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Ceropegia gilboaensis (Apocynaceae), a new species from the Midlands of KwaZulu-Natal, South Africa

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Abstract

A new species of *Ceropegia* (Apocynaceae-Asclepiadoideae-Ceropegieae), *C. gilboaensis,* is described from the Midlands of KwaZulu-Natal, South Africa, where it occurs along exposed rock sheets in Midlands Mistbelt Grassland. This new tuberous species, which lacks the tubular trap-flowers typical of *Ceropegia* s.str., is assigned to section *Chamaesiphon*. *Ceropegia gilboaensis* is vegetatively and floristically most similar to *C. ngomensis* (formerly *Brachystelma ngomense*); both species have prostrate stems and foul-smelling, cylindrical-campanulate, striated and dark-coloured flowers characteristic of a sapromyiophilous pollination strategy.

Keywords: *Brachystelma*, Ceropegieae-Stapeliinae, dolerite, endemism, Midlands Mistbelt Grassland, mimicry, sapromyiophily

Introduction

The Apocynaceae are a super-diverse family of plants ranking among the ten largest Angiosperm families (Ollerton *et al*. 2019). Within its subfamily Asclepiadoideae, the subtribe Ceropegieae-Stapeliinae is particularly well documented to have evolved high degrees of floral complexity and synorganization, with the vast majority of species being pollinated by Diptera (Ollerton *et al*. 2019). In *Ceropegia* s.l. (sensu Endress *et al*. 2018; henceforth *Ceropegia*), highly specialized floral phenotypes have evolved in adaptation to flies as pollinators. Most intriguing are the complex tubular kettle-trap flowers found in *ca*. 220 species formerly recognized as *Ceropegia* s.str. Linnaeus (1753: 211). Flies, as a functionally and taxonomically diverse pollinator group, have apparently driven multiple evolutionary shifts between tubular kettle-trap flowers and simpler non-trap flowers (Ollerton *et al*. 2017); the latter are found in *ca*. 140 species formerly recognized as *Brachystelma* Brown (1822: t. 2343) (included in *Ceropegia* s.l. by Bruyns *et al*. 2017 and Endress *et al*. 2018), and *ca*. 360 vegetatively distinct stem-succulent species forming a monophyletic group known as the stapeliads (included in *Ceropegia* s.l. by Bruyns *et al*. 2017, but kept separate by Endress *et al*. 2018). These shifts in functional morphology of flowers have resulted in diversification of floral traits and concomitant pollination strategies.

One such strategy is the mimicry of substrates used by flies when laying eggs, such as dung or carrion. Characteristic for brood-site mimicking species is a combination of features such as dark maroon to reddish-purplish, often speckled or radially striped and foul-smelling flowers presented close to the ground (Johnson & Jürgens 2010; Johnson & Schiestl 2016; Jürgens *et al*. 2006; Jürgens & Shuttleworth 2015). A large number of open-flowered *Ceropegia* species (Dyer 1980, Styles & Wragg 2008), as well as most of the stem-succulent stapeliads (Bruyns 2005; Du Plessis *et al*.

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2018) present such floral features and can appear quite similar (Fig. 1). These similarities, however, are often a result of convergent evolution and accordingly do not necessarily reflect close phylogenetic relationships (Bruyns *et al*. 2017).

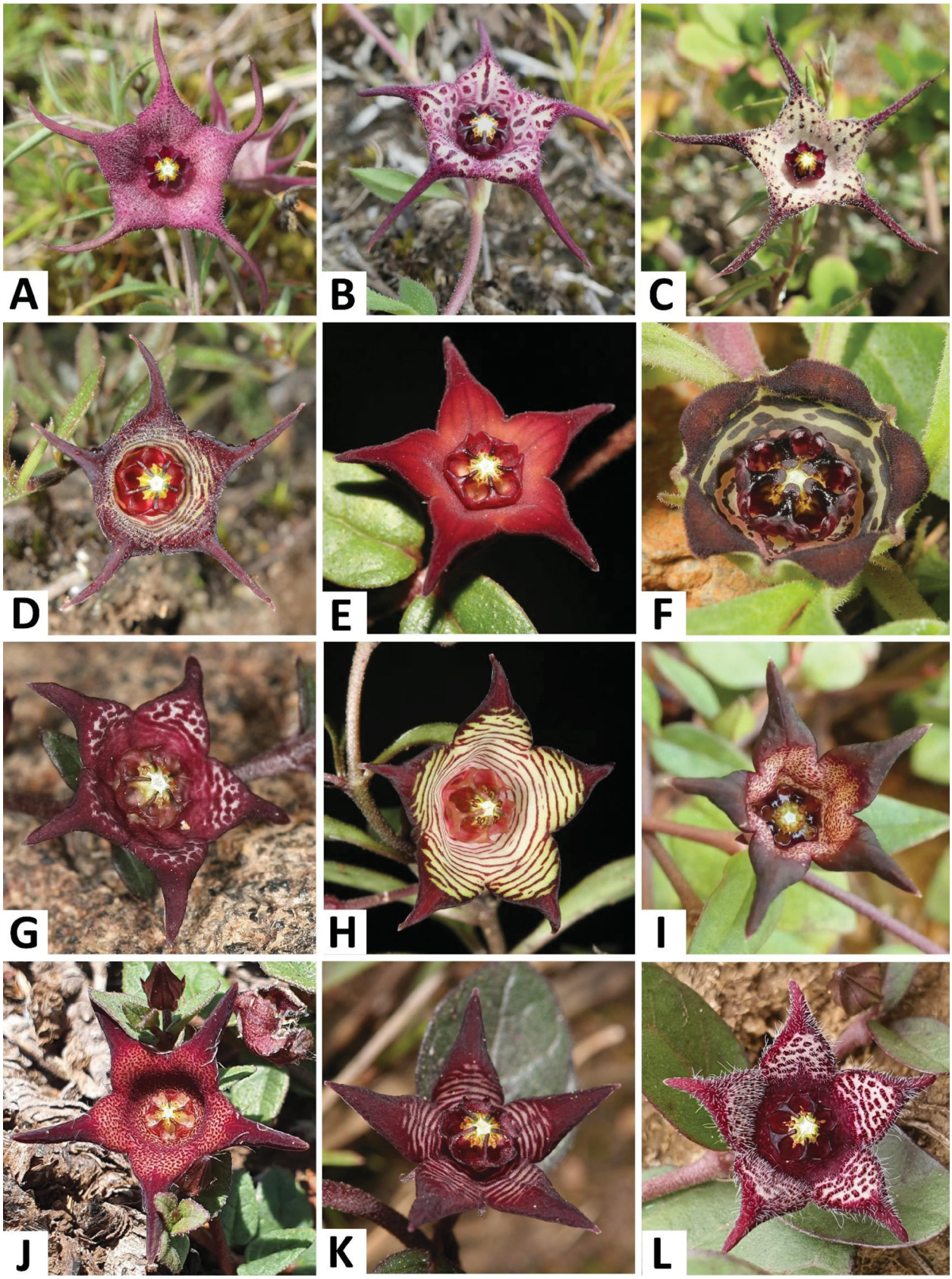

FIGURE 1. Flowers of selected South African brood-site mimicking species of *Ceropegia* sect. *Chamaesiphon*. A–D, *C. australis*; E, *C. bruceae*; F, *C. chlorozona*; G, *C. coddii*; H, *C. modestantha*; I, *C. ngomensis*; J, *C. petrophila*; K, *C. pulchellior*; L, *C. remota*. Photographs: Annemarie Heiduk (A–C, I); David Styles (D–H, J–L).

In Africa, tuberous brood-site mimicking *Ceropegia* species belong to section *Chamaesiphon* Huber (1957: 34), which is well represented in the northeastern region of southern Africa. Within KwaZulu-Natal and in neighbouring provinces (Eastern Cape, Mpumalanga) and countries (Lesotho and eSwatini) sectional members are exemplified by *C. australis* (Dyer 1977a: 12) Bruyns in Bruyns *et al*. (2017: 433), *C. bruceae* (Dyer 1977a: 13) Bruyns in Bruyns *et al*. (2017: 433), *C. campanuliformis* Bruyns in Bruyns *et al*. (2017: 433), *C. chlorozona* (Bruce 1938: t. 3370) Bruyns in Bruyns *et al*. (2017: 433), *C. coddii* (Dyer 1955: t. 1181) Bruyns in Bruyns *et al*. (2017: 433), *C. modestantha* (Dyer 1954: t. 1165A) Bruyns in Bruyns *et al*. (2017: 434), *C. ngomensis* (Dyer 1977b: 255) Bruyns in Bruyns *et al*. (2017: 434), *C. petrophila* (Dyer 1977a: 17) Bruyns in Bruyns *et al*. (2017: 434), *C. pulchellior* Bruyns in Bruyns *et al*. (2017: 433), and *C. remota* (Dyer 1976: 55) Bruyns in Bruyns *et al*. (2017: 435) (see Figs 1A–L). Here we describe a further species of *Ceropegia*, *C. gilboaensis* from KwaZulu-Natal in South Africa, which, based on its prostrate stems and foul-smelling, burgundy striated flowers fitting the brood-site mimicry syndrome, is placed in *C.* sect. *Chamaesiphon*. It is clearly separable on the basis of a combination of vegetative and floral characters.

Materials and methods

The description of *Ceropegia gilboaensis* is based on morphological investigation of plants in habitat and of spirit preserved material. Measurements were taken using hand-held digital callipers and a Motic SMZ 168 Stereo microscope reticule. Relevant literature was consulted when comparing characters of the new species with other *Ceropegia* species exhibiting similar vegetative and floral traits; fresh material of a subset of such species was also examined. Authors of the plant names follow IPNI (2022+) but in the notation required by *Phytotaxa*; herbarium codes follow Thiers (2022 [continuously updated]). Nomenclatural issues are in accordance with the Shenzhen Code (Turland *et al*. 2018).

Results

Ceropegia gilboaensis is distinct from other brood-site mimicking species in *C.* sect. *Chamaesiphon* in combining the following characters: prostrate stems with ovate-elliptic leaves, cylindrical-campanulate and glabrous corollas up to 6.3 mm deep, the fused corolla portion being ±1/2, and with transverse burgundy bands, and verrucose follicles (see also Table 1). It is, however, considered most similar to the KwaZulu-Natal endemic *C. ngomensis* (found in grasslands in the vicinity of Ngome in Zululand, Fig. 2) with regard to both growth habit and floral morphology. Two further endemics from KwaZulu-Natal which are superficially similar and occur in closer geographic proximity (Fig. 2) to *C. gilboaensis* are *C. modestantha* (Fig. 1H) and *C. pulchellior* (Fig. 1K). *Ceropegia gilboaensis* may be mistaken for *C. modestantha* based on its campanulate flowers, and with *C. pulchellior* due to its similar vegetative habit. Given its unique syndrome of characters (Table 1), *C. gilboaensis* is clearly separable as a new species.

TABLE 1. Morphological features of non-trap, brood-site mimicking species in *Ceropegia* sect. *Chamaesiphon* which occur in KwaZulu-Natal and neighbouring provinces and countries (see also Fig.1).

***Ceropegia* species**	**Habit**	**Leaves**	**Corolla**	**Corolla lobes**	**Corolla trichomes**	**Proportion of corolla fused**
C. gilboaensis*	prostrate	ovate-elliptic	cylindrical-campanulate, 4.5–6.3 mm deep	narrowly triangular, keeled	no	±1/2
C. alpina	prostrate to sub-erect	broadly-ovate to oblong-lanceolate	broadly campanulate, *ca.* 2 mm deep	triangular	yes	±1/2
C. australis*	sub-erect to erect	narrowly elliptic-lanceolate	campanulate, *ca.* 3 mm deep	ovate-lanceolate, attenuate	yes	±1/3
C. bruceae	prostrate	ovate to broadly ovate	flat or shallowly saucer-shaped	ovate-lanceolate	no	±1/3 or less
C. campanuliformis	erect to sub-erect	ovate-elliptic	campanulate	broadly triangular, longitudinally striated	yes	±2/3

...continued on the next page

TABLE 1. (Continued)

Ceropegia species	Habit	Leaves	Corolla	Corolla lobes	Corolla trichomes	Proportion of corolla fused
C. chlorozona*	sub-erect	ovate-elliptic	bowl-shaped, 4–6 mm deep	broadly triangular-ovate	yes	±1/2
C. coddii*	prostrate	ovate to broadly ovate	shallowly saucer-shaped, *ca.* 3 mm deep	lanceolate, rarely triangular	no	±1/3 or less
C. modestantha*	erect to sub-erect	elliptic-lanceolate	campanulate, 2–3 mm deep	triangular to narrowly-triangular, apically tapering	no	±1/2 or less
C. ngomensis*	prostrate	ovate to lanceolate	cylindrical-campanulate, *ca.* 5 mm deep, distinctly keeled or fluted corolla lobe base	triangular-ovate, keeled	no	±1/2
C. perdita*	sub-erect to erect	ovate to elliptic	campanulate, 3–4.5 mm deep	ovate-lanceolate, replicate	yes	±1/5 or less
C. petrophila*	erect to sub-erect	elliptic-ovate to lanceolate	shallowly campanulate, 3–5 mm deep	basally ovate to lanceolate, apically tapering	yes	±1/3 or less
C. pulchellior*	prostrate	ovate to lanceolate	flat or shallowly saucer-shaped	ovate-lanceolate,	no	±1/3 or less
C. remota*	prostrate	broadly ovate to lanceolate	campanulate, *ca.* 3 mm deep	triangular, margins recurved	yes	±1/3
C. swazica	prostrate	broadly ovate	saucer-shaped, *ca.* 1.5–2 mm deep	triangular	yes	±1/3 or less
C. spathulata	sub-erect to erect	linear-lanceolate	campanulate, *ca.* 4–5 mm deep	lanceolate-linear	yes	±1/4 or less

*These species occur in KwaZulu-Natal.

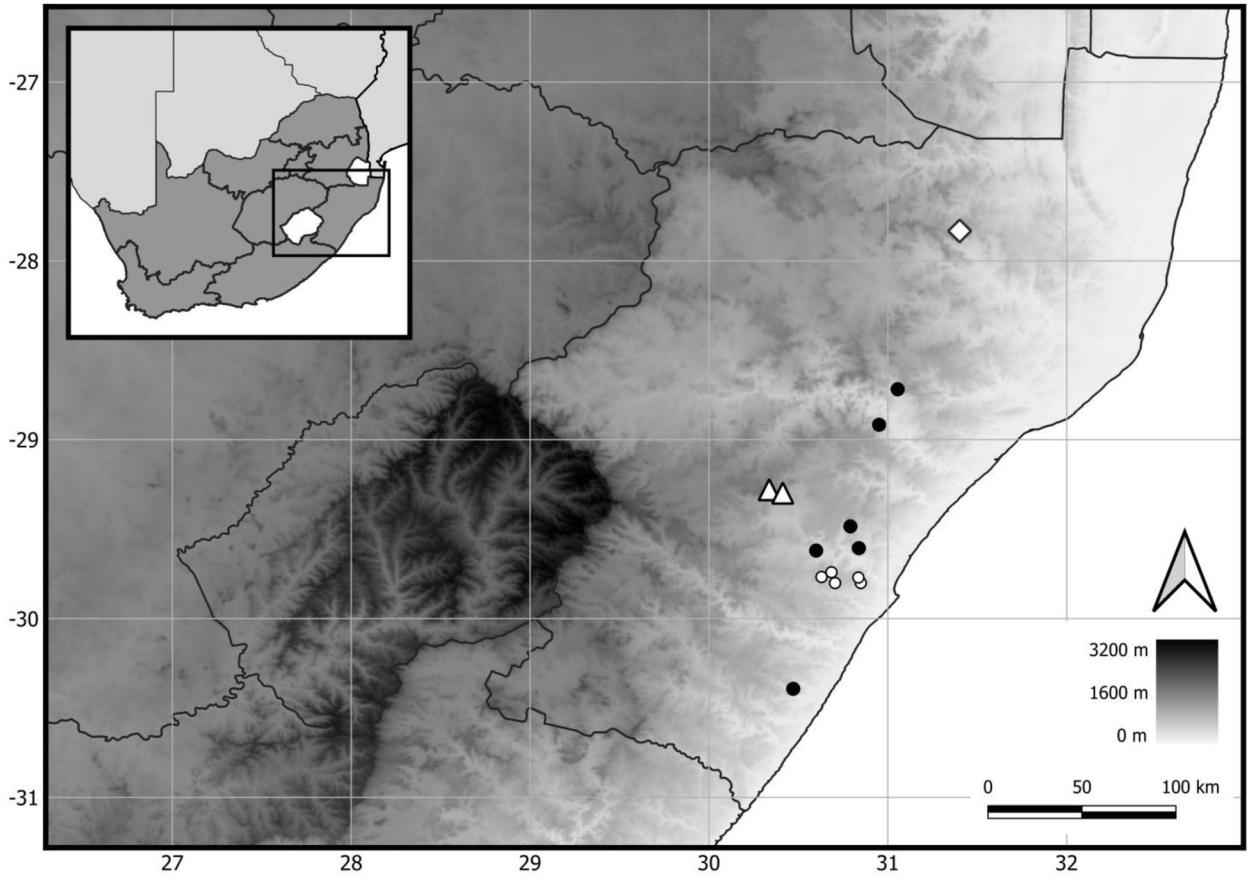

FIGURE 2. Known distribution of *Ceropegia gilboaensis* (open triangle), *C. modestantha* (filled circle), *C. pulchellior* (open circle) and *C. ngomensis* (open diamond).

Taxonomic treatment

Ceropegia gilboaensis Heiduk, N.R.Crouch & D.Styles ***sp. nov.*** (Figs 3, 4A−E, 5A)

Diagnosis:—Plants of *Ceropegia gilboaensis* are perennial tuberous succulents with a prostrate growth habit, ovate to elliptic leaves, verrucose follicles, and a cylindrical-campanulate corolla, that can be separated from *C. ngomensis* (Figs 1I, 5B) in lacking the distinctly keeled or fluted corolla lobe bases that embed the gynostegium forming a characteristic 5-star shaped corolla mouth in *C. ngomensis*. The basally fused corolla lobes of *C. gilboaensis* have transverse burgundy bands but are purple-mottled in *C. ngomensis*. In *C. gilboaensis*, the inner corona lobes are adpressed to the back of the stamens along their full length and closely proximate to subconnivent over the style-head, whilst in *C. ngomensis* they are short and only adpressed to the base of the stamens. The outer corona lobes are deeply bifid in *C. gilboaensis* but undivided to form five cups with incurved margins in *C. ngomensis*.

Type:—SOUTH AFRICA. KwaZulu-Natal, the Karkloof, Mt Gilboa, *ca*. 1620 m, 12 November 2020, *D.G.A. Styles & A. Heiduk 5841* (holotype; NU0092539!).

Description:—Perennial dwarf herb. *Root* a subterranean tuber, 20–40 mm in diameter, *ca*. 20 mm high, somewhat depressed on upper side, rounded below. *Stems* 1 or 2, up to 150 mm long, produced annually, branched sparingly at base, slender, creeping, prostrate, shortly pubescent. *Leaves* in 3–6(–8) pairs, shortly petiolate (to 1.7 mm long), lamina elliptic-ovate, 10–12 × 7–9 mm, ciliate with white hairs along the thin often purplish margins, pubescent above and below, venation prominent on lower surface and recessed on upper surface, basally rounded, apically acute. *Flowers* 1(–2) lateral at nodes, open in succession, with pungent fetid, slightly acidic-fecal floral scent; pedicels slender, pubescent, 6–7 mm long. *Sepals* narrowly triangular, 2.2–3.7 mm long, sparsely pubescent. *Corolla* steep cylindrical-campanulate, *ca*. 13–14 mm across, corolla lobes spreading, divided into fused and unfused section ± halfway; tube 4.5–6.3 mm deep, velvety, glabrous (rarely with sparse white trichomes on margins of corolla lobe tips), cream within with raised, transverse burgundy bands that proximally are more entire than distally; lobes narrowly triangular, 3.3–5.4 mm long, keeled, concave above, proximally cream with raised burgundy striations, distally velvety and brownish-red to rarely olive-green. *Gynostegium* sessile, glabrous, dark purple. *Gynostegial corona* 3.6–4.4 mm in diam., 2.0–3.1 mm high, of staminal and interstaminal parts, *interstaminal (outer) corona lobes* joined to form a cup with V-shaped outer margin, deeply bifid, lobules *ca*. 0.3 mm long, falcate, inclined towards the inner lobes; *staminal (inner) corona lobes* adpressed to stamina along their entire length and incumbent on style-head, linear, *ca*. 1.7 × 0.3 mm, apices inclined over the staminal column, closely proximate to subconnivent. *Pollinarium* pollinia sagittate, *ca*. 450 × 400 µm, brownish, insertion crest *ca*. 250 µm long, stramineous; caudicles *ca*. 90 µm long; corpusculum sagittate, *ca*. 315 × 140 µm, brown. *Follicle* with both mericarps developing, erect, *ca*. 40–45 mm long and 4 mm at widest point, verrucose, green flecked with purple, maturing to purple-brown. *Seeds* ovate-elliptic, *ca*. 6 × 2 mm, brown, comose, coma *ca*. 7 mm, white.

Additional material examined:

Ceropegia gilboaensis: SOUTH AFRICA. KwaZulu-Natal, the Karkloof, Mt Gilboa, *ca*. 1630 m, 03 April 2022, *D.G.A. Styles & A. Heiduk 6032* (NU0092540!; fruiting material).

Distribution and ecology:—*Ceropegia gilboaensis* is to date known only from the Karkloof in the KwaZulu-Natal Midlands, South Africa. It is the only representative of the genus documented from the Karkloof, and is considered endemic there, at elevations of 1320−1670 m. This new species is found within grassland, growing exposed in shallow soil on the margins of, and in between, dolerite rock outcrops. Common grasses at the sites include *Aristida junciformis* Trin. et Rupr. (1842: 143) and *Sporobolus natalensis* (Steudel 1855: 154) Durand & Schinz (1894: 822). Associated herbaceous species include *Aloe neilcrouchii* Klopper & Smith (2010: 95), *Crassula dependens* Bolus (1881: 391) and *Ledebouria sandersonii* (Baker 1870: App. 5) Venter & Edwards (2003: 50).

The national vegetation map shows that *C. gilboaensis* occurs in Midlands Mistbelt Grassland and Mooi River Highland Grassland (South African National Biodiversity Institute 2006–2018). In this area, Midlands Mistbelt Grassland appears to have been mapped as occurring below a contour approximating an elevation of 1500 m, and Mooi River Highland Grassland above this. However, this likely represents an over-simplification of the floristics in contact areas, where *C. gilboaensis* occurs just above 1500 m.

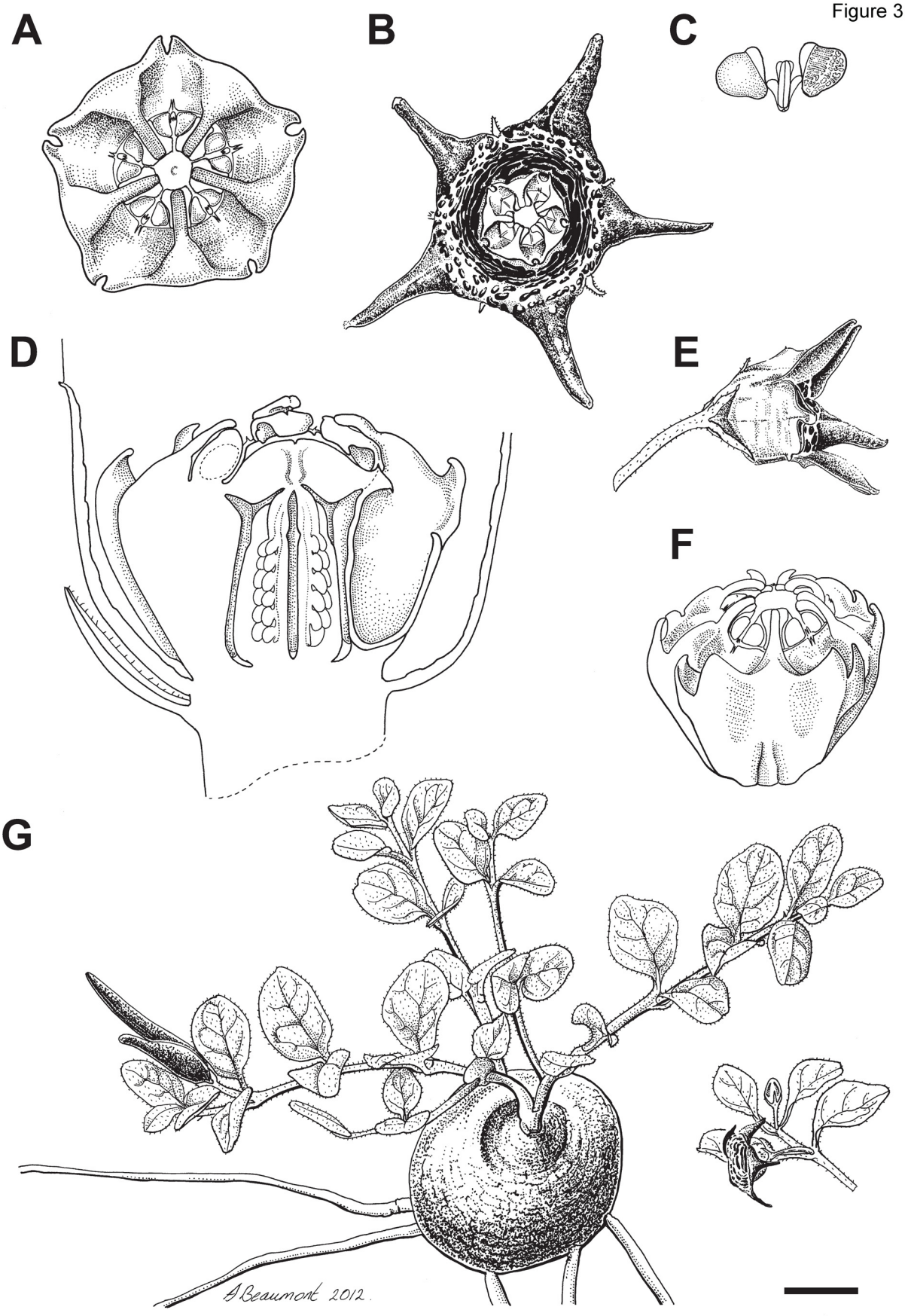

FIGURE 3. *Ceropegia gilboaensis*. A, Gynostegium in dorsal view; B, Flower in dorsal view; C, Pollinarium; D, Half flower detail; E, Flower in lateral view; F, Gynostegium in dorso-lateral view; G, Habit with detached flowering shoot. Scale bar: A: 1 mm; B: 2.5 mm; C: 0.6 mm; D: 0.8 mm; E: 4 mm; F: 1.3 mm; G: 10 mm. Artist: Angela Beaumont.

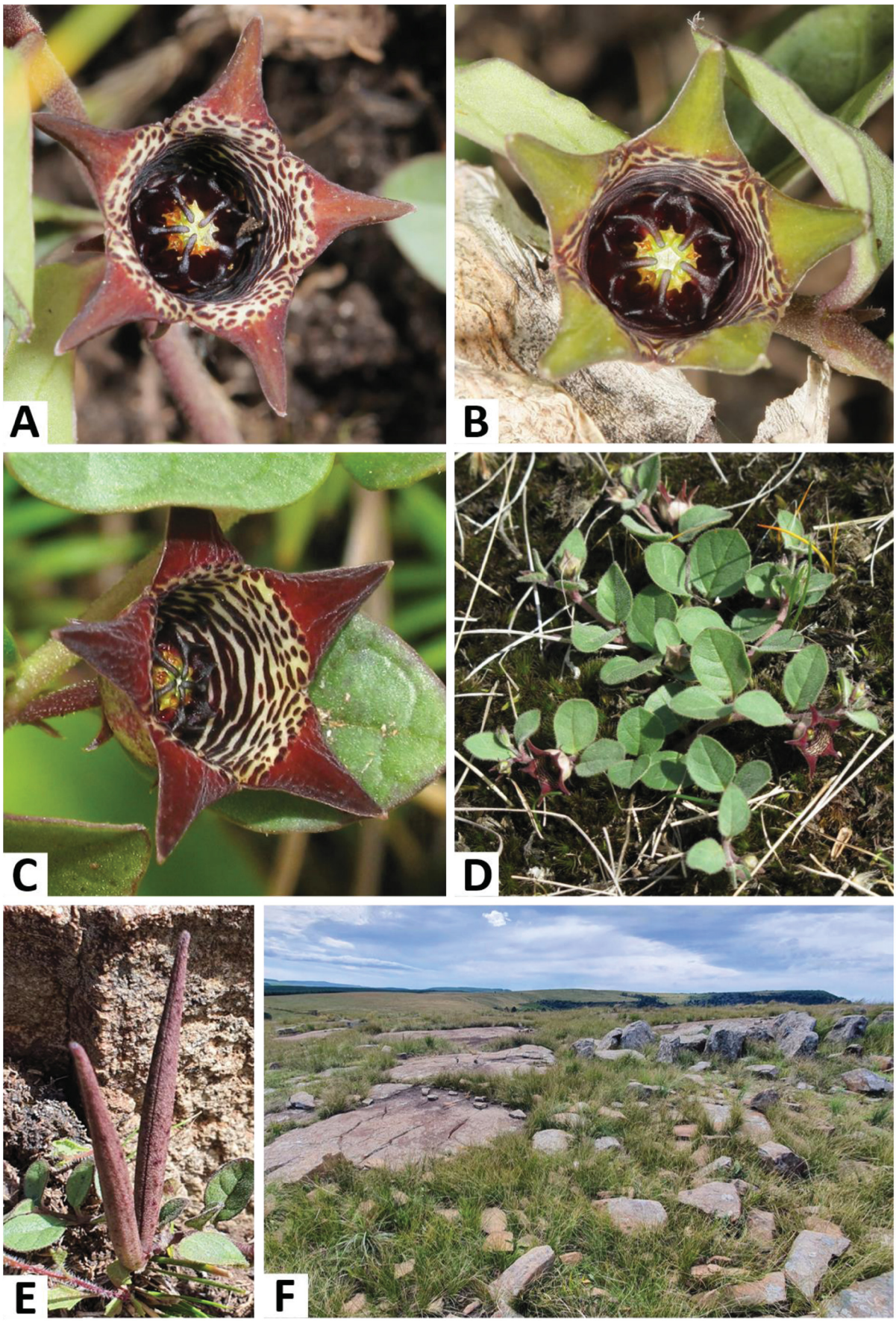

FIGURE 4. *Ceropegia gilboaensis* (Karkloof, KwaZulu-Natal Midlands, South Africa). A, Common brownish-red colour form; B, Rare olive-green colour form; C, Flower lateral view showing the deep cylindrical-campanulate tube; D, Whole habit; E, Mature follicle; F, Habitat. Photographs: David Styles (A,B,E,F); Neil Crouch (C,D).

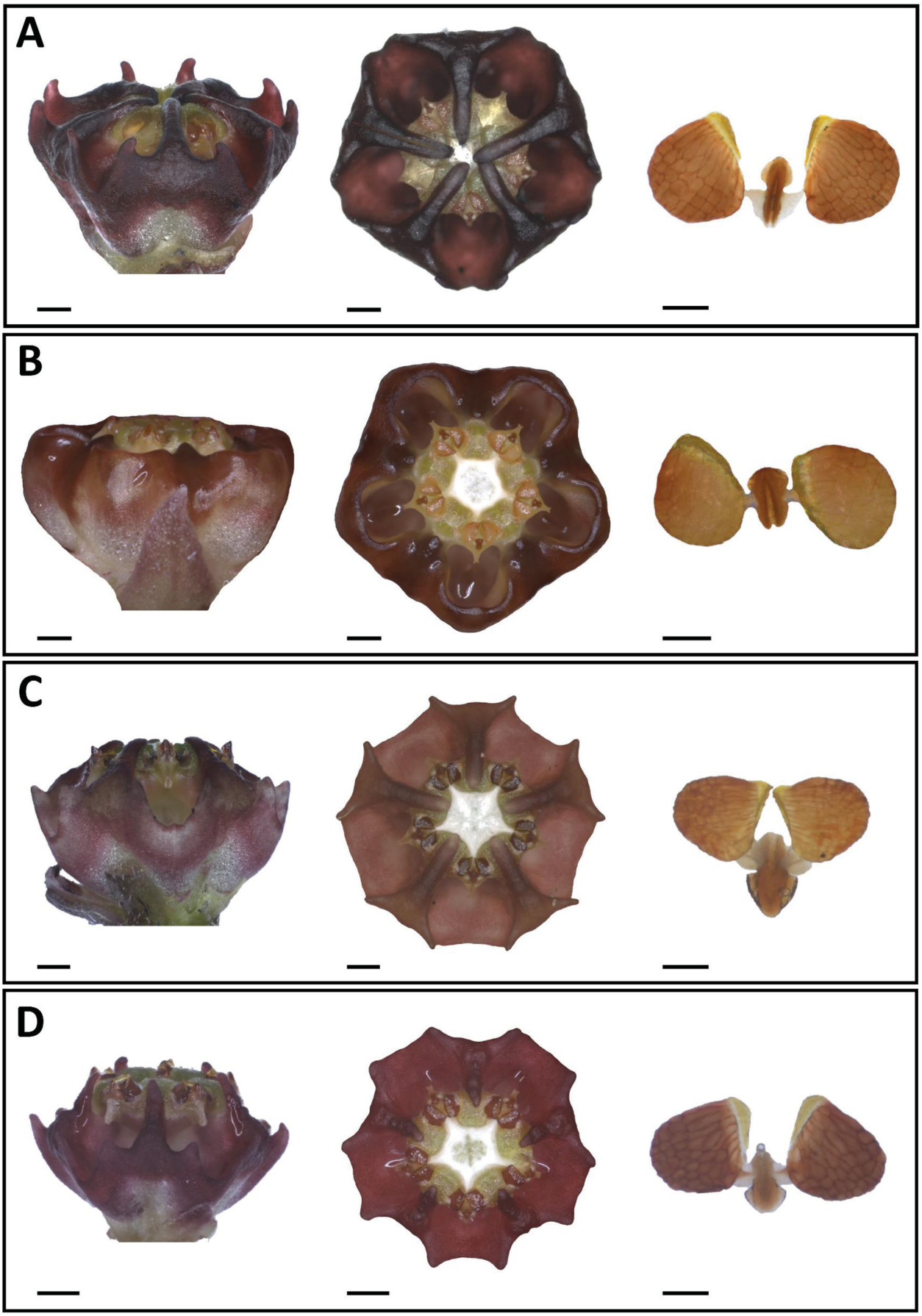

FIGURE 5. Gynostegial corona in lateral (left) and dorsal (centre) view, and pollinaria (right). A, *Ceropegia gilboaensis*, B, *C. ngomensis*; C, *C. modestantha*; D, *C. pulchellior*. Scale bars: 0.5 mm (gynostegia), 200 µm (pollinaria). Photographs: Annemarie Heiduk.

Midlands Mistbelt Grassland is described as "forb-rich, tall, sour *Themeda triandra* [Forsskal (1775: 178)] grasslands transformed by the invasion of native Ngongoni grass (*Aristida junciformis* subsp. *junciformis*). Only a few patches of the original species-rich grasslands remain." (Mucina *et al*. 2006: 422). This vegetation type is "Endangered (one of the most threatened vegetation types of KwaZulu-Natal)" according to Mucina *et al*. (2006: 423). Furthermore, the Mistbelt of KwaZulu-Natal has been identified as an important centre of endemism (Mucina *et al*. 2006), although not yet formally recognized as such (Mucina *et al*. 2006; Van Wyk & Smith 2001). More limited floristic information is provided on Mooi River Highland Grassland, which is also considered threatened, but with the status of Vulnerable rather (Mucina *et al*. 2006).

Phenology:—Seen in flower from October to December, and in fruit from January to April.

Etymology:—*Ceropegia gilboaensis* is named for the type locality at Mt Gilboa in the Karkloof, South Africa, where it was discovered in 2008 by Isabel Johnson, a field botanist, ecological consultant and dedicated conservationist.

Conservation Status:—*Ceropegia gilboaensis* is only known from two localities 7.5 km apart from each other. At each locality, plants were observed within an area of less than 1 km^2. However, a study of aerial imagery indicates that within the surrounding landscape there may be a further 35 km^2 of similar habitat in which *C. gilboaensis* could potentially occur. The total number of plants is estimated at less than 250 individuals. The grassland habitat at one of the two localities suffers from the trampling effects of cattle, but does not otherwise appear to be under anthropogenic threat. The species' conservation status is suggested as Endangered (EN) under IUCN criteria B2(a)(b)(iii) and D (IUCN Standards and Petitions Subcommittee 2019).

Discussion

Ceropegia gilboaensis is a new species in section *Chamaesiphon*, the largest section in *Ceropegia* s.l. with 115 tuberous species (Bruyns *et al*. 2017). The overwhelming majority (*ca*. 90%) of these are species with open non-trapping, brood-site mimicking flowers; species with kettle-trap flowers have evolved in at least three subclades within the section (Bruyns *et al*. 2017). Many non-trap flowered species in sect. *Chamaesiphon* convergently evolved morphological features considered typical for brood-site mimicking plants, i.e., prostrate or sub-erect stems, foul smelling, reddish-purplish or maroon speckled or striated flowers presented close to the ground (Johnson & Schiestl 2016; Fig. 1A–L).

Among the brood-site mimicking species in sect. *Chamaesiphon*, *C. gilboaensis* appears to be most closely related to *C. ngomensis* (Fig.1I)—a KwaZulu-Natal endemic species only known from the area of Ngome, about 220 km north-east of the Karkloof where *C. gilboaensis* occurs. *Ceropegia ngomensis* is the only other South African species presenting similarly structured steep cylindrical-campanulate corolla tubes in combination with prostrate stems. Preliminary unpublished molecular findings support a close relationship between both species (Heiduk *et al*. unpublished). Although *C. gilboaensis* also shares particular vegetative and floral characters with other brood-site mimicking members of sect. *Chamaesiphon* occurring in KwaZulu-Natal and adjacent regions, it may be distinguished as explicated below (see also Table 1).

The prostrate stems with elliptic leaves of *C. gilboaensis* are distinct from the sub-erect to erect stems with commonly elliptic- or ovate-lanceolate leaves of *C. alpina* (Dyer 1977a: 18) Bruyns in Bruyns *et al*. (2017: 433), *C. australis*, *C. campanuliformis*, *C. chlorozona*, *C. modestantha*, *C. perdita* (Dyer 1977a: 10) Bruyns in Bruyns *et al*. (2017: 434), *C. petrophila* and *C. spathulata* (Lindley 1827: t. 1113) Bruyns in Bruyns *et al*. (2017: 435).

The corolla of *Ceropegia gilboaensis* is, with rare exception (one plant found with sparse white trichomes on corolla lobe margins), glabrous, allowing for separation from *C. alpina*, *C. australis*, *C. campanuliformis*, *C. chlorozona*, *C. perdita*, *C. petrophila*, *C. remota*, *C. swazica* (Dyer 1976: 56) Bruyns in Bruyns *et al*. (2017: 435) and *C. spathulata* which all have distinctively puberulous, hirsute or pilose corolla lobes and/or vibratile hairs fringing the corolla lobes (Fig. 1, Table 1; Dyer 1980).

In *Ceropegia gilboaensis* the corolla is steep cylindrical-campanulate (Figs 3A–B, F, 4A–D), which is distinct from the bowl-shaped corolla of *C. chlorozona* (Fig. 1F) and the flat or shallowly saucer-shaped corollas of *C. bruceae* (Fig. 1E), *C. coddii* (Fig. 1G), and *C. pulchellior* (Fig. 1K). Campanulate corollas are also characteristic of *C. alpina*, *C. australis* (Figs 1A–D), *C. modestantha* (Fig. 1H), *C. perdita*, *C. petrophila* (Fig. 1J), *C. remota* (Fig. 1L) and *C. spathulata*. However, in these species the corollas are less steep and the corolla lobes generally proportionally longer than the fused portion of the corolla (*ca*. ±1/2 in *C. gilboaensis*, see Table 1); in *C. campanuliformis*, the corolla lobes are proportionally shorter (±1/3) than the fused part of the corolla.

The follicles of *Ceropegia gilboaensis* are verrucose, while they are smooth in all other species discussed here. Generally, raucous, non-smooth follicles are rather rare in *Ceropegia* although known for example from the succulent-leaved climbers *C. sandersonii* Hooker (1869: t. 5792), which has follicles markedly verrucose to tuberculate, and *C. cimiciodora* Obermeyer (1933: t. 488) in which species they are thinly tuberculate (Dyer 1980). Within sect. *Chamaesiphon*, verrucose follicles have not earlier been reported.

Ceropegia pulchellior and *C. modestantha* are two KwaZulu-Natal endemics that grow in rocky grasslands in relatively close proximity to *C. gilboaensis* (Fig. 2), which in view of their superficial similarity could lead to confusion with *C. gilboaensis*. However, in addition to the differences mentioned above, *C. gilboaensis* can be distinguished from these species as follows: when viewed from above, the sepals of *C. pulchellior* protrude from beneath the fused corolla portion, a feature not seen in *C. gilboaensis*. The spreading corolla lobe tips are basally ovate and distally attenuate-tapering and often reflexed in *C. modestantha* but are clearly triangular in *C. gilboaensis*. In *C. pulchellior* the gynostegium projects from the centre of the corolla whereas in *C. gilboaensis*, as also in *C. modestantha*, the gynostegium is sunk into the fused section of the corolla. The margin formed by the outer corona lobes is U-shaped in both *C. modestantha* (Fig. 5C) and *C. pulchellior* (Fig. 5D), while it is V-shaped in *C. gilboaensis* (Fig. 5A). The outer corona lobes are lower than the style-head in *C. modestantha* (Fig. 5C) and *C. pulchellior* (Fig. 5D) but are level with the style-head in *C. gilboaensis* (Fig. 5A).

Both *Ceropegia modestantha* and *C. pulchellior* occur on Natal-Group sandstone while *C. gilboaensis* occurs on dolerite, as does *C. ngomensis*. *Ceropegia modestantha* is relatively widely distributed, ranging from near Nkandla in the north, to the Little Noodsberg, and south to the Umzinto coastal escarpment (Dyer 1980; Styles & Wragg 2008). *Ceropegia pulchellior* has a more limited distribution than *C. modestantha*, occurring between Pietermaritzburg and Durban along a narrow line of suitable habitat (Styles & Wragg 2008), with an outlier subpopulation to the south, "on an isolated mountain top near Eston…" (Styles & Wragg 2008: 46), within the range of *C. modestantha*. There, both species apparently co-occur and probably hybridize (Styles & Wragg 2008). A third species occurring relatively close to *C. gilboaensis*, but ranging somewhat further to the northeast is *C. chlorozona*, which grows on dolerite as well as sandstone.

Other species in sect. *Chamaesiphon* share vegetative and/or floral characteristics with *C. gilboaensis* but are geographically separated from it. From north to south these species occur as follows: *C. bruceae* and *C. coddii* on the Mpumalanga escarpment and in areas of north-eastern eSwatini (Dyer 1980), with *C. coddii* also being recorded in KwaZulu-Natal (pers. obs.); *C. swazica* in eSwatini and adjacent Mpumalanga; *C. remota* in the Utrecht-Wakkerstroom-Paulpietersburg areas of KwaZulu-Natal; *C. petrophila* at Boston, Byrne and at Underberg in KwaZulu-Natal; *C. perdita* in the Drakensberg (Dyer 1980) above 2000 m near the trijunction of KwaZulu-Natal, Eastern Cape and Lesotho; *C. alpina* above 2300 m in southern Lesotho; *C. campanuliformis* and *C. spathulata* in the Eastern Cape; *C. australis* at Port Shepstone and as far south as Port St. Johns, restricted to Msikaba Formation sandstone. This last-mentioned species shows remarkable variation in flower colour and the length of the corolla lobes (Figs 1A–D; see also Dyer 1983), even within the same population (Figs 1A–C).

The following key distinguishes the 10 brood-site mimicking species of *Ceropegia* sect. *Chamaesiphon* which occur in KwaZulu-Natal and may be confused with *C. gilboaensis*:

1. Stems prostrate 2
- Stems sub-erect to erect 6
2. Flowers flat or shallowly campanulate, fused portion of corolla ±1/3 or less 3
- Flowers steep cylindrical-campanulate, fused portion of corolla ±1/2 4
3. Corolla flat or shallowly saucer-shaped, glabrous 5
- Corolla campanulate, with white trichomes on upper surface ..... *C. remota*
4. Corolla lobe bases purple mottled, distinctly fluted, mouth 5-star-shaped, corona lobes not covering the style head .. *C. ngomensis*
- Corolla lobe bases with broken, transverse, burgundy bands, mouth not 5-star shaped, corona lobes covering style head ..... *C. gilboaensis*
5. Corolla flat, less than ±12 mm in diameter ..... *C. pulchellior*
- Corolla shallowly saucer-shaped, 17–20 mm in diameter ..... *C. coddii*
6. Corolla glabrous ..... *C. modestantha*
- Corolla papillate or with trichomes on upper surface 7
7. Corolla bowl-shaped, fused portion of corolla ±1/2 ..... *C. chlorozona*
- Corolla (shallowly) campanulate, fused portion of corolla ±1/3 or less 8
8. Leaves narrowly elliptic-lanceolate, trichomes on upper corolla surface ..... *C. australis*
- Leaves ovate to elliptic to lanceolate, with or without trichomes on corolla lobe margins 9
9. Flowers 2–several, corolla papillate, rugose ..... *C. perdita*
- Flowers solitary, corolla margins with long trichomes, tubers finger-like, irregularly shaped ..... *C. petrophila*

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