

Taxonomy of Atlantic Central African Orchids 1. A New Species of *Angraecum* sect. *Pectinaria* (Orchidaceae) from Gabon and Equatorial Guinea

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Abstract—During a recent survey of Atlantic central African orchids, we collected four orchid specimens in Rio Muni (Equatorial Guinea) that share the general morphology of *Angraecum gabonense*, the most frequent member of *Angraecum* section *Pectinaria* in Central Africa, but differ in leaf shape and flower size. Further inspection of specimens deposited at the Wageningen herbarium and cultivated in their greenhouse led to the discovery of additional specimens from the Monts Doudou area in Gabon. Comparison with other *Angraecum* specimens indicate that these collections represent a new species, which we describe here as *Angraecum atlanticum*, the fifth species of *Angraecum* section *Pectinaria* recorded in central Africa. The new species is restricted to submontane forests covering the mountain chain situated along the coasts of Gabon and Equatorial Guinea. The distinguishing features of the species include its leaves, which are more widely spaced than *A. gabonense*, and are 2.2 mm wide; its petals and sepals, which are slightly longer than the lip; its spur, which is somewhat inflated in the middle; and its larger ovary. Information on the ecology, phenology and distribution of *Angraecum atlanticum* is presented, along with a preliminary conservation assessment using the IUCN Red List Categories and Criteria.

Keywords—Africa, conservation assessment, Monts Doudou, Rio Muni, submontane forest.

Angraecum Bory is one of the largest orchid genera in tropical Africa, with 226 species currently recognized (Govaerts et al. 2009). Its center of diversity is Madagascar and the Mascarene islands, which harbor 148 species. In Gabon and Equatorial Guinea, there are about 25 species. *Angraecum* is varied vegetatively and is well adapted to tropical habitats. Most species are epiphytes, but a few are lithophytes. According to Schlechter (1918), the genus is defined to include plants with a clinandrium deeply divided into two broad lobes with a rudimentary tooth-like rostellum in the center. The two pollinia are usually attached, through distinct but rudimentary stipites or stipe-like caudicules, either to a single viscidium or each to one of two separate viscida. The lip in *Angraecum* is almost always undivided, rarely with a short anterior lobe, enveloping the column only at the base, but with a more or less concave and spreading lamina above. The genus was first reviewed by Schlechter (1918, 1925) and then by Summerhayes (1956, 1958a, 1958b). The most recent revision (Garay 1973) recognized 19 sections, of which sect. *Pectinaria* (Benth.) Schltr. comprises species with a one-flowered inflorescence, a sessile ovary, short or nearly obsolete peduncles, and alternate, fleshy, elongated leaves with a distinct blade, or are linear. Garay (1973) listed four species from Atlantic Central Africa and five from Madagascar and La Réunion (Table 1). Since 1997, a survey of Atlantic Central African orchids has been conducted during two Ph. D. studies (Stévant 2003; Droissart 2009). Cultivation of more than 10,000 living orchid specimens in nine shade-houses situated in São Tomé, Gabon, Equatorial Guinea and Cameroon has yielded more than 4,000 fertile specimens, including material of 26 taxa that have been described as new (Stévant and Geerinck 2000; Stévant et al. 2003, Stévant and Nguema 2004; Stévant and Cribb 2004a, 2004b; Stévant

et al. 2007; Droissart et al. 2009a, 2009b), although an additional 10 or more new species still remain to be described. This paper represents the first in a new series of publications based on these collections and focusing on orchid taxonomy in this diversified geographical area. The present contribution presents a description of a new species in *Angraecum* section *Pectinaria* along with an analytical key to the central African members of the group to facilitate identification.

MATERIAL AND METHODS

The first collection of the new species was made by J. M. Reitsma et al. in Doussala (Monts Doudou, Gabon) in May 1985. A living plant was collected and cultivated in the Gabonese orchid collection at the Wageningen University greenhouse under accession number 85PTGA-039. Four herbarium specimens were then collected by F. M. Van der Laan, J. C. Arends, and T. H. J. Damen from this living plant, but the species remained unidentified. From 1999–2002, during an orchid survey undertaken by T. Stévant in the Monte Alén National Park in Equatorial Guinea, four specimens were collected and identified as a new *Angraecum* species. While preparing the checklist of Gabon (Sosef et al. 2006), inspection of specimens deposited at the Wageningen herbarium led to the discovery of the four additional specimens collected from the living plant 85PTGA-039. These collections represent a new species, which we describe here as *Angraecum atlanticum*.

The data presented are based on literature revisions and an analysis of *Angraecum* collections at BRLU compared with specimens housed at WAG, P and K (herbarium acronyms according to Holmgren and Holmgren 1998). The description presented below is based on spirit collections, although colors are given based on living material cultivated at WAG and pictures taken in the field. The distribution of other *Angraecum* species cited below is derived from Govaerts et al. (2009). The conservation status of the new species was assessed by applying the IUCN Red List Categories and Criteria, version 3.1 (IUCN 2001; IUCN and SSC 2006). Morphological studies were done using a Zeiss Stemi SV11 stereomicroscope on both dried and spirit material.

TABLE 1. List of the *Angraecum* sect. *Pectinaria* (Benth.) Schltr. according to Garay (1973).

Name	Distribution	Habitat
<i>A. atlanticum</i> Stévant & Droissart	Rio Muni (Equatorial Guinea) and Gabon	Submontane forest
<i>A. dasycarpum</i> Schltr.	Madagascar	Lowland forest
<i>A. doratophyllum</i> Summerh.	São Tomé and Príncipe	Montane and submontane forest
<i>A. gabonense</i> Summerh.	WC. Trop. Africa Cameroon to Democratic Republic of Congo	Lowland forest
<i>A. hermannii</i> (Cordem.) Schltr.	La Réunion	Montane (mesothermic) forest
<i>A. humblotianum</i> Schltr.	Madagascar	Lowland and submontane forest
<i>A. pectinatum</i> Thouars	Mascarenes, Comoros, Madagascar	Lowland forest
<i>A. pungens</i> Schltr.	Nigeria to Democratic Republic of Congo	Lowland forest and swampy forest
<i>A. subulatum</i> Lindl.	W. & WC. Trop. Africa (Ghana to Democratic Republic of Congo)	Lowland forest and swampy forest

TAXONOMIC TREATMENT

Angraecum atlanticum Stévant and Droissart, sp. nov.—
TYPE: EQUATORIAL GUINEA (RIO MUNI). Monte Alén National Park, Engong inselberg: 5 km NW from Engong village, 1°37'26"N, 10°17'49"E, 1,100 m, 20 Jul 2001, Stévant 1020 (holotype: BRLU!; isotypes: MO!, K!, WAG!).

Angraecum atlanticum ab *A. gabonense* quam labello sepalis petalisque tenuiter longioribus, calcaris medio tenuiter inflato, foliis minus imbricatis et circa 2.2 mm latis differt.

Stem pendant, branched, leafy, up to 25 cm long, 0.8 mm in diameter. Root system extensive and succulent, roots up to 0.5 mm in diameter. Leaves elliptical, fleshy, 1.8–2.2 mm wide, 10–16 mm long, curved, folded along the midvein forming a channel, apically with a sharp narrowly triangular point 2–2.5 mm long, internodes 6–7 mm long. Inflorescence short, less than 1 mm long, emerging along the stem or opposite a leaf, suberect, sessile, one-flowered; sheath brown, much shorter than the ovary. Flowers white, scented, bract one, amplexicaul, broadly ovate, apiculate, 1.8–1.3 mm long. Dorsal sepal 5.5 × 1.7 mm, elliptical, 4-nerved, concave, margins recurved in the apical half. Lateral sepals 5.5 × 1.5 mm, elliptical, 5-nerved, concave, margins recurved in the apical half. Petals 4 × 1.2 mm, elliptical, 3-nerved, concave, margins recurved in the apical half, similar in shape to the sepals. Lip 4 × 4 mm, obovate-rhomboid, when flattened, widest in the basal third, acutely acuminate distally; spur 4–4.5 × 0.8 mm, ellipsoidal, slender, straight, somewhat inflated in the middle, attenuate in the basal four fifths. Pedicel and ovary not twisted, 5 × 0.7 mm. Column short; 1 × 0.8 mm. Pollinia 2, pyriform. Figure 1.

Additional Specimens Examined—GABON. Doussala, 12 Sep 1986, Van der Laan 1068 (WAG); *ibid.*, 28 Aug 2006, Damen 183 (WAG); *ibid.*, 1995, Musampa-Nseyi s. n. (WAG); 30–65 km SSW-SW of Doussala, Doudou Mountains, 7 Jun 1992, Arends 836 (WAG).

EQUATORIAL GUINEA (RIO MUNI). Monte Alén National Park, Engong inselberg, 5 km NW from Engong village, 1°37'26"N, 10°17'49"E, 1,100 m, 11 May 2002, Parmentier & Esono 2842 (BRLU); *ibid.*, 21 Jul 2001, Stévant 1008 (BRLU); *ibid.*, 20 Jul 2001, Stévant 1077 (BRLU); *ibid.*, 1 Aug 1999, Ndong Bokung & Stévant 25 (BRLU).

Distribution—*Angraecum atlanticum* occurs in Atlantic Central Africa (Fig. 2) and has only been recorded to date from the Engong inselberg in the Monte Alén National Park in Rio Muni (Equatorial Guinea) and Doussala in the Doudou Mountains in Gabon. The distribution of this species corresponds to the Atlantic Sector of the Lower Guinea Domain (Senterre 2005), which is the coastal part of the Lower Guinea Domain as defined by White (1979).

Habitat and Ecology—*Angraecum atlanticum* is found in submontane vegetation rich in epiphytes. In Rio Muni (Equatorial Guinea), it occurs in high submontane forest rich in Burseraceae (mainly represented by the genus *Dacryodes*

Vahl), where it was found growing in the shrubby fringe of an inselberg as an epiphyte on branches among bryophytes and *Stolzia* sp. (Fig. 3). The medium-sized tree branches (between 3–5 cm diameter) from which the specimens were collected had fallen out of the canopy. In this environment, the new species was growing well since the plant was flowering each time we visited the site during three years. The altitude range of the species was estimated as around 600 m in Gabon and 1,100 m in Equatorial Guinea.

Phenology—Flowering in May, and from July to September.

Etymology—The specific epithet refers to the distribution of the novelty which appears to be restricted to submontane vegetation on the upper slopes of the mountains situated close to the Atlantic coast of Atlantic central Africa.

Cultivation—Two specimens of *A. atlanticum* are grown in the WAG greenhouse, mounted on slabs of tree fern fiber

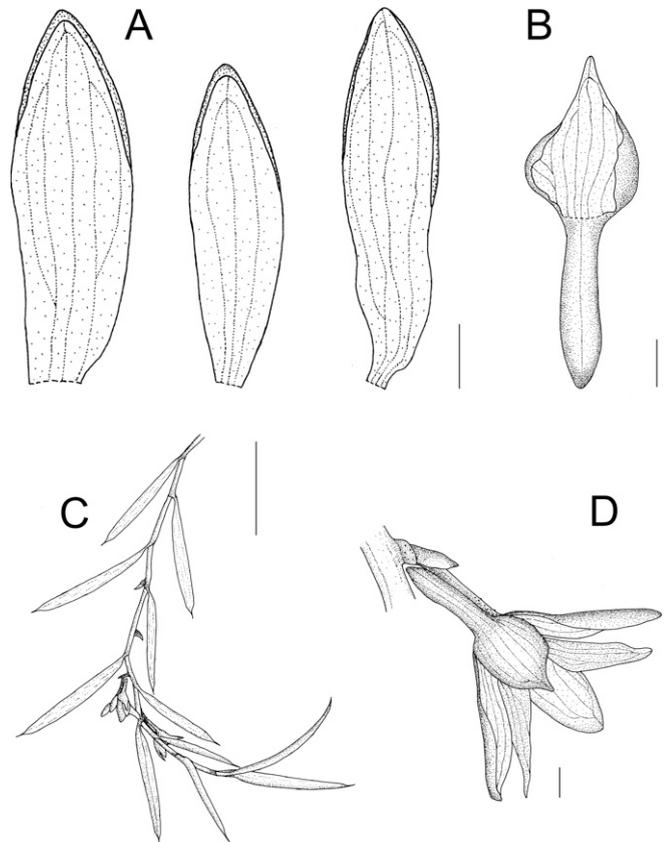
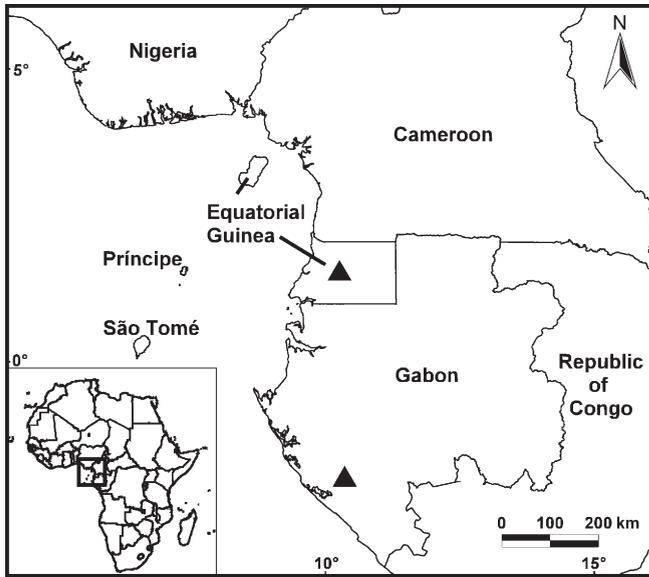


FIG. 1. *Angraecum atlanticum*. A. (left to right) Dorsal sepal, petal, lateral sepal. B. Lip and spur. C. Stem and leaves. D. Flower. Bars. 1 mm (A, B & D), 1 cm (C).



▲ *Angraecum atlanticum* Stévert & Droissart

FIG. 2. Distribution of *Angraecum atlanticum* in Atlantic Central Africa.

in a humid, semishaded environment, one facing south and the other north. The minimum greenhouse temperature is 21°C during the day and 16°C at night. When outside radiation reaches 500 W/m² a shade screen is closed. During the summer, plants are misted over each morning, and in winter every other day.

Conservation Status—*Angraecum atlanticum* is known only from two localities. Further exploration is needed to find more locations for this species. It is to be hoped that more plants and new sites for *A. atlanticum* will be located in the future. While additional field work may reveal more populations of this plant, the localities where it has been collected are situated in two protected areas, Monte Alén National Park in Equatorial Guinea and Moukalaba Doudou National Park in Gabon, at sites that are difficult to access and do not appear to be under pressure from logging. Since the two known populations of *A. atlanticum* occupy an area of less than 20 km², we assign the species a provisional status of Vulnerable (VU D2)

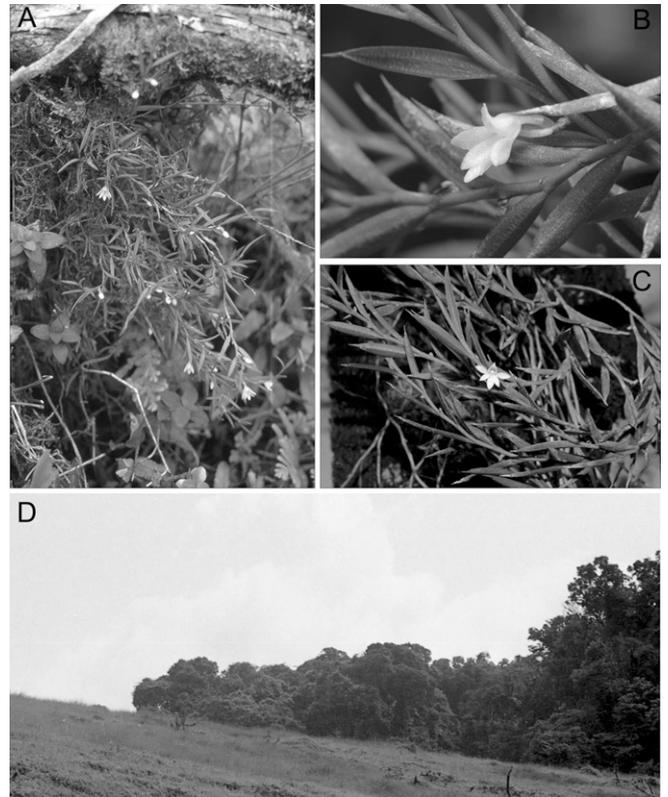


FIG. 3. *Angraecum atlanticum*. A. In the wild in Equatorial Guinea. B–C. Culture at WAG, habit and flower. D. Type locality: forest fringe of the inselberg of Engong (Equatorial Guinea).

based on the IUCN (2001) Red List criteria, at least until other populations are found. According to observations made in Monte Alén, this species seems to be uncommon in this habitat. Moreover, submontane vegetation occupies small patches of forest reported from 600–1,200 m on isolated mountains distributed along Atlantic central Africa oceanic coast. Given the distribution of *A. atlanticum*, it is very likely that this species is also present in the Monts de Cristal and the Massif du Chaillu in Gabon and in the Ngovayang and Akom II forest area in southern part of Cameroon.

KEY TO ATLANTIC CENTRAL AFRICAN *ANGRAECUM* SECT. *PECTINARIA*

The following key is provided to facilitate distinguishing the new species described here from the five other members of *Angraecum* sect. *Pectinaria* that occur in Atlantic central Africa. These species can easily be distinguished from one another by leaf characteristics, but also by their habitat and distribution.

1. Leaves subulate-terete, more or less falcate, 3–13 cm long, 1–2.5 mm wide; sepals about 4 mm long; lip boat-shaped, broad when flattened out *A. subulatum* 2.
1. Leaves oblong-lanceolate, flattened, fleshy, 1.1–4.5 cm long, 2–6 mm wide; sepals 6–11 mm long; lip much broader than long 3.
2. Leaves 2.5–4.5 cm long, 3–6 mm wide 3.
3. Lip slightly trilobed, apex acute; mouth of the spur small, spur straight, 4–5 mm long; Continental Africa (Nigeria to Democratic Republic of Congo) *A. pungens*
3. Lip entire, apex acuminate; mouth of the spur wide, spur sharply recurved near the middle, 13–14 mm long; endemic to São Tomé and Príncipe *A. doratophyllum*
2. Leaves 1.1–2 cm long, 2–4 mm wide 4.
4. Petals and sepals slightly longer than the lip; spur somewhat inflated in the middle; internodes 6–7 mm long, leaves 2–2.5 mm long, up to 2.2 mm wide, with a sharp narrowly triangular point; submontane forest, Gabon and Equatorial Guinea (Rio Muni) *A. atlanticum*
4. Petals and sepals more than two times longer than the lip; spur inflated beyond the middle; internodes 2.5–5 mm long, leaves 1–1.5 mm long, up to 3.5 mm wide, with a sharp triangular point; lowland forest, continental Africa (Cameroon to Democratic Republic of Congo) *A. gabonense*

DISCUSSION

Angraecum atlanticum was discovered by the first author during a fieldtrip to the Engong inselberg in the Monte Alén National Park (Equatorial Guinea). It was immediately distinguishable from *A. gabonense*, which it most closely resembles, by its narrower leaves held almost parallel to the stem. By contrast, the leaves of *A. gabonense* are oblique to the stem. Sterile material tentatively referred to this species (Parmentier and Kouob 1936) was erroneously recorded from Cameroon by Droissart et al. (2006) as *A. atlantica* Stévant inédit. and as *A. sp. nov.* 1 (aff. *pungens*) by Stévant and Droissart (2006). Comparison with dried specimens of *A. atlanticum* clearly shows that it belongs to *A. gabonense*. The distribution of *A. atlanticum* is therefore limited to Equatorial Guinea and Gabon, although it certainly could be expected in the region of South Cameroon, where its preferred habitat, submontane forest, can be found in the Ngovayang and Akom II forest areas. *Angraecum atlanticum* is the seventh endemic orchid species that was found in submontane forests of west central Africa (Droissart 2009). According to this author, these fragmented blocks of primary forest could be considered a unique area of endemism characterized by a rich endemic flora that strongly differs from the lowland forest.

The presence of narrowly elliptical and fleshy leaves in several species belonging to sect. *Pectinaria* suggests that they may be adapted to dry microhabitats, such as the highest part of the canopy. A living plant was collected by J. M. Reitsma et al. in Doussala (Monts Doudou, Gabon) in May 1985 and cultivated in the Gabonese orchid collection at the Wageningen University Greenhouse under accession number 85PTGA-039. It seems that all herbarium specimens deposited at WAG were collected from this living specimen which is still present in the WAG greenhouse. However, information on herbarium specimens is somewhat uncertain, although they appear to refer to the same location. Specimens *Van der Laan 1068*, *Damen 183*, *Musampa-Nseyia s. n.* all give the locality as "Doussala," while the *Arends 836* specimen is more precise: "30–65 km SSW-SW of Doussala." The latter corresponds precisely to the locality where the cultivated specimen (1985PTGA039) was collected. All these Gabonese herbarium specimens of *Angraecum atlanticum* were cited as *A. atlantica* by Sosef et al. (2006). All specimens from Equatorial Guinea were collected in the field and were gathered over nearly a three year period from the same fallen branches in the shrubby fringes of the Engong inselbergs. Recent studies of angraecoid orchids based on vegetative anatomy and morphology (Carlsward et al. 2006b) as well as molecular data (based on ITS, *trnL*, *trnL-trnF*, and *matK*, *rps16*; Carlsward et al. 2006a; Micheneau et al. 2008) suggest a polyphyletic origin for *Angraecum* as well as for some of its sections. Results based on samples of four species of sect. *Pectinaria* suggest that members of this group appear to be polyphyletic, with species from Madagascar and those of continental Africa placed in different clades. Further molecular studies are thus needed to clarify relationships in the genus.

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