Blumea 69, 2024: 201–210
www.ingentaconnect.com/content/nhn/blumea

RESEARCH ARTICLE

https://doi.org/10.3767/blumea.2024.69.03.01

Cassytha (*Lauraceae*) in Africa and the description of a new species from Gabon

J.J. Wieringa[1], E.L.A.N. Simons[1]

Key words

cryptic species
graminicola
hemiparasitic
key
map
taxonomy

Abstract *Cassytha* is a (hemi)parasitic genus of *Lauraceae* with its main diversity in Australia. To characterise a new species from Gabon, we studied and revised the African species of this genus. Previously 3 or 4 taxa were recognised to occur in Africa, in this study we recognise 5 species; next to our new species we resurrect *Cassytha schliebenii* to species level. The new species, *Cassytha graminicola*, is parasitising on monocotyledons, especially grasses, and is likely the first recorded annual among the *Lauraceae*. *Cassytha paradoxae* from the New World also seems to use monocotyledons as host, and should be recognised as a valid species.

Citation: Wieringa JJ, Simons ELAN. 2024. Cassytha (Lauraceae) in Africa and the description of a new species from Gabon.
Blumea 69 (3): 201–210. https://doi.org/10.3767/blumea.2024.69.03.01.
Effectively published online: 5 November 2024.

INTRODUCTION

Within the otherwise completely woody *Lauraceae*, the twining, herbaceous and parasitic genus *Cassytha* Osbeck ex L. is the odd man out. Because of its completely different habit, but also several other unique morphological characters, *Cassytha* has been classified in the past as its own subfamily (Kostermans 1957) or even family (Lindley 1836). Although currently it is no longer considered as a separate subfamily but is classified in its own tribe, *Cassytheae*, *Cassytha* does constitute an old and fairly basal lineage of *Lauraceae* (Chanderbali et al. 2001, Rohwer & Rudolph 2005, Song et al. 2017) and diverged from its sister clade in the Upper Cretaceous between 102 and 79 mya (Yang et al. 2023). *Cassytha* in general is an Australian and Old World genus, except for the pantropical *C. filiformis* L. and the American *C. paradoxae* Proctor, with the highest diversity in Australia (Weber 1981). Modern regional treatments for Africa recognised three species, although they do not treat them all simultaneously (Verdcourt 1996, Diniz 1997). These three African species appear to be closely related, and due to the lack of vegetative characters, the circumscription and delimitation of the taxa is difficult and has changed over the years.

While curating specimens from Gabon, we came across a specimen that at first sight looked more like *Cuscuta* L. (*Convolvulaceae*), but based on its flowers clearly belonged to *Cassytha*. An examination of other Gabonese *Cassytha* material in WAG resulted in the discovery of a second specimen. Shortly after this discovery, the second author embarked on a collection trip in the coastal parts of Gabon and was able to find a third population of this clearly distinct species. During a similar mission of the first author a fourth population was discovered and studied. In the course of this study some more herbarium specimens have been collected in Gabon. This paper will deal with this new species, but we will also try to elucidate the taxonomy of the other African species of *Cassytha*. We follow synonymy of 'Plants of the World Online' (POWO continuously updated) unless stated otherwise.

[1] Naturalis Biodiversity Center, Nationaal Herbarium Nederland, P.O. Box 9514, 2300 RA Leiden, The Netherlands;
corresponding author e-mail: Jan.Wieringa@naturalis.nl.

MATERIAL AND METHODS

This study is based on the herbarium specimens present in BR, BRLU, COI, L, U and WAG (acronyms according to Thiers continuously updated), with in addition a loan of selected material from K. All species, except *C. schliebenii* Robyns & R.Wilczek, were studied in the field by the authors during various collection expeditions in tropical Africa and the Cape. Flowers and fruits were examined in dry state or after rehydrating. Where spirit material was present at WAG this was used as well.

RESULTS

Variation and delimitation of African Cassytha species

Before this study, three species of *Cassytha* were considered as accepted in Africa: the pantropical *C. filiformis* that occurs in most areas of tropical Africa from Senegal in the west to Madagascar, Mauritius and the Seychelles in the east, *C. pondoensis* Engl. from south-eastern Africa (South Africa to Tanzania) and *C. ciliolata* Nees from the Eastern Cape and Western Cape provinces of South Africa. The last flora to distinguish all three species is the treatment by Stapf (1912). In those days *C. pondoensis* and *C. ciliolata* were distinguished from *C. filiformis* by the shorter and more capitate inflorescences. Later studies (e.g., Verdcourt 1996) already found this character to be fairly variable in *C. pondoensis*. We consider it not reliable for identification purposes, although *C. filiformis* indeed has the tendency to have longer inflorescences with more flowers than the two other species. Moreover, the 'capitate' inflorescences are merely flowers concentrated at the very end of the peduncle,

where the 'spike'-like inflorescences also have flowers on the stalk of the peduncle, next to some at the very end.

Cassytha filiformis vs C. pondoensis s.lat.

Verdcourt (1996) mentions several characters for distinguishing *C. pondoensis* s.lat. (Fig. 2, 3) (sensu Diniz 1997, Vercourt 1996: including *C. schliebenii*) from *C. filiformis* (Fig. 1). Our analysis of flowers of these two entities shows that only one of these characters – hairiness of the inside of the petals – really shows a discontinuous distribution and we regard it as a reliable character to distinguish between these two entities. When material is identified using only this character, all material with densely rusty-hairy inflorescences (a character used by Diniz 1997) ends up in *C. pondoensis*, but also some specimens that are nearly glabrous, rendering general inflorescence indumentum unreliable (see also below). Next to the characters mentioned by Verdcourt (1996), we also found an additional one: there seems to be a difference in shape of the outer stamens between the two species: *C. filiformis* in general has distinct lateral 'teeth' resulting in an arrow-shaped stamen and is usually hardly ciliate (though Fig. 1d is ciliate), while *C. pondoensis* shows a more rounded lateral margin that is often clearly ciliate (Fig. 2d), although usually not ciliate in the *C. schliebenii* material (Fig. 3g). *Cassytha pondoensis* in general has a

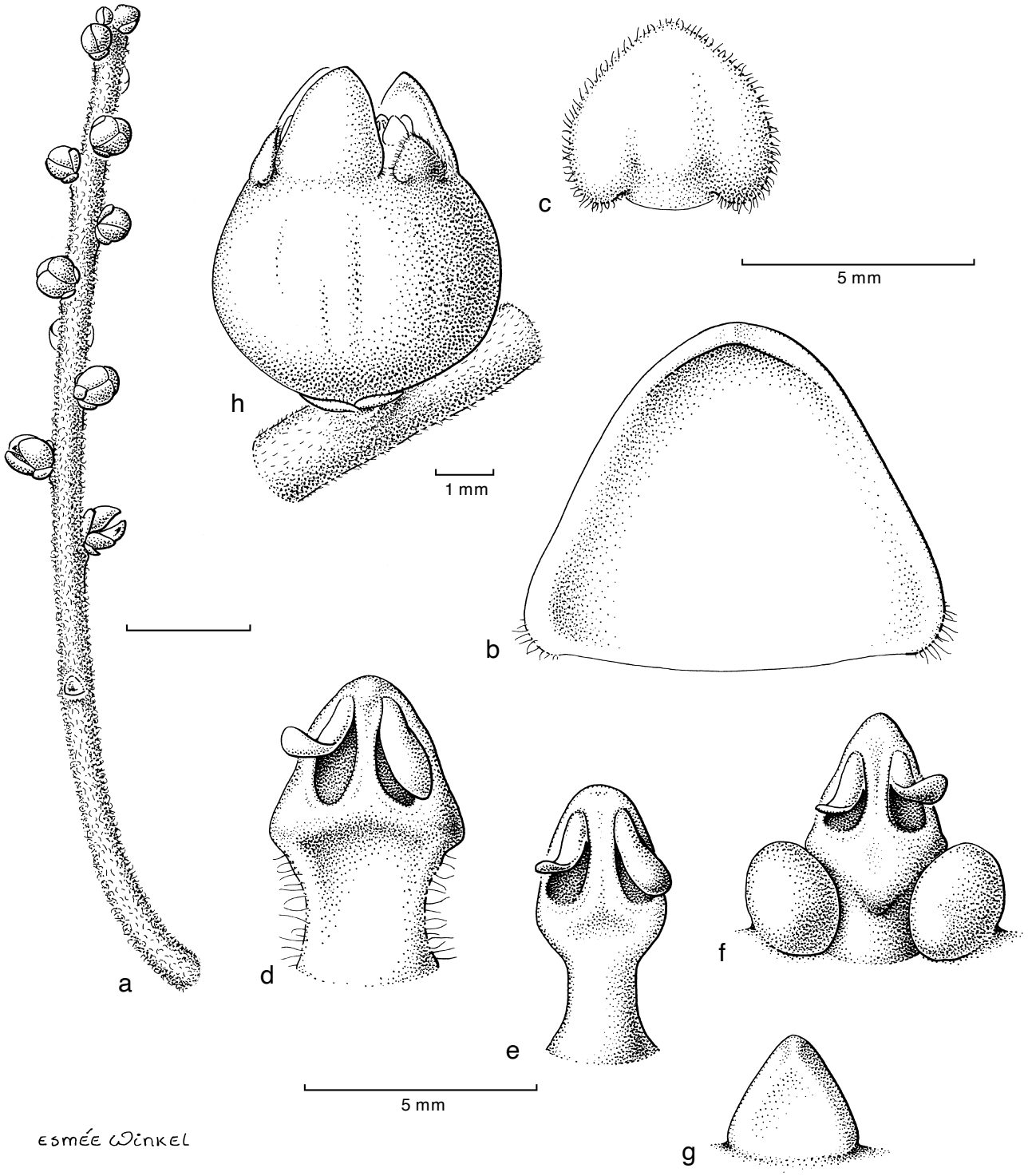


Fig. 1 *Cassytha filiformis* L. a. Inflorescence; b. petal from inside; c. sepal from outside; d. stamen of first (= outer) row, from inside; e. stamen of second row, from inside; f. stamen of third row, from outside; g. staminode (4th row); h. fruit surrounded by the hypanthium and floral remains (*Wieringa 7677*, WAG-spirit). — Drawing Esmée Winkel.

hairy hypanthium outside (glabrous in *C. filiformis*), but when it matures it is mostly glabrescent, rendering this character not useful for material with only mature fruits, but at least as long as the ovaries develop, the hairs are present in this species, and it does constitute a reliable character.

However, among the hundreds of specimens examined of *C. filiformis*, we found three complicating specimens from Gabon and Equatorial Guinea. In our opinion these specimens clearly belong to *C. filiformis*. *Breteler 13155* shows densely ciliate petals, with a few hairs on the inner side of the petals as well; also the filaments are hairy, which is unusual for this species. *Lisowski M-190* has inflorescences with normal flowers and one inflorescence that shows very hairy flowers; not only the petals are hairy on both sides, but even the stamens are completely covered in hairs. *Breteler 12163* shows both very hairy flowers and nearly glabrous ones in the same inflorescence, each on a different side. One flower even has one hairy petal and one glabrous petal next to each other. Since the peduncle and rachis are also hairy on one side and glabrous on the other, we speculate this plant is a chimera that for a part has a freak character, caused by a single mutation, that makes it hairy. So, the shift from glabrous to hairy inflorescences likely is caused by this mutation and seems a character that could easily be misleading in some specimens. However, in such cases all

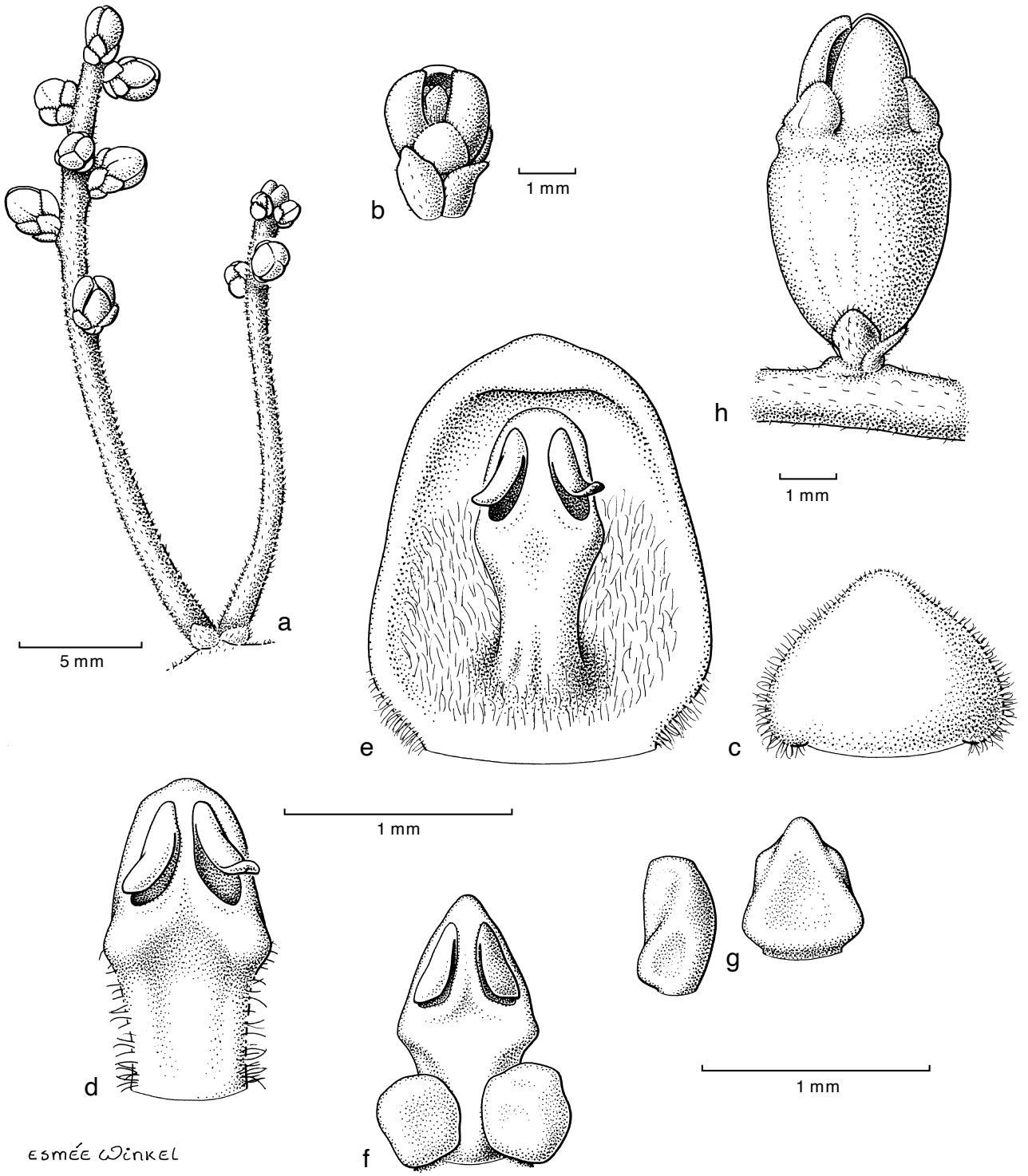


Fig. 2 *Cassytha pondoensis* Engl. a. Inflorescence; b. flower; c. sepal from outside; d. stamen of first (= outer) row, from inside; e. petal with stamen of second row, from inside; f. stamen of third row, from outside; g. staminodes (4th row), lateral and inside view; h. fruit surrounded by the hypanthium and floral remains (*Wieringa 8030*, WAG). — Drawing Esmée Winkel.

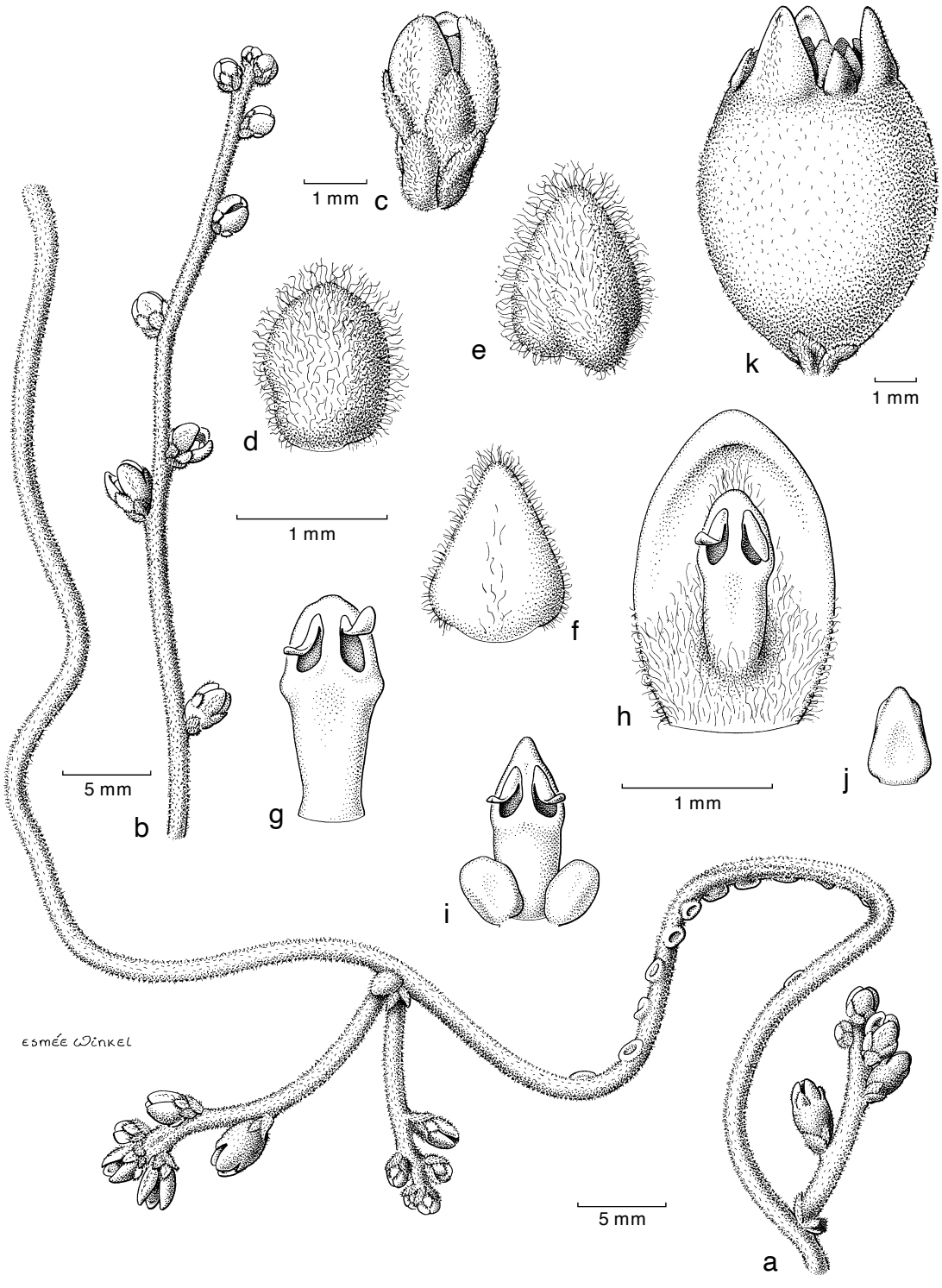
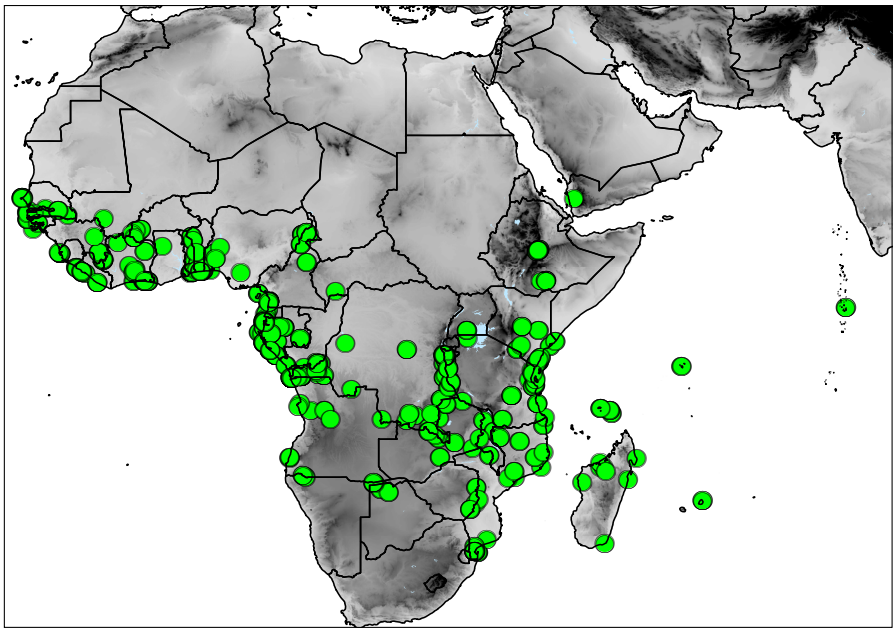


Fig. 3 *Cassytha schliebenii* Robyns & R.Wilczek. a. Stem with haustoria and inflorescences; b. inflorescence; c. flower; d. bract from outside; e. bracteole from outside; f. sepal from outside; g. stamen of first (= outer) row, from inside; h. petal with stamen of second row, from inside; i. stamen of third row, from outside; j. staminode (4th row); k. fruit surrounded by the hypanthium and floral remains (a–j: *Stolz 574*; k: *Jean Pawek 6850*; all WAG). — Drawing Esmée Winkel.

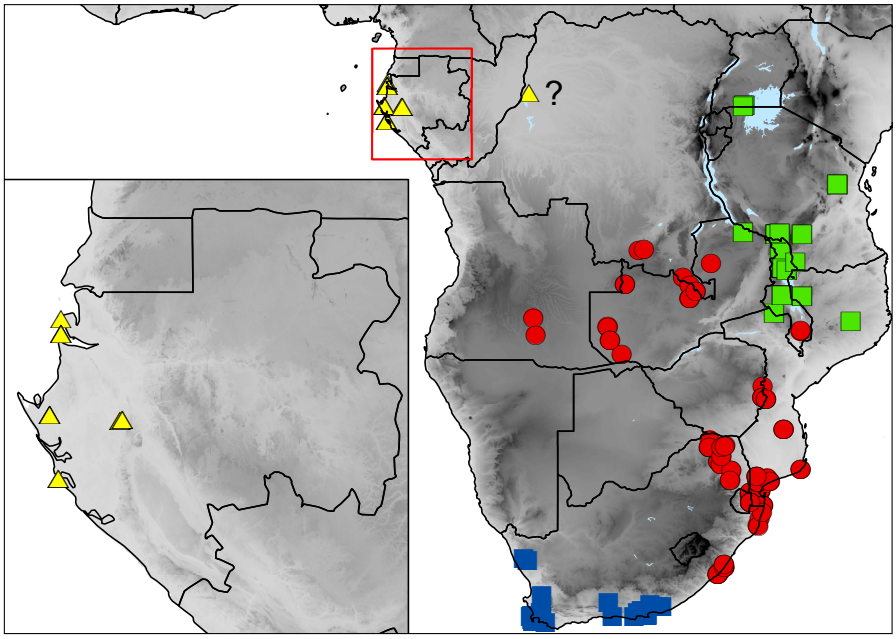
elements become more hairy, not only the inside of the petals. Because we found different congruent characters to separate *C. filiformis* and *C. pondoensis*, and both taxa clearly have different, partly overlapping, distributions (compare Map 1 and 2, respectively), we consider them as distinct species. Where there is a tendency for specimens to vary in indumentum density, the presence of hairs on specific organs should be valued as more significant, but attention should be paid to parts of the plant with seemingly freak hairiness, which is manifested even in organs that are not supposed to be hairy. We encountered one collection from Zimbabwe (*Wild* 56) with the inside of the petals glabrous that we still consider to be *C. pondoensis* based on a branching inflorescence, hairy hypanthium and stamen- and sepal-shape fitting this species.

As far as hypanthium colour in mature fruits is mentioned on labels, *C. filiformis* is reported as green to white, while *C. pondoensis* is often reported as red and only once as white. Further studies may reveal the use of hypanthium colour between these species.

Typically, *C. filiformis* and our new species *C. graminicola* have single none-branching inflorescences, while the other species regularly show multiple or branching inflorescences from the same axil. An exception is formed by *C. filiformis* material from



Map 1 Distribution of *Cassytha filiformis* in Africa.



Map 2 Distribution of *Cassytha* species in Africa except *C. filiformis*. *Cassytha ciliolata* (■); *C. graminicola*, also in more detail on the inset map (▲); *C. pondoensis* (●); *C. schliebenii* (■).

the Seychelles that is regularly branching as well, but in all other aspects relates to *C. filiformis*.

Cassytha pondoensis s.str. vs C. schliebenii

Diniz (1997) and Verdcourt (1996) considered *C. schliebenii* (Fig. 3) to be conspecific with *C. pondoensis* (Fig. 2), where Diniz (1997) still recognised it as a variety (*C. pondoensis* s.lat.). The difference would be the shape of the sepals and denser rusty indumentum, also in fruit. We found the sepal shape difference to be present indeed, and that this character has a geographical component: all specimens from the north-eastern half of the distribution area of *C. pondoensis* s.lat. have the narrower sepals characteristic for *C. schliebenii* (Map 2). Moreover, all specimens with narrower sepals are very hairy, where specimens with the broader sepals vary from nearly glabrous to very hairy. Especially the indumentum on the outside of the sepals and petals is distinctive (Table 1). Verdcourt (1996) lumped both species, because in his opinion some of the characters used by Diniz (1997, as 'unpublished' seen by Verdcourt) would not be constant. For a part of these characters he was right, but apparently Verdcourt did not even have a clear view on the segregation of these two taxa with *C. filiformis* since he identified the only record we have seen of *C. schliebenii* from Uganda as *C. filiformis*. We agree that spike length does not distinguish the two, nor does stem indumentum. However, we consider sepal shape, sepal-, petal- and mature fruit indumentum enough characters to maintain both taxa as separate species.

Future research might also check hypanthium colour in ripe fruits. Based on the few herbarium labels relating to 'fruit'-colour, *C. schliebenii* would have green, reddish tinged green and red 'fruits', while those of *C. pondoensis* seem quite variable, being described as green, white, opaque yellow, orange-green or red. Collectors are encouraged to not only assess the colour of the

hypanthium around the fruit (which is usually described as the fruit colour), but also to note down the colour of the actual fruit which is hidden inside the hypanthium.

Cassytha ciliolata vs C. filiformis and C. pondoensis

To our surprise we could not find any recent treatment that segregates *C. ciliolata* (Fig. 4) from either *C. filiformis* (Fig. 1) or *C. pondoensis* (Fig. 2). As discussed above the characters used by Stapf (1912) are not reliable on their own. However, we do consider *C. ciliolata* a distinct species. *Cassytha ciliolata* is a very common species in the Cape region and geographically isolated from all other species (Map 1, 2). It can be recognized because its mature stem is always glabrous and it (nearly) always has a short (< 17 mm long) capitate inflorescence that often branches at the base. In one case (*Thode A985*) we found a single inflorescence of 38 mm long; which is also unusual since it is spicate. Unusually long inflorescences were also observed in *C. filiformis* and *C. schliebenii* (up to 130 mm long) and seem to be a mixed form of a new stem and an inflorescence. They are a nuisance for an identification key, but do not challenge the fact that these entities should be recognised as species.

Cassytha filiformis may also be glabrous, but in general has a spicate inflorescence that rarely branches (except on the Seychelles, see above). *Cassytha pondoensis* may have capitate inflorescences, but is usually more hairy and at least its petals are hairy inside.

Sometimes gatherings of *C. filiformis* show short, mainly capitate looking inflorescences (e.g., *W.J.J.O. de Wilde 3247 & 4760*). The other characters of such collections, however, clearly point towards *C. filiformis* in our opinion.

The only other African species that shows a glabrous stem and capitate inflorescences is our new species *C. graminicola* from Gabon. However, that species has a hairy hypanthium, unbranched peduncles and much thinner stems. *Cassytha ciliolata* is the only African *Cassytha* that may have staminodes in the second row of stamens.

Cassytha graminicola

Our new Gabonese species actually is the easiest to recognise of all African species. It has very thin, completely glabrous stems. It deserves the name 'filiformis' far better than *C. filiformis* does, and, from a distance, looks more like a thin European *Cuscuta* than a *Cassytha*. Also the 6 ribs on the fruiting hypanthium are characteristic for this species.

Cassytha graminicola vs species outside Africa

The majority of *Cassytha* species occurs in Australia. Using the key of Weber (1981), *C. graminicola* keys out to clave 8, where *C. capillaris* Meisn. and *C. filiformis* are put next to each other. Neither circumscription fits, since the hypanthium (fruit) of *C. graminicola* is neither glabrous nor strigose. Other characters of *C. capillaris* that do not fit *C. graminicola* are the richer inflorescence (3–10 flowers), the completely red hypanthium and different shape of the stamens.

Outside Africa and Australia two more species are currently recognised. *Cassytha larsenii* Kosterm. has been described from Thailand and Indochina (Kostermans 1994), but contrary to *C. graminicola* it has villous young stems, sepals and petals. *Cassytha pergracilis* (Hatus.) Hatus. is an endemic species of the Ryukyu Islands (Japan) which has also been recorded to grow on grasses and *Cyperaceae* (Kokubugata &Yokota 2012). In contrast to the glabrous (sub-)capitate inflorescence of *C. graminicola* it has a sparsely hispid spike with really tiny bracts and bracteoles (c. 0.3 mm (Hatusima 1971) vs 0.6–1.1 mm in *C. graminicola*).

One more species with thin stems has been described but is currently not recognised by POWO (continuously updated),

Table 1 Morphological comparison of the African species of *Cassytha*.

	C. filiformis	*C. pondoensis*	*C. schliebenii*	*C. ciliolata*	*C. graminicola*
Young stems	glabrous to hairy	hairy	hairy	usually glabrous, rarely hairy	glabrous
Older stems	usually glabrous, sometimes hairy	often hairy	often hairy	glabrous	glabrous
Stem width of main developed stem (dry, mm)	0.5–1.7	0.6–2.1	0.65–2.0	0.75–1.9	0.25–0.6
Inflorescence branching	single (rarely branching)	often branching	sometimes branching	often branching	single
Inflorescence shape	spike	capitate to spike	capitate to spike	capitate	capitate
Peduncle and rachis length (mm)	12–50(–70)	3–40	3–20(–130)	2–16(–38)	2–7
Peduncle indumentum	glabrous to hairy	hairy to densely tomentose	densely tomentose	glabrous or brown-red to black hairy	glabrous
Sepal shape	broad, fairly rounded, constricted to base (heart-shaped)	broad, fairly rounded, triangular?	narrow, acute	broad, triangular to ovate	narrow, acute
Sepal indumentum outside	ciliate	ciliate	hairy outside and ciliate	ciliate	ciliate
Petals indumentum outside	glabrous	glabrous, rarely hairy at base	hairy, entirely or only at base	glabrous, rarely few hairs at base	glabrous
Petals indumentum inside	glabrous	hairy	hairy	glabrous to hairy	glabrous
Filaments of 1st stamen row	usually not ciliate	often ciliate	usually not ciliate	ciliate or not	not ciliate
Shape stamens of 1st row	distinctly broadened in teeth (arrow-shaped)	slightly broadened	slightly broadened	toothed or knobbed	gradually widening
2nd row of stamens	fertile	fertile	fertile	fertile to sterile	fertile
Hypanthium outside	glabrous	hairy when young, usually glabrous in mature fruit	hairy, also in mature fruit	glabrous	hairy
Hypanthium colour in fruit	green to yellow, rarely white	green, green-orange to red, rarely white or opaque yellow	(green?) reddish tinged to red	red	green-yellow with red petals

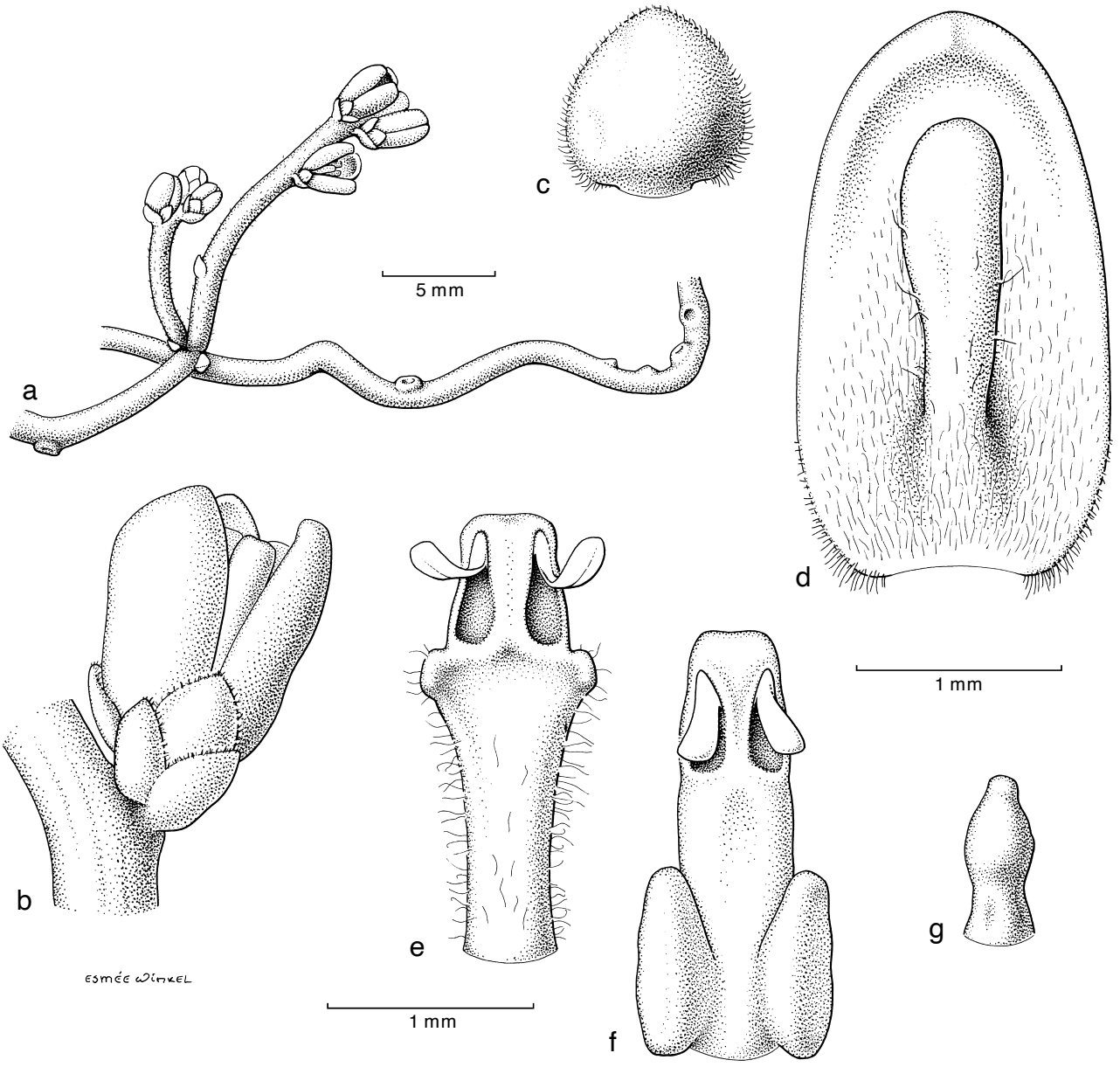


Fig. 4 *Cassytha ciliolata* Nees. a. Stem with haustoria and inflorescences; b. flower; c. sepal from outside; d. petal with staminode of second row, from inside; e. stamen of first (= outer) row, from inside; f. stamen of third row, from outside; g. staminode (4th row) (*Wieringa 7934*, WAG-spirit). — Drawing Esmée Winkel.

probably because it was mentioned as synonym of *C. filiformis* by Van der Werff (2001) without further discussion. *Cassytha paradoxae* from Honduras, Surinam and Brazil (Proctor 1983) has subsessile, (usually) solitary and relatively large flowers (2–3 mm long). It also differs from *C. graminicola* by its red-pubescent young stems, larger scale leaves and larger, red hypanthium in fruit. Especially the solitary flowers make this species quite unique in *Cassytha*, although we found one inflorescence with 2 flowers on one of the paratypes, *Harley 15718* (U). In our opinion *C. paradoxae* should be recognised as a valid species. It occurs in Guyana as well (*Maas & Westra 4031*, U).

We consider the new species to be an annual. Its thin stems render it less likely to survive long droughts. Moreover, we consider it to be parasitizing only on grasses and other herbs, which all die during the dry season, and more so, because most of these savannas get burned every dry season, which would certainly kill such a fragile plant. According to Weber (1981), all *Cassytha* species known so far are perennials that, at least with some stems, are parasitising on woody plants and survive the dry season by using these woody plants for water. Weber apparently missed *C. pergracilis*, which is growing on *Cyperaceae* and *Gramineae*, and after this overview Proctor (1983) described *C. paradoxae* which seems to be growing on herbs as well. Proctor does not state explicitely whether his species is an annual or perennial species. If we are correct, *C. graminicola*, and possibly *C. pergracilis* and *C. paradoxae*, are the first *Cassytha*, and even *Lauraceae* species, that are annuals. It is most interesting that on three continents three *Cassytha* species exist that grow on monocotyledons, and that may all be annuals. Molecular studies must show whether they are closely related, or that this host-shift occurred three times, but given some of the other characteristics of these species they do not seem to be directly related. Australia, which harbours the largest diversity in *Cassytha*, seems to lack such a species.

Cassytha graminicola Wieringa & E.L.A.N.Simons, *sp. nov.* — Fig. 5, 6; Map 2

Cassytha graminicola differs from *C. filiformis* in its thinner stems, hairy hypanthium, capitate inflorescence and 6-ribbed hypanthium in fruit. — Type: *E.L.A.N. Simons et al. 1066* (holo WAG (incl. spirit material and tissue for DNA); iso LBV, and some additional duplicates to be distributed), Gabon, Estuaire, Parc National Pongara, Pointe Pongara, 0°20.8'N, 9°21.2'E, 17 Dec. 2012.

Etymology. The name *graminicola* refers to the habit of this species to grow on grasses.

Herbaceous hemiparasitic climber to 50 cm high, probably an annual. *Stems* 0.4–0.6 mm thick in fresh condition (side branches ≥ 0.15 mm diam), 0.25–0.6 mm thick when dry, up to 1 m long, light green, light brown or orange-yellow to red, likely changing from colour by age, going from green to orange or red, glabrous. *Leaves* scaly, lanceolate-triangular, 0.2–0.3 by 0.05–0.1 mm. Leaves and *haustoria* pale yellowish green to brownish yellow to reddish brown. *Inflorescence* axillary, (sub-) capitate, 2–7 mm long, flowers (2–)3(–4), all arranged at the end of the peduncle, in inflorescences with 2 flowers sometimes a third sterile bract present. *Bract* ovate to orbicular with bluntly acute apex, c. 0.7–1.1 by c. 0.8 mm, glabrous with ciliate margins, pale green. *Bracteoles* ovate to triangular-ovate with bluntly acute apex, 0.6–1.1 by 0.4–1.0 mm, glabrous with ciliate margins. *Flowers* sessile, ovoid to obovoid, 1.3–2.0 mm long. *Hypanthium* in flower still poorly developed, hairy. *Sepals* 3, rounded triangular to ovate, apex bluntly acute, 0.5–0.7 by 0.5–0.6 mm, glabrous with margin ciliate except at the apex, dirty white. *Petals* 3, ovate to oblong-ovate, 1.2–1.8 by 0.9–1.4 mm, glabrous, creamy to bright white, reddish tinged at base. *Stamens* in 4 rows of 3, inner (2) row(s) as staminodes; filament part widening to the obtrullate-shaped anther part, glabrous, white; outer 2 rows introrse; third stamen row extrorse or sterile (staminodes), at base with subsessile glands; staminodes (4th row) obtrullate. *Ovary* ovoid, c. 0.4 by 0.3 mm, with 1 ovule, style c. 0.6 mm long, stigma slightly capitate. *Hypanthium* around fruit ellipsoid to obovoid with 6 longitudinal ribs, 3.5–4.5 by 3.0–3.5 mm, medium green with tiny dark red spots, sparsely hairy outside, glabrous inside, sepals in fruit pale green, petals in fruit and hypanthium at petal insertion medium to dark red. *Fruit* ellipsoid to ovoid, c. 3 by 2.5 mm, glabrous, with 2 longitudinal darker lines, apical 20 % of fruit paler and slightly swollen, reminiscent of *Eleocharis* R.Br. fruits (*Cyperaceae*), the darker lines continue over this area.

Distribution — Known from six collections from five localities in western Gabon; see notes.

Habitat — Moist or drier savanna on sandy soil. The species seems restricted to savannas within the rainforest zone, all at low altitude (0–20 m) in the Gabonese sedimentary basin.

Ecology — *Cassytha graminicola* is a hemiparasite that, as far as we can assess, only parasitises on grasses (*Gramineae/Poaceae*) or some other grass-like monocotyledons like *Xyris* L., *Mesanthemum* Körn. and *Cyperaceae*. The remark on *Mouandza Mbembo 410*), whereby the author was only aware of a single Gabonese species, that the species grows both on trees and savanna herbs is in our option a more wider observation of seeing *C. graminicola* on herbs and *C. filiformis* on trees (and herbs/shrubs?), where only the first was collected under that number. On an earlier occasion Mouandza Mbembo did collect *C. filiformis* in that area (*Mouandza Mbembo 70*). The holotype was found growing on *Ctenium newtonii* Hack. (*Poaceae*). It is all the more remarkable that it is growing on grasses and other monocotylodons, because most other species of this genus, except *C. paradoxae* and *C. pergracilis*, are rarely recorded as such. Dawkins (*Dawkins D623*, *C. schliebenii*) even explicitly mentions that haustoria attempts to connect to grasses were unsuccessful. *Cassytha ciliolata* has been recorded to grow on perennial *Restionaceae*. *Cassytha graminicola* probably is an annual, which would be unique for the family. Like other *Cassytha* species at the early stages of development it is a

Fig. 5 *Cassytha graminicola* Wieringa & E.L.A.N.Simons. a. Fruits; b. winding stem with flowers; c. inflorescence and fruit; d. stems winding over grasses with some inflorescences; e. part of savanna infested by *Cassytha graminola*. — Photos: a, b. Simons & Damen (*Simons, Damen et al. 1066*); c–e. J. Wieringa (*Wieringa et al. 8636*).

hemiparasite containing chlorophyll in its green stems. As far as we can assess the chlorophyll slowly disappears in this species during maturation, and the plants become rather yellow to brown or red, rendering it a holoparasite in this phase.

IUCN Red List assessment (IUCN Standards and Petitions Committee 2024) — So far this species is known from 5 locations, with an EOO of 17 092 km^2 and an AOO of 24 km^2. Within the EOO only a very limited proportion of the area is suitable for this species. Two of these locations fall outside protected areas, one is within a national park (Pongara), but the very collection site has been developed for tourism since the collection was made. The location at Cap Esterias has a protection status, but this area is threatened by the expansion of Libreville. Hence a further decline of the known populations can be foreseen. We assess this species as endangered: EN B2a, b(i, ii, iv).

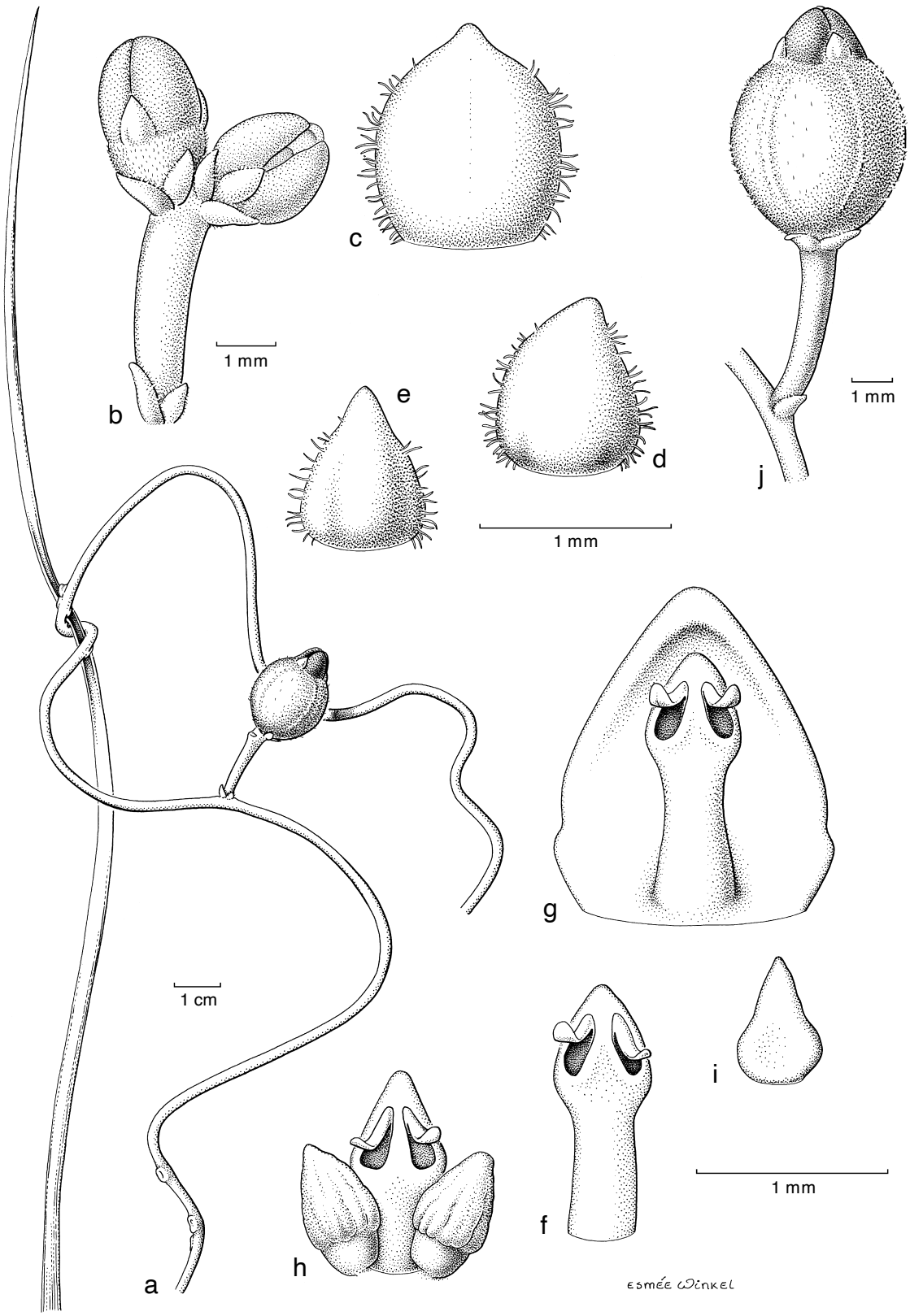


Fig. 6 *Cassytha graminicola* Wieringa & E.L.A.N.Simons. a. Stem with haustoria and infructescence, winding around grass; b. inflorescence; c. bract from outside; d. bracteole from outside; e. sepal from outside; f. stamen of first (= outer) row, from inside; g. petal with stamen of second row, from inside; h. stamen of third row, from outside; i. staminode (4th row); j. fruit surrounded by the hypanthium and floral remains (*Simons 1066*, WAG, incl. spirit). — Drawing Esmée Winkel.

Additional material (paratypes). Gabon, Estuaire, Cap Esterias, on a small savanna east of the road between Raponda Walker Arboretum and the Cap, *J.J. Wieringa et al. 8636* (LBV, WAG), N0°34.858' E9°21.124', 28.xi.2015 (fl, fr). – Moyen-Ogooué, near Rigsite, c. 10 km S of Lake Ezanga, *F.I. van Nek 656* (LBV, WAG), S1°01' E10°15', 4.ii.1991 (fl, fr); SW of Lambaréné, near Lake Ezanga; Conoco drilling site, *G.D. McPherson 15291* (BR, LBV, MO, WAG), c. S1°00' E10°17', 13.ii.1991 (fl, fr). – Ogooué-Maritime, env. 5 km au SE de Mbilapé, *O.L.S. Lachenaud et al. 2297* (BR, BRLU, LBV, MO, WAG), S0.92597° E9.182667°, 24.xi.2016 (fl, fr); Parc National Loango, *J.-C. Mouandza 410* (LBV, MO, WAG), S1°55.37' E9°18.67', 24.iv.2005 (fl, fr).

Note — *Germain 8864* (BR) from Congo (Kinshasa) may belong to *C. graminicola* as well. It has the same slender stems, small flowers, grows on grasses, but shows long inflorescences with only 3 flowers slightly spaced near the apex (so not typically capitate). The long inflorescence and somewhat spaced flowers might be caused by a single mutation where the entire inflorescence is stretched, but this specimen may also represent another new species of *Cassytha*. We refrain from definitely naming it until more material becomes available and consider it a doubtful *C. graminicola* for now. We exclude this specimen from the IUCN Red List assessment.

DISTRIBUTION OF THE OTHER AFRICAN SPECIES

Cassytha ciliolata

South Africa (Western and Eastern Cape provinces). Map 2.

Cassytha filiformis

Gambia, Senegal, Mali, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Burkina Faso, Ghana, Togo, Benin, Nigeria, Cameroon, Central African Republic, Equatorial Guinea, Gabon, Congo (Brazzaville), Congo (Kinshasa), Angola, Namibia, Botswana, Zimbabwe, Zambia, Malawi, Mozambique, Tanzania, Burundi, Uganda, Kenya, Ethiopia, Seychelles, Madagascar, Mauritius and the Maldives. Map 1. Outside Africa: in the New World from Central America, the Caribbean (including Florida) to tropical South America. In Asia from Yemen over India to Japan and reaching south to Australia and to the Pacific.

Cassytha pondoensis

Congo (Kinshasa), Angola, Zimbabwe, Zambia, Malawi, Mozambique, Swaziland, South Africa. Map 2.

Cassytha schliebenii

Zambia, Malawi, Mozambique, Tanzania, Uganda. Map 2.

IDENTIFICATION KEY

Preparing a key for the African species proved a little complicated. This is caused by the fact that several characters that reliably distinguish two species, proved to vary in a third, rendering it difficult to use these characters in the start of the key. We offer two solutions: a key that uses a combination of characters and a table (Table 1) where several relevant characters can be compared between the species.

Key to African species of Cassytha

1. Older stems glabrous, young stems glabrous or rarely with some hairs. Inflorescences (nearly) always short (< 17 mm long) 2
1. Stems often hairy, when glabrous inflorescences (or at least some of the inflorescences) > 20 mm long 3
2. Stems relatively thick (> 0.75 mm when dry), hypanthium glabrous, without ribs. — South Africa . . . . . *C. ciliolata*
2. Stems relatively thin (< 0.6 mm when dry), hypanthium sparsely hairy, with 6 longitudinal ribs. — Gabon . . *C. graminicola*
3. Petals inside glabrous. — Tropical Africa . . . . *C. filiformis*
3. Petals inside hairy. — Central, southern and eastern Africa 4
4. Sepals longer than wide, hairy outside. Petals hairy outside, especially in basal half. Hypanthium in fruit hairy . . . . . *C. schliebenii*
4. Sepals usually wider than long, only ciliate, glabrous outside. Petals outside glabrous, rarely hairy at base. Hypanthium in mature fruits (sub)glabrous . . . . . *C. pondoensis*

Acknowledgements Esmée Winkel made excellent drawings of the African taxa, for which we are most grateful. Aglaia Bouma gave suggestions for improvement of the text of this paper. The Uyttenboogaart-Eliasen Stichting and Hugo de Vries Fonds are acknowledged for providing funding for our collecting expedition to Gambia and Senegal, which resulted in the first records of *Cassytha* in Gambia. Claudia Baider kindly provided material from Mauritius. The CENAREST in Gabon assisted many field missions in Gabon during which the specimens of our new species were collected. Some of this field work was supported by the Alberta Mennega Stichting and Hugo de Vries Fonds. We thank the curators of BR, BRLU, COI and K for sending us herbarium specimens that were instrumental for this study. We are grateful to Jens Rohwer and Henk van der Werff for reviewing our manuscript and providing valuable comments and advice.

REFERENCES

Chanderbali AS, Van der Werff H, Renner SS. 2001. Phylogeny and historical biogeography of Lauraceae: Evidence from the chloroplast and nuclear genomes. Annals of the Missouri Botanical Garden 88: 104–134.

Diniz MA. 1997. 145 Lauraceae. In: Pope GV (ed), Flora Zambesiaca 9(2): 45–59. Royal Botanic Gardens, Kew.

Hatusima S. 1971. On some species of the Lauraceae from Japan and Taiwan. The Journal of Geobotany 19: 25–28.

IUCN Standards and Petitions Committee. 2024. Guidelines for using the IUCN Red List Categories and Criteria. Version 16. https://www.iucnredlist.org/documents/RedListGuidelines.pdf [last accessed 14 Aug. 2024].

Kokubugata G, Yokota M. 2012. Host specificity of Cassytha filiformis and C. pergracilis (Lauraceae) in the Ryukyu Archipelago. Bulletin of the National Museum of Nature and Science, Series B (Botany), Tokyo, 38: 47–53.

Kostermans AJGH. 1957. Lauraceae. Pengum, Balai Besar Penjel, Kehut, Indonesia 57: 1–64.

Kostermans AJGH. 1994. Four new asiatic Lauraceae and a new species of Durio Adans. (Bomhacaceae). Rheedea 4: 13–16.

Lindley J. 1836. A natural system of botany, 2nd ed. Longman, Rees, Orme, Brown, Green & Longman, London.

POWO. Continuously updated. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. http://www.plantsoftheworldonline.org/ [last accessed 16 July 2024].

Proctor GR. 1983. New plant records from the Mosquitia region of Honduras. Moscosoa 2: 19–22.

Rohwer JG, Rudolph B. 2005. Jumping genera: The phylogenetic positions of Cassytha, Hypodaphnis, and Neocinnamomum (Lauraceae) based on different analyses of trnK intron sequences. Annals of the Missouri Botanical Garden 92: 153–178.

Song Y, Yu W-B, Tan Y, et al. 2017. Evolutionary comparisons of the chloroplast genome in Lauraceae and insights into loss events in the Magnoliids. Genome Biology and Evolution 9: 2354–2364. https://doi.org/10.1093/gbe/evx180.

Stapf O. 1912. Order CXVI. Laurineae. In: Thiselton-Dyer WT (ed), Flora Capensis 5, sect. 1: 493–502. Reeve & Co., London.

Thiers BM. Continuously updated. Index Herbariorum. https://sweetgum.nybg.org/science/ih [last accessed 12 Jan. 2024].

Van der Werff H. 2001. Lauraceae Juss. In: Stevens WD, Ulloa Ulloa C, Pool A, et al. (eds), Flora de Nicaragua. Monographs in Systematic Botany from the Missouri Botanical Garden, St. Louis 85(II): 1190–1206.

Verdcourt B. 1996. Lauraceae. In: Polhill RM (ed), Flora of Tropical East Africa. Balkema, Rotterdam.

Weber J. 1981. A taxonomic revision of Cassytha (Lauraceae) in Australia. Journal of the Adelaide Botanic Gardens 3: 187–262.

Yang Z, Ferguson DK, Yang Y. 2023. New insights into the plastome evolution of Lauraceae using herbariomics. BMC Plant Biology 23: 387.