

Taxonomic revision of the African genera *Brieya* and *Piptostigma* (Annonaceae)

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Background and aims – Annonaceae are an important family in tropical rain forests of Africa. Here, we present a revision of the west-central African genus *Piptostigma* of the tribe Piptostigmateae. Previous molecular phylogenetic analyses of Piptostigmateae have revealed that the genus as currently circumscribed is paraphyletic. The aims of the article are: (1) to clarify the generic delimitation of the genus *Piptostigma*, especially in relation to its current polyphyletic delimitation; (2) to provide a new updated key to the genera of tribe Piptostigmateae; and (3) to provide for the first time in over 100 years a complete taxonomic revision of genera *Brieya* and *Piptostigma*.

Material and methods – Normal practices of herbarium taxonomy were used for the morphological study of about 200 specimens from B, BR, BRLU, G, HBG, K, L, LBV, LISC, MO, P, U, US, WAG, YA and Z. We sequenced three plastid regions for 32 samples representing 26 ingroup (Piptostigmateae) and six outgroup species in order to explore the paraphyly of *Piptostigma*. The open source software QGIS was used to generate the distribution maps of the species and their conservation status was obtained using the IUCN categories and criteria.

Key results – Molecular and morphological evidence support the reinstatement of the genus *Brieya* De Wild. Three keys are presented, one to the genera of Piptostigmateae and the two others to the species of *Brieya* and *Piptostigma*. A total of thirteen species are described for *Piptostigma* and two for the genus *Brieya*. Four new species are presented for the genus *Piptostigma*: *P. macrophyllum*, *P. mayndongtsaezanum*, *P. goslineanum* and *P. submontanum*.

Key words – Annonaceae, *Piptostigma*, *Brieya*, taxonomy, tropical Africa.

INTRODUCTION

Annonaceae (Magnoliidae) is a pantropical family of trees, shrubs and lianas representing an important component of tropical rain forest ecosystems worldwide (Chatrou et al. 2012). Annonaceae are among the most abundant families in the tropical rain forests of Africa generally within the ten most species rich families (e.g. Phillips et al. 2002, Maas et al. 2003, Kenfack et al. 2007, Sonké & Couvreur 2014, Sosef et al. 2017). To date there are 44 genera and around 400 species found in Africa (excluding introduced species) (Couvreur 2014a, Couvreur et al. 2012). Many recent revi-

sions and monographs have improved our knowledge of African Annonaceae (Chatrou 1998, Kenfack et al. 2003, Maas et al. 2003, Deroin & Luke 2005, Versteegh & Sosef 2007, Couvreur 2009, 2014b, Botermans et al. 2011, Fero et al. 2014) and the family also has a dedicated scratchpad page (<http://annonaceae.myspecies.info>).

The genus *Piptostigma* Oliv. belongs to subfamily Malmeeoideae, the second most diverse subfamily in Annonaceae, and to tribe Piptostigmateae which is sister with moderate support to the rest of the subfamily (Chatrou et al. 2012). Besides *Piptostigma*, the tribe contains five other strictly African genera (*Annickia* Setten & Maas, *Green-*

wayodendron Verdc., *Polyceratocarpus* Engl. & Diels, *Mwasumbia* Couvreur & Johnson and *Sirdavidia* Couvreur & Sauquet) whose phylogenetic relationships were recently elucidated (Pirie et al. 2006, Couvreur 2009, Chatrou et al. 2012, Couvreur et al. 2015). Tribe Piptostigmateae is morphologically diverse containing a range of different sexual systems (bisexual, androdioecious), inflorescence types, variation in perianth arrangements and numbers, as well as varying numbers of stamens and carpels (Couvreur et al. 2009, 2015).

Although *Piptostigma* was thought to be well circumscribed morphologically, delimitation of species was problematic (Le Thomas 1969). This is mainly due to overall few collections of this genus, very variable inflorescence lengths (even within species) as well as little leaf shape variation, making the identification of species (especially sterile material) hard (Le Thomas 1969). The situation became even more complicated when the main morphological character used to separate “*Piptostigma*” from other African genera (the long inner petals and sepal-like outer petals) was found to be homoplastic within the Piptostigmateae (Couvreur et al. 2009). Indeed, a molecular phylogenetic analysis of tribe Piptostigmateae showed that the species *Piptostigma fasciculatum* rendered the genus polyphyletic (Couvreur et al. 2009). Interestingly, this species (with a second species described later) used to be classified in the genus *Brieya*.

The aims of this article are: (1) to clarify the generic delimitation of the genus *Piptostigma*, especially in relation to its current polyphyletic delimitation; (2) to provide a new updated key to the seven genera of tribe Piptostigmateae; and (3) to provide for the first time in over 100 years a complete taxonomic revision of the genera *Brieya* and *Piptostigma*, with the description of four new species.

Taxonomical history

The genus *Piptostigma* was first described in 1865 and was distinguished from other genera of African Annonaceae by its longer inner petals vs. the sepal-like shorter outer petals, an unusual character within the African Annonaceae. In the original publication (Oliver 1865), the author described two species *P. pilosum* and *P. glabrescens* with the former name now considered as the type species for this genus (Fries 1959), although it was not clearly stated. Thirteen years after, in 1878 the name was sunk into a section of *Phaeanthus* because this latter South East Asian genus is also characterized by outer petals being similar to the sepals in size and considerably smaller than the inner petals (Chaowasku et al. 2014). This classification however, was not followed by subsequent authors (*Phaeanthus* is not related to *Piptostigma*: Chatrou et al. 2012, Chaowasku et al. 2014). In 1899, an additional species, *P. longepilosum*, was described, then two other ones two years later: *P. multinervium* and *P. preussii* (the latter synonym of *P. glabrescens* since 1969). Several species were described during following decades: *P. mortehanii* and *P. latipetalum* in 1913 (the latter name designated in the present work as synonym of *P. pilosum*), *P. calophyllum* and *P. macranthum* in 1915, *P. mayumbense* in 1926 (designated in the present work as synonym of *P. macranthum*), *P. giganteum* in 1927 (designated in the present work as synonym of

P. pilosum), *P. aubrevillei* in 1936 (designated in the present work as synonym of *Brieya fasciculata*), *P. oyemensse* and *P. fouryi* in 1950 (the latter name is designated in the present work as synonym of *P. mortehanii*).

No new species have been described in *Piptostigma* since 1955, probably because species delimitation within this genus is often difficult.

The genus *Brieya* was first described in 1914 (De Wilde 1914) and included one species *B. fasciculata*. Although this species presented the longer inner petals characteristic of the species within *Piptostigma*, the author indicated that *Brieya* was different by the stalked flowers in clusters and the individual fruits (monocarps) not fused at the base (see below). *Brieya latipetala* was later described, in 1950. One year later, Boutique (1951) indicated that *Brieya* possibly could be synonym of *Piptostigma*. Fries (1955) clarified the situation by indicating that in the original description of *Piptostigma*, Oliver (1865) did not describe the fruits, but only cited a note from Reverend George Thomson “fruits of several united carpels”. Subsequently, Engler & Diels (1901) repeated this in the description of the fruits for the genus, although their drawing of *P. longepilosum* had clearly free monocarps. *Piptostigma* does not have united monocarps, and thus the observation by Thomson was incorrect. Fries (1955) indicated that for this reason *Brieya* does not deserve recognition and presented the combination *P. latipetalum* (Exell) R.E.Fr. Because the name *P. latipetalum* Baker f. from 1913 was already in use, Fries (1959) proposed the substitute name *P. exellii*.

MATERIAL AND METHODS

Molecular phylogenetics

Taxon sampling – In order to assess the phylogenetic placement of *Piptostigma fasciculatum* we increased sampling within the tribe compared to previous analyses (Couvreur et al. 2009, 2015). A total of 32 samples representing 26 ingroup and six outgroup species were used for this study. For the outgroups, representatives of all four subfamilies were also included (Chatrou et al. 2012). In *Piptostigma*, seven species out of thirteen were included. For *Piptostigma fasciculatum* we included three specimens, one from Liberia, one from Cameroon and one from Gabon. We included all currently recognized species of *Greenwayodendron* (2/2), seven species out of eight for *Annickia*, four species out of eight for *Polyceratocarpus* and the two monotypic genera, *Sirdavidia* Couvreur & Sauquet (two individuals) and *Mwasumbia* Couvreur & Johnson (table 1).

DNA was extracted from silica gel dried leaves using the DNeasy Plant Mini Kit (Qiagen, Valencia, CA). We amplified three chloroplast regions: the *trnL* intron and *trnL-trnF* spacer (*trnLF*), *rbcL* and the *psbA-trnH* intergenic spacer. The universal primers C/D and E/F (Taberlet et al. 1991) were used to amplify and sequence *trnLF*. The *rbcL* marker was amplified using two primer combinations, 1F/724R and 636F/1460R (Fay et al. 1998). The *psbA-trnH* intergenic spacer was amplified and sequenced using primers *psbA* and *trnH* (GUG) (Hamilton 1999). PCR amplifications were conducted using the FailSafe kit with Premix E (Epicentre, Madison, WI), according to manufacturer’s instructions and by

Table 1 – Collections and GenBank numbers.

Species	Collector name, number	Herbarium acronym	Country	Genbank numbers		
				<i>psbA_trnH</i>	<i>rbcL</i>	<i>trnL-trnF</i>
<i>Anaxagorea phaeocarpa</i> Mart.	Maas, P.J.M., 8592	U	Ecuador	AY841426	AY238952	AY231284
<i>Cleistopholis glauca</i> Pierre ex Engl. & Diels	Wieringa, J.J., 3278	WAG	Gabon	AY841432	AY841603	AY841681
<i>Annona senegalensis</i> Pers.	Chatrou, L.W., 469	U	–	NA	AY841597	AY841674
<i>Duguetia staudtii</i> (Engl. & Diels) Chatrou	Andel, T.R. van, 3290	U	Cameroon	DQ125124	AY738178	AY740590
<i>Malmea dielsiana</i> (Saff.) R.E.Fr.	Chatrou, L.W., 122	U	Peru	AY841473	AY319063	AY319177
<i>Crematosperma cauliflorum</i> R.E.Fr.	Chatrou, L.W., 224	U	Peru	AY841448	AY743519	AY743565
<i>Greenwayodendron suaveolens</i> (Engl. & Diels) Verdc.	McPherson, G., 15802	WAG	Gabon	AY841466	AY841524	AY841538
<i>Greenwayodendron oliveri</i> (Engl.) Verdc.	Jongkind, C.C.H., 1795	WAG	Ghana	AY841465	AY743451	AY743470
<i>Annickia affinis</i> (Exell) Versteegh & Sosef	Sosef, M.S.M., 1877	WAG	Gabon	AY841442	AY841594	AY841671
<i>Annickia ambigua</i> (Robyns & Ghesq.) Setten & Maas	Faye, A., 65	YA	Republic of Congo	KU716119	KU716136	KU716127
<i>Annickia chlorantha</i> (Oliv.) Setten & Maas	Couvreur, T.L.P., 414	WAG	Cameroon	KU716117	KU716137	NA
<i>Annickia kummeriae</i> (Engl. & Diels) Setten & Maas	Johnson, D.M., 1942	OWU	Tanzania	AY841443	AY238959	AY231285
<i>Annickia letestui</i> (Le Thomas) Setten & Maas	Wieringa, J.J., 6102	WAG	Gabon	KU716118	KU716138	NA
<i>Annickia pilosa</i> (Exell) Setten & Maas	Sosef, M.S.M., 1803	WAG	Gabon	AY841444	AY743469	AY841726
<i>Annickia polycarpa</i> (DC.) I.M.Turner	Jongkind, C.C.H., 10892	WAG	Gabon	KU716116	KU716139	KU716128
<i>Sirdavidia solanonna</i> Couvreur & Sauquet	Couvreur, T.L.P., 596	WAG	Gabon	NA	KP144081	KP144079
<i>Sirdavidia solanonna</i> 8	Couvreur, T.L.P., 597	WAG	Gabon	NA	KP144082	KP144080
<i>Mwasumbia alba</i> Couvreur & D.M.Johnson	Couvreur, T.L.P., 85	WAG	Tanzania	NA	EU747680	EU747674
<i>Polyceratocarpus microtrichus</i> Ghesq. ex Pellegr.	Bos, J.J., 6684	WAG	Gabon	NA	EU747683	EU747677
<i>Polyceratocarpus parviflorus</i> (Baker f.) Ghesq.	Couvreur, T.L.P., 632	WAG	Cameroon	KU716120	KU716140	KU716120
<i>Polyceratocarpus pellegrinii</i> Le Thomas	Wilde, J.J.E. de, 8718	WAG	Gabon	NA	EU747684	EU747678
<i>Polyceratocarpus</i> sp. ined.	Couvreur, T.L.P., 101	WAG	Tanzania	NA	EU747681	EU747675
<i>Brieya fasciculata</i> De Wild. (<i>Piptostigma fasciculatum</i>) Cameroon	Couvreur, T.L.P., 511	WAG	Cameroon	KU716122	KU716142	KU716131
<i>Brieya fasciculata</i> De Wild. (<i>Piptostigma fasciculatum</i>) Liberia	Jongkind, C.C.H., 1862	WAG	Ghana	AY841497	AY841647	AY841725
<i>Brieya fasciculata</i> De Wild. (<i>Piptostigma fasciculatum</i>) Gabon	Couvreur, T.L.P., 578	WAG	Gabon	NA	KU716144	KU716131
<i>Piptostigma macranthum</i>	Faye, A., 52	YA	Republic of Congo	NA	KU716145	KU716132
<i>Piptostigma mortehani</i>	Wieringa, J.J., 2779	WAG	Gabon	AY841498	AY743454	AY743473
<i>Piptostigma multinervium</i>	Couvreur, T.L.P., 523	WAG	Gabon	KU716126	KU716146	KU716133
<i>Piptostigma oyemense</i>	Kandem, N., 159	YA	Cameroon	KU716124	KU716147	KU716134
<i>Piptostigma pilosum</i>	Wieringa, J.J., 2030	WAG	Gabon	AY841499	AY841648	AY841726
<i>Piptostigma macrophyllum</i>	Couvreur, T.L.P., 518	WAG	Cameroon	KU716125	KU716148	KU716135
<i>Piptostigma submontanum</i>	Couvreur, T.L.P., 625	WAG	Cameroon	KU716123	KU716143	KU716130

adding 0.5 U of Taq DNA polymerase (Promega, Madison, WI) in a total volume of 50 µL. The PCR program was as follows: 35 thermal cycles at 94 °C for 1 min, 50–55 °C for 50 s, 72 °C for 50 s and a final extension at 72 °C for 3 min. Sequencing was performed at Macrogen. Sequences were edited using Geneious ver. 1.5.6 (Drummond et al. 2010) and manually aligned in the PAUP* text editor (ver. 4.10b; Swofford 2002). Microsatellites and ambiguously aligned regions (in *trnL*F and *psbA-trnH* spacers) were excluded from all analyses.

Phylogenetic analyses – Maximum Parsimony (MP) analyses were performed on the combined dataset using PAUP* (ver. 4.10b; Swofford 2002). Heuristic searches were performed with 5000 random sequence addition iterations, saving ten trees in each, with tree bisection-reconnection branch-swapping. Gaps were treated as missing. The strict consensus tree was computed using the remaining trees. Relative support for each node was assessed by performing 100 bootstrap replications (Felsenstein 1985, Salamin et al. 2003) with TBR branch swapping (ten random addition sequences, saving ten trees per replicate). Maximum likelihood analyses were conducted using RAxML ver. 7.2.7 (Stamakis 2006) on the CIPRES portal teragrid (Miller et al. 2010). ML bootstrap analyses and the inference of the optimal tree were conducted simultaneously. The optimal tree was inferred using a GTR+Γ model, whereas a similar yet more computationally efficient model (GTR+CAT) was employed for the 1000 bootstrap iterations (Stamakis et al. 2008).

Morphological study

Around 200 herbarium specimens from B, BR, BRLU, G, K, LBV, MO, P, YA and Z were examined for this study (acronyms according to Thiers continuously updated). Online resources such as JSTOR Global Plants (<http://plants.jstor.org>) were also consulted, mainly for studying type specimens and are marked with the indication “web” after the acronym (seen online only). For two species, spirit and fresh material were available. All specimens seen are cited. Measurements, colours and other details given in the descriptions are based on living material, spirit and herbarium specimens, and data derived from field notes.

For the description of leaves, bracts, sepals, petals, we followed the terminology of the Systematics Association Committee for Descriptive Biological Terminology (1962), and for the description of fruits, we followed Stearn (1983). Ecological and geographical data were collected from specimen labels as well as field observations. Georeferenced specimen data were imported into QGIS version Lyon (www.qgis.org) to produce the distribution maps.

In cases where no holotype was indicated for a particular name, we selected a lectotype. In addition, when the above selected type specimen had several duplicates identified by different barcode numbers, we further selected one of them as the lectotype, placing the remaining duplicates as isolecotypes (with the mention “designated here”). This was done following the International Code of Nomenclature for algae, fungi, and plants (McNeill et al. 2012), articles 9.2-3, 10-12.

Chorology

For each species, the distribution map was established and its chorology defined following the classification of White (1979, 1983, 1993).

Preliminary conservation assessments

The conservation assessments followed the criteria and categories of the IUCN Red List (IUCN 2012) and were based on the distribution given by herbarium specimens (Schatz 2002). Since we missed information on species populations (Criteria A, C and D) and on analysis of their extinction's probability (Criterion E), we based our analyses on geographical range only (Criteria B and D). The conservation status was assessed by calculating the extent of occurrence (EOO) and the area of occupancy (AOO) using GeoCAT (Bachman et al. 2011) and applying the IUCN guidelines (2012, 2013). The minimum AOO was estimated based on a user defined grid cell of 2 km².

RESULTS AND DISCUSSION

Phylogeny

The total length of the matrix was 2920 characters, 185 of which were excluded because they were ambiguously aligned (2735 characters analysed). Maximum parsimony analyses identified 32 most parsimonious trees 349 steps long. The Maximum Likelihood analysis returned an identical topology, with similar bootstrap values as those found under the MP bootstrap analyses (fig. 1). Resolution between all genera of Piptostigmateae is well supported, and the paraphyly of *Piptostigma* is confirmed even when species sampling was significantly improved. Indeed, all individuals sampled of *Brieya* (*Piptostigma*) *fasciculata* from three different countries clustered together with maximum support and were sister with strong support to the rest of *Piptostigma* species and *Polyceratocarpus*. These results support the reinstatement of the genus *Brieya*, separate from *Piptostigma* (see below). We adopt this solution rather than sinking all three genera (*Polyceratocarpus*, *Brieya* and *Piptostigma*) into a single large genus. The three genera show convincing morphological differences indeed (see key below). Finally, resolution within genera is limited, except within *Polyceratocarpus* where all nodes are resolved. It is important to note that the tribe Piptostigmateae is not resolved in our analysis, with the two Malmeoideae species (*Crematosperma cauliflorum* R.E.Fr. and *Malmea dielsiana* Saff. ex R.E.Fr.) ending up as sister to the genus *Annickia*, therefore implying that the tribe Piptostigmateae is paraphyletic. This relationship, however, is not supported. This is due to the difficulty in resolving the sister group relationship between *Annickia* and the remaining Piptostigmateae (Pirie et al. 2006, Chatrou et al. 2012), in combination with the limited amount of data used in the analyses presented here.

Morphology of *Brieya* and *Piptostigma*

Habit – Species are mostly composed of medium-sized trees with a maximum height that rarely exceeds 15 m. The trunks are straight (*P. macranthum* and *P. glabrescens*) to fluted

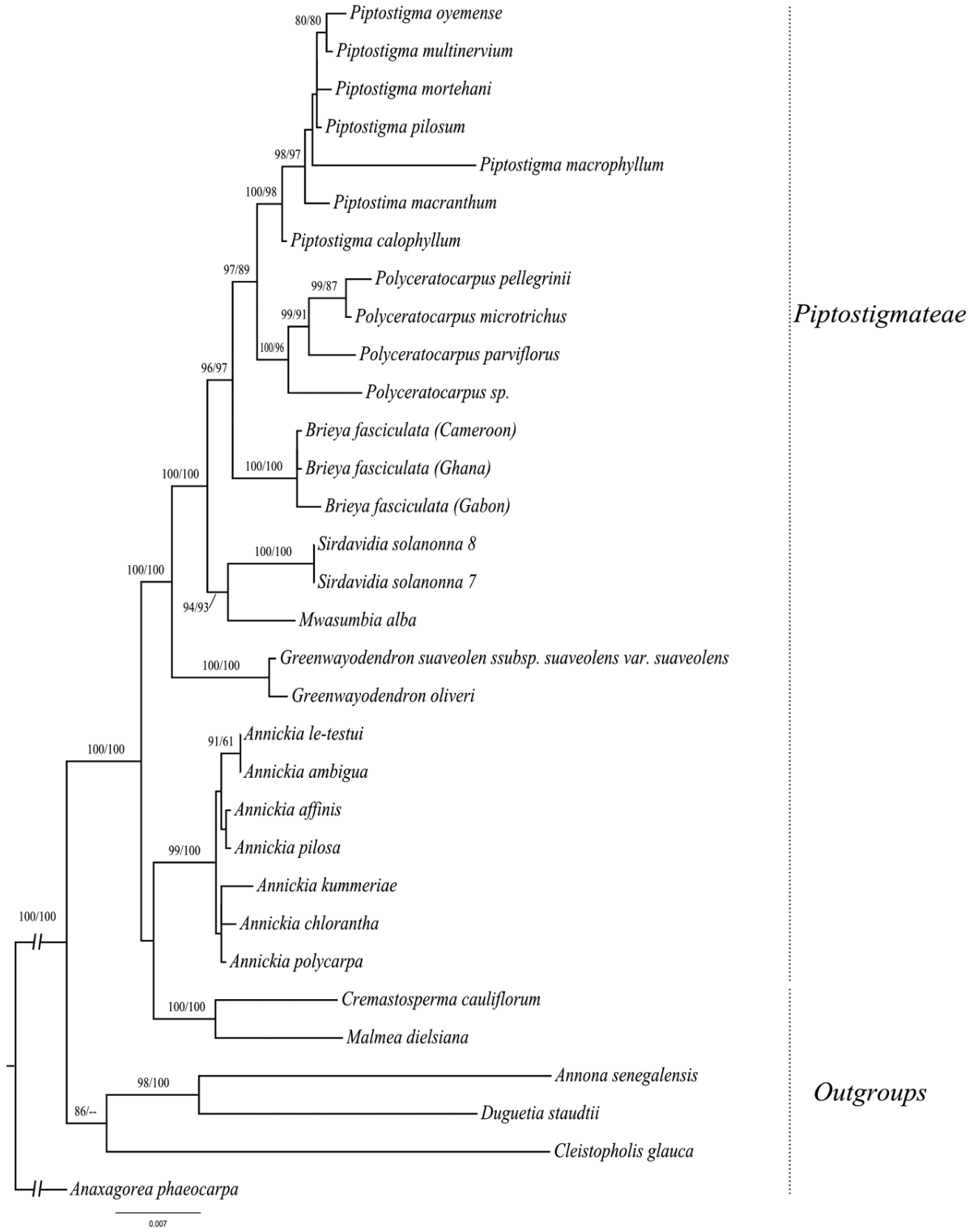


Figure 1 – Maximum likelihood tree representing the position of different groups within the tribe Piptostigmateae. Values above branches represent support values: left: Maximum parsimony bootstrap values; right Maximum Likelihood values.

(e.g. *P. calophyllum*). *Piptostigma* is reported to have a spiral phyllotaxis (Johnson 2003) of the primary axis (the trunk) and thus should follow the Roux architectural model (Hallé et al. 1978). However, this information was not verified in the field and no information about the architecture of *Brieya* was found.

Branches – The young branches of all the species are generally pubescent (e.g. *B. fasciculata*, *B. latipetala*, *P. fugax*, *P. glabrescens*, *P. macranthum*) or tomentose (*P. calophyllum*, *P. submontanum*) or even hispid (*P. mortehanii* and *P. longepilosum*). Pubescence tends to disappear with age and old branches are therefore generally glabrous or glabrescent. Nevertheless, the pubescence persists on old branches in some cases (*B. latipetala*, *P. longepilosum*, *P. mortehanii* and *P. multinervium*).

Leaves – Leaves follow the typical Annonaceae characteristics: they are alternate, distichously arranged and petiolate. The petiole in both genera is generally short and robust. The petioles are generally pubescent, densely pubescent or tomentose, with appressed hairs often ranging from ~0.5 to 0.8 mm long, but there is an extreme case where longer hairs (c. 4 mm long) are mixed with shorter ones (*P. longepilosum*). The leaf lamina is uniformly inserted on top of the petiole in all species in both genera, providing little taxonomic usefulness, unlike in some other genera of Annonaceae such as *Monodora* Dunal, *Isolona* Engl., *Uvariastrum* Engl. & Diels (Couvreur 2009, 2014b).

The leaf lamina is simple with entire margins. The size of the leaves varies considerably within *Piptostigma*, ranging from ~7 cm (*P. fugax* and *P. longepilosum*) to up to 66 cm long in some specimens of *P. calophyllum*. Such large leaves are quite rare across African Annonaceae, and one other known example is *Monodora myristica* (Gaertn.) Dunal (Couvreur 2009).

The shape of the leaf lamina is not very variable within *Piptostigma* being in general obovate for most species. This leads to difficulty in identifying sterile material. It is particularly hard to separate sterile specimens of *P. glabrescens*, *P. multinervium*, *P. goslineanum* (see key) and even *P. fugax*, or specimens of *P. macrophyllum* and *P. pilosum*. Nevertheless, some species have characteristic leaf shapes such as the clearly oblong laminas of *P. macranthum*, or the elliptic laminas of *P. oyemense* and *P. mayndongtsaezanum*. The two species of *Brieya* have obovate leaf laminas, making them hard to separate based on leaf morphology.

The lamina apex can be attenuate (*P. mayndongtsaezanum*), acuminate (e.g. *P. goslineanum*, *P. glabrescens* and *P. multinervium*) or mucronate (*P. calophyllum* and *P. mortehanii*). The base of the leaf lamina is a useful taxonomical character for distinguishing species within *Piptostigma* even though it can be quite variable in some species (*P. multinervium* and *P. glabrescens*). The lamina base ranges from slightly furrowed (*P. calophyllum* and *P. pilosum*) to cuneate (*P. oyemense*), acute (*P. mortehanii*), obtuse (*P. longepilosum* and *P. mayndongtsaezanum*) or cordate (*P. pilosum*, *P. calophyllum*). In *Brieya* the base is always cordate.

In most cases, the leaf lamina is glabrous on the upper side and pubescent or tomentose on the lower side, with hairs generally shorter than 1 mm. Exceptionally, the lamina can

be glabrous on both sides (*P. longepilosum*) or pubescent on both sides (*P. calophyllum*, *P. submontanum* and *P. mortehanii*). Finally, the lamina can be pubescent on the upper side and glabrous on the lower side (*P. macrophyllum*).

The midrib is impressed above, which is a general character for central African Annonaceae, except for *Monodora* and *Isolona* (Couvreur 2009). The midrib is clearly salient on its lower side and generally pubescent.

Secondary venation is eucamptodromous in both genera (fig. 2), meaning that the secondary veins gradually diminish towards the margins without forming prominent marginal loops in the other typical venation pattern found in Annonaceae (brochidodromous type venation). The highly parallel and generally numerous secondary veins provide one of the most diagnostic characters for distinguishing *Piptostigma* even when sterile (fig. 2A). The secondary veins are parallel, opposite to subopposite and most species have more than twenty pairs of secondary veins. The highest number of pairs of secondary veins is found in *P. calophyllum* (30–66) and the lowest number is found in *P. fugax* (15–23). However, variation of secondaries is dependent on leaf size, and thus is not a good character to identify species. The pattern of secondary venation in *Brieya* (fig. 2B) intermediates between

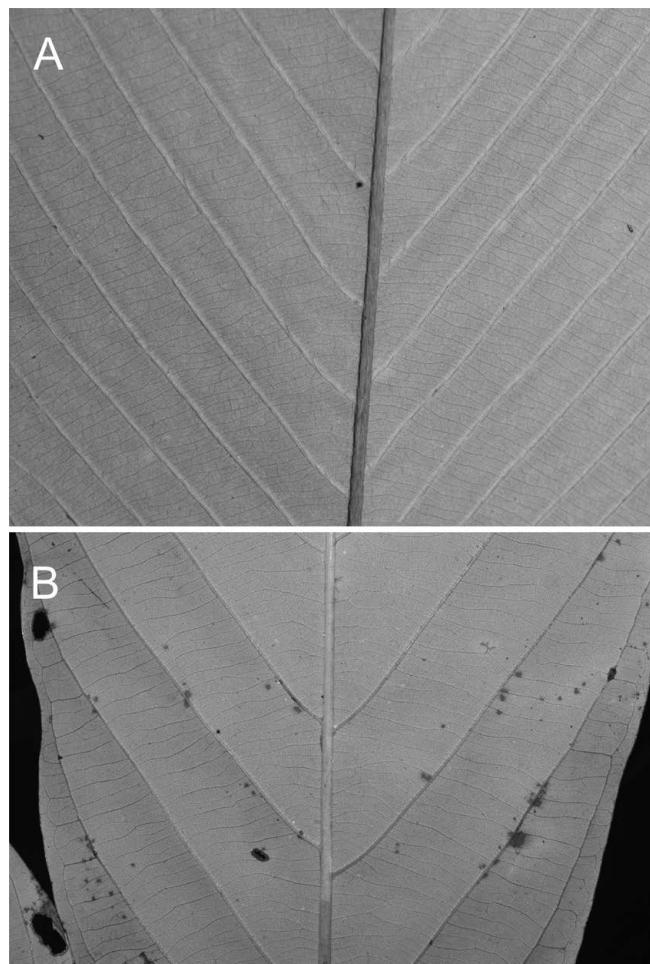


Figure 2 – View of secondary veins on the lower side of leaves: A, *Piptostigma multinervium* from Couvreur, T.L.P. 616; B, *Brieya fasciculata* from Couvreur, T.L.P. 511. Photographs: T.L.P. Couvreur.

that found in *Piptostigma* and some species of *Polyceratocarpus*. The secondary veins are not as parallel like in *Piptostigma*, but curved upwards towards the margins and are generally fewer in number (less than 20 pairs). In both genera, the tertiary veins are parallel (percurrent), almost perpendicular to the secondary veins.

Inflorescence – Inflorescences in Annonaceae are monotelic, meaning they are characterized by a terminal flower with one to several lateral cymosely branched partial inflorescences (Weberling & Hoppe 1996). Annonaceae have only a single prophyll consequently leading to a monochasial ramification of the partial inflorescences with the consecutive floral branches all arranged in a vertical plane. This type of partial inflorescence is termed a rhipidium (Weberling & Hoppe 1996) (see fig. 3B). In Annonaceae rhipidiate inflorescences

can develop terminally on branches and later adopt a leaf-opposed, sub-axillary or extra-axillary position due to overtopping of the later axis, or develop in the axils (axillary) of the foliage (Fries 1919, 1959, Weberling & Hoppe 1996).

In *Piptostigma*, the inflorescences are axillary consisting of a single rhipidium (*P. fugax*, *P. oyemense*) or more generally several rhipidia. There are generally 2–4 flowers per rhipidium but in some cases there is just one fully developed flower (*P. fugax*, *P. oyemense*). In *Brieya*, inflorescences are also axillary with one to three highly reduced rhipidia (fig. 4A–B). The inflorescences in both genera are found on old branches and for most species in *Piptostigma* are also cauliflorous. Cauliflory has not been observed in *Brieya*. In some cases, cauliflory is pushed to an extreme where the

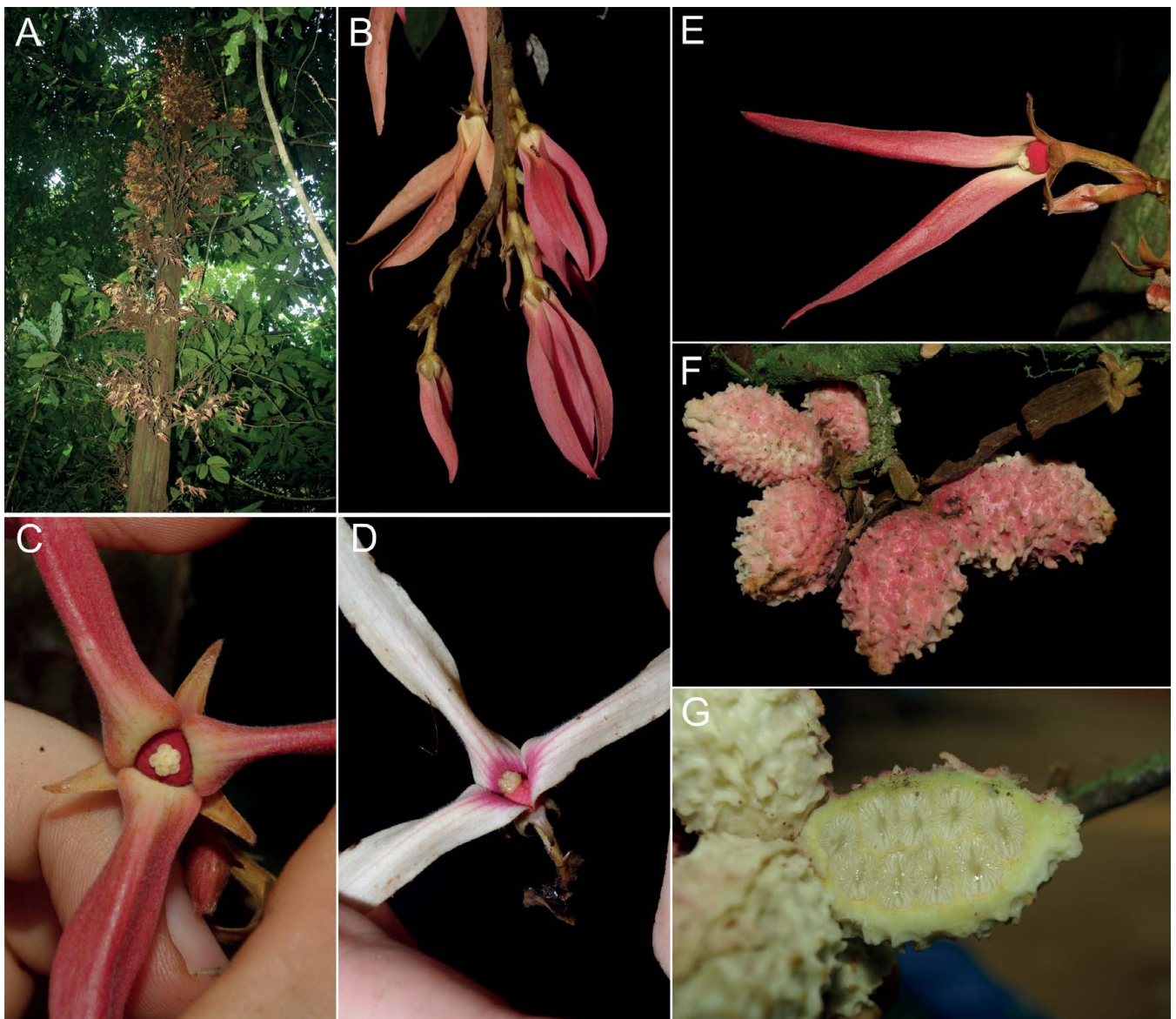


Figure 3 – A, example of extreme cauliflory in *Piptostigma multinervium*; B, view of a *P. multinervium* rhipidium; C, upper view of a *P. multinervium* flower; D, upper view of a *P. oyemense* flower; E, detail of *P. multinervium* receptacle, one petal missing (A–C, E from Couvreur, T.L.P. 616); F & G, example of longitudinal section and outer view of fruits (D: Couvreur, T.L.P. 917, F & G: from Couvreur, T.L.P. 544). Photographs: T.L.P. Couvreur.

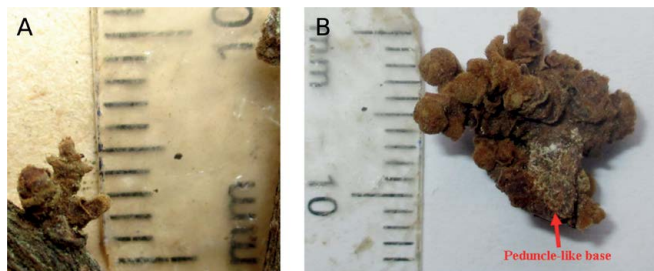


Figure 4 – Inflorescence of *Brieya fasciculata*: A, common size from Letouzey, R. 5605; B, maximum size from Letouzey, R. 10718.

whole trunk is covered with inflorescences (e.g. *P. multinervium*, fig. 3A).

In both genera, the base of the inflorescence can appear to be stalked, especially in older structures. Maas et al. (2007) indicated that this is not a true peduncle, but possibly results from short old internodes that have become indistinct with age. They nevertheless refer to this structure as peduncle-like and we shall adopt this terminology here too. The peduncle-like structure is followed by a zone of indeterminate growth representing the main axis or second order axes. The internodes within the indeterminate region, referred to as axial internodes, can be very variable in length even within species. The length of the axial internodes and thus the overall size of the inflorescences appear to be an important distinc-

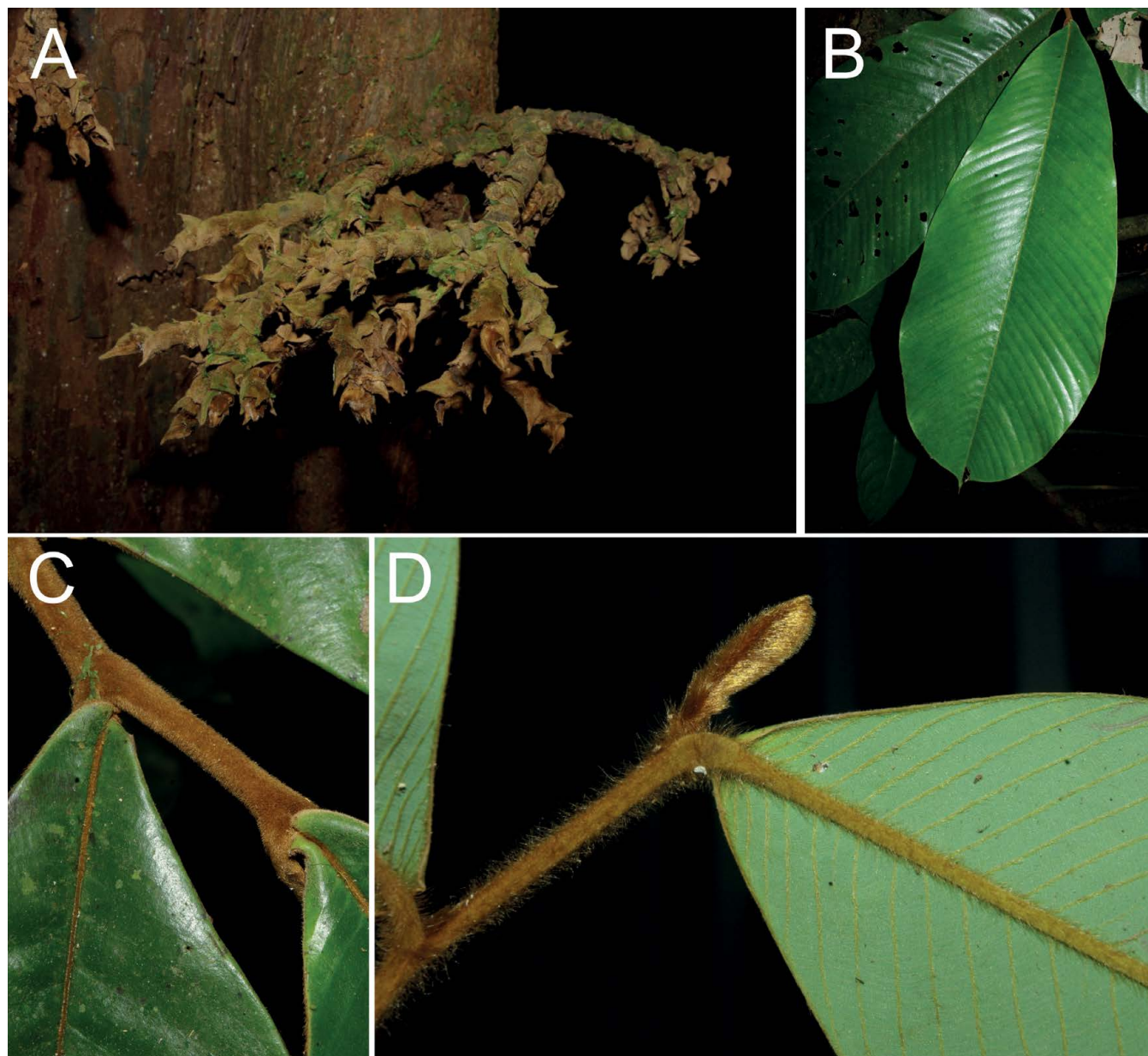


Figure 5 – *Piptostigma submontanum*: A, old cauliflorous inflorescence; B, upper side of a leaf; C, detail of young branches, note tomentose hairs; *Piptostigma mortehanii*: D, lower side of the leaf base, note short hispid hairs. A–C. From Couvreur, T.L.P. 625; D. from Couvreur, T.L.P. 667 Photographs: T.L.P. Couvreur.

tive character between the two genera. *Brieya* always has highly reduced axial internodes shorter than 1 mm, making the inflorescences very compact and small (fig. 4), whereas in *Piptostigma* axial internodes are always longer than 2 mm (generally more than 1 cm long) making the inflorescences longer and more robust (figs 3D & 5A). In *Piptostigma*, we can distinguish three main groups (redefined from Maas et al. 2007):

- (1) compact: internodes are shorter than 1 cm giving a very compact appearance to the inflorescence. This type is common in *P. calophyllum*, *P. submontanum* (cf. fig. 5A) or *P. macranthum*, but can also be found in other species (e.g. *P. multinervium*);
- (2) lax or sub-lax: internodes are between 1 and 4 cm long, leading to more or less long inflorescences and found in most species;
- (3) panicle-like: internodes between 5 and 10.5 cm long leading to long pendant inflorescences.

Piptostigma mortehanii produces the longest inflorescences of the genus with axial internodes up to 10.5 cm leading to inflorescences up to 2.7 m long. A few other genera produce very long inflorescences in Africa such as *Anonidium* and one species in *Isolona*, *I. cauliflora* Verdc. (Couvreur 2009). The large variability of inflorescence length has led to some confusion in the past (Le Thomas 1969). Even though inflorescence length has been used in several other Annonaceae genera to separate species such as in *Unonopsis* R.E.Fr. (Maas et al. 2007), or *Mitrephora* Hook.f. & Thomson (Weerasooriya & Saunders 2010), it appears of limited use within *Piptostigma*. Based on our observations the same species can have very long to short inflorescences with no other distinctive features. This is the case, for example, in *P. mortehanii* where inflorescence size ranges from compact to panicle-like (one specimen from Ghana: *Enti* 35527, K). This variation might be linked to different ecological conditions that affect the growth of the inflorescences, but this will need to be analysed in more detail in the field.

Flowers – Flowers in both genera are actinomorphic, cyclic, trimerous with one whorl of three free sepals and two whorls of three free petals each (referred to as outer and inner petals), and bisexual, conforming to the general pattern found within Annonaceae (van Heusden 1992) (figs 3B–C, 6A–B & 7A–C). In *Piptostigma*, the flowering pedicel is variable in length ranging from 0.4 cm (*P. macranthum*) to c. 5 cm long and is almost always densely pubescent. In *Brieya*, the pedicel is always longer than 1 cm, up to 5 cm long in some specimens of *B. fasciculata*, and finely pubescent. The pedicel in both genera is bibracteate, bearing a lower and upper bract conforming to Fries' type 2, the most common situation across Annonaceae (Fries 1955). The upper bract is positioned above the invisible articulation and is always found in the lower half of the pedicel. In *Piptostigma*, the lower bract is generally persistent, except in some cases in the very long inflorescences of *P. mortehanii*. The upper bract is variable in shape with three main groups distinguished within *Piptostigma*:

- (i) small, elliptic, long acute at the apex, appressed against the pedicel or sometimes not (*P. multinervium*, *P. oyemensense*, *P. glabrescens*, *P. mortehanii*, *P. macrophyllum*, *P. fugax* and *P. pilosum*);

- (ii) large, rounded and amplexicaul (*P. macranthum* and *P. calophyllum*) or
- (iii) medium, rounded towards the middle and acute towards the apex, amplexicaul (*P. longepilosum*).

In *Brieya*, the lower and upper bracts are minute and generally caducous.

The sepals in both genera are free, valvate, small and triangular or ovate, not showing any useful variation between species. Within African Annonaceae, both *Brieya* and *Piptostigma* are characterized by outer petals that are sepal-like (or sepaloid) and much smaller than the inner petals. Longer inner petals, though quite rare in Annonaceae, do occur in several genera in Southeast Asia such as *Phaeanthus* (Mols & Keßler 2000b), *Miliusa* (Mols & Keßler 2003), one species of the South American genus *Guatteria* Ruiz & Pav. (*G. heteropetala* Benth.) (Erkens & Maas 2008) and at some degree in some other genera such as *Orophea* Blume, *Marsypopetalum* Scheff., *Trivalvaria* Miq., *Pseuduvaria* Miq., *Polyalthia* Blume and *Popowia* Endl. (Chaowasku et al. 2014). The latter authors have shown that this state of outer petals, being similar to the sepals in size and considerably smaller than the inner petals, has evolved multiple times from the ancestral state of showy outer petals (outer petals much larger than sepals).

The androecium has numerous extrorse stamens conforming to the typical Annonaceae configuration (van Heusden 1992). The disposition of anthers in Annonaceae flowers is still poorly understood and more data is needed to better understand this (Endress & Armstrong 2011). In the genus *Piptostigma*, the stamens are numerous and molar- or drum-like shaped. The two anthers are symmetric, marginal or embedded into the connective body. The apical prolongation of the connective is broad, short and glabrous without much variation between species. The filament is very short or absent.

The carpels are free, ranging from one to twelve, implanted into the hollow of the concave receptacle; the ovaries are generally oblong, densely pubescent or tomentose, with appressed hairs. The stigma is generally lobed, mostly spherical to transversely ellipsoid, very often pubescent, rarely glabrous. Ovule number is few, ranging from three to ten in *Piptostigma*; and from eight to twelve in *Brieya*. The ovules are biseriate, but some species appear to have a uniseriate placentation (*P. fugax*, *P. glabrescens*, *P. macrophyllum* and *B. latipetala*).

Both *Brieya* and *Piptostigma* are characterized by abundant pubescence of the pedicels, the carpels and the lower side of bracts, sepals and external petals. Of all the perianth parts, only the inner petals show a pubescence on both sides. The stigma of all the species is pubescent to some degree and the apical part of the connective is always glabrous.

Fruits – The fruits of *Brieya* and *Piptostigma* are apocarpic with one to several free monocarps. These monocarps are sessile to subsessile and indehiscent, a condition also shared with the closely related genus *Polyceratocarpus* (Couvreur et al. 2009). Even though in the protologue of the genus *Piptostigma* there is mention of basally fused monocarps (Oliver 1865) this is not true. Generally, there are 1–3(–5) monocarps per fruit (see figs 3E–F & 6C–D). In *Brieya*, the



Figure 6 – A & B, flowers of *Piptostigma fugax*: A, outer view; B, upper view [from Couvreur, T.L.P. 693; note the few carpels (4)]; C, flower and monocarp of *Piptostigma maydongtsaeianum* from van der Burgt, X.M. 790; D, monocarps of *Piptostigma macrophyllum* from Couvreur, T.L.P. 518; E & F, flower and leaf of *Piptostigma pilosum* from Couvreur, T.L.P. 1047. Photographs: A, B & D–F: T.L.P. Couvreur; C: X.M. van der Burgt.

monocarps are oblong to rounded, glabrous and quite large, ranging from 3 to 7.2 cm long (fig. 7D). In *Piptostigma*, the shape of the monocarps is variable between species, being ovoid (*P. mortehanii*, *P. macrophyllum*, *P. fugax* and *P. pilosum*), obovoid (*P. macranthum* and *P. calophyllum*), ellipsoid (*P. mayndongtsaeum*, *P. glabrescens*, *P. goslineum*, *P. fugax* and *P. pilosum*) or oblong (*P. multinervium*).

The surface and ornaments of the monocarps provide a useful taxonomic character to separate species within *Piptostigma*. We define three main groups (fig. 8):

- Group I: muricate-verrucate (see Stearn 1983), glabrescent to glabrous.

The first set of this group includes species with the surface of monocarps covered with short hard or soft excrescences

(muricate), providing an unusual aspect to the fruit. No other genus in Africa has such an ornamentation of the monocarp, though some species in South East Asia do, e.g. *Monocarpia borneensis* Mols & Keßler (Mols & Keßler 2000a). The example species of this set are *P. macranthum* (fig. 8A) and *P. multinervium* (fig. 8B).

The second set of the group is made of species with a warty surface (verrucate). Examples: *P. macrophyllum* (fig. 8D), *P. oyemense* (fig. 8E), *P. mayndongtsaeum* (fig. 8F) and *P. submontanum* (fig. 8C).

- Group II: tuberculate-pusticulate, tomentose.

This group includes one species with the surface of monocarps covered with wart-like projections (tuberculate) and a tomentose indumentum: *P. mortehanii* (fig. 8G); and four

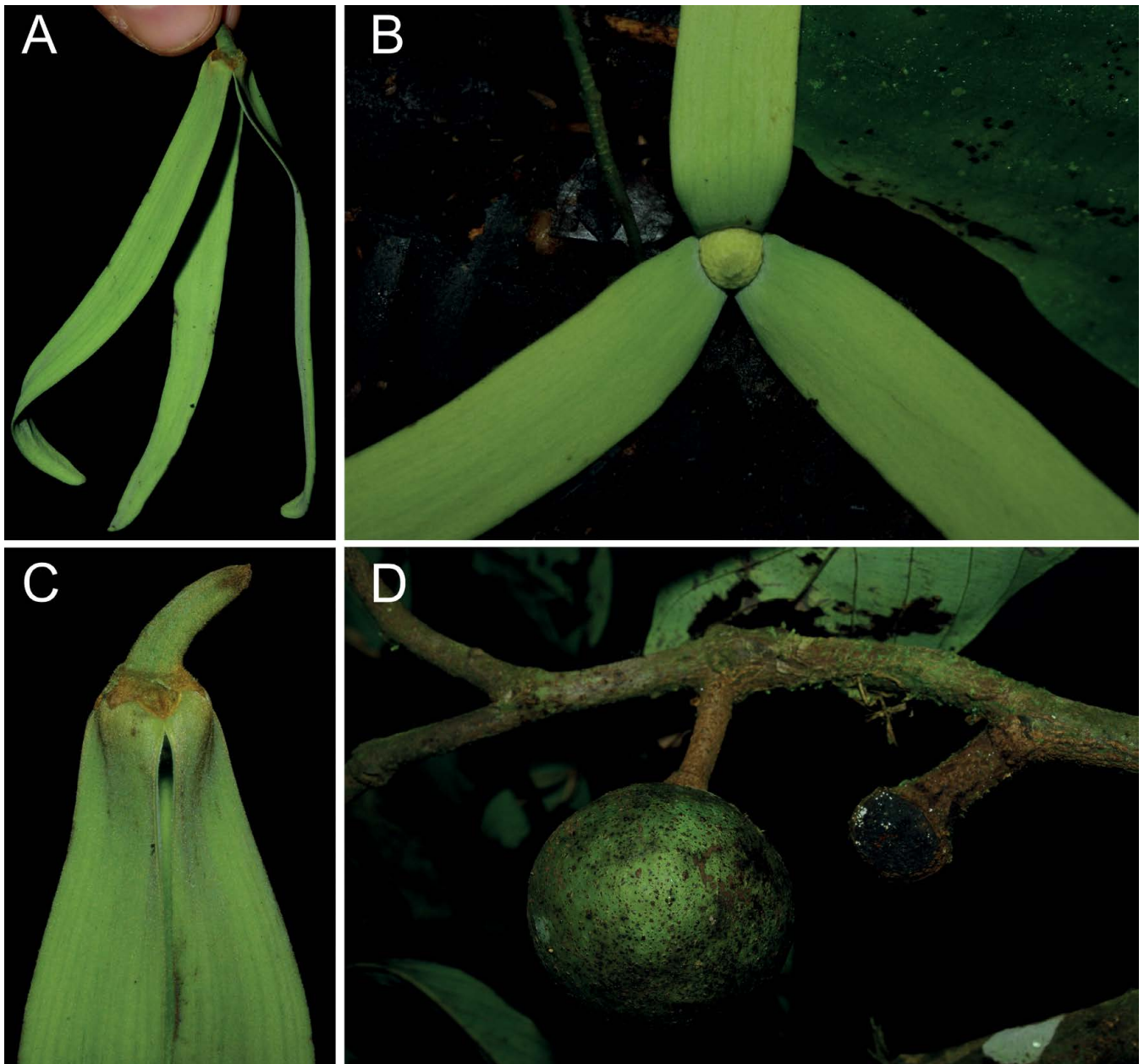


Figure 7 – *Brieya fasciculata*: A–C, flower (A, outer view; B, upper view; C, base); D, monocarp. From Couvreur, T.L.P. 511. Photographs: T.L.P. Couvreur.

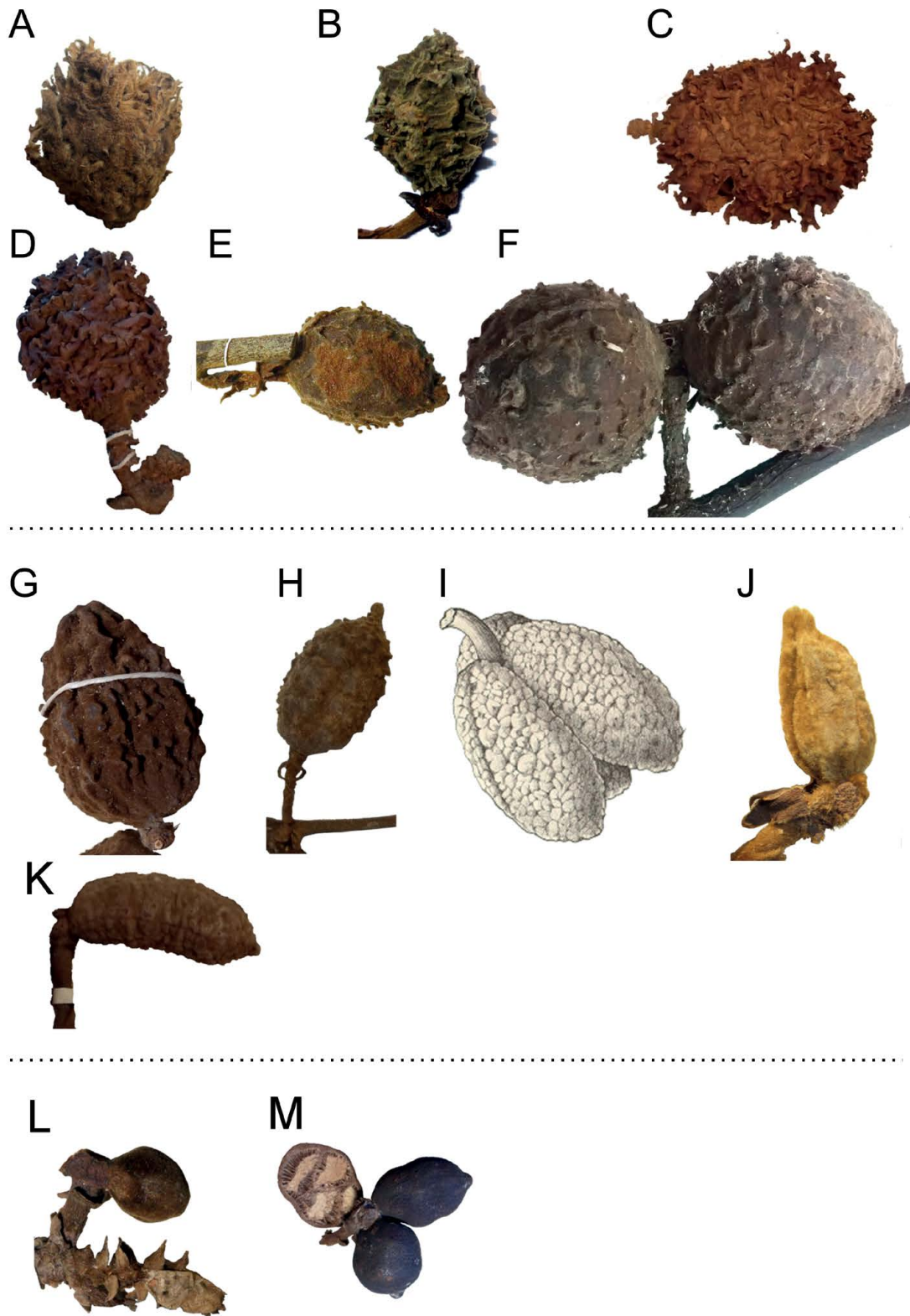


Figure 8 – Different groups of monocarps in the genus *Piptostigma*. Group I (A–F): A, *P. macranthum* from Satabié, B. 1037; B, *P. multinervium* from Bos, J.J. 4625; C, *P. submontanum* from Letouzey, R. 14535; D, *P. macrophyllum* from Letouzey, R. 14590; E, *P. oyemense* from Hallé, N. 4734; F, *P. mayndongtsaeum* from Sainge, M. 558; Group II (G–K): G, *P. mortehanii* from Ollome, J.-B. s.n.; H, *P. fugax* from Kouamé, F.N. 1131; I, *P. longepilosum* (reproduced from Engler & Diels 1901); J, *P. pilosum* from Thomas, D.W. 4755; K, *P. glabrescens* from Hallé, N. 4087; Group III (L–M): L, *P. calophyllum* from Fleury, J.F. 33400; M, *P. goslineanum* from Fleury, J.F. 33134.

others with the surface of monocarps dotted with pustules (pusticulate): *P. fugax* (fig. 8H), *P. longepilosum* (fig. 8I), *P. pilosum* (fig. 8J) and *P. glabrescens* (fig. 8K).

- Group III: smooth or punctulate, glabrous.

In this group, whatever the shape of the monocarp, its surface does not present any visible ornamentation; therefore the surface appears to be smooth or punctulate (minutely or finely dotted) when magnified: *P. goslineanum* (fig. 8M) and *P. calophyllum* (fig. 8L).

Seeds – The seeds of *Piptostigma* and *Brieya* are mostly ellipsoid, but can present many other shapes: broadly ellipsoid or cubical (*P. longepilosum*), oblong (*P. submontanum* and *P. longepilosum*) or semi-spherical (*P. macrophyllum*). In both genera, the seed number varies from five to twelve per monocarp. We did not observe more than twelve seeds, although some reports suggest up to eighteen per monocarp (van Setten & Koek-Noorman 1992). Seed size varies between 10 and 17 mm long and between 4 and 5 mm wide. Smaller seeds have been measured in *P. pilosum* (1.5–3.5 mm long, 2–3 mm wide), but this might be related to the small size of the immature fruit. The testa can be reticulate (with a raised network of narrow and sharply angled lines frequently presenting a geometric appearance, each area or depression outlined by the reticulum being an interspace), for example in *P. macranthum*; or favulariate (with the surface finely ribbed, the ribs separated by zigzagging furrows), for example in *P. macrophyllum*, *P. multinervium* and *P. submontanum*.

Pollination biology – Little is known about pollination biology of African Annonaceae (Gottsberger et al. 2011, Gottsberger 2012, Saunders 2012). A recent study however, studied the pollination of several African species, including one species of *Piptostigma* in the Banyang Mbo Wildlife Sanctuary in the Southwest region of Cameroon (Gottsberger et al. 2011). Unfortunately, a proper identification was not available. From the photographs and the sterile specimen, this species could be *P. multinervium*. As for all Annonaceae, the flowers of *Piptostigma* are protogynous (Gottsberger 2012). For this particular species of *Piptostigma* a three-day cycle in anthesis was recorded: the first day and part of the second day in a pistillate phase and the rest of the second and third day in a staminate phase. During the pistillate phase, the stigmas secrete a sticky exudate leading to the carpels to be stuck together. This can be inferred as a compitum during pollination (the “extragynoecial compitum” of Endress 1982). The secretion of this exudate is quite common across apocarpous Annonaceae (Endress 1982, Gottsberger 2012). At the end of the staminate phase all stamens fall off, followed by the petals. In terms of pollinators, not much is known. Gottsberger et al. (2012) recorded that black staphylinid beetles were highly attracted by the flowers during both the pistillate and staminate phases. During our field observations, we saw weevils covered in pollen nested in between the androecium and the petals, or larger beetles walking around the carpels. However, this does not represent a proper test of pollination agents and more studies have to be carried out. In any case, it would appear as if *Piptostigma* is beetle-pollinated (cantharophilous), conforming to the majority of Annonaceae species (Saunders 2012).

Table 2 – Classification of the different *Brieya* and *Piptostigma* species into the three major phytochoria of the Guineo-Congolian Region following White (1979).

Phytochoria	Species
Upper Guinea Domain	<i>Brieya fasciculata</i>
	<i>Piptostigma fugax</i>
	<i>Piptostigma mortehani</i>
Lower Guinea Domain	<i>Brieya fasciculata</i>
	<i>Piptostigma callophyllum</i>
	<i>Piptostigma fugax</i>
	<i>Piptostigma glabrescens</i>
	<i>Piptostigma goslineanum</i>
	<i>Piptostigma longepilosum</i>
	<i>Piptostigma macranthum</i>
	<i>Piptostigma macrophyllum</i>
	<i>Piptostigma mayndongtsaeaneum</i>
	<i>Piptostigma mortehani</i>
	<i>Piptostigma multinervium</i>
	<i>Piptostigma oyemense</i>
	<i>Piptostigma pilosum</i>
	<i>Piptostigma submontanum</i>
Congolia Domain	<i>Brieya latipetala</i>
	<i>Piptostigma mortehani</i>

General chorology (phytochoria according to White 1979, 1983)

Brieya and *Piptostigma* are both endemic to the Guineo-Congolian region, with no species occurring in East Africa. This represents an exception as most non-monotypic genera of African Annonaceae also occur in East Africa (Couvreur et al. 2006, 2008).

Brieya has two species, *B. fasciculata* and *B. latipetala*, the former known from the Upper and Lower Guinea Domains while the latter is restricted to northern Angola. Although the known localities of *B. latipetala* fall within White’s (1983) transition zone with the Zambezian Region, the species should be considered as a transgressing element of the Congolia Domain.

Piptostigma is the most diverse genus of Piptostigmata with thirteen recognized species. The genus is concentrated in the Lower Guinea Domain (table 2). This Domain is clearly the most important centre of diversity in *Piptostigma* where all the thirteen accepted species are recorded, and most of those species inhabit tropical rain forests. The Upper Guinea Domain harbours two species (*P. fugax* and *P. mortehanii*), while the Congolia Domain harbours one species (*P. mortehanii*).

Table 3 – Preliminary conservation statuses of the species of *Piptostigma* and *Brieya*.

Species	Conservation status
<i>Brieya fasciculata</i>	LC
<i>Brieya latipetala</i>	CR B2ab(i,ii,iii,iv,v)
<i>Piptostigma calophyllum</i>	VU B2ab(iii,v)
<i>Piptostigma fugax</i>	LC
<i>Piptostigma glabrescens</i>	LC
<i>Piptostigma goslineanum</i>	EN B2ab(i,ii,iii,iv,v)
<i>Piptostigma longepilosum</i>	VU B1ab(i,ii,iii,iv,v)+B2bc(i,ii,iii,i v,v)
<i>Piptostigma macranthum</i>	LC
<i>Piptostigma macrophyllum</i>	VU B2abc(i,ii,iii,iv)
<i>Piptostigma mayndongtsaeum</i>	EN B2ab(i,ii,iii,iv,v)
<i>Piptostigma mortehani</i>	LC
<i>Piptostigma multinervium</i>	LC
<i>Piptostigma oyemense</i>	LC
<i>Piptostigma pilosum</i>	LC
<i>Piptostigma submontanum</i>	EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)

Preliminary conservation assessment

Within the thirteen species of the genus *Piptostigma*, a total of six (46 %) species are potentially threatened with extinction (table 3): three are listed as Endangered (EN) (*P. goslineanum*, *P. mayndongtsaeum* and *P. submontanum*) and three as Vulnerable (VU) (*P. calophyllum*, *P. longepilosum* and *P. macrophyllum*). The remaining ones are listed as Least Concern (LC). For the two species of the genus *Brieya* (table 3), *B. latipetala* is listed as Critically Endangered (CR) and *B. fasciculata* as Least Concern (LC).

Taxonomic treatment

Piptostigma Oliv. (Oliver 1865: 158–159). – Type species: *Piptostigma pilosum* Oliv.

Phaeanthus Hook.f. & Thomson sect. *Piptostigma* (Oliv.) Baillon (Baillon 1878).

Tree or shrub, pubescent. Leaves simple, entire, petiolate, distichous, exstipulate, venation eucamptodromous, secondary veins subparallel, opposite to subopposite, midrib impressed adaxially, salient abaxially, tertiary veins regularly parallel. Inflorescence axillary, variable in length, consisting of a single or several rhipidia with one to several flowers per rhipidia, cauliflorous or ramiflorous. Flowers hermaphroditic, actinomorphic, trimerous, pedicellate, apocarpic; sepals 3, free, ovate to lanceolate, acute; petals 6, in two whorls of 3, free, valvate, the external ones resembling the sepals but slightly longer, the internal ones much longer than outer ones, lanceolate to linear, concave at the base. Stamens numerous, densely packed on the receptacle, filament absent or very short; anthers mostly cuneate–oblong, extrorse, connective's

Key to the genera of Piptostigmateae

1. Bark slash yellow, petals 3 in one whorl.....*Annickia*
- 1'. Bark slash cream to light red, petals 6 in two whorls.....2
2. Outer petals reduced, sepal like, smaller than inner petals.....3
- 2'. Outer petals not reduced, sub equal to larger than inner petals.....4
3. Secondary veins less than 20 pairs (11–17); inflorescence highly reduced and compact, generally not longer than 10 mm long, rarely up to 15 mm long, axial internodes shorter than 1 mm.....*Brieya*
- 3'. Secondary veins generally more than 20 pairs (15–66); inflorescence longer than 15 mm, axial internodes longer than 2 mm.....*Piptostigma*
4. Petals linear, fruits clearly stipitate.....*Greenwayodendron*
- 4'. Petals elliptic, ovate to rounded, fruits sessile to subsessile.....5
5. Tertiary veins parallel with impressed midrib above.....*Polyceratocarpus*
- 5'. Tertiary veins variously curved and anastomosing.....6
6. Midrib raised above, ovules biseriate.....*Polyceratocarpus pellegrini**
- 6'. Midrib impressed above; ovules uniseriate.....7
7. Inner and outer petals 4–9 mm long, all petals reflexed at anthesis, red; stamens bright yellow; carpel 1.....*Sirdavidia (solannona)*
- 7'. Inner and outer petals 12–18 mm long, outer petals reflexed, inner petals pendulous and sometimes connivent at the tips, white; stamens cream–white; carpels 4.....*Mwasumbia (alba)*

* In *Polyceratocarpus*, *P. pellegrini* differs from all other species of the genus by the absence of the parallel tertiary venation (Le Thomas 1969), but is distinct within the whole tribe by its raised midrib (impressed for all other species of the tribe). Molecular phylogenetics indicates that *P. pellegrini* is nested within *Polyceratocarpus* (fig. 1).

Key to the species of *Piptostigma*

1. Petioles, young branches and midribs densely tomentose golden-brown, secondary veins (30–)40–65 pairs, rarely less than 40. Cameroon, Gabon.....2
- 1'. Petioles, young branches and midrib not tomentose, glabrous, densely pubescent or hispid; secondary veins less than 40.....3
2. Leaf base decurrent to cuneate; petiole 2–4 mm long; fruits verrucate, very shortly pubescent; above 1 000 m elevation. Cameroon.....13. *P. submontanum*
- 2'. Leaf base acute to obtuse or rarely broadly cordate; petiole 4–11 mm long; fruits smooth or punctulate, tomentose brown; below 1 000 m elevation. Cameroon, Gabon.....1. *P. calophyllum*
3. Leaf base rounded.....4
- 3'. Leaf base acute, obtuse or cuneate.....6
4. Leaf lamina narrowly oblong to oblong, rarely narrowly obovate, shiny above; carpels 9–12. Cameroon, Gabon, Republic of Congo, Cabinda (Angola).....6. *P. macranthum*
- 4'. Leaf lamina obovate to narrowly obovate, narrowly elliptic to elliptic, matte above; carpels 3–8.....5
5. Petiole and young branches hispid, hairs up to 4 mm long; petiole 4–7 mm long; leaf lamina 7–24 cm long, glabrous below. Cameroon.....5. *P. longepilosum*
- 5'. Petiole and young branches densely pubescent, hairs shorter than 4 mm, petiole 2–4 mm long; leaf lamina 25–41 cm long, sparsely pubescent below. Nigeria, Cameroon, Equatorial Guinea, Gabon.....12. *P. pilosum*
6. Upper side of the leaf lamina pubescent at least towards the base and the midrib.....7
- 6'. Upper side of the leaf lamina glabrous even at the base and near the midrib.....8
7. Leaf lamina 11.5–20.5 cm long, petiole 3–4 mm long; young branches hispid; inflorescence 30–270 cm long; carpels 3–4; monocarp broadly ovoid, tuberculate and pubescent. Cameroon, Democratic Republic of Congo, Gabon, Ghana.....9. *P. mortehanii*
- 7'. Leaf lamina 21–41 cm long, petiole 6–7 mm long; young branches not hispid, but normally pubescent; inflorescence up to 8 cm long; carpels c. 5; (sub) globose, verrucate and glabrous. Cameroon.....7. *P. macrophyllum*
8. Leaf lamina elliptic to narrowly elliptic.....9
- 8'. Leaf lamina obovate to very narrowly obovate.....10
9. Petiole 6–8 mm long; leaf base obtuse; inflorescence composed of 2–5 rhipidia; sepals 1.8–3 mm long, carpels 4; monocarps shortly pubescent. Cameroon, Equatorial Guinea.....8. *P. mayndongtsaeum*
- 9'. Petiole 3–4 mm long; leaf base cuneate; inflorescence composed of 1(–2) rhipidia; sepals 5–6 mm long; carpels 3; monocarps glabrous on old fruits, (shortly pubescent on young ones). Cameroon, Gabon.....11. *P. oyemense*
10. Inflorescence composed of a single 1-flowered rhipidium; carpel generally one, sometimes 3, more rarely 4. Widely distributed (Liberia to Cameroon).....2. *P. fugax*
- 10'. Inflorescence composed more than 2 multi-flowered rhipidia; carpels 4 or more.....11
11. Monocarps ovoid or ellipsoid, obtuse at the base, smooth or punctulate, finely pubescent to glabrous. Cameroon.....4. *P. goslineanum*
- 11'. Monocarps ellipsoid, aculeate, rarely verrucate, sparsely pubescent to glabrous. Cameroon, Gabon.....10. *P. multinervium*
- 11''. Monocarps oblong, often transversally throttled, bumpy and pustulate, glabrous. Cameroon, Equatorial Guinea, Gabon, Republic of Congo.....3. *P. glabrescens*

apex truncate, transversely rhomboidal; carpels not fused, 1–14, pubescent; stigma depressed–globular, obscurely lobate, pubescent; ovules 3–12, uni- or biseriate. Fruits apocarpous with 1–10 monocarps; monocarps sessile, free, indehiscent, spherical, ovoid or ellipsoid-oblong. Seeds in 1–2 rows, mostly ellipsoid.

1. *Piptostigma calophyllum* Mildbr. & Diels (Diels 1915: 443) – Type: Cameroon, South Region, Ebolowa, 4 Jul. 1911, *Mildbraed, G.W.J.* 5791 (holo-: B [B100154077];

iso-: HBG [HBG502525, HBG502527, HBG50252] web, L [L0196773] web, P [P00363307], YA [YA0002833]).

Tree, 8–10 m tall, 6–20 cm in dbh, trunk straight, vertical or slightly sinuous, fluted or not. **Young branches** tomentose, hairs 0.5 mm long, erect, golden brown. **Leaves**: petiole 4–11 mm long, 3–6 mm in diameter, tomentose, hairs 0.5–0.8 mm long, erect, brown; leaf lamina 30–66 cm long, 14–34 cm wide, length:width ratio 2, obovate, coriaceous, upper side glabrous, lower side densely pubescent, especially towards the base, hairs c. 0.8 mm long, erect or ap-

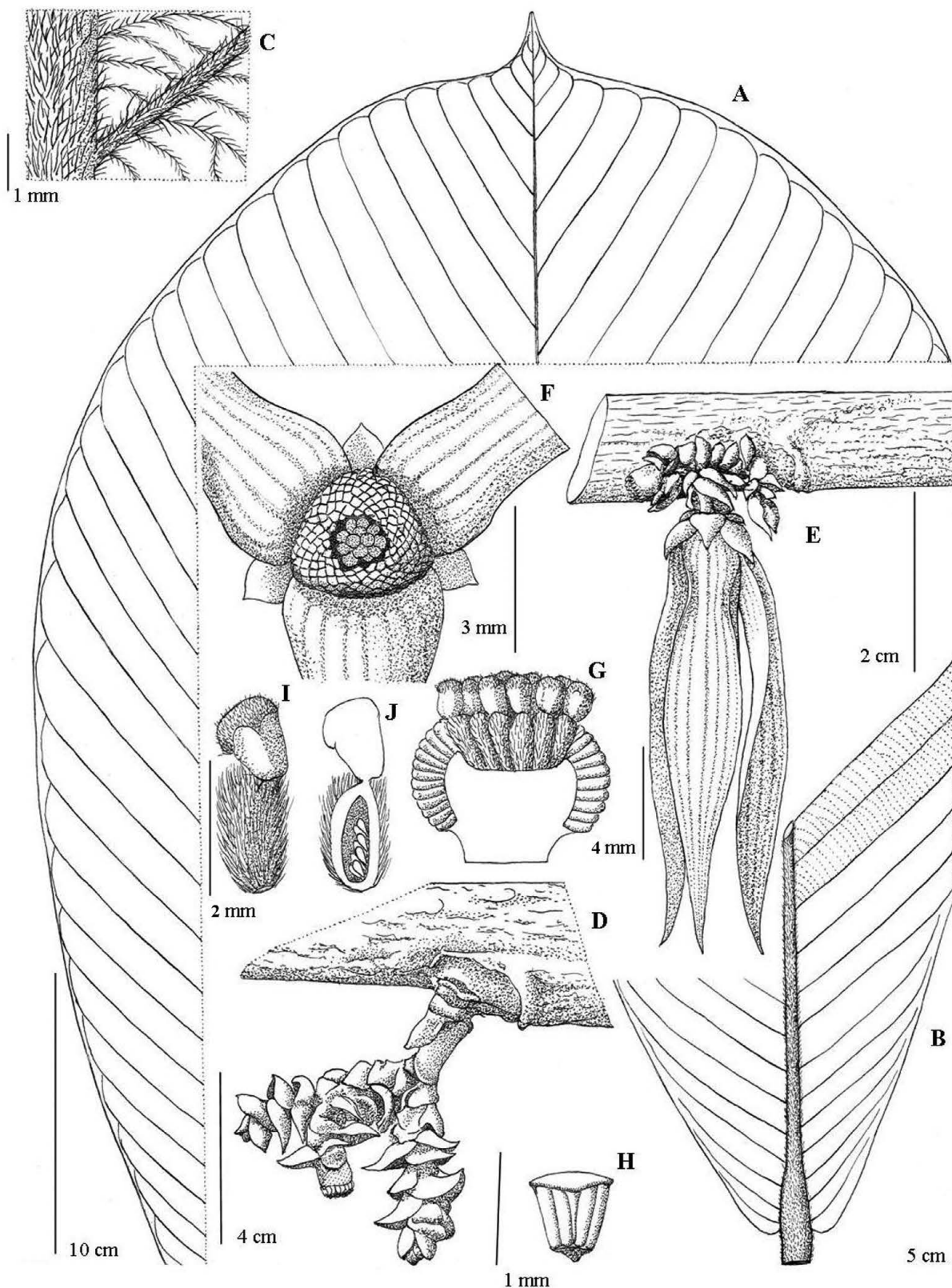


Figure 9 – *Piptostigma calophyllum*: A–B, leaf (apical portion and basal portion); C, pubescence (lower portion of leaf); D, inflorescence; E–F, flower (outer and upper views); G, receptacle (longitudinal section); H, stamen; I–J, carpel (outer side and longitudinal section). A–J from Hallé, N. 2263. Drawn by H. Lamourdedieu. © Publications Scientifiques du Muséum national d'Histoire naturelle, Paris; modified from Le Thomas (1969: 115, pl. 19).

pressed towards the margin of the leaf, base acute to obtuse and narrowly cordate or more rarely broadly cordate, apex mucronate to emarginate-mucronate, acumen 7–8 mm long; midrib tomentose on both sides, hairs c. 1 mm long, erect or appressed, golden brown; secondary veins (30–)40–63 pairs, sparsely pubescent on the upper side at the base of the leaf, hairs c. 0.8 mm long, erect, tomentose on the lower side, hairs c. 1 mm long, appressed. **Inflorescences** cauliflorous, 2–2.5 cm long, 1.5–3 cm wide, composed of 3–6 rhipidia, peduncle-like base 5–9 mm long, 3–5 mm in diameter, axial internodes 2–4 mm long, compact, rhipidia 2–4 flowered, sympodial rachis 10–15 mm long, with flower internodes less than 1 mm long; lower and upper bracts identical, c. 7 mm long, c. 7 mm wide, length:width ratio 1, very broadly ovate, glabrous inside, tomentose outside, hairs c. 0.5 mm long, appressed, brown, caduceus, base rounded, apex acuminate. **Pedicele**: in flower c. 6 mm long, c. 3 mm in diameter, tomentose, hairs c. 0.5 mm long, appressed, light brown; in fruit 8.5–11 mm long, 3–4 mm in diameter, tomentose, hairs c. 0.5 mm long, appressed. **Sepals** 4–5 mm long, c. 4 mm wide, length:width ratio 1–1.25, very broadly ovate, glabrous inside, tomentose outside, hairs c. 0.5 mm, appressed, hollow and cambered at the base. **Outer petals** 5–7 mm long, 3–4 mm wide, length:width ratio 1.5, ovate, concave, glabrous inside, tomentose outside, hairs c. 0.5 mm long, appressed, base lobate, apex obtusely acuminate. **Inner petals** 50–60 mm long, 6–8 mm wide, length:width ratio 7.5–8.3, narrowly ovate, twisted or not, pubescent inside, hairs c. 1 mm long, appressed in all directions, basal portion in contact with the receptacle glabrous, reddish, pubescent outside, hairs c. 0.5 mm long, appressed, brown. **Receptacle** c. 3 mm long, 3 mm wide, spherical. **Stamens** numerous, c. 0.7 mm long, sessile, molar-shaped, glabrous. **Carpels** 8–10, c. 3 mm long, c. 0.8 mm in diameter, narrowly oblong, densely pubescent outside, hairs 0.5–1 mm long, appressed, golden brown, sessile; ovules biseriate, c. 6–10; stigma c. 0.8 mm in diameter, sessile, 8-lobed, densely pubescent. **Fruit**: mono-carps 2–5, 1.2–3.5 cm long, 1–2.8 cm in diameter, broadly obovoid, smooth or punctulate, tomentose brown, hairs c. 0.2 mm long, erect. Seeds not seen. Figs 8L & 9.

Distribution – *Piptostigma calophyllum* is present in Cameroon and Gabon (fig. 10).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – Species of Biafrean and littoral forests, lowland primary or secondary rain forests. Altitude 0–450 m a.s.l.

Preliminary IUCN conservation status – Vulnerable [VU]. The extent of occurrence (EOO) of *Piptostigma calophyllum* is estimated to be 121,892 km² (far exceeding the 20,000 km² upper limit for Vulnerable status under the criterion B1), whereas its area of occupancy (AOO) is estimated to be 28 km² (which falls within the limits for Endangered status under the criterion B2). Nevertheless, the species, previously recorded from two countries, is known from seven different locations according to the IUCN (less than 10 locations, the upper limit under the subcriterion a- of criterion B2 for the Vulnerable status). Interestingly, this species has recently been (2016) recollected around Edea (north of the town) in a

secondary forest where it was quite abundant (Ghogue 3000 and 3001). Besides those collections, it has only been recollected once (Wieringa 6104) since the early 1970s. Field studies in Cameroon, as well as in Gabon, have documented *Piptostigma calophyllum* from unprotected sites that appear to be under human pressure. These sites are subject to selective logging for timber exploitation. Small-scale activities such as shifting agriculture and collecting firewood also alter gradually the sites where the species occurs. We thus project that the ongoing loss of its habitat will induce a continuous decline in the number of mature individuals in the near future. *Piptostigma calophyllum* is quite frequent and occurs in secondary forests, thus, a continuous decline of its EOO and AOO is not predicted. The first two conditions a and b for the criterion B2 are however filled, *Piptostigma calophyllum* is therefore assigned a preliminary status of VU B2ab(iii,v).

Additional specimens studied – **Cameroon**: Bassin du Mungo, Jun. 1917, Fleury, J.F. 33400 (P); Edea, 15 Jan. 2016, Ghogue, J.P. 3000 (WAG, YA); Edea, 15 Jan. 2016, Ghogue, J.P. 3001 (WAG, YA); Edea, s.d., Letouzey, R. s.n. (B, HBG, L, YA); Route Douala-Edéa, près du km 28, 18 Jan. 1962, Letouzey, R. 4011 (P, YA); Akak, 10 Km à W de Sangmélina, 11 Mar. 1970, Letouzey, R. 10157 (P, YA); Piste Meyo Ntem-Evouzok, 75 Km W du 1er et 3e bras du Ntem, 28 Nov. 1972, Letouzey, R. 15272 (P).

Gabon: Abanga, chantier CEFA (Compagnie Exploitation Forestière Africaine), 5 Jun. 1963, Hallé, N. 2263 (P); région de Lastoursville, Koulamotou, 17 Apr. 1931, Le Testu, G.M.P.C. 8751 (P); c. 30 km ENE of Lastoursville, 7 km on a logging road from Bambié forestry camp heading North., 23 Jan. 2008, Wieringa, J.J. 6104 (LBV, WAG).

Phenology – In flower from March to June, and in fruit from November to March.

Notes – *Piptostigma calophyllum* is easily distinguished from other species by its large obovate leaf laminas (longer than 30 cm), rounded cordate leaf lamina base (but see below), tomentose petioles and young branches as well as compact inflorescences, and tomentose smooth monocarps. *P. calophyllum* can be confused with *P. submontanum* because of their common tomentose branches and petioles, but *P. submontanum* is characterized by decurrent to cuneate leaf

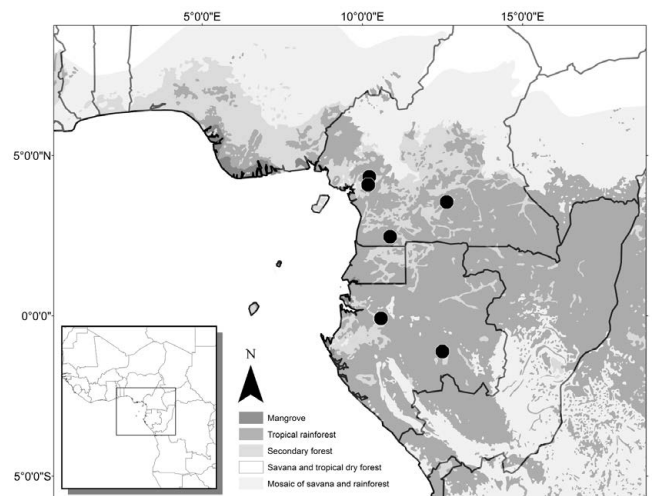


Figure 10 – Distribution of *Piptostigma calophyllum*.

lamina base, muricate glabrous monocarp ornaments and occurs in submontane areas (above 900 m a.s.l.).

Until now, *Letouzey*, R. 10157 (P) is the only fruiting specimen of *P. calophyllum*. Unfortunately, we were not able to properly observe the seeds.

There remains some confusion around the exact identity of the specimens *Letouzey*, R. s.n. [YA0002411, YA0002412, P02032164] & *Letouzey*, R. 4011 [YA0002847] both collected around the Douala-Edéa Reserve in Cameroon. Although bearing a strong resemblance to *P. calophyllum* (large leaves, tomentose branches, lowland rain forest), the leaf base is very different being broadly cordate instead of acute to obtuse. Unfortunately, this material lacks flowers and fruits, making proper identification difficult. We have nevertheless decided to keep these specimens under the name *P. calophyllum*.

2. *Piptostigma fugax* A.Chev. ex Hutch. & Dalziel (Hutchinson & Dalziel 1927b: 52) – Type: Côte d'Ivoire, Bas-Sassandra, Cavally basin, Lepos' country: Grabo and surrounding village, at the foot of Mount Copé, 26–28 Jun. 1907, *Chevalier*, A.J.B. 19620 [lecto-: P (P00363296), designated here; isolecto-: P (P00363297)].

Tree or shrub, 0.5–10 m high, dbh 6–7 cm in diameter. Young branches densely pubescent, hairs brown, 0.2–1.5 mm long, appressed, older branches glabrescent. Leaves: petiole 2–4 mm long, 1–1.5 mm in diameter, densely pubescent; lamina 7–24 cm long, 3–6.5 cm wide, length:width ratio 2.8–3.8, obovate to narrowly obovate, upper side glabrous, lower side pubescent on younger leaves, hairs 0.5–0.8 mm long, appressed, older ones glabrous to glabrescent, grey, base acute to obtuse, apex acuminate to acute, acumen 3–7 mm long; midrib puberulent on the upper side, densely pubescent on the lower side, hairs brown c. 0.8 mm long, appressed; secondary veins (15–)18–23 pairs, glabrous on the upper side, densely pubescent on the lower side at least for younger leaves, hairs 0.8–1.5 mm long, appressed, brown. Inflorescences on old branches or sometimes cauliflorous, overall 0.6–1.6 cm long, composed of 1 rhipidium, peduncle-like base not apparent, axial internodes absent, but rhipidium compact in aspect, rhipidium 1-flowered, sympodial rachis 0.5–2 cm long, with flower internodes 1–5 mm long; upper bracts c. 4 mm from the base of the pedicel, similar to the lower bracts at the upper part of the rhipidium, c. 2.5 mm long, 1 mm wide, length:width ratio 2.5, ovate, glabrous inside except along the margins, densely pubescent outside, hairs appressed, borders slightly rolled toward the top, lower bracts caducous. Pedicel: in flower 4–6 mm long, c. 1.5 mm diameter, densely pubescent, hairs appressed; in fruit 11–13 mm long, c. 2.5 mm diameter at the base, tomentose, hairs c. 0.5 mm long, appressed. Sepals c. 5 mm long, c. 2 mm wide, length:width ratio 2.6, narrowly ovate, glabrous inside, 7-veined, pubescent outside, hairs c. 0.5 mm long, appressed towards the top, 7-veined, veins parallel, salient, base thick, second half slender, curved, reduced to 0.8 mm wide. Outer petals c. 11 mm long, 1.5 mm wide, length:width ratio 7.3, narrowly ovate, glabrous inside, pubescent outside, hairs c. 0.5 mm long, appressed towards the top. Inner petals 20–40 mm long, 4–10 mm wide, length:width ratio 3–4, narrowly ovate, inner side glabrous below, shortly pubescent

above, hairs c. 0.2 mm long, erect or rolled, cambered near the middle, outer side pubescent, hairs c. 0.5 mm long, appressed towards the top, base thick, margins folded outwards, upper portion slender, folded or curved towards the apex, reduced to 1 mm wide. Receptacle 3–4 mm long, 4–5 mm wide, transversely broadly ellipsoid, depressed at the apex. Stamens numerous, c. 1.1 mm long, c. 1 mm wide, drum-like shape, filament 0.1 mm long. Carpels 1–3(–4), c. 2 mm long, 1 mm in diameter, oblong, outer side tomentose, hairs appressed towards the top; ovules uniseriate, 3–5; stigma 1 mm long, 1 mm wide, spherical, compacted, shortly pubescent, hairs erected, cavity largely hollow. Fruit: monocarp 1(–3), c. 4.5 cm long, 2 cm wide, ovoid or ellipsoid, cuspidate, pustulate, shortly tomentose, hairs 0.1–0.2 mm, exocarp thin, smooth, endocarp fleshy. Seeds c. 5, c. 13 mm long, 5 mm wide, ellipsoid to narrowly ellipsoid. Figs 6A–B & 8H.

Distribution – *Piptostigma fugax* occurs mainly in West Africa. It is found in Liberia, Côte d'Ivoire, Ghana and Cameroon (fig. 11).

Chorology – Element of the Upper and Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – *Piptostigma fugax* occurs in the understorey of primary and secondary rain forests on granitic and clay soils. It can also be found along the roadside in forest patches or among cultivations. Altitude 100–700(–1 300) m a.s.l.

Preliminary IUCN conservation status – Least Concern [LC]. *Piptostigma fugax* was previously assessed under IUCN criteria 2.3 in 1998 (Olfield et al. 1998) as VU. *Piptostigma fugax* is largely distributed in West Africa with a disjunct population in Cameroon. Its EOO is 543,647 km² (exceeding the 20,000 km² upper limit for Vulnerable status under the criterion B1). The species is known from 17 “locations” (*sensu* IUCN 2012), exceeding the upper limit for Vulnerable status. The species has been collected recently in both West (e.g. *Scoupe*, M. 113) and Central Africa (*Couvreur*, T.L.P. 672) and has been found in several national parks (National park of Taï, Ivory Coast and National Park of Campo Ma'an, Cameroon). *Piptostigma fugax* is quite fre-

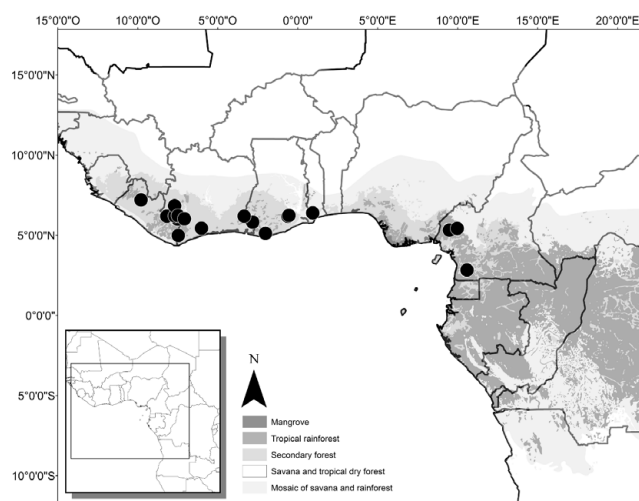


Figure 11 – Distribution of *Piptostigma fugax*.

quent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since the conditions for applying subcriteria a under criterion B1 and B2 are not met, and considering its frequency in its large area of distribution, the species is thus assigned a preliminary status of LC.

Additional specimens studied – **Liberia:** 10 miles NW of Zwedru, 21 Jul. 1970, *Jansen, J.W.A.* 2079 (MO, WAG); Peahtah, 8 Oct. 1926, *Linder, D.H.* 962 (K).

Ivory Coast: entre le moyen Sassandra et le moyen Cavally abords des cultures, Jun. 1907, *Chevalier, A.J.B.* 19193 (P); F.C. de Goin-Débé, sud bord de piste, sud Goin-Débé, 15 Feb. 1994, *Kouamé, F.N.* 1131 (G); forêt de Boléko, Sep. 1955, *Nozeran, R.* s.n. (P); F.C. Scio, Pinhou, Lobykro à 5 km, Bloc 31 parcelle 151 de la Sodefor, 28 Aug. 2001, *Nusbaumer, L.P.G.A.* 642 (G); F.C. Scio, Pinhou, Lobykro à 5 km, Bloc 31 parcelle 151 de la Sodefor, 1 Sep. 2001, *Nusbaumer, L.P.G.A.* 673 (G); between Guiglo and Taï, Aug. 1954, *Schnell, R.A.A.* 6025 (K); P.N. de Tai, zone Est, Secteur V6, groupe de transect VB, RL1, 25 Nov. 2009, *Scoupe, M.* 113 (G); Songan, secteur de Bettie, 19 Oct. 1998, *Téré, H.G.* 2835 (G);

Ghana: Meumuni Camp, Jun. 1952, *Andoh, J.E.* 5666 (K, WAG); Western Region, Tarkwa, Neung Forest Reserve, 8 Jun. 1972, *Enti, A.A.* 736 (MO); Atewa Range F.R., 10 May 1967, *Enti, A.A.* GC 36374 (K); at Kibi, at intersection of Accra-Kumasi Road and dirt road to Apapam (across from Ghana Police Station, Kibi Headquarters), 6 km to Apapam, turn right, 8 Jul. 1995, *Harder, D.K.* 3394 (MO); Attwa Range Forest reserve, 3 Aug. 1948, *Unknown* 328 (MO); Atewa Range Forest Reserve, about 2 km S of the town of Asiakwa, on logging road travelling westwards, over the main ridge, 6.13.57 N 0.33.10 W, 15 Nov. 1995, *Schmidt, H.H.* 1707 (MO).

Cameroon: Ekundu Kundu to Erat, c. 2.5 Km., 28 Apr. 1996, *Cheek, M.R.* 8198 (YA); Campo Ma'an National Park, Nyabessan, on trail 11 km north of Ebianemeyong village (7 km from Nyabessan to Campo road), 11 Feb. 2015, *Couvreur, T.L.P.* 672 (P, WAG, YA); Campo Ma'an National Park, Nyabessan, on trail 11 km north of Ebianemeyong village (7 km from Nyabessan to Campo road), 12 Feb. 2015, *Couvreur, T.L.P.* 681 (P, WAG, YA); Ntali, 30 Nov. 2000, *Etuge, M.* 4853 (YA).

Phenology – This species produces flowers between April and October and fruits from July to February.

Notes – *Piptostigma fugax* resembles *P. oyemense* in having a single rhipidium with a single remaining flower with 1–3(–4) carpels, a unique combination of characters in *Piptostigma*. It can however be distinguished from *P. oyemense* by the fact that its leaf laminas are obovate while those of *P. oyemense* are elliptic.

Two specimens (*Chevalier* 19620 and 19193) were cited in the publication of *Chevalier* (1920). Here we designate specimen 19620 as the lectotype because this specimen is deposited in two duplicates in Paris and because it is also already present on JSTOR as the type.

3. *Piptostigma glabrescens* Oliv. (Oliver 1865: 159). – Type: Equatorial Guinea, Rio Muni, Kongui River, Aug.–Sep. 1862, *Mann, G.* 1792 [holo-: B (B100154078); iso-: K (K000199000, K000199706) web, P (P00363305)].

Piptostigma preussii Engl. & Diels (Engler & Diels 1901: 54). – Type: Cameroon, South-West Region, Barombi-Station, Apr. 1890, *Preuss, C.G.T.* 251 [holo-: B (B100154082); iso-: K (K000105585) web].

Piptostigma glabrescens var. *lanceolatum* Le Thomas (Le Thomas 1969: 120, as “var. *lanceolata*”), **synon. nov.** – Type: Gabon, Ogooué-Ivindo Region, Bélinga, mines de fer, 12 Aug. 1966, *Hallé, N.* 4087 [holo-: P (P00363300); iso-: P (P00323698, P00363299)].

Tree 8–10 m tall, 12–15 cm dbh, trunk straight. **Young branches** pubescent, hairs c. 0.2 mm long, erect, brown, older branches glabrous, striate longitudinally. **Leaves:** petiole 2–3 mm long, 1–1.5 mm in diameter, pubescent, hairs c. 1 mm long, appressed; leaf lamina 12–30 cm long, 4–8.5 cm wide, length:width ratio 2–3.5, obovate to very narrowly obovate, upper side glabrous, lower side pubescent, hairs 0.5–1 mm long, mostly appressed towards the margin, white, base acute to obtuse, apex acuminate, acumen 14–17 mm long; midrib glabrous on the upper side, pubescent on the lower side, hairs c. 1.2 mm long, appressed, brown; secondary veins 19–27 pairs, glabrous on the upper side, pubescent on the lower side, hairs c. 1 mm long, appressed towards the leaf's margin, not always persistent. **Inflorescences** cauliflorous on the whole length of the trunk, up to 55 cm long overall, composed of 10–28 rhipidia, peduncle-like base 5–20 mm long, 4–8 mm in diameter, axial internodes 1–15 cm long, lax to panicle-like, rhipidia 3–5 flowered, sympodial rachis 2–7 cm long, with internodes 2–5 mm long; upper bract 3–4 mm from the basis of the pedicel, 2–5 mm long, 1–1.5 mm wide, length:width ratio 2–3, ovate to narrowly ovate, glabrous inside, tomentose outside, hairs 0.5–0.8 mm, appressed, brown; lower bract 4–5 mm long, 2.5–3 mm wide, length:width ratio 1.6, narrowly ovate, glabrous inside, tomentose outside, hairs c. 0.4 mm long, appressed, brown. **Pedicel:** in flowers 11–13 mm long, c. 1.5 mm diameter, tomentose, hairs c. 0.8 mm long, appressed, light brown; in fruit 1.6–2 cm long, 0.6 cm wide, densely pubescent, hairs c. 0.5 mm long, appressed, brown. **Sepals** c. 4 mm long, c. 2 mm wide, length:width ratio 2, triangular, glabrous inside, tomentose outside, hairs c. 0.7 mm long, appressed. **Outer petals** 5–6 mm long, c. 2 mm wide, length:width ratio 2–3, ovate to narrowly ovate, glabrous inside, tomentose outside, hairs c. 0.8 mm long, appressed, longitudinally ridged (one central ridge). **Inner petals** 30–50 mm long, 5–10 mm wide, length:width ratio 4.5–6, narrowly to very narrowly ovate, sparsely and shortly pubescent inside, hairs c. 0.8 mm long, appressed, light golden, pubescent outside, hairs c. 1 mm long on its lower part to 0.2 mm long on its upper part, appressed, brown, 5-ridged on its lower part. **Receptacle** c. 4 mm long, c. 4 mm wide, spherical. **Stamens** numerous, c. 1 mm long, tooth-shape, filament c. 0.2 mm long, c. 0.5 mm wide, medium pollinic lobes in front, the two marginal ones behind. **Carpels** 5–8, c. 1.1 mm long, c. 0.8 mm in diameter, broadly oblong, tomentose, hairs 0.5 mm long, appressed, brown; ovules 8, uniseriate; stigma 5-lobed, c. 0.5 mm diameter, pubescent. **Fruit:** monocarpis up to 8, 2–6.5 long, 0.9–2.1 cm wide, length:width ratio 2.2–3, oblong to narrowly oblong, 1–2 times transversally ribbed or not, bumpy, pustulate, longitudinally ridged, glabrous or finely pubescent, hairs greyish to brown, base acute or obtuse, apex acuminate or not (acumen c. 0.6 cm). Figs 8K & 12I–L.

Distribution – *Piptostigma glabrescens* is present in Cameroon, Equatorial Guinea, Gabon and the Republic of Congo (fig. 13).

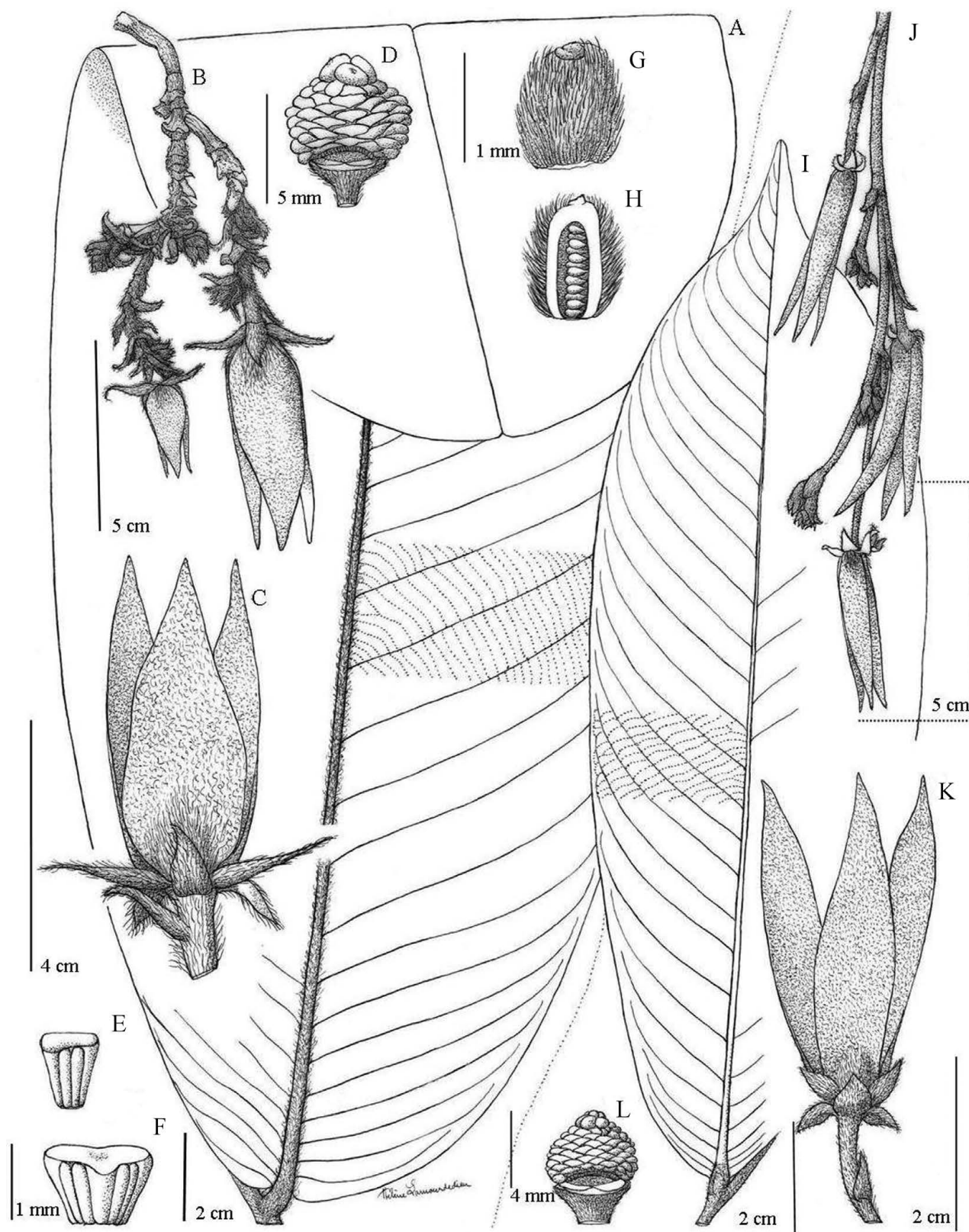


Figure 12 – *Piptostigma pilosum*: A, leaf; B, inflorescence; C, flower; D, receptacle; E–F, stamens; G–H, carpel (outer side and longitudinal section). A–H from *Le Testu, G.M.P.C.* 8465. *Piptostigma glabrescens*: I, leaf; J, inflorescence; K, flower; L, receptacle. I–L from *Letouzey* 4167. Drawn by H. Lamourdedieu. © Publications Scientifiques du Muséum national d’Histoire naturelle, Paris; modified from Le Thomas (1969: 119, pl. 20).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The plant occurs in forests and fields on black volcanic soils. Altitude 200–1 000 m a.s.l.

Preliminary IUCN conservation status – Least Concern [LC] – *Piptostigma glabrescens* is largely distributed in Central Africa where it has been collected in four different countries. Its Extent of Occurrence (EOO) is more than 264,407 km² (exceeding the 20,000 km² upper limit for Vulnerable status under the criterion B1). The species is known from 17 “locations” (*sensu* IUCN 2012), exceeding the upper limit for Vulnerable status. *Piptostigma glabrescens* is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since the conditions for applying subcriteria a under criterion B1 and B2 are not met, and considering its large area of distribution, the species is thus assigned a preliminary status of LC.

Additional specimens studied – **Cameroon**: nouvelle route Edéa-Douala, NO Edéa, 9 Apr. 1984, *Achoundong, G.* 980 (YA); 20 km from Kribi, Lolodorf road, 16 Jun. 1969, *Bos, J.J.* 4793 (K, WAG, YA); SE slopes of Elephant Mt., SE of Kribi, 26 Feb. 1970, *Bos, J.J.* 6415 (K, MO, P, WAG, YA); 20 km from Kribi, about 3 km N. of Lolodorf road, 18 Mar. 1970, *Bos, J.J.* 6594 (B, MO, P, WAG, YA); Douala, route RAZEL, s.d., *Endengle, E.* s.n. (P, YA); Ebo Forest Reserve, 2 May 2016, *Kamdem, G.N.* 428 (YA); Ebo Forest Reserve, 4 May 2016, *Kamdem, G.N.* 436 (YA); Bella, 45 km NE Kribi, 25 Jan. 1962, *Letouzey, R.* 4167 (P, YA); Hikoa Mahouda (chaîne de l’Hikoa Mandeng - 30 km ENE Edéa), 17 Dec. 1973, *Letouzey, R.* 12415 (P, YA); pente septentrionale du Nta Ali (1266 m), descente de la côte 1009 à MBIO, 30 km SE Mamfe, 21 Jun. 1975, *Letouzey, R.* 13912 (P); Tissongo, Strip B, 1 Jul. 1976, *McKey, D.B.* 98 (K); Tissongo, Strip A, 7 Jul. 1976, *McKey, D.B.* 103 (K); Nkoemvone, station de cacao, 14 km on the road from Ebolowa to Ambam, 9 Sep. 1975, *Wilde, J.J.F.E.* de 8453 (K, P, WAG); Bipindi, s.d. (integrated in the collections Jan. 1914), *Zenker, G.A.* 505 (B, G, P, WAG); Bipindi, 1901, *Zenker, G.A.* 2396 (B, BR, G, K, L, P, WAG); Bipindi, 1908, *Zenker, G.A.* 3654 (B, BR, G, K, L); Bipindi, 1911, *Zenker, G.A.* 4006 (BR, G, K, U); Bipindi, 1912, *Zenker, G.A.* 4472 (B, BR, G, K, L, MO).

Gabon: Toucan, 12 Jun. 2002, *Bourobou, H.P.* 728 (LBV, P, WAG); Rabi, 24 Mar. 1990, *Breteler, F.J.* 9474 (P, WAG); Rabi, 1 Mar. 2007, *Choo, J.* 761 (MO); Rabi-Kounga, Rabi 51, 2007, *Choo, J.* 762

(MO); CFAD Rougier Ivindo, ouest du Parc National de l’Ivindo, zone tampon., 15 Mar. 2009, *Dauby, G.V.* 1697 (MO, WAG); Bélinda, 9 Nov. 1964, *Hallé, N.* 3086 (P); Bélinda, 1964, *Hallé, N.* 3377 (P).

Republic of Congo: Village de Moutséné Batéké, piste de Bouba, 20 Jan. 1965, *Bouquet, A.* 1035 (P).

Phenology – The plant produces flowers from December to April and fruits in June.

Notes – *Piptostigma glabrescens* is close to *P. multinervium*, but can be distinguished by its glabrous older branches, striate longitudinally while *P. multinervium*’s are shortly or sparsely pubescent, its lamina base acute to obtuse while *P. multinervium*’s is cuneate to obtuse, its monocarps oblong to narrowly oblong while *P. multinervium*’s are ellipsoid to broadly ellipsoid.

The distinction of *Piptostigma glabrescens* var. *lanceolatum* by Le Thomas (1969) was mostly based on the shape of sepals and inner petals, persistent on the fruits of two Gabonese specimens (*Hallé, N.* 3377 & 4087) (“lanceolate, longer and more tiny than on the type variety (of *P. glabrescens*)” without any other precision on the measurements). Our comment is that *P. glabrescens* has shown to be a very variable species, in the shape of the leaf laminas as well as that of the perianth’s parts. Although the leaves of *Hallé*’s specimens are quite large, they are obovate as any other *P. glabrescens*’ leaves. For the sepals and inner petals, the description “lanceolate, longer and more tiny” simply means narrowly to very narrowly ovate. The sepals of *P. glabrescens* are triangular and the inner petals narrowly to very narrowly ovate. Also, Le Thomas described the monocarps of *P. glabrescens* as follows: “cylindrical oblong, 4–4.5 cm long, 2–2.7 cm wide, slightly wrinkled and longitudinally corded, velvety and light-ochraceous”; and those of *P. glabrescens* var. *lanceolatum* as: “cylindrical bent, 4–6 cm long, 2.5 cm wide, verruculate-tuberculate and tomentous brown-ochraceous”. When we compare our observations on more than thirty specimens of *P. glabrescens* with the two descriptions of Le Thomas, we only conclude that the two above mentioned Gabonese specimens only bear more mature fruits. *Piptostigma glabrescens* var. *lanceolatum* therefore cannot be treated as a separate taxon.

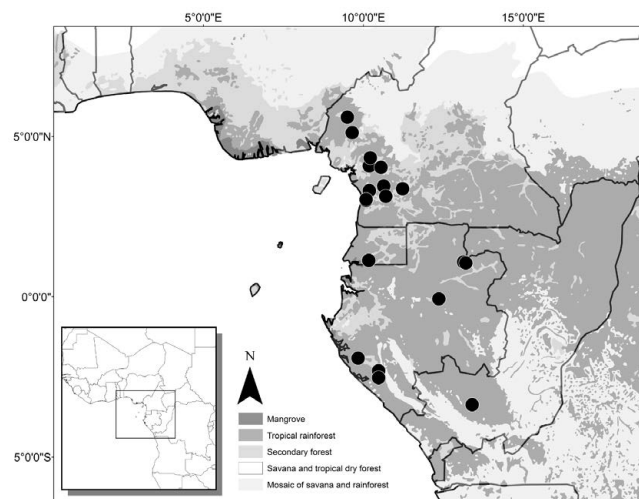


Figure 13 – Distribution of *Piptostigma glabrescens*.

4. *Piptostigma goslineanum* Ghogue, Sonké & Couvreur, sp. nov.

Type: Cameroon, Littoral Region, around Douala, Jun. 1917, *Fleury, J.F.* 33134 [holo-: P (P02032174); iso-: P (P02032172, P02032173, P02032175)].

Piptostigma longisetosa [sic] Engl., in sched. (*Fleury* 33134, P).

Tree 8–10(–30) m tall, 12–15 cm in dbh, presence of thick buttresses on mature individuals. **Young branches** pubescent, hairs 0.2–1 mm long, erect, brown, older branches glabrescent to glabrous. **Leaves**: petiole 2–4 mm long, 1–2 mm in diameter, pubescent, hairs c. 1 mm long, erect or appressed; leaf lamina 9.5–26 cm long, 3.5–10 cm wide, length:width ratio 2.7–3.3, very narrowly obovate to obovate, papery, upper side glabrous, lower side dotted or granulated, greyish, sparsely pubescent, hairs 0.5–1 mm long, erect or appressed in all directions, brownish, base acute

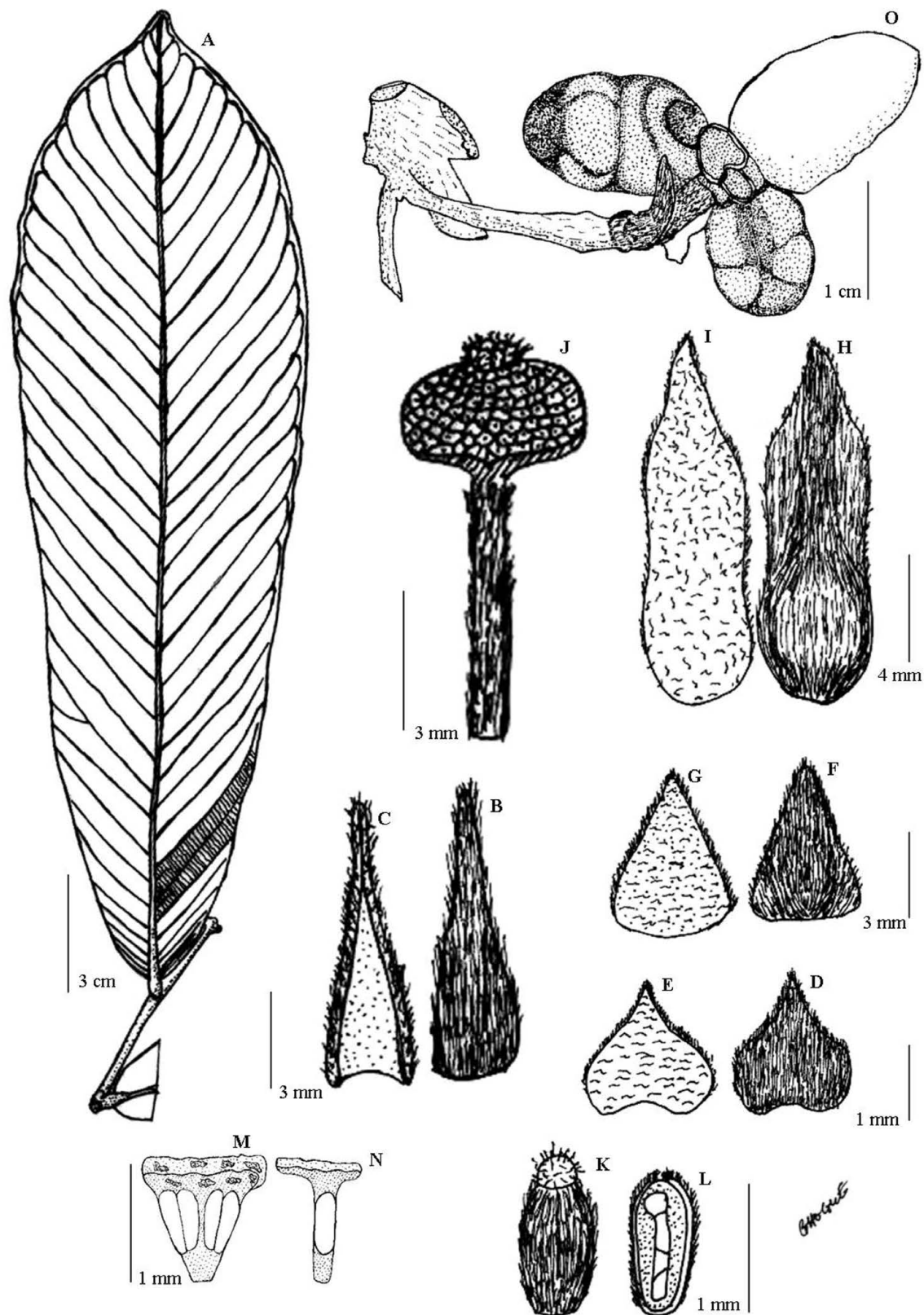


Figure 14 – *Piptostigma goslineanum*: A, leaf; B–C, bract (lower and upper sides); D–E, sepal (lower and upper sides); F–G, external petal (lower and upper sides); H–I, internal petal (lower and upper sides); J, receptacle; K–L, carpel (outer side and longitudinal section); M–N, stamen (front and transversal views); O, fruit. A–C, J–O from *Achoundong*, G. 1267; D–I from *Couvreux*, T.L.P. 1023. Drawn by J.-P. Ghogue.

to obtuse, apex acuminate, acumen 5–18 mm long; midrib glabrous on the upper side, pubescent to tomentose on the lower side, hairs c. 1.2 mm long, appressed, brownish; secondary veins 17–33 pairs, glabrous on the upper side, pubescent to tomentose on the lower side, hairs c. 1 mm long, appressed towards the margin of the leaf. **Inflorescence** cauliflorous and ramiflorous, 7.2–12 cm long over all, composed of 2–7 rhipidia, peduncle-like base 1.5–6.5 cm long, c. 1 cm in diameter, axial internodes 5–35 mm long, compact to lax, rhipidia 2–13 flowers in succession, sympodial rachis 6–38 mm long, internodes 2–10 mm long, compact to lax; upper bracts c. 2 mm from the basis of the pedicel, c. 3.5 mm long, c. 1.5 mm wide, length:width ratio 2.3, ovate to narrowly ovate, inner side glabrous, outer side tomentose, hairs 0.8–1.2 mm long, appressed, brown, lower bracts 7.5 mm long, 5 mm wide, length:width ratio 1.5, ovate, divided by a longitudinal median line on both sides, inner side glabrous, outer side tomentose, hairs 0.5–1 mm, appressed, sometime finely acuminate. **Pedicel**: in flower, c. 7 mm long, c. 2 mm diameter, pubescent, hairs c. 0.8 mm long, appressed, brown; in fruit, 1–1.5 cm long, 0.4 cm wide, tomentose, hairs c. 0.8 mm long, appressed; **Sepals** c. 12 mm long, c. 4 mm wide, length:width ratio 3, narrowly ovate, glabrous inside, tomentose outside, hairs c. 0.7 mm long, appressed. **Outer petals** c. 15 mm long, c. 4 mm wide, length:width ratio 3.75, narrowly ovate, glabrous inside, tomentose outside, hairs c. 0.8 mm long, appressed, longitudinally ridged (one central ridge). **Inner petals** 38–45 mm long, 10–12 mm wide, length:width ratio 3.75, narrowly ovate, up to 9-ridged outside. **Receptacle** c. 3 mm long, c. 3 mm wide, spherical. **Stamens** numerous, c. 1 mm long, c. 1 mm wide, tooth-shape, flattened to the top, filament c. 0.2 mm long, c. 0.3 mm wide, pollinic lobes at the same plane as the filament. **Carpels** 4, c. 1.5 mm long, c. 0.5 mm in diameter, narrowly oblong, tomentose, hairs 0.5 mm long, appressed, brown; ovules 8, uniseriate; stigma c. 0.5 mm diameter, pubescent. **Fruit**: monocarps 3–4, 2–3.5 cm long, 1–2 cm in diameter, length:width ratio 1.5–2.5, ovoid or ellipsoid, slightly lumpy when dry, smooth or punctulate, finely pubescent to glabrous, obtuse at the base, exocarp c. 2 mm thick, hard. **Seeds** 4–5, biseriate, c. 1 cm long, 0.6 cm large, ellipsoid, testa favulariate. Figs 8M & 14.

Distribution – *Piptostigma goslineanum* is endemic to Western Cameroon, from the Bamenda highlands to the lowland forests around Douala and Edea (fig. 15).

Habitat and ecology – *Piptostigma goslineanum* is found in the understorey of submontane and lowland rain forests. Altitude unknown.

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Etymology – The epithet *goslineanum* given to this species is an eponym in honour of the Tropical African botanist George Gosline (U.S.A.) who has worked mostly in Western Cameroon and the Democratic Republic of Congo.

Preliminary IUCN conservation status – Endangered [EN]. The extent of occurrence (EOO) of *Piptostigma goslineanum* is estimated to be over 17,807 km² (less than 20,000 km² upper limit for Vulnerable status under the cri-

terion B1) and its minimal area of occupancy (AOO) is estimated to be 32 km² (within the limits for the Endangered status under the criterion B2). *Piptostigma goslineanum* is endemic to Western Cameroon and has not been collected in a protected area. Among the sites where *P. goslineanum* has been collected, some are currently subject to a great deal of human pressure, especially from intensive exploitations in the Bamenda highlands and industrial agriculture in the lowlands. The species is known from twelve specimens representing a total of five “locations” (*sensu* IUCN 2012), within the limit for Endangered status. We project that the ongoing loss of its habitat will induce a strong continuous decline in the number of subpopulations and mature individuals as well as an important decline of its EOO and AOO. *Piptostigma goslineanum* is therefore assigned a preliminary status of EN B2ab(i,ii,iii,iv,v).

Additional specimens studied – **Cameroon**: Nta Ali, Sud-Est Mamfè, 17 jun. 1985, *Achoundong, G.* 1267 (YA); track above Kupe village towards summit, Kupe Village, 24 Jan. 1995, *Cable, S.* 787 (K); main trail, Kupe Village, 16 Nov. 1995, *Cheek, M.R.* 7849 (K); Kupea site, Kupe Village, 16 May 1996, *Cheek, M.R.* 8328 (K); just north of Bulutu on Ebonji-Ngusi road ascending ridge to east, Mungo River F.R., 30 Nov. 1999, *Cheek, M.R.* 10197 (K); Bayang Mbo Wildlife Sanctuary, before Mbu river, 27 Mar. 2016, *Couvreur, T.L.P.* 1023 (YA, WAG); Ezeze road, Nyasoso, between shrike and Max’s trail, following the river upwards, 25 Jun. 1996, *Etuge, M.* 2420 (K); main trail towards Mount Kupe, Kupe Village, 9 Jul. 1996, *Etuge, M.* 2698 (K); Lombé, Strip A, 8 Jul. 1976, *McKey, D.B.* 105 (K); Douala-Edea Reserve, Lombe camp, Nov. 1977, *Thomas, D.W.* 510 (BR, K, MO); Lombe Camp site, Douala-Edea Reserve, 30 May 1976, *Waterman, P.G.* 801 (K).

Phenology – The plant produces flowers in November and fruits from May to July.

Note – *Piptostigma goslineanum* closely resembles *P. glabrescens* by the shape and the size of their leaf laminas, but the inflorescences of *P. goslineanum* are generally shorter than 12 cm long with 2–7 rhipidia, while those of *P. glabrescens* can reach up to 55 cm long with 10–28 rhipidia. Also, the monocarps of *P. goslineanum* are smooth, glabrous and ovoid to ellipsoid in shape, while those of *P. glabrescens* are pusticulate, pubescent and oblong in shape.

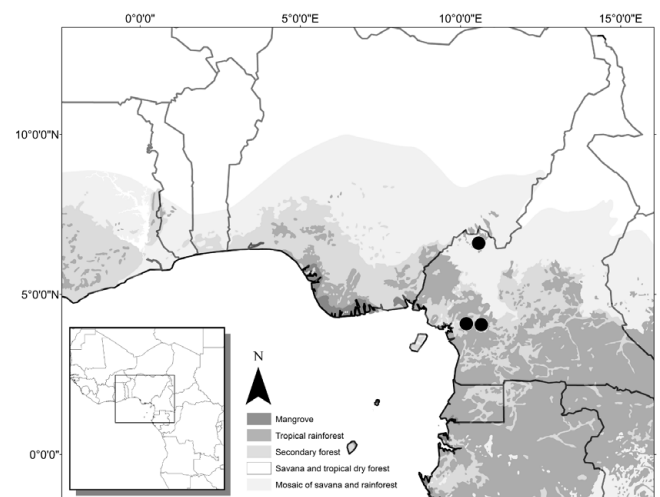


Figure 15 – Distribution of *Piptostigma goslineanum*.

5. *Piptostigma longepilosum* Engl. ex Engl. & Diels (Engler & Diels 1899: 297; 1901: 55) – Type: Cameroon, South Region, around Bipinde, 1896, *Zenker, G.A.* 1075 [holo-: B (B100154079); iso-: HBG (HBG502530) web, L (L0183458) web, M (M0107925) web, NY (NY00026195) web, P (P00363294, P00363295) web, S (S07–13478) web, WU (WU0025868) web].

Tree 4–16 m tall, dbh unknown, trunk canaliculated. **Young branches** hispid, hairs 4–5 mm long, yellow brown, older ones shortly pubescent to glabrescent, hairs c. 0.2 mm long, hispid. **Leaves**: petiole 4–7 mm long, 1.5–3 mm in diameter, pubescent, hairs 0.2–5 mm long, hispid; leaf lamina 7.7–24.3 cm long, 4–10.3 cm wide, length:width ratio 2–2.7, obovate to narrowly obovate, glabrous on both sides, base rounded to obtuse, apex attenuate to acuminate, acumen 3–10 mm; midrib densely pubescent on the upper side, hairs c. 1 mm long, appressed, pubescent on the lower side, hairs c. 2–5 mm long, the shortest appressed, the longest hispid; secondary veins 14–34 pairs, glabrous on the upper side, pubescent on the lower side, hairs 2–4 mm long, appressed or hispid. **Inflorescences** cauliflorous, 16–37 cm long, 10–20 cm wide, pubescent all over, especially on the younger parts, hairs 1–2 mm long, erected or appressed, 1–4 rhipidia, peduncle-like base 0.5–2 cm long, 0.4–0.5 cm in diameter, axial internodes 1.4–4 cm long, lax or sub-lax, rhipidia 2–15 flowers in succession, sympodial rachis 4.5–15 cm long, with flower internodes 1–2.5 cm long; lower and upper bracts similar on the upper portion of the rhipidia, 6–12 mm long, 4–6 mm wide, length:width ratio 1.5–2, ovate, glabrous inside, slightly reticulate, pubescent outside, hairs c. 1 mm long, appressed, base amplexicaul, apex acute. **Pedicel**: in flower 9–12 mm long, c. 2 mm in diameter, densely pubescent, hairs c. 1 mm long, erect; in fruits, c. 10–12 mm long, 4 mm in diameter, pubescent. **Sepals** c. 6 mm long, c. 4 mm wide, length:width ratio 1.5, ovate, folded externally at the base, glabrous inside, tomentose to pubescent outside, hairs 0.5–0.8 mm long, appressed. **Outer petals** 6–10 mm long, 3–4 mm wide, length:width ratio 2.1, elliptic, dorsoventrally twisted, glabrous inside, pubescent outside, hairs 0.8–1 mm long, appressed, brown. **Inner petals** 40–80 mm long, 10–15 mm wide, length:width ratio 4–8, narrowly elliptic, pubescent inside especially along the midrib to glabrous near the base, hairs c. 0.5 mm long, erect, pubescent to densely pubescent outside at the base, less so towards the apex, hairs c. 1 mm long, appressed, interspaced with longer hairs, c. 2 mm long, erect, white. **Receptacle** 4.5 mm long, 5 mm wide, transversely ellipsoid, depressed towards the apex. **Stamens** numerous, 2 mm long, 1.5 mm wide, drum-like shape, filament 0.5 mm long. **Carpels** 3–5, c. 1.5 mm long, c. 1 mm in diameter, oblong, tomentose outside, hairs c. 0.5 mm long, appressed; ovules 9–12, biseriate; stigma 1.5 mm long, 1 mm in diameter, ellipsoid, pubescent, hairs c. 0.5 mm long, erect. **Fruit**: monocarps 1–3, c. 1.5 cm long, 2 cm wide, narrowly ellipsoid, dorsi-ventrally bent, pusticulate, exocarp 2.1 mm thick, hard, outer side densely pubescent, hairs c. 0.5 mm long, erect; seeds 10–12, c. 10 mm long, c. 8 mm in diameter, broadly ellipsoid to cubical or oblong. Fig 8I.

Distribution – *Piptostigma longepilosum* is only known from Cameroon (fig. 16).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – *Piptostigma longepilosum* is found in the understorey of lowland primary rain forests. Altitude 0–120 m a.s.l.

Preliminary IUCN conservation status – Vulnerable [VU]. The extent of occurrence (EOO) of *Piptostigma longepilosum* is estimated to be over 11,981 km² (less than 20,000 km² upper limit for Vulnerable status under the criterion B1) and its minimal area of occupancy (AOO) is estimated to be 32 km² (within the limits for Endangered status under the criterion B2). *Piptostigma longepilosum* is endemic to Western Cameroon and has been collected in a protected area. Among the sites where *P. longepilosum* has been collected, some are currently subjected to a great deal of human pressure, especially from industrial agriculture in the lowland forest. The species is known from eight specimens representing eight “locations” (*sensu* IUCN 2012), within the limit for Vulnerable status. We project that the ongoing loss of its habitat will induce a strong continuous decline in the number of subpopulations and mature individuals as well as an important decline of its EOO and AOO. *Piptostigma longepilosum* is therefore assigned a preliminary status of VU B1ab(i,ii,iii,iv,v)+B2bc(i,ii,iii,iv,v).

Additional specimens studied – **Cameroon**: Boa/Mokoko, 31 May 1994, *Acworth, J.M.* 289 (MO); route de Bipindi à Dehani, 1918, *Annet, E.* 420 (P); about 45 km from Kribi, about 8 km N of Lolodorf road, 2 Apr. 1970, *Bos, J.J.* 6683 (K, MO, P, WAG, YA); Mokoko Forest Reserve, 2 May 1994, *Ekema, S.N.* 862 (MO, YA); Dikoume Balondo forest, 3 May 1994, *Sonké, B.* 1173 (BR, WAG); Korup National Park, 1987, *Thomas, D.W.* 6906 (YA); Mokoko forest reserve, 21 May 1994, *Watts, J.* 1104 (MO).

Phenology – The plant produces flowers from April to September and fruits in May.

Note – *Piptostigma longepilosum* is easily identified by its long hispid pubescence (hairs 4 mm long) on the young branches, petiole and midrib with its rounded to obtuse leaf lamina base. *Piptostigma mortehanii* also has a hispid pubescence, but its hairs are much shorter than in *P. longepilosum* (shorter than 4 mm) and the leaf lamina base is acute.

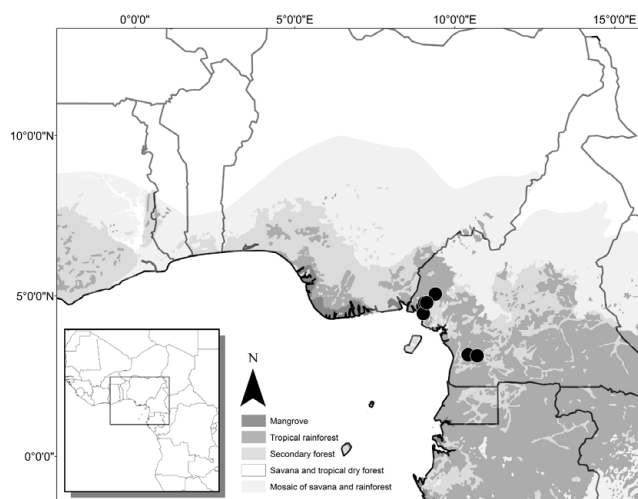


Figure 16 – Distribution of *Piptostigma longepilosum*.

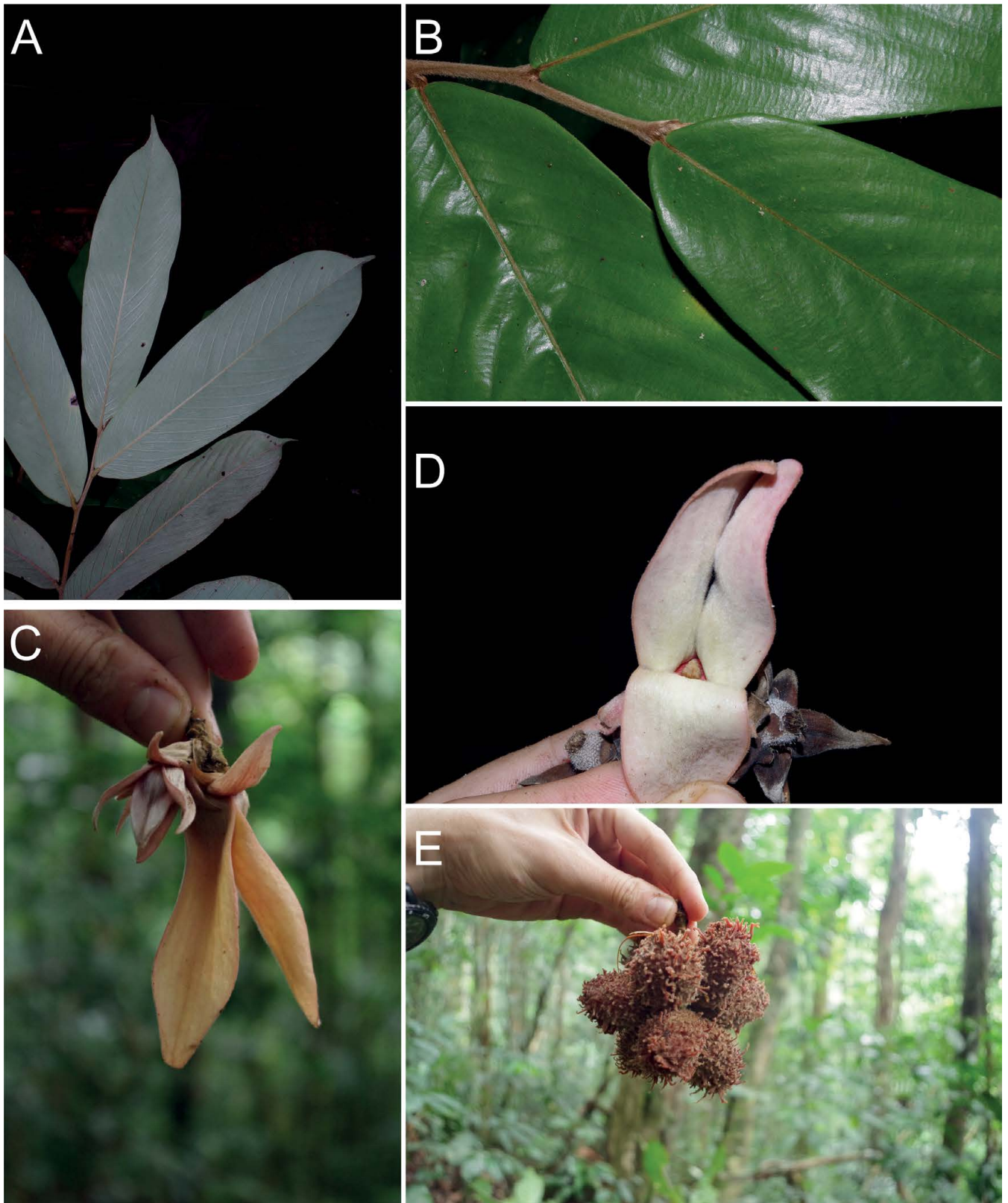


Figure 17 – *Piptostigma macranthum*: A, leaves, lower side; B, detail of upper side of leaves; C, inflorescence and a single open flower; D, detail of inner side of flower; E, fruits. From Couvreur, *T.L.P.* 1125. Photographs: T.L.P. Couvreur.

6. *Piptostigma macranthum* Mildbr. & Diels (Diels 1915: 442). – Type: Cameroon, South Region, Mimfia (Bipindi), 1902, *Zenker, G.A.* 2528 [holo-: B (B100154080); iso-: BR (BR0000013174743), G (G00442261), K (K000199001) web, P (P00363282) web, (P00363283), S (S07-13471) web].

Piptostigma mayumbense Exell (Exell 1926: 10), **synon. nov.** – Type: Angola, M'bullu mountains, Mayumbe, alt. 500 m, 15 Feb. 1919, *Gossweiler, J.* 7807 [holo-: B (B100460898)].

Tree 6–18 m high, 15–21 cm in dbh, stem straight. **Young branches** pubescent, hairs 0.2–0.5 mm, erect or slightly appressed, older branches glabrous. **Leaves:** petiole 2–3 mm long, 2–3 mm in diameter, pubescent, hairs 0.2–0.5 mm long, the shorter ones erect, the longer appressed; leaf lamina 14–31 cm long, 7–9 cm wide, length:width ratio 2.3–3.4, narrowly oblong to oblong or more rarely narrowly ovate, upper side glabrous, lower side pubescent, hairs, c. 1.5 mm long, appressed towards the margin of the leaf, caducous, base rounded and cordate, apex attenuate or acuminate to mucronate, acumen c. 5 mm long; midrib pubescent on the upper side, densely pubescent on the lower side, hairs 0.8–1.5 mm long, appressed; secondary veins 16–30 pairs, glabrous on the upper side, pubescent on the lower side, hairs c. 1.5 mm long, appressed. **Inflorescences** cauliflorous, 10–14.5 cm in overall length, composed of 2–4 rhipidia, pubescent overall, hairs 0.5–0.8 mm long, erect or appressed, peduncle-like base 0.6–2.5 cm long, c. 5–8 mm in diameter, rhipidia with 2–4 flowers in succession, sympodial rachis 1–7 cm long, internodes 0.5–0.8(–1.5) cm long, compact to sub-lax; lower and upper bracts similar on the upper portion of the rhipidia, c. 10 mm long, 10 mm wide, length:width ratio 1, broadly ovate, hoof-like, inner side glabrous, outer side tomentose, hairs c. 1 mm long, appressed, base amplexicaul. **Pedicels:** in flower up to 5–9(–20) mm long, 3–5 mm in diameter, tomentose, hairs c. 0.5 mm long, erect; in fruit 2–2.5 cm long, c. 6 mm in diameter, pubescent, hairs 0.2–0.5 mm long, erect, brown. **Sepals** c. 9 mm long, c. 8 mm wide, length:width ratio 1.12, broadly triangular, folded along the margins, glabrous inside, tomentose outside, hairs 0.8–1 mm, appressed, slightly veined longitudinally at the base. **Outer petals** 12–28 mm long, 9–11 mm wide, length:width ratio 1.3–2.6, broadly to narrowly triangular, slightly veined longitudinally at the base, glabrous inside, tomentose outside, hairs 0.8–1 mm long, appressed, base truncate, apex acute. **Inner petals** 40–55 mm long, 10–20 mm wide, length:width ratio 2.75–4, elliptic to narrowly elliptic, densely pubescent inside except in the lower part appressed against the receptacle, hairs c. 0.4 mm long, erect, tomentose outside, hairs c. 1 mm long, appressed, humpy at the base. **Receptacle** 9 mm long, 10 mm wide, transversely ellipsoid. **Stamens** numerous, 2 mm long, 0.8 mm wide, drum-like shape, filament 0.8 mm long. **Carpels** 9–12, sessile, c. 2 mm long, c. 1 mm in diameter, ellipsoid-oblong, bending, tomentose outside, hairs c. 0.5 mm long, appressed; ovules c. 8, biseriate; stigma sessile, compacted in a unique mass, bulky, pubescent. **Fruit:** monocarps 3–6, 3–4 cm long, 2.5–4 cm wide, broadly obovoid, aculeate, laces c. 10 mm long, 1 mm in diameter, exocarp c. 3 mm thick, woody, densely pubescent, hairs grey to golden brown, c. 1.2 cm long, appressed. **Seeds** c. 6, c. 10 mm long, c. 5 mm wide, ellipsoid, testa reticulate. Figs 8A & 17.

Distribution – *Piptostigma macranthum* occurs in Cameroon, Gabon, Republic of Congo and Angola (fig. 18).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The species is found in forest edges or in closed forests along rivers. Altitude 50–500 m a.s.l.

Preliminary IUCN conservation status – Least Concern [LC]. *Piptostigma macranthum* is quite frequent throughout much of its large range, and no particular threats that could result in an important decline of its EOO and AOO have been identified. Since we have no evidence of an immediate threat and considering its frequency in its large area of distribution, *Piptostigma macranthum* is assigned a preliminary status of LC.

Additional specimens studied – **Cameroon:** About 10 km from Kribi, Lolodorf road, 27 May 1969, *Bos, J.J.* 4647 (K, MO, P, WAG, YA); Akomimbang, Mbalmayo, 13 Nov. 1957, *Letouzey, R.* s.n. (P, YA); Nkolmebengue, 50 km NE Campo, 25 Nov. 1992, *Satabié, B.* 1037 (YA); c. 50 km South of Badjob, c. 60 km Southwest of Eséka, South bank of the Njong river, 19 Mar. 1964, *Wilde, W.J.J.O.* de 2132 (BR, P, WAG); Bipindi, May 1902, *Zenker, G.A.* s.n. (P).

Gabon: entre Kembélé et Pounga, 22 Jan. 2008, *Dauby, G.V.* 358 (BRLU); Cristal Monts, WCS transect, 13 Sep. 2009, *Nguema Ekomo, D.* 356 (MO); left bank of the Mbei River, downstream of the hydroelectric power station at Kinguéle, 25 Jan. 1983, *Wilde (WALK-B), J.J.F.E.* de 200 (K, MO, P, WAG).

Republic of Congo: on road to Dimonika village, right, 5 km after Mvouti on main road from Dolisie to Pointe Noire, 22 Sep. 2015, *Couvreux, T.L.P.* 805 (IEC, YA, WAG); Réserve de biosphère de Dimonika, 5 Feb. 2014, *Faye, A.* 52 (IEC, YA).

Phenology – The plant produces flowers from November to January.

Vernacular name – *Nom-owé* (Yaoundé, Cameroon).

Notes – *Piptostigma macranthum* is easily distinguished from other species of *Piptostigma* by its characteristic narrowly oblong to oblong leaf lamina shape, shiny upper side of leaf lamina, rounded and cordate leaf lamina base and thick compact inflorescences. In our phylogeny, *P. macranthum* appears as an early diverging species within the genus (fig. 1).

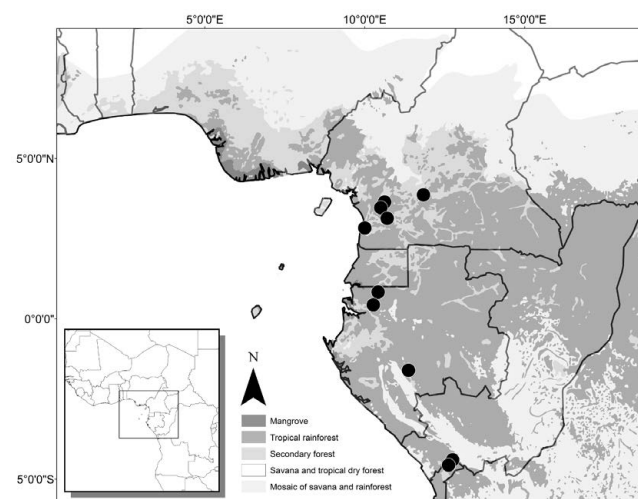


Figure 18 – Distribution of *Piptostigma macranthum*.

The type specimen of *P. mayumbense* (Gossweiler 7807, Mayombe mountain range) is sterile but the unique leaf that composes this collection is oblong with a rounded and cordate base leading us to synonymise this name with *P. macranthum*. The recent collections of *P. macranthum* in the Mayombe range (Couvreur 805 and Faye 52) in the Republic of Congo also comfort this decision.

7. *Piptostigma macrophyllum* Ghogue, Sonké & Couvreur, sp. nov.

Type: Cameroon, South-West region, above small Koto village (Mt. Cameroon), 6 Mar. 1985, Thomas, D.W. 4493 [holo-: YA (YA0002852); iso-: MO (MO3282523)].

Tree, 5–10 m tall, dbh unknown, trunk striate and lumpy, branches low and horizontal. **Young branches** pubescent, hairs c. 0.2 mm long, erect, brown. **Leaves**: petiole 6–7 mm long, 3–4 mm in diameter, pubescent, hairs c. 0.1 mm long, brown, erect or appressed; leaf lamina 25–41 cm long, 9–16 cm wide, length:width ratio 2–3, obovate to narrowly obovate, papery, upper side slightly pubescent, at least towards the midrib, c. 1.2 mm long, appressed, lower side glabrous, base acute to obtuse, apex acuminate, acumen 25 mm long; midrib glabrous on the upper side, sparsely pubescent on the lower side, hairs c. 1.5 mm long, appressed; secondary veins 21–28 pairs, glabrous on the upper side, pubescent to glabrescent on the lower side. **Inflorescence** cauliflorous and ramiflorous, c. 8 cm long overall, composed of 2–6 rhipidia, peduncle-like base 5–10 mm long, c. 4 mm in diameter, axial internodes 5–15 mm long, compact to sub-lax, rhipidia with 2–3 flowers in succession, sympodial rachis up to 7 cm long, internodes 2–10 mm long; upper bract c. 3 mm or less from the basis of the pedicel, identical to the lower bract, c. 12 mm long, 3 mm wide, length:width ratio 4, narrowly to very narrowly ovate, inner side glabrous, outer side tomentose, hairs c. 0.8 mm long, appressed, brown, finely acuminate, acumen c. 6 mm long. **Pedicel**: in flower, 8–10 mm long, c. 2 mm diameter, tomentose, hairs c. 0.8 mm long, appressed, brown; in fruit, 10–12 mm long, c. 4 mm diameter, glabrous. **Sepals** c. 9 mm long, c. 3 mm wide, length:width ratio 3, narrowly ovate, glabrous inside, tomentose outside, hairs c. 0.8 mm, appressed. **Outer petals** 9–15 mm long, 2.5–3 mm wide, length:width ratio 3.6–5, narrowly triangular, glabrous inside, tomentose outside, marked on the whole length by a longitudinal symmetric line, hairs c. 0.8 mm long, appressed. **Inner petals** 25–35 mm long, 4–5 mm wide, length:width ratio 6.25–7, very narrowly ovate, 8-ribbed longitudinally, pubescent inside but most densely towards the top, hairs c. 0.4 mm long, white, appressed in all directions, tomentose outside, hairs c. 0.8 mm long, appressed, brown. **Receptacle** c. 5 mm long, c. 5 mm wide, pyramidal, hollow to the top. **Stamens** numerous, c. 2 mm long, tooth-shaped, filament c. 0.5 mm long. **Carpels** c. 5, c. 3 mm long, c. 1 mm in diameter, narrowly oblong, tomentose outside, hairs 0.5–1 mm long, appressed, brown; ovules 4–6, biseriate, oblong, ovoid or spherical; stigma sessile, 5-lobed, c. 1 mm diameter, densely pubescent. **Fruit**: monocarps 1–3, c. 33 mm long, c. 35 mm diameter, (sub-)globose, verrucate, glabrous, pericarp pulpy. **Seeds** c. 6, wrapped in a thin pulp, biseriate,

13–15 mm long, 12 mm. wide, semi spherical, testa favulariate. Figs 6D, 8D & 19.

Distribution – *Piptostigma macrophyllum* is endemic to Cameroon (fig. 20).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The plant is found in forests and meadows on black volcanic soil. Altitude 550–1 000 m a.s.l.

Etymology – The epithet *macrophyllum* refers to the general larger size of its leaves compared to those of *Piptostigma multinervium* of closer resemblance.

Preliminary IUCN conservation status – Vulnerable [VU]. The extent of occurrence (EOO) of *Piptostigma macrophyllum* is estimated to be over 28,618 km² (more than 20,000 km² upper limit for Vulnerable status under the criterion B1). However, its minimal area of occupancy (AOO) is estimated to be 32 km² (within the limits for Endangered status under the criterion B2). *Piptostigma macrophyllum* is endemic to Western and southern Cameroon and has never been collected in a protected area. The species is known from eight specimens representing a total of six “locations” (*sensu* IUCN 2012), within the limit for Vulnerable status. *Piptostigma macrophyllum* is therefore assigned a preliminary status of VU B2abc(i,ii,iii,iv).

Additional specimens studied – **Cameroon**: Cameroon Mountain, near Njonji crater lake, 20 Jun. 2001, Andel, T.R. van TVA 3728 (WAG, YA); on trail through palm oil plantation, 3 km before lava flow and Seme Beach hotel when coming from Limbe, 18 Oct. 2013, Couvreur, T.L.P. 518 (WAG, YA); Ebo Forest Reserve, Djuma camp, transect 5, 16 Feb. 2014, Couvreur, T.L.P. 637 (P, WAG, YA); abords de la Lobé, à 25 km à l’ENE de Campo, 24 Mar. 1968, Letouzey, R. 9156 (P, YA); Monts Rumpi - Entre Dikome Balue (1200 m) et Ifanga Nalende (650 m), 35 Km NNW Kumba, 25 Mar. 1976, Letouzey, R. 14590 (YA); between Bomana and Kotto II, 26 Apr. 1996, Tchouto Mbatchou, G.P. 1378 (YA); between Ikenge and Esukutang, about 6 km W of Ikenge, 3 Apr. 1978, Thomas, D.W. 7645 (MO, P, YA).

Phenology – This species flowers and fruits from March to April.

Notes – By the large size of its leaf laminas and the papery consistency of its lamina, *P. macrophyllum* is close to *P. pilosum*, their geographical distribution even overlaps. Nevertheless, the leaf laminas of *P. pilosum* are mostly oblong or elliptic and only exceptionally narrowly obovate like those of *P. macrophyllum*. Finally, the inflorescences of *P. pilosum* are less dense and less pubescent than those of *P. macrophyllum*.

The monocarps of *P. macrophyllum* strongly resemble those of *P. multinervium* both belonging to group I. However, the monocarps of *P. macrophyllum* are verrucate while those of *P. multinervium* are aculeate, sometimes very close to verrucate (fig. 2). In addition, there are several other characters that distinguish both species such as the larger size of the leaf laminas in *macrophyllum* (25–41 cm long vs. 13–21 cm long in *multinervium*), the lower side of the leaf laminas being glabrous in *P. macrophyllum* and pubescent in *P. multinervium*; and the sepals narrowly ovate in *P. macrophyllum* while broadly triangular in *P. multinervium*.

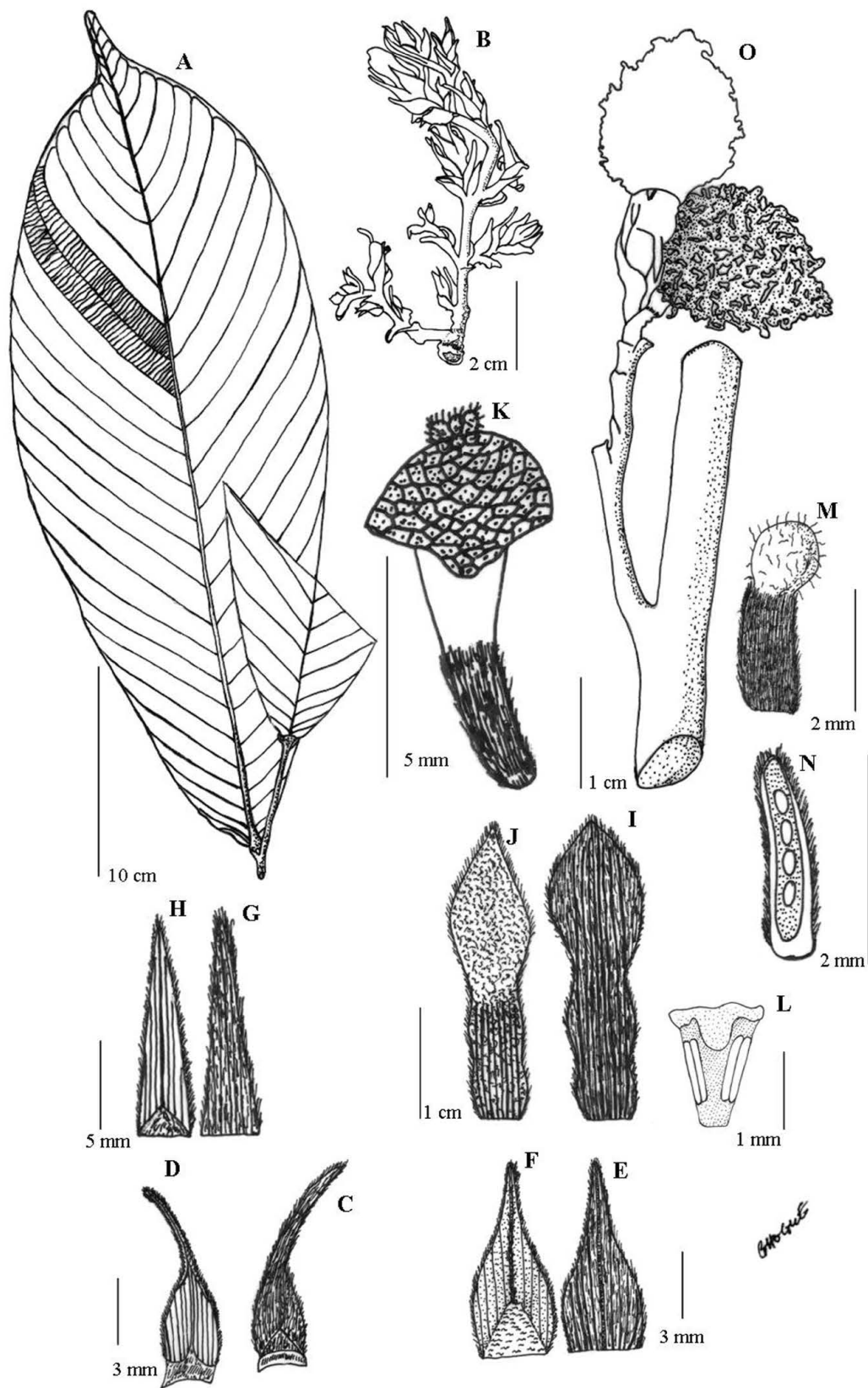


Figure 19 – *Piptostigma macrophyllum*: A, branch with developed leaf; B, inflorescence; C–D, bract (lower and upper sides); E–F, sepal (lower and upper sides); G–H, external petal (lower and upper sides); I–J, internal petal (lower and upper sides); K, receptacle; L, stamen; M–N, carpel (outer side and longitudinal section); O, young fruit. A–O from Thomas, D.W. 4493. Drawn by J.-P. Ghogue.

8. *Piptostigma mayndongtsaeaeum* Ghogue, Sonké & Couvreur, *sp. nov.*

Type: Cameroon, South-West Region, Korup National Park, 25 Aug. 2004, *van der Burgt, X.M.* 689 [holo-: WAG (WAG0204511); iso-: BR (BR0000013174750), P (P06901232)].

Tree up to 10 m high, up to 17 cm in dbh. **Young branches** shortly pubescent, hairs c. 0.8 mm long, brown, appressed towards the top, older ones glabrous. **Leaves:** petiole 6–8 mm long, 2–3 mm in diameter, shortly pubescent, hairs c. 0.5 mm long, brown, appressed towards the apex of the leaf; leaf lamina 23.5–36.5 cm long, 6.5–8.5 cm wide, length:width ratio 4, narrowly elliptic, sometime narrowly obovate, papery, upper side glabrous, lower side sparsely pubescent, hairs c. 0.5 mm long, appressed towards the margin of the leaf, base obtuse, apex attenuate, acumen 2.5 cm long; midrib pubescent on the upper side, pubescent to glabrescent on the lower side; secondary veins 22–32 pairs, glabrous on the upper side, densely pubescent on the lower side, hairs c. 1 mm long, brown, appressed. **Inflorescences** cauliflorous or ramiflorous on old branches, up to 34 cm long overall, composed of 2–5 rhipidia, peduncle-like base 15–30 mm long, 2–4 mm in diameter, axial internodes 1–5 cm long, lax or panicle-like, rhipidia with 2–10 flowers in succession, sympodial rachis 3.5–10 cm long, internodes 1.2–1.7 cm long; upper bract c. 2 mm long, c. 2 mm wide, very broadly ovate, inner side glabrous, outer side tomentose, hairs c. 0.5 mm long, appressed; lower bracts c. 2.5 mm long, 2.5 mm wide, very broadly ovate, inner side glabrous, outer side tomentose, hairs c. 0.5 mm long, appressed. **Pedicel:** in flower, 5–7 mm long, 1.5–2 mm in diameter, densely pubescent, hairs c. 0.5 mm long, appressed, light brown; in fruit, c. 15 mm long, 3 mm wide, pubescent. **Sepals** 1.8–3 mm long, 2–2.5 mm wide, length:width ratio 0.9–1.2, broadly to depressed ovate, slightly asymmetric, dentate to the upper margins, glabrous inside, tomentose outside, hairs c. 0.8 mm, erect or appressed, slightly veined longitudinally. **Outer petals** 5–6 mm long, c. 5 mm wide, length:width ratio 1, very broadly obovate, dentate to the upper margin, glabrous inside, tomentose outside, hairs c. 0.8 mm long, appressed, 7-veined longitudinally, 3

veins each side of a medium one. **Inner petals** 30–40 mm long, 8–10 mm wide, length:width ratio 3.75–4, narrowly elliptic, densely pubescent inside except on the lower part appressed against the receptacle, hairs 0.1–0.3 mm long, erect, white, densely pubescent outside, hairs c. 0.5 mm long, appressed, 7-veined longitudinally, 3 veins each side of a medium one. **Receptacle** 3.5–4 mm long, c. 4 mm wide, triangular prism. **Stamens** numerous, 1–1.2 mm long, 1–1.5 mm wide, drum-like to molar shape, 0.2–0.3 mm long. **Carpels** c. 4, c. 2 mm long, c. 1 mm in diameter, ellipsoid-oblong, bending, tomentose outside, hairs c. 0.5 mm long, appressed; ovules 4–6, biseriate; stigma sessile, 4-lobed, each lobe subdivided into 3–5 sub-lobes, pubescent. **Fruit:** monocarpis 1–3, 2.1–4.3 cm long, 2.7–5.3 cm wide, length:width ratio 0.7–0.8, transversely ellipsoid, slightly verrucate, shortly pubescent, pericarp thin, woody, endocarp fleshy. **Seeds** c. 6, biseriate, 1.6 cm long, 1 cm wide, length:width ratio 1.6, ellipsoid. Figs 6C, 8F & 21.

Distribution – *Piptostigma mayndongtsaeaeum* occurs on the western slope of Mt. Cameroon and in Malabo (Equatorial Guinea) (fig. 22).

Habitat and ecology – *Piptostigma mayndongtsaeaeum* is found in primary rain forest on well-drained sandy soils, intermixed with crystalline rocks. Altitude c. 100 m a.s.l.

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Etymology – The name given to this species is an eponym in honour of the first author's mother "May Ndong Tsa".

IUCN conservation status – Endangered [EN]. The extent of occurrence (EOO) of *Piptostigma mayndongtsaeaeum* is estimated to be over 6,061 km² (less than 20,000 km² upper limit for Vulnerable status under the criterion B1) and its minimal area of occupancy (AOO) is estimated to be 20 km² (within the limits for Endangered status under the criterion B2). *Piptostigma mayndongtsaeaeum* has been collected in Western Cameroon and in Equatorial Guinea. Among the sites where *P. mayndongtsaeaeum* has been collected, some are currently subjected to a great deal of human pressure, especially from intensive agricultural exploitations in Western Cameroon. The species is known from five specimens representing three subpopulations. These three subpopulations represent a total of two "locations" (*sensu* IUCN 2012), within the limit for Endangered status. The collection from Malabo was done recently, while the one from Cameroon was made in 2005 in a protected area (Korup National Park). Nevertheless, we project that the ongoing loss of its habitat will induce a strong continuous decline in the number of subpopulations and mature individuals as well as an important decline of its EOO and AOO. *Piptostigma mayndongtsaeaeum* is therefore assigned a preliminary status of EN B2ab(i,ii,iii,iv,v).

Additional specimens studied – **Cameroon:** Ndian, Chimpanzee camp beside the large hut, South of Korup National Park, Mundemba, camping site in primary lowland forest, 19 Jun. 2000, *Sainge, M.* 558 (MO); Korup National Park, along transect "P" and in 25 ha study plot, Mar. 1986, *Thomas, D.W.* 5840 (MO); Korup National Park, P plot, subplot 12F, 29 Oct. 2005, *van der Burgt, X.M.* 790 (K, WAG, YA).

Equatorial Guinea: Moraka to Peter's camp pt 342, 28 Jan. 2009, *Luke, W.R.Q.* 13188 (MO).

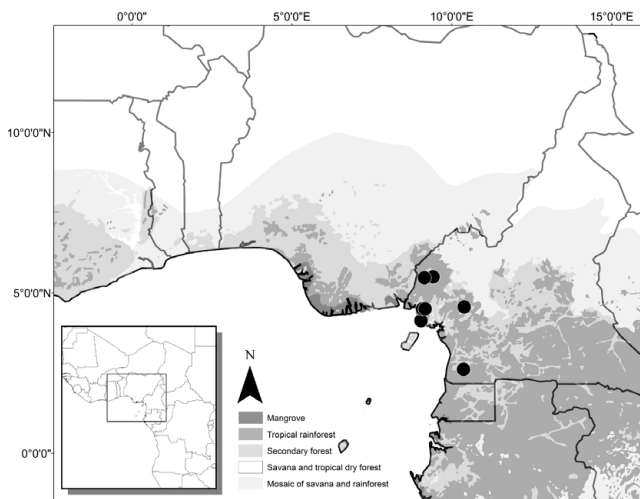


Figure 20 – Distribution of *Piptostigma macrophyllum*.

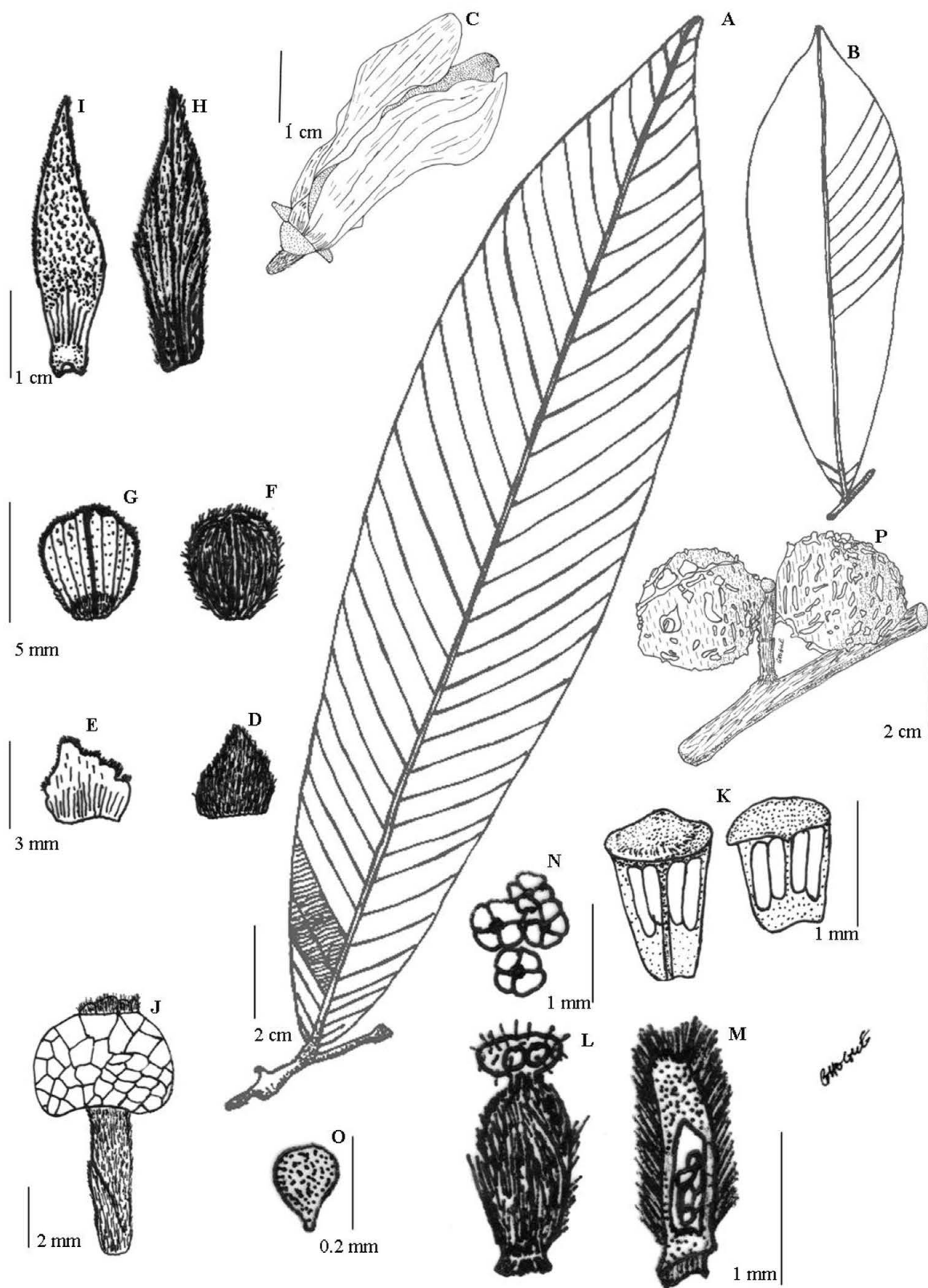


Figure 21 – *Piptostigma mayndongtsaeum*: A–B, leaves; C, flower; D–E, sepal (lower and upper sides); F–G, external petal (lower and upper sides); H–I, internal petal (lower and upper sides); J, receptacle; K, stamens; L–M, carpel (outer side and longitudinal section); N, stigma (upper view); O, ovule; P, fruit. A from van der Burgt, X.M. 689; B & P from Sainge, M. 558 (MO); C–O from van der Burgt, X.M. 790. Drawn by J.-P. Ghogue.

Phenology – The species fruits in August and flowers in October.

Notes – *Piptostigma mayndongtsae anum* differs from other species of the genus by the narrow shape of its leaf lamina (from narrowly to very narrowly elliptic) and the shape of its monocarp (transversely ellipsoid).

9. *Piptostigma mortehanii* De Wild. (De Wildeman 1913: 383). – Type: Democratic Republic of Congo, Dundusana, Oct. 1913, *Mortehan*, M.G. 626 [holo-: BR (BR-SP880211)].

Piptostigma fouryi Pellegr. (Pellegrin 1950: 75), **synon. nov.** – Type: Cameroon, Otottomo forest reserve, near Yaoundé, 1935, *Foury*, C. 73 [holo-: P (P00363302)].

Piptostigma mortehanii De Wild. var. *pilosa* Sillans (Sillans 1953: 554). – Type: Central African Republic, Oubangui, Région de Boukoko, 9 Jan. 1952, *Tisserant*, C. 2335 [holo-: P (P00363279) web; iso-: P (P00363278, P00363280) web].

Piptostigma longipilosa Engl. var. *parapilosa* Tisser., in sched. (*Tisserant*, C. 2335, P).

Tree, 3–10 m tall, 15–20 cm in dbh, stem often leaning. **Young branches** hispid, hairs 1–1.5 mm long, erect, older branches pubescent to glabrescent, hairs 0.2–0.3 mm long, erect. **Leaves**: Petiole 3–4 mm long, 2–3 mm in diameter, hispid, hairs 1–2 mm long, erect; leaf lamina 11.5–20.5 cm long, 3–12.5 cm wide, length:width ratio 1.8–3.4, obovate to narrowly obovate, upper side pubescent towards the base near the midrib, hairs c. 1.5 mm, appressed in all directions, becoming puberulent with shorter hairs than above to glabrous, lower side sparsely pubescent, hairs c. 0.8 mm, erect or appressed, base acute, apex mucronate to acuminate, acumen 2–6 mm long; midrib pubescent on the upper side, hairs 0.5–0.8 mm, appressed or erect, tomentose on the lower side, hairs 1.5–2 mm long, appressed or erect; secondary veins 24–34 pairs, sparsely pubescent on the upper side, hairs 0.5–0.8 mm long, appressed, densely pubescent on the lower side, hairs c. 0.8 mm, appressed (fig. 5B–D). **Inflorescence** cauliflorous, particularly abundant towards the base of the stem, 0.3–2.7 m long overall, composed of up to 15 rhipidia, peduncle-like base 18–30 mm long, 5–8 mm in diameter,

axial internodes 1–10.5 cm long, lax to panicle-like, rhipidia with 2–8 flowers in succession, sympodial rachis 4–32 cm long, internodes 1–4 cm long; lower bracts 4–8 mm from the base of the pedicel upwards, more or less identical to the upper bracts, c. 6 mm long, 4 mm wide, length:width ratio 1.5,

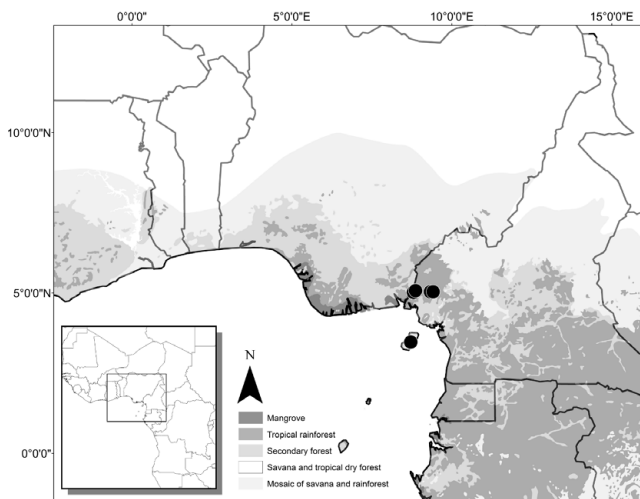


Figure 22 – Distribution of *Piptostigma mayndongtsae anum*.

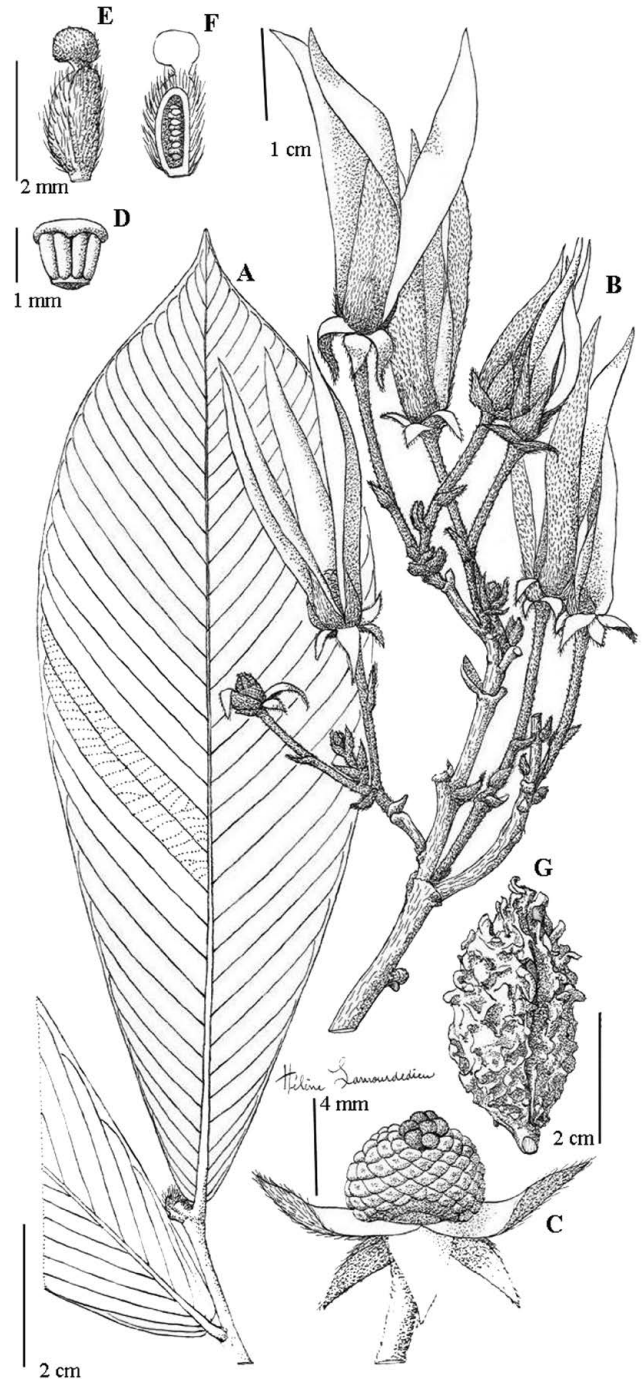


Figure 23 – *Piptostigma multinervium*: A, leaf; B, inflorescence; C, receptacle; D, stamen; E–F, carpel (outer side and longitudinal section); G, monocarp. From *Lolo* 6. © Publications Scientifiques du Muséum national d'Histoire naturelle, Paris; modified from Le Thomas (1969: 123, pl. 21).

ovate, inner side glabrous, outer side tomentose, hairs 0.5–1.5 mm, appressed, base amplexicaul, apex acute. **Pedicele**: in flower 5–8 mm long, 1.5–2 mm large, tomentose, hairs 0.5–1.5 mm long, appressed, brown; in fruit, 1–1.5 cm long, 3 mm wide, pubescent, hairs c. 0.5 mm long, erect or appressed. **Sepals** 4–5 mm long, 4–5 mm wide, length:width ratio 1, broadly to depressed ovate, inner side pubescent towards the top or glabrous, hairs c. 0.2 mm long, erect, outer side pubescent, hairs 0.5–1.5 mm long, appressed. **Outer petals** 8–9 mm long, 4–5 mm large, length:width ratio 1.8–2, narrowly ovate, inner side pubescent in upper half or glabrous, hairs c. 0.2 mm, erect, outer side pubescent, hairs 0.5–1.5 mm long, appressed. **Inner petals** 15–20 mm long, 4–7 mm wide, length:width ratio 2–5, narrowly to very narrowly elliptic, inner side tomentose, hairs c. 0.2 mm long, erect, outer side tomentose on the prominent veins, pubescent on the lamina, hairs c. 1 mm long, appressed. **Receptacle** c. 2.5 mm long, c. 5 mm wide, transversely ellipsoid, depressed apically. **Stamens** c. 40, c. 1.5 mm long, 0.5–1 mm wide, deltoid, filament 0.5 mm long, connective thick, dilated. **Carpels** 3–4, c. 1.5 mm long, c. 1 mm in diameter, oblong, tomentose outside, hairs c. 0.5 mm long, appressed; ovules c. 12, biseriate; stigma sessile, 1 mm long, 1 mm in diameter, spherical, pubescent. **Fruit**: monocarpis 1–2, 1.8–2.3 cm long, c. 1.8 cm in diameter, broadly ovoid, tuberculate, pubescent, hairs 0.2–0.5 mm long, erect. **Seeds** 2–5, 1.2 cm long, 1.5 cm wide, transversally broadly ellipsoid, longitudinally divided by a strong raphe. Figs 5D, 8G.

Distribution – *Piptostigma mortehanii* occurs in Ghana, Cameroon, Central African Republic, Gabon and Democratic Republic of Congo (fig. 24).

Chorology – Element of all three Domains (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – *P. mortehanii* is found in the forest understorey, often on flooded or swampy soils and along rivers.

Preliminary IUCN conservation status – Least Concern [LC]. *Piptostigma mortehanii* is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since we have no evidence

of an immediate threat and considering its frequency in its large area of distribution, *Piptostigma mortehanii* is assigned a preliminary status of LC.

Additional specimens studied – **Cameroon**: Ottotomo Forest Reserve, 3 km after reserve base, near small loggers road, 2 May 2013, *Couvreur, T.L.P.* 436 (WAG, YA); Ottotomo Forest Reserve, 3 km after reserve base, near small loggers road, 15 Jan. 2015, *Couvreur, T.L.P.* 667 (WAG, YA); Likouk-Lokoundji, 14 Jan. 1974, *Mezili, P.* 250 (P, WAG, YA); Mokoko forest Reserve, Transect to plot 13, 3 May 1994, *Ndam, N.* 1205 (YA); Korup National Park, Transects P and Q, Apr. 1979, *Thomas, D.W.* 1110 (K); 40 km NW of Eséka, W of Yaoundé, on the other bank of the Kélé river, 13 Dec. 1963, *Wilde, W.J.J.O. de* 1476 (B, K, WAG, YA).

Democratic Republic of Congo: Plateau Isalowe, Isangi, 12 Feb. 1979, *Breyne, H.* 3617 (BR); Befale, Rivière Nkoyo, 28 Dec. 1957, *Evrard, C.M.* 3152 (BR, K); route Bokakata-Bolomba (Terr. Basankusua), 18 Sep. 1958, *Evrard, C.M.* 4820 (BR); Yalikungu (Mondombe, Terr. Ikela), 28 Dec. 1958, *Evrard, C.M.* 5400 (BR, K); Djolu, 23 Feb. 1959, *Evrard, C.M.* 5810 (BR); Ile Batuku, en face du village de Yalamba, en amont de Basoko, Oct. 1948, *Germain, R.G.A.* 4638 (BR, K); environs de Ikela, Jun. 1949, *Germain, R.G.A.* 5075 (BR, K); Yangambi, s.d., *Gilbert, G.C.C.* 8835 (BR, MO, P); Yangambi, 1950, *Gilbert, G.C.C.* 8833 (BR); Yangambi, s.d., *Gilbert, G.C.C.* 8419 (K); Yangambi, 1950, *Gilbert, G.C.C.* 9065 (MO); Yangambi, s.d., *Gilbert, G.C.C.* 9066 (BR, K, P); Yangambi, s.d., *Gilbert, G.C.C.* 9368 (BR, K, P); Yangambi, 15 Apr. 1958, *Léonard, A.* 286 (BR); Cirque source de la Ngula (affluent Aruwimi) Km 62 route Bengamisa à partir de Weko, 7 Jul. 1939, *Louis, J.L.P.* 15501 (BR, K); Yangambi-Yakusu, 4 Oct. 1939, *Louis, J.L.P.* 16159 (BR, K, MO, P).

Gabon: Mbèl-Komo, 1968, *Ollome, J.-B.* s.n. (P); Rabi, 2.4 km on the road to Divangui, 25 Sep. 1994, *Wieringa, J.J.* 2779 (LBV, U, WAG).

Ghana: Ankasa Forest Reserve, 1 Jul. 1966, *Enti, A.A.* GC 35527 (K).

Phenology – The plant produces flowers from September to February and fruits from February to December.

Vernacular names – *Midzighi* (fang language – Gabon); *mopeto* (lissongo language – Central African Republic); *boela bosa* or *inaola a boela bosa* (turumbu language – Democratic Republic of Congo).

Notes – *Piptostigma mortehanii* is easily distinguished by its midrib and secondary veins being densely pubescent or tomentose on the lower side of the leaf lamina, the whole side presenting sometime a brownish aspect like for *P. calophyllum*. It happens that the hispid hairs on the petiole and young branches remind those of *P. longepilosum*, however in the later species these hairs are significantly longer (1 mm vs. more than 4 mm). In addition, the leaf lamina base of the latter is rounded while in *P. mortehanii* it is acute.

We have consulted the type specimen of *Piptostigma fouryi*, *Foury, C.* 73 ([P00363302]) and recently recollected material in the type locality (*Couvreur, T.L.P.* 436 & 667). These specimens present morphological characters strongly linking it to *Piptostigma mortehanii* such as the hispid pubescence on the young branches and midrib, the shape of the leaves being obovate to narrowly obovate with an acute base and tomentose indumenta of the lower side of the leaf lamina, the midrib and the secondary veins.

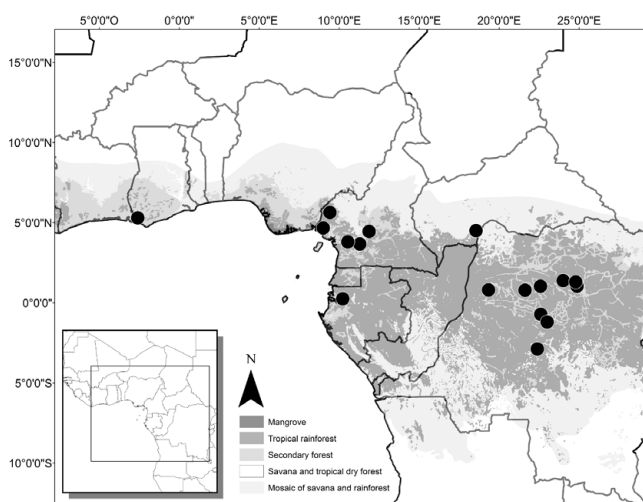


Figure 24 – Distribution of *Piptostigma mortehanii*.

10. *Piptostigma multinervium* Engl. & Diels (Engler & Diels 1901: 55). – Type: Cameroon, South Region, Bipindi and surrounding area, Mar. 1901, *Zenker, G.A.* 2263 [holo-: B (B100460901); iso-: BM (BM000553960) web, G (G00442259), GOET (GOET005683) web, HBG (HBG502522) web, K (K000199004, K000199005) web, P (P02031265, P00363277) web, WAG (WAG0065102) web, WU (WU0038180) web].

Tree 5–10 m high, 10–15 cm in dbh **Young branches** densely pubescent, hairs c. 1 mm long, appressed, older branches shortly or sparsely pubescent, hairs c. 0.2 mm long, erect, bark finely cracked longitudinally. **Leaves:** petiole 1.5–4 mm long, 2–3 mm in diameter, pubescent, hairs 0.5–1.5 mm, appressed, brown, or glabrescent on older ones; leaf lamina 13–21 cm long, 3–8 cm wide, length:width ratio 2–4, narrowly obovate to obovate, upper side glabrous, lower side pubescent, hairs c. 1 mm long, appressed towards the margin of the leaf, parallel to the secondary veins, light brown, base cuneate to obtuse, apex acuminate, acumen 5–10 mm long; midrib glabrous on the upper side, pubescent on the lower side, hairs c. 1.2 mm long, appressed, brown; secondary veins 13–31 pairs, glabrous on the upper side, pubescent on the lower side, hairs c. 1.2 mm long, appressed towards the margin, brown. **Inflorescence** cauliflorous and ramiflorous, 5–27 cm long overall, composed of up to 15 rhipidia, peduncle-like base 0.8–2 cm long, 0.8–1 cm in diameter, axial internodes 0.5–4 cm long, rhipidia with up to 6 flowers in succession, sympodial rachis 1.5–7 cm long, internodes 6–8 mm, lax or sublux; upper bract 5–10 mm from the basis of the pedicel, 5–7 mm long, 1.2–2.2 mm wide, length:width ratio 3–4, narrowly ovate, glabrous inside, tomentose outside, hairs 0.5–1 mm long, appressed, brown, lower bract 5–7.5 mm long, 4–5 mm wide, length:width ratio 1.25–1.5, largely ovate to ovate, divided by a longitudinal median line on both sides, inner side glabrous, outer side tomentose, hairs 0.5–1 mm, appressed, sometime finely acuminate. **Pedicel:** in flower 9–12 mm long, c. 1.5 mm in diameter, pubescent, hairs c. 0.2 mm long, appressed, brown; in fruit c. 2 cm long, c. 0.5 cm in diameter, pubescent, hairs c. 0.5 mm long, appressed. **Sepals** c. 5 mm long, c. 4 mm wide, length:width ratio 1.2, broadly triangular, asymmetric, glabrous inside, tomentose outside, hairs c. 0.8 mm, appressed, brown. **Outer petals** c. 8 mm long, c. 4 mm wide, length:width ratio 2, ovate, glabrous inside, pubescent outside, hairs c. 0.8 mm long, appressed, shiny brown, up to 12 times longitudinally veined. **Inner petals** c. 35 mm long, 12 mm wide, length:width ratio 3, narrowly ovate, marked longitudinally with 9–11 salient and symmetric veins, homogeneously pubescent inside, hairs c. 1 mm long, erect, white, tomentose outside at the base in contact with the receptacle, hairs c. 1.2 mm long, appressed, brown, pubescent above especially on the veins, hairs c. 1.2 mm long, appressed, brown. **Receptacle** c. 5 mm long, 6.5 mm wide, transversally ellipsoid, depressed towards the apex. **Stamens** numerous, c. 1.5 mm long, 1 mm wide, filament c. 0.4 mm long. **Carpels** 4–6, c. 2.2 mm long, c. 1 mm in diameter, oblong, sessile, tomentose outside, hairs c. 0.5 mm long, appressed, brown; ovules c. 8, biseriate; stigma sessile, 4–6-lobed, flatten, c. 0.5 mm long, c. 1.5 mm diameter, transversely narrowly ellipsoid, pubescent, hairs c. 0.2 mm long. **Fruit:** monocarps 1–4, c. 4 cm

long, 2.8 cm diameter, ellipsoid to broadly ellipsoid, sessile, glabrous, muricate, rarely verrucate, laceworks seemingly caduceus, exocarp 2–6 mm thick, woody, hard. **Seeds** 5–7, biseriate, 1.7 cm long, 1.1 cm large, ellipsoid, testa favulitate. Figs 3, 8B & 23A–G.

Distribution – *Piptostigma multinervium* is endemic to Atlantic Central Africa, ranging from Cameroon southwards to southern Gabon. It has yet to be collected in Equatorial Guinea (fig. 25).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – *Piptostigma multinervium* is found in the understorey of old growth or primary lowland rain forests and is often common on swampy soils. Altitude 200–900 m a.s.l.

Preliminary IUCN conservation status – Least Concern [LC]. *Piptostigma multinervium* is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since we have no evidence of an immediate threat and considering its frequency and its large area of distribution, *Piptostigma multinervium* is assigned a preliminary status of LC.

Additional specimens examined – **Cameroon:** Nkolmylon, 20 Km route Yaoundé-Douala, 30 Mar. 1984, *Achoundong, G.* 893 (YA); 12 km from Kribi, S. of Lolodorf road, 3 May 1969, *Bos, J.J.* 4625 (BR, MO, P, WAG, YA); 25 km from Kribi, 2 km N of Lolodorf road, 28 Jul. 1970, *Bos, J.J.* 7163 (MO, P, WAG); Ebo Forest Reserve, Djuma camp, Djashaka trail, 13 Feb. 2014, *Couvreur, T.L.P.* 616 (WAG, YA); Mambe Massif, above Boga village, 100 km along road from Yaoundé to Edea, 19 Jun. 2014, *Couvreur, T.L.P.* 649 (WAG, YA); Colline Nkoldjobe, Mbam Minkoum, 15 Mar. 1978, *Dang, D.* 681 (P, YA); Mvini, 35 km E. Campo, 27 Feb. 1982, *Hoshino, J.* 359 (YA); Lolodorf, 18 Apr. 1928, *Lolo* 6 (P); Ebo proposed national park, Hospital trail 1430 m from Ndogbayembe trail, 26 Mar. 2006, *MacKinnon, L.E.* 52 (YA); near Lac Tissongo, 21 Feb. 1975, *McKey, D.B.* 47 (P, YA); Lake Tissongo study area, Douala-Edea Reserve, Jun. 1976, *Waterman, P.G.* 839 (K); Bipindi, s.d., *Zenker, G.A.* s.n. (B); Bipindi, s.d., *Zenker, G.A.* s.n. (B).

Gabon: Rabi, 29 Mar. 1990, *Breteler, F.J.* 9604 (LBV, WAG); Bokoué, Mar. 1952, *Corbet* 703 (P); along road Mandji to Rabi, Km 15, 8 Nov. 2013, *Couvreur, T.L.P.* 553 (P, WAG, YA); along road

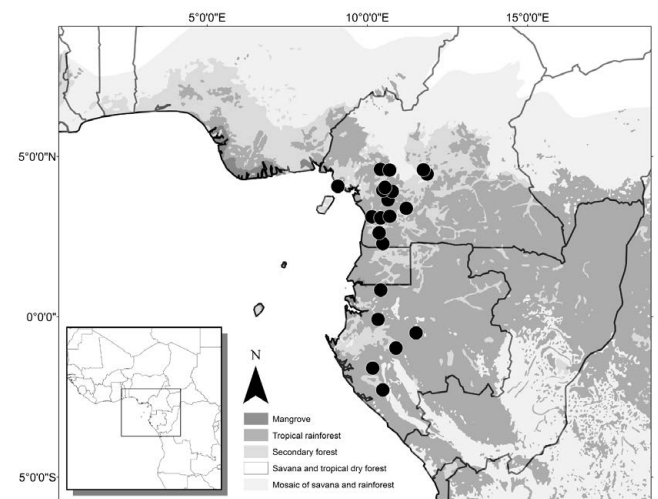


Figure 25 – Distribution of *Piptostigma multinervium*.

between Mandji and Rabi, about Km 19 from Mandji, 8 Nov. 2013, *Couvreux*, T.L.P. 554 (P, WAG, YA); 19 km ENE de Belle Vue, 7 Jan. 1987, *Dibata*, J.J. 23 (MO, WAG); Pembilembi, entre Agouma et les Echiras, 19 Dec. 1925, *Le Testu*, G.M.P.C. 5838 (P); Mont de Cristal, Wildlife conservation Society transect, 2001, *Nguema Ekomo*, D. 1827 (MO); Crystal Mountains, 55150 m on transect G., 22 May

2001, *Nguema Miyono*, N.S. 1827 (MO, WAG); camp transect Lee à 9 km du camp de base (SOFORGA), 2001, *Niangadouma*, R. 23 (MO, WAG); Koumounabwali Massive, c. 34 km along the Bondola river, counting from the road Lambaréné-Foumagou, 15 Dec. 1995, *Wilde*, J.J.F.E. de 11619 (LBV, WAG); Massif de Koumounabouali, 11 Dec. 1996, *Wilde*, J.J.F.E. de 11751 (LBV, WAG).

Phenology – *P. multinervium* produces flowers from February to April and fruits from February to June.

Note – By the shape and the size of the leaf lamina, *Piptostigma multinervium* is close to *P. glabrescens*; and by the external aspect of the monocarp, close to *P. macrophyllum*. See notes of both species for more details on the differences.

11. *Piptostigma oyemense* Pellegr. (Pellegrin 1950: 75). – Type: Gabon, Oyem, Between Ogooué and Cameroon, 21 Jun. 1934, *Le Testu*, G.M.P.C. 9624 [holo-: P (P00363276); iso-: BR (BR0000008802774, BR0000008802446) web, BM (BM000553961) web, P (P00363274, P00363275) web].

Tree 2–6 m tall, c. 10 cm dbh. **Young branches** pubescent, hairs 0.5–1 mm long, appressed, older branches glabrous. **Leaves**: petiole 3–4 mm long, 1–2 mm wide, pubescent, hairs c. 0.2–0.5 mm, erect or appressed; leaf lamina 11–27 cm long, 4–9 cm wide, length:width ratio 2.5–3, elliptic to narrowly elliptic, upper side glabrous, shiny, lower side sparsely pubescent when young, becoming glabrous, base cuneate, apex acuminate, acumen 2–25 mm long; midrib glabrescent to glabrous on the upper side, pubescent on the lower side on young leaves and at the base near the petiole only for elder ones, hairs c. 0.8 mm long, appressed; secondary veins 21–29 pairs, glabrous on the upper side, pubescent on the lower side on young leaves, hairs c. 0.8 mm long, appressed, becoming glabrous. **Inflorescence** cauliflorous, composed of 1(–2) rhipidia, peduncle-like base 7–10 mm long, c. 3 mm in diameter, rhipidia with 1–2 flowers in succession, sympodial rachis 27–42 mm long, axial internodes 3–6 mm long, compact; upper bracts c. 2 mm from the base of the pedicel, c. 3.5 mm long, 2 mm wide, length:width ratio 1.75, obtrullate, glabrous inside, tomentose outside, hairs 0.5–0.8 mm, appressed, brown, lower bracts c. 4.2 mm long, 1.5 mm wide, length:width ratio 2.8, narrowly obtrullate, inner side glabrous, veined longitudinally, slightly hooded to the top, tomentose, outer side tomentose, hairs c. 1 mm long, appressed. **Pedicel**: in flower, 11–18 mm long, 1–1.2 mm in diameter, pubescent, hairs 0.5–0.8 mm long, appressed; in fruit, c. 12 mm long, 1.5 mm in diameter, pubescent, hairs c. 0.5 mm long, appressed. **Sepals** 5–6 mm long, 3–4 mm wide, length:width ratio 1.6, trullate, 7-veined longitudinally on both sides, glabrous inside, tomentose outside, hairs c. 0.8 mm long, appressed, apex acuminate. **Outer petals** 12–14 mm long, 3–4 mm wide, length:width ratio 4.6, narrowly to very narrowly triangular, 7-veined longitudinally, glabrous inside, pubescent to tomentose outside, hairs 0.5–0.8 mm, appressed, apex long acuminate, acumen c. 3 mm long. **Inner petals** 40–50 mm long, 5–10 mm wide, length:width ratio 5–7.5, very narrowly trullate, pubescent inside, hairs c. 0.1 mm long, erect, pubescent to tomentose outside, 7-veined, veins salient, hairs appressed. **Receptacle** c. 4 mm long, c. 5 mm wide, transversely ellipsoid, depressed towards the top. **Stamens** numerous, c. 1 mm long, c. 1 mm in diameter. **Carpels** c. 3, sessile, c. 1.5 mm long, c. 1 mm



Figure 26 – *Piptostigma oyemense*: A, branch (with a leaf and a flower); B, receptacle; C, stamen; D–E, carpel (outer side and longitudinal section). A–E from *Le Testu*, G.M.P.C. 9624. © Publications Scientifiques du Muséum national d'Histoire naturelle, Paris; modified from Le Thomas (1969: 123, pl. 21).

in diameter, oblong, outer side tomentose, hairs appressed; stigma not seen; ovules 10, biseriate. **Fruit:** monocarp 1–3, 3–4 cm long, 2.5–3 cm in diameter, broadly ellipsoid to ellipsoid, verrucate, shortly pubescent on young fruits, glabrous on elder ones, exocarp woody, thin, hard. **Seeds** 3–5, c. 1–1.5 cm long, 8–10 mm wide, ellipsoid. Figs 3D, 8E & 26.

Distribution – *Piptostigma oyemense* is endemic to Atlantic Central Africa, ranging from Cameroon southwards to southern Gabon. It has not yet been collected in Equatorial Guinea (Muni) but is expected to occur there (fig. 27).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The plant is found in rain forests on the slope of mountains. Altitude 450–900 m a.s.l.

Preliminary IUCN conservation status – Least Concern LC. *Piptostigma oyemense* was previously assessed under IUCN criteria 2.3 in 1998 (Olfield et al. 1998) as VU D2. Many more collections are now attributed to *Piptostigma oyemense* and the species is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since we have no evidence of an immediate threat and considering its frequency and its large area of distribution, *Piptostigma oyemense* is assigned a preliminary status of LC.

Additional specimens studied – **Cameroon:** Bomana, Onge, 5 Oct. 1993, Akogo, M. 34 (K, WAG); Akom II, 12 Dec. 2013, Kamdem, G.N. 159 (YA).

Gabon: 30 km E SE of Lambaréné, 3–4 km on road after Mabounié “camp de vie”, 22 Nov. 2015, Couvreur, T.L.P. 917 (LBV, YA, WAG); Abanga, chantier CEFA (Compagnie Exploitation Forestière Africaine), 5 Jun. 1963, Hallé, N. 2264 (P); Monts de Cristal, Nkam / Méla, 30 Jan. 1968, Hallé, N. 4734 (P); Crystal Mountains, Mbe NP, south of Mont Mbilan, 12 Feb. 2005, Leal, M.E. 267 (MO, WAG); Setté Cama region, 22 May 1997, McPherson, G.D. 17055 (MO, WAG); Cristal mountain, Tchimbélé dam region, 22 Sep. 2000, McPherson, G.D. 17953 (MO); 5 km on a forestry road to Koumounabwali Mountains from Bembodié, 17 Jan. 2005, Wieringa, J.J. 5546 (K, WAG).

Phenology – This species produces flowers from January to June and fruits from September to January.

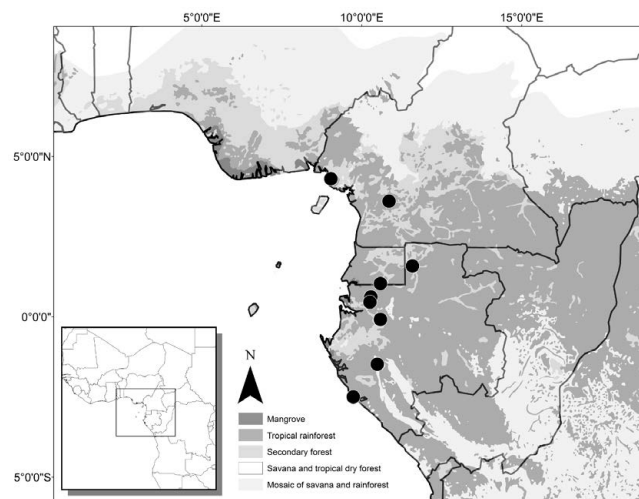


Figure 27 – Distribution of *Piptostigma oyemense*.

Notes – This species is characterized by the elliptic shape of its leaf laminas and its inflorescence presenting most of the time only one rhipidia. Its old leaves are glabrous on both sides.

12. *Piptostigma pilosum* Oliv. (Oliver 1865: 159). – Type: Nigeria, Cross River State, s.d., Thomson, G. 61 [holo-: K (K000199008); iso-: B (B100154081)].

Piptostigma latipetalum Baker f. (in Rendle et al. 1913: 120), nom. nud., see note.

Piptostigma giganteum Hutch. & Dalziel (Hutchinson & Dalziel 1927a: 151), **synon. nov.** – Type: Nigeria, Cross River State, Oban District, Talbot, P.A. 1336 [lecto-: K (K000199007) web, **designated here**; isolecto-: K (K000199006) web].

Tree 3–10 m tall, 8–10 cm in dbh. **Young branches** densely pubescent, hairs c. 0.2 mm long, erect or appressed, old ones longitudinally striate, glabrous. **Leaves:** petiole 2–4 mm long, 2–3 mm in diameter, densely pubescent, hairs c. 0.5 mm long, erect; leaf lamina 25–41 cm long, 9–17.2 cm wide, length:width ratio 2.3–3, narrowly elliptic to elliptic or narrowly obovate to obovate, upper side glabrous, shiny when dried, lower side sparsely pubescent, pale when dried, hairs caducous, 0.2–0.5 mm long, appressed in all directions, white, base rounded and cordate, apex acuminate, acumen 11–27 mm long; midrib densely pubescent on the upper side, hairs c. 0.5 mm long, erect, brown, densely pubescent on the lower side, hairs c. 1 mm long, appressed towards the apex of the leaf; secondary veins 20–28 pairs, glabrous on the upper side, pubescent on the lower side, hairs c. 1 mm long, appressed towards the margin of the leaf. **Inflorescences** cauliflorous, 14–16 cm long overall, composed of 2(–3) rhipidia, peduncle-like base c. 10 mm long, c. 3 mm in diameter, axial internodes 0.3–2.3 cm long, compact to subslax, rhipidia with 1–3 flowers in succession, sympodial rachis 3.5–5 cm long, internodes 1.5–2 cm long; lower bract more or less identical to the upper bract, c. 12 mm long, c. 5 mm wide, length:width ratio 2.4, ovate, inner side glabrous, outer side pubescent, hairs 0.5–1 mm long, appressed towards the apex, brown, apex largely acuminate, acumen c. 5 mm long. **Pedicel:** in flower 1–2.5 cm long, c. 3 mm in diameter, tomentose, hairs c. 0.8 mm long, appressed; in fruit, c. 10 mm long, c. 3 mm diameter, tomentose, hairs 0.8–1 mm long, appressed, brown. **Sepals** 7–8 mm long, 6–7 mm wide, length:width ratio 1.1, broadly ovate, inner side glabrous, slightly veined longitudinally, outer side pubescent, cambered at the centre base, hairs appressed towards the apex, base rounded, apex acute. **Outer petals** 7–8 mm long, 3–3.5 mm wide, length:width ratio 2.6, narrowly ovate, inner side glabrous, longitudinally veined, outer side pubescent, hairs c. 0.5 mm long, appressed, base rounded, apex acuminate. **Inner petals** 30–60 mm long, 8–15 mm wide, length:width ratio 3.6, narrowly trullate, falcate, base rounded, narrowed to 5 mm wide, apex attenuate, inner side pubescent, hairs c. 0.2 mm long, erect, 6–7 ridged on its lower half, outer side sparsely pubescent, hairs c. 0.5 mm long, erect, longitudinally 8-veined, veins thick, densely pubescent, hairs c. 0.8 mm long, appressed. **Receptacle** c. 5 mm long, c. 4 mm wide, spherical to broadly ellipsoid, depressed at the apex. **Stamens** numer-

ous, c. 1 mm long, c. 0.1 mm wide, drum-like shape, filament less than 0.1 mm long. **Carpels** 5–8, sessile, c. 1.1 mm long, c. 0.4 mm in diameter, narrowly oblong, tomentose outside, hairs appressed; ovules 8–10, biseriate; stigma sessile, c. 0.5 mm long, c. 0.5 mm wide, spherical, pubescent. **Fruit**: monocarps 2–5, 1.3–3 cm long, 0.8–1.8 cm wide, ovoid or ellipsoid, cuspidate, pusticulate, c. 6 times longitudinally ribbed, hairs 0.2–0.5 mm long, erect, brown on young monocarps, exocarp 0.8–1 mm thick, hard, endocarp fleshy, c. 0.2 mm thick. **Seeds** c. 7, c. 1.5–3.5 mm long, 2–3 mm wide, ellipsoid. Figs 6E & F, 8J & 12A–G.

Distribution – *Piptostigma pilosum* is present in Nigeria, Cameroon, Equatorial Guinea and Gabon (fig. 28).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The species is found in the understorey of mature rain forests. Altitude 50–390 m a.s.l.

IUCN conservation status – Least Concern [LC]. *Piptostigma pilosum* is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since we have no evidence of an immediate threat and considering its frequency and its large area of distribution, *Piptostigma pilosum* is assigned a preliminary status of LC.

Additional specimens studied – **Nigeria**: Oban Forest Reserve, 23 Jan. 1957, *Onochie, C.F.A.* F.H.I. 36127 (K); Oban, 30 Jan. 1912, *Talbot, P.A.* 1290 (K, P); Oban, 5 Feb. 1912, *Talbot, P.A.* 1420 (K); Eket, 1912, *Talbot, P.A.* 3143 (K, Z).

Cameroon: on trail leading to top of Mt Etinde, after Ekonjo village, 1 Apr. 2016, *Couvreur, T.L.P.* 1030 (YA, WAG); Mt Cameroon National Park, on the Bomona trail behind Bomona village, 10 km NW from Idenau, 3 Apr. 2016, *Couvreur, T.L.P.* 1047 (YA, WAG); near Bai Kuke, S.E of Mbonge, 25 Jan. 1958, *Keay, R.W.J.* FHI 37372 (K, P); Korup National Park, along footpath from Ndian River at PAMOL field 69 and transect P, 24 Jan. 1985, *Thomas, D.W.* 4311 (MO, P, YA); Korup National Park, between the Ndian River at PAMOL field and 2.5 Km on transect “P”, 12 Apr. 1985, *Thomas, D.W.* 4755 (MO, P, YA); Bipindi, Jan. 1914, *Zenker, G.A.* s.n. (MO).

Equatorial Guinea: Badja, E trail above pt 338, 21 Jan. 2009, *Luke, W.R.Q.* 13118 (K).

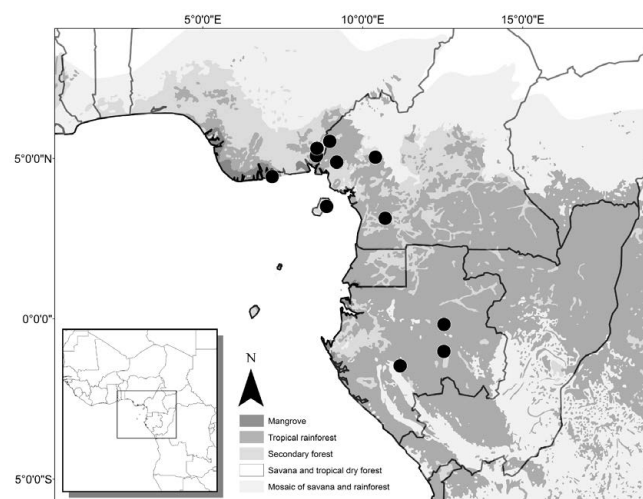


Figure 28 – Distribution of *Piptostigma pilosum*.

Gabon: Chutes de la Bemba, 1 Sep. 1926, *Le Testu, G.M.P.C.* 6037 (P); région de Lastoursville, Rongassa, 23 Oct. 1930, *Le Testu, G.M.P.C.* 8465 (P); Languoé, 27 Aug. 2006, *Nguema Ekomo, D.* 670 (BR).

Phenology – *Piptostigma pilosum* produces flowers from January to April, then from August to October. It produces fruits from January to April.

Note – Because of the large size of their leaf laminas, *P. pilosum* and *P. macrophyllum* can sometimes be confused. However, the leaf laminas of *P. pilosum* are mostly elliptic with the base rounded and cordate, while those of *P. macrophyllum* are always obovate with the base acute to obtuse. The inflorescence of *P. pilosum* generally presents very few rhipidia, only exceptionally up to three, while they can go up to six for *P. macrophyllum*.

Piptostigma giganteum is only known from the type specimen, *Talbot* 1336 and its status has been suggested as doubtful (Le Thomas 1969). Despite the larger size of the leaf lamina (33 cm long, 21 cm wide) most other characters clearly resemble *P. pilosum* (leaf lamina base rounded and cordate, number of secondary veins, size and shape of inner petals). The type specimen of this species (*Talbot* 1336) exists in two duplicates and the authors did not clearly indicate a holotype. Here we designate one as lectotype and the other one as isolectotype.

The characters described above for *P. giganteum* are also present in *P. latipetalum*, so far represented by the type specimen collected in Oban (Cross River State, Nigeria), *Talbot* 1290, deposited in Kew and Paris. *P. latipetalum* is here considered as *nomen nudum* because there is no diagnosis or description associated to it in Rendle (1913).

13. *Piptostigma submontanum* Ghogue, Sonké & Couvreur, sp. nov.

Type: Cameroon, South-West Region, Rumpi Mountains, between Lokando (900 m) and Dikome Balue (1200 m), 30 km NNW Kumba, 23 Mar. 1976, *Letouzey, R.* 14535 [holo-: YA (YA0002870); iso-: P (P02032181)].

Tree, 25 m tall, 20 cm in dbh, trunk straight, red brown. **Young branches** tomentose, hairs 0.5 mm long, erect, golden brown. **Leaves**: petiole 2–4 mm long, c. 2 mm diameter, tomentose, hairs 0.5–0.8 mm long, erect or appressed, brown; leaf lamina 40–49 cm long, 16–23 cm wide, length:width ratio 2–2.5, obovate, coriaceous, upper side pubescent near the base, then glabrous, hairs c. 0.5 mm long, erect, lower side densely pubescent, hairs c. 0.8 mm long, shiny brown, appressed towards the margin of the leaf, base decurrent (e.g. *Couvreur* 625) to cuneate (e.g. *Letouzey, R.* 14535) and narrowly cordate, apex mucronate (e.g. *Couvreur* 625) or acuminate (e.g. *Letouzey, R.* 14535), acumen 8–13 mm long; midrib tomentose on both sides, hairs c. 0.8 mm long, appressed, golden brown; secondary veins 58–65 pairs, sparsely pubescent on the upper side at the base of the leaf, hairs c. 0.5 mm long, erect, tomentose on the lower side, hairs c. 0.8 mm long, appressed. **Inflorescences** cauliflorous, 5–7 cm long overall, composed of 10–16 rhipidia, peduncle-like base 10–18 mm long, 5–10 mm in diameter, axial internodes 2–5 mm long, compact, rhipidia with 1–4 flowers in succession, sympodial rachis 2–4 cm long, in-

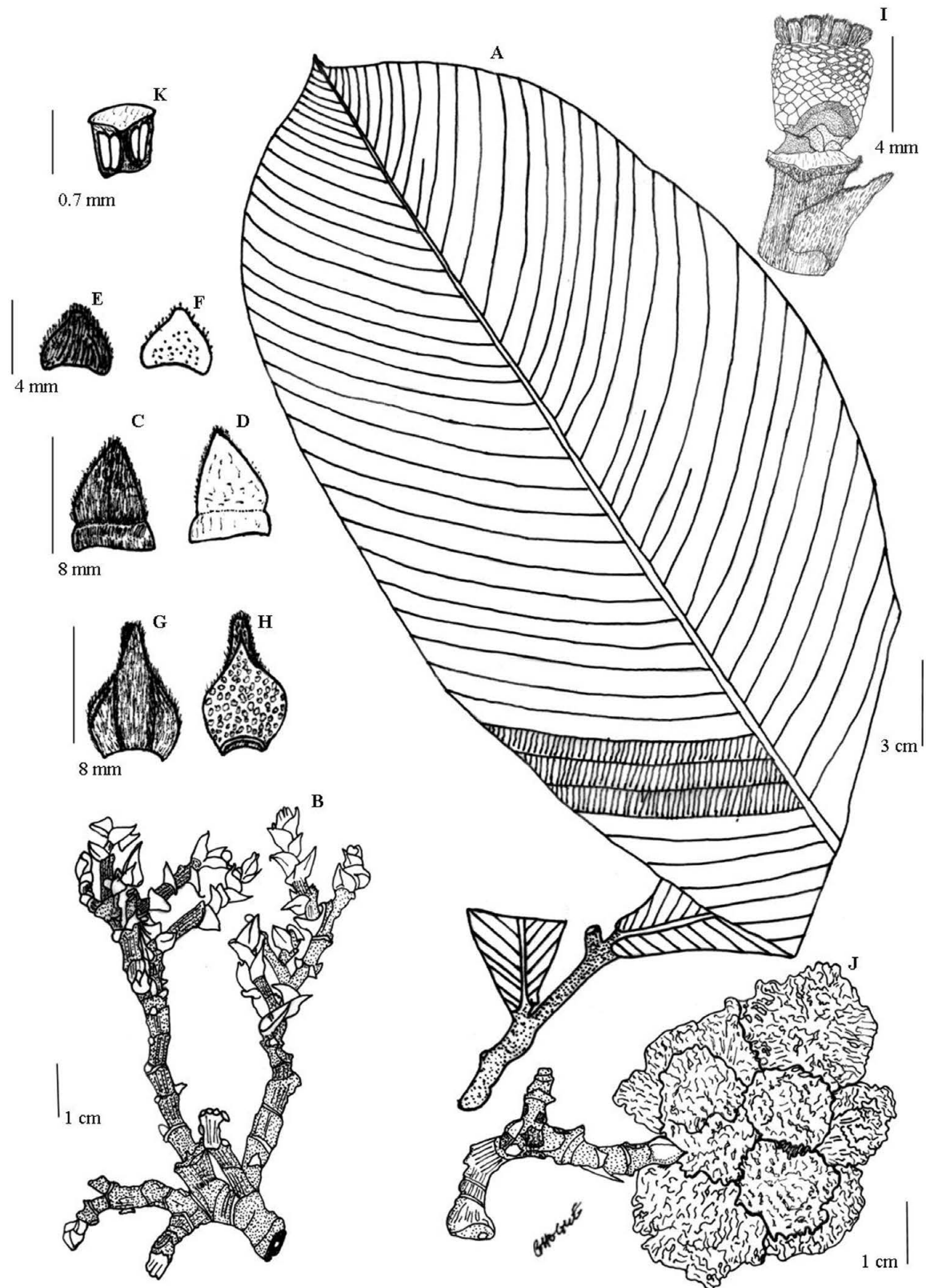


Figure 29 – *Piptostigma submontanum*: A, leaf; B, inflorescence; C–D, lower bract (lower and upper sides); E–F, upper bract (lower and upper sides); G–H, sepal (lower and upper sides); I, receptacle; J, fruit; K, stamen. A & C–K from *Letouzey, R.* 14535; B from *Couvreur, T.L.P.* 625. Drawn by J.-P. Ghogue.

ternodes 1–3 mm long; lower bract 7–8 mm long, c. 4 mm wide, length:width ratio 1.75–2, ovate, amplexicaul, glabrous inside, tomentose outside, hairs c. 0.5 mm, appressed, brown; upper bract 4–6 mm long, 6 mm wide, length:width ratio 2/3–1, depressed to very broadly ovate, glabrous inside, tomentose outside, hairs c. 0.5 mm long, appressed, brown. Pedicel: in flower 2–6 mm long, 2–3 mm in diameter, tomentose, hairs c. 0.5 mm long, appressed; in fruit c. 25 mm long, c. 4 mm diameter, tomentose, hairs c. 0.5 mm long, appressed. Sepals 5–8 mm long, 5 mm wide, length:width ratio 1.6, ovate, slightly twisted outwards on the lower margins, then inwards near the tip, glabrous inside except the top, pubescent, reticulate, cambered at the base, tomentose outside, hairs c. 0.5 mm, appressed. Outer petals c. 5 mm long, c. 4 mm wide; length:width ratio 1.25, triangular, inner side glabrous, outer side densely pubescent, hairs c. 0.5 mm long, appressed, base truncate, apex acute. Inner petals 50–60 mm long, 5–7 mm wide, length:width ratio 8.5–10, narrowly elliptic, inner side glabrous, outer side densely pubescent, hairs c. 0.5 mm long, appressed, base truncate, apex attenuate, longitudinally 8-veined, veins thick. Receptacle c. 4 mm long, c. 4 mm wide, triangular prism, flat on top. Stamens numerous, 0.6–0.7 mm long, c. 0.5 mm wide, sessile, molar-shaped. Carpels 12–15, c. 2 mm long, c. 1 mm in diameter, oblong, sessile, densely pubescent, hairs 0.5–1 mm long, appressed, golden brown; ovules biseriate, 8; stigma not seen. Fruit: monocarps 1–2, 2–3 cm long, 1–2.5 cm in diameter, obovoid, narrowed at the junction with the receptacle, verrucate, sessile, very shortly pubescent, hairs less than 0.1 mm long, erect, pericarp pulpy. Seeds 6–8, biseriate, 0.6–1.2 cm long, 0.3–0.5 cm wide, oblong, testa favulariate. Figs 5A–C, 8C & 29.

Distribution – *Piptostigma submontanum* is endemic to Cameroon (fig. 30).

Chorology – Element of the Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The plant is a species of sub-mountain rain forest. It is often found in association with *Santiria trimera* (Oliv.) Aubrév., *Syzygium staudtii* (Engl.) Mildbr.,

Parkia bicolor A.Chev., *Allanblackia gabonensis* (Pellegr.) Bamps. Altitude 900–1 200 m a.s.l.

Etymology – The epithet *submontanum* given to this species refers to its submontane occurrence.

Preliminary IUCN conservation assessment – Endangered [EN]. The extent of occurrence (EOO) of *Piptostigma submontanum* is estimated to be over 1,650 km² (less than 5,000 km² upper limit for Endangered status under the criterion B1) and its minimal area of occupancy (AOO) is estimated to be 20 km² (within the limits for Endangered status under the criterion B2). *Piptostigma submontanum* is endemic to Western Cameroon. Among the sites where *P. submontanum* has been collected, some are currently subjected to a great deal of human pressure, especially from potential exploitation for oil palm (Hoyle & Levang 2012). The species is known from six specimens representing four “locations” (*sensu* IUCN 2012), within the limit for Endangered status. We project that the ongoing loss of its habitat will induce a strong continuous decline in the number of subpopulations and mature individuals as well as an important decline of its EOO and AOO. *Piptostigma submontanum* is therefore assigned a preliminary status of EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v).

Additional specimen studied – **Cameroon**: Mount Kupe, Edip to Kodmin, 2 Dec. 1998, *Cheek, M.R.* 9177 (K); Ebo Forest Reserve, Djuma camp, Djashaka trail, 15 Feb. 2013, *Couvreux, T.L.P.* 625 (WAG, YA); Mount Kupe, Kodmin, 21 Nov. 1998, *Gosline, W.G.* 198 (K); Abang road and then right to the forest, 11 Dec. 1999, *Gosline, W.G.* 256 (K); Ebo Forest Reserve, 4 May 2016, *Kamdem, G.N.* 440 (YA).

Phenology – The plant flowers in February and produces fruits in March.

Note – By the large size of its leaf laminas (40–49 × 16–23 cm), its young branches, midribs and secondary veins tomentose on the lower side of the leaf and the brown colour of its hairs, *Piptostigma submontanum* is close to *P. calophyllum*. However, its leaf lamina base is decurrent and its monocarps are verrucate while the leaf lamina base of *P. calophyllum* is acute to obtuse and its monocarps smooth. This species is resolved as the sister species of the rest of *Piptostigma* (fig. 1).

Brieya De Wild. (De Wildeman 1914: 383). – Type species: *Brieya fasciculata* De Wild.

Tree or shrub; leaves shortly petiolate, venation eucamptodromous, tertiary percurrent. Inflorescence axillary, consisting of highly reduced and compact rhipidia on old branches; flowers hermaphrodite, pedicellate, sepals 3, free, very broadly to depressed ovate, petals 6, free, in two whorls, valvate, the external ones reduced and resembling the sepals, the internal ones very narrowly ovate or elliptic to linear; stamens numerous, incisor-like shape, filament absent or very short; carpels 4, oblong or pyramidal; stigma spherical, pubescent; ovules 8–18, uni- or biseriate. Fruits apocarpous, monocarps 1–3, sessile, free, ellipsoid to broadly ellipsoid; seeds ellipsoid.

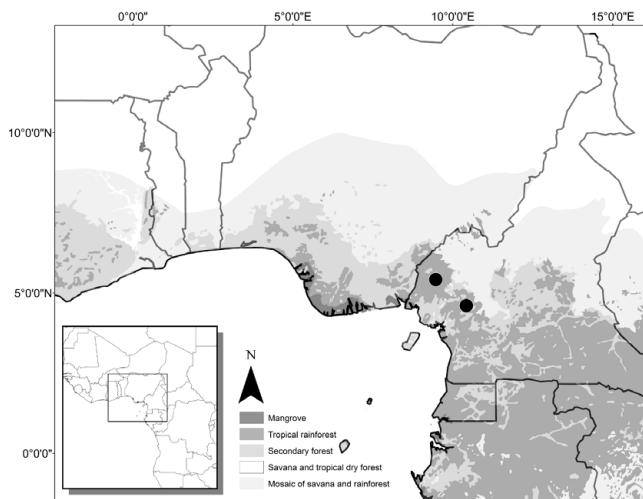


Figure 30 – Distribution of *Piptostigma submontanum*.

Key to the species of *Brieya*

1. Old branches pubescent; inflorescence composed of a single rhipidium; inner petals very narrowly ovate to very narrowly elliptic; shrub, 4 m tall. Angola.....2. *B. latipetala*
- 1'. Old branches glabrous; inflorescence composed of several highly reduced rhipidia; inner petals linear; tree, 10–25 m tall. Ivory Coast, Ghana, Cameroon, Equatorial Guinea (Malabo), Gabon, Republic of Congo, Democratic Republic of Congo.....1. *B. fasciculata*

1. *Brieya fasciculata* De Wild. (De Wildeman 1914: 384) – *Piptostigma fasciculatum* (De Wild.) Boutique ex Fries (Fries 1959: 115–116). – Type: Democratic Republic of Congo, Bas-Congo, Kingamu, Ganda sumi, 14–16 Oct. 1911, *De Briey, J.* 66 [holo-: BR (BR-S.P.880319); iso-: BR (BR0000008803252, BR0000008803245, BR0000008803191)].

Piptostigma aubrevillei Ghesq. ex. Aubrév. (Aubréville 1936). – Type: Côte d'Ivoire, Mudjika, 1933, *Aubréville, A.* 2115 [lecto-: P (P02032149), **designated here**].

Tree, 10–25 m tall, 20–50 cm in dbh, trunk slightly fluted at base. **Young branches** pubescent, hairs 0.2–0.4 mm long, appressed, old branches glabrous. **Leaves**: petiole 2–5 mm long, c. 2 mm in diameter, pubescent, hairs c. 0.3 mm long, appressed; leaf lamina 12–24 cm long, 6–8 cm wide, length:width ratio 2–3, narrowly oblong to oblong or narrowly obovate to obovate, upper side glabrous, lower side glabrous or pubescent, hairs c. 0.2 mm long, appressed in all directions, base obtuse, sometimes slightly cordate, rarely acute, apex shortly acuminate to obtuse, acumen 5–8 mm long; midrib pubescent on the upper side, hairs c. 0.5 mm long, appressed, pubescent on the lower side, hairs c. 0.5 mm long, appressed; secondary veins 11–17 pairs, glabrous on the upper side, sparsely pubescent on the lower side, hairs c. 0.5 mm long, appressed. **Inflorescences** ramiflorous, on old branches, 4–15 mm long overall, composed of 1–7 rhipidia, peduncle-like base 0–2 mm long, c. 3 mm in diameter, axial internodes 0.5–1 mm long, compact, rhipidia with 1–4 flowers in succession, sympodial rachis 2–6 mm long, internodes c. 0.2 mm long; lower bract 0–1 mm from the basis of the pedicel, 2–3 mm long, 1.5–1.6 wide, length:width ratio 1.3–1.9, ovate, concave, persistent or not, inner side glabrous, outer side tomentose, hairs 0.1–0.2 mm long, appressed, brown; upper bracts c. 1 mm long, 1.6 mm wide, length:width ratio 0.6, depressed ovate, inner side glabrous, outer side tomentose, hairs 0.1–0.2 mm long, appressed, brown. **Pedicels**: in flower 1.2–1.6 cm long, c. 5 mm in diameter, pubescent, hairs c. 0.2 mm long, appressed in all directions; in fruit 1.5–2.3 cm long, 0.4–0.5 cm diameter, glabrous. **Sepals** 1.5–2 mm long, 1.5–2 mm wide, length:width ratio 0.9–1, depressed to very broadly ovate, inner side glabrous, outer side tomentose, hairs 0.5–1 mm long, appressed, brown. **Outer petals** c. 1.5–2 mm long, c. 1.5 mm wide, length:width ratio 1, circular, inner side glabrous, outer side tomentose, hairs 0.5–1 mm long, appressed, brown, apex acuminate. **Inner petals** 38–108 mm long, 3–7 mm wide, length:width ratio 12–16, linear, pubescent on both sides, hairs 0.1–0.3 mm long, erect or appressed, white. **Receptacle** c. 5 mm long, c. 5 mm wide, spherical, concave. **Stamens**

numerous, molar shaped, glabrous, c. 1 mm long, c. 0.5 mm wide, filament c. 0.1 mm long. **Carpels** c. 4, c. 2 mm long, c. 0.8 mm wide, slightly pyramidal, star-like in section, oblong, tomentose outside, hairs 0.5–1 mm long, appressed, brown; ovules 16–20, biseriate; stigma sessile, spherical, pubescent, hairs 0.1–0.2 mm long, erect. **Fruit**: monocarps 1–3, sessile, 4.2–4.6 cm long, 2.5–4 cm wide, ellipsoid to broadly ellipsoid, smooth or punctulate, glabrous, exocarp c. 5 mm wide, fleshy. **Seeds** 10–12, biseriate, c. 10 mm long, c. 4 mm wide, ellipsoid. Figs 4, 7 & 31.

Distribution – *Brieya fasciculata* is present in Ivory Coast, Ghana, Cameroon, Equatorial Guinea (Malabo), Gabon, Republic of Congo, Democratic Republic of Congo and Angola (fig. 32).

Chorology – Element of the Upper and Lower Guinea Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – *Brieya fasciculata* is a species of lowland to submontane rain forests in primary or secondary habitats. Altitude 250–810 m a.s.l.

Preliminary IUCN conservation status – Least Concern [LC]. *Brieya fasciculata* is quite frequent throughout much of its large range, and an important decline of its EOO and AOO cannot be predicted. Since we have no evidence of an immediate threat and considering its frequency and its large area of distribution, *Brieya fasciculata* is assigned a preliminary status of LC.

Additional specimens studied – Ivory Coast: Mt Dou, s.d. [received at P in 1932], *Aubréville, A.* Herb. Mus. Paris/1065 (P); s. loc., s.d. [received at P in 1932], *Aubréville, A.* Herb. Mus. Paris/1500 (P); s. loc., 25 Jan. 1957, *Aubréville, A.* 38 (P); Dakpadou – Sago, 28 Mar. 1978, *Geerling, C.* 2279 (MO, WAG); Sassandra: P.N. de Taï, entre Dziroutou et le Mt. Niénoukoué, Jan. 1999, *Menzies, A.* CC 1549 (G).

Ghana: Bunsu Bungalow Arboretum, Eastern Region, Akim, Bunsu, 16 Jul. 1946, *Akpabla, G.K.* 978 (K); Asiakwa district: Sagyimase village: Atewa Range (Forest Reserve), between 6–8 km NW of intersection of Accra-Kumasi Road at Sagyimase along forest access road, Jul. 1995, *Harder, D.K.* 3338 (MO); Accra plains, 15 Nov. 1994, *Jongkind, C.C.H.* 1862 (MO, WAG); Mprisu, Ashanti, Sep. 1930, *Vigne, C.* 2057 (K).

Cameroon: Kagwene, Plot 5: Ekaw valley, 13 Jul. 2009, *Ashworth, J.* 310 (YA); on trail from Ekongo village, located 5 km before the entrance to Limbe, 7 km on secondary road, on flank of Mt Etinde, 16 Oct. 2013, *Couvreur, T.L.P.* 510 (P, WAG, YA); on trail from Ekongo village, located 5 km before the entrance to Limbe, 7 km on secondary road, on flank of Mt Etinde, 100 m in Mont Cameroon National Park, 16 Oct. 2013, *Couvreur, T.L.P.* 511 (P, WAG, YA); Rumpi mountains, forest trail, c. 5 km after Dikome Balue village, c. 40 km north of Kumba, 10 Jan. 2016, *Couvreur, T.L.P.*

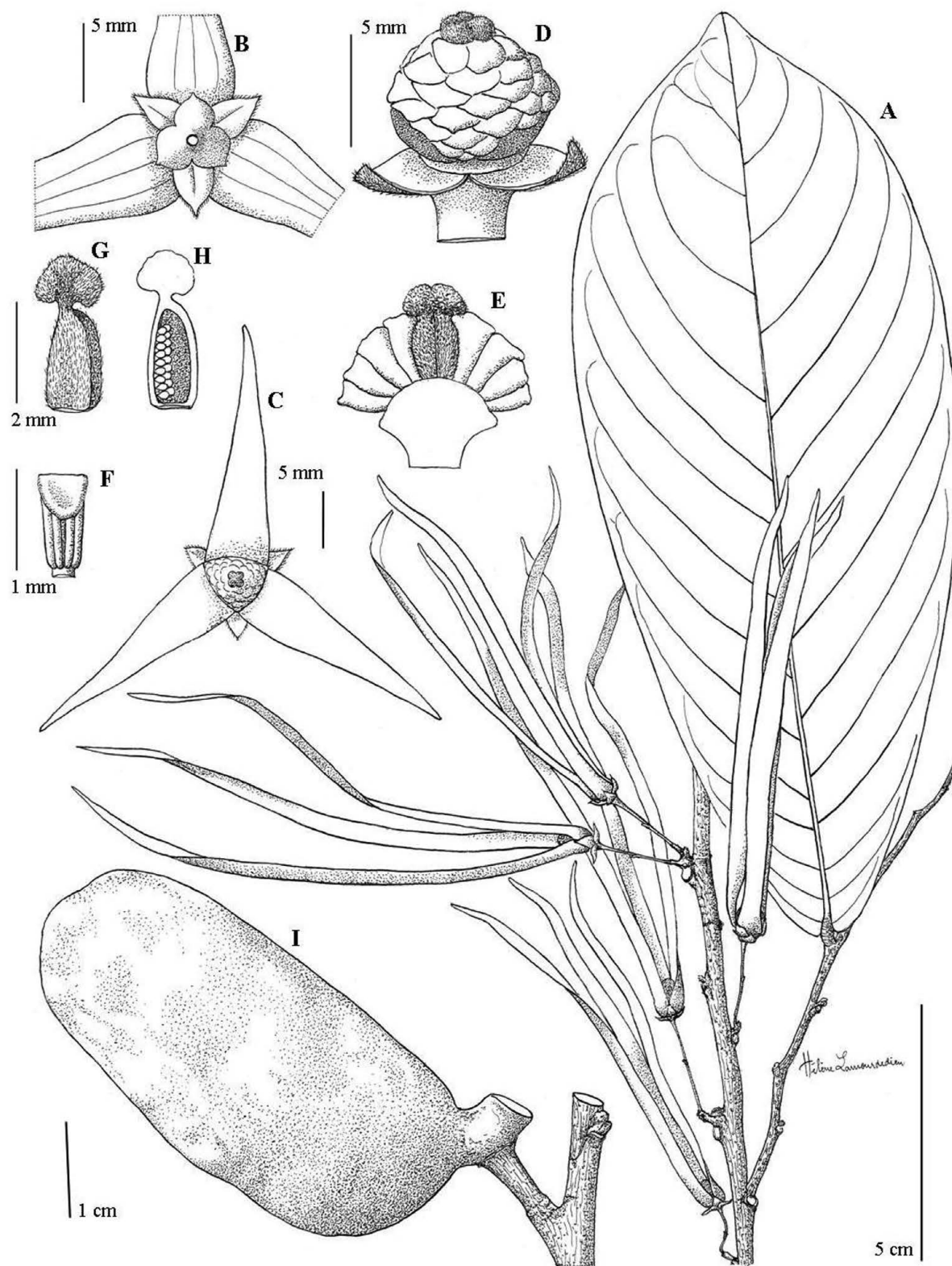


Figure 31 – *Brieya fasciculata*: A, branch with a leaf and flowers; B–C, flower (lower and upper views); D–E, receptacle (transversal view and longitudinal section); F, stamen; G–H, carpel (outer side and longitudinal section). A from Aubréville Herb. Mus. Paris 1500; B–H from Hallé 3166 (specimen not seen); I from Germain, R.G.A. 2396. Published as “*Piptostigma fasciculata*”. © Publications Scientifiques du Muséum national d’Histoire naturelle, Paris; modified from Le Thomas (1969: 127, pl. 22).

957 (WAG, YA); Kupe-Muanenguba. Kupe Village, trail to Kupe rock saddle, 28 Nov. 1999, *Gosline, W.G.* 234 (YA); entre Asip et Mang (60 Km ENE de Lomié), 13 Aug. 1963, *Letouzey, R.* 5605 (P, YA); aux abords de la Lobé, à 50 Km au SSE de Kribi, et à 30 Km à l'ENE de Campo, 23 Mar. 1968, *Letouzey, R.* 9132 (P, YA); Batéka Malen, 20 km NE de Moloundou, 23 Apr. 1971, *Letouzey, R.* 10718 (P, YA); près Ngong (25 km NE Eséka), 12 Dec. 1973, *Letouzey, R.* 12345 (YA); Njonji, 21 Apr. 1987, *Nning, J.* 385 (MO).

Equatorial Guinea: San Antonio, North Camp, Trail Pt 348, 2 Feb. 2009, *Luke, W.R.Q.* 13308 (K).

Gabon: Abanga, chantier CEFA (Compagnie Exploitation Forestière Africaine), 2 Jun. 1963, *Hallé, N.* 2160 (P); Bélinga, mines de fer, route de Mvadi, 25 Jul. 1966, *Hallé, N.* 132 (P); Mbe National Park, Monts de Cristal, Kinguele Dam area, on west-facing slope (2–15° incline), 1 Apr. 2004, *SIMAB series* 50612 (MO).

Republic of Congo: Odzala N.P., Entre Mbomo et Mboko, 12 Apr. 1994, *Doucet, J.-L.* 1712 (BR); Odzala N.P., 6 km au N de la Lékdi, Feb. 1994, *Doucet, J.-L.* 1738 (BR).

Democratic Republic of Congo: Vallée de la N'kula, Luki, 14 Jan. 1948, *Donis, C.* 2313 (BR); Leopoldville, Mar. 1957, *Flamigni, A.* 10272 (BR, K, WAG); forêt de Kibiya, N'kolo-Bolobo, Jan. 1952, *Flamigni, A.* 10371 (BR, K); Gimbi Station INEAC - Extension pour Hévéa, 6 Jul. 1944, *Germain, R.G.A.* 2396 (K, MO); Zone de Mambasa (Ituri forest), 19 Mar. 1991, *Hart, T.B.* 1105 (BR, K, MO); forêt aux environs du camp de Téturi, MGL, Aug. 1943, *Michelson, A.* 461 (BR); Luki, 4 Feb. 1947, *Toussaint, L.* 2151 (BR, K, MO); Vallée de la N'kula, Luki, 19 Jun. 1947, *Toussaint, L.* 2387 (BR, K, MO).

Angola: Bucu Zau, Male Lembo, 1919, *Gossweiler, J.* 7224 (K).

Phenology – The plant produces flowers from August to December and fruits in March.

Notes – *Brieya fasciculata* is distinguished from *B. latipetala* by the fact that it has several highly reduced rhipidia and its inner petals are linear, while *B. latipetala* has a single rhipidium and its inner petals are ovate to elliptic.

The combination under *Piptostigma* was suggested as an alternative by Boutique (1951: 306) and formally proposed by Fries (1959).

Out of the five specimens cited by Aubréville for the name *P. aubrevillei* in the protologue, we have chosen *Au-*

brévile 2115 as lectotype because this specimen is in both flower and fruit.

2. *Brieya latipetala* Exell (Exell 1950 [published 1951]: 418) – *Piptostigma latipetalum* (Exell) R.E.Fr. [Fries 1955: 38, non Baker f. (Rendle et al. 1913: 120)]. – *Piptostigma exellii* R.E.Fr. (Fries 1959: 116). – Type: Angola, Lunda District, Dundo, near the River Luachimo, 700 m, 6 Jun. 1948, *Gossweiler, J.* 14048 [holo-: BM (BM000553955) web; iso-: K (K000198999), P (P00363304), US (US00098704) web].

Tree or shrub, c. 4 m tall, dbh unknown. **Young and old branches** pubescent, hairs c. 0.5 mm long, appressed. **Leaves:** petiole 2–3 mm long, c. 2 mm in diameter, densely pubescent, hairs c. 0.5 mm long, appressed; leaf lamina 12–17.6 cm long, 4.4–8.6 cm wide, length:width ratio 2–2.8, oblong to narrowly oblong, upper side glabrous with a shiny-waxy tinge especially on younger leaves, lower side shortly pubescent, brown, hairs c. 0.5 mm long, erect, interspaced with longer hairs (c. 0.8 mm long), base cordate, apex acuminate, acumen 0.5–0.8 cm long; midrib sparsely pubescent on the upper side, pubescent on the lower side, hairs c. 0.8 mm long, appressed; secondary veins 11–14 pairs, glabrous on the upper side, pubescent on the lower side, hairs c. 0.8 mm long, appressed towards the margin of the leaf. **Inflorescences** ramiflorous on old branches, c. 4 mm long over all, composed of 1–3 rhipidia, axial internodes c. 0.5 mm long, compact; upper and lower bracts not seen. **Pedicel:** in flower c. 8 mm long, 1 mm in diameter, densely pubescent, hairs 0.5–0.8 mm long, appressed; in fruit 1.5–2 cm long, 1.5–3 mm in diameter, glabrous. **Sepals** c. 2 mm long, 4 mm wide, length:width ratio 0.5, depressed ovate, inner side glabrous, outer side sparsely pubescent, hairs c. 0.5 mm long, erect. **Outer petals** c. 2.6 mm long, 2.5 mm wide, length:width ratio c. 1, very broadly ovate, inner side glabrous, outer side pubescent, hairs 0.8–1 mm long, appressed. **Inner petals** c. 40–50 mm long, 10–20 mm wide, length:width ratio 3–4, narrowly ovate to narrowly elliptic, pubescent up to 4/5th to the apex on both sides, hairs c. 0.2 mm long, erect, glabrous at the base. **Receptacle** c. 5 mm long, c. 5 mm wide, spherical, depressed apically. **Stamens** numerous, c. 1.7 mm long,

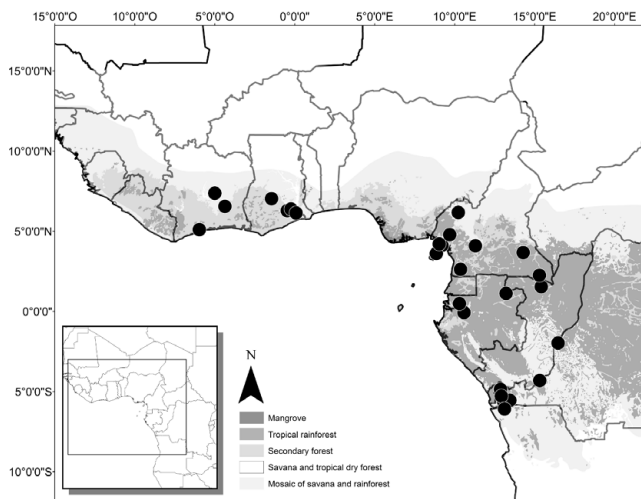


Figure 32 – Distribution of *Brieya fasciculata*.

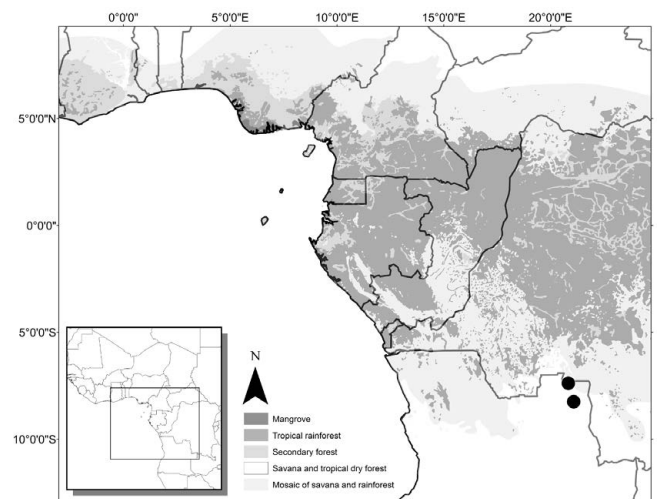


Figure 33 – Distribution of *Brieya latipetala*.

c. 1 mm wide, molar shaped, polygonal on the top. Carpels c. 4, c. 2 mm long, c. 0.8 mm diameter, oblong to narrowly oblong, tomentose outside, hairs c. 0.6 mm long, appressed, brown; ovules 8–12, biseriate; stigma 0.4 mm long, 0.8 mm in diameter, transversely broadly ellipsoid, pubescent, hairs c. 0.1 mm long. Fruit: monocarps 1(–2), 3–7.2 cm long, c. 1.5–2.2 cm wide, ellipsoid, lumpy, smooth or puncticulate, rounded at apex. Seeds not seen.

Distribution – *Brieya latipetala* is endemic to northern Angola (fig. 33).

Chorology – Element of the Congolia Domain (White 1979) of the Guineo-Congolian Region (table 2).

Habitat and ecology – The species is sporadic in humid gallery forests along rivers.

Preliminary IUCN conservation status – Critically Endangered [CR]. *Brieya latipetala* is a rare species only collected twice in very close locations northern Angola over sixty years. Its minimal area of occupancy (AOO) is estimated to be 8 km² (within the limits for Critically Endangered status under the criterion B2). *Brieya latipetala* is endemic to Northern Angola. The site where it has been collected is currently subjected to a great deal of human pressure, especially Civil war (1975–2002) and *B. latipetala* might be now extinct. However, the label of the type specimen indicates that it was collected close to the River Luachimo. Google Earth images suggest that there are still some small patches of forest along that river near the village, although it is not possible to know if these patches are secondary or not. Nevertheless, we project that the ongoing loss of its habitat will induce sever continuous decline of the AOO, the number of subpopulations and mature individuals. *B. latipetala* is therefore assigned a preliminary status of CR B2ab(i,ii,iii,iv,v).

Additional specimen studied – **Angola**: Camissombo, 20 Apr. 1949, Machado, O.X.B. 158 (LISC).

Phenology – The plant bears flowers and fruits in June.

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