1862)	4 sections, 41 species	*Chrysoscias* E.Mey. *Orthodanum* E.Mey. *Copisma* E.Mey. *Polytropia* Presl.	*R. angustifolia* DC. (=*R. uniflora* Harv.), *R. chrysoscias* Benth., *R. leucoscias* Benth., *R. microscias* Benth. *R. bullata* Benth., *R. nitens* Benth., *R. nitida* (E.Mey.) Harv., *R. sordida* (E.Mey.) Schinz (=*R. orthodanum* Harv.), *R. trichodes* (E.Mey.) Harv. *R. adenodes* Eckl. & Zeyh., *R. argentea* (E.Mey.) Harv., *R. caribaea* (Jacq.) DC. (=*R. gibba* E.Mey.), *R. crassifolia* Benth., *R. ficifolia* Benth., *R. glandulosa* (Thunb.) DC., *R. grandifolia* Harv., *R. hirsuta* Eckl. & Zeyh., *R. memnonia* DC., *R. minima* DC., *R. nervosa* Harv., *R. puberula* Harv., *R. quadrata* Harv., *R. rotundifolia* Walp., *R. secunda* Eckl. & Zeyh., *R. sigmodes* Benth., *R. simplicifolia* E.Mey., *R. totta* (Thunb.) DC. (=*R. pilosa* (E.Mey.) Steud.), *R. viscidula* Steud. *R. ferulaefolia* Harv., *R. pinnata* Harv.
Bentham and Hooker (1865)	11 sections in total., 5 in southern Africa, 41 species	*Copisma* E.Mey. *Chrysoscias* E.Mey. *Cyanospermum* (Wight and Arnott) Benth. *Orthodanum* E.Mey. *Polytropia* Presl.	*R. argentea* (E.Mey.) Harv., *R. capensis* (Burm.f.) Schinz (=*R. glandulosa* (Thunb.) DC.), *R. totta* (Thunb.) DC. (=*R. pilosa* (E.Mey.) Steud.), *R. rotundifolia* Walp. *R. ferulaefolia* Benth. ex Harv., *R. pinnata* Harv. *R. hirta* (Andrews) Meikle & Verdc. (=*R. cyanosperma* Benth. ex Baker) *R. chrysoscias* Benth. ex Harv., *R. leucoscias* Benth. ex Harv., *R. microscias* Benth. *R. trichodes* (E.Mey.) Harv., *R. nitida* (E.Mey.) Harv.
Baker (1871)	4 sections, 3 in southern Africa, 18 species	*Cyanospermum* (Wight and Arnott) Benth. *Copisma* *Arcyphyllum* (Ell.) Torrey and Gray	*R. hirta* (Andrews) Meikle & Verdc. (=*R. cyanosperma* Benth. ex Baker), *R. resinosa* (Hochst. ex A. Rich.) [excluded in this section by Moteetee et al., 2012] *R. minima* (L.) DC., *R. caribaea* (Jacq.) DC., *R. minima* (L.) DC. var. *prostrata* (Harv.) Meikle (=*R. memnonia* (Delile) DC.) *R. densiflora* (Roth) DC.
Baker (1923)	5 sections, 59 species	*Cyanospermum* (Wight and Arnott) Benth. *Arcyphyllum* (Ell.) Torrey and Gray *Chrysoscias* Benth. *Polytropia* Presl. *Eurhynchosia* (*Rhynchosia* Lour.)	*R. hirta* (Andrews) Meikle & Verdc. (=*R. cyanospermum* Baker f.) *R. connata* Baker f., *Rhynchosia densiflora subsp. chrysadenia* (Taub.) Verdc. (=*R. densiflora* (Roth) DC.) *R. angustifolia* DC., *R. chrysoscias* Benth., *R. leucoscias* Benth., *R. microscias* Benth., *R. ferulaefolia* Benth. ex Harv., *R. pinnata* Harv. *R. adenodes* Eckl. & Zeyh, *R. albissima* Gand., *R. angulosa* Schinz, *R. argentea* (Thunb.) Harv., *R. bakeri* Schinz, *R. bullata* Benth. ex Harv., *R. burkei* Burtt-Davy & Baker f., *R. capensis* (Burm.f.) Schinz (=*R. glandulosa* (Thunb.) DC.), *R. ciliata* (Thunb.) Druce Steud. (=*R. puberula* Eckl. & Zeyh.), *R. clivorum* S.Moore, *R. chrysantha* Schltr. ex Zahlbr. *R. confusa* Burtt-Davy, *R. crassifolia* Benth., *R. dieterlenae* Baker f., *R. fleckii* Schinz, *R. galpinii* Baker f., *R. grandifolia* Steud. (=*R. simplicifolia* E.Mey.), *R. harmsiana* Schltr. ex Zahlbr., *R. harveyi* Eckl. & Zeyh., *R. hirsuta* Eckl. & Zeyh., *R. jacottettii* Schinz (=*R. reptabunda* Schinz), *R. komatiensis* Harms, *R. minima* (L.) DC (=*R. longiflora* Schinz.), *R. minima* (L.) DC. var. *prostrata* (Harv.) Meikle (=*R. memnonia* (Delile) DC.), *R. monophylla* Schltr., *R. nervosa* Benth. & Harv., *R. nitens* Benth., *R. ovata* J.M.Wood & M.S.Evans, *R. pauciflora* Bolus, *R. pegleri* Baker f., *R. pentheri* Schltr. ex Zahlbr., *R. quadrata* Harv., *R. reptabunda* N.E.Br., *R. rotundifolia* Walp., *R. rudolfii* Harms, *R. schlechteri* Baker f., *R. secunda* Eckl. & Zeyh., *R. sordida* (E.Mey.) Schinz (=*R. orthodanum* Harv.), *R. spectabilis* Schinz, *R. stenodon* Baker f., *R. totta* (Thunb.) DC, *R. totta* var. *venulosa* (Hiern) Verdc. (=*R. elegantissima* Schinz), *R. totta* var. *rigidula* (DC.) Moteetee & M.M.le Roux (=*R. rigidula* (Eckl. & Zeyh.) DC.), *R. venulosa* (Hiern) K.Schum. (=*R. venulosus* K.Schum.), *R. villosa* (Meisn.) Druce (=*R. sigmodes* Benth. ex Harv), *R. viscidula* Steud., *R. woodii* Schinz

Fig. 1. Morphology and growth habit: (A) *R. angustifolia*, (B) *R. chrysoscias*, (C) *R. leucoscias*, (D) R. microscias.

The name Chrysoscias is derived from the Greek words “chryso” for golden and “scias” for shade-loving plant. Species in this section are characterised by golden glands on the leaf surface and fruits, and golden bulbous-based hairs that are variably distributed on the stems, leaflets, calyces, and sometimes on the pods; they are mostly found creeping or twining in shady places although they can also occur in full sun. Based on our observations, the species are restricted to the Core Cape Subregion of the Greater Cape Region of South Africa.

In the last revision of the South African species of Rhynchosia, Baker (1923) used leaflet shape and the extent of fusion of calyx lobes as diagnostic characters for this section. The degree of fusion of the calyx lobes can only be used to distinguish R. chrysoscias from the other species in this section. An examination of herbarium specimens has indicated that there is confusion between R. chrysoscias and R. leucoscias as these species are morphologically very similar, with overlapping distributions. There is also confusion between R. angustifolia and R. leucoscias var. angustifolia as they both have narrow-linear leaflets and solitary or sub-solitary flowers. This clearly shows that there is extensive variation in morphological characters in the section, which results in uncertainties when determining species delimitations. Therefore, the aim of the present paper is to provide a revision of section Chrysoscias with a key to the species, correct nomenclature, complete synonymy, typification, descriptions, diagnostic features of the species, distribution maps, and habitat notes. We recognise four species in this treatment of the section (R. chrysoscias, R. leucoscias, R. angustifolia and R. microscias).

2. Materials and methods

We studied herbarium specimens housed at BOL, JRAU, PRE, and those loaned from NBG (including SAM) supplemented by extensive field work of almost all the taxa throughout their known geographical distributions. Type specimens were examined online at www.plants. jstor.org. Distribution data for all species were gathered during field trips, from herbarium material and field notes. Leistner and Morris (1976) was used to locate the quarter degree squares for the place names. For floral dissections, flowers were rehydrated in boiling water and mounted in glycerol. Illustrations were drawn using a camera lucida attachment. Images of leaf surfaces and anatomical sections were taken using a Zeiss Stereo microscope, 6.3 × micro-lens and Zeiss compound microscope. For anatomical studies herbarium material was first rehydrated by placing in boiled distilled water for about 24 h at 50 °C, the water was then completely drained and the material placed in FAA for a minimum of 24 h. The material was subsequently treated according to a modification (a five day final infiltration) of the method of Feder and O'Brien (1968) for embedding in glycol methacrylate (GMA) and infiltrated with GMA over five days. Sections were made using a 2045 Multicut Rotary Microtome. Staining was done according to the periodic acid Schiff/toluidine blue (PAS/TB) staining method (Feder and O'Brien, 1968). For Scanning Electron Microscopy (SEM) studies, leaf

and calyx surface appendages, air dried material was mounted on carbon stubs and gold coated using an Emscope gold coater. These were then viewed with a Tescan SEM at 8 kV using the Vega3TC software program, photographed with an Oxford instruments X-Max camera and also viewed with Phenom Pro SEM at 5 kV using the ProSuite software program, photographed with Phenom built in camera. Description of vegetation types of all the species follows the standard vegetation types in Mucina and Rutherford (2006).

3. Results and discussion

3.1. Vegetative morphology

Species of Rhynchosia section Chrysoscias are climbing or twining creepers, or spreading prostrate herbs from 0.2–1.0 m long (Fig. 1). Stems are slender, suffruticose at the base, branches firm-herbaceous, shortly pubescent to densely grey-pilose and sometimes glandular (especially in R. chrysoscias). Leaflets are pinnately trifoliolate and their shape varies from linear, through narrowly linear, linear-lanceolate and lanceolate to oblong-lanceolate, with revolute margins. The leaflet shape is of limited diagnostic value but can be used to distinguish between R. leucoscias (oblong-lanceolate or linear-lanceolate) and R. angustifolia (leaflets narrowly-linear). Rhynchosia leucoscias has the largest leaflets [(24.0–)32.0–58.0(– 70.5) × 7.5–15.0 mm] while R. angustifolia has the smallest leaflets [15.0–30.0 × 1.0–3.0(– 3.5) mm]. Petiole length is variable among species and although of limited diagnostic value, it can distinguish R. leucoscias (8–20 mm) from the other species which all have shorter petioles [R. angustifolia (2.2–4.5 mm), R. chrysoscias (3.5–7.8) and R. microscias [(3.0–)4.3–8.6 mm)]. Cross sections of petioles revealed that the petiole shape is somewhat irregular and consists of one layer of uniseriate and orbicular epidermal cells and a ring of five isolated vascular bundles (Fig. 2). Like most of the papilionoid taxa, species in this section have persistent stipules, with shapes varying from broadly oblong to ovate or ovate-lanceolate. In R. chrysoscias and R. microscias the stipules are ovate-lanceolate while in R. leucoscias and R. angustifolia they are broadly oblong.

3.2. Reproductive morphology

In this section the flowers are either borne in axillary umbels, or are solitary to sub-solitary (R. angustifolia). The peduncles range from 15 to 60 mm, bearing 1-many flowers.

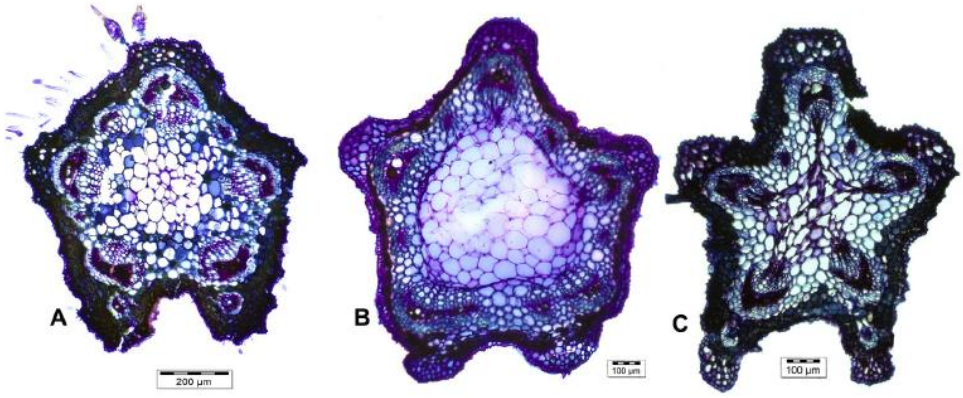

Fig. 2. Cross section of petioles showing the arrangement of tissues (A) *R. chrysoscias*; (B) *R. leucoscias*, (C) *R. microscias*. Vouchers: A from *Muir 2967* (PRE); B from *Cooper 1497* (PRE) and C from *Fourcade 6027* (PRE).

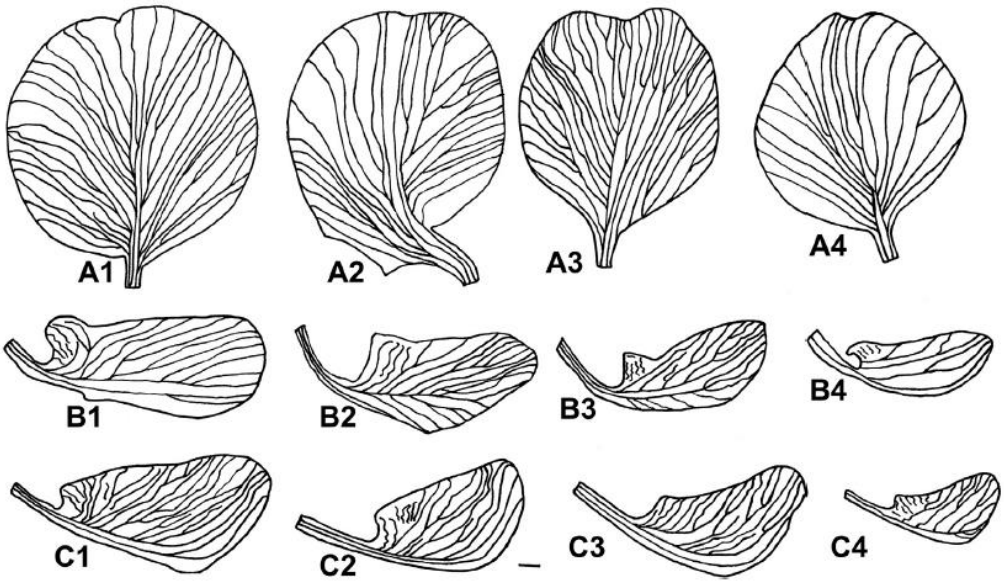

Fig. 3. Petal shape: (A) Standard; (B) Wing; (C) Keel. (A1, B1 & C1) *Rhynchosia chrysoscias*; (A2, B2 & C2) *R. leucoscias*; (A3, B3 & C3) *R. angustifolia*; (A4, B4 & C4) *R. microscias*; Vouchers: A1, B1, C1 from *Burger 1130* (PRE); A2, B2, C2 from *Williams 3297* (PRE); A3, B3, C3 from *Goldblatt 4789* (PRE); A4, B4, C4 from *Muir 114*. Scale bar A1–C5 = 6 mm. Artist: Thulisile Jaca.

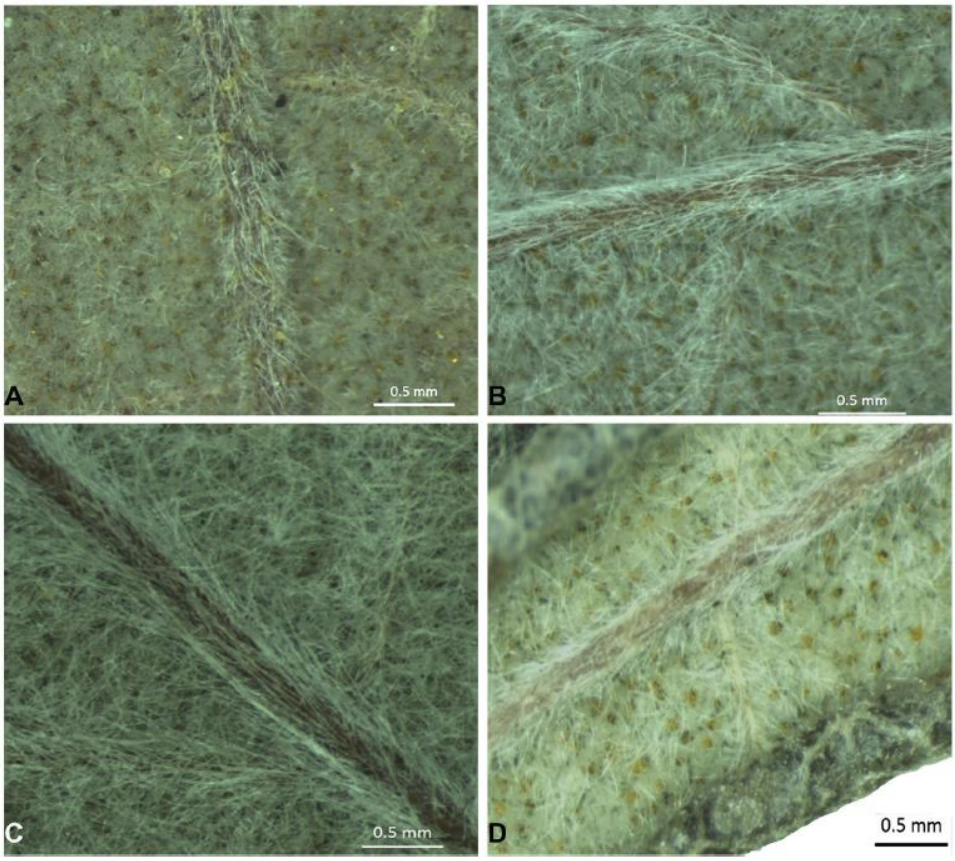

Fig. 4. Leaflets showing the indumentum and glands on the abaxial surface: (A) *R. chrysoscias*; (B) *R. leucoscias*; (C) *R. microscias* and (D) *R. angustifolia*. Vouchers: A from *Taylor 1073* (PRE); B from *Stirton 11,168* (PRE); C from *Acocks 14,631* (PRE); and D from *Williams 2582* (PRE).

Pedicels are shorter than the peduncles, ranging from 1 to 20 mm. Bracts are caducous, broadly-oblong to ovate-lanceolate, acute and attached at the base of each pedicel; bracteoles absent. The flowers are yellow in all species. The calyx lobes are generally bilabiate with the upper lobes connate to the middle in R. chrysoscias and connate to beyond the middle in the rest of the species. The calyx lobes are lanceolate to linear-lanceolate and the upper ones equal to or slightly shorter (4.5–13.0 mm) than the vexillum (8.0–15.5 mm). The standard petal is generally large (8–15 × 6–15), ovate to broadly obovate, slightly emarginate, glabrous, without appendages and shortly clawed (Fig. 3A1–A4). The wing petals are oblong to obliquely-oblong, subcordate at the base and exhibit little surface sculpturing. The wing petals are equal to or longer than the keel petals in all species except in R. microscias, where they are slightly shorter than the keel (Fig. 3B1–B4). The size of the wings ranges from 6 to 15 × 2–8 mm with a well-developed claw. The keel petals are generally uniform in shape throughout the section and are shorter and slightly broader than the wings. They are generally rostrate to rostrate-oblong or rostrate-obovate (Fig. 3C1–C4). In R. chrysoscias, R. leucoscias and R. angustifolia the keels are larger than (7–14 × 5–14 mm) in R. microscias where the keels are smaller, ranging from 4 to 8 × 3–4 mm.

Fruits with a caducous or persistent calyx, unilocular, oblong, broadly-oblong to ovoid, mucronate, rarely compressed, slightly turgid, dehiscent, straight or slightly curved and 1–2 seeded. The dehiscence of the valves is along both sutures, opening apically with valves twisting downwards. Seeds are brown or black with brown mottling, somewhat compressed, smooth and oblong-reniform to ovoid. The mature seeds remain attached to the open fruits.

3.3. Leaf vestiture and anatomy

The distribution and type of trichomes are important taxonomic characters for distinguishing between the species in this section. The vestiture is composed of both glandular and non-glandular trichomes (bulbous-based and uniseriate hairs) [Figs. 4 and 5A–H]. The cross section of the leaf and SEM micrographs revealed that there are four types of trichomes that occur in section Chrysoscias, differentiated according to their shape (terminology adapted from Vargas et al., 2015). The four types of trichomes are:

- Spherical capitate glands (S) with circular to semi-circular apical cells and unicellular bases (Fig. 5A, B & G).
- Ellipsoid capitate glands (E) that are oblong in shape with unicellular bases (Fig. 5C).
- Bulbous-based hairs (BB) with rounded bases, apically elongated cells; distributed on stems, both the abaxial and adaxial leaflet surfaces and petioles of R. chrysoscias, and calyces of all other species in this section (Fig. 5A & E).
- Uniseriate hairs (U) comprising of one to three cells (Fig. 5D, F & H).

The non-branched uniseriate hairs are comprised of one to three cells. These trichomes usually have terete cells at the base and elongated apical cells. Both glandular and non-glandular trichomes are homogenously distributed on the petiole surface. Details of trichome distribution and other epidermal features are tabulated in Table 2.

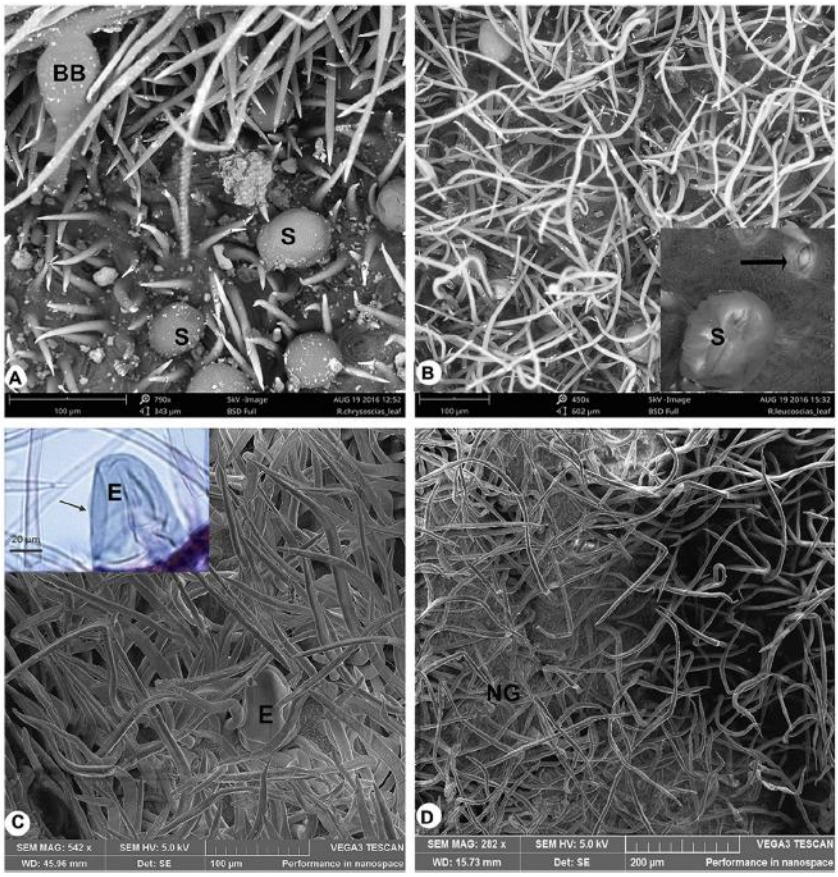

Fig. 5. SEM micrographs and the cross section of the leaf showing trichome morphology: (A & E) *R. chrysoscias*; (B, G & H) *R. leucoscias*; (C & D) *R. angustifolia*; (F) *R. microscias*. (BB) bulbous-based trichome; (E) ellipsoid trichome; (U) uniseriate trichome; (S) spherical trichome. Vouchers: A from *Taylor 1073* (PRE); B from *Stirton 11,168* (PRE); C from *Williams 2582* (PRE); D from *Zeyher 1689* (SAM); E from *Muir 2967* (PRE); F from *Fourcade 6027* (PRE); G & H from *Cooper 1497* (PRE).

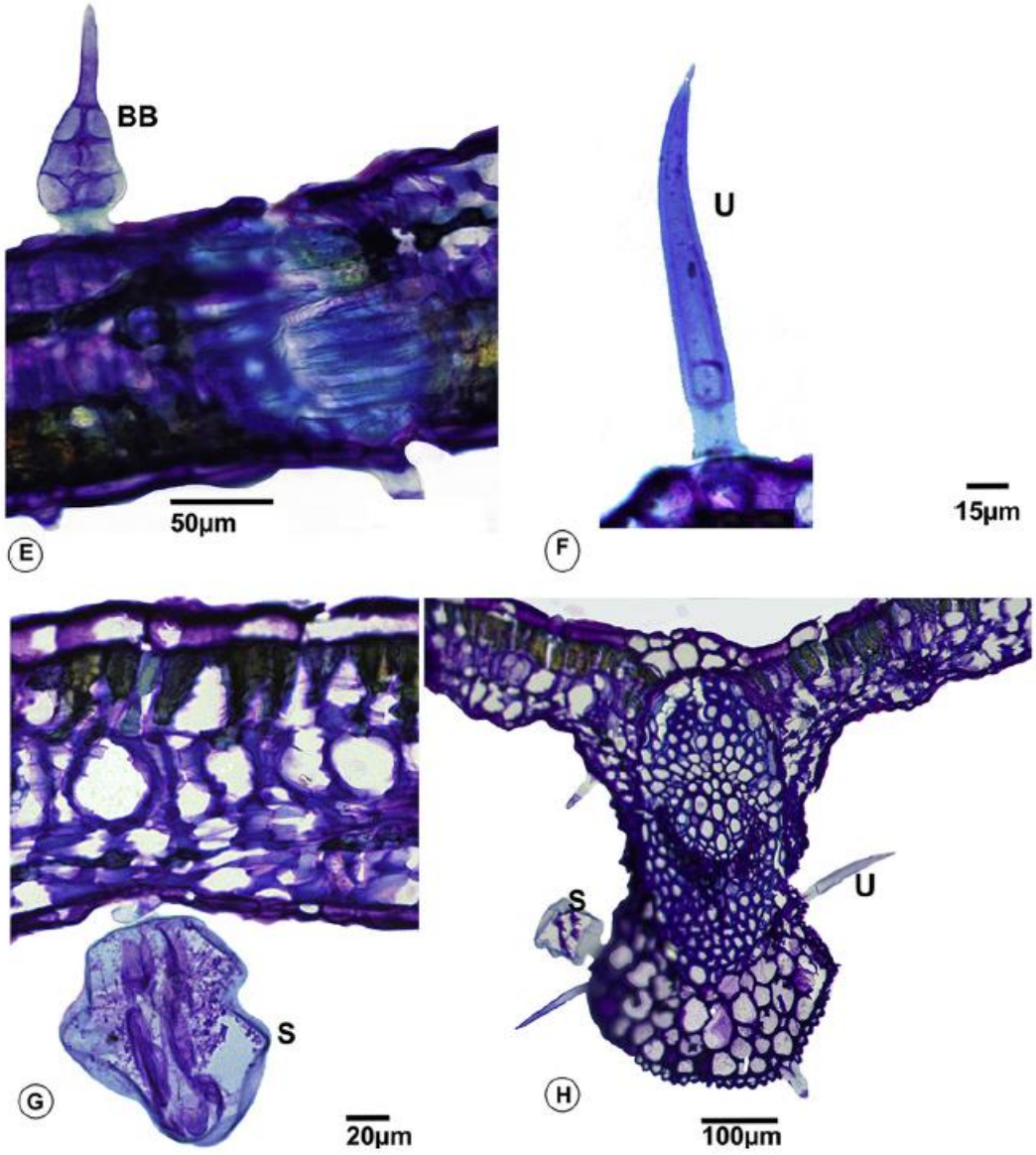

Fig. 5 (*continued*).

Glandular trichomes are of the vesicular type, orange-yellow to golden or rarely colourless (some specimens of R. angustifolia). Vesicular glands (E and S) consist of a squat head of cells contained within a shallow depression of the epidermis (Moteetee and Van Wyk, 2006). These glands are present on the leaflets in R. chrysoscias, R. leucoscias and R. angustifolia and only on the stipules in R. microscias. In R. chrysoscias they are distributed abundantly throughout the plant on the stems, petioles, and leaflets (both surfaces); in R. leucoscias and R. angustifolia they are on the upper surface of the stipules, abaxial surface of the leaflets and only rarely on the adaxial surface of the leaflets.

There are two types of non-glandular trichomes, the bulbous-based hairs and the uniseriate (simple) hairs. The bulbous-based hairs are present in all the species.

In R. chrysoscias they occur on the stems, stipules (upper surface), petioles, leaflets (both surfaces), calyces and pods; while they are only present on the calyces and pods in R. leucoscias, R. angustifolia and R. microscias.

The uniseriate hairs consistently occur throughout the plant (stems, stipules, petioles, leaflets, bracts, calyces and pods) in all the species. In R. chrysoscias they are villous on stems, petioles and pods, pilose to slightly pubescent on the stipules, puberulous above and villous below on the leaflets and golden yellow on the calyces. In R. leucoscias they are silky-silvery on the stems and calyces, tomentose on the stipules and petioles, on the leaflets they are white tomentose on the lower and puberulous on the upper surface, and villous on the pods. In R. angustifolia they are silky-canescent on the stems, tomentose on the stipules and petioles, on leaflets they are white tomentose on the lower surface and sparsely pubescent on the upper surface, silky-silvery on calyces and villous on the pods. In R. microscias they are silky-canescent on the stems and petioles, pubescent on stipules and calyces, on the leaflets they are canescent-sericeous on the lower surface, glabrescent on the upper surface and villous on pods.

In transverse sections of the leaf blade, in all species, the epidermis consists of a single layer of cells and tends to have sinous cell outlines on the abaxial surface and occasional stomata. On the adaxial surface the epidermis has larger cells with polygonal outlines and no stomata. The stomata are always on the abaxial surface of the leaf and each stoma has two subsidiary cells which are parallel to the longitudinal axis of the pore and guard cells (paracytic).

4. Taxonomic treatment

4.1. Rhynchosia section Chrysoscias

Benth. in Fl. Cap. 2: 249 (1862); Baker f. in Bothalia 1: 113–138; 117 (1923). Type species: R. chrysoscias Benth. [Note: R. chrysoscias is herewith designated as the type species for this section for the reason that the species holds the section name and is the first listed species in Harvey's, 1862 treatment].

Table 2
Epidermal features of *Rhynchosia* sect. *Chrysoscias*.

Taxon	Distribution of glandular trichomes				Distribution of non-glandular trichomes				
	Petiole	Leaf		Stipule	Petiole	Leaf		Stipule	Calyx
		1	2			1	2		
R. chrysoscias	E, S	E, S	S	S	BB, U	BB, U	BB, U	BB, U	BB, U
R. leucoscias	E	E, S	S, R	E, S	U	U	U	U	BB, U
R. angustifolia	E	E, S	S, R	E, S	U	U	U	U	BB, U
R. microscias	–	–	–	E, S	U	U	U	U	BB, U

1, abaxial surface; **2**, adaxial surface.
Trichome type: **BB**, bulbous-based trichomes; **E**, ellipsoid capitate trichomes; **S**, spherical capitate trichomes; **U**, uniseriate trichomes.
–, absence; **R**, rare.

Plants subshrubs, stems twining. Stipules deciduous, broad to broadly oblong, ovate to ovate lanceolate, glandular, slightly pubescent or slightly pilose above with bulbous-based hairs (only in R. chrysoscias), acute. Leaflets pinnately trifoliolate; lanceolate, oblong-lanceolate, linear, linear-lanceolate to narrowly linear with slight to strongly revolute margins; glandular or non-glandular, tomentose, sericeous, or villous below and puberulous to glabrescent above with reticulate venation. Flowers yellow, solitary to sub-solitary or in axillary umbels bearing 1–8(–10) flowers, peduncles longer (15–45 mm) than the petiole (2–20 mm); bracts broadly-oblong to ovate-lanceolate, silky-villous to pubescent and glandular above, acute to sub-acute or obtuse. Calyx bilabiate, golden yellow or silky-silvery with bulbous-based hairs, the two uppermost lobes somewhat connate at the base, segments lanceolate. Standard petal broadly obovate, large (8–15 × 6–15), without appendages, slightly emarginate; wing petals ovate to obovate, subcordate at the base; keel petals rostrate, 4–11 × 3–14 mm, somewhat broader than the wings (6–15 × 3–8). Stamens diadelphous (9 + 1), anthers monomorphic, dorsifixed. Ovary narrowly oblong, subsessile, pubescent, 2-ovuled; style hairy below (silky-silvery), glabrous and curved upwards. Pods oblong to broadly-oblong or ovoid, villous or pilose, compressed to slightly turgid, mucronate and somewhat dehiscent. Seeds 1–2, brown or black.

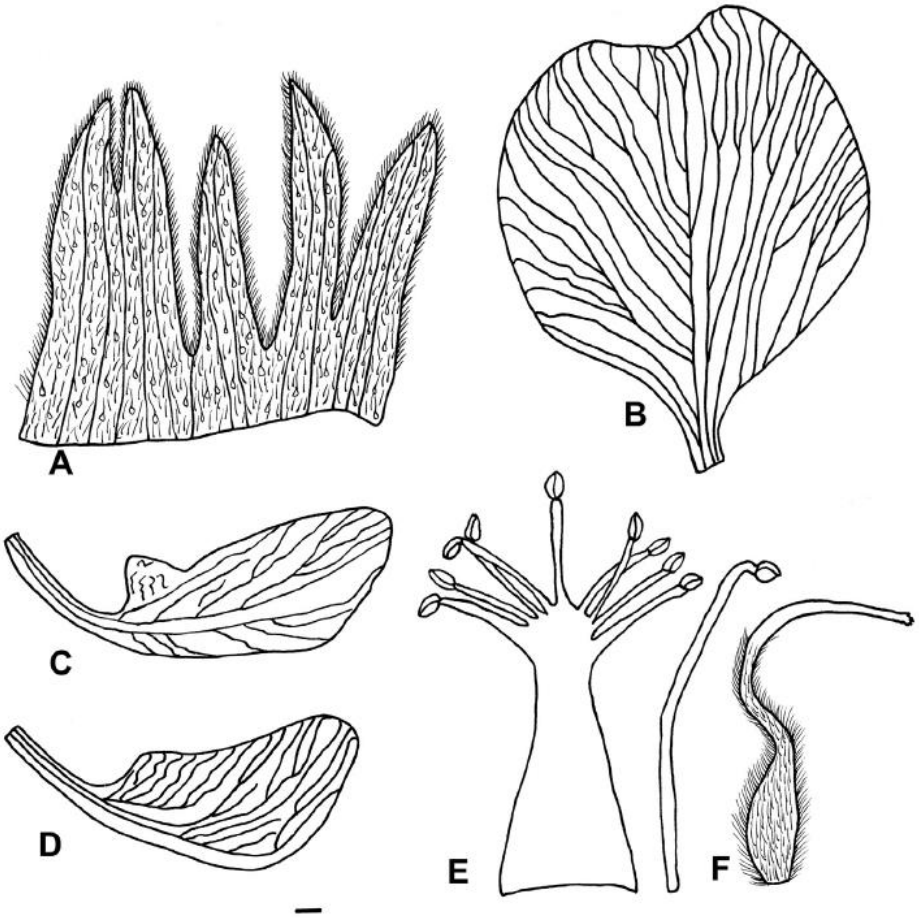

Fig. 6. Reproductive morphology of *Rhynchosia angustifolia*: (A) calyx opened with upper lobes to left; (B) standard petal (adaxial view); (C) wing petal; (D) keel petal; (E) stamens; (F) pistil. Voucher: *Goldblatt 4789* (PRE). A–F scale bar = 6 mm. Artist: Thulisile Jaca.

4.2. **Key to species**

1a. Leaflets not gland dotted, up to 8 flowers per umbel .....4. R. microscias. 1b. Leaflets gland-dotted, flowers in umbels with 3–5 flowers .....2. 2a. Lower surface of the leaflets with bulbous-based hairs on midrib, two uppermost calyx lobes connate to the middle.....2. R. chrysoscias. 2b. Lower surface of the leaflets without bulbous-based hairs, two uppermost calyx lobes connate to above the middle.....3. 3a. Leaflets oblong-lanceolate; flowers in umbels with 2–5 flowers.....3. R. leucoscias. 3b. Leaflets narrowly-linear; flowers solitary to sub-solitary with 1–2 flowers.....1. R. angustifolia.

4.2.1 Rhynchosia angustifolia

(Jacq.) DC., Prod. 2: 388 (1825); Baker f. in Bothalia 1:113–138; 117 (1923). Glycine angustifolia, Jacq. Schoenb. 2: 55–56, t. 231 (1797). Type: Jacq., Schoenb., t. 231 (1797), iconotype, here designated.

Cylista angustifolia Eckl. & Zeyh. Enum. Pl. Afric. Austral. 2: 258 (1836). Type: same as above. Rhynchosia uniflora Harv. in Fl. Cap. 2: 249 (1862). Type: same as above. Rhynchosia leucoscias var. angustifolia Harv. in Fl. Cap. 2: 249 (1862), syn. Nov. Type: South Africa. Western Cape, Caledon (3419): River Zondereinde [Riversondereind] (–BB), precise date unknown, Zeyher 2410 (S, lecto.!; here designated; SAM!, isolecto.) [Note: The sheet with herbarium number S.12–9918].

Twining subshrub up to 0.7 m, stems silky-canescent. Stipules ovate, acute to subacute, (3.5–)4–6 × 2–3 mm, glandular and tomentose to pubescent above. Leaflets narrowly-lanceolate to linear, white to tomentose and glandular below, sparsely pubescent above without bulbous-based hairs, (15–)27–34 × 1–3(–3.5) mm long; margins strongly revolute; petioles (2.0–)3.5–5.0 mm long. Peduncles 20–42 mm long, solitary to sub-solitary, bearing 1–2 flowers; pedicels 3.5–4.5 mm long. Flowers axillary, (11–)12–20 × 4–6 mm. Calyx silky-silvery, upper lip equal to lower lip, 6–10 mm long, tube 2 mm long; the two uppermost calyx lobes connate to beyond the middle. Standard 8–12 × 6–11 mm, claw 2–3 mm long; wings 9–10 × 3–4 mm, almost equal to the keel, claw 3.5–5.0 mm long, longer than that of the standard petal and the keel; keel slightly larger than wings, 8.0–11.0 × 3.5–4.0 mm, claw 2–3 mm long (Fig. 6). Pods oblong, villous, 13–14 mm long; seeds black. Flowers from late winter through summer and autumn: August–April.

4.2.1.1 **Diagnostic characters**.

Rhynchosia angustifolia has a similar growth form to that of R. leucoscias in that they are both twining sub-shrubs (except that R. angustifolia is strongly twining) and that they both have leaflets with glands. It can be easily distinguished from R. leucoscias by its narrower leaflets [(15–)27–34 × 1–3(– 3.5) mm vs. (24–)32–58(– 70.5) × 7.5–15.0 mm] that are strongly revolute, solitary to sub-solitary flowers, and by its shorter peduncles (20–42 mm vs 20–60 mm long). It can be distinguished from R. chrysoscias by the lack of bulbous-based hairs on the leaflets.

4.2.1.2 **Distribution and habitat.**

Rhynchosia angustifolia is restricted to the Caledon area from Zwarteberg, Helderberg (Grootvaderbosch), Viljoen Pass, Lebanon to Hermanus and extends to the Riversonderend Mountains (Fig. 7) and a disjunct population further east in the Langeberg area. It grows along river catchments in fairly moist to well-drained sandy soils as well as on dry rocky mountain slopes in sandy loam soils in Overberg Dune Strandveld (FS 7), South Sonderend Sandstone Fynbos (FFs 14) and Central Ruens Shale Renosterveld (FRs 12) vegetation.

4.2.1.3 Nomenclatural notes.

Jacquin's illustration shows clearly the strongly twining growth habit characteristic of R. angustifolia. The Cylista angustifolia specimen in TCD is chosen

as lectotype because it is part of Zeyher's collection with Ecklon and Zeyher's Enumeratio label. Zeyher 2410 in S is a mixed collection of Cylista angustifolia (R. leucoscias) and R. leucoscias var. angustifolia (R. angustifolia); the collection referred to here is the branch in the upper right hand corner of the sheet with a R. leucoscias var. angustifolia label and a herbarium number S.12–9918. The specimen in S is chosen as lectotype because there are locality details on the sheet and it is of good material.

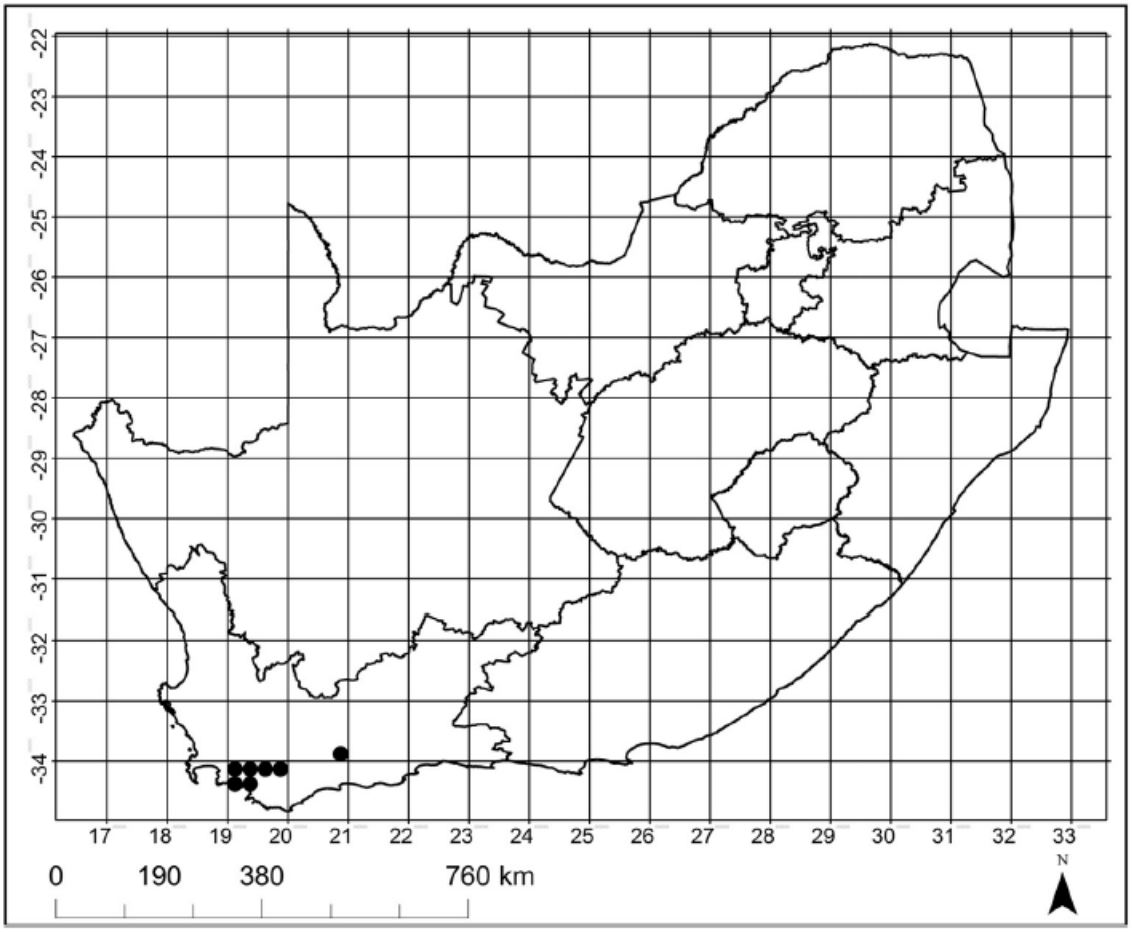

Fig. 7. Known distribution of *Rhynchosia angustifolia* in South Africa.

When erecting Rhynchosia leucoscias var. angustifolia, Harvey (1862) noted that it could be distinguished from the typical variety by its fewer flowers (sub-solitary) and very narrow leaflets. He also mentioned that R. uniflora (now R. angustifolia) is much like R. microscias and can only be distinguished by its constantly solitary flowers on short pedicels. We observed a close similarity (strongly twining habit, narrow-linear leaflets, and solitary to sub-solitary flowers) between R. leucoscias var. angustifolia and R. angustifolia such that it is difficult to distinguish or separate the two taxa. We believe that Harvey only saw one specimen of R. uniflora (Zeyher 1689) and now with extensive collections from the type locality, it is clear that there is only one species. Therefore R. leucoscias var. angustifolia is

here synonymised with R. angustifolia and the latter name is preserved to take Jacquin's earlier name of Glycine angustifolia referring to the narrow leaflets.

4.2.1.4. **Additional specimens examined.**
South Africa. WESTERN CAPE PROVINCE: 3320 (Langeberg): Grootvadersbosch State Forest (– DD), east of Barend Koen Road on southerly slopes of ridge approaching Spitskop from southwest, 23 Sep 1985, McDonald and Morley 1045 (NBG, PRE). 3419 (Caledon): Grabouw (– AA), 9 Aug 1966, Kruger 107 (PRE), Viljoens Pass (– AA), 26 Aug 1940, Compton 9213 (NBG), 26 Sep 1962, Taylor 4088 (PRE), 3 Oct 1972, Smith 33 (PRE), 5 Apr 1973; Lebanon State Forest, Jakkalsrivier catchment (– AA), Hayness 795 (PRE), 13 Oct 1970, Kruger 1075 (PRE); Hermanus (– AC), Vogelgat Nature Reserve, 1 Sep 1978, Goldblatt 4789 (PRE), 4 Dec 1980, Stirton 8455 (PRE), 9 Aug 1987, Williams 3800 (NBG); Vogelgat (– AD), east of Base Camp, 11 Sep 1978, Williams 2582 (PRE, NBG); Genadendal, Riviersonderend mountains on Kanonberg north of Genadendal (–BA), 10 Oct 1995, Meyer 1034 (PRE), Oct 1950, Stokoe SAM55911 (PRE); Caledon, Riviersonderend (–BB), 2 Sep 1951, Esterhuysen 18,775 (NBG, PRE), 9 Oct 1998, Oliver 11,186 (NBG).

4.2.2. **Rhynchosia chrysoscias**
Benth. ex Harvey and Sonder in Fl. Cap. 2: 248–249 (1862). Type: South Africa. Precise locality unknown: Thunberg s.n. sub THUNB-UPS 16799 (UPS, lecto. - micro-fiche!, here designated); THUNB-UPS 16798 (UPS!, isolecto. - micro-fiche) Glycine erecta Thunb., Prodr.: 131 (1800) & Fl. Cap.: 592 (1823). Type: same as above. Cylista lancifolia Eckl. & Zeyh., Enum. Pl. Afric. Austral. 2: 259 (Jan, 1836). Type: South Africa. Western Cape, Knysna (3423): Langekloof and Plettenbergsbay [Plettenberg Bay] (–AB), precise date unknown, Ecklon and Zeyher 1690 (S, holo; SAM!, iso.). Chrysoscias grandiflora E.Mey., Comm.: 139 (Feb, 1836). Type: South Africa. Western Cape, George (3322): Kaijmansgat [Kaaiman's Gat] (–DC), 7 Sep 1831, Drége 3794 (P, holo.!; MO!, iso.)

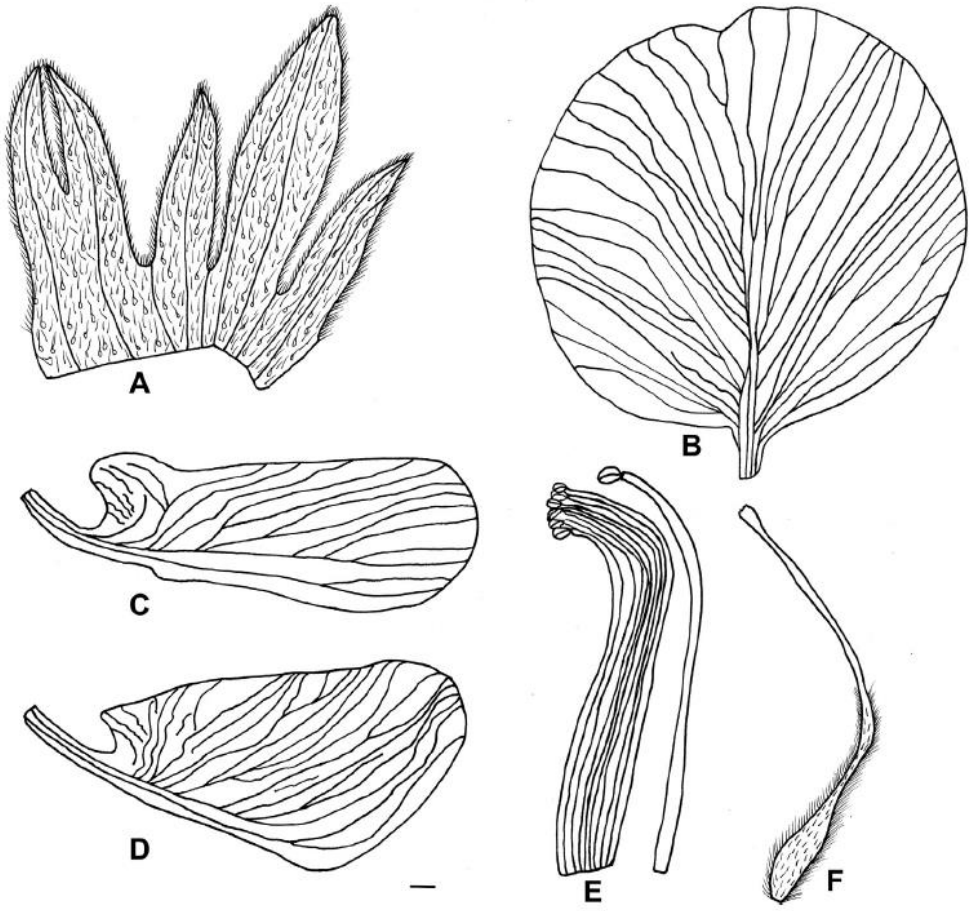

Fig. 8. Reproductive morphology of *Rhynchosia chrysoscias*: (A) calyx opened with upper lobes to left; (B) standard petal (adaxial view); (C) wing petal; (D) keel petal; (E) stamens; (F) pistil. Voucher: *Burgers 1130* (PRE). A–F Scale bar = 6 mm. Artist: Thulisile Jaca.

Creeping subshrub, stems twining sometimes prostrate or sprawling, villous, glandular, golden yellow when young, forming mats of about 0.5 m long, up to 2.0 m long when twining. Stipules broadly oblong, acute 5.8–8.2 × 2.6–5.3 mm, glandular and slightly pilose above. Leaflets lanceolate to oblong-lanceolate, puberulous above, with bulbous-based hairs on both surfaces, villous below, glandular, margins revolute, 30–40 × 5–10 mm; petiole 3.5–7.8 mm long. Peduncles 20–50 mm long, umbels bearing 3–5 flowers. Flowers axillary,11–20(– 22) × 4–7 mm. Calyx golden yellow, upper lip 9.5–13.0 mm long, lower lip 11.5–15.0 mm long; tube 2 mm long; the two uppermost lobes connate to the middle. Standard 10.0–15.5 × 7–15 mm, claw 2.0–3.5 mm long; wings narrower than the keel 9.0–15.0 × 3.5–8.0 mm, claw 3–5 mm; keel larger than wings, 8.5–14.0 × 5.0–14.0 mm, claw 3.0–6.5 mm long (Fig. 8). Pods oblong, villous, 14–15 mm long; seeds black or brown. Flowers from late winter through spring and mid-summer: late July–December.

4.2.2.1 **Diagnostic characters.**

Rhynchosia chrysoscias can be distinguished from other species in this section by the golden bulbous-based hairs that occur on young stems, leaflets and calyces and the vesicular glands that occur throughout the plant. In others species

the golden bulbous-based hairs only occur on the calyces. The standard petal is much larger than those of R. leucoscias and R. microscias (10.0–15.5 × 7.0–15.0 mm vs. 8–11 × 6–9 mm in R. microscias and 9.5–13.0 × 7.5–12.5 mm in R. leucoscias).

4.2.2.2 Distribution and habitat.

Rhynchosia chrysoscias has a widespread distribution in the Core Cape Subregion, from the Western Cape to the Eastern Cape Province. It is widely distributed along coastal areas from Bredasdorp easterly up to Port Elizabeth and is the most widespread species in this section (Fig. 9). Rhynchosia chrysoscias and R. leucoscias are sometimes confused with each other not only because of their similar morphological characters but also due to their strongly overlapping distributions. However, R. leucoscias grows in moist to dry sandy soils in Kouga Grassy Sandstone (FFs 28) and Overberg Sandstone Fynbos (FFs 12) vegetation, while R. chrysoscias prefers dry grassy vegetation from Eastern Little Karoo (Skv 11) through to Gamka Karoo (NKI 1), Baviaanskloof Shale Renosterveld (FRs 18) and Central Ruens Shale Renosterveld (FRs) vegetation at ± sea level and moist sandy soils in Potberg Sandstone Fynbos (FFs 17) and Tsitsikamma Sandstone Fynbos (FFs 20) vegetation. Both species seem to track recently burnt vegetation.

4.2.2.3 Nomenclatural notes.

Thunberg's specimen is chosen as lectotype for Rhynchosia chrysoscias because of all the synonyms listed by Harvey (1862), Glycine erecta Thunb. is the oldest. Had the name not been already taken by De Candolle's Rhynchosia erecta, this would be the correct name for this species.

4.2.2.4 Additional specimens examined.

South Africa. WESTERN CAPE: 3321 (Ladismith): Langeberg, Garcia State Forest (–CC), along path above Rooiwaterspruit to Stinkhoutbos, 21 Nov 1991, McDonald 2106 (NBG), Garcias Pass (–CC), 30 Aug 1923, Muir 2967 (PRE); Lebombo Mountains (–CC), 30 Aug 1926, Muir 2344 (PRE). 3322 (George): Victoria Bay hillside (–BA), 19 Aug 1944, Compton 15,778 (NBG); Terblanchberg, Moordkuils catchment (–CC), 24 May 1983, Volk 596 (PRE), Ruytersbosch (–CC), 19 Sep 1951, Van Niekerk 81 (PRE); Gradockberg (–CD), 30 Jul 1963, Taylor 3683 (PRE), Aug 1912, Rogers 4311 (PRE), Montagu pass (–CD), Jun 1927, Fourcade s.n. (PRE), Outeniqua Pass at Telkom substation at the start of Pass-to-Pass trail (–CD), 14 Sep 2011, Boatwright 597 (NBG); Kleinplaat (–DC), 28 Jul 1966 Lange 20 (PRE). 3323 (Willowmore): Knysna division, Kranskop west station (–CC), Sep 1960 Horn s.n. sub PRE 55977 (PRE), Natures Valley (–CC), 5 Jul 1949, Immelman 80 (PRE), 15 Dec 1959, Codd 9971 (PRE); 7.5 miles from Keurbooms River to Storms River (–DC), 24 Sep 1969, Marsh 1330 (PRE); Tsitsikamma Park, Elandsbosrivier (– DD), 8 Sep 1975, Bower 573 (PRE). 3324 (Steytlerville): Baviaanskloofrivier (–CA) 12 Sep 1973, Thompson 1905 (PRE). 3420 (De Hoop): Potberg Nature Reserve, in Boskloof at southern side of Mountain (–BC), 7 Sep 1978, Burgers 1130 (PRE), 2 Apr 1985, Scott 549 (PRE), 14

Oct 1940, Pillans 9446 (PRE); Bredasdorp (–CA), 21 Sep 1962, Taylor 4014 (PRE). 3422 (Mossel): Groenvlei (–BB), 25 Dec 1953, Taylor 1073 (PRE, NBG). 3423 (Knysna): 27.2 km from Keurboom River mouth (–AB), 14 Oct 1928, Gillett 1574 (PRE), Spitskop Fynbos Reserve (–AB), 17 Sep 1970, Geldenhuys 131 (PRE), Keurboomstrand, 5 Sep 1955, Theron 1781 (PRE), Plettenbergbaai, 13 Dec 1967, Grobbelaar 681 (PRE). EASTERN CAPE: 3325 (Port Elizabeth): Suurberg [Zuurberg] pass (–BC), 13 Aug 1973, Bayliss 5901 (NBG), Alexandria District, Zuurberg Inn (–BC), 22 Sep 1953, Archibald 740 (PRE), Zuurberg (–BC), 17 Sep 1933, Long 1097 (PRE); Uitenhage, Groendal Wilderness, Farm Grootplaat (–CA), 4 Sep 1974, Scharf 1540 (PRE); Zwartkops catchment, steep valley head (–CB), 18 Jul 1974, Scharf 1433 (PRE). 3424 (Humansdorp): near Clarkson (–AB), Aug 1926, Thode A814 (PRE); Coldstream, 11 Nov 1935, Laughton s.n. (PRE).

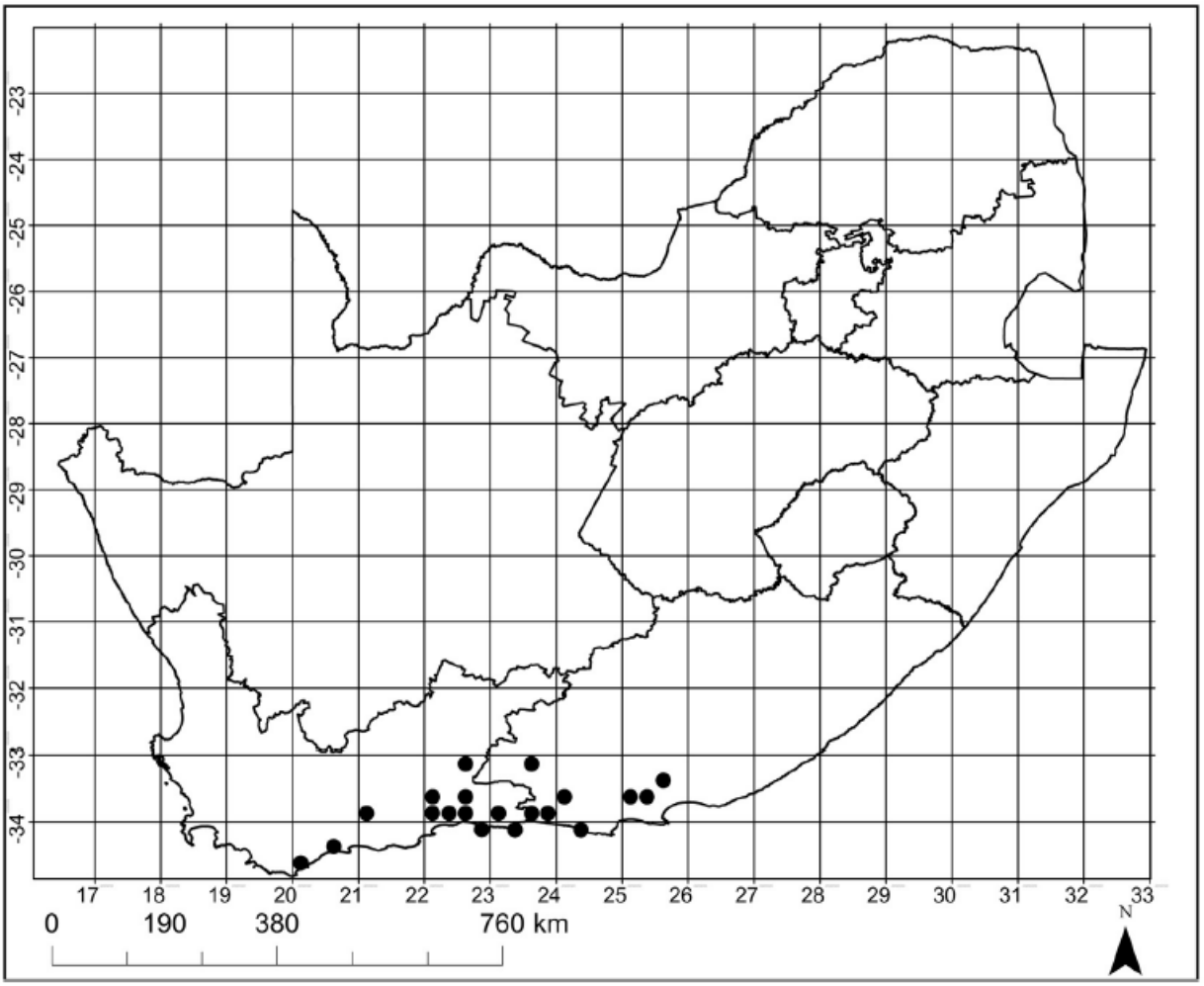

Fig. 9. Known distribution of *Rhynchosia chrysoscias* in South Africa.

4.2.3. **Rhynchosia leucoscias**

Benth. in Fl. Cap. 2: 249 (1862). Type: South Africa. Eastern Cape, Port Elizabeth (3325): 'Vanstaadensberg' [Van Stadensberg] (–CC), precise date unknown, Ecklon

and Zeyher 1688 (SAM, lecto.! here designated; M!, isolecto.) (See nomenclatural note i).

Cylista argentea Ecklon and Zeyher (1836). Type same as above. (See nomenclatural note ii). Cylista angustifolia E. Mey., in Linnaea, 7: 171 (1832). Type: South Africa. Western Cape, Caledon (3419): Rivier Zondereinde (–BB), precise date unknown, Zeyher 2410 (S, lecto! here designated) [Note: sheet with herbarium number S.12–9920 is chosen as lectotype]. (See nomenclatural note iii).

Chrysoscias calycina E. Mey., in Comm., 140 (1836). Type same as above. (See nomenclatural note iv). Twining subshrub, stems twining, occasionally creeping, young stems silky silvery. Stipules broadly oblong, acute (4.0–)6.0–8.0 × (–3.0)3.8–5.2 mm long, glandular and tomentose above. Leaflets oblong-lanceolate to linear, white tomentose and glandular below, puberulous above, without bulbous-based hairs on both surfaces, margins revolute, (24.0–)32.0–58.0(– 70.5) × 7.5–15.0 mm; petiole 8–20 mm long. Peduncles 20–60 mm long, subsolitary, umbels bearing 2–5 flowers. Flowers axillary, 12–20(– 25) × 4–5 mm. Calyx silky-silvery; upper lip 7–10 mm long, lower lip 6–11 mm long, tube 2–3 mm long; the two uppermost lobes connate to above the middle. Standard 9.5–13 × 7.5–12.5 mm, claw 2–3 mm long; wings slightly shorter than the keel (8–)9–10 × 3.5–4.0(– 6) mm, claw 3.5–5.0 mm; keel slightly larger than wing, 7.0–11.0 × 3.5–5.0 mm, claw 2–3(– 4) mm long (Fig. 10). Pods broadly oblong, villous, 13–15 mm long; seeds black. Flowers from late winter through spring and mid-summer: August–December.

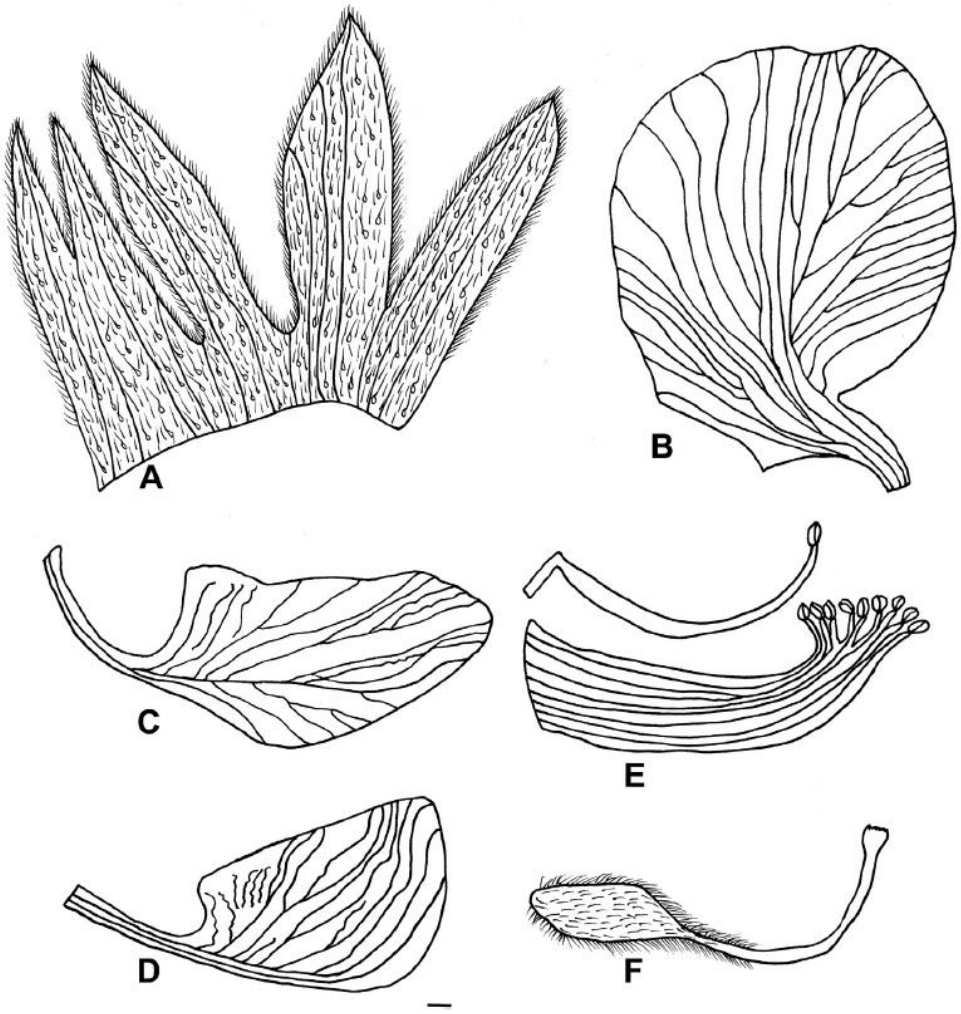

Fig. 10. Reproductive morphology of *Rhynchosia leucoscias*: (A) calyx opened with upper lobes to left; (B) standard petal (adaxial view); (C) wing petal; (D) keel petal; (E) stamens; (F) pistil. Voucher: *Williams 3297* (PRE). A–F scale bar = 6 mm. Artist: Thulisile Jaca.

4.2.3.1 **Diagnostic characters.**

Rhynchosia leucoscias is a twining sub-shrub, occasionally creeping, with stems that are silky-silvery when young and grow from 0.5–2.0 m long if twining. It is similar to R. chrysoscias in leaflet shape but differs markedly in its reticulate white tomentose leaflets with glands on the lower surface but without bulbous-based hairs on the midrib. The standard petal is smaller than in R. chrysoscias but much larger than that of R. microscias (9.5–13 × 7.5–12.5 mm vs. 10.0–15.5 × 7–15 mm in R. chrysoscias and 8–11 × 6–9 mm in R. microscias).

4.2.3.2 **Distribution and habitat.**

The species is restricted to the Core Cape Subregion from the Western Cape Province to the Eastern Cape Province. It extends west to the Caledon area and east from Knysna up to the Port Elizabeth area (Fig. 11). Rhynchosia leucoscias and R. chrysoscias strongly overlap in distribution and may sometimes be confused with each other. Rhynchosia leucoscias grows in moist to dry sandy soils in short

Kouga Grassy Sandstone Fynbos (FFs 28), Southern Afrotemperate Forest (FOz 1) and Overberg Sandstone Fynbos (FFs 12) vegetation.

4.2.3.3 Nomenclatural notes.

i) The specimen in SAM is chosen as lectotype for Rhynchosia leucoscias because it is likely to be part of Zeyher's collection acquired by Pappe. The sheet has Pappe's label with which he replaced the original Enumeratio plantarum label of Zeyher and Ecklon. Zeyher 2410 in S is a mixed collection of Cylista angustifolia and R. leucoscias var. angustifolia (R. angustifolia). ii) The name R. argentea is not adopted because it has been taken up by Rhynhcosia argentea Harv. iii) The collection referred to here is the one on the bottom left of the sheet with a C. angustifolia label and a herbarium number S.12–9920. iv) Rhynchosia calycina is not adopted because it has been taken by Rhynchosia calycina Guill. & Perr.

4.2.3.4 Additional specimens examined.

South Africa. WESTERN CAPE: 3418 (Simonstown): Kogelberg Forest Reserve (–BD), 11 Jun 1986, Boucher 1525 (PRE); near Spinnekopnes jeep track, before crossing second stream (–BD), 12 Oct 1989, Maitre 569 (NBG); Palmiet River track along jeep track (–BD), 14 Sep 2011, Boatwright 668 (NBG); 50 m right of road up first and old powers installation before reaching Oudenbosch (–BD), 12 Dec 1991, Kruger 170 (NBG). 3419 (Caledon): Vogelgat Nature Reserve (– AD), 15 Oct 1986, Stirton 11,168 (PRE); Vulture stream (– AD), 20 Sep 1986, Williams 3686 (PRE); 11 Sep 1978, Williams 3297 (PRE, NBG); Riversondereind (–BB), without date, Zeyher s.n. (NBG). 3422 (Uitzicht): Brenton on Sea (–BB), 9 Nov 1979, Hugo 2051 (PRE). 3423 (Knysna): east of The Heads (– AA), 17 Dec 1919, Schönland 3387 (PRE); 12 Jan 1958, Story 2863 (PRE). EASTERN CAPE: 3324 (Steytlerville): Elandsberg Mountains (–DB) 30 Sep 1984, Stirton 10,878 (NBG). 3325 (Port Elizabeth): Vanstadensberg mountains (–CC), 30 Sep 1984, Stirton and Zantovska 11,610 (NBG); Longmore Forest Station (–CC), 28 Sep 1978, Hugo 1415 (NBG); Uitenhage (–CD), 1860, Cooper 1497 (PRE); Port Elizabeth (–DC), Gordon PRE55958 (PRE). 3424 (Humansdorp): (–CD), Mar 1930, Thode A2532 (PRE). Without precise localities and dates: Gordon s.n. sub PRE55958 (PRE), Marloth 9338 (PRE).

4.2.4. Rhynchosia microscias

Benth. in Fl. Cap. 2: 249 (1862); Baker f. in Bothalia 1: 116. (1923). Type: South Africa. Western Cape, George (3322): mountain sides near George (–CD), Aug 1836, Drége s.n. (S, holo.!; CGE!, K!, MO!, REG!, TUB!, iso.).

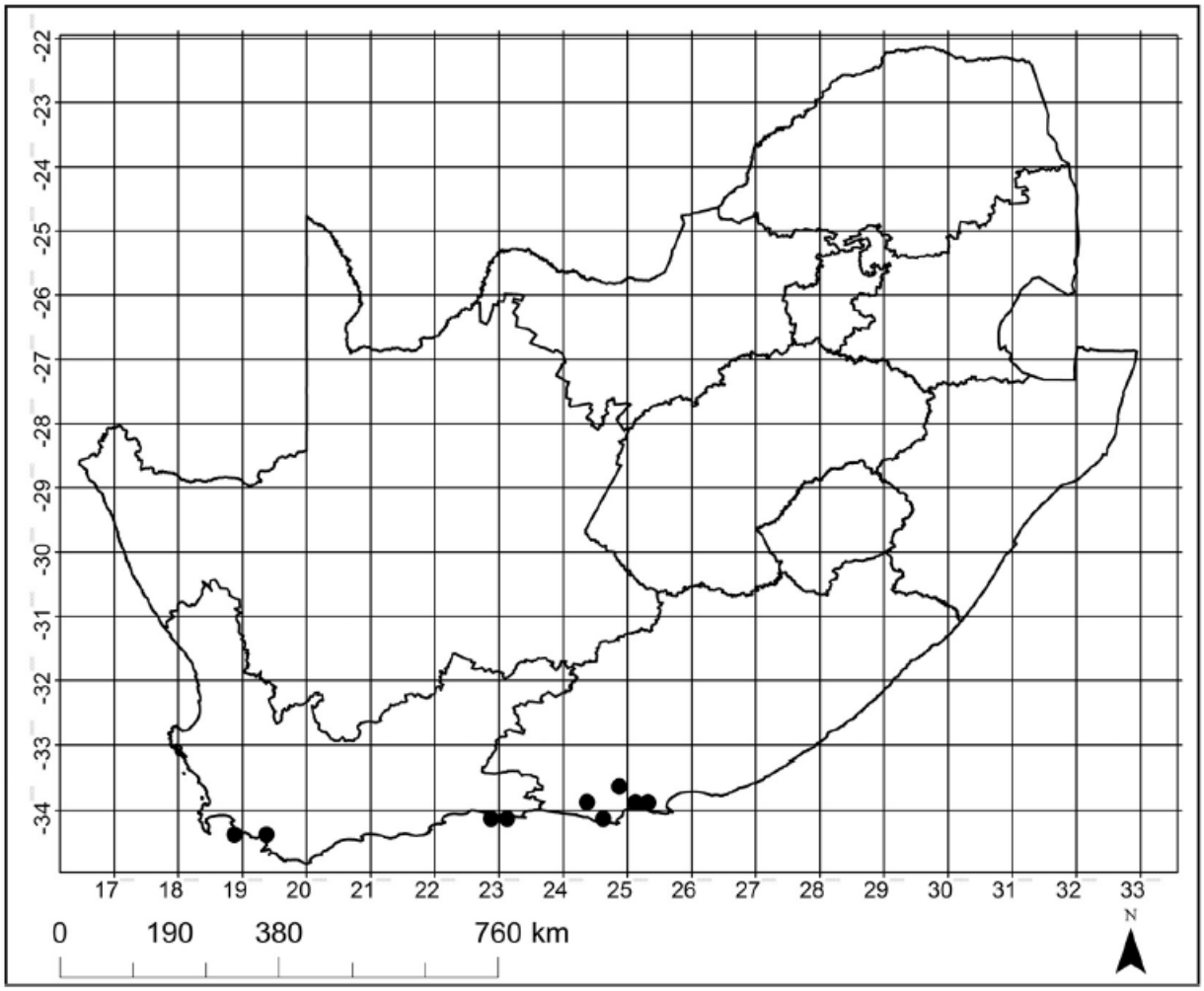

Fig. 11. Known distribution of *Rhynchosia leucoscias* in South Africa.

Chrysoscias parviflora E. Mey., Comm., 139 (1832). Type: same as above. See nomenclatural note i). Twining subshrub up to 5 m long, stems silky-canescent. Stipules ovate-lanceolate, acute 5.5–8.0 × 2.6–8.0 mm, pubescent above. Leaflets lanceolate to linear-lanceolate, canescent and sericeous below, non-glandular, glabrescent above without bulbous-based hairs, margins revolute, (30–)40–50 × 6–11 mm long; petioles (3.0–)4.3–8.6 mm long. Peduncles 15–45 mm long, umbels bearing 4–8(– 10) flowers. Flowers axillary, 9.0–10.0 × (2.5–)3.0–4.0 mm. Calyx cano-pubescent; upper lip 4.5–9.5(– 12.5) mm long, lower lip 6.0–12.5 mm long; tube 2–3 mm long, the two upper most lobes connate beyond the middle Standard 8–11 × 6–9 mm, claw 1.5–3.0 mm long; wings 6.0–8.0 × 2.0–3.5 mm, slightly narrower than the keel, claw 3.5–4.0 mm long; keel slightly broader than wing, 4–8 × 3–4 mm, claw 2.5–3.0 mm long (Fig. 12). Pods ovoid, villous, 12–14 mm long; seeds brown or black. Flowers from late winter through spring: July–September.

4.2.4.1 **Diagnostic characters.**

Rhynchosia microscias is similar to both R. chrysoscias and R. leucoscias in leaflet shape, from which it can be easily distinguished by its greyish sericeous, non-glandular leaflets as opposed to villous and glandular in R. chrysoscias, white tomentose and glandular in R. leucoscias. It can also be distinguished from the other species in the section by flowers that are noticeably smaller; 9–10 × (2.5–)3–4 mm compared to 11–20(– 22) × 4–7 mm in R. chrysoscias, 12–20(– 25) × 4–5 mm in R. leucoscias and (11–)12–20 × 4–6 mm in R. angustifolia.

4.2.4.2 **Distribution and habitat.**

Rhynchosia microscias occurs in the Core Cape Subregion from the Western Cape Province to the Eastern Cape. It extends from Riversdale, east through Mossel Bay, George to Knysna and Tsitsikamma (Fig. 13). This species prefers sandstone slopes and moist mountainous areas in Mossel Bay Shale Renosterveld (FRs 14), South Outeniqua Sandstone Fynbos (FFs 19) and North Outeniqua Sandstone Fynbos (FFs 18) as well as Tsitsikamma Sandstone Fynbos (FFs 20) vegetation.

4.2.4.3 Nomenclatural note.

i) The name R. parviflora is not adopted because it has been taken up by Rhynchosia parviflora (E. Mey.) Steud.

4.2.4.4 **Additional specimens examined.**

South Africa. WESTERN CAPE: 3321 (Ladismith): Hills above Langfontein (– DD), without date, Muir 2343 (PRE); Cloete's Pass, 4 Jul 1948, Acocks 14,631 (PRE). 3322 (George): Near George (–CD), Aug 1830, Drége s.n. sub PRE27007 (PRE); Montagu Pass, Jun 1943, Fourcade 6027 (NBG, PRE). 3323 (Jonkersberg): Gouna (–CC), without date, Taylor 1310 (PRE); Aug 1942, Fourcade 5707 (NBG); Concordia (–CC), 19 Aug 1970, Keet 558 (PRE); Tsitsikamma Lottering Bush (–DC), 16 Sep 1897, Galpin 3989 (PRE). 3421 (Riversdale): Lebombo Mountains, Welgevonden near Langeberg (–BA), Jul 1913, Muir 1114 (PRE). 3423 (Knysna): Kruisfont (– AA), 26 Mar 1979, Van Daalen 175 (PRE).

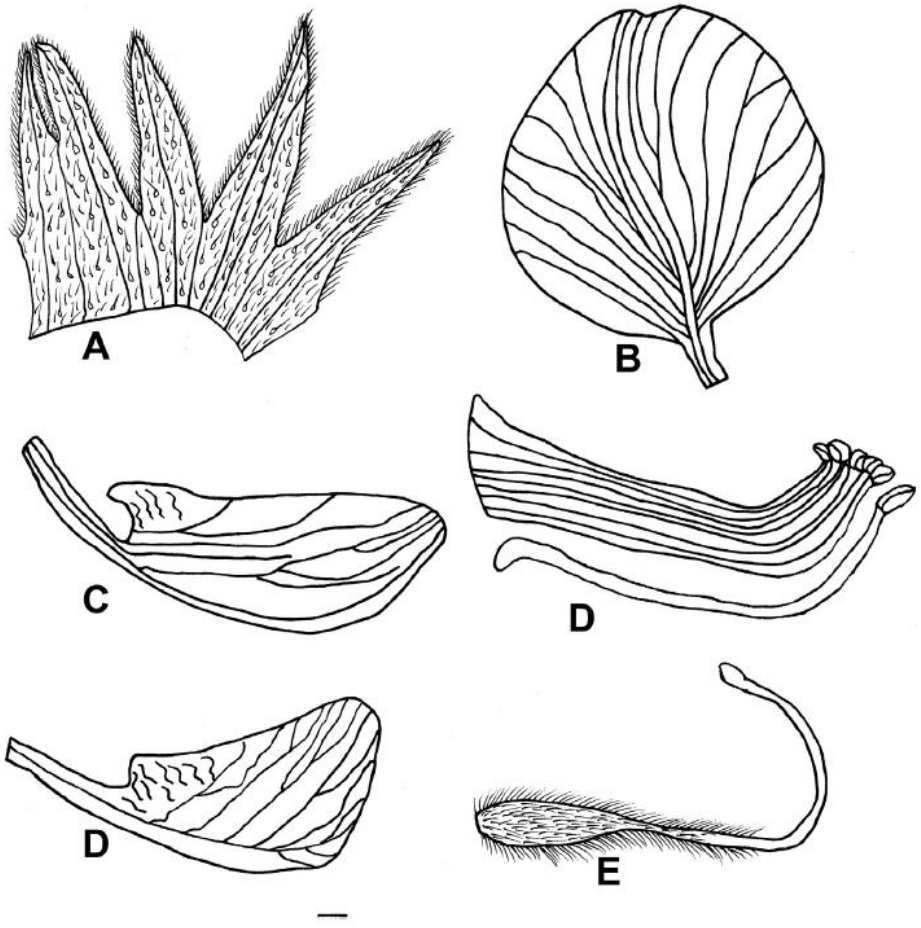

Fig. 12. Reproductive morphology of *Rhynchosia microscias*: (A) calyx opened with upper lobes to left; (B) standard petal (adaxial view); (C) wing petal; (D) keel petal; (E) stamens; (F) pistil. Vouchers: A–D from *Muir 114* (PRE); E–F from *Acocks 14,131* (PRE). A–F scale bar = 6 mm. Artist: Thulisile Jaca.

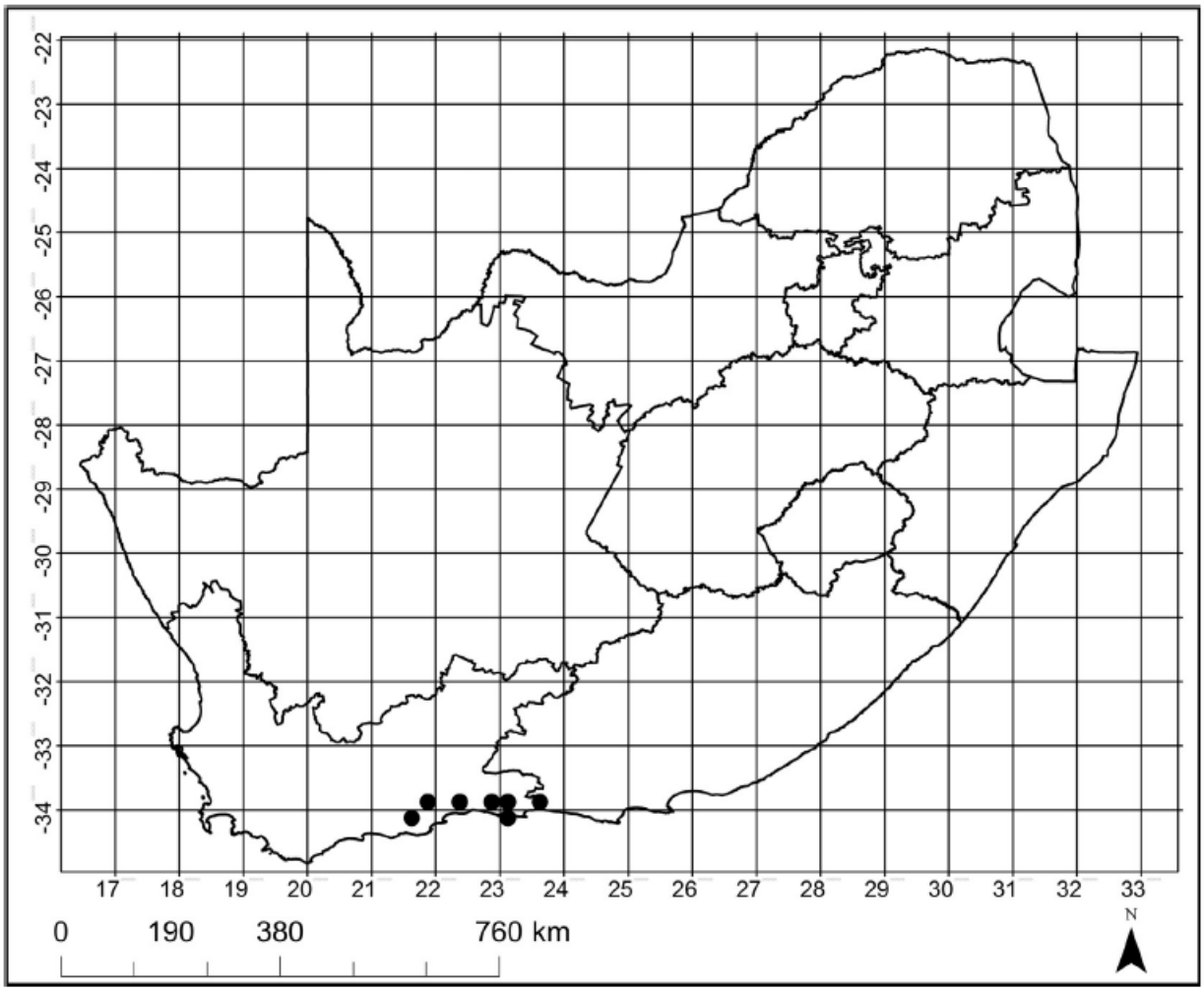

Fig. 13. Known distribution of *Rhynchosia microscias* in South Africa.

Acknowledgements

The authors wish to express their gratitude to the curators of PRE and NBG (including SAM) for their assistance with herbarium material. Images of anatomy sections were generated at the Biosystematics Microscopy Imaging Systems, Biosystematics Division, Agricultural Research Council – Plant Protection Research Institute. We thank the anonymous reviewers who provided useful comments that improved the manuscript. The University of Johannesburg, the National Research Foundation Thuthuka Programme (76177) and the South African National Department of Environmental Affairs through its funding of the South African National Biodiversity Institute Invasive Species Programme are gratefully acknowledged for financial support.

References

Baker, J.G., 1871. Leguminosae. Flora of Tropical East Africa, p. 218.

Baker, E.G., 1923. Revision of the South African species of Rhynchosia. Bothalia 1, 113–138.

Bentham, G., Hooker, J.D., 1865. Leguminosae. Genera Plantarum. Vol. 1(2). Lovell Reeve, London, pp. 542–543.

De Candolle, A., 1825. Prodromus Systematus Naturalis. 2. Sumptibus Sociorum Treuttel et Wurtz, Paris, pp. 384–389.

Ecklon, C.F., Zeyher, C.L.P., 1836. Enumaratio Plantarum Africae Australis extratropicae 2. Perthes & Besser, Hamburg, pp. 252–256.

Feder, N., O'Brien, T.P., 1968. Plant microtechnique: some principles and new methods. American Journal of Botany 55, 123–142.

A checklist of South African plants. In: Germishuizen, G., Meyer, N.L., Steenkamp, Y., Keith, M. (Eds.), Southern African Botanical Diversity Network Report No. 41. SABONET, Pretoria.

Glen, H.F., 2002. Cultivated Plants of Southern Africa. Jacana, Johannesburg, p. 206.

Grear, J.W., Dengler, N.G., 1976. The seed appendage of Eriosema (Fabaceae). Brittonia 28, 281–288.

Harvey, W.H., 1862. In: Thiselton-Dyer, W.T. (Ed.), Leguminosae. Flora Capensis 2. Reeve and Co., London, pp. 247–258.

Lackey, J.A., 1981. Tribe 10. Phaseoleae DC. (1825). In: Polhill, R.M., Raven, P.H. (Eds.), Advances in Legume Systematics Part 1. Royal Botanic Gardens, Kew, pp. 301–327.

Leistner, O.A., Morris, J.M., 1976. Southern African Place Names: Annals of the Cape Province Museum. Vol. 12.

Manyelo, T.S., 2014. A phylogenetic study of South African Species of Rhynchosia (Phaseoleae, Fabaceae). M.Sc. (Botany) [unpublished]. University of Johannesburg. Available on: https://ujdigispace.uj.ac.za.

Meyer, E.H.F., 1836. Commentariorum de Plantis Africae Australioris 2. Leopoldum Voss, Leipzig, pp. 131–140.

Moteetee, A.N., Le Roux, M.M., 2016. The Rhynchosia totta complex (Phaseoleae, Fabaceae) in southern Africa, including the description of a new variety and new species. Bothalia 46, a2041. https://doi.org/10.4102/abc. v46i1.2041.

Moteetee, A.N., Van Wyk, B.-E., 2006. A revision of the genus Bolusafra (tribe Phaseoleae, Fabaceae). South African Journal of Botany 71, 604–608.

Moteetee, A.N., Boatwright, J.S., Jaca, T.P., 2012. A review of Rhynchosia section Cyanospermum (Phaseoleae, Fabaceae) in South Africa. South African Journal of Botany 81, 124–127.

Moteetee, A.N., Boatwright, J.S., Jaca, T.P., 2014. A review of Rhynchosia section Polytropia (Phaseoleae, Fabaceae) and a new species from the Western Cape Province, South Africa. Systematic Botany 39, 1127–1131.

Mucina, L., Rutherford, M.C. (Eds.), 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Ramcharan, E.K., McAndrews, J.H., Grear, J.W., 1973. Pollen morphology of Rhynchosia and Eriosema (Fabaceae). Canadian Journal of Botany 51, 2395–2399.

Schrire, B.D., 2005. Tribe Phaseoleae. In: Lewis, G.B., Schrire, B., Mackinder, B., Lock, M. (Eds.), Legumes of the World. Royal Botanical Gardens, Kew, UK, pp. 409–410.

Turner, B.L., 2011. Systematics of the Rhynchosia senna complex (Fabaceae). Lundellia 14, 27–31.

Vargas, W., Sartori, A.L.B., Dias, E.S., 2015. Novelties in secretory structures and anatomy of Rhynchosia (Fabaceae). Annals of the Brazilian Academy of Sciences 87, 83–93.

Verdcourt, B., 2001. Rhynchosia. In: Pope, G.V., Polhill, R.M. (Eds.), Flora Zambesiaca. 3(5). Royal Botanic Gardens, Kew, pp. 168–210.