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A synoptic revision of the creeping herbaceous African species of *Ardisia* (Primulaceae or Myrsinaceae) with six new species from Cameroon and Gabon

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Abstract. Currently 39 species of *Ardisia* are recognised from continental Africa, of which three (*A. sadebeckiana* Gilg, *A. schlechteri* Gilg, and *A. ebo* Cheek, each endemic to Cameroon and known from a single collection) are herbaceous, with creeping, horizontal, rooting herbaceous stems, the stem apex more or less ascending to up to c. 10 cm tall above the ground (decumbent). These species lack the distinctive plagiotropic (perpendicular and horizontal) aerial reproductive stems seen in most woody *Ardisia* species of Africa (instead sporadically producing rooting ascending stems from the horizontal stem) and have distichous leaves (not spiralled as in most species in Africa). Accordingly, they are proposed as a separate subgenus *Kamardisia*. Study of herbarium material revealed that six additional species exist which are described and illustrated in this paper, together with preliminary conservation assessments. These are: *A. hansii* (South Region, Cameroon and Belinga, Gabon), *A. massaha* (Belinga, Gabon), *A. chaillu, A. minuta, A. waka* (all Chaillu Massif, Gabon), *A. ngounie* (Ogooué-Maritime, Gabon). We provide a key to the identification of the nine herbaceous species, provide preliminary conservation assessments for each, and notes on shared characteristics of the African herbaceous species including the taxonomic value of leaf microcharacters (oil glands and trichomes). We also make a preliminary report on the possibility of bacterial colonisation of marginal leaf pores in some of these herbaceous species. All of the species are range restricted, the most wide-ranging with only three sites. All but one species is threatened, and almost all of those are Critically Endangered (provisional assessments). The two first published species have not been seen for more than 125 years, despite being in easily accessible, well-botanised locations, and are both feared extinct. We discuss actions to attempt to refind these species and safeguard the remainder.

Keywords: ardisiaquinones, bacterial nodules, conservation, extinct species, *Paraburkholderia*.

INTRODUCTION

Ardisia Sw. (Swartz 1788) is a genus placed in the family Primulaceae or Myrsinaceae (Julius et al. 2021; Ståhl and Anderberg 2004). The genus is

pantropical, estimates of the total number of species vary from 400 to c. 1000 species (POWO continuously updated; Julius et al. 2021; Ståhl and Anderberg 2004). New species to science are continually being published, especially from Asia e.g. China (Mao, Hu 2013 and Quan, Tan 2024), Vietnam (Nuraliev et al. 2021), the Philippines (Magtoto et al. 2021), and above all from Malaysia (Julius and Utteridge 2012, 2021, 2022; Julius et al. 2017, 2023).

In Africa, the species are mainly shrubs of evergreen forest understorey. A small number of Asian species are cultivated e.g. *Ardisia crenata* Sims (also known as coralberry or Christmas berry), in gardens due to its attractive red berries that persist through winter and its glossy, evergreen foliage. *Ardisia crispa* (Thunb.) A.DC is similarly planted https://www.rhs.org.uk/plants/30319/ardisia-crispa/details.

Ardisia japonica Blume is cultivated as a groundcover plant. The genus is known in Asia for being of value in traditional medicine. Species have been used for the treatment of cancer, hypertension, irregular menstruation, gonorrhea, diarrhea and postnatal syndromes, among others. The chemical basis of these uses was reviewed by Liu et al. (2022). Among the compounds produced are alkylbenzoquinones, specifically ardisiaquinones. In one African species these compounds have been shown to have antiproliferative and antimicrobial properties (Dzoyem et al. 2014).

In Africa, many species of *Ardisia* are range-restricted, and as a result threatened with extinction. Of the c. 40 species accepted, 12 have been assessed for their extinction risk level on the IUCN Red List, all but two of which are Cameroonian. The assessments were mainly on the basis of Cable and Cheek (1998) and Onana and Cheek (2011). Of the ten Cameroonian species assessed seven are Critically Endangered, the highest level of threat (e.g. *Ardisia etindensis* Taton, in Cheek and Cable 2000a).

Many of the species now included in the genus *Ardisia* have been included in other genera, some of which have in recent decades been synonymised with *Ardisia* e.g. *Tetrardisia* Mez (Larsen & Hu 1995). Large scale molecular phylogenetic studies show that several accepted genera are embedded in the wider genus *Ardisia*, especially in Asia (Julius et al. 2021 using nrITS; Larson et al. 2023 using 353 nuclear markers).

Most continental African *Ardisia* species were formerly included in the genus *Afrardisia* Mez (Mez 1902). The continental African species of *Ardisia* (based on a sample of four taxa) form a single subclade in Julius et al. (2021) suggesting they are monophyletic. In contrast, in Larson et al. (2023) the two continental African taxa included in the study appear embedded in separate subclades of mainly Asian species including one as sister to the accepted segregate genus *Fittingia* Mez (Mez 1902).

Baker (in Oliver 1877) published the first two tropical African species, from Sao Tomé and Gabon. Twenty-five years later, eight further species from Cameroon were published (Gilg 1902). In the same year, Mez (1902) grouped all ten then known African species into his newly erected genus *Afrardisia,* separated from *Ardisia* by a single character: the ovules were stated to be uniseriate (not biseriate or multiseriate as in *Ardisia sensu stricto*). In 1913, nine further new species, one from the Democratic Republic of the Congo (DRC, formerly Belgian Congo) and eight from Cameroon, were published by Gilg and Schellenberg (1913). De Wildeman (1925), Good (1927) and Perrier de la Bâthie (1953) then published three new species, respectively from DRC, Angola (Cabinda) and from Madagascar. De Wit (1958) revised the genus *Afrardisia*. He described a new species from Brazzaville, Republic of Congo, and synonymised six other species (*A. brunneo-purpurea* Gilg, *A. haemantha* Gilg, *Afrardisia ledermannii* Gilg & Schellenb., *Afrardisia hylophila* Gilg & Schellenb., *Afrardisia dentata* Gilg & Schellenb. and *Afrardisia rosacea* Gilg & Schellenb.). De Wit excluded the only species described from Madagascar at that point (*Afrardisia didymopora* H.Perr.) from the genus. He also neotypified many names for which types had been destroyed at B in 1943. Capuron (1963) described a further new species from Madagascar.

Taton (1979) showed that the placentation character used by Mez to separate the African species from the rest of the genus, breaks down, making *Afrardisia* a synonym of *Ardisia*. Accordingly, he transferred names from *Afrardisia* making six new combinations in *Ardisia*. He also published eighteen new species, one from DRC, ten from Cameroon, one from the Republic of Congo and six from Gabon. Taton and Lejoly (1980) published *A. lisowskii* Taton & Lejoly from DRC. In 2010, Cheek published two new species from Cameroon (Cheek in Cheek et al. 2010). *Ardisia ebo* Cheek (Cheek and Xanthos 2012) was published from Cameroon and Gabon. Up to this point, a total of thirty-nine species of continental African *Ardisia* have been published and accepted (African Plant Database, continuously updated).

African *Ardisia* have been treated in several regional and national Flora and checklist accounts. Sixteen species in the genus *Ardisia* from Gabon have been recognized (Sosef et al. 2006). In Cameroon, twenty-two species in the genus *Ardisia* have been accepted (Onana 2011), the highest number for any tropical African country. In the Flora of West Tropical Africa, a total of seven species (published under the formerly recognized genus *Afrardisia*) are recognized, all from eastern Nigeria and adjoining former British Cameroon (Hepper 1963). For

the Flora of tropical East Africa, only two species in the genus *Ardisia* are recognised, one of which, in Zanzibar, remains unnamed and dubious (Halliday 1984). In DRC, a total of ten species in the genus *Ardisia* have been accepted (Taton 1980). The genus has not been recorded in the Flora Zambesiaca, nor the Flora of southern Africa areas.

The African species are all understorey species of evergreen forest from sea-level to 2400 m alt. The majority are shrubs or small trees of 0.3–2(–20) m tall. These woody species generally have an erect principal (orthotropic) vegetative axis from which horizontal plagiotropic reproductive branches arise in most species. The plagiotropic shoots are widened and laterally flattened at their base as occurs also in many of the Asian species.

African herbaceous creeping Ardisia

Among the known species of African *Ardisia*, three are unusual in being herbaceous and decumbent to procumbent, with long horizontally creeping and rooting, slender, flexible stems that do not increase in thickness with age/distance from stem apex. The stems terminate with a short (< 10 cm tall), more or less ascending, leafy reproductive part, which if decumbent produces long aerial adventitious roots which appear contractile, pulling the lower aerial part of the stem towards the ground. The elongating stem apex thus remains more or less fixed in height above the ground. New shoots arise at intervals from the horizontal surface/subterranean stem about 15–20 cm distant from the apex of the principal axis. The new shoots root, propagating vegetatively and by repetition form carpets on the floor of the forest (e.g. *A. ebo,* Cheek and Xanthos 2012). In these herbaceous creeping species plagiotropic branches are not produced (Cheek and Xanthos 2012). The known African herbaceous species are *A. schlechteri* Gilg, *A. sadebeckiana* Gilg and *A. ebo* Cheek, all of low altitude evergreen rainforest in coastal Cameroon. The first two species were collected in the 1890s, published (Gilg 1902) and have not been found since, leading to concerns that they are extinct.

In preparation for revising *Ardisia* for the accounts for the Flore du Gabon and the Flore du Cameroun as steps towards revising all the continental African species, it was decided to begin with the herbaceous taxa. In the paper describing *Ardisia ebo*, significant heterogeneity in leaf micro-structures was recorded among the specimens, warranting further taxonomic investigation (Cheek & Xanthos 2012). Material of herbaceous taxa collected from Gabon and Cameroon subsequent to Taton's synoptic revision (Taton 1979) was also studied, resulting in the discovery of the several taxonomic novelties recorded in this paper.

MATERIAL AND METHODS

This study is mainly based on the herbarium specimens, including corresponding field notes, at the herbaria of the Royal Botanic Gardens, Kew (K), Natural History Museum U.K. (BM), National Museum of Natural History, Paris, France (P) and National Herbarium of Cameroon (YA). Herbarium loans included those from the Wageningen herbarium at Naturalis, Leiden, the Netherlands (WAG) and Meise Botanic Garden, Belgium (BR). It was not possible to obtain specimens from BRLU due to digitising operations, nor was it possible to access specimens at LBV and YA. The study is also based on the study of digital images of herbarium specimens from other herbaria e.g. Herbarium Hamburgense (HBG) via GBIF (continuously updated). However, digital images do not give the resolution needed for comprehensive taxonomic studies since insufficient or no detail of trichomes and internal leaf structures can be observed, which are often diagnostic at species level. Herbarium codes follow Index Herbariorum (Thiers continuously updated). All specimens cited have been seen unless indicated "n.v.". Herbarium practices and procedures follow Davies et al. (2023). 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). 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. Density of structures was assessed using a 2 × 2 mm square aperture cut in a paper mask. Oil gland structures in the leaf were examined in transmitted light by using the torch (flashlight) function on an inverted standard smartphone e.g. Samsung Galaxy S10, held below a dried herbarium leaf under the dissecting microscope. The drawings were made with the same equipment with a Leica 308700 camera lucida attachment. It was necessary to soak or boil the flowers and fruits to rehydrate them so as to allow dissection and observation of the inner structures of the corolla and androecium. The format of the descriptions and terminology for specialised structures generally follows Beentje (2016) and those in other papers describing new species in *Ardisia* (e.g. Cheek and Xanthos 2012). Measurements were made of stems, leaves, inflorescences, flowers and fruits by using a microscope eyepiece micrometre and a graduated ruler.

In every description the range of measurements is given with the extreme dimensions indicated in parentheses. Provisional conservation assessments were made using the criteria and categories of IUCN (2012) using the required IUCN cell-size of 4 km^2.

RESULTS

Based on the current study of herbarium specimens and related literature, a total of nine creeping herbaceous species of *Ardisia* are recognised in Africa, In addition to the three previously described species, six new creeping species were discovered hiding among specimens collected between 1974 and 1996. Additional taxa were indicated but could not be described due to lack of material or difficult access (see under *Ardisia sadebeckiana* and in discussion). All these species, including the newly described species, appear to be endemic to Gabon and/or Cameroon. A key to these nine species of *Ardisia* is presented below. Treatments of all nine species are presented in alphabetical order, with illustrations and full descriptions and illustrations of all six new species to science and synoptic accounts of the other three species.

Morphological characteristics of herbaceous African Ardisia

The herbaceous species described in this paper differ in several features from other African species of *Ardisia*:

1) Their stems appear not to thicken or to become woody, remaining slender, flexible and have the same diameter as newly formed stems, even 30 cm or more from the stem apex.
2) In all species observed, the older part of the stems appears to be horizontal, running along the surface and rooting, only the apical part curving upwards, becoming aerial and ascending towards the vertical, but never reaching more than about 10 cm above the soil level. The lower nodes of the aerial part develop long adventitious roots that drop to soil level on the side of the stem that is moving forward, pulling the lower aerial nodes towards the ground. This appears to be a continuous process, regulating the height of the stem apex above the ground (keeping it low).
3) Plagiotropic (perpendicular) side shoots, so characteristic of the genus as a whole, with their laterally compressed, triangular bases, are not produced in the African herbaceous species. Inflorescences are borne on the main axis and not on the plagiotropic stems as in most woody African *Ardisia*. Side shoots which root immediately, giving rise to new plants are produced sporadically from the horizontal part of the main axis 15 to 30 cm distant from the apex of the main stem.
4) The leaf phyllotaxy of the primary stem is distichous (in two ranks) not spiralled as in woody African species.
5) Large (comparatively: visible with a 10× hand lens, c. 0.1 mm diam.) peltate, adpressed scales occur on the abaxial surface in most, but not all of the herbaceous species. These are unknown on the leaves in the shrubby species of Africa.

In view of the above marked architectural and morphological separation of these species not only from all other African species of the genus, but those globally, they are here proposed as a separate subgenus:

Kamardisia Cheek, **subgen. nov.**

Type species: *Ardisia ebo* Cheek, Kew Bull. 67: 281. 2012.

Diagnosis

Differing from all other subgenera and species groups of *Ardisia* in: the herbaceous habit (stems not thickening with age), primary stems prostrate or decumbent, rooting adventitiously along their length, with distichous phyllotaxy and absence of plagiotropic branches (not with erect primary stems that become woody, with spiral phyllotaxy and with one or more plagiotropic branches).

Notes

Nine species, comprising three in Cameroon and six new species (this paper) in Gabon (one of these extending to Cameroon). It is possible that these species represent not just a separate subgenus but a distinct genus, apart from *Ardisia*. However, additional data including from pollen and from molecular phylogenetic studies in the context of a global study of the genus is advisable before making this designation formally. For the moment, none of the taxa of this group have been studied for their pollen nor included in any molecular study.

Microstructures as important taxonomic characters in African Ardisia

Oil glands. Taton (1979) was first to draw attention and to illustrate in detail the oil glands in the leaves (and other structures) of African *Ardisia* as valuable taxonomic characters. Features of value at separating spe-

cies are based on observations in a) reflected light on i) the adaxial and ii) the abaxial surfaces and b) in transmitted light. In some species in reflected light these are invisible, in others black, in others an intermediate state. In transmitted light they are most comprehensively seen and measured accurately.

These structures vary in:

1) Density, (expressed as a number in a 2 × 2 mm square measured between midrib and margin at mid length of a blade).
2) Shape (from orbicular, to elliptic, to linear)
3) Size
4) Uniformity (in some species a reticulation on a blade is typically occupied by a large elliptic oil gland and several much smaller satellite glands)
5) Position (while some species have oil glands scattered evenly through the blade, in others they are present only in the marginal ½ to ¼ of the blade)
6) Prominence (in some species the oil glands appear flat, at the same level as the blade surface, in others they can be raised like a hill)
7) (In transmitted light) colour, varying from colourless, to brown, to red, to black.

Indumentum. The variation in indumentum, primarily on the leaf blade surfaces, matches the variation and taxonomic value of the oil glands. In the herbaceous species two main types of indumentum were observed:

Peltate scales. Usually red in colour (sometimes drying black and then confused with oil glands) these vary in shape and size, and complement (the mixture of scales present), from one species to another. Most Gabonese herbaceous species in this paper have (comparatively) large (0.1 mm diam.) orbicular peltate scales (absent from all Cameroonian species). In some species the scales are bow-tie-shaped (figure of 8), while in others they are Y-shaped, these scales being generally in the range of 0.05 to 0.075 mm diam. Smaller still (<0.05 mm diam.) are trifid, quadrate, stellate, or linear centrally attached (medifixed) structures presumed to be homologous with these scales. These are at the limit of visibility with a normal dissecting microscope. Mixtures of different shapes appear characteristic of some species.

Hairs. These are basally attached, cylindrical, and short or long, simple or branched (sometimes large and stellate with irregular sinuous, filamentous arms).

Glands. Globose red sessile glands characterise some species (e.g. on the pedicels of *A. chaillu*).

Key to the herbaceous species of *Ardisia* Sw. in continental Africa

1. Leaves with red, circular or slightly lobed, peltate scales conspicuous on at least the abaxial leaf-blade (c. 0.1 mm diam., visible with a 10× hand lens) 5

– Leaves lacking circular, peltate scales on the abaxial blade surface (< 0.1 mm diam., not visible with a 10× hand lens) 2

2. Leaves 3–7(–8) cm wide; flowers 3–6 per inflorescence; calyx lobes c. 2 mm long 3

– Leaves (1.5–) 1.9–2.8 cm wide; flowers 2(–3) per inflorescence; calyx lobes 0.7–0.8 mm long ..... ***A. ebo***

3. Leaf-blade 5.5– 7(–8) cm wide; base cordate, margin entire ..... ***A. sadebeckiana***

– Leaf-blade 3–5 cm wide; base acute, margin crenate 4

4. Petiole 7–10(–18) mm long; leaf-blade discolorous, drying black above, dull white below ..... ***A. schlechteri***

– Petiole 3–5(–10) mm long; leaf-blade ±concolorous, drying green on both surfaces ..... ***A. massaha***

5. Leaves 4.4–5.3 × 2.1–2.2 cm, apex acuminate ..... ***A. minuta***

– Leaves 4.3–9.3(–12.2) × (2.7–)5–6.3 cm, apex acute or rounded 6

6. Leaf apex broadly rounded, base abruptly cordate ..... ***A. ngounie***

– Leaf apex acute, base obtuse or rounded 7

7. Leaves rhombic, the distal ½ to ⅔ with distinct marginal teeth; pedicels glabrous apart from sessile globose, red glands; fruit with 5 longitudinal lines; leaf nervation inconspicuous ..... ***A. chaillu***

– Leaves elliptic or ovate-lanceolate, margins entire or sinuous, sometimes with inconspicuous marginal teeth proximally and distally; pedicels with broad, short acute hairs, non-glandular; fruit (where known) lacking longitudinal lines; leaf nervation conspicuous 8

8. Peltate scales present on adaxial as well as abaxial blade surface; leaf length: width ratio <2; secondary and tertiary veins raised, conspicuous on adaxial surface of leaf; calyx lobes about as long as wide ..... ***A. hansii***

– Peltate scales present only on abaxial blade surface; leaf length: width ratio >2; secondary and tertiary veins inconspicuous on adaxial surface of leaf; calyx lobes nearly twice as broad as long ..... ***A. waka***

TAXONOMIC TREATMENT

Ardisia chaillu P.Peng & Cheek, **sp. nov.** (Figures 1, 2).

Type: Gabon, Ngounié. Massif of Chaillu. Near Mouyanama, about 27 km. E. of Mimongo; alt. ±800 m; 1°39′ S, 11°46′ E; fr. 26 Nov. 1983, *A.M. Louis*, *F.J. Breteler* & *J. de Bruijn 915* (holotype WAG [WAG1113120]).

Diagnosis

Ardisia chaillu differs from *A. hansii* P.Peng & Cheek to which it is similar (in habit, also both have similar leaves with an acute blade apex, and large circular peltate scales on the abaxial leaf surface), by having distinct marginal teeth in the distal ½ to ⅔ of the blade, pedicels glabrous apart from sessile globose glands on the surface (Fig. 1J), pectinate sepal margins, and fruit with 5 longitudinal lines (*Ardisia hansii* has leaves with marginal teeth inconspicuous, pedicels lacking globose glands but with broad, short acute hairs, entire sepal margins, and fruits with no longitudinal lines).

In addition, the leaves of *Ardisia chaillu* are generally larger, in the region of 10 cm long (in *A. hansii* they are generally 4 to 7 cm long and only exceptionally 8 cm) and the oil glands are black, but obscure on the adaxial surface in reflected light, while in *A. hansii* they are conspicuous at the surface, brown and numerous.

Description

Small creeping shrubby herb, forming leafy mats. Stems decumbent, creeping horizontally, terete, 1.75–3 mm diam., internodes 0.4–2.4 cm long, distal part unbranched, erect, c. 20 cm high, producing adventitious roots, new stems arising c. 12 cm apart along the creeping portion, indumentum densely furfuraceous, red-brown in the distal 1–2 cm below the stem apex, then abruptly glabrescent, epidermis grey-brown, longitudinally ridged. Leaves alternate, the blade rhombic, 4.3–10.4 × (2.1–)3.3–4.2 cm, apex acute, (1–)3–4 × 3–4 mm, base acute, often slightly asymmetric, margin revolute, obscurely crenate, crenations (6–)12–16 on each side in the distal ½ – ¾ of the blade, each (0.25–)0.35–0.875 × 2.5–4(–4.75) mm, lateral nerves 12–14 on each side of the midrib, brochidodromous, inframarginal nerve 1.9–3.5 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; trichomes evenly distributed on the abaxial leaf surface, orbicular peltate scales red (Fig. 1 B), 0.1–0.125 mm diam., 33–39 per 2 × 2 mm, also appearing on the adaxial leaf surface in density of 3–6 per 2 × 2 mm, c. 0.075 mm diam., dark red (Fig. 1 C), adaxial surface otherwise glabrous; suborbicular scales smaller and darker, c. 0.05 mm diam., 3–11 per 2 × 2 mm; oil glands orbicular, elliptic or oblong, appearing dark black in transmitted light, but inconspicuous in reflected light on both surfaces sometimes very slightly raised (but more frequently not and then invisible), 0.1–0.6(–1.13) mm in diam., 7–10 per 2 × 2 mm, flower-shaped scales (with c. 5 radiating obovate arms) clustered on the midrib, red, 0.05–0.075 mm diam., 2–6 per 0.25 × 0.25 mm, slender inclusions visible in the midrib, yellow-orange or dark brown, 0.25–1.38 mm diam.. Petiole plano-convex, (2.5–)4–9(–13) mm long, 0.75–1.25 mm wide, oil glands visible raised strongly at the surface, amber, elliptic, 0.2–0.3 mm diam., indumentum as stem apex. Inflorescences axillary, fasciculate, c. 7 per stem, 1–4-flowered; peduncle suberect, 0.25–0.75 × 0.75–0.88 mm, indumentum as stem apex, bracts 2–3, spatulate (Fig. 1 G), concave, 1.5–2.6(–4) × 0.4–0.75 mm, indumentum as stem apex, bracteoles resembling bracts, 1 × 0.25 mm. Pedicel subcylindrical, 6–8 × 0.5 mm, sessile glands on the surface dark red, 2–4-lobed, tiny irregular, 0.025–0.05 mm diam., 5–8 per 0.25 × 0.25 mm, oil glands visible raised strongly at surface, fulvous, elliptic, 0.125–0.15(–0.2) mm diam., 2–4 per 0.25 × 0.25 mm. Calyx cupular, reflexed on mature fruits, tube 0.25 × 1.25–1.375 mm, lobes 5, overlapping, subtriangular, 0.6 × 0.75–0.88 mm, apex acute, oil glands visible raised strongly at surface, fulvous, elliptic, 0.075–0.18 diam., 3–5 per 0.25 × 0.25 mm, sessile glands (Fig. 1 J) on the surface of pedicels, margin pectinate, lined with simple hairs 0.025–0.125 mm long (Fig. 1 I).

Flowers not seen. *Fruits* (immature) dark green (Fig. 1 F), globose, c. 2–2.625 mm diam., glands visible raised slightly at surface, orbicular to elliptic, pale red in reflected light, 0.1–0.4 mm diam., mature fruits (Fig. 1 H) globose, orange 6–7 mm diam., with 5 pale longitudinal lines (see Fig 1H); glands raised strongly at surface, orbicular to elliptic, 0.275–0.8 mm diam., dark red in reflected light.

Etymology

Ardisia chaillu is named as a noun in apposition for the Chaillu Mountains in southern Gabon (which extend into Republic of Congo) from where the type specimen originates.

Phenology

Fruiting in November.

Distribution and habitat

Endemic to Gabon, near Mouyanama, East of Mimongo. Old secondary, partly primary evergreen forest, alt. ±800 m.

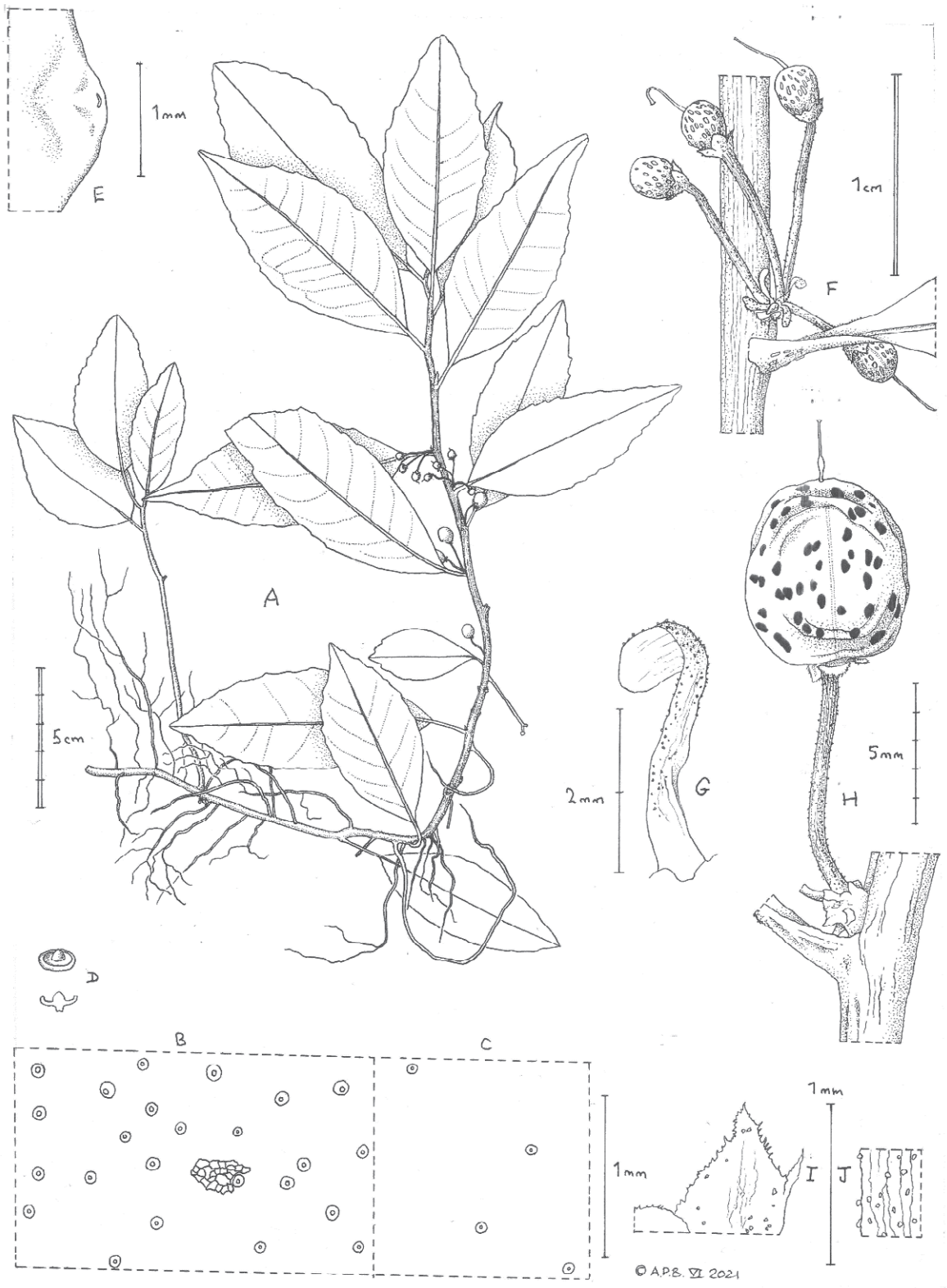

Figure 1. *Ardisia chaillu* P.Peng & Cheek – **A.** habit, whole plant in fruit; **B.** abaxial leaf surface showing peltate scales (orbicular discs) and detail of lower epidermis; **C.** adaxial leaf surface showing peltate scales; **D.** detail of the peltate scale; **E.** adaxial leaf margin showing pore; **F.** node with immature fruits; **G.** spatulate bract; **H.** mature fruit; **I.** sepal showing oil glands and pectinate margin lined with simple hairs; **J.** pedicel surface showing sessile glands. From *A.M. Louis*, *F.J. Breteler* & *J. de Bruijn 915*. All drawn by Andrew Brown.

Figure 2. Holotype of *Ardisia chaillu* P.Peng & Cheek (*Louis et al.* 915 [WAG1113120]).

Conservation status

Only known from the type specimen. Observations on Google Earth (viewed April 2024) at the grid reference given for the type specimen failed to detect any obvious threats at the site, however image resolution was low. We here provisionally assess the species as Vulnerable VU D2 since only a single site is known in an area that appears not formally protected. Other areas in the Chaillu are subject to open cast mining and logging (Cheek pers. obs.) which could well pose a threat to this species in the near future.

Notes

The type specimen had not previously been identified to species (Sosef et al. 2006).

The species is most likely to be confused with *A. hansii* which is geographically disjunct (see diagnosis for differentiating features). Other herbaceous *Ardisia* species in the Chaillu Massif are *A. minuta* and *A. waka*.

Ardisia ebo Cheek, Kew Bull. 67: 281. 2012.

Type: Cameroon, Littoral Region, Ebo Proposed National Park, Yingui Commune, 4°19' 00" N 10°25' 40" E; 23 Apr. 2005; fl. fr.; *Cheek* 12503 (holotype K [K000678251]; isotypes WAG, YA).

Diagnostic features

Similar to *A. schlechteri* Gilg, both having elliptic leaves with subacuminate apices, acute to obtuse bases, lacking conspicuous peltate scales, *A. ebo* differing by having concolorous smaller leaves, (1.5)–1.9(–2.8) cm wide, with oil bodies conspicuous, raised on the abaxial surface, calyx lobes 0.7–0.8 mm long. (*Ardisia schlechteri* has discolorous larger leaves, (3.7)–4.2–5 cm wide, oil glands conspicuous, black on the adaxial surface, and c. 2 mm long calyx lobes).

Etymology

Ardisia ebo is named as a noun in apposition for the highly threatened yet species diverse Ebo forest in Littoral Region, Cameroon from where the type and only known specimen originates.

Phenology

Flowering and fruiting in April.

Distribution and habitat

Ardisia ebo appears endemic to the Ebo Forest of Cameroon: Littoral Region, near Yabassi and Yingui, Lowland to submontane evergreen forest; alt. 550 – 800 m. (Cheek and Xanthos 2012).

Conservation status

Only known from the type specimen. Despite several further botanical surveys at Ebo in recent years, no further collections of this taxon have been found. The forest is highly threatened by ongoing logging which may be followed by agriculture. As a result the species is assessed as Critically Endangered (Lovell and Cheek 2020). The Ebo forest contends as one of the important sites for plant conservation in Cameroon and is designated as an Important Plant Area (Murphy et al. 2023). Ebo is globally important for the high number of other published globally unique species of plant, e.g. *Palisota ebo* Cheek (Commelinaceae, Cheek et al. 2018), *Uvariopsis dicaprio* Cheek & Gosline (Annonaceae, Gosline et al. 2022), *Memecylon ebo* R.D.Stone & Cheek (Melastomataceae, Stone et al. 2024), *Begonia ebo* H.Lockwood (Begoniaceae, Lockwood and Tchatchouang 2025). Ebo also has the highest number of Critically Endangered

species of all Important Plant Areas in Cameroon since the two last mentioned species take the total to 25, surpassing the Ngovayang massif which has 24 such species (Murphy et al. 2023). Both are extremely important priorities for conservation in Cameroon.

Notes

In the protologue, several other specimens were ascribed to this taxon from further southeast (Cheek and Xanthos 2012), but these have now been segregated as the separate taxon *A. hansii* (see following species in the current paper). *Ardisia ebo* differs from *A. hansii* e.g. in lacking the large (clearly visible with x 10 hand lens) peltate orbicular scales of the abaxial blade. The ranges of the two taxa are separated by about 200 km geographically.

In sharing the absence of large conspicuous peltate scales, and also the general elliptic, crenate, leaf shape, *Ardisia ebo* is also similar to *A. schlechteri,* which is known only from sea level at the coast northwest of Mt Cameroon, about 150 km to the NW of Ebo. *A. schlechteri* differs among other features in having larger leaves which are discolorous, and longer petioles, and in having dense orbicular oil glands that show black on the adaxial blade surface in reflected light (see diagnostic features under *A. schlechteri* below and Table 1).

Comparisons of *A. ebo* in the protologue (Cheek and Xanthos 2012) with *A. schlechteri* and *A. sadebeckiana* (the only other herbaceous *Ardisia* species then known in Africa) are flawed because at that time the second author did not have access to the type and only specimens of either species (in fact the type of the first only came to light recently), and so the characteristics given were based on those in the literature which are misleading since based on other material now known not to be conspecific.

Ardisia hansii P.Peng & Cheek, **sp. nov**. (Figures 3, 4).

Type: Cameroon, South Region. 4 km. on the road from N'Koemvone to 'Akoakas rock'; 2°49′ N, 11°10′ E, fl. fr. 4 Oct. 1974, *J.J.F.E de Wilde 7605B* (holotype K [K000678894]; isotype WAG [WAG1113076]).

Diagnosis

Ardisia hansii differs from *Ardisia chaillu*, to which it is similar (in habit, also both have similar leaves with an acute blade apex, and large circular peltate scales on the abaxial leaf surface), by having leaves with inconspicuous marginal teeth, pedicels with broad, short, acute hairs, lacking globose glands, entire sepal margins, and fruits with no longitudinal lines (*A. chaillu* having distinct marginal teeth in the distal ½ to ⅔ of the blade, pedicels glabrous apart from sessile globose glands on the surface (Fig. 1J), pectinate sepal margins, and fruit with 5 longitudinal lines). In addition, the leaves of *Ardisia chaillu* are generally larger, in the region of 10 cm long (in *A. hansii* they are generally 4 to 7 cm long and only exceptionally 8 cm) and the oil glands are black, but highly obscure on the adaxial surface in reflected light, while in *A. hansii* they are conspicuous at the surface, brown and numerous.

Description

Small creeping herb or subshrub, forming leafy mats. Stems decumbent, creeping horizontally for 30 cm or more, terete, 1.25–2 mm diam., internodes 0.2–3.4 cm long, distal part unbranched, erect, 3.5(–18) cm high, producing adventitious roots, new stems arising 10–15 cm apart along the creeping portion, indumentum densely furfuraceous, red-brown (Fig. 3 B) in the distal 1–2 cm below the stem apex, then abruptly glabrescent, epidermis pale brown, longitudinally ridged. Leaves alternate, elliptic, (2–)4–7.8(–8) × (1.2–)2–3.4(–4) cm, apex acute, 1–5 × 2–4 mm, base acute, often slightly asymmetric, margin revolute, obscurely crenate, crenations 12–16 on each side in the distal ½ – ¾ of the blade, 0.3–0.5(–1) × (2–)3–5 mm (Fig. 3 C), lateral nerves 12–14 on each side of the midrib, brochidodromous, inframarginal nerve 1.5–3.25 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; trichomes evenly spread on the abaxial leaf surface, orbicular peltate scales (Fig. 3 D) dark brown or dark red, 0.1–0.125 mm diam., 34–41 per 2 × 2 mm, (also appearing on the adaxial leaf surface in density of 2–3 per 2 × 2 mm, which is otherwise glabrous); suborbicular scales smaller and darker, c. 0.05 mm diam., 3–11 per 2 × 2 mm; stellate hairs sparse, interspersed with scales, centre dark red, grading to translucent, towards the distal end, 0.075–0.38 mm diam., 3–5 per 2 × 2 mm, each stellate hair 3–6 armed; cross-shaped scales on the abaxial leaf surface dark red or pale red, 0.075–0.1 mm diam., 3–8 per 2 × 2 mm; oil glands (Fig. 3 D) orbicular, elliptic or oblong, appearing dark black, yellow-orange or colourless in transmitted light, black and inconspicuous in reflected light, not raised or raised very slightly, 0.1–0.625 mm diam., 9–25 per 2 × 2 mm. Petiole canaliculate, 4–13 mm long, 0.5–1.68 mm wide, indumentum as stem apex. Inflorescences axillary, fasciculate, sessile, 2–11 per stem, (1–)3(–4)-flowered; bracts 2–4, narrowly triangular, concave, 0.75–2.25 × 0.25–0.5 mm, stellate hairy (Fig. 3 H), dark brown, 0.05–0.125 mm diam. c. 22 per 0.25 × 0.25 mm. Pedicel curving downwards, subcylindrical, 1.5–7 ×

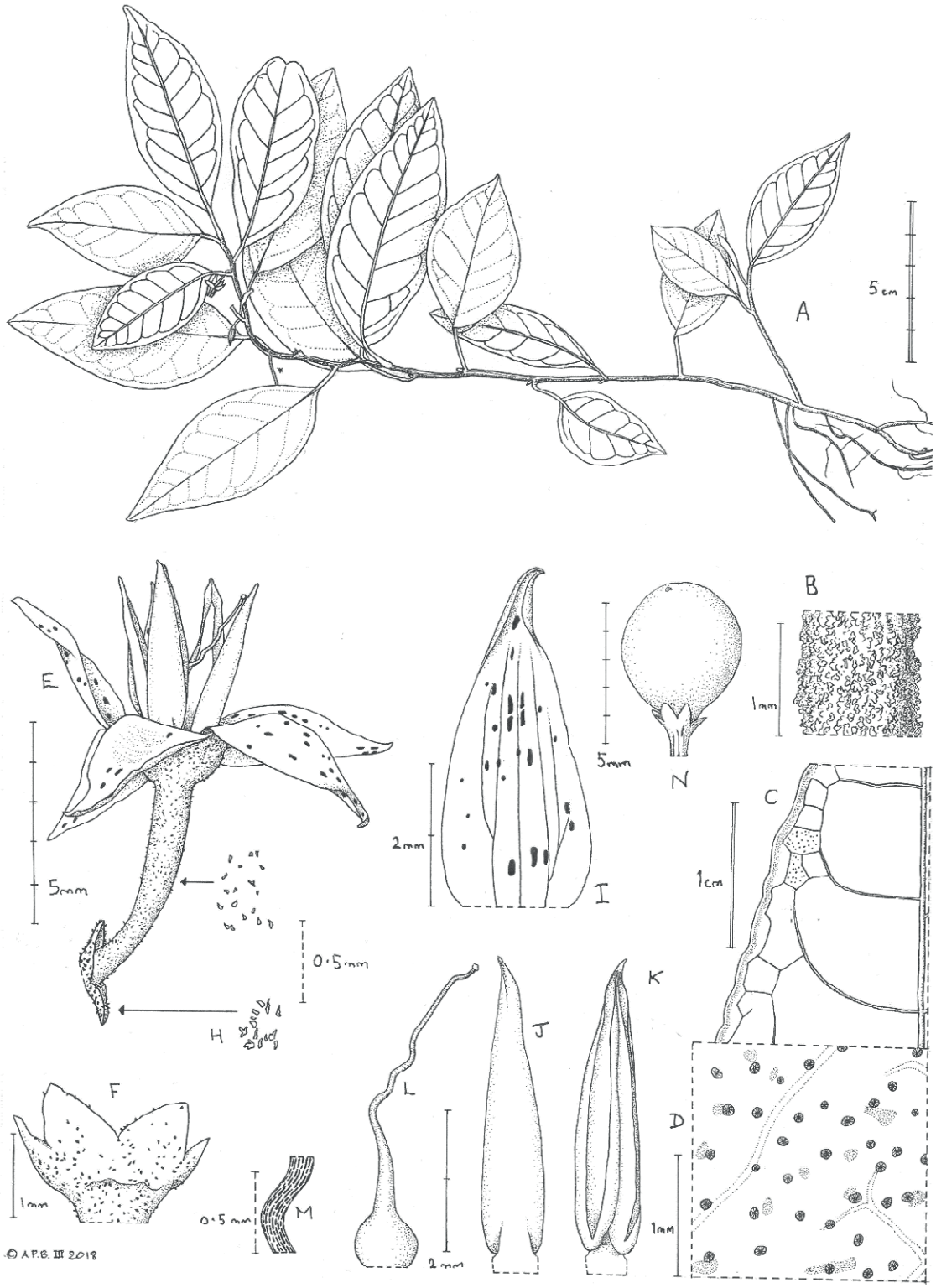

Figure 3. *Ardisia hansii* P.Peng & Cheek – **A.** habit, whole plant in flower, * = adventitious roots; **B.** stem indumentum; **C.** abaxial leaf margin with scales; **D.** abaxial leaf surface showing peltate scales (dark discs) and oil glands (stippled areas); **E.** flower, side view, inverted; **F.** calyx; **G.** indumentum of pedicel; **H.** indumentum of flower bracts; **I.** petal (inner face); **J.** stamen (outer face); **K.** stamen (inner face); **L.** ovary, style and stigma; **M.** detail of style showing parallel pigmented bars; **N.** fruit (immature). [A, C-M. from *J.J.F.E. de Wilde* 8144; B. from *J.J.F.E de Wilde* 7605B; N. from *Breteler* & *J.J. F.E. de Wilde* 573]. All drawn by Andrew Brown.

Figure 4. Holotype of *Ardisia hansii* P.Peng & Cheek (WAG1113076).

0.25–1 mm, oil glands visible, raised strongly at surface or not, ivory or orangish red, suborbicular or oblong, 0.1–0.45 diam., 2–4 per 0.25 × 0.25 mm, indumentum as bracteoles (Fig. 3 G); flower buds oblong, whitish or pale yellow, 2–6 × 1.1–2.1 mm, apex contorted. Calyx (Fig. 3 F) cupular, tube 0.38–0.6 × 1–1.5 mm, lobes 5, subtriangular, 0.5–1 × 0.5–0.75 mm, apex attenuate or acuminate, glands visible raised strongly at surface, ivory or orange, suborbicular, 0.05–0.125 diam., 4–8 per 0.25 × 0.25 mm, indumentum as bracts, margin lined with simple or two-branched hairs of 0.025–0.1 mm long; corolla (Fig. 3 E) spreading, white or pale lilac, lobes (Fig. 3 I) 5, ovate-elliptic, 3.25–5 × 1.38–2 mm, glands visible at adaxial and abaxial surface, ivory or orange, suborbicular or oblong, 0.05–0.45 mm long, 2–4 per 0.25 × 0.25 mm. Androecium yellow, stamens (Fig. 3 J,K) 5, erect, staminal tube present, pale yellow, 0.15 × 0.5 mm, filaments pale yellow, flattened. 0.175 × 0.6 mm, anthers orange in the centre, pale yellow at the margin, introrse, dehiscing by two longitudinal slits, sagittate, 4–4.25 × 0.88–1.25 mm, connective 0.18 × 0.12 mm, pollen pale yellow, hidden in the inner sunken part of the anther; gynoecium (Fig. 3 L) superior, ovary globose, dark red, c. 0.75 × 0.8 mm, style terete, c. 4.2 mm long. Fruit (immature) globose, green (Fig. 3 N), c. 4 mm diam., mature fruits globose, dark red, c. 7 mm diam., glands visible raised strongly at surface, suborbicular, elliptic or oblong, dark red, 0.175–0.65 in diam.

Etymology

The epithet commemorates the collector of the type specimen (and co-collector of all the other specimens known), Dr. Hans (J.F.F.E.) de Wilde of the excellent former Herbarium Vadense at Wageningen, Netherlands. He did much to support Dutch-Gabon botanical co-operation and has been a prolific botanical researcher e.g. of the Meliaceae and Begoniaceae in Africa, collector and teacher, training several competent taxonomic botanists. Many of the new Gabonese species in this paper result from specimens collected by this botanist and his students.

Phenology

Flowering in April and October, buds in November. Fruiting in April and October (immature fruits in September).

Distribution and Habitat

Ardisia hansii occurs in Cameroon and Gabon. In Cameroon at N'kolandom, and also at a site from N'Koemvone to 'Akoakas rock'. In Gabon at Bélinga. Shaded and semi-shaded humid closed high forest, alt. 550–800 m.

Conservation status

The two specimens from Cameroon were collected only about 2 km and less than one year apart. The location in Cameroon at N'kolandom appears to have intact forest canopy (observed on Google Earth April 2025) but has cleared areas only 100 metres distant, and extensive oil palm plantations in the area are increasing in size. The Belinga site is a future open cast iron ore mining site. We calculate an Area of Occupancy of 8 km^2 following the IUCN required cell size, which with the threats and two locations gives a provisional conservation assessment of Endangered (EN B2ab(iii)). The extent of occurrence cannot be calculated as only two points are known.

Notes

The Gabon specimen differs in slight details from the Cameroon specimens e.g. the oil glands appear black and opaque in transmitted light, rather than brown and translucent in the Cameroon material. These specimens were all formerly included within *A. ebo* (Cheek and Xanthos 2012). *Ardisia hansii,* while still rare and restricted, is the most common and widespread of the creeping herbaceous species known so far from Africa, and the only one that is known from more than one country.

Additional material

CAMEROON. South Region: N'kolandom, old secondary vegetation between the village and hill facing the village; alt. ±550 m; 2°48' N, 11°10' E; 5 Apr. 1975; fl. fr.; *J. J. F. E. de Wilde 8144* (K000678252, P04520135, WAG1113077, WAG1113978). **GABON**. Bélinga. Iron mine exploration area; alt. ±750–800 m; 13 Sept. 1978; fl. buds, imm. fr.; *F. J. Breteler* & *J. J. F. E. de Wilde 573* K [K000678893], P [P04520137], WAG [WAG1113080, WAG1113079]).

Ardisia massaha P.Peng & Cheek, **sp. nov.** (Figures 5, 6).

Type: Gabon, Ogooué-Ivindo, about 14 km. along the SOMIFER-road from Bélinga to Makokou. Place called 'Grotte de Massaha' Cave with humid walls of iron ore in shade; alt. ±900–950 m; fr. 18 Sept. 1978, *F.J. Breteler* & *J.J.F.E. de Wilde 707* (holotype WAG [WAG1112951]).

Diagnosis

Differs from *A. ngounie* to which it is most similar (both have 1.55–3.5 mm diam. stems, elliptic leaves, 4.3–12.2 × 2.7–6.3 cm, 8–10 crenations on each side in the distal ½ – ¾ of the blade, 8–10 lateral nerves on each side of the midrib, 3-lobed scales on the abaxial leaf surface and no peltate scales on both adaxial as well as abaxial leaf surfaces), by having an acute apex and base to the leaf-blade, 2-lobed scales on the abaxial leaf surface, no scales on the adaxial leaf surface and archipelago-like oil glands. (*Ardisia ngounie* has an obtuse or rounded, rarely acute leaf-blade apex, a cordate base, 4-lobed scales on the abaxial leaf surface, 3–4-lobed scales on adaxial leaf surface and orbicular or elliptic oil glands).

Description

Small creeping shrublet, forming leafy mats. *Stems* decumbent, terete, 1.9–3 mm in diam., internodes 0.5–1.5 cm long, distal part unbranched, erect 15–18 cm high, producing adventitious roots, new stems arising c. 5 cm apart along the creeping portion, indumentum densely furfuraceous, red-brown in the distal 1–1.5 cm below the stem apex, then abruptly glabrescent, epidermis dark green, longitudinally ridged. Leaves alternate, elliptic, (5.2–)6–9.2(–10.3) × 3–4.9 cm, apex acute, 1–2 × 4–5 mm, base acute, often slightly asymmetric, margin revolute, obscurely crenate, crenations 8–10 on each side in the distal ½ – ¾ of the blade, 0.25–0.5 × 1.5–5 mm, lateral nerves 8–10 on each side of the midrib, brochidodromous, inframarginal nerve 2.5–6.5 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; trichomes evenly attached to the abaxial leaf surface, 2-lobed scales bowknot-shaped, pale red or red, c. 0.075 mm diam., 6–8 per 2 × 2 mm; 3-lobed scales Y-shaped, pale red or red, 0.075–0.1 mm diam., 10–12 per 2 × 2 mm; oil glands visible on the abaxial leaf surface, orbicular or elliptic, 2 or 3 clustered, dark black, not raised, 0.025–0.225 mm diam., 20–34 per 2 × 2 mm; stellate hairs sparse, interspersed with scales, red, 0.125–0.85 mm in diam., 3–6 per 2 × 2 mm, each stellate hair 2–7-armed, clustered on the midrib of abaxial leaf surface, red, 0.05–0.5 mm diam., 4–8 per 0.25 × 0.25 mm, each stellate hair 3–5-armed (Fig. 5 C). Petiole plano-convex (Fig. 5 B), 3–5(–10) mm long, 0.8–1.35 mm wide. Inflorescences axillary, fasciculate, sessile, 3–5 per stem, 2–4-flowered; bracts 2–4, concave, spatulate, 1–2.25 × 0.6–1 mm, simple or forked hairy (Fig. 5 E), dark red, 0.05–0.12 mm long 5–8 per 0.25 × 0.25 mm bracteoles resembling bracts, c. 1.25 × 0.5 mm. Pedicel curving downwards, subcylindrical, 3–3.2(–8) × 0.25–0.55 mm, stalked glands (Fig. 5 H) visible on the surface, brown, c. 0.05 mm long, 18–24 per 0.5 × 0.5 mm; flower buds elliptic, amber, (1–)1.5–2(–3.2) × 0.75–1.25 mm, apex contorted. Calyx (Fig. 5 G) cupular, tube 0.25–0.4 × 0.6–1.25 mm, lobes 5, ovate, 1.25–1.75 × 0.5–1.25 mm, apex acute, margin lined with simple hairs of 0.05–0.15 mm long. Flower not seen. Fruit (mature) globose (Fig. 5 F), red, 7–9 mm diam., glands visible raised strongly at surface, globose, elliptic or oblong, dark black, 0.15–0.75 diam., 14–19 per 2 × 2 mm.

Etymology

Ardisia massaha is named as a noun in apposition for the place called 'Grotte de Massaha'[Massaha cave], Gabon, from where the type specimen originates.

Phenology

Fruiting in November.

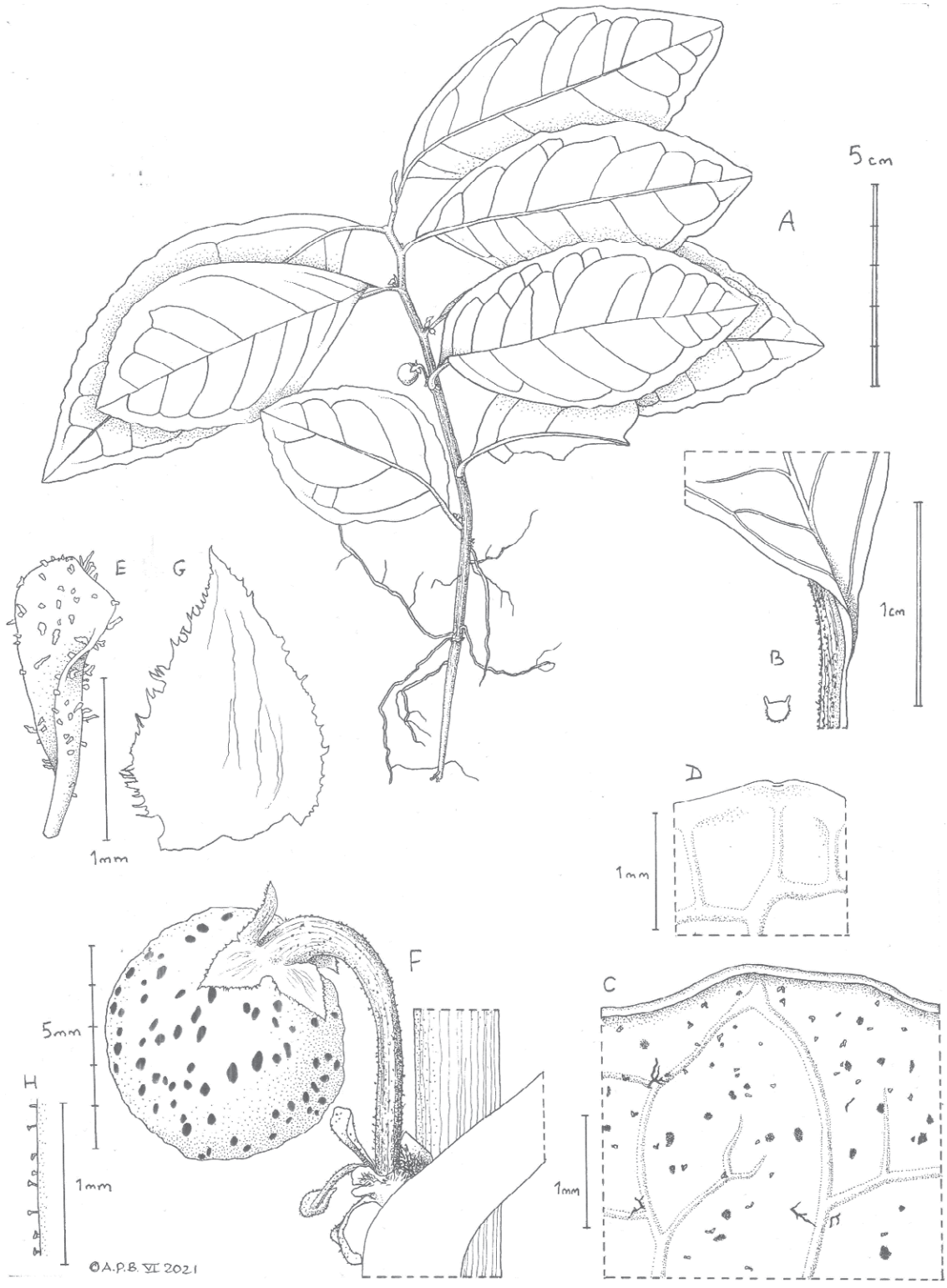

Figure 5. *Ardisia massaha* P.Peng & Cheek – **A.** habit, whole plant in fruit and flower bud; **B.** base of lamina with part of petiole showing plano-convex transverse section; **C.** abaxial leaf surface showing 2/3-lobed scales (smaller irregular trichomes), oil glands (stippled areas) and stellate hairs; **D.** adaxial leaf margin showing pore; **E.** indumentum of spatulate bract; **F.** mature fruit with pedicel, bracts and flower bud; **G.** calyx lobe, outer face; **H.** pedicel surface showing stalked glands. From *F.J. Breteler* & *J.J.F.E. de Wilde 707*. All drawn by Andrew Brown.

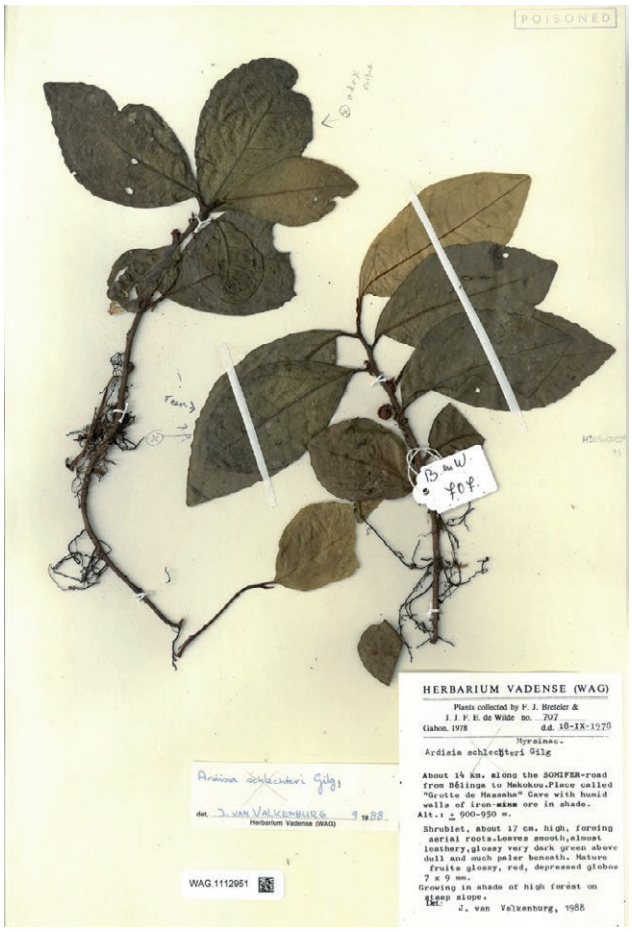

Figure 6. Holotype (WAG) of *Ardisia massaha* P.Peng & Cheek.

Distribution and habitat

Ardisia massaha occurs in Gabon at the Massaha cave on the road from Bélinga to Makokou. Steep slope in cave of iron ore in shade of high forest, alt. ± 900–950 m.

Conservation status

Only known from the type specimen. As the species grows on iron ore, on a road constructed by the former iron ore mining company SOMIFER, iron ore mining directly or indirectly may pose a threat to this species. We calculate the area of occupancy as 4 km^2 using the required IUCN gridcell size, and as there is a single location the provisional assessment is Critically Endangered (CR) B2ab(iii). Iron ore mining at Belinga has been controversial and is of concern for the likely negative consequences for biodiversity conservation (Tzinieris 2014). Future environmental impact surveys for the Belinga iron ore mine should take this species into account.

Notes

The specimen had previously been identified as *A. schlechteri*, which is endemic to the base of Mt Cameroon in SW Region, Cameroon. Please see the key for differences. The other herbaceous *Ardisia* species from Belinga is *A. hansii.*

Ardisia minuta P.Peng & Cheek, **sp. nov.** (Figures 7, 8).

Type: Gabon, Ngounié. Mouyanama, slope of Mount Ngondo, fr. 8 Mar. 1984, *A.M. Louis 1460* (holotype WAG [WAG1113081]; isotype LBV n.v.).

Diagnosis

Ardisia minuta differs from all other herbaceous species in the minute dimensions of its stature (c. 5 cm tall) and its minute leaf blades (the largest reaching 5.3 cm long). Otherwise it is similar to *Ardisia hansii* (both have small leaves, an acute or acuminate leaf apex, stems <2 mm diam. and 0.1–0.125 mm diam. orbicular peltate scales on the abaxial leaf surface), differing by the orbicular peltate scales 7–8 per 2 × 2 mm on adaxial leaf surface and erect pedicels with sessile glands. (*Ardisia hansii* has orbicular peltate scales 2–3 per 2 × 2 mm on the adaxial leaf surface and downward curved pedicels with simple hairs).

Description

Small creeping herb, probably forming leafy mats. Stems decumbent, creeping horizontally, terete, (0.9–) 1.3–2 mm diam., internodes 2–12 mm long, distal part unbranched, erect c. 5 cm high, producing adventitious roots, indumentum densely furfuraceous, red-brown in the distal c. 1.25 cm below the stem apex, then abruptly glabrescent, epidermis dark green, longitudinally ridged. Leaves alternate, elliptic, 4.4–5.3 × 2.1–2.2 cm, apex acuminate, 0.05–0.08 × 0.05–0.08 cm, base acute, often slightly asymmetric, margin revolute, obscurely crenate, crenations 6–8 on each side in the distal ½ – ¾ of the blade, 0.5–0.75 × 2.75–4.75 mm, lateral nerves 8–10 on each side of the midrib, brochidodromous, inframarginal nerve 1–2.4 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; trichomes evenly attached to the abaxial leaf surface, orbicular peltate scales (Fig. 7 D) red, 0.1–0.125 mm diam., 35–41 per 2 × 2 mm, (also appearing on the adaxial leaf surface (Fig. 7 E) in density of 7–8 per 2 × 2 mm, 0.075–0.1 mm diam., dark red, otherwise glabrous); suborbicular scales smaller and darker, c. 0.05 mm diam., 6–11 per 2 × 2 mm, stellate hairs sparse,

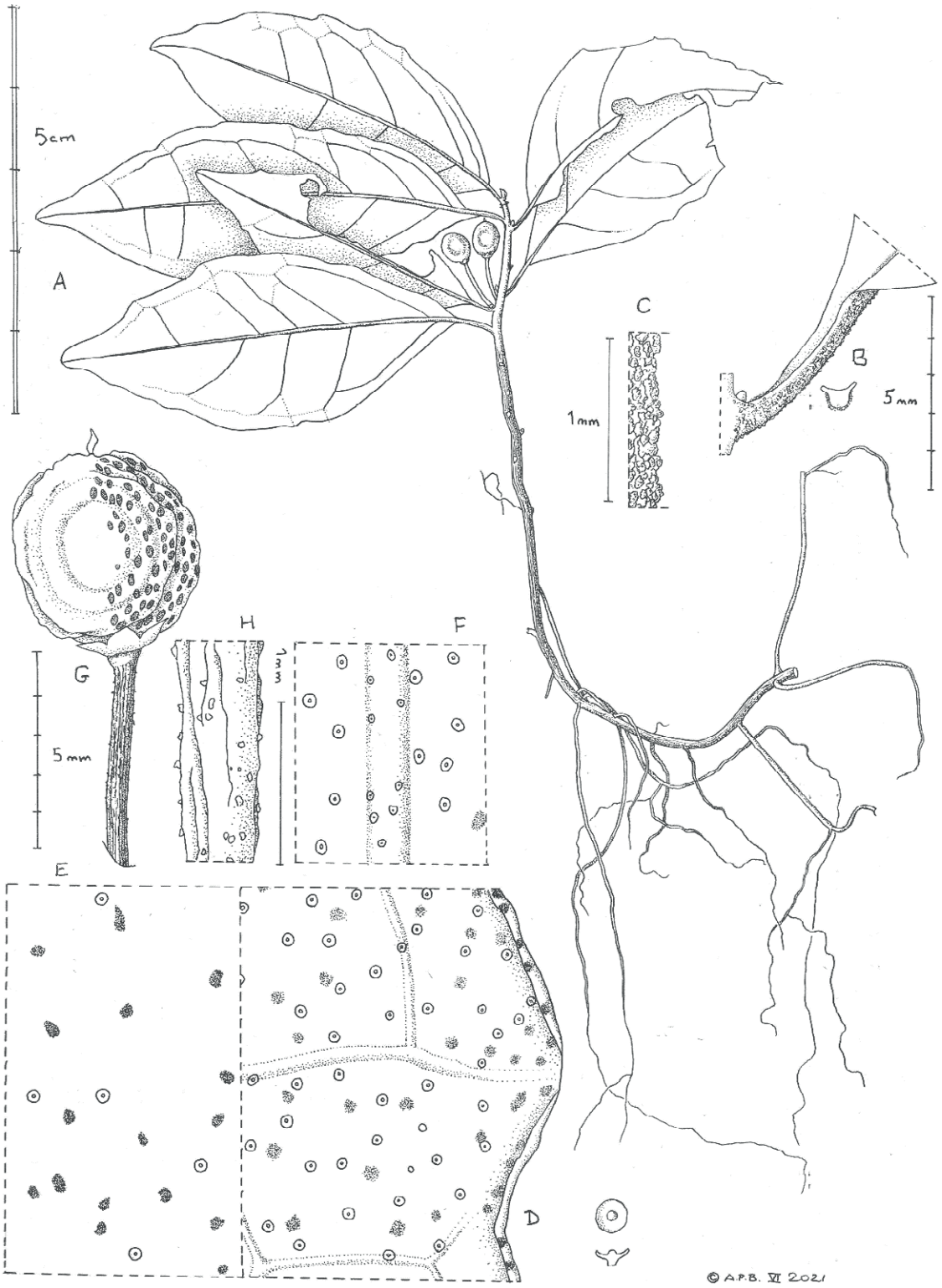

Figure 7. *Ardisia minuta* P.Peng & Cheek – **A.** habit, whole plant in fruit; **B.** base of lamina with part of petiole showing transverse section plano-convex; **C.** indumentum of petiole abaxial surface; **D.** abaxial leaf surface showing peltate scales (orbicular discs) and oil glands (stippled areas); **E.** adaxial leaf surface showing peltate scales (orbicular discs) and oil glands (stippled areas); **F.** abaxial leaf surface with midrib showing flower-shaped scales on the midrib surface and peltate scales on the leaf surface; **G.** mature fruit showing oil glands; **H.** pedicel surface showing sessile glands. From *A.M. Louis 1460*. All drawn by Andrew Brown.

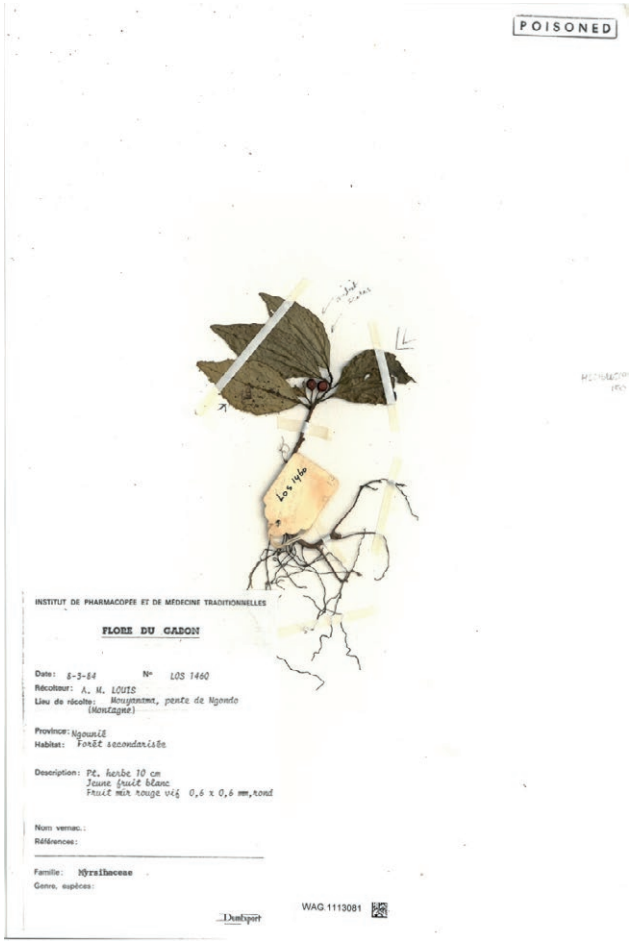

Figure 8. Holotype of *Ardisia minuta* P.Peng & Cheek (WAG).

interspersed with scales, 0.1–0.23 mm diam., 1–3 per 2 × 2 mm, each stellate hair 3–4 armed flower-shaped scales (Fig. 7 F) on the midrib of abaxial leaf surface red, 0.05–0.075 mm diam., 5–10 per 0.25 × 0.25 mm, slender inclusions in the midrib raised slightly, elliptic to oblong, yellow, 0.15–0.4 mm diam., 1–2 per 0.25 × 0.25 mm, oil glands (Fig. 7 D) visible raised strongly at abaxial leaf surface, suborbicular to elliptic, appearing dark black in transmitted light, 0.075–0.35 mm diam., 13–20 per 2 × 2 mm. Petiole plano-convex (Fig. 7 B), (1.5–)4–5 mm long, 0.5–0.9 mm wide. Inflorescences axillary, fasciculate, c. 3 per stem, 2-flowered; peduncle suberect, c. 0.25 × 0.625 mm, indumentum as stem apex, bracts 2, narrowly subtriangular, concave, c. 0.5 × 0.45 mm, indumentum as stem apex, bracteoles resembling bracts, 0.75–1 × 0.25–0.3 mm, indumentum as stem apex. Pedicels erect, subcylindrical, 5.5–5.75 × 0.38–0.45 mm, sessile glands (Fig. 7 H) on the surface dark red, irregular, minute, 0.025–0.05 mm diam., 5–8 per 0.25 × 0.25 mm. Calyx cupular, tube c. 0.25 × 1.25 mm, lobes 5, overlapping, subtriangular, c. 0.625 × 1 mm, apex acute, glands visible, raised strongly at surface, fulvous, elliptic, 0.075–0.15 diam., 3–5 per 0.25 × 0.25 mm, margin lined with simple hairs 0.075–0.125 mm long. Flower not seen. *Fruit* (immature) globose, white, mature fruit red in reflected light, globose, c. 6 mm diam., oil glands (Fig. 7 G) visible, raised slightly at the surface, suborbicular to elliptic, red, 0.1–0.625 mm diam., 30–33 per 2 × 2 mm.

Etymology

The epithet, treated as an adjective in apposition, is derived from the Latin '*minuta*', which means small. The name refers to the small leaves, stems and upright stems of this species which are all smaller than those of all other species of African *Ardisia*.

Phenology

Fruiting in March.

Distribution and Habitat

Ardisia minuta is endemic to the Chaillu Massif of Gabon: Ngounié, Mouyanama, slope of Mount Ngondo. Secondary forest.

Conservation status

Only known from the type specimen. *Ardisia chaillu* is also recorded from the same area (slopes of Mt Mouyanama in the Chaillu massif) where it was collected a few months earlier by the same collector A.M. (Ard) Louis. No detailed locality data was given for the only known specimen so we can only deduce that as for the aforementioned species that there are no obvious immediate threats at the site. We here provisionally assess the species as Vulnerable VU D2, since only a single site is known in an area that appears unprotected. Other areas in the Chaillu are subject to open cast mining and logging (Cheek pers. obs.) which could pose an imminent threat to *Ardisia minuta* in the near future.

Notes

Ardisia minuta is easily the smallest known African *Ardisia* species.

Ardisia ngounie P.Peng & Cheek, **sp. nov.** (Figures 9, 10).

Type: Gabon, Ngounié, along a forestry road W of Bembodié; 1°28.8′ S, 10°28.4′ E, fr., 27 Oct. 1994, *J.J. Wieringa 2938* (holotype WAG [WAG1113216]; isotypes WAG [WAG1112947], LBV n.v.)

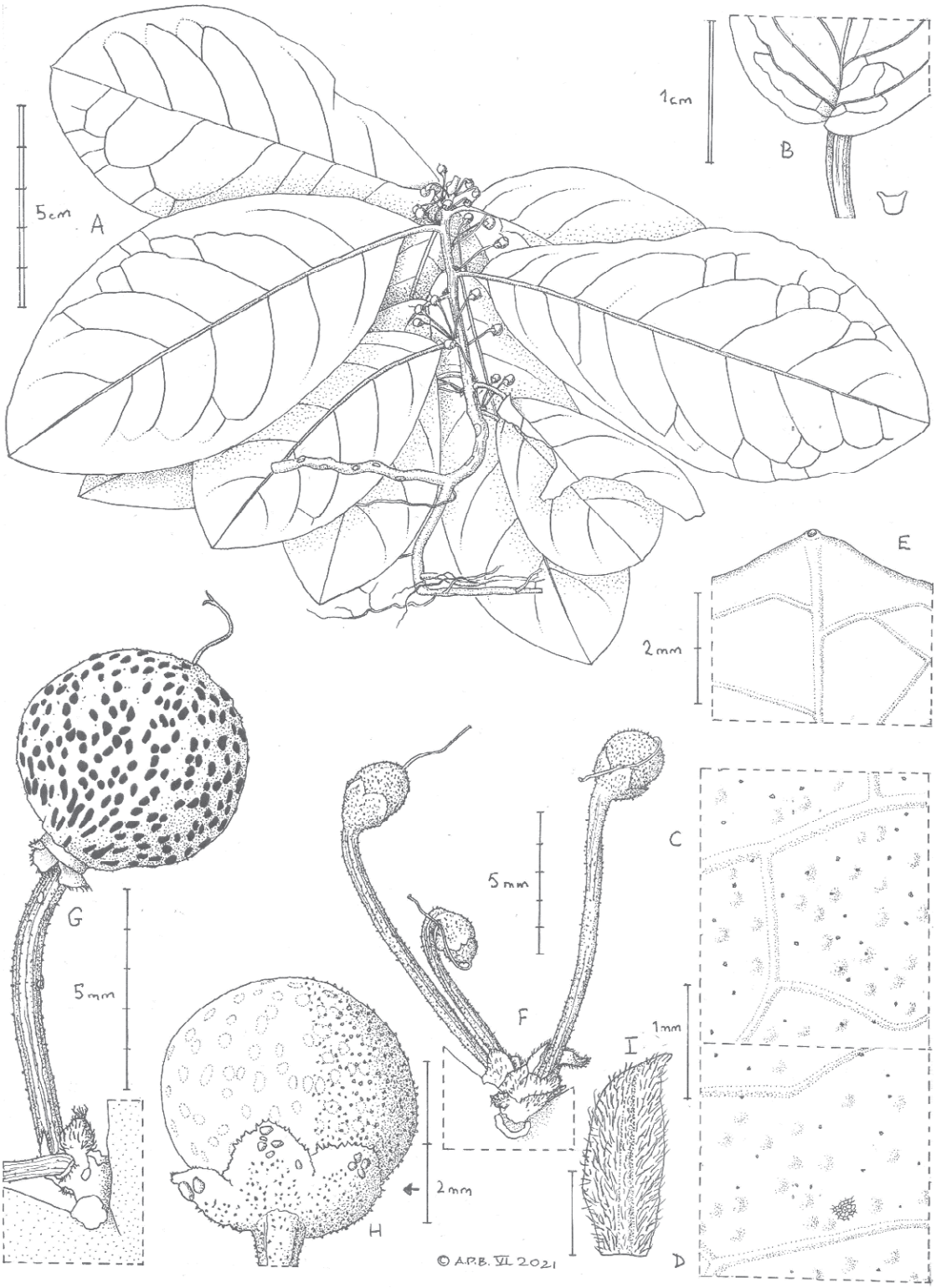

Figure 9. *Ardisia ngounie* **A.** habit, whole plant in fruit; **B.** base of lamina with part of petiole showing transverse section plano-convex; **C.** abaxial leaf surface showing 3-/4-lobed scales (smaller irregular trichomes) and oil glands (stippled areas); **D.** adaxial leaf surface showing 3/4-lobed scales (smaller irregular trichomes), oil glands (stippled areas) and detail of upper epidermis; **E.** adaxial leaf margin showing pore; **F.** immature fruits; **G.** mature fruit; **H.** mature fruit showing details of calyx; **I.** indumentum of bract. A–F-, H, I. from *J.J. Wieringa 2938*; G. from *J.J.F.E de Wilde 11744*. All drawn by Andrew Brown.

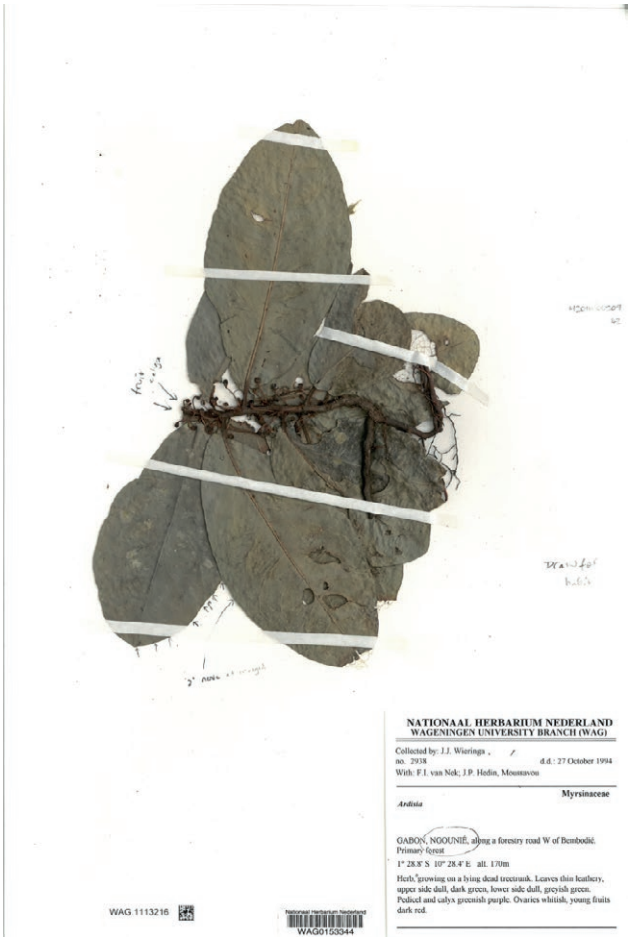

Figure 10. Holotype of *Ardisia ngounie* P.Peng & Cheek (WAG1113216).

Diagnosis

Ardisia ngounie is not likely to be confused with any other in Africa since it alone appears to be fully procumbent, the stem apex not ascending but remaining prostrate. *Ardisia ngounie* is further distinct in the rather thick leaf blades which are rounded to obtuse at the apex and subcordate at the base.

Description

Small creeping herb, probably forming leafy mats. Stems (including apex) procumbent, terete, 1.55–2.9(–3.5) mm diam., internodes 0.3–0.6 cm long, distal part unbranched, erect 9–12 cm high, producing adventitious roots, indumentum densely furfuraceous, red-brown in the distal 1–1.5 cm below the stem apex, then abruptly glabrescent, epidermis dark green, longitudinally ridged. Leaves alternate, coriaceous, elliptic, rarely slightly obovate-elliptic, 4.3–9.3(–12.2) × (2.7–)5–6.3 cm, apex obtuse or rounded, base cordate, often slightly asymmetric, margin revolute, obscurely crenate, crenations 8–10 on each side in the distal ½ – ¾ of the blade, 0.45–0.75 × 3.5–7 mm, lateral nerves 8–10 on each side of the midrib, brochidodromous, inframarginal nerve 1.5–5.25 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; trichomes evenly attached to the abaxial leaf surface, 3-lobed scales Y-shaped, pale red, red or dark red, 0.05–0.075 mm diam., 4–9 per 2 × 2 mm, 4-lobed scales cruciform or chromosome-shaped, pale red, red or dark red, 0.05–0.075 mm diam., 9–22 per 2 × 2 mm (Fig. 9 C), (also appearing on the adaxial leaf surface (Fig. 9 D), pale red or red, 3-lobed scales Y-shaped, 0.04–0.075 mm diam., 2–6 per 2 × 2 mm, 4-lobed scales cruciform, 0.0375–0.05 mm diam., 8–12 per 2 × 2 mm, which is otherwise glabrous); stellate hairs sparse, interspersed with scales, red, 0.1–0.65 mm in diam., 1–4 per 2 × 2 mm, each stellate hair 3–5-armed, clustered on the midrib of abaxial leaf surface, red, 0.28–0.42 mm diam., 1–4 per 0.25 × 0.25 mm; oil glands (Fig. 9 C) visible on the abaxial leaf surface, orbicular or elliptic, appearing brown in transmitted light, black and inconspicuous in reflected light, strongly raised, 0.125–0.25(–0.38) mm in diam., 74–85 per 2 × 2 mm. Petiole plano-convex (Fig. 9 B), 3–10 mm long, 0.85–2.5 mm wide, indumentum as stem apex. Inflorescences axillary, fasciculate, sessile, 2–13 per stem, 1–3-flowered; bracts 4, spatulate, concave, 1.5–2.25 × 1–1.25 mm, midrib thick raised, dark red, indumentum as stem apex (Fig. 9 I); bracteoles resembling bracts, 3, c. 1.5 × 1 mm. Pedicel curving downwards, subcylindrical, 6–11 × 0.25–0.75 mm, sessile glands on the surface pale red or red, 2 or 3 lobed, c. 0.05 mm in diam., 10–12 per 0.25 × 0.25 mm. Calyx (Fig. 9 H) cupular, tube 0.25–0.375 × 1.25–1.75 mm, lobes 5, inner thicker, dark brown, outer scarious, thinner, pale brown, shallow or not, overlapping, reflexed or not, subtriangular, 0.625–0.75 × 0.75–1 mm, apex acute, oil glands visible on the surface, pale brown, 0.05–0.075 mm in diam., margin lined with simple or forked hairs of 0.1–0.125 mm long. Corolla scar conical frustum-shaped, pale brown, c. 0.2 × 1.7 mm. Flower not seen.Fruit (immature) globose (Fig. 9 F), dark red, (0.875–)1.375–2.25(–3) mm in diam., mature fruits (Fig. 9 G) globose, red, 7–9 mm in diam., glands visible raised strongly at surface, suborbicular, elliptic or oblong, dark black, 0.15–0.675 mm in diam., 14–19 per 2 × 2 mm.

Etymology

Ardisia ngounie is named as a noun in apposition for the Ngounié Province, Gabon from where the type specimen originates

Phenology

Fruiting October and December.

Distribution and habitat

Ardisia ngounie appears restricted to the lower western slopes of the Koumounabouali Massif in the Ngounié Province, south of the lower reaches of the Ogooué River, Gabon. It occurs in primary evergreen forest, alt. 170–350 m.

Conservation status

The two known specimens were collected about 18 km apart, both in the lower western slopes of the Massif of Koumounabouali which reaches 800 m alt.,. The area is unprotected and appears to be logged, in fact one of the specimens was reported as being accessed from a logging road. While logging in Gabon is usually well managed and sustainable, it nevertheless can pose threats to highly local plant species such as this species. This is because log-loading areas and logging trails can destroy the habitat in which they have been placed by the soil compaction and clearance necessary to form them. However, these threats are not considered likely to kill imminently all the plants of the species, so therefore we provisionally assess the species as VU (Vulnerable) D2.

Notes

Both specimens had not previously been identified to species (Sosef et al. 2006). The species is not likely to be confused with any other since it alone appears to be fully procumbent, the stem apex not ascending but remaining prostrate. *Ardisia ngounie* is further distinct in the rather thick leaf blades which are rounded to obtuse at the apex and subcordate at the base. No other herbaceous *Ardisia* is known to be sympatric, but *A. waka* occurs in the Waka National Park, only c. 50 km to the east.

Additional material

GABON. Ngounié, Massif of Koumounabouali; 1°19.6′ S, 10°26.9′ E; alt. 350 m; fr., 11 Dec. 1996, *J.J.F.E de Wilde 11744* (WAG1112947).

Ardisia sadebeckiana Gilg, Bot. Jahrb. Syst. 30: 97. 1901.

Type: Cameroon, South Region, S of Kribi, Grand Batanga; fl. 22 Oct. 1890, *M. Dinklage 902* (lectotype HBG [HBG509261], designated here; isolectotype: HBG [HBG509262]).

(≡) *Afrardisia sadebeckiana* (Gilg) Mez in H.G.A. Engler (ed.), Pflanzenr., IV, 236: 187. 1902.

Diagnostic characters

Ardisia sadebeckiana is a particularly distinct species among the four species (*A. ebo, A. schlechteri, A. massaha*) which lack large, conspicuous peltate scales on the abaxial leaf blade. It is the only one with leaves >5 cm wide, and is further separated due to the obovate leaves with a short mucro at the otherwise rounded apex (the other species having more or less elliptic leaves which are acuminate or subacuminate), the base is abruptly cordate (versus acute). The erect part of the stem is the most pronounced of all the herbaceous species, and this species appears the closest in the group to being a `subshrub'.

Etymology

The name means "in honour of (or to the glory of) Sadebech, presumably for Dr Richard Sadebach, director of the botanical museum of Hamburg whose death was reported in 1905 (Anon. 1905).

Phenology

Flowering in October.

Distribution and habitat

Ardisia sadebeckiana is only known from Cameroon, in the South Region at Grand Batanga just to the south of the city of Kribi. Lowland evergreen forest at sea-level near the coast.

Conservation status

For the moment *Ardisia sadebeckiana* is only known with certainty from the type specimen of which two duplicates survive at HBG. This was collected during the German Colonial Period (1884–1916) when Grand (Gross) Batanga was a major port for Cameroon, close to the now larger port of Kribi. It is remarkable that the species appears not to have been seen since, despite the Kribi area having been a major botanical collection centre, especially in the 1970s and 1980s thanks to the efforts of the staff of Herbarium Vadense (WAG) who had a base there at the former herbarium KRIBI funded by Tropenbos. During this time many new species to science were brought to light including several of those in this paper. This suggests that *Ardisia sadebeckiana* may be/have been highly range-restricted to the former forests of Grand Batanga itself which have been heavily cleared or otherwise impacted by humans over the last 100 years. We urge that attempts are made to refind this

species, and should it be rediscovered, measures should be put in place to support its survival, such as a public education campaign.

In recent decades all coastal forest up to c. 2.5 km from the sea has been replaced by palm oil plantations, and much of that which survives has been urbanised, or cleared as log parks (storage depots for timber for export). Therefore, we assess the species provisionally here as Critically Endangered (Possibly Extinct) CR (PE) B2ab(iii) since only a single site (AOO 4 km^2) with major and ongoing threats was recorded 135 years ago. However, the species has not been the subject of targeted searches so it cannot be certain that it is extinct and it may yet survive in a small intact fragment of its habitat. However, other species at Grand Batanga are also feared extinct, such as *Ledermanniella batangensis* (Engl.) C. Cusset (Ghogue 2010) at the Lobé Falls, the most species-diverse site (10 species) for Podostemaceae in Africa (Cheek et al. 2017).

Notes

Of the two sheets at HBG we select as lectotype that barcoded HBG509261 since this bears both the original handwritten field label in Dinklage's hand, and also a label which the author of the name, Gilg, has written the name *Ardisia sadebeckiana*, dating it 1898, four years before his protologue was published.

Ardisia sadebeckiana is the first collected of all the African herbaceous *Ardisia* species and with *A. schlechteri,* the first to be published (Gilg 1902).

Although the species was described from Cameroon, the name *Ardisia sadebeckiana* has been applied to many specimens of prostrate herbaceous species of *Ardisia* collected in Gabon. The situation was not helped by de Wit's (1958) neotypification of the name onto an erect species in that country. This strange error was highlighted in the annotations by Taton on de Wit's neotype. But then Taton himself, in preparation for his magnum opus (Taton 1979) determined specimens from Gabon of another, albeit similar, taxon as *Ardisia sadebeckiana*. These differ from the type e.g. in having dentate, concolorous leaves (vs entire, discolorous leaves). Among the specimens named as this taxon in various herbaria there are likely several additional novel taxa which we intend to describe once we can arrange for a loan. Some of the material described in this paper as new to science, e.g. *Ardisia massaha*, had previously been identified as *A. sadebeckiana*.

Ardisia schlechteri Gilg, Bot. Jahrb. Syst. 30: 97. 1901 (Figures 11, 12).

Type: Cameroon, South West Region, Mt Cameroon, Bibundi, fl., April 1899, *Schlechter 12417* (holotype B, destroyed n.v.; lectotype Z [Z-000088438], designated here).

(≡) *Afrardisia schlechteri* (Gilg) Mez in H.G.A. Pflanzenr., IV, 236: 185. 1902.

Diagnostic features

Ardisia schlechteri is similar to *A. ebo,* both having elliptic leaves with subacuminate apices, acute to obtuse bases, the abaxial surface lacking conspicuous peltate scales. *Ardisia schlechteri* has discolorous larger leaves, (3.7)–4.2–5 cm wide, oil glands conspicuous, black on the adaxial surface, and c. 2 mm long calyx lobes, while *A. ebo* differs by having concolorous smaller leaves, (1.5)–1.9(–2.8) cm wide, with oil bodies conspicuous, raised on the abaxial surface, calyx lobes 0.7–0.8 mm long.

Etymology

Named for the collector of the type and only specimen of this species, Rudolf Schlechter (1872–1925), a prodigious field collector of herbarium specimens in the tropics and also a prolific and expert publisher of taxonomic research at B in many plant families.

Distribution and habitat

Ardisia schlechteri is known from Bibundi, Cameroon, on the coast of Mt Cameroon in the SW Region:

Table 1. Diagnostic characters separating *Ardisia schlechteri* and *A. ebo*. Data taken from the specimens cited in this paper.

	Ardisia schlechteri	*Ardisia ebo*
Leaf blade dimensions	(5.8–)7–9.5 x (3.7–)4.2–5 cm	(2.8–)4.7–6.5 x (1.5–)1.9–2.8 cm
Leaf blade colour	Discolorous, upper surface drying blackish green, abaxial surface off white.	Concolorous, both surfaces more or less green
Adaxial blade surface	Oil glands numerous, dense, black in reflected light	Oil glands not visible in reflected light
Abaxial surface	Oil glands not visible in reflected light	Oil glands conspicuous in reflected light, raised
Petiole length (cm)	0.7–1.2(–1.8)	0.4–0.8

Figure 11. *Ardisia schlechteri* Gilg - **A.** habit, whole plant with flower buds; **B.** adaxial leaf-blade surface near midrib showing dense black oil glands (not coloured) visible in reflected light; **C.** abaxial leaf-blade surface near margin showing sparse black oil glands (not coloured) visible in reflected light; **D.** flower bud, rehydrated; **E.** sepal, outer surface with oil glands (coloured); **F.** petal, outer surface with oil glands; **G.** pistil; **H.** stamen, adaxial face. All drawn from *Schechter* 12417 (lectotype Z) by Andrew Brown.

only known from the type collection cited above. Lowland evergreen forest sea-level at the coast.

Conservation status

The first conservation assessment of *Ardisia schlechteri* was as Critically Endangered (CR) A1c+2C (Cable and Cheek 1998) using the previous IUCN notation, when the species was already considered possibly extinct. This assessment was maintained in Cheek and Cable (2000b) and also in the Red Data Book of the Plants of Cameroon (Onana and Cheek 2011). The species was not found in the intensive botanical surveys of c. 1991 to 1995 that were focussed on prioritisation for conservation of plant species around Mt Cameroon (see Cheek and Cable 1997). The surveys included the only site known for the species, Bibundi, a small fishing village encroached by oil palm plantations initiated in the colonial era, probably soon after Schlechter's visit, which may have rendered this species extinct. The second author has spent time botanising in the Bibundi area in 1995 but failed to refind this species.

Botanical surveys that have been carried out subsequently in other forest areas in S W Region Cameroon and adjoining regions since 1991 (Cheek et al. 1992; Cheek et al. 1996; Cable and Cheek 1998; Cheek et al. 2000; Maisels et al. 2000; Chapman and Chapman 2001; Harvey et al. 2004; Cheek et al. 2004; Cheek et al. 2006; Cheek et al. 2010; Harvey et al. 2010; Cheek et al. 2011) have resulted in over 40,000 specimens and produced over 100 new species to science, but no further records of *A. schlechteri*. Further searches especially at Bibundi are advisable to target this species in the unlikely case that it survives, so that it might then be protected from extinction.

Other lowland forest species collected by Schlechter at Mt Cameroon at the same time as he collected *Ardisia schlechteri* that are now considered extinct are *Oxygyne triandra* Schltr. (Thismiaceae, Cheek et al. 2018; Cheek and Williams 1999) and *Afrothismia pachyantha* Schltr. (Afrothismiaceae, Cheek et al. 2019; 2024).

Notes

What was considered the only known specimen of this species was destroyed at B in 1943 (Taton 1979) until in 2022 we found the previously unknown isotype at Z (Fig. 12) by searching through gbif.org, see https://www.gbif.org/occurrence/2575329283.

Since the Z duplicate is original material and matches the protologue we select it here as lectotype. For the moment is the only material known. It consists of three short aerial stems, one of which bears flowers. It is possible that additional duplicates will be found.

Figure 12. Lectotype of *Ardisia schlechteri* Gilg (Z barcode 000088438).

The only known figure of this species (Fig. 11) was made from the Z specimen while on loan to K. Since there is so little material, we did not rehydrate and dissect the flower bud for fear of damage.

Taton (1979) without having seen the type, already had stated that Hepper's (1963) conjecture that *Olorunfemi* in FHI 30692 might be considered this species was unlikely, and this is beyond doubt now that the type has been seen. Several other specimens from Cameroon and even Gabon have also been identified as this species, some of them also prostrate herbaceous species, but all of them that we have seen are non-conspecific. In Sosef et al. (2006) two specimens are identified as *Ardisia schlechteri,* these are *Breteler* & *J.J.F.E. de Wilde 707* (type of *A. massaha,* described above) and *Louis* 1852 at LBV which we have not been able to access or view.

Ardisia waka P.Peng & Cheek, **sp. nov.** (Figures 14, 15).

Type: Gabon, Ngounié. Old forest along exploitation road, km 2 SE of Forestry Camp Waka, situated about 32 km SE of Sindara, 1 14 S, 10 53 E, Waka River basin. alt. ±300–400 m, fl., 10 Dec. 1983, fl. *A.M. Louis*, *F.J. Breteler* & *J. de Bruijn 1251* (holotype K [K000593393]; isotypes WAG [WAG1113113], LBV n.v.).

Diagnosis

Ardisia waka is similar to *A. chaillu* in having large (>0.1 mm in diam.) peltate scales on both adaxial and abaxial blade surfaces, leaves of similar size, and in the globose sessile glands on the pedicels, but differs in the broadly elliptic leaves with apex acute, obscurely crenate leaves with oil glands sparse and very inconspicuous in the marginal ¼ of the leaf blade (vs lanceolate, acuminate, conspicuously crenate, with black oil glands, conspicuous in both reflected and transmitted light throughout the width of the blade in *A. chaillu*).

Description

Small creeping shrublet, c. 10 cm tall. Stems decumbent, terete, 1.6–2.5 mm diam., producing adventitious roots from basal leaf axils, internodes 0.3–2 cm long, distal part unbranched, oil glands visible in the most distal internode, suborbicular or elliptic, appearing black in reflected light, 0.075–0.15 mm diam., 2–3 per 0.25 × 0.25 mm, erect, indumentum densely furfuraceous, red in the distal 1.5–2 cm below the stem apex, then abruptly glabrescent, epidermis dark green, longitudinally ridged. Leaves alternate, distichous, broadly elliptic, (5.2–)8.2–11 × 3–6.1 cm, apex acute to subacuminate, base acute, often slightly asymmetric, margin revolute, obscurely crenate, crenations 6–8 on each side in the distal ½ – ¾ of the blade, each 0.4–1 × 5–6.5 mm, lateral nerves 8–10 on each side of the midrib, brochidodromous, inframarginal nerve 2.4–4.8 mm from the margin, tertiary nerves coarsely reticulate, raised on adaxial surface, moderately conspicuous; abaxial trichomes evenly spread, orbicular peltate scales pale red or red, 0.125–0.15 mm diam., 29–34 per 2 × 2 mm; suborbicular scales smaller and darker, 0.05–0.1 mm diam., 3–6 per 2 × 2 mm, (also appearing on the adaxial leaf surface (Fig. 13 C); abaxial stellate hairs sparse, interspersed with scales, 0.175–0.375 mm diam., 1–3 per 2 × 2 mm, each stellate hair 3–5 armed (Fig. 13 D); abaxial midrib trichomes: 1) cross-shaped scales dark red, c. 0.075 mm diam., 4–6 per 0.5 × 0.5 mm, 2) flower-shaped scales dark red, 0.075–0.1 mm diam., 2–6 per 0.5 × 0.5 mm, 3) stellate hairs 3–4 armed, dark red, 0.1–0.2 mm diam., 2–4 per 0.5 × 0.5 mm; oil glands in the midrib longitudinal, elliptic to oblong, appearing dark black in reflected light, 0.225–1.75 mm long, 2–3 per 0.5 × 0.5 mm (Fig. 13 I); oil glands of the blade only in the marginal 1/5th, obscure and usually sparse, black in transmitted and reflected light, elliptic c. 0.2 × 0.1 mm; adaxial orbicular peltate scales red or dark red, 0.075–0.1 mm diam., 7–8 per 2 × 2 mm; suborbicular scales dark red, 0.05–0.075 mm diam., 4–5 per 2 × 2 mm, adaxially otherwise glabrous. Petiole plano-convex to canaliculate (Fig. 13 B), 3–13 × 1–1.75 mm, indumentum as stem. Inflorescences axillary, fasciculate, sessile, 2 per stem, 2-flowered; bracts 2, narrowly triangular, concave, c. 1.75 × 0.5 mm, oil glands visible raised strongly on the surface, suborbicular or elliptic, appearing dark brown in reflected light, 0.075–0.175 mm diam., 3–4 per 0.25 × 0.25 mm, indumentum as stem apex, bracteoles resembling bracts, 2, c. 1.25 × 0.375 mm, indumentum as stem apex. Pedicel curving downwards, subcylindrical, 6–10 × 0.5–0.75 mm, sessile glands on the surface dark red, 2 or 3 lobed, 0.05–0.075 mm diam., 6–12 per 0.25 × 0.25 mm, oil glands visible on the surface, elliptic or oblong, dull yellow, not raised, 0.075–0.45 mm diam., c. 2 per 0.25 × 0.25 mm. Flower buds (Fig. 13 E) narrowly ovoid, drying pale brown, 4.5–5.25 × 1.9–2.25 mm, apex acute, contorted. Calyx cupular, tube 0.5 × 1.5–1.875 mm, lobes 5, broadly subtriangular, shallow, overlapping, 0.75–0.875 × 1–1.375 mm, apex acute, oil glands visible on the outer surface, orbicular or suborbicular, yellow, 0.075–0.1 mm diam., 8–10 per 0.5 × 0.5 mm, margin lined with simple hairs of 0.075–0.125 mm long. Corolla (Fig. 13 F) spreading, white, lobes 5, elliptic, 4.5–5 × 2.25–2.5 mm, glands visible on the surface, orbicular, elliptic or oblong, yellow, 0.05–0.45 mm diam., 3–6 per 0.5 × 0.5 mm; androecium yellow, stamens (Fig. 13 G) 5, erect, staminal tube present, strong pale yellow, 0.25 × 1 mm, filaments white, 0.05 × 0.5 mm, anthers introrse, dehiscing by two longitudinal slits, sagittate, yellow, 1.625 × 0.5 mm; oil glands visible on the distal connective surface, abundant, densely clustered, yellow, suborbicular or elliptic, 0.075–0.2 mm diam., 6–8 per 0.25 × 0.25 mm, connective appendage absent; ovary globose (Fig. 13 H), strong dark red, 1.125 × 1 mm, oil glands dense on the distal half; style terete, c. 3.25 mm long. Fruit not seen.

Etymology

Ardisia waka is named as a noun in apposition for the Waka National Park, Gabon from where the type and only known specimen originates.

Phenology

Flowering December.

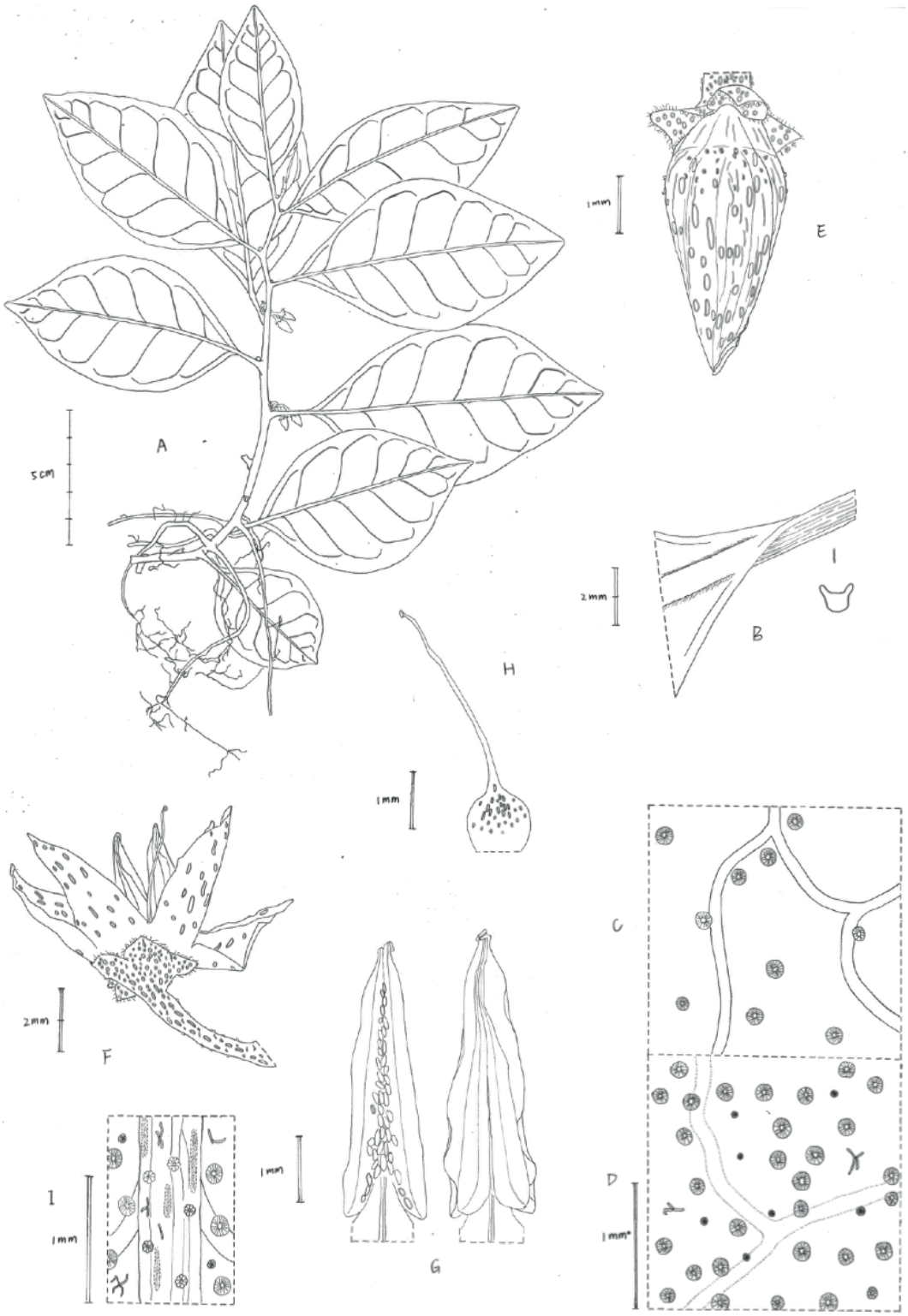

Figure 13. *Ardisia waka* P.Peng & Cheek – **A.** habit, whole plant with flower buds; **B.** base of lamina with part of petiole showing transverse section; **C.** adaxial leaf surface showing peltate scales; **D.** abaxial leaf surface showing peltate scales (larger discs), suborbicular scales (smaller discs) and stellate hairs; **E.** flower bud; F: flower, side view, inverted; **G.** stamen (dorsal face left, ventral right); **H.** ovary, style and stigma; **I.** abaxial midrib showing peltate scales (larger discs), flower-shaped scales (crenate discs), stellate hairs and oil glands (stippled oblong areas). From *A.M. Louis*, *F.J. Breteler* & *J. de Bruijn 1251*. All drawn by Peng Peng.

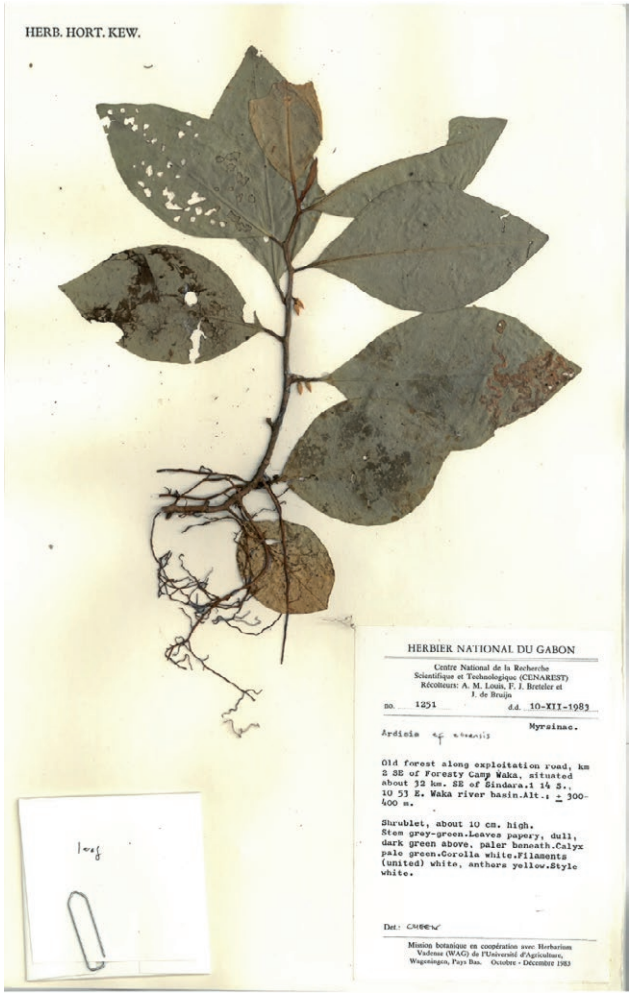

Fig. 14. Holotype of *Ardisia waka* P.Peng & Cheek.

Distribution and habitat

Ardisia waka is unique to the Waka National Park in the Chaillu Massif of Gabon in mature evergreen forest in a river basin, alt. ± 300–400 m.

Conservation status

While a single site is known (AOO 4 km^2), there appear to be no credible threats to *Ardisia waka* which is in the middle of a large National Park protected by guards (https://en.wikipedia.org/wiki/Waka_National_Park; accessed July 2025).

While some illegal hunting and logging may occur at the margins, it is not reported from the centre and in any case there is nothing to indicate that hunting would negatively affect this plant species. Therefore, for the present we assess the species as Least Concern. Should credible threats emerge the species should be reassessed as Critically Endangered.

Notes

Ardisia waka is unusual in seemingly lacking oil glands in the leaf blade except along the midrib. However, faint and inconspicuous (in both reflected and transmitted light) oil glands can be found in the marginal c. ¼ if searched for with a good microscope.

DISCUSSION

Possible bacterial nodulation in African Ardisia

During the observations for the morphological characterisation of the new species, unexpected black areas were noticed under the epidermis near the marginal teeth on the abaxial leaf-blade of some species such as *Ardisia minuta*. These black areas appeared different from the oil glands that also occur within the leaf-blade. While the oil glands are usually translucent and are distributed in a regular pattern throughout the leaf blade, the black areas were opaque and restricted to marginal areas. Further, the black areas occur along the veinlets that lead to the apex of the teeth where they can terminate in pores. The same observations were made in other herbaceous species e.g. *A. chaillu* (Fig. 1E), A. *massaha* (Fig 5D) and *A. ngounie* (Fig. 9E). In the literature review conducted at the start of the project, references were found to bacterial colonisation in one group of Asian *Ardisia* species, the *Ardisia crenata* group, yet it is stated that such colonisation in *Ardisia* is only known within that species group and not elsewhere in the genus (Yang & Hu 2018). Investigation of the literature showed that the leaves of those Asian species are colonised when in bud stage at the stem apex from an exudate, the *Paraburkholderia* bacteria entering through the developing leaf through the marginal teeth pores (Lersten and Horner 1976; Lemaire et al. 2011). The bacterial colonisation in the *Ardisia crenata* group results in regular patterns. The markings observed in this research project for the African herbaceous species are less regular but still distinct. To date confirmation by direct observation of bacterial rods using SEM has not been possible, also, this was not the focal point of the project which is alpha taxonomic elucidation of the species of *Ardisia*. It is intended to investigate the bacterial colonisation in greater depth in the future. Bacteria are also known to colonise African Rubiaceae (Lersten and Horner 1976). Four genera of African Rubiacaeae are now known to be colonised (Cheek and Onana 2024). Studies have shown that the same lineage of bacteria that colonise Asian *Ardisia* also

colonise African Rubiaceae, the Asian *Ardisia* bacterial taxa being basal in the lineage, while the African Rubiaceae endosymbiont taxa are terminal (Lemaire et al. 2011; Pinto-Carbó et al. 2018). If bacterial colonisation is confirmed in African *Ardisia* we postulate that they are likely sister to African Rubiaceae taxa rather than the Asia *Ardisia* taxa because African herbaceous *Ardisia* are sympatric with African Rubiaceae with bacterial nodules which are much more frequent and species diverse in the range of the herbaceous *Ardisia* (Cameroon and Gabon) than are the *Ardisia* species (Cheek pers. obs. 1991 onwards). Lemaire et al. (2011) have shown that horizontal transfer of bacteria from the environment to plants has occurred multiple times and reject long co-speciation of plants and endosymbiotic bacteria.

Geographic and morphological species groupings

Large peltate leaf-scales (c. 0.1 mm diam.) are only found in the Gabonese species, excepting *A. hansii* which occurs both in Gabon and in the South Region of Cameroon. Of the Gabonese species, only *A. massaha* (north-eastern Gabon) shares the absence of these large scales with the three Cameroon endemic species. While in Cameroon two of the species occur at sea-level in coastal forest, the other Cameroonian endemic and all of the Gabonese species are associated with the lower slopes of inland submontane areas, several species (*A. chaillu*, *A. ebo*, *A. hansii*) reaching 800 m alt. (which is often taken as the lower boundary of submontane or cloud forest) and *A. massaha* reaches c. 950 m alt. Most of the species are not sympatric. However, three species occur in different parts of the Chaillu Massif which appears the centre of diversity for the group, followed by Belinga (two species). The three Chaillu species all share sessile globose glands on the pedicels. Also in fruit (unknown in *A. waka*), the pedicels are erect.

CONCLUSIONS

It is important to detect, delimit and formally name species such as those in this paper as new to science, since until they are scientifically recognised, they are essentially invisible, and only when they have a scientific name can their inclusion on the IUCN Red List be facilitated (Cheek et al. 2020). Most (77%) species named as new to science today are already threatened with extinction (Brown *et al.* 2023). All but one of the six new species in this paper are provisionally assessed as threatened. Many new species to science have evaded detection until today, because they are in genera that are long overdue in terms of a full taxonomic revision, as is the case in *Ardisia* (not revised for 45 years), or because they have minute ranges which have remained unsurveyed until relatively recently, as has also been the case with herbaceous *Ardisia* especially in Gabon.

If further global extinction of plant species is to be avoided, effective conservation prioritization is crucial, backed up by investment in protection of habitat, ideally through reinforcement and support for local communities who often effectively manage the areas concerned. Important Plant Areas (IPAs) programmes, often known in the tropics as TIPAs (Darbyshire et al. 2017; Murphy et al. 2023) offer the means to prioritize areas for conservation based on the inclusion of highly threatened plant species, among other criteria. Such measures are vital if further species extinctions are to be avoided of rare, highly threatened species as is feared has occurred already with *Ardisia sadebeckiana* and *A. schlechteri* in Cameroon.

Limitations and further work

This study is mainly based on specimens from the herbarium of the Royal Botanic Gardens, Kew (K) and those loaned from the National Herbarium of the Netherlands, Wageningen (WAG) at Naturalis, and the Meise Botanical Garden (BR), supplemented by some observations during a short visit to the Paris Herbarium (P) and the Natural History Museum (BM). However, we were not able to access specimens at the two principal herbaria for Cameroon (YA) and Gabon (LBV), nor that for the Republic of Congo (IEC) due to both timing (most of this study was conducted in the covid years) and lack of funds and permits. It is likely that additional records of species of this group, including further new species, will result from these countries when this deficiency can be addressed. Important specimens at Herbarium Hamburgense (HBG) were available only as digital images, so studies of the physical specimens are advisable to enhance this study.

In this study much progress has been made resolving species limits in the herbaceous, creeping African *Ardisia*. A further and more ambitious project is to repeat this study for the woody species of African *Ardisia*. In addition, molecular phylogenetic work would be highly valuable to resolve the evolutionary relationships of the different species of African *Ardisia* groups identified in this study.

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