Diversity of Orchids in the Gamba Complex, Gabon

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1 Introduction

In spite of the presence of 400-500 orchid species in Gabon (Stévart 2003), there have not been many studies of Orchidaceae in this country. Several publications on the flora of Gabon include Orchidaceae (Florence and Hladik 1980, Hallé 1965a, Hallé and Le Thomas 1967, 1970, Hladik and Hallé 1973, Raponda-Walker and Sillans 1961, White and Abernethy 1997). New species from Gabon were published in the Flore des Orchidaceae du Cameroun (Szlachetko and Olszewski 1998b, 2001a, b). Several articles have been published about Gabonese orchids, in particular Cribb *et al.* (1989) described *Eggelingia gabonensis* P.J.Cribb & Laan and *Ancistrorhynchus crystalensis* P.J. Cribb & Laan, from northern Gabon; Szlachetko and Olszewski (1998a) described the genus *Renzorchis* Szlach. & Olsz.; Stévart *et al.* (2003) described *Polystachya moniquetiana* Stévart & Geerinck; Stévart and Nguema (2004) described *Polystachya bipoda* Stévart, *P. lejolyana* Stévart and *P. riomuniensis* Stévart & Nguema, and Stévart and Cribb (2004) described *Tridactyle pentalobata* P.J.Cribb & Stévart. Hallé (1965b) discussed two species that are poorly known from Gabon. Biteau *et al.* (2001) published a booklet with illustrations and ecological information for 18 orchid species. Recently, several inventories of Gabon revealed 51 new species records for the country (Stévart *et al.* in press), which has greatly contributed to the knowledge of orchids here. In addition, the Flora of Orchidaceae of Gabon, by Szlachetko and Olszewski, was recently published (Szlachetko *et al.* 2004a and b).

The Gamba Complex is situated in the southwestern part of Gabon (see map page xxxii). It consists of an assemblage of protected areas with diverse landscapes and contains an important proportion of the flora and fauna of Gabon. The only publication that mentions the Orchidaceae of the Gamba Complex (Sosef *et al.* 2004) lists 28 species of Orchidaceae recorded from Monts Doudou.

The objectives of this study are 1) to compile a list of Orchidaceae for the Gamba Complex, 2) to determine the value of orchids for conserving plant diversity, 3) to evaluate the species richness of Orchidaceae in the Gamba Complex and 4) to evaluate their origins and floristic affinities.

2 Materials and Methods

2.1 Study sites

Orchidaceae were collected in two main regions within the Gamba Complex: 1) the coastal region (Gamba and Rabi localities), characterized by low relief and the presence of lowland forests, lagoons, swampy forests, and savannas, and 2) Monts Doudou, with steep slopes, situated in the interior of the country. The vegetation on Monts Doudou was described by Sosef *et al.* (2004). These authors documented the presence of submontane vegetation on the high slopes and revealed many endemic species. A thorough description of the Gamba Complex is given in Lee *et al.* (this volume).

2.2 Data sources

The floristic data presented in this chapter come from examinations of herbarium specimens of Orchidaceae from Wageningen (WAG), Libreville (LBV), Bruxelles (BRLU and BR) and Royal Botanic Gardens Kew (K). These collections have two origins: inventories undertaken by the National Herbarium of Gabon in collaboration with the University of Wageningen in the Rabi and Gamba region, as well as in Moukalaba-

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Doudou National Park (135 herbarium specimens) and collection of live plants from Rabi that are cultivated in the garden of Jean Philippe Biteau in Libreville. These latter samples were mainly collected in the frame of inventories done by Smithsonian Institution with the support of Shell Foundation and Shell Gabon. Data used in the parsimony analyses presented here pertain to the Orchidaceae flora from the Gamba Complex and nine other sites in Atlantic Central Africa from surveys conducted by Stévart (2003).

2.3 Parsimony analysis of distribution

The parsimony analysis of distribution (PAD) is a phylogenetic method, created by Rosen (1988) that uses cladistic methods to analyze biogeographic data. This method allows one to generate cladograms directly from the data on species distributions, does not require systematic studies of the taxa, and allows one to combine data on the distributions of non-related taxa (Manrique *et al.* 2003). The data used are presented in a matrix of area by species (equivalent to matrices of taxa by characters in systematics) in which the presence of a taxon in a given area is denoted with a 1 and its absence by 0. Analogous to systematics, the presence of a taxon is considered as a derived character and its absence as a primitive character. A hypothetical area in which all the taxa are absent is added in order to determine the root of the tree. This method is also called the Parsimonious Analysis of Endemicity (PAE) when one uses only taxa endemic to the region studied. The resulting cladograms show the relationships that exist between zones of endemism or between phytogeographic regions.

3 Results and Discussion

3.1 Flora

The flora of the Gamba complex includes 73 species of Orchidaceae, of which 20 (27%) are terrestrial and 53 (73%) are epiphytes (see Appendix 1). This list is based on specimens identified to species (63), as well as subspecies and varieties (10). The epiphytic genera with the most species were *Bulbophyllum* (12 taxa) and *Polystachya* (9 taxa). The richest terrestrial genus was *Eulophia* (6 taxa). In Africa, these genera are widespread and contain a high number of species.

Of the 73 taxa, 42 (28 epiphytic and 14 terrestrial) were reported from the region of Monts Doudou and 41 (32 epiphytic and nine terrestrial) in the region of Gamba and Rabi (Appendix 1). Almost 94% of the taxa documented at Gamba were found most frequently in dense lowland forest. The savannas and swampy prairies contain 8% of orchid species. Two species are restricted to the submontane and montane forests: *Angraecum* aff. *pungens* sp. nov. and *Cynorkis debilis* (Hook.f.) Summerh.

Forty-six taxa are not mentioned in Sosef *et al.* (2004). This is mainly because the data included in Sosef *et al.* (2004) for the Gamba Complex were obtained only from Monts Doudou (eastern part of the Complex). The coastal part of the complex is rich in prairies and savannas, which harbor terrestrial orchids such as *Eulophia*, and heliophilic species like *Plectrelminthus caudatus* (Lindl.) Summerh. var. *caudatus*. In addition, *Polystachya concreta* (Jacq.) Garay & Sweet was erroneously reported by Sosef *et al.* (2004). In Africa, this species is synonymous with *Polystachya tessellata* Lindl. (Geerinck 1992).

Two species collected in the Gamba Complex have never before been reported for Gabon: *Polystachya letouzeyana* Szlach. & Olsz. and *Diaphananthe plehniana* (Schltr.) Schltr. The first was thought to be endemic to Cameroon (Szlachetko and Olszewski 2001a) and the second was known only from Ivory Coast, Nigeria, and Cameroon (Perez-Vera 2003). These discoveries extend the ranges of these species to the south. These two orchids are very rare and their habitat, the lowland littoral forests, covers only a small portion of Atlantic Central Africa and is under high threat of deforestation.

3.2 Endemism

The five taxa listed below were collected in the Gamba Complex. They are endemic to the lower Guinean region. Three of them are new species and will be described elsewhere.

- *Polystachya letouzeyana* Szlach. & Olszewski
  Reported in Cameroon and Gabon (Fig. 1).
  This species seems to be restricted to the Atlantic area of the lower Guinean domain. It has never been reported from Gabon (collected by J.C. Arends, J.J.F.E de Wilde & A.M. Louis 657, BR, WAG). Unlike *Polystachya supfiana* Schltr., a clearly related species found in submontane forest of the lower Guinean domain, this species is an epiphyte in lowland forest. This species is known only from two collections and its distribution is limited. It appears to be very rare in its habitat.

- *Angraecum* sp. nov. 2 (section *Dolabrifolia)*
  This epiphytic epecies is endemic to Gabon (Fig. 1) and was found in lowland forest and swampy forest areas. This species is fairly abundant, but its distribution appears to be restricted to the Atlantic area of Gabon. The five collections made of this species come from two localities: between Kinguélé and Tchimbélé in Monts de Cristal and from Rabi, in the Gamba Complex. In addition, it has been reported from Ndjolé, along the road to Cocobeach and along the road to Airdich (J.P. Biteau, pers. comm.).
- *Diaphananthe* sp. nov. 1
  This species has been reported in Equatorial Guinea (Rio Muni) and Gabon (Fig. 1). This epiphytic species was found at low and mid altitudes (between 25-760 m). It is found in very humid mountain forests of certain inselbergs as well as in humid forests along rivers that flow through the valleys surrounding Monts de Cristal. This species has been collected four times in three different sites. Its range is limited so it may be considered a rare species.
- *Angraecum* sp. nov. 1 (aff. *pungens)*
  Reported in Equatorial Guinea (Rio Muni), Cameroon (?), and Gabon. This epiphytic species lives at mid altitudes (between 730-1100 m) in submontane vegetation along the hills of Monts Doudou and the rocky outcrops of Monte Alén. At Monte Alén, we found this species within the shrubby fringe of the outcrop, on medium-sized tree branches (between 3-5 cm) that had fallen out of the canopy. In this environment, the species was growing well and flowered several times. This species is known only from two sites and its distribution is very limited since it lives only in submontane forests, restricted to the summits of the few mountains that are found along the Central African Atlantic coast. It is thus very rare. A specimen sampled in Cameroon (Parmentier and Kouob 1936) seems to belong to this species. This species is therefore, likely to be found in Cameroon as well, but more samples are needed to verify this record.
- *Habenaria stenochila* Lindl.
  Reported in Cameroon, Central African Republic, Príncipe, and Gabon (Fig. 1). This species is found at low and mid altitudes (between 150-650 m) in a wide variety of habitats. It seems to be more common at low altitudes and in open areas along rivers,

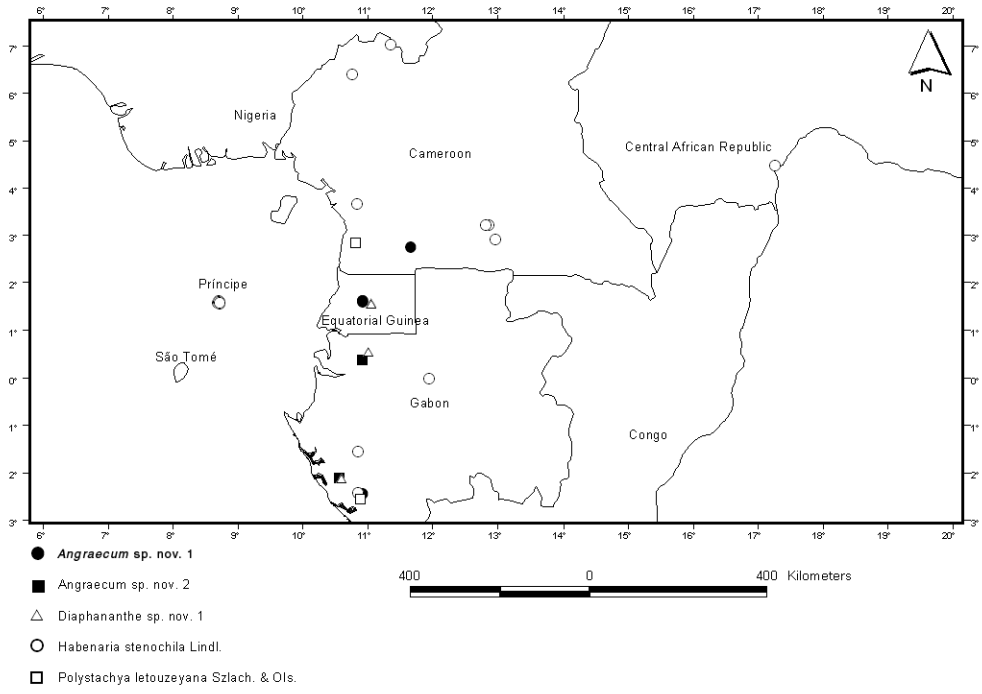

Figure 1. Distribution in Atlantic Central Africa of the five orchid species endemic to the lower Guinean region and reported from Gamba Complex.

roads and trails. In Príncipe, it is also found on tops of ridges and boulders. It is occasionally found in the understory of dense forest so it is principally terrestrial, but it is also found on rocks. This species has a wide distribution within the lower Guinean domain. It is common and has been sampled many times.

3.3. Phytogeography of Orchidaceae in the Gamba Complex

Within the Gamba Complex, the Orchidaceae found in the region of Monts Doudou and those found in the coastal zone appear to fall into two different biogeographic groups (Fig. 2). The coastal species are similar to species found near Libreville. The coastal species group differs from the continental flora, likely due to differences in climate and the presence of different vegetation types (swampy forests, savannas, etc.). The flora of Monts Doudou is more similar to the continental flora. The Orchidaceae of the Gamba Complex seem to be independent of the flora of the oceanic islands of the Gulf of Guinea (Annobon, São Tomé and Príncipe) but are similar to the flora of Bioko, which has clearly been derived from the continental flora.

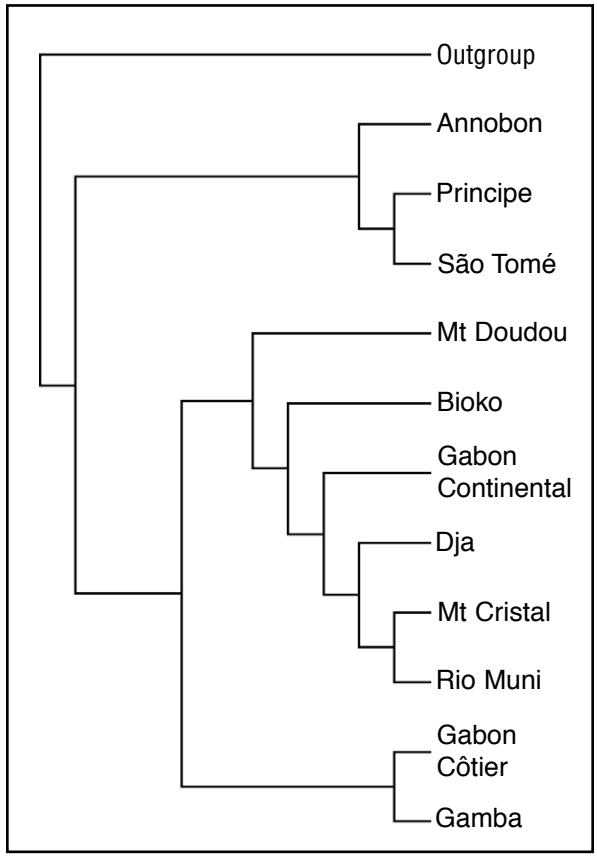

Figure 2. Cladogram obtained using PAD for 218 taxa of Orchidaceae collected in Atlantic Central Africa. Number of equally parsimonious trees = 1, L = 487, Ci = 0.44, Ri = 0.44. (GabonCôtier = coastal/littoral region of Gabon; Gamba = coastal region of the Gamba Complex; MtDoudou = Monts Doudou; GabonContinental = continental region of Gabon; Dja = biosphere reserve located in the southern and eastern provinces of Cameroon; MtCristal = Monts de Cristal; RioMuni = continental region of Equatorial Guinea).

The similarity between the orchid flora of Gamba, the Congolese domain, and the upper Guinean domain was very high (Fig. 3). These two regions, along with the lower Guinean domain (to which the Gamba complex pertains), form a homogeneous floristic ensemble called the Guinean-Congolese region (White 1979). The number of lower Guinean endemic orchid species present in Gamba is low. The low similarity of the Gamba orchid flora to the islands in the Gulf of Guinea is comparable to the low similarity between Gamba and East Africa or Kivu, areas located far from Gabon.

4 Discussion

The family Orchidaceae was reported with low conservation importance in the Monts Doudou area (Sosef *et al.* 2004), the majority of the species examined in that study had a wide distribution. However, among the 46 Orchidaceae taxa that we added in the Gamba Complex, four species could be considered important to biodiversity conservation: *Polystachya letouzeyana* Szlach. & Olsz. (endemic to Gabon and Cameroon, known only from two localities, category 1A according to the categories used by Sosef *et al.* 2004), *Angraecum* sp. nov. 1 (aff. *pungens*) (endemic to Gabon and Rio Muni, known only from two localities, category 1A according to Sosef *et al.* 2004), *Angraecum* sp. nov. 2 (section *Dolabrifolia*) (endemic to Gabon, fairly common, category 1B according to Sosef *et al.* 2004), and *Diaphananthe* sp. nov. 1 (endemic to Gabon and Rio Muni, known from three localities, category 1A according to Sosef *et al.* 2004). Considering these species, the Orchidaceae has a strong conservation value in the Gamba Complex. If we apply the method of Sosef *et al.* (2004) to the entire Orchidaceae flora of the Gamba Complex, the value of the Orchidaceae is equivalent to that of the Begoniaceae. The low value attributed to the Orchidaceae by these authors was due to the low level of species determination of the specimens used for their study (examination of the undetermined species in their collection revealed three new taxa), as well as

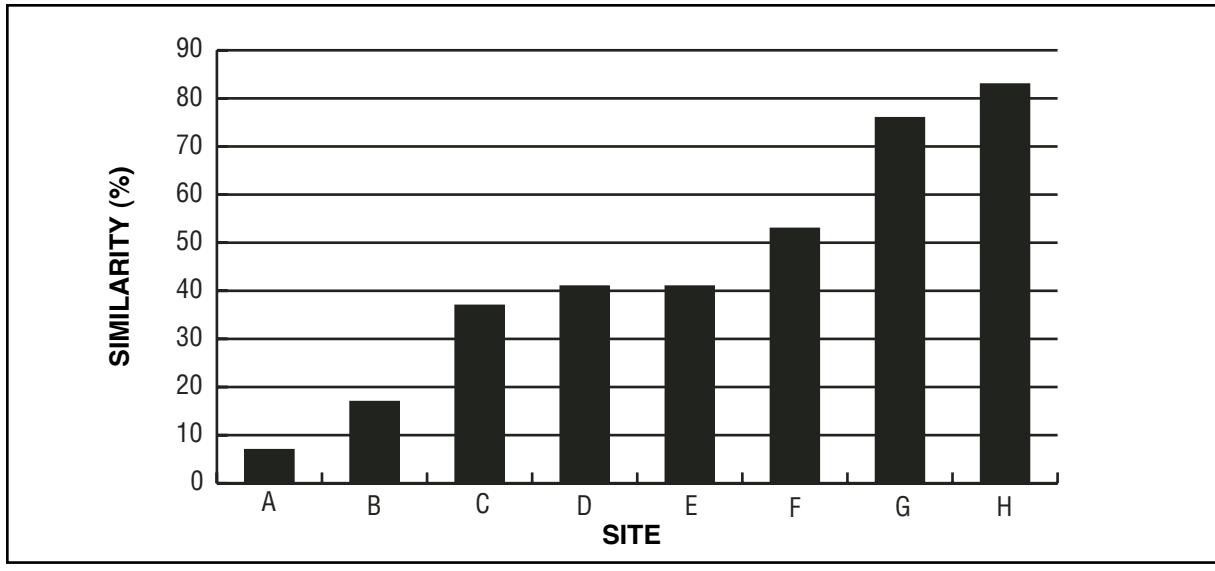

Figure 3. Similarity between the Orchidaceae flora of the Gamba Complex and the flora of other regions: (A = endemic to the lower Guinean domain; B = Sudanese region; C = Eastern portions of the Democratic Republic of Congo, Rwanda and Burundi; D = Islands of the Gulf of Guinea; E = Uganda, Kenya, Tanzania; F = South and Zambezian Africa; G = Upper Guinean domain; H = Congolese domain). The bars represent the percentage of species in common between the Gamba Complex and the different phytogeographic areas. One species may be represented in more than one area, thus the sum of the percentages is more than 100.

the paucity of knowledge available on the rare and endemic orchid species of Atlantic Central Africa.

The data used in this study come mainly from 149 herbarium specimens. This sample size is fairly low compared to other Atlantic Central African zones where more intensive surveys have been made. For example, 394 Orchidaceae specimens were collected from Monts de Cristal in Gabon (Stévart *et al.* in press) and 765 from the Dja Reserve in Cameroon (Stévart 2003). One of the difficulties inherent in studying orchids is that their identification requires fertile specimens. Most often, the samples collected in the field are sterile and in poor condition. Live cultures of orchids are thus very useful. Since most orchid species in Atlantic Central Africa are epiphytes, (73% in the Gamba Complex) they are more difficult to collect. Furthermore, several Orchidaceae genera are poorly known or are difficult to identify (for example the genus *Bulbophyllum*).

Given the area and diversity of habitats in the Gamba Complex, the likely number of orchid species is probably between that of Monts de Cristal and Rio Muni, between 126 and 192 species (Table 1). For the sites that have been intensively surveyed, the relation between species richness and area can be calculated according to Arrhenius' law (Stévart 2003, Fig. 4).

We expect to see further differences in species richness between Monts Doudou and the coastal area of the Gamba Complex. The diversity of epiphytes is almost always higher at mid to high altitudes than at low altitudes. Sosef *et al.* (2004) found an increase in plant diversity with higher altitude on Monts Doudou. The fact that we did not find higher orchid diversity on Monts Doudou than in the lower coastal area in this study is likely due to insufficient sampling.

Five species present in the Gamba Complex are endemic to the lower Guinean domain, as defined by White (1979). This number may seem low but it represents almost 10% of the Orchidaceae species endemic to Atlantic Central Africa that are recorded in Gabon.

One possible explanation for the presence of these five species is that they are paleoendemics, taxa formerly widespread across relict forest areas. Since the last dry phase in Africa during the Pleistocene, the mountain forests have moved to lower altitudes. Species usually characteristic of lowland forests were maintained in a series of forest refugia, located in the Congolese river complex and in the coastal Atlantic basins (Colyn and Gautier-Hion 1998). Another explanation is that the species are neoendemics associated with altitudinal variation in the two principal forest vegetation types in the region: lowland forest and submontane forest. In this scenario, the forest was not divided up and the coastal forest experienced a stable climate as a result of abundant precipitation (foehn effect).

Table 1. Comparison of orchid species richness with other sites (data from Stévart 2003).

Locality	Annobon	Príncipe	São Tomé	Bioko	Monts de Cristal (Gabon)	Dja Reserve (Cameroon)	Gamba Complex	Rio Muni	Gabon	Cameroon
Species Richness	19	136	104	98	126	111	73	192	400	489
Area (km2)	17	71	954	2000	4100	5210	11320	26000	257700	475000
Maximum altitude (m)	655	948	2024	3007	900	800	820	1120	1120	4070

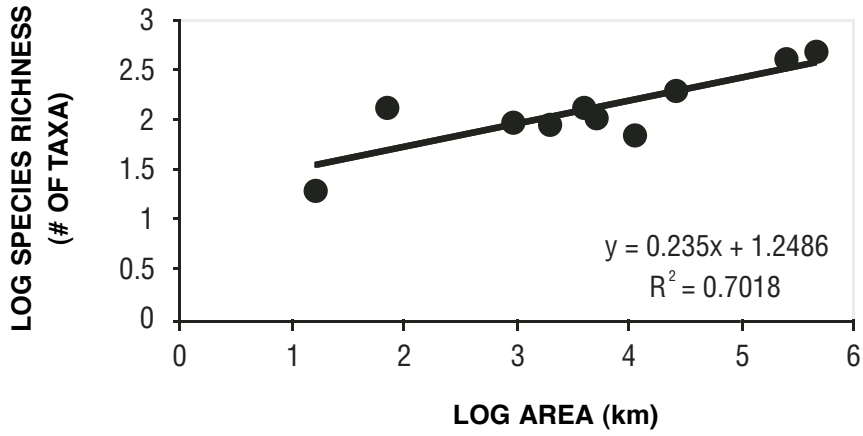

Figure 4. Relation between area (log) and species richness (log) (R2 = 0.7018, p = 0.002; data from Table 1).

5 Conclusion

With 73 taxa reported, the Orchidaceae flora of the Gamba Complex is far from being completely known. Given the area and diversity of habitats, the number of orchid species in the Gamba Complex is likely to be two to three times higher. Further inventories are needed.

Despite the low number of samples examined, our work shows that the Orchidaceae are one of the most important families for the conservation of plant diversity in the Gamba Complex. This area contains Orchidaceae from the Atlantic forests that are rare and poorly known. The diversity of Orchidaceae may be explained by historical factors and by the endemism that has resulted. The origin of the orchid flora of the Gamba Complex is linked with the flora of coastal Atlantic Central Africa which extends from the south of Cameroon to north of Congo Brazzaville.

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Appendix 1. List of Orchidaeceae present in the Gamba Complex (E = epiphyte, T = terrestrial).

Species	Reference collection	E/T	Sosef et al. 2004	Rabi and Gamba	Monts Doudou
Aerangis arachnopus (Rchb.f.) Schltr.	J.J.F.E. de Wilde & R.W. de Wilde-Bakhuizen 11330	E		X	
Aerangis calantha (Schltr.) Schltr.	F.J. Breteler, C.C.H. Jongkind, J.J. Wieringa & J.-M. Moussavou 9451	E		X	
Ancistrorhynchus capitatus (Lindl.) Summerh.	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 60	E	X	X	X
Ancistrorhynchus recurvus Finet	J.J. Wieringa 1726	E	X	X	X
Angraecum aff. aporoides sp. nov. 2	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 9848	E		X	
Angraecum aff. pungens Stévart sp. nov.	F.M. Van der Laan 1068	E			X
Angraecum affine Schltr.	T. Stévart & O.S.G. Pauwels 1871	E		X	
Angraecum aporoides Summerh.	F.J. Breteler, C.C.H. Jongkind, J.J. Wieringa & J.-M. Moussavou 9771	E		X	
Angraecum gabonense Summerh.	F.J. Breteler, C.C.H. Jongkind, J.J. Wieringa & J.-M. Moussavou 1073	E		X	
Angraecum multinominatum Rendle	F.J. Breteler, C.C.H. Jongkind, J.J. Wieringa & J.-M. Moussavou 9649	E		X	
Angraecum podochiloides Schltr.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 667	E	X	X	X
Brachycorythis macrantha (Lindl.) Summerh.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 689	T			X
Brachycorythis pubescens Harv.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 9159	T			X
Bulbophyllum barbigerum Lindl.	T. Stévart & O.S.G. Pauwels 1874	E		X	
Bulbophyllum cocoinum Lindl.	J.J.F.E. de Wilde & C.C.H. Jongkind 9650	E			X
Bulbophyllum colubrinum (Rchb.f.) Rchb.f.	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 9860	E		X	
Bulbophyllum falcatum (Lindl.) Rchb.f. var. *velutinum* (Lindl.) J.J.Verm.	J.J. Wieringa & H.M. van de Poll 1357	E		X	
Bulbophyllum intertextum Lindl.	J.M. Reitsma & B. Reitsma 1955	E	X		X
Bulbophyllum ivorense P.J.Cribb & Pérez-Vera	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 9094	E	X		X
Bulbophyllum oreonastes Rchb.f.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 70	E	X	X	X
Bulbophyllum oxychilum Schltr.	T. Stévart & O.S.G. Pauwels 1873	E		X	
Bulbophyllum pumilum (Sw.) Lindl.	J.J.F.E. de Wilde & C.C.H. Jongkind 3268	E	X		X
Bulbophyllum resupinatum Ridl. var. resupinatum	T. Stévart & O.S.G. Pauwels 1876	E		X	
Bulbophyllum saltatorium Lindl. var. *albociliatum* (Finet) J.J.Verm.	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 1975	E	X	X	X
Bulbophyllum schimperianum Kraenzl.	F.J. Breteler, C.C.H. Jongkind, T. Nzabi & J.J. Wieringa 11432	E		X	
Calyptrochilum christyanum (Rchb.f.) Summerh.	J.M. Reitsma & B. Reitsma 1727	E	X		X
Chamaeangis ichneumonea (Lindl.) Schltr.	J.M. & B.Reitsma 1716	E	X	X	X
Chamaeangis vesicata (Lindl.) Schltr.	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 9760	E		X	
Cheirostylis divina (Guinea) Summerh. var. *divina*	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 704	T			X
Cynorkis debilis (Hook.f.) Summerh.	J.M. Reitsma & B. Reitsma 1953	E	X		X

Appendix 1. *Continued.*

Species	Reference collection	E/T	Sosef et al. 2004	Rabi and Gamba	Monts Doudou
Cyrtorchis injoloensis (De Wild.) Schltr.	J.J.F.E. de Wilde & R.W. de Wilde-Bakhuizen 11378	E		X	
Cyrtorchis ringens (Rchb.f.) Summerh.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 653	E	X		X
Diaphananthe bidens (Sw. ex Pers.) Schltr.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 8994	E	X		X
Diaphananthe plehniana (Schltr.) Schltr.	X.M. van der Burgt 85	E		X	
Diaphananthe rohrii (Rchb.f.) Summerh.	J.P. Biteau & T. Stévart 33	E		X	
Diaphananthe rutila (Rchb.f.) Summerh.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 9020	E	X		X
Diaphananthe sp. nov. 1	T. Stévart & O.S.G. Pauwels 1868	E		X	
Eulophia angolensis (Rchb.f.) Summerh. var. *angolensis*	J.J.F.E. de Wilde & R.W. de Wilde-Bakhuizen 11292	T		X	
Eulophia bouliawongo (Rchb.f.) J.Raynal	J. Schoenmaker 9	T		X	
Eulophia cucullata (Afz. ex Sw.) Steud.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 1759	T			X
Eulophia euglossa (Rchb.f.) Rchb.f.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 9105	T	X		X
Eulophia gracilis Lindl.	J.J.F.E. de Wilde & R.W. de Wilde-Bakhuizen 11374	T		X	
Eulophia milnei Rchb.f. var. *milnei*	F.I. van Nek 141	T		X	
Genyorchis apetala (Lindl.) J.J.Verm.	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 9869	E		X	
Habenaria buntingii Rendle	T. Stévart & O.S.G. Pauwels 1872	T		X	
Habenaria genuflexa Rendle	F.I. van Nek 518	T		X	X
Habenaria stenochila Lindl.	J.J.de Wilde, J.C.Arends & J.de Bruijn 9100	T	X		X
Liparis deistelii Schltr.	M.S.M. Sosef, Y. Issembé & J.-M. Moussavou 737	E			X
Liparis nervosa (Thunb.) Lindl.	J.J.de Wilde, J.C.Arends & J.de Bruijn 9161	T			X
Liparis tridens Kraenzl.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 9012	E	X	X	X
Listrostachys pertusa (Lindl.) Rchb.f.	J.M. Reitsma & B. Reitsma 2831	E	X		X
Manniella gustavi Rchb.f.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 680	T	X		X
Microcoelia microglossa Summerh.	J.M. Reitsma & B. Reitsma 1688	E	X		X
Phaius mannii Rchb.f.	G.M.P.C. Le Testu 1392	T		X	X
Platycoryne paludosa (Lindl.) Rolfe	J.J.de Wilde, J.C.Arends & J.de Bruijn 9162	T			X
Plectrelminthus caudatus (Lindl.) Summerh. var. *caudatus*	J.J.F.E. de Wilde & L.J.G. van der Maesen 10924	E		X	
Polystachya adansoniae var. *stuhlmannii* (Kraenzl.) Geerinck	J.J. Wieringa 4347	E			X
Polystachya galeata (Sw.) Rchb.f.	T. Stévart & O.S.G. Pauwels 1867	E		X	
Polystachya letouzeyana Szlach. & Olsz.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 657	E			X
Polystachya paniculata (Sw.) Rolfe	J.M. Reitsma & B. Reitsma 1973	E	X		X
Polystachya polychaete Kraenzl.	J.M. Reitsma, A.M. Louis & J. de Bruijn 1006	E	X		X
Polystachya *seticaulis* Rendle	J.M. Reitsma & B. Reitsma 1954	E	X		X

Appendix 1. *Continued.*

Species	Reference collection	E/T	Sosef et al. 2004	Rabi and Gamba	Monts Doudou
Polystachya tessallata Lindl.	F.J. Breteler, C.C.H. Jongkind, T. Nzabi & J.J. Wieringa 641	E		X	X
Polystachya victoriae Kraenzl.	A.R. Verhoeff 1	E		X	
Solenangis scandens (Schltr.) Schltr.	F.J. Breteler, C.C.H. Jongkind & J.J. Dibata 10127	E		X	
Summerhayesia laurentii (De Wild.) P.J.Cribb	C.C.H. Jongkind 613	E	X		X
Tridactyle anthomaniaca (Rchb.f.) Summerh.	J.J.F.E. de Wilde & Arends, J.C.; J. de Bruijn 8995	E	X		X
Tridactyle laurentii (De Wild.) Schltr. var. *laurentii*	J.J.F.E. de Wilde & Arends, J.C.; Louis, A.M.; Wieringa, J.J. 9718	E		X	
Tridactyle tridactylites (Rolfe) Schltr.	J.C. Arends, J.J.F.E de Wilde & A.M. Louis 634	E			X
Vanilla africana Lindl. subsp. *africana*	F.J. Breteler, Y. Issembé, J.-M. Moussavou & O. Pascal 14547	T		X	
Zeuxine elongata Rolfe	J.M. Reitsma, A.M. Louis & J. de Bruijn 1088	T	X		X
Zeuxine occidentalis (Summerh.) Geerinck	Y. Issembe & M.S.M. , M.S.M., Sosef, J.-M. Moussavou, G. Nang Essouma 424	T	X		X
Zeuxine tetraptera (Rchb.f.) T.Durand & Schinz	T. Stévart & O.S.G. Pauwels 1878	T		X	
Total			27	41	42