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REGULAR PAPER

Notes on the plants of Bakossi, Cameroon, and the new *Cola etugei* and *Cola kodminensis* (Sterculiaceae s. str.)

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Background and aims – This paper reports a further discovery during preparation for a monograph of the genus *Cola*, and also in the context of a long-term botanical survey in the Cross River-Sanaga interval of west-central Africa, focussing on species discovery and conservation through the Tropical Important Plant Areas programme.
Methods – Normal practices of herbarium taxonomy have been applied to study the material collected. The relevant collections are stored in the Herbarium of the Royal Botanic Gardens, Kew, London (K) and at the Institute of Research in Agronomic Development – National Herbarium of Cameroon (YA).
Key results – Two species new to science, small trees or shrubs of cloud forest, are formally named from the Bakossi tribal area and assessed for their conservation status. *Cola etugei*, is endemic to the western slopes of Mt Kupe with conservation status assessed as Critically Endangered (CR B1+2ab(iii)) according to the 2012 criteria of IUCN. *Cola kodminensis* from the Bakossi Mts is also assessed as Critically Endangered (CR B1+2ab(iii)). This publication increases the number of documented narrowly endemic, threatened species in the Bakossi tribal area, and helps make the case for formal protection of Mt Kupe, which with 33 endemic and near-endemic plant species remains an extremely high candidate for such protection. Further effort is needed to publish the remaining informally named species of this location, and investment to support the protection of the mountain by local communities.

Keywords – Cloud forest; conservation; Cross-Sanaga Interval; Important Plant Areas; submontane forest; TIPA.

INTRODUCTION

During botanical surveys 1993–2000 of the Bakossi tribal area in Kupe Muanenguba division, S.W. Region, Cameroon, among the 22 species of the genus *Cola* encountered, were two that matched no other known species of the genus and which were provisionally named as "*Cola sp. nov. 'etugei'*" and "*Cola sp. nov. 'kodminensis'*" (Cheek et al. 2004: 411, Fig. 14D & E). The first was commonly encountered in fruit above the village of Nyasoso (c. 800 m), frequently used as base for surveys up to the peak of Mt Kupe. The second was found further to the west in the Bakossi Mts at c. 1100 m, also in fruit. It was decided not to publish these species since flowers were not available of either. However, since after 20 years flowers have still not been obtained, and since in the course of monographic studies of the genus no other species has been found to match these two, it has been decided to publish both. This will allow conservation assessments to be accepted by IUCN for both species and so facilitate conservation management prioritisation in Bakossi.

The genus *Cola* Schott. & Endl.

Cola was included in tribe Sterculieae of Sterculiaceae s. lat. of the core Malvales for most of the twentieth century. Molecular phylogenetic investigations of Malvales showed that

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in place of the traditional four families recognised (Malvaceae, Bombacaceae, Sterculiaceae, Tiliaceae) there is a choice of either recognising nine subfamilies in a super-Malvaceae (Bayer et al. 1999; Bayer & Kubitzki 2003) or recognising the same units as the families, Bombacaceae, Brownlowiaceae, Byttneriaceae, Dombeyaceae, Durionaceae, Helicteraceae Malvaceae sensu stricto, Sparrmanniaceae, Sterculiaceae, and Tiliaceae (Baum et al. 1998; Cheek & Dorr 2007; Cheek 2007). *Cola* can therefore now be placed either in Malvaceae-Sterculioideae or Sterculiaceae s. str. We prefer the latter approach since it is less cumbersome and minimises taxonomic instability (Cheek & Dorr 2007).

The Sterculiaceae s. str. are characterised within Malvales by unisexual flowers with a single perianth whorl which lack an epicalyx. The male flowers have an androgynophore bearing the anthers in a terminal capitulum or ring, the gynoecium vestigial and inconspicuous. Female flowers usually have a sessile or subsessile gynoecium developing into an apocarpous fruit of (1–)4–5(–15) fruitlets or mericarps, the base surrounded by indehiscent anthers. The family is pantropical, with c. 415 species arranged in 13 genera (Cheek 2007).

Pterygota Schott & Endl. pantropical, with dehiscent, woody mericarps containing dry, winged seeds, is in a sister relationship with *Cola*, while *Octolobus* Welw., confined to tropical Africa, with numerous spirally inserted indehiscent mericarps, is sister to *Pterygota*-*Cola* combined (Wilkie et al. 2006). The remaining genera of the *Cola* clade, *Hildegardia* Schott & Endl., *Firmiana* Marsili*, Pterocymbium* R.Br. and *Scaphium* Schott & Endl. all have winged fruitlets and are wind-dispersed, and all but the first are confined to SE Asia and adjoining areas. In comparison, the pantropical genus *Sterculia* L., sometimes confused with *Cola*, is in an entirely different subclade, and always has dehiscent fruit with the seeds with radicle directed away from the hilum and hard-coated, borne on a placenta with irritant hairs.

The genus *Cola* with 100–125 species of trees and shrubs, the most species-diverse genus in the Sterculiaceae s. str. (or Malvaceae-Sterculioideae), is characterised by indehiscent (rarely tardily dehiscent) mericarps containing seeds with a soft, fleshy seedcoat, the radicle directed towards the hilum. The endocarp is glabrous. *Cola* is mostly confined to evergreen lowland and submontane forest in continental sub-Saharan Africa, with only two species in deciduous forest or woodland. While some of the species are widespread, many are extremely local, and some are known from few or single forest patches and so are vulnerable to extinction. Eight species of *Cola* in Cameroon alone have been assessed as threatened (Onana & Cheek 2011). *Cola nitida* (Vent.) Schott. & Endl. and *Cola acuminata* (P.Beauv.) Schott. & Endl. are planted throughout the tropics for their seeds which act as stimulants when chewed and are an ingredient of the eponymous and ubiquitous 'Cola' soft drinks. Two other species also have stimulant seeds, but are only locally cultivated (Cheek 2002a; Cheek & Dorr 2007).

Most species of *Cola* occur in Tropical Africa, with only three species, *Cola natalensis* Oliv., *Cola greenwayi* Brenan and *Cola dorrii* Cheek in South Africa (Cheek et al. 2018c). In East Africa (Uganda, Kenya and Tanzania), 21 species are native (Cheek & Dorr 2007). However, West and Central Africa are the heartland of *Cola*. The largest number for any flora region is that in the Flora of West Tropical Africa (FWTA), with 42 species, and with an additional nine imperfectly-known species (Keay & Brenan 1958). Additional new species from West Africa have since been published, e.g. Jongkind (2013). Thirty-three species are recorded from Gabon (Hallé 1961) and 32 from D.R. Congo (Germain 1963). The *Flore du Cameroun* account awaits completion. New Cameroonian species have recently been published by Kenfack et al. (2018) and for Gabon by Breteler (2014). Further new species are likely to be found, particularly in Gabon, where, while 336 *Cola* specimens are recorded as being identified to species, a further 140 remain unidentified (Sosef et al. 2005: 395–397).

The genus was last monographed by Schumann (1900) when 33 species were recognized. Although Brenan did much research on the genus throughout its range, he confined himself, largely, to publishing accounts of new species (e.g. Keay & Brenan 1958). This paper is part of the preparation for a monograph of the genus that began 17 years ago (Cheek 2002a, 2002b; Cheek & Dorr 2007; Cheek et al. 2018c, 2019a, 2019b).

The conservation importance of forest in Bakossi

The Bakossi tribal area in Kupe Muanenguba division, SW Region, Cameroon, is comprised largely of three closely adjacent highland areas, all part of the Cameroon Highlands: (1) the Mwanenguba caldera (2411 m) to the north, south of which lies (2) Mt Kupe (2064 m), a horst formed by uplifted syenite (igneous rock similar to granite) along the Chide fault; (3) the Bakossi Mts (highest peak 1895 m) the larger, western two-thirds of the Bakossi tribal area, formed by uplift of ancient basement complex material but containing some volcanic crater lakes.

Rainfall varies from only 3 m per annum at the south-eastern base of Mt Kupe, to 6–7 m on the south-western slopes of Mt Kupe. Rainfall mainly occurs from March to October inclusive, but no month has less than 50 mm of precipitation in the wettest areas. The soils vary from highly fertile along the Chide trough due to volcanic activity where they are intensively cultivated, to nutrient-poor on the ancient highly leached rocks of the Bakossi Mts (Wild 2004).

The plants of the area were inventoried in *The plants of Kupe, Mwanenguba and the Bakossi Mountains, Cameroon: a conservation checklist* (Cheek et al. 2004) which documented 2412 taxa, including 82 endemic to the checklist area of 2390 km^2. These results were based on analysis of 14 538 specimens, most of which were collected in survey work 1993–2000. Mt Kupe (33 endemic and near-endemic species) and the Bakossi Mts (22 endemic and near-endemic species), together with the Rumpi Hills to the West, are thought to contain the largest block of relatively intact submontane (cloud) forest, 800–1900 (–2000) m , in Africa (Cheek et al. 2004: 6).

Mt Kupe, despite the extremely high number of endemic and near-endemic species, all threatened, remains formally unprotected, although an Integral Ecological Reserve has been proposed there and supported by local communities. Fortunately, the Bakossi Mts National Park has been formal-

ly recognised by the Government of Cameroon (although it does not include the areas with the highest recorded number of endemics) based on the plant species documented in Cheek et al. (2004).

Threats to the globally important biodiversity of Bakossi come from forest clearance upslope of on Mt Kupe, despite its country-wide reputation for its summit being the home of powerful spirits that can capture and enslave the living. The Bakossi Mts are threatened by logging activities, while much of the formerly forested slopes on Mwanenguba are now cleared. Upgrading of roads by the European Union has allowed improved communications and access to markets for the villages along the Tombel-Bangem road, and a new road has been created from Bangem, the regional capital, to Nguti, to the northwest of Bakossi, where major oil palm plantations are intended. For the moment development is suspended due to the secessionist movement in SW and NW Regions of Cameroon for an independent Ambazonia. Since the end of 2016, many villages were evacuated as their inhabitants sought refuge outside the area.

The Bakossi study is part of a long-term survey of plants in Cameroon to support improved conservation management led by botanists from Royal Botanic Gardens, Kew and the IRAD (Institute for Research in Agronomic Development)-National Herbarium of Cameroon, Yaoundé. This study has focussed on the Cross-Sanaga interval (Cheek et al. 2001) which contains the area with the highest species diversity per degree square in tropical Africa (Barthlott et al. 1996). The herbarium specimens collected in these surveys formed the primary data for the series of Conservation Checklists that began at Mt Cameroon (Cheek et al. 1996), with the Plants of Mt Cameroon (Cable & Cheek 1998) and continued with Mt Oku and the Ijim Ridge (Cheek et al. 2000), Bali-Ngemba (Harvey et al. 2004), Mt Kupe, the Bakossi Mts and Mwanenguba (Cheek et al. 2004), Dom (Cheek et al. 2010) and Lebialem (Harvey et al. 2010). Work is underway to continue with a checklist for the forests of Ebo (Cheek et al. 2018d).

Among the new botanical taxa discovered in Bakossi are two genera new to science, *Kupea* Cheek & S.A.Williams (Triuridaceae-Kupeae, Cheek et al. 2003), and *Kupeantha* Cheek (Rubiaceae-Coffeeae, Cheek et al. 2018a). Among the numerous new species discovered in both the Bakossi Mts and Mt Kupe, most of which are endemic to Bakossi, are: *Coffea bakossii* Cheek & Bridson (Cheek et al. 2002a), *Coffea montekupensis* Stoff. (Stoffelen et al. 1997), *Dracaena kupensis* Mwachala et al. (Mwachala et al. 2007), *Mussaenda epiphytica* Cheek (Cheek 2009), *Psychotria bakossiensis* Cheek & Sonké and *Psychotria geophylax* Cheek & Sonké (Cheek & Sonké 2005), *Psychotria ngollengollei* Cheek (Cheek et al. 2009), *Psychotria nubisylvae* O.Lachenaud (Lachenaud 2019) and *Rhaptopetalum geophylax* Cheek & Gosline (Cheek et al. 2002b).

The two species of *Cola* described in this paper as *Cola etugei* Cheek and *Cola kodminensis* Cheek. were first recognised as distinct species over 15 years ago (Cheek et al. 2004: 411, Fig. 14D&E), but were not published for the reasons stated in the species treatments below. It is important to formally name them now to enable their conservation assessments to be accepted by IUCN and so to facilitate conservation management prioritisation.

The number of species described as new to science each year exceeds 2000, adding to the estimated 369 000 already known (Nic Lughadha et al. 2016), although the number of flowering plant species known to science is disputed (Nic Lughadha et al. 2017). Only 7.2% have been assessed and included on the Red List using the IUCN (2012) standard (Bachman et al. 2019), but this number rises to 21–26% when additional evidence-based assessments are considered, and 30–44% of these assess the species as threatened (Bachman et al. 2018). Newly discovered species, such as the two *Cola* species reported in this paper, are likely to be range-restricted and threatened, since widespread species tend to have been already discovered. There are notable exceptions to this rule (e.g. *Deinbollia oreophila* Cheek (Cheek & Etuge 2009) a species widespread in the Cameroon Highlands). However, generally, it is the more localised, rarer species that remain undiscovered. This makes it all the more urgent to find, document and protect such species before they become extinct, as is *Oxygyne triandra* Schltr. (Cheek et al. 2018e), or possibly extinct, in the case of another Cameroon Highland cloud forest tree, *Vepris bali* Cheek (Cheek et al. 2018b). Most of the 815 Cameroonian species Red Listed in the "Red Data Book, Plants of Cameroon" are threatened with extinction due to habitat clearance, mainly for small holder and plantation agriculture following logging (Onana & Cheek 2011). Efforts are now being made to delimit the highest priority areas in Cameroon for plant conservation as Tropical Important Plant Areas (TIPAs) using the revised IPA criteria set out in Darbyshire et al. (2017). This is intended to help avoid the global extinction of additional endemic species such as *Cola etugei* and *Cola kodminensis*.

MATERIAL AND METHODS

The methodology for the surveys in which these species were discovered is recorded in Cheek & Cable (1997). Herbarium material was examined with a Leica Wild M8 dissecting binocular microscope fitted with an eyepiece graticule measuring in units of 0.025 mm at maximum magnification. Illustrations were made with the same equipment with a Leica 308700 camera lucida attachment. The material of the new species was tested unsuccessfully against the *Cola* keys of Keay & Brenan (1958), Cheek (2002a) and that for Gabon (Hallé 1961). Material of all species of *Cola* available at BM, K, P and YA was viewed in order to attempt to achieve morphological matching. Specimens were also inspected from the following herbaria: BR, BNRH, EA, FHO and PRE. Material from WAG at L was inaccessible during the period of this study. Nomenclatural changes were made according to the International Code of Nomenclature for algae, fungi, and plants (Turland et al. 2018). Names of species and authors follow IPNI (continuously updated). The format of the description follows those in other papers describing new species in the *Cola*, e.g. Cheek et al. (2002a, 2002b, 2018c, 2019a).

All specimens cited have been seen unless indicated ("n.v."). Points were geo-referenced using locality informa-

Table 1 – **Characters distinguishing *Cola etugei* and *Cola attiensis* (*including *C. bodardii*).**
* Data for *Cola attiensis* from Hallé (1961).

	Cola attiensis*	***Cola etugei***
Range	Ivory Coast and Gabon	Mt Kupe, Cameroon
Habitat	lowland forest	submontane forest
Largest blade dimensions	26 × 10 cm	18.6(–19.8) × 8.1(–9.3) cm
Lateral nerves on each side of the midrib	7–15	(5–)6–8(–9)
Position of inflorescences	on the trunk or stems below the leaves	among the leaves
Number of carpels	(4–)5	3(–4)
Number ovules per carpel	1–2	8
Fruiting carpel shape	globose-apiculate	long cylindric-long rostrate
Fruiting carpel indumentum	glabrous	stellate hairy

tion from herbarium specimens. The map was made using SimpleMappr (https://www.simplemappr.net).

The conservation assessment follows the IUCN (2012) standard. GeoCAT was used to calculate red list metrics (Bachman et al. 2011). Herbarium codes follow Index Herbariorum (Thiers continuously updated).

TAXONOMIC TREATMENT

Cola etugei Cheek, **sp. nov.**

Figs 1, 3

Diagnosis – Similar vegetatively to *Cola attiensis* Aubrév. & Pellegr. (including *Cola bodardii* Pellegr.), differing in the cylindrical, 3–8-seeded stellate hairy fruitlets (not globose, 1–2-seeded, glabrous). See also table 1 for diagnostic differences between these two species.

Type – Cameroon, South West Region, Nyasoso, 4°49′N, 9°42′E, the 'Nature Walk', 8 Dec. 1993, fr., *Cheek 5668* (holotype: K, barcode K000027441; isotypes: BR, SCA, US, WAG, YA).

References – Cheek et al. (2004: 411, Fig. 14D, as "*Cola sp. nov. 'etugei'*"); Onana (2011: 145).

Description – Dioecious or monoecious, evergreen shrub (1–)1.5–2(–3) m tall, with a single main axis and several lateral branches arising from near ground-level, extending near horizontally before arching upwards. Terminal buds ovoid, 3–3.5 × 2–2.2 mm, apex rounded; bud-scales appressed, ovoid-bluntly acuminate, c. 2.5 × 1.5 mm, densely covered in appressed grey-white 10–12-armed stellate hairs 0.2 mm diam.; leafy stems terete, 2(–4) mm diam. at the lowest leafy node, internodes at the beginning of a seasons growth longest, 1–2 cm long, the 3–4 nodes with caducous (not seen) scale-leaves, subsequent internodes progressively shorter, from 3 mm long to 0.5 mm long. Indumentum of stems at first 100% covered mainly with dense glossy orange 6–8-armed stellate hairs 0.35–0.5 mm diam., arms usually directed in opposite directions along axis of stem, mixed with sparse larger hairs, c. 0.7 mm diam.; stellate hairs intertwined with a few (5–10% cover) inconspicuous simple patent hairs 0.1–0.25 mm long; older stems with stellate hairs fallen, the sparse simple hairs persistent, exposing the dull-white epidermis, with longitudinal wrinkles, lenticels absent or inconspicuous, epiphytic algae, lichens, liverworts and mosses common. Leaves 3–6 per season's growth, alternate, spirally inserted, the first-formed leaves of the season largest, with longer petioles, the last-formed about ⅔ the size, with shorter petioles; leaves of the previous one or two seasons often persistent, leaf-blades monomorphic, elliptic, less usually oblong to slightly oblanceolate, the largest leaves of each stem (12–)14.9–18.6(–19.8) × (4.7–)5.2–8.1(–9.3) cm, acumen narrowly triangular ((1–)1.2–2 × (0.3–)0.6–0.8(0.9) cm, smallest leaves of each stem (4.3–)6.7–11.4(–12.6) × (1.7–)2.6–5.0(–5.2) cm, acumen 0.9–1.7 × (0.3–)0.4–0.8 cm, base acute, the outer basal edges concave or straight; lateral nerves (5–)6–8(–9) on each side of the midrib, arising at 60–70° from the midrib, towards the margin, arching upwards and forming a weak and incomplete, looping marginal nerve; intersecondaries at first straight, then flexuose, uniting with tertiary nerves; quaternary nerves conspicuous, abaxial surface with bright red minute flattened ± orbicular scales 0.05 mm wide, 0.25–0.3 mm apart indumentum otherwise absent except the proximal third of the midrib on the abaxial surface 40–50% covered in red papillae. Stipules (fig. 1F) caducous, papery, oblong, 10–12 ×1.5–2 mm, apex triangular, acute, base with parallel sides 1.5 mm wide, midrib raised on abaxial surface, indumentum completely covering abaxial surface, hairs pale orange, stellate, dimorphic; smaller (fig. 1G) comet-like, 0.3–1 mm wide, (2–)3–10-armed, the arms all directed towards the base of the petiole; larger (fig. 1H) c. 1.5 mm diam., 10–12-armed, arms radiating in all directions. Petioles (fig. 1B) pulvinate, adaxial surface more or less flattened, the shortest petioles per stem (0.5–)1.3(–1.7) cm long, the longest 1.9–5.2(–6.0) cm, breadth 0.7–0.8 mm, pulvini distal c. 2.5 mm long, 1.2 mm wide; indumentum covering 60–70% of the surface when young, a mixture of persistent simple, patent hairs 0.05–0.1 mm long and caducous 0.3–0.4 mm wide, 6–8-armed stellate hairs, the arms directed to either the base or apex of the petiole (fig. 1C). Inflorescence: buds present among the leaves, or on naked stems of previous 1–2 seasons growth, globose 1.2–1.5 mm diam., flowers 1–2 per axil, flower buds enclosed in 6–7 variously shaped bracts, bracts brown, matt, mainly concave elliptic, c. 1.25 × 1.25 mm, rarely to 3.5–1.5 mm. Male flowers not seen. Female flowers (part reconstructed from fruits) with pedicels (4–)6–11 mm long, terete, articulated 1–1.5 mm below the flower, indumentum dense, stellate 0.25–0.3 mm diam.,

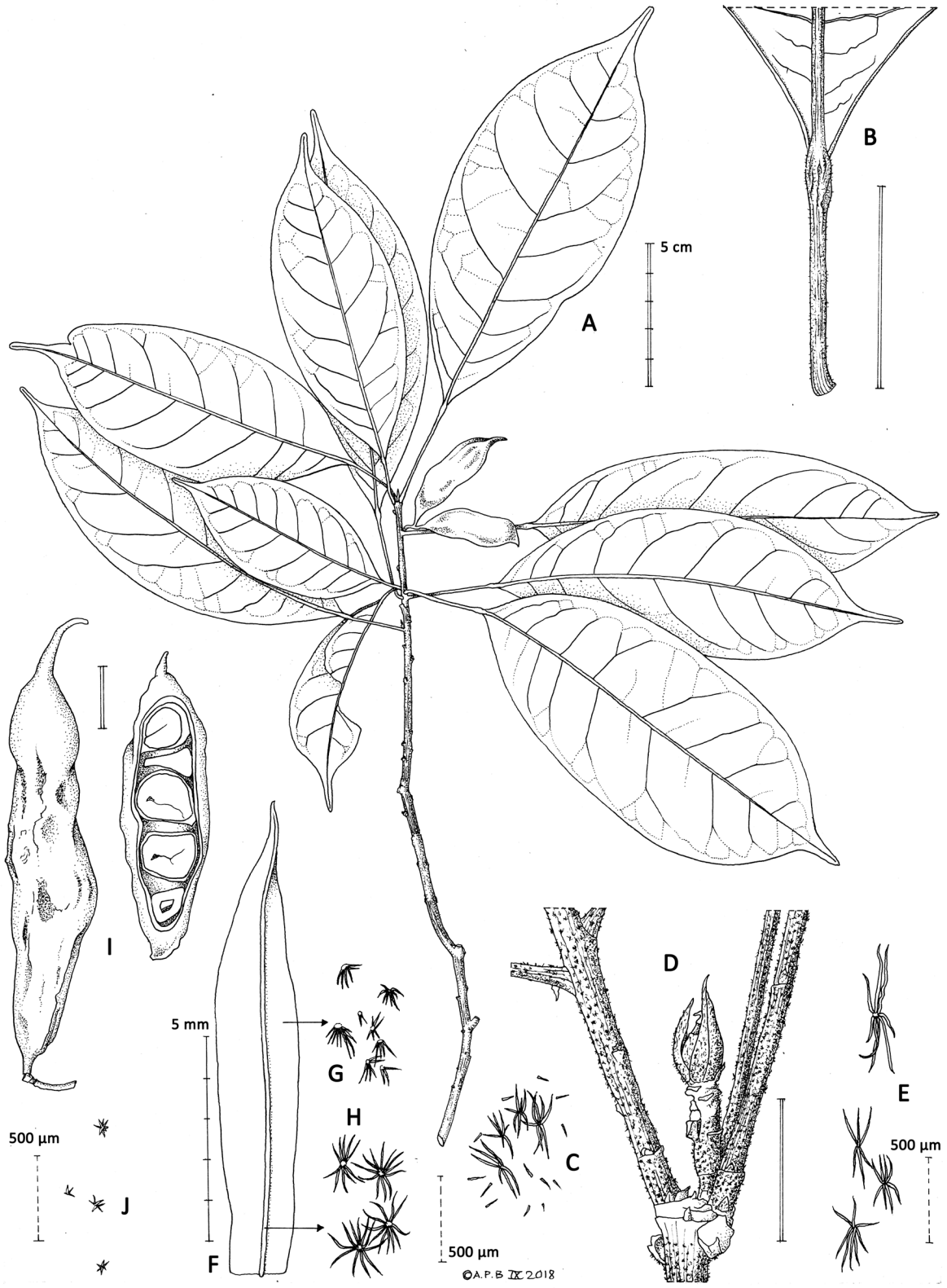

Figure 1 – *Cola etugei*. **A**. Habit, fruiting stem. **B**. Petiole with distal pulvinus, and base of leaf-blade, abaxial surface, proximal portion. **C**. Petiole indumentum from fully developed leaf. **D**. Habit, showing three current season's shoots one with apical bud, and three petiole bases. **E**. Stem indumentum. **F**. Stipule, abaxial surface. **G**, **H**. Stellate hairs from F. **I**. Mericarps from fruit, right hand opened to show seeds. **J**. Indumentum from fruit surface. Scale bars: A = 5 cm; B, D, I = 1 cm; F = 5mm; C, E, G, H, J = 0.5mm. A & B from *Gosline et al. 135*; C–H from *Cheek 9518*; I & J from *Cheek 5668*. All drawn by Andrew Brown.

5–7(–(11) slender arms & dull orange or dull white. Stamens 5(–6), anthers elliptic 1.1–1.2 mm long, 0.7 mm wide, densely stellate hairy, hairs 0.05 mm diam. Gynoecium 3(–4) carpellate. Fruit 1–3 per leafy stem, perianth lobes not persisting, carpels 1(–3) at maturity, yellow, smooth, 3–8 seeded, pendulous, each cylindric (length: breadth ratio 3–4:1), (3.4–)4.0–7.6 × (1.1–)1.3–1.8(–2.0) cm, rostrum cylindric, tapering to the apex, 0.5–1.2 × (0.3–)0.4–0.7 cm; stipe 0.3–0.8 × 0.4–0.6 cm; stigmas not persistent, surface not sculptured, slightly constricted between the seeds, surface densely red stellate hairy when young, at maturity with only sparse 4–8-armed hairs 0.06–0.1 mm diam.

Habitat and distribution – Shrub of submontane (cloud) forest; 860–1100m. Cameroon, South West Region, known only from Mt Kupe, W. slope above Nyasoso and Mbulle villages (fig. 3).

Phenology – During the more than six years over which our botanical survey of Mt Kupe was conducted in the 1990's (Cheek et al. 2004), surveys were conducted upslope from Nyasoso village, the principal base camp, traversing the location of *Cola etugei* every month of the year.

Among the eleven resulting specimens of *Cola etugei*, all were in fruit, apart from one which was sterile, despite attempts to find the species in flower (M. Cheek pers. obs., 1998). We conclude that the flowers are both inconspicuous and produced in months outside those when fruiting specimens are known, probably in the late dry season/early wet season April–June, supported by the only immature fruiting collection being made 11 July 1992. Fruiting collections were mainly made in October (6 specimens), but also November (2 specimens) and December and July (1 specimen each). The wettest season is May to October. On the evidence of *Cheek 9518*, the annual flush of new shoots and leaves occurs in late wet season. Therefore, vegetative growth is static and dormant most of the year. Terminal buds are present through the dry season.

Etymology – Named for Martin Etuge Ekwoge, generally referred to as Martin Etuge, horticulturalist and parataxonomist of Bakossi, who collected one of the original specimens of the species, and who was one of the principal plant specimen collectors for the 'Plants of Mount Kupe, Mwanenguba and the Bakossi Mountains' (Cheek et al. 2004). Of the 14,538 specimens recorded on our database for that area, 3,170 were collected by Martin Etuge.

Conservation assessment – *Cola etugei* is distributed over an area of 8–12 km², we estimate, equating to both the area of occupancy and extent of occurrence. Within its range it can be locally common (Cheek pers. obs., 1993–1998). We estimate that 200–300 mature individuals exist. Its entire range is outside the boundary of the proposed Mt Kupe Integrated Ecological Reserve and at risk of small-holder agriculture expansion upslope from Nyasoso. At one key site 'the Nature Walk' it has suffered losses through path clearance and clearance of corridors in the forest understorey by ornithologists to facilitate setting of mist nets. Since there is a single threat-based location we here assess *Cola etugei* as Critically Endangered CR B1+B2ab(iii) using the IUCN (2012) criteria. A poster campaign to highlight the rarity and conservation importance of *Cola etugei* is advisable and to discourage clearance of its forest understorey habitat within its range.

Cola etugei was known to be a distinct species over ten years ago (Cheek et al. 2004: 411). Formal publication was delayed in the hope of finding flowering material in order to provide a complete description. However, twenty years have elapsed since the last specimen was collected, during which time no flowers have been preserved, while threats and loss of its habitat have continued, so it has been decided to delay no longer.

Additional specimens examined – Cameroon: **South West Region**: Meme division, Nyasoso, Mt. Kupe, Nature Trail, 900 m, 11 Jul. 1992, fr., *J.I. Wheatley 480* (K000027438 SCA, YA); ibid. Nyasoso, 4°49' N, 9°42' E, 900 m, 8 Dec. 1993, fr., *M. Cheek 5668* (K000027442, SCA, YA); Mt. Kupe, Nyasoso, Shrike Trail leading from Nyasoso to summit of Mt. Kupe, 4°49′N, 9°41′E, 1100 m, 24 Nov. 1994, fr., *P. Lane* 245 (K, barcode K000027436, K, barcode K000027437, YA); Nyasoso, Nature Trail, 4°49′N, 9°41′E, 860 m, 21 Oct. 1995, fr., *M. Etuge 1293* (K, barcode K000027440, SCA, WAG, YA); Mt. Kupe, Nyasoso, on the Nature Trail, eastward above the cave, 4°49′24″N, 9°41′00″E, 940 m, 23 Oct. 1995, fr., *D. Sebsebe 4989* (K, barcode K000027439, SCA, WAG, YA); Nyasoso, above the school (GSHS) in the Nature Trail, 4°49′N, 9°41′E, 900 m, 21 Oct. 1998, fr., *M. Cheek 9287* (K, barcode K000027443, YA); Nyasoso, near Ellasa-Pong Rock, 4°48′N, 9°41′E, 1000 m, 31 Oct. 1998, st., *M. Cheek 9518* (K, barcode K000027444, WAG, YA); Nyasoso, 2 km South of Nyasoso, trails up to South side and down North side of Ellasa-Pongy rock, 4°48′N, 9°41′E, 1000 m, fr., 1 Nov. 1998, *W.G. Gosline et al. 135* (K, barcode K000027445, WAG, YA); Mt. Kupe, Nyasoso, 4°50'N, 9°41'E, 890 m, fr., 2 Oct. 1995, *Abu Juam Musah 85* (K , YA, SCA, K,); ibid. *Abu Juam Musah 127* (K001400042, YA, SCA, K,); *Abu Juam Musah* 193 (K001208981 YA, SCA, K,) .

Notes – The first collection of *Cola etugei* was made by Josceline Wheatley in July 1992. In the following six years a total of eleven specimens were gathered in the course of an intensive botanic survey that led to the book *The plants of Kupe, Mwanenguba and the Bakossi Mountains, Cameroon: a conservation checklist* (Cheek et al. 2004).

During the years of collection in the Bakossi tribal area, specimens of diverse taxa were collected from the north, west and southern slopes of Mt Kupe (much of the east has been deforested), and also from the Bakossi Mts to the West and the Mwanenguba massif to the North, an area of 2390 km². In all, over 14000 specimens (Gosline 2004) have been collected in the area. However, the eleven specimens of *Cola etugei* were all confined to a narrow altitudinal band in lower submontane forest immediately above the settlements of Nyasoso and Mbulle on the west slope of Mt Kupe. Among other species also apparently strictly endemic to Mt Kupe on current evidence are: *Afrothismia kupensis* Cheek (Cheek et al. 2019c), *Afrothismia saingei* T.Franke (Franke 2004), *Brachystephanus kupeensis* I.Darbysh. (Champluvier & Darbyshire 2009), *Bulbophyllum jaapii* Szlach. & Olsewski (Szlachetko & Olsewski 2001), *Peucedanum kupense* I.Darbysh. & Cheek (Darbyshire & Cheek 2004) and *Psy-*

drax bridsoniana Cheek & Sonké (Cheek & Sonké 2004). Other species are near-endemic, found only in one other location, such as the Ebo forest to the east, e.g. *Costus kupensis* Maas & H.Maas (Maas-van de Kamer et al. 2016), *Microcos magnifica* Cheek (Cheek 2017) and *Uvariopsis submontana* Kenfack et al. (Kenfack et al. 2003) or the Rumpi Hills to the west, e.g. *Psychotria cheekii* O.Lachenaud (Lachenaud 2019).

Cola kodminensis Cheek, **sp. nov.**

Figs 2, 3

Diagnosis – Differing from *Cola zemagoana* Kenfack in that the fruitlet length: breadth ratio is 3:1, fruitlets 4–4.5 cm long, longitudinally wrinkled, hairs inconspicuous (not 9:1, fruitlets 7–10 cm long, smooth, conspicuously stellate hairy); proximal part of adaxial midrib densely stellate hairy (not glabrous); stem of current season with indumentum mainly stellate (not mainly simple).

Type – Cameroon, South West Region, Mwanzum to Kodmin, 5°00′N, 9°49′E, 18 Nov. 1998, fr., *Cheek 9682* (holotype: YA; isotypes: BR, K, US).

References –Cheek et al. (2004: 411, Fig. 14E, as "*Cola sp. nov. 'kodminensis'*"); Onana (2011: 145).

Diagnosis – Probably dioecious, evergreen treelet 3–6m tall. Trunk unbranched to 2 m tall. Bud-scales 4–6, ovate 2.5–3 × 1–2 mm, apex rounded, base broad, outer surface densely covered with grey long-limbed stellate hairs 0.5–0.7 mm diam., appressed to surface. Stem of current season's growth, brown hairy, (1–)2–3 mm diam. at the lowest leafy node, hairs stellate, of two types: (1) smaller, 0.15–0.25 mm diam, (3–)4–8(–9)-armed, arms subequal, radial; (2) larger, aligned along the long axis of the stem, 0.4–0.5 mm long, 0.15–0.25 mm wide, 5–8-armed. Stems of previous season's growth black, matt, uneven, with epiphytes, uncovered areas with a 10–15% cover of simple erect translucent hairs 0.15 mm long. Leaves 3–4(–5) per season's growth, spirally arranged; blades monomorphic, consistent in shape and size throughout the season. Leaf-blades slightly discolorous, upper surface dark grey, matt, lower surface, pale grey-brown, slightly glossy, oblanceolate-elliptic or narrowly elliptic, (6.1–)15.8–21.6(–23.2) × (2.8–)4.2–6.5(–7.6) cm, apex narrowly long-acuminate, acumen 1.4–3.6 × 0.3–0.5 cm apex rounded, base obtuse to abruptly rounded. Secondary nerves (5–)7–12 on each side of the midrib, arising at 50–80° from the midrib above, arching gradually upwards, becoming parallel with the margin and uniting through tertiary nervelets to the secondary above, forming a weak infra-marginal nerve 2–3mm from the margin, domatia absent. Intersecondary nerves connecting the tertiary nerves, flexuose (zig-zagging); tertiary and quaternary nerves conspicuous, raised, forming a fine reticulum, glabrous, apart from the proximal portion of the abaxial surface (indumentum as petiole). Galls (fig. 2 B–D) present on 9 out of 10 leaves, (3–)18–30 galls per blade, each 2–3mm diam., conspicuous on upper surface on adaxial surface, margin slightly raised, centre depressed; 2.5–3.8 mm diam. on abaxial surface, volcano-like with central aperture, glabrous. Petioles terete, (0.2–)1–1.5 × 0.15–0.2 cm, pulvini absent, rarely detectable, below blade, indumentum as stem, but stellate hairs smaller (0.1–)0.15 mm diam., 5–6(–8)-armed. Stipules caducous, mature stipules (fig. 2 L) triangular, flat at base, involute at apex 0.8–0.9 × 0.25 cm indumentum densely brown pubescent, stipules at stem apex (fig. 2I) narrowly lanceolate 10–15 × 2 mm, the distal half filiform, sinuous 0.2–0.3 mm wide, margins involute, adaxial surface midrib thickened, raised. Inflorescences axillary, 2 or more flowered (only known in fruit). Bracts caducous, not seen. Male flowers not seen. Female flowers only known from post-anthetic fruiting material. Pedicels 6–10.5 × 2–2.5 mm, articulated 2–4.5 mm from the base, indumentum stellate, hairs 6–10-armed, 0.25 mm diam. Perianth divided by 9/10 into 5 lobes, each 5–5.5 mm long, 3–3.4 mm wide (fig. 2M), the margins neither conspicuously inflexed nor membranous. Posture unknown; outer surface covered (c. 80% cover) in dimorphic stellate hairs (fig. 2N), large brown shining 8–12-armed hairs (0.3–)0.4–0.6 mm diam., arms often sinuous, radiate; small white (4–)5–7(–9)-armed hairs 0.1–0.15 mm diam., inner surface with minute translucent vesicles 0.05 mm diam., 40–50% cover. Stamens 4 (sterile, viewed in old female flowers), widely spaced, uniseriate each 1.5 × 0.5 mm, widely spaced on a short androgynophore. Carpels 3–4, aborting to 1–3 per fruit, each mericarp shortly cylindric 4–4.5 × 1.2–1.5 cm, rostrum cylindrical, curved or straight, 0.5–0.8 cm long, apex obtuse; base lacking stipe, tapering; surface red, longitudinally wrinkled when live (pers. obs. M. Cheek), inconspicuously and sparsely black stellate hairy, hairs 5–10% cover, 0.15–0.3 mm diam., 5–8-armed, arms radial. Seeds 2 per mericarp, with sweet-tasting, juicy, scanty white seed coat. Fig. 2.

Habitat and distribution – Cameroon: South West Region, known only from submontane (cloud) forest 1100 m elevation in the Bakossi Mts (fig. 3). Species associated with *Cola kodminensis* at the type location were *Diospyros kupensis* Gosline (Gosline & Cheek 1997), *Graptophyllum glandulosum* Turrill (1912), *Penianthus* sp., *Lomariopsis* sp., *Diogoa zenkeri* (Engl.) Exell & Mendonça (Exell & Mendonça 1951) and *Symphonia globulifera* L.f. (Linnaeus 1782).

Etymology – Meaning 'from Kodmin', so expressing gratitude to the people of the village of that name who hosted our botanical teams in the Bakossi Mts for several months, during which time the type specimen of this species was collected.

Conservation assessment – *Cola kodminensis*, although it may be widespread along the Bakossi escarpment, is equally likely to be a point endemic restricted to the site at which it was discovered. Following the guidance of IUCN (2012), which recommends using the precautionary principle, we here assess the extinction risk of the species based on the second scenario. Therefore, we estimate the area of occupancy as 4 km² using the cell-size preferred by IUCN. The extent of occurrence is considered slightly larger (IUCN 2012). Threats are localised clearance of habitat to provide resting points or sites for exotic fruit trees, as was observed at intervals along the path on which the type collection was made (M. Cheek pers. obs., 1998). We assess the species as Critically Endangered CR B1+B2ab(iii). It is to be hoped that future survey work will show this species to be more widespread than so far evidenced so that this extinction risk assessment can be revised. If this does not materialise, protection *in situ* is advised by raising awareness of this and

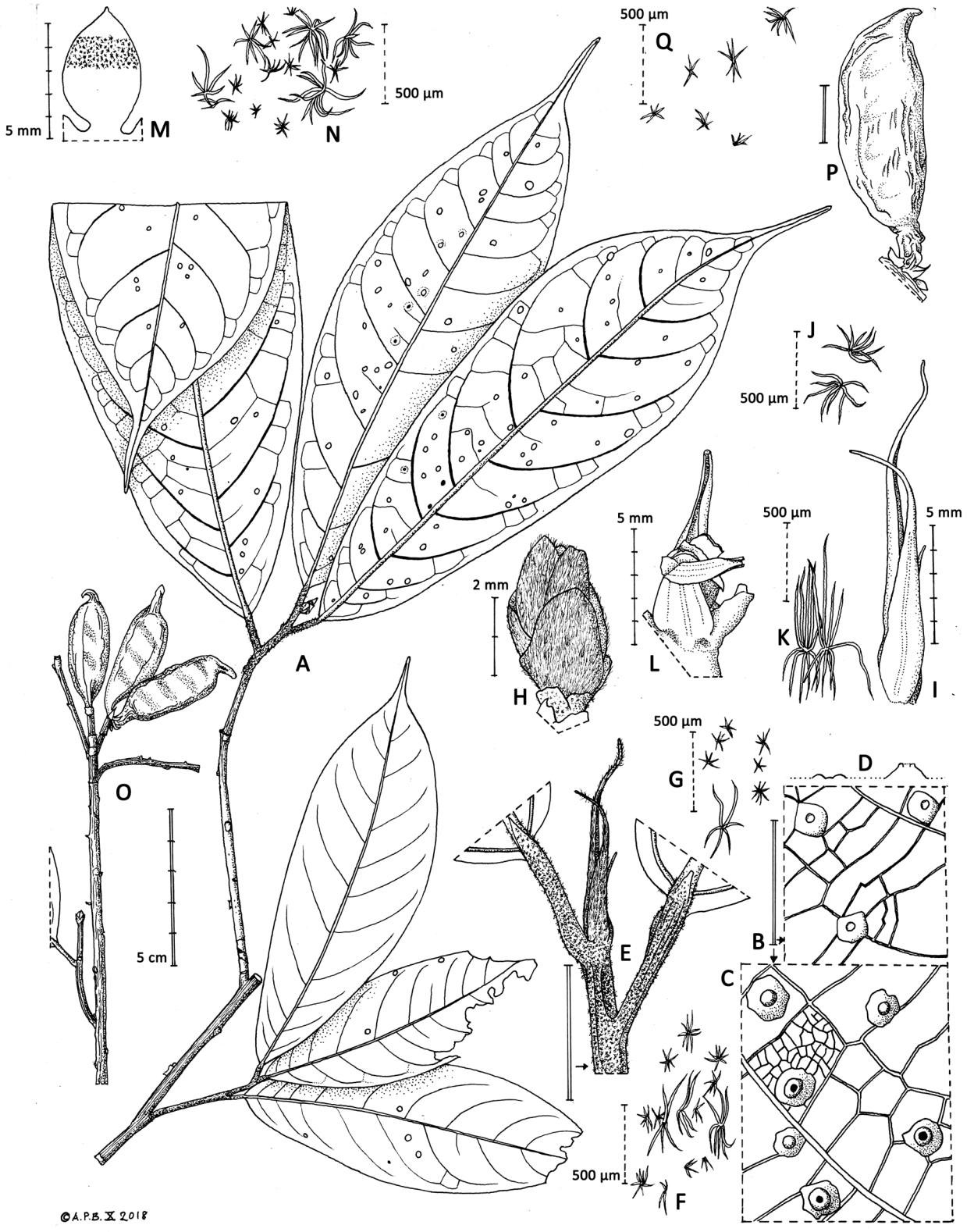

Figure 2 – *Cola kodminensis*. **A**. Habit. **B**. Detail of galls from adaxial leaf-blade. **C**. Detail of galls from abaxial leaf-blade. **D**. Gall profiles, left adaxial and right abaxial surface. **E**. Stem apex showing immature stipules. **F**. Detail of indumentum on stem (from E). **G**. Indumentum detail from petiole (from E). **H**. Dormant bud, with bud-scales. **I**. Immature stipules (from E). **J**. Hairs from stipule apices (from I). **K**. Bipolar hairs from main part of stipule (from I). **L**. Mature stipules. **M**. Perianth lobe, abaxial surface. **N**. Indumentum (from M). **O**. Fruits. **P**. Fruit with a single mericarp visible, persistent tepals at base. **Q**. Indumentum from fruit surface. All drawn from *Cheek 9682* by Andrew Brown.

Table 2 – **Characters separating *Cola kodminensis* from *Cola zemagoana*.**
Characters for the last partly taken from Kenfack et al. 2018 and from *D. Thomas 4712*(K).

	Cola zemagoana	*Cola kodminensis*
Altitude	c. 200 m	1100 m
Stipule shape & dimensions	ligulate (7–)10–18 × 1 mm	triangular 9 × 2.5 mm
Fruitlet length (cm)	7–10	4–4.5
Fruitlet length:breadth	9:1	3:1
Fruit rostrum length	15–25mm	9–10mm
Fruiting pedicel	15–25mm long articulated	7–9mm long not articulated
Fruit surface (live material)	smooth (lacking wrinkles), conspicuously stellate-hairy	longitudinally wrinkled, hairs inconspicuous
Stem indumentum	simple, 0.5mm long	mainly stellate, some simple 0.2mm long
No. seeds per mericarp	3–5	2
Leaf-blade indumentum	glabrous	adaxial midrib (proximal portion) densely covered in persistent stellate hairs.

other rare species among the inhabitants of the Bakossi Mts. Alternatively, the boundaries of the Bakossi National Park might be extended southward to include this and many other threatened species which are currently unprotected. However, given the ongoing violence (2016–) in anglophone Cameroon between the armed forces of the government and those seeking independence, these actions seem near to impossible in the immediate future.

Notes – *Cola kodminensis* was collected (*Cheek 9682* on 18th Nov. 1998) along the main footpath that links villages in lowland western Bakossi, such as Nyangdong, with those of eastern Bakossi such as Muambong. Between the village of Mwanzum at c. 1000 m in the west, and Kodmin at c. 1300 m in the east, the path climbs up a nearly vertical escarpment clothed in cloud forest, which at the time had probably never been surveyed for plants and remains incompletely known. Among the 14 numbers (*Cheek 9679–9691*) collected that day in climbing the escarpment, apart from the *Cola*, several other specimens proved to belong to taxa new to science.

These were *Phyllanthus nyale* Petra Hoffm. & Cheek (Hoffmann & Cheek 2003), *Talbotiella bakossiensis* Cheek (Mackinder et al. 2010) and *Newtonia duncanthomasii* Mackinder & Cheek (Mackinder & Cheek 2003). Some additional species endemic to the Bakossi Mts are *Amphiblemma monticola* Jacq.-Fél. (Cheek & Woodgyer 2007), *Hypolytrum pseudomapanioides* D.A.Simpson & Lye (Simpson et al. 2004), *Impatiens frithii* Cheek (Cheek & Csiba 2002), *Keetia bakossiorum* Cheek (Cheek 2006), *Ledermanniella onanae* Cheek (Cheek 2003) and *Memecylon bakossiense* R.D.Stone et al. (Stone et al. 2008).

The specimen *Cheek 9682* was identified as a new species "*Cola sp. nov. kodminensis*" in Cheek et al. (2004). However, David Kenfack, visiting Kew before that book was published, asserted that the specimen was conspecific

Figure 3 – *Cola etugei* (red dot) and *Cola kodminensis* (blue dot) global distribution.

with a taxon from Korup that he was intending to publish. For this reason, the range attributed to "*Cola sp. nov. 'kodminensis'*" in Cheek et al. (2004) is "Bakossi Mts & Korup". When reviewing Kenfack's new taxon, published as *Cola zemagoana* Kenfack (Kenfack et al. 2018), it was discovered that the Bakossi material was not cited. Kenfack concluded that, after all, it represents a separate taxon, and listed several features that distinguished it from his Korup taxon (D. Kenfack, Smithsonian Institution, Washington, D.C., USA, pers. comm. to Cheek, 2018).

Table 2 enumerates the characters that separate *Cola zemagoana* from *C. kodminensis*. However, these two short-petioled species share many features. The size and shape of the leaves are similar and both species share similar indumentum on the perianth, and the female flowers have only four sterile stamens. The mericarps of both species are cylindric and rostrate. Since most species of *Cola*, and all Guineo-congolian short-petioled *Cola* species such as this new species, are lowland, we conjecture that the submontane *Cola kodminensis* arose from a common lowland ancestor shared with *Cola zemagoana.* It is likely that the fruit were consumed by drills, *Mandrillus leucophaeus* (Cuvier, 1807), colonial ground-dwelling primates restricted to the Cross-Sanaga interval that were once present along the escarpment before they were all but exterminated by being hunted-out in the 1990s. It is equally likely that tree-dwelling monkeys such as Preuss's guenon, *Allochrocebus preussi* (Matschie, 1898), which descends to the forest floor to feed (M. Cheek pers. obs.). consume the fruit, which, as in many species of *Cola*, are attractive to primates due to their colour and their thick, sweet, white, edible seedcoat.

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