



Aerangis (Orchidaceae) in Madagascar, the Mascarenes, and the Comoro Islands

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Summary. The genus *Aerangis* Schltr. (Orchidaceae, subfamily Epidendroideae, tribe Vandeeae, subtribe Angraecinae) in Madagascar and adjacent archipelagos is revised. Twenty-seven species have been recorded from the region, all of them endemic. Twenty of these are endemic to Madagascar, three to the Comoros only, three to the Comoros and Madagascar and one to Madagascar and Réunion. A third of all *Aerangis* in the area were assessed to be immediately endangered with 15% Critically Endangered (CR) and 18.5% Endangered (EN). 37% are considered Vulnerable (VU), 15% Near Threatened (NT) and 11% are of Least Concern (LC). Section *Microterangis* (Schltr.) Hermans is newly established. All the species are described and their typification, history, identification, pollination, distribution and habitat are discussed. The nomenclature and identity of *Aerangis citrata* (Thouars) Schltr., *A. cryptodon* (Rchb.f.) Schltr., *A. ellisii* (B.S.Williams) Schltr., *A. hildebrandtii* (Rchb.f.) P.J.Cribb & Carlsward, *A. ikopana* Schltr., *A. modesta* (Hook.f.) Schltr., *A. monantha* Schltr., *A. polyura* (Sander ex Mast.) Hermans and *A. rostellaris* (Rchb.f.) H.Perrier, are reassessed. Conservation assessments, illustrations and distribution maps are included for all the species. A checklist of the sections, species and a key to their identification are provided. *Aerangis bursiculata* Hermans is described from the Comoros for the first time.

Key Words. Conservation assessments, Identification, Morphology, New species, Revision, Section *Aerangis*, Section *Microterangis*, Taxonomy.

Introduction

Many species in the orchid genus *Aerangis* are horticulturally desirable and were therefore much sought after in the late 19th century by commercial collectors, such as Curtis, Hildebrandt and Humblot, and missionaries, including Baron, Ellis and Fox, mainly for cultivation by European nurseries (Bull, Low, F. Sander & Co, Veitch & Sons) and wealthy orchid enthusiasts. They relied to a great extent on H. G. Reichenbach f. (1823 – 1889) to identify and name them. The plants were often from unspecified origin and most specimens sent to Reichenbach comprised just a few flowers, sometimes from different sources. This meant that many species were poorly defined, which has led to subsequent confusion. Later authors were denied access to Reichenbach's herbarium between 1889 and 1914, due to a clause in his will, or failed to compare novelties with type material for other reasons; this led to several misapplied names in taxonomic works by Finet, Schlechter, Perrier de la Bâthie (Perrier henceforth) and in horticulture, as discussed below. Reliable taxonomy is the basis of good phylogenetic interpretation and for the study of biodiversity and conservation, it was therefore essential to review the various

protologues, illustrations and herbarium collections to establish the true identity of every species.

The genus belongs to the Angraecoid orchids, a name commonly used for predominantly Afro-Madagascan plants in the subtribe Angraecinae, which is characterised by monopodial growth, leaves in two rows, and white or pale flowers with a lip often with an elongate spur.

Stewart (1979) revised the mainland African species of *Aerangis* more than 40 years ago and more recently published some of her studies of those from the West Indian Ocean (Stewart 1986a – d; Stewart 2006 and Stewart *et al.* 2006). This unfinished work was updated by la Croix (2014, 2022) and by floras and checklists for the area (Du Puy *et al.* 1999; Hermans *et al.* 2007; Cribb & Hermans 2009; Bosser & Lecoufle 2011 etc). As part of the work on *Angraecoid Orchids* (Stewart *et al.* 2006) the first author was given access to Stewart's notes and has since added further material and interpretation to finally complete this much-needed monograph.

Correct identification of *Aerangis* species is generally straightforward but one should consider the variability in size of the flowers and spur, as discussed under

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A. ellisii (B.S.Williams) Schltr. and others. The stage of development of the flowers also needs to be taken into account, with the corolla often strongly reflexing sometime after opening, individual segments can also reflex with age and, in some species, any colouration can become more intense. The shape of the rostellum is variable, even within a single species and on one inflorescence, and can change shape and can become more curved as it develops. A significant feature in some species, including *A. articulata* (Rchb.f.) Schltr., *A. modesta* (Hook.f.) Schltr. and *A. spiculata* (Finet) Senghas, is the distinct pseudo-pedicel forming a conical projection at the junction of the rachis and pedicel, often partly covered by the floral bract.

Material and Methods

This revision is based on work during the last 30 years on the orchid flora of Madagascar and neighbouring islands. Over this time, photographs of West Indian Ocean herbarium specimens (including BM, BR, BRLU, CBNM, CGE, DUB, E, G, HEID, K, L, M, MARS, MAU, MO, P, REU, SZU, TAN, TEF, W, WAG, WU, M, SZL, ZSS) were systematically examined, databased and interpreted. Where necessary, the critical specimens, notably the type collections, have been dissected and drawn. This archive now contains over 3500 records for *Aerangis*. In addition, an extensive bibliography on the orchid flora of the region by J. & C. Hermans (in Du Puy *et al.* 1999, updated in Hermans *et al.* 2007), has been kept up-to-date and now contains over 2400 references, and has been an invaluable resource for this work.

An updated checklist was compiled as the basis for this review. New descriptions, including information on distribution, habitat, elevation etc. were prepared for all the species. Most of the authors have visited many type and other localities during extensive field-work in Madagascar and the Mascarenes.

Initially a provisional key to the species was prepared and all the unidentified herbarium specimens and photographic records were then identified and named; one being recognised as new. A few proved to be impossible to identify because of their poor condition or missing parts. Landy Rajaovelona provided the detailed preliminary Conservation assessments. Jean-Michel Hervouet extracted the locality information and constructed distribution maps for each species. Photographs and/or drawings or references are provided for all species accepted in this revision. Because of the importance of having reliably identified voucher references for any further phylogenetic or taxonomic work, all the available herbarium material is listed under each species. Unless otherwise stated, all listed specimens have been seen by at least one of the authors. For clarity, a summary of easily recognisable characteristics has been added for each species.

Species were circumscribed by combinations of clearly defined morphological features of the plant, inflorescence and individual flower structure, especially, shape of the rachis, pseudo-pedicel, spacing of the flowers, size and shape of the floral bracts, lip structure, relative length of the spur and the shape of the rostellum and anther. Habitat and distribution were also taken into account.

Abbreviations of titles of periodicals and books are according to Botanico-Periodicum-Huntianum, Harvard University Index of Botanical Publications and the Kew World Checklist of Selected Plant Families (WCSP 2022) and citation of taxonomic literature follows (Stafleu & Cowan 1976 – 1988). Authors of taxa are abbreviated according to Brummitt & Powell (1992), abbreviations of herbaria follow *Index Herbariorum* (Holmgren *et al.* 1990). The most relevant literature references for each species have been included; especially those with an illustration, description or particular significance. Initials of collectors were only used when there was a possibility of confusion. Classification of vegetation zones broadly follow Gautier *et al.* 2018. Nomenclatural synonyms are listed in date order, as are literature references and herbarium specimens.

Lectotype or neotypes have been designated where necessary, holotypes being recognised when one particular specimen was indicated by the author in the protologue as the type and/or used by the author when no type was indicated; this follows the International Code of Nomenclature (Wiersema *et al.* 2018) while also taking into account McNeill (2014: 1112).

Unlike some descriptions in the literature, overall plant size given does not include the inflorescence because habit was considered a more useful characteristic. Inflorescences are often disproportionate to the plant and more variable than the vegetative parts of the plant.

Measurements: definitions used for plants are as follows: small; < 5 cm; medium > 5 cm < 15 cm; large > 15 cm. For flowers: very small; < 8 mm; small > 8 mm < 15 mm; medium > 15 mm < 25 mm; large > 25 mm. Measurements are mainly based on dried herbarium material.

History, taxonomy and phylogeny of *Aerangis*

In 1809, Louis Marie Aubert-Aubert du Petit-Thouars (henceforth Thouars) described the first species in the genus from Madagascar as *Angraecum citratum*, or *Angorkis citrangis* using his alternative nomenclature, and illustrated it in 1822.

The genus *Aerangis* was established by Reichenbach (1865: 190) based on the tropical African *Aerangis flabellifolia* and distinguished from the allied *Angraecum* Bory by the shape of the rostellum and caudicle. However, Reichenbach and other 19th century authors failed to use this generic name for any of the

Madagascan or Comorian species, classifying them instead in *Angraecum* for the larger flowered species or *Saccolabium* Blume for the smaller ones.

Reichenbach first described *Aerangis articulata*, *A. hildebrandtii* (Rchb.f.) P.J.Cribb & Carlswald, *A. hyaloides* (Rchb.f.) Schltr., *A. fastuosa* (Rchb.f.) Schltr., *A. fuscata* (Rchb.f.) Schltr. and *A. cryptodon* (Rchb.f.) Schltr. He also named *A. ellisii* but Williams included the novelty in his Manual of 1871 first. All were newly imported and cultivated plants from Madagascar and the Comoros, several of them collected by Léon Humblot.

Following Reichenbach, Hooker described *Aerangis modesta* in 1883, Ridley *A. rostellaris* (Rchb.f.) H.Perrier in 1885, Rolfe *A. xprimulina* (Rolfe) H.Perrier in 1890b and Sander introduced *A. polyura* (Sander ex Mast.) Hermans in 1892; all again from recently imported cultivated plants and all first described in *Angraecum*. Reichenbach and other botanists sometimes received specimens of the same species from different nurseries and amateur growers, often leading to superfluous names, including: *Angraecum descendens* Rchb.f. in 1882a and *A. calligerum* Rchb.f. in 1887b (= *Aerangis articulata*), *Angraecum dubuyssonii* God.-Leb. in 1887 (= *Aerangis ellisii*), *Angraecum boutoni* Rchb.f. in 1881a and *Saccolabium humblotii* Rchb.f. in 1885b (= *Aerangis hildebrandtii*), *Angraecum sanderianum* Rchb.f. in 1888 (= *Aerangis modesta*), *Angraecum mooreanum* T.Lawr. ex Mast. in 1897 (= *Aerangis polyura*), *Angraecum rostellare* Rchb.f. in 1885a, *A. avicularium* Rchb.f. in 1887c, *Angraecum stylosum* Rolfe in 1895, *A. fournierae* André in 1896 and *Angraecum metallicum* J.H.Veitch ex Wynne in 1896 (= *Aerangis rostellaris*). Reichenbach also confused *Aerangis fuscata* and *A. spiculata* and he obviously experienced difficulties identifying some of these cultivated plants; when describing *Angraecum descendens*, he complained that: “My position is, however, a very weak one. Mr Low sent me twice inflorescences, and they are so widely distinct one from another that one might hesitate when seeing them both aside” (Reichenbach 1882a: 558). He was undoubtedly under some pressure to name these desirable ‘novelties’ to satisfy the burgeoning commercial trade in orchids.

This confusion was perpetuated in later orchid literature where several species, notably *Aerangis articulata*, *A. cryptodon*, *A. ellisii*, *A. modesta* and *A. polyura* have been misinterpreted. These and other species of medium size are vegetatively similar. Nurserymen frequently sold plants under incorrect names and these mistakes often remained undetected by growers and editors, and thus plants came to be illustrated and listed under incorrect names. It was fortuitous that John Day (1863 – 1887) illustrated several of the key cultivated species in his *Scrapbooks*, now kept at K.

Finet (1907), in his review of the African Sarcanthinae, created the new genus *Rhaphidorrhynchus* for

Angraecum species with a concave clinandrium with raised membranous margins and an elongate rostellum with the pollinia attached to a single tegula and he placed several *Aerangis* species from the Madagascan region in his new genus (*Aerangis citrata* (Thouars) Schltr., *A. fastuosa*, *A. modesta*, *A. stylosa* (Rolfe) Schltr., *A. umbonata* (Finet) Schltr.), together with mainland African *Aerangis* and species now belonging in other genera, he also included his new species *Rhaphidorrhynchus spiculata* Finet (= *Aerangis spiculata*) based upon a Humblot collection.

Schlechter (1913), in the first instalment of the accounts of Perrier’s Madagascan collections, described *Aerangis divitiflora* (Schltr.) P.J.Cribb & Carlswald, *A. macrocentra* (Schltr.) Schltr., *A. oligantha* (Schltr.) P.J.Cribb & Carlswald (now *A. lacroixiae* J.M.H.Shaw) and *A. pulchella* (Schltr.) Schltr., all as *Angraecum*. In his new classification of the Afro-Malagasy Angraecoid orchids, Schlechter (1918) recognised 32 genera, and originally proposed the subtribes Angraecinae and Aerangidinae but failed to validate them. He established the new genus *Chamaeangis* Schltr. together with sect. *Microterangis* Schltr. for the small-flowered western Indian Ocean species. He resurrected Reichenbach’s *Aerangis* with sect. *Eu-Aerangis* for the species with an extended column and a common stipe and transferred many taxa to it. In the third instalment on Perrier’s collections, Schlechter (1925) added *Aerangis monantha* Schltr. and *A. ikopana* Schltr. to the Madagascan flora; many of his species were illustrated posthumously in Mansfeld (Schlechter 1932). During most of Schlechter’s time, Reichenbach’s herbarium was unavailable for study, being locked up in Vienna under the terms of Reichenbach’s notorious will (Bräuchler *et al.* 2021: 302), there also is no evidence that the herbarium at Kew was consulted. This meant that some of the species Schlechter described, including *Aerangis malmquistiana* Schltr. (= *A. cryptodon*), *A. pumilio* Schltr. (*A. hyaloides*) and *A. crassipes* Schltr. (= *A. modesta*) were already well established under a different name. Schlechter (1925: 389 – 390) listed several “*Aerangis* (?) nov. spec.” based on Perrier’s herbarium material but none have been located and many may have been lost.

Following Schlechter’s death, Perrier (1938a, b) described his own collections and those of other French explorers in Madagascar, culminating in his orchid accounts for the *Flore de Madagascar* (Perrier 1939, 1941). He too, never saw the type material at Vienna (W) and Kew (K) and, as a consequence, misapplied several names, including *Aerangis cryptodon* and *A. stylosa*, he misunderstood *A. ellisii* and *A. articulata*, and described several new species which can no longer be regarded as distinct, including *A. alata* H.Perrier (= *A. cryptodon*), *A. anjouanensis* H.Perrier (= *A. polyura*) and *A. clavigera* H.Perrier (= *A. macrocentra*). He correctly

added four species to the Madagascar flora: *Aerangis pallidiflora* H.Perrier collected by François; *A. concavipetala* H.Perrier and *A. decaryana* H.Perrier collected by Decary; and *A. coursiana* (H.Perrier) P.J.Cribb & Carlsward (as *Chamaeangis*) collected by Cours.

Summerhayes (1966) circumscribed and validated Schlechter's subtribes Angraecinae and Aerangidinae, with *Aerangis* Rchb.f. as the type of the latter, the division being based on rostellum shape and chromosome number (generally, $n = 25$ for Aerangidinae and $n = 19$ for Angraecinae).

Senghas (1983) described *Aerangis seegeri* Senghas from a plant collected by Rauh and himself, the species being already known in the 19th century as *Angraecum nummularium* and illustrated by Day in 1887 but never validated. Senghas (1985) separated the Madagascar and Comorian species previously ascribed to *Chamaeangis* to his new genus *Microterangis*, which he distinguished by the structure of the pollinarium and differentiated it from *Aerangis* by the smaller yellow, green or orange flowers rather than predominantly white flowers. Senghas (1986) also divided *Aerangis* s.s. into subgenus *Uniflorae* Senghas for species with one or rarely two flowers and an articulate pedicel and subgenus *Aerangis* (informally “*Pluriflorae*”) with more flowers and the pedicel lacking articulation. These subgenera are difficult to circumscribe and there could be a case for a section to include few-flowered species such as *Aerangis bovicornu* Hermans, *A. fastuosa*, *A. fuscata*, *A. monantha* and *A. punctata* J.Stewart but both *A. fastuosa* (chosen as the subgenus type by Senghas) and *A. fuscata* can have up to five flowers, and an articulate pedicel is by no means unique to the subgenus. Further phylogenetic work is needed to clarify the subdivision of the genus and therefore only two sections, not corresponding to Senghas' subgenera, are recognised here.

Hillerman & Holst (1986), in their popular illustrated treatise on the Angraecoid orchids, including *Aerangis*, almost exclusively used the nomenclature of Perrier and perpetuated some of the erroneous interpretations outlined above.

The most significant contribution to the nomenclature and popularisation of *Aerangis* s.s. in recent times has been by Joyce Stewart; starting with a monograph of *Aerangis* from mainland Africa (Stewart 1979), followed by a series of articles on the species from Madagascar and the Comoros in the *Bulletin of the American Orchid Society* (Stewart 1986a–d), including the description of the new *Aerangis punctata*, an illustrated checklist in *Orchid Digest* (Stewart 2006) and culminating in the *Angraecoid Orchids* (Stewart *et al.* 2006). Her interpretation was followed to a great extent by subsequent treatments and floras (Du Puy *et al.* 1999; Hermans *et al.* 2007; Cribb & Hermans 2009; Bosser & Lecoufle 2011; la Croix 2014 & 2022; Hervouet 2018).

Szlachetko (1995) subdivided the Afro-Malagasy Angraecoid orchids into six subtribes, including Aerangidinae, containing *Aerangis*. These subtribes were mainly based on column morphology, in particular rostellum and pollinarium structures. Szlachetko & Olszewski (2001) recognised three sub-genera: subgen. *Aerangis* for most species from Africa and the Madagascar area, subgen. *Barombia* (Schltr.) Szlach. & Olszewski for a single African species and subgen. *Uniflorae* for a few Madagascan species, as defined by Senghas (1986).

Based on phylogenetic analyses for a limited number of species, Chase *et al.* (2003) recognised Angraecinae and Aerangidinae. In the most recent molecular phylogenetic analyses of Vandaeae (Carlsward *et al.* 2006; Micheneau *et al.* 2008), Szlachetko's subtribes were found to be individually polyphyletic, but together they formed a well-supported clade. Therefore, Carlsward *et al.* (2006) proposed recognising a broadly circumscribed subtribe Angraecinae that included all other previously named angraecoid subtribes of Vandaeae. They also examined the root and leaf anatomy of several species and included several *Aerangis* and *Microterangis*, in their DNA analysis of Vandaeae; *Microterangis* species were found to be nested within *Aerangis* and sister to *Aerangis punctata*. From this, and from similarities in column structure, it was concluded by Cribb & Carlsward (2012) that *Microterangis* are small-flowered species of *Aerangis* that evolved in the Comoros or northern Madagascar from a common ancestor of the larger-flowered Malagasy *Aerangis*.

Several contributors in Pridgeon *et al.* (2014: 344–349) provided a general overview of the genus, including a description, anatomy, distribution, palynology, cytogenetics, phylogenetics and ecology as part of *Genera Orchidacearum*.

la Croix monographed the genus in 2014 with the nomenclature of the Madagascan species broadly based on Stewart *et al.* (2006) but with *Microterangis* included in *Aerangis*. This work has recently been re-issued (la Croix 2022).

In the latest overview of the classification of Orchidaceae Chase *et al.* (2015) updating Chase *et al.* (2003), Aerangidinae have been included in Angraecinae and *Microterangis* is confirmed to form part of *Aerangis*.

Aerangis bovicornu Hermans, an unusual species related to *A. fastuosa* was added to the Madagascan flora by Hermans (in J. Hermans *et al.* 2021).

Pollination and Scent

The pleasant evening or night fragrance of *Aerangis* flowers has been recorded for several species; Day (1887: t. 57) writing about *A. articulata* and *A. ellisii* noted: “this has not much scent — very little indeed, except at night, but I have notes in my remarks on *A. ellisii* that the perfume of that was so strong that a single bloom was almost overpowering and like *Gardenia*

— but as I draw all my orchids by gaslight then that was its most fragrant time.” *Aerangis ikopana* was said to be scented of roses (Bossier 17386 P) and *A. seegeri* of sandalwood (Hermans 5386 K).

Kaiser (1993: 130–134) analysed the chemical composition of the evening scent of several African *Aerangis*, including *A. fastuosa* from Madagascar. Veitch & Grayer (2014: 345) summarised research on the chemical composition for the floral fragrances of *Aerangis*.

Nilsson *et al.* (1987) studied the pollination of several Angraecoid orchids by hawkmoths in Central Madagascar, including *Aerangis monantha* (as *A. fuscata*) which was visited by *Panogena lingens* Butler, whilst the pollination of *Aerangis articulata* remained unknown since no pollen vector was found. They also explained the pollination mechanism in *Aerangis* which is different from other Angraecoid genera, this work was also reproduced in Arditti (1992: 474). Nilsson & Rabakonandrianina (1988) made a detailed study of the pollination of *Aerangis ellisii* growing on inselberg in central Madagascar and showed that the principal pollinators were the hawkmoths *Agrius convolvuli* and *Panogena lingens* and also found that the nectar in the spur of *Aerangis ellisii* was also accessible to long-proboscis hawkmoths which are unable to act as pollinators. Nilsson’s work on *Aerangis* pollination was summarised by van der Cingel (2001: 156).

Martins & Johnson (2007) and Koopowitz & Marchant (1998), studied pollination of mainland African species and also analysed their nectar.

Pridgeon *et al.* (2014: 349) outlined current research on pollination in the genus; all species for which pollinators have been established are pollinated by hawkmoths.

Conservation status

Using the IUCN Red List Categories and Criteria (IUCN 2012), we produced preliminary risk of extinction assessments for each species. In order to gather the most comprehensive georeferenced distribution dataset, historical collections were georeferenced post facto when locality information was sufficiently precise and if not, these specimens were not taken into account in the preliminary assessments. We imported georeferenced specimen data into GeoCAT Geospatial Conservation Assessment Tool. GeoCAT can be accessed from the following URL: <http://geocat.kew.org/>. The tool was developed to utilise spatially referenced primary occurrence data to analyse two aspects of the geographic range of a taxon: the extent of occurrence (EOO) and the area of occupancy (AOO). Within GeoCAT, we have allowed the user to choose the cell size using three methods (Bachman *et al.* 2011). The default is 2 km² cell size (as recommended in the IUCN guidelines — IUCN 2010). The number of locations

(sensu IUCN) were estimated with regard to the size of the main threat, in which a single location may encompass more than one adjacent subpopulation. For these preliminary assessments, only the criterion B, based on three parameters, EOO, AOO and number of locations thresholds, was used. These preliminary assessments should not be considered as IUCN Red List assessments, but as reliable indication of the threat level weighing on these species. (L. Rajaovelona).

The assessments of the 27 species showed a third of all *Aerangis* in the area to be immediately endangered with four (15%) Critically Endangered (CR) and five (18.5%) Endangered (EN). Ten species (37%) are Vulnerable (VU), four (15%) Near Threatened (NT) and only three (11%) are of Least Concern (LC). The main threats are habitat loss and fragmentation, over-exploitation and some collecting of endemic species in the Indian Ocean Islands.

Distribution and habitat

A total of 58 species of *Aerangis*, including three natural hybrids, are currently recognised. They are distributed throughout tropical and southern Africa, Madagascar, the Comoros, Réunion and Sri Lanka. Thirty-one species and two varieties occur in mainland Africa, none of them occurring on the islands of the Indian Ocean. Most sub-Saharan African countries host at least one species, with the largest number in Tanzania, where there are 19 species, followed by Kenya and Malawi, each with 10 (la Croix 2022).

One species, *Aerangis holo-glottis* (Schltr.) Schltr. has been found along the coast of eastern Africa and also in Sri Lanka. However, in Sri Lanka it only has been collected from the Royal Botanic Garden, in Peradeniya, and is likely to have been introduced there.

Twenty-seven species have been recorded from the western Indian Ocean region of Madagascar, the Comoros and Réunion, all of them endemic to the area. Twenty of these are endemic to Madagascar, three to the Comoros only, three to the Comoros and Madagascar and one, *Aerangis punctata*, to Madagascar and Réunion. No species have been reported from any of the other islands in the western Indian Ocean.

Most species in the Madagascar region inhabit moist evergreen forest with a few from montane ericoid thicket, moist semi-deciduous forest, sclerophyllous woodland, dry deciduous forest, dry spiny thicket and littoral thicket. Some also occur in degraded and secondary forest. They are found from sea level to over 2000 m, but most are from medium to high elevations. Almost all species are epiphytes on trunks or main branches of trees but some of the smaller species are twig epiphytes; they generally prefer shaded and moist conditions. Very few are lithophytes growing on rocks or among boulders.

Distribution mapping. Georeferenced maps with WGS 84 projection have been used as a background for the distribution maps. They have been freely downloaded from the following websites: www.fao.org/geonetwork/srv/en (land cover of Madagascar, dated 2009), <https://www.data.gouv.fr> (Réunion), <https://gadm.org> (country outlines of Comoros). Similar data can be found at www.diva-gis.org.

The locality coordinates come from the authors' own observations, using a Garmin etrex 10 GPS with the WGS 84 projection, or from the Tropicos website gazetteer to Malagasy botanical collecting localities: www.tropicos.org. The localities of all specimens have been double-checked using Google Earth: <https://earth.google.com>.

A relational database with two tables: localities and observed species, was built with the database management system 4D version 17 (www.4d.com), storing a total of about 450 observations or collected specimens (after discarding duplicates). A computer program was then written in 4D programming language to automatically produce one CSV file per species (ASCII files with comma-separated values), every file containing a list of coordinates for a given species. Eventually the open-source Geographical Information System QGIS version 2.18.10 (www.qgis.org) was used to compose the final maps in jpeg format, combining the countries outlines, Madagascar land cover and the location spots for every species. Distribution is only shown for the area under review in this paper. A simple underlying vegetation map was used as a background for each species; a map of the whole area covered and the distribution of all *Aerangis* species, as well as maps showing the different provinces and regions of Madagascar are included for reference (Maps 1, 2 and 3).

Taxonomic Treatment

Aerangis Rchb.f. (Reichenbach 1865: 190). Type: *Aerangis flabellifolia* Rchb.f. = *Aerangis brachycarpa* (A.Rich.) T.Durand & Schinz.

Radinocion Ridl. in Henriques (Ridley 1887: 200). Type: *R. flexuosum* Ridl. = *Aerangis flexuosa* (Ridl.) Schltr.

Rhaphidorhynchus Finet (1907: 32). Type: *R. bilobus* (Lindl.) Finet = *Aerangis biloba* (Lindl.) Schltr.

Barombia Schltr. (Schlechter 1914: 600). Type: *B. gracillima* (Kraenzl.) Schltr. = *Aerangis gracillima* (Kraenzl.) J.C.Arends & J.Stewart.

Microterangis (Schltr.) Senghas (1985: 22). Type: *M. hariatiana* (Kraenzl.) Senghas = *Aerangis hildebrandtii* (Rchb.f.) P.J.Cribb & Carlsward.

Epiphytic or rarely lithophytic *herbs* with short or sometimes elongated subwoody stems bearing numerous long aerial roots in the lower part. Stems usually not branched, covered with the remains of overlapping leaf-sheaths, bearing few to several leaves towards the apex. *Leaves* distichous, usually fleshy and shiny, sheathing at the base, longer than broad and often wider in the upper half, unequally bilobed or emarginate at the apex. *Inflorescence* pendent, arcuate, spreading or erect, short to very long, often more or less zig-zag, few- to many-flowered. *Flowers* resupinate, very small to large, white, buff or orange-brown; ovary elongated, straight or slightly curved; pedicel sometimes leaving a short peg when the flower drops. Sepals and petals free, spreading or reflexed. *Lip* entire, often similar to the sepals and petals, spurred at the base, ecallose or with few low ridges at mouth of spur; spur cylindrical or thickened towards the base, often elongate, decurved or rarely rising above ovary. *Column* short and stout or somewhat elongated and slender, often narrowed towards the base and enlarged at the level of the stigma; clinandrium straight or sloping; anther-cap sometimes beaked; rostellum entire, elongate, deflexed or porrect; pollinia 2, sessile on a single stipe attached to a single thin viscidium; stigma an oval or rhombic sticky depression. *Seed-capsule* cylindrical or ellipsoid.

ETYMOLOGY. From the Greek *aer*, air, and *angos*, vessel, presumably referring to the epiphytic nature of the plants and the nectar-filled spurs.

Artificial key to the sections of *Aerangis* in the W Indian Ocean region

Flowers very small; tepals, lip and spur less than 2.5 mm long; flowers numerous, green or brownish-orange.....

..... sect. **Microterangis**

Flowers small to very large; tepals lip and spur more than 5 mm long; flowers single to many, generally white or pale in colour

..... sect. **Aerangis**

Aerangis sect. **Microterangis** (Schltr.) Hermans **comb. nov.**

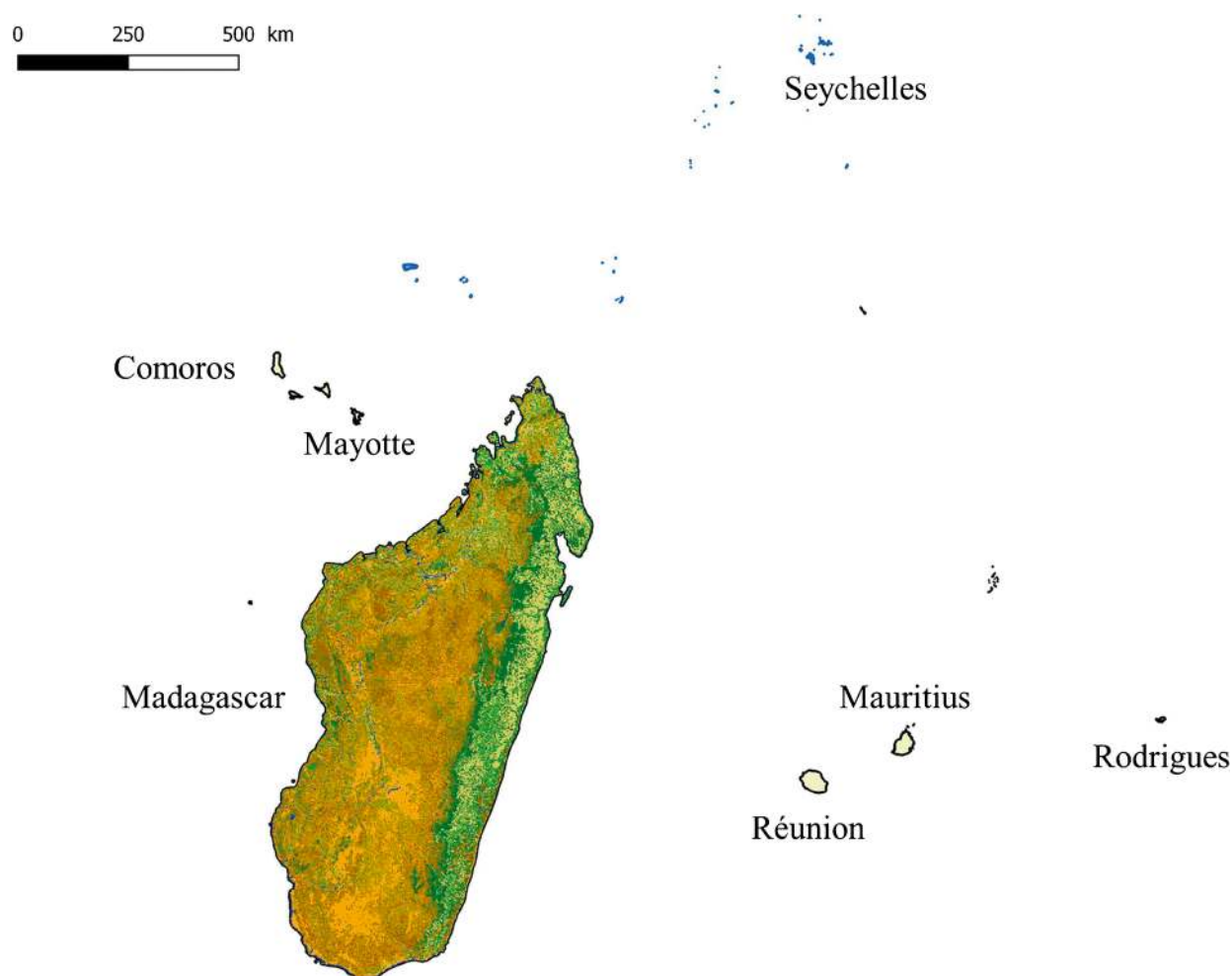
<http://www.ipni.org/urn:lsid:ipni.org:names:77340868-1>

Senghas (1985: 22) = *Aerangis hildebrandtii* (Rchb.f.) P.J.Cribb & Carlsward 2012.

Microterangis (Schltr.) Senghas (1985: 21).

Basionym: *Chamaeangis* Schltr. sect. *Microterangis* Schltr., *Beih. Bot. Centralbl.* 36: 107 (Schlechter 1918). Type: *Microterangis hariatiana* (Kraenzl.)

Small epiphytic *herbs* with a short stem, leaves close together, elliptic or obovate, the apex unequally lobed. *Inflorescences* generally appearing simultaneously, rachis



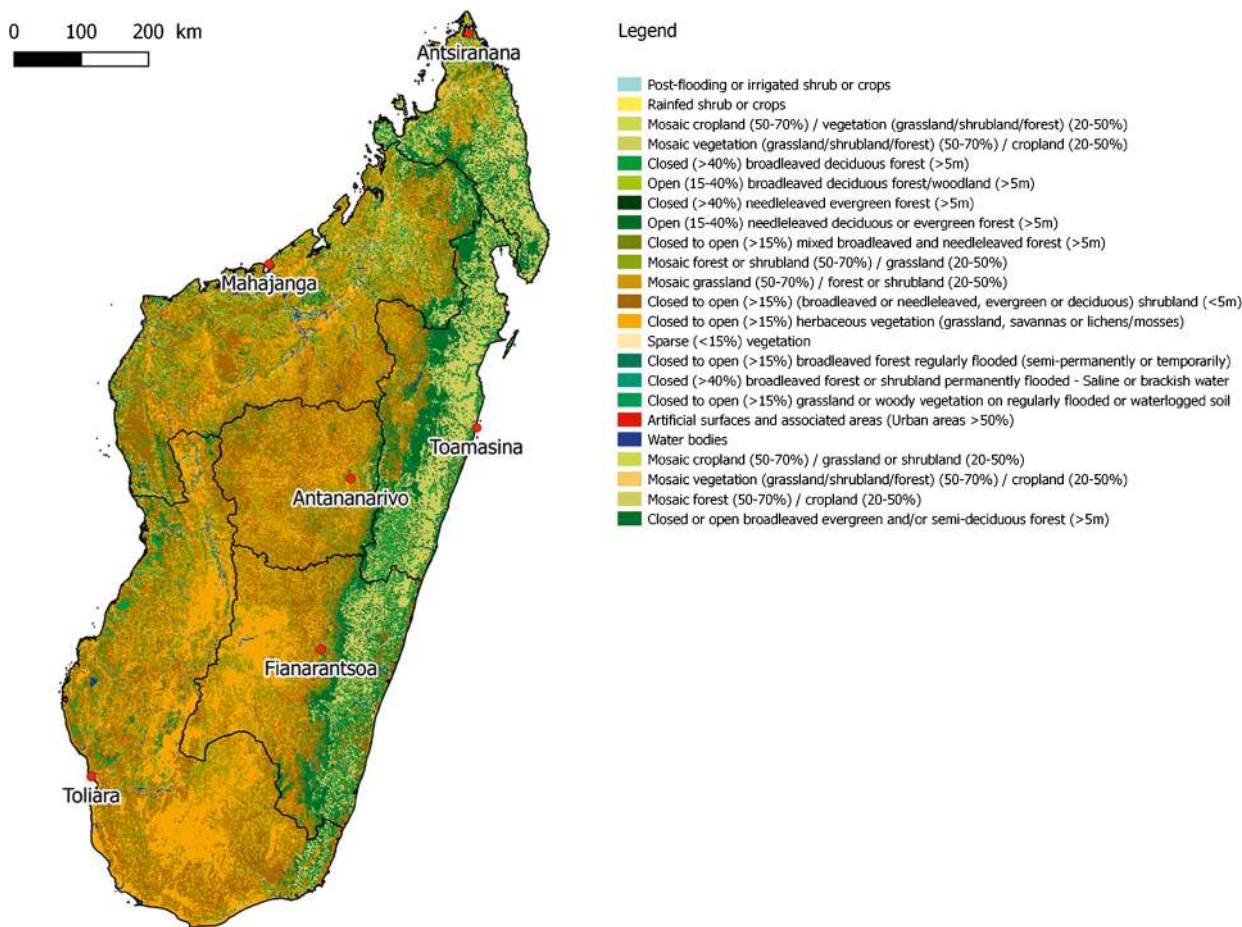
Map 1. Madagascar and surrounding Islands.

with many flowers, floral bracts membranous, enveloping the pedicel. *Flowers* very small, greenish-yellow to orange-brown, alternate, sepals and petals free, lip entire or sub-entire, spur short and more or less swollen at the apex, column short, with a single common stipe on a small, rounded viscidium.

Five species from the Comoros and Madagascar.

NOTES. The section was first recognised by Schlechter in 1918 as a division of his new genus *Chamaeangis* Schltr. (Schlechter 1918: 107) for species from Madagascar and the Comoros with a short stem, thin leaves and a single stipe of the pollinia and a rounded viscidium; he included *Chamaeangis divitiflora*, *C. hariatiana*, *C. oligantha* and *C. pobeguini*. He suggested that the section could later be raised to the rank of genus. This was done by Senghas in 1985 who separated the Madagascar and Comorian species previously ascribed

to *Chamaeangis* to his new genus *Microterangis*, with the same characteristics defined by Schlechter. Otherwise, he recognised *Microterangis* in the same key couplet as *Aerangis*, distinguishing the former by its smaller yellow, green or orange, rather than predominantly white, flowers. Szlachetko (2001) illustrated the floral structure of both *Aerangis* and *Microterangis*, showing their similarity in column, stigma, rostellum and pollinarium shape. Carlswald *et al.* (2006) included 16 species of *Aerangis* and two of *Microterangis*, containing the type species, *M. hariatiana*, in their DNA-based analyses of vandaceous orchids. The *Microterangis* species were nested within *Aerangis*, sister to the Malagasy species *A. punctata*. On this basis, Cribb & Carlswald (2012) considered *Microterangis* to be small-flowered species of *Aerangis* that evolved in the Comoros or northern Madagascar from a common ancestor of larger-flowered *Aerangis*. *Microterangis* is treated here as a section of *Aerangis*, based on the distinct morphology of the



Map 2. Vegetation map and Provinces of Madagascar.

inflorescence and flowers; this makes the genus paraphyletic but we do not consider monophyly to be an essential property of supraspecific taxa in this context.

The identity and nomenclature of several of the species in the section is complex; *Aerangis hildebrandtii*, in particular, has gathered several names. This may be due to them being placed in different genera and therefore eluding comparison by authors. The shape,

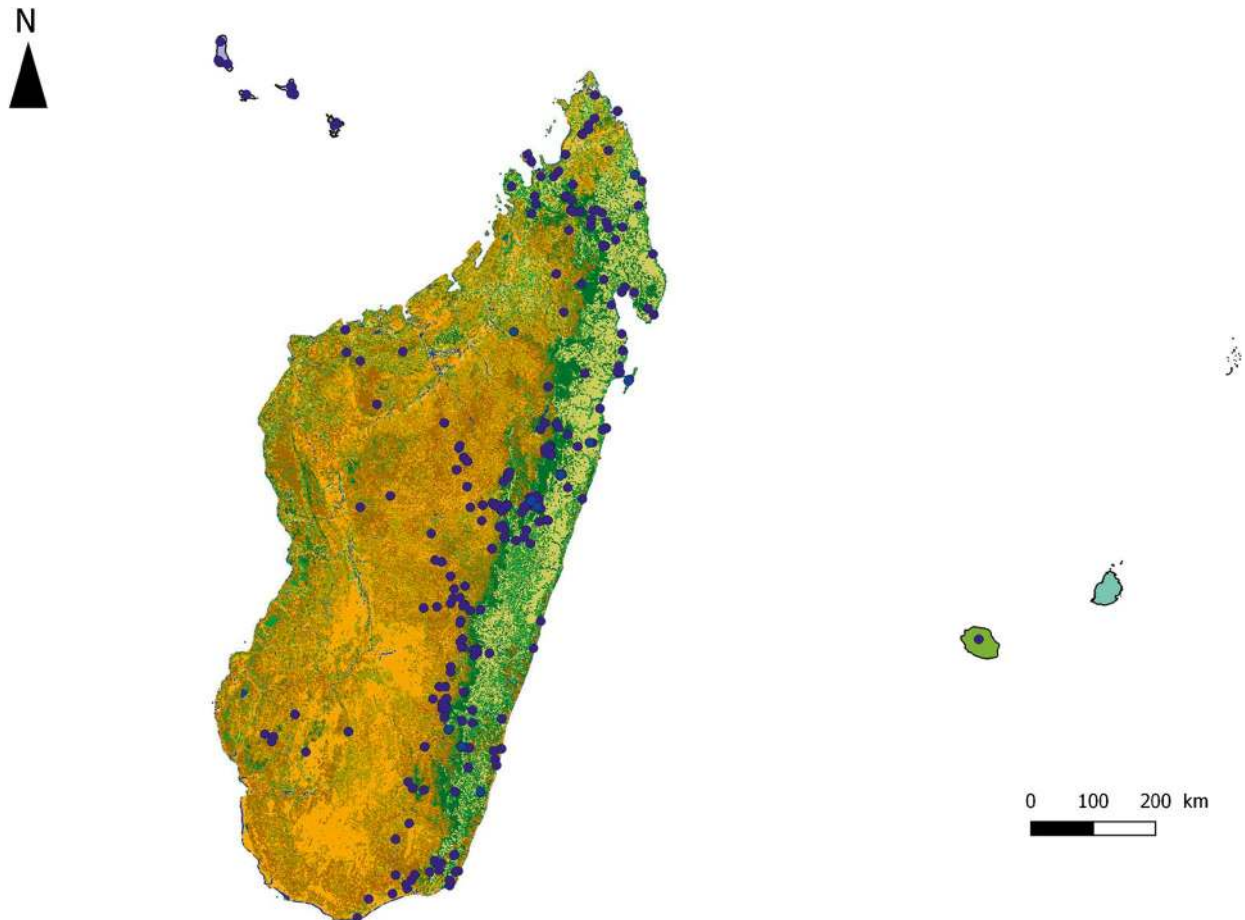
colour and size of the flowers are variable and the spur clearly expands and inflates as the flowers develop.

It is interesting to note that the flowers of *Aerangis hildebrandtii* develop basipetally, opening from the apex to the base of the inflorescence and in the other species they develop acropetally, opening from the base to the apex or indeterminate as in *Aerangis bursiculata*.

Artificial key to the species of *Aerangis* in the W Indian Ocean region

1. Flowers very small; tepals, lip and spur less than 2.5 mm long; flowers numerous, green or brownish-orange..... 2
 1'. Flowers small to very large; tepals, lip and spur more than 5 mm long; flowers single to many, generally white or pale 6
 2. Leaves large, over 6.5 cm long; inflorescence densely flowered; flowers yellow to orange, developing basipetally **A. hildebrandtii**
 2'. Leaves short, less than 6.5 cm long; inflorescence densely or loosely flowered; flowers green or yellowish-brown, not developing basipetally..... 3
 3. Inflorescence laxly flowered, much longer than the leaves; lip naviculate **A. lacroixiae**
 3'. Inflorescence densely flowered, short or slightly longer than the leaves; lip obovate 4

4. Leaves flat; inflorescence shorter or slightly longer than the leaves; spur slightly inflated to clavate 5
- 4'. Leaves undulate; inflorescence about as long as the leaves; spur greatly inflated **A. bursiculata**
5. Leaves elliptic; inflorescence shorter than the leaf; lip apex apiculate **A. coursiana**
- 5'. Leaves narrowly elliptic; inflorescence about as long as the leaf; lip apex rounded **A. divitiflora**
6. Rachis with fewer than 6 flowers 7
- 6'. Rachis with more than 6 flowers 11
7. Lip shorter than 10 mm; spur less than 30 mm **A. bovicornu**
- 7'. Lip longer than 10 mm; spur more than 65 mm 8
8. Tepals and lip entirely white; rostellum very long **A. fastuosa**
- 8'. Sepals and petals pink greenish-brown; rostellum short 9
9. Roots glabrous; inflorescence elongate, with 2 – 5 flowers; lip angular **A. fuscata**
- 9'. Roots more or less verrucose; inflorescence short, with 1 – 2 (rarely 3) flowers; lip obovate 10
10. Leaf surface pitted and with silvery dots; petals slightly shorter and narrower than the sepals; lip obovate
..... **A. punctata**
- 10'. Leaf surface smooth and unspotted; petals the same size as the sepals, lip ovate **A. monantha**
11. Spur less than 5 cm long 12
- 11'. Spur more than 5 cm long 18
12. Flowers white or pale yellow 13
- 12'. Flowers green or brown 17
13. Flowers not opening widely; spur less than 10 mm long **A. hyaloides**
- 13'. Flowers segments spreading or recurved; spur more than 10 mm long 14
14. Flower segments spreading; spur less than 25 mm long 15
- 14'. Flowers segments strongly recurved, spur 30 – 50 mm long 16
- 15'. Dorsal sepal smaller than the other segments and arching forward; spur more than 25 mm long **A. citrata**
- 15'. Dorsal sepal not much smaller than the other segments, not arching forward; spur less than 25 mm long
..... **A. xprimulina**
16. Lip less than 10 mm long; spur inflated towards the apex **A. macrocentra**
- 16'. Lip more than 10 mm long; spur not inflated towards the apex **A. pulchella**
17. Flower segments strongly reflexed; spur more than 18 mm long, slightly inflated at the apex
..... **A. pallidiflora**
- 17'. Flower segments star-shaped, recurved but not reflexed when mature; spur less than 18 mm long, distinctly
inflated at the apex **A. seegeri**
18. Flowers star-shaped, segments recurved but not reflexed when mature 19
- 18'. Flower segments reflexed when mature 20
19. Apical flower of inflorescence larger than the basal ones; lip slightly ridged at the base; spur usually more than
8 cm long **A. articulata**
- 19'. All flowers of the inflorescence similar in size; lip not ridged at the base; spur usually less than 8 cm long
..... **A. modesta**
20. Plant medium in size (leaf less than 11 cm long); flowers medium in size (lip less than 13 mm long) 21
- 20'. Plant large (leaf generally more than 11 cm long); flowers large (lip more than 13 mm long) 24
21. Lip less than 9 mm long; sepals and petals elliptic, veined red **A. concavipetala**
- 21'. Lip more than 10 mm long; sepals and petals not elliptic, not veined red 22
22. Leaves distinctly undulate; spur distinctly thickened and flattened towards the apex **A. decaryana**
- 22'. Leaves flat; spur only slightly inflated or flattened towards the apex 23
23. Flowers white or tinted pink at the base of the segments; tepals similar in size and attenuate **A. ikopana**
- 23'. Flowers salmon coloured or tinted pink overall; dorsal sepal shorter than the sepals and petals and obtuse
..... **A. polyura**
24. Generally lithophytic plant with a distinct stem; inflorescence erect or suberect **A. ellisii**
- 24'. Generally epiphytic plant with a short stem; inflorescence pendent or arching 25
25. Leaves distinctly undulate; spur more than 14 cm long **A. spiculata**
- 25'. Leaves flat or margins slightly undulate; spur less than 14 cm 26
26. Base of the spur expanded; distinct teeth and ridges at the base of the lip **A. cryptodon**
- 26'. Base of the spur not expanded; without distinct teeth and ridges at the base of the lip **A. rostellaris**



Map 3. Distribution of *Aerangis* in Madagascar and surrounding Islands.

Aerangis articulata (Rchb.f.) Schltr. (Schlechter 1914: 597, 1915: 426, 1918: 113, 1927: 590); Perrier (1930: 58, 1938a: 39, 1941: 116); Hawkes (1953: 176); Moir (1963a: 382); Hawkes (1965: 34); Garay (1973: 505); Moir (1979: 159); Tysen Northen (1980: 32); Stewart (1986a: 800); Nilsson *et al.* (1987: 310); Arditti (1992: 474); Baumann (1991: 671); Hillerman & Holst (1986: 113); Hillerman (1990: 12); Bechtel *et al.* (1992: 49); Karasawa (1992: 157); Chiron (1994: 22); Hermans & Hermans (1995: 282); Stewart (1995: 4); Leroux (1996: 79); Blowers (1997: 330); Hermans & Hermans (1998: 113); Du Puy *et al.* (1999: 9); Hermans *et al.* (1998: 14); Petitjean & Petitjean (2003: 18); Cribb & Tibbs (2004: 238); Lecoufle (2006: 12); Stewart (2006: 200); Stewart *et al.* (2006: 235); Hermans *et al.* (2007: 5); Guillon (2008: 111); la Croix (2008: 31); Cribb & Hermans (2009: 278); Bosser & Lecoufle (2011: 64); Hermans (2012: 3); la Croix (2014: 132); Oviatt & Nerison (2014: 522); Pridgeon *et al.* (2014: pl. 134); Hervouet (2018: 67); Cribb (2021: 31) the photo is of *Aerangis modesta*; Junginger (2022: 188); la Croix (2022: 143). Type:

Madagascar, Sept. 1871, Ellis s.n. (Reichenbach herbarium W, R39523), **lectotype designated here.**

Angraecum articulatum Rchb.f. (Reichenbach f. 1872a: 73); Godefroy-Lebeuf (1881b: 147); Williams (1885: 114); Ridley (1885: 483); Sander (1890: 13, t.55); Veitch (1891: 122); Rolfe in Linden & Rodigas (1892: 43 pl. 380); Stein (1892: 68) as *Angraecum*; Bois (1893: 190); Watson & Bean (1893: 44) the plate is *Aerangis modesta*; Williams (1894: 96); Durand & Schinz (1895: 40); Sander (1901: 10); Baron (1901: 719); Watson & Chapman (1903: 48); Palacky (1906: 8); Sander (1927: 47); Curtis (1950: 59).

Rhaphidorhynchus articulatus (Rchb.f.) Poiss. (Poisson 1912: 185).

Angorchis articulata (Rchb.f.) Kuntze (1891: 651).

Angraecum descendens Rchb.f. (Reichenbach f. 1882a: 558); Williams (1885: 115); Williams (1894: 98). Type: Madagascar, cult. Low, Low s.n. as *Angraecum dependens in sched.* (Reichenbach herbarium W, R39517, two large single flowers only), **lectotype designated here.**

Angraecum calligerum Rchb.f. (Reichenbach f. 1887b: 552); Reichenbach (1887d: 356); (Poisson 1912: 185); Hillerman & Holst (1986: 187). Type: Madagascar, cult. *Bull* ? s.n. (Reichenbach herbarium W, R39521), **lectotype designated here**.

Aerangis calligera (Rchb.f.) Garay (1974: 373); Hillerman (1992: 33).

Aerangis stylosa sensu H.Perrier (1938a: 37, 1941: 109) *non* Schltr. *non* Rolfe.

Medium-sized to large 10–40 cm tall, epiphytic *herb* on an ascending stem 4–18 cm long and 0.8–1.5 cm in diam., covered by thick striate sheaths, roots copious, fleshy, greyish-white, glabrous, 2–4 mm in diam. *Leaves* 3–12 towards the apex, more or less distichous, flat, narrowly obovate, to elliptic, 6–25 × 1.8–3.5 cm, attenuate towards the base into a 1–2.5 cm petiole, unequally emarginate at the apex, pale to dark green, often paler underneath, the mid-vein darker, surface slightly glossy, margins slightly recurved, sometimes undulate, darker green or brownish-red. *Inflorescences* axillary, arching to pendent, pale green to greenish-brown up to 35 cm long but generally shorter, 2–4.5 mm in diam., bearing 6–25 flowers in two parallel rows, 8–24 mm apart, the apical one often discernibly larger than the basal one; peduncle 0.5–1.5 cm, covered by 2–3 brown amplexant sheaths; rachis racemose, more or less zig-zag, articulate. *Floral bracts* thin, amplexant, broadly triangular ovate, acute, green becoming brown, 2.1–3.9 × 1.2–3.9 mm, almost completely enveloping the base of the pedicel and a short stem-like conical projection between the rachis and the pedicel, 0.5–1.3 × 0.3–0.6 mm. *Flowers* medium to large, very variable in size, the perianth up to 38 × 42 mm, sepals, petals and lip white, spur white, often tinted green, the column ivory. *Pedicel* and *ovary* narrowly turbinate, straight, glabrous or slightly dark brown-scurfy and shallowly ridged towards the apex, 16–24 × 1–2.1 mm, whitish-green to brownish-green. *Dorsal sepal* ovate, attenuate, the margins a little recurved, 16.5–27 × 4.2–7 mm; *lateral sepals* elliptic, acuminate, spreading, slightly reflexed towards the apex, dorsally ridged along the mid-vein, 16.5–26 × 3.6–6.5 mm. *Petals* elliptic, acute to acuminate, 16.3–24 × 4–8 mm. *Lip* narrowly obovate, the base flat, then attenuate towards the apex and reflexed, 15–26 × 5.5–8.5 mm, with two short longitudinal rounded undulations at the base, the apex often convex and appearing twisted; *spur* slightly widened at the base, first arching along the ovary then pendent, subulate, longer in the apical flowers, 75–120 × 0.6–1.5 mm. *Column* stout, 3–6 × 2–5 mm, emarginate at the apex, glabrous to shortly hairy especially around the androclinium, rostellum lobes spreading, the margins crenate to lacerate, rostellum curved forward, c. 1.5 mm long, stigma oval; anther cap distinctly rostrate with

the apex often bifid, 2.2–2.8 × 2–2.5 mm; pollinia 2, 0.8–1 × 0.5–1.1 mm, stipes strap-shaped, viscidium broadly rectangular, the lateral margins clasping the rostellum. *Seed-capsule* fusiform, 18–32 × 4–8 mm. Figs 1 and 2.

RECOGNITION. When mature, *Aerangis articulata* is a large plant with a distinct stem and a long arching-pendent inflorescence, the flowers large with the lip similar to the tepals, the segments not reflexed, and with a long spur. The apical flowers are generally much larger than the basal ones and have a longer spur. The lateral sepals are dorsally ridged, the lip with two short undulations at the base. The rostellum margins are often lacerate and the rostellum is hooked forward. The anther cap is distinctly rostrate.

DISTRIBUTION. Madagascar: Antananarivo, Antsirana, Fianarantsoa, and Toamasina provinces (Map 4). Records from the Comoros are misidentifications of *Aerangis modesta* or *A. polyura*.

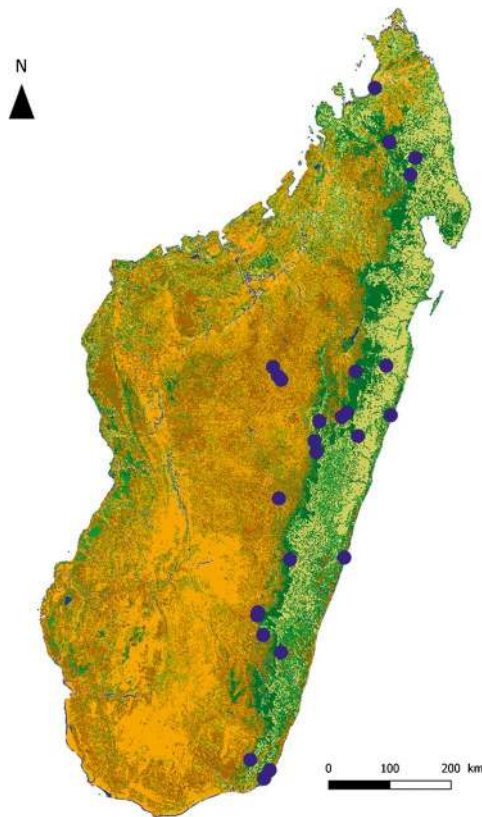
SPECIMENS EXAMINED. MADAGASCAR. NW 1887, Baron 5321 (K); Mananjary, March–April 1909, Geay, 7760 (P00099105); Manankazo, NE of Ankazobe, 1500 m, Nov. 1913, Perrier 11308 (P00099107); Farafangana, Vondrozo, Sept. 1926, Decary 5255 (P00099103); Farafangana, Ivohibe, Decary 5102 (K, P00099102, TAN); N of Mangindrano, Ambohimirahavy, 1800–2000 m, Jan.–Feb. 1951, Humbert & Capuron 25008 (P00099106); Mananjary, March 1963, Moiz s.n. (P00513705-6); Analamanga, Ambohitantely, Oct. 1963, Bosser 18438 (P00099100); Fianarantsoa, S of Ambositra, 1000–1200 m, Feb. 1964, Bosser 17748 (P00099099 and spirit); Analamanga, Lake Tsiazompanihy, 1500 m, March 1970, Bosser 20012 (P00099101); Mandena, 0–10 m, March 1989, Dumetz *et al.* 635 (K, MO-2856026 377158, P00099094); Ranomafana NP, S of Namorona R., March 1992, Malcomber & Schatz 1302 (MO2856103 4252457); Ambohitantely NW of Ankazobe, 1350 m, Nov. 1992, David DuPuy *et al.* M551 (K); Andapa, Mandritsarahely village, 875 m, Oct. 1994, Ravelonarivo *et al.* 433 (K, MO, P00755167, TAN); Andohahela, SE of Andranodambo, 1500–1600 m, Dec. 1995, Rakoton-drainibe 3241 (P00067375); Taolanaro, Ste Luce, 10 m, Feb. 1995, David DuPuy *et al.* M850 (K, K-spirit 59062.000TAN001150); Anjozorobe, cult. Razafindratsira, 1996, Hermans 3533 (K); towards Ampitan-kely from Tsinjoarivo, Dec. 1997, Hermans 4320 (K); Andringitra, 1500 m, Jan. 2000, Messmer & Randriambololona NM851 (G, P06168542); Marojejy, Oct. 2001, Gautier *et al.* LG3810 (G, P06797047); Mandena, 2004, Hermans 3873 (K); Moramanga, Ambatovy, 1022 m, Oct. 2005, Antilahimena, *et al.* 4029 (TAN); NE of Ankazobe, 2005, Hermans 4116 (K); Andringitra, 1513 m, Jan. 2005, Fischer & Andriantiana FS2022-2005 (WU); Moramanga, Analamay/Ambatovy, 1073 m, Oct. 2007,



Fig. 1. *Aerangis articulata* in John Day's Scrapbooks (Day 1887: 42: 19). Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.



Fig. 2. *Aerangis articulata*. **A** in habitat, Madagascar; **B** part of inflorescence; **C** close-up of flower. PHOTOS: J. HERMANS.



Map 4. Distribution of *Aerangis articulata*.

Antilahimena 5784 (TAN); Ambatovy forest, 1035 m, Oct. 2008, *Antilahimena et al.* 6629 (MO-2856014 6438791, P, TAN); Ambatovy, 1045 m, Oct. 2008, *Ratolojanahary* 01 (MO, TAN); Toamasina, Sahafesenina, 1190 m, Dec. 2008, *Fischer & Andriantiana* FS2090 (WU); Ambatovy, 2011 – 2015, *Ambatovy Shade House* 233, 319, 598, 639bis, 829, 1220bis, 1663, 1752, 2529, 3539, 4634, 5309 (BRLU1874A598/2, BRLU-1051A639bis, BRLU1183A1667/13, K1133A598/2, MO1873A598/2, MO3649A1220/3, MO3610A829, MO1050A639bis, MO1911A4838, TAN1880A4838, TAN3609A82, TAN1052A598/1, TAN1759A1752/2, TAN1162A1220, TAN1804A3539/2, TAN3163A5309/1); Ambatovy, 1071 m, Oct. 2011, *Ramahenina et al.* 56 (MO, TAN); Ambatovy, 2012 – 2018, *Ambatovy Spirit* (BRLU1183A1663/13, MO, MO1050A639bis, TAN578A456/11, TAN1144A319, TAN2683A4738/3, TAN3610A829); Toamasina, Analamazaotra, 992 m, Dec. 2013, *Razafindraibe et al.* 517, 647 (TAN); 4634 (TAN3615A4634); Analamanga, Ambohimanga, 1609 m, Feb. 2015, *Antananarivo Spirit* 43T65 (TAN); Ambalabe, 625 m, Oct. 2016, *Antananarivo Shade House* 373 (K561T373, P562T373, BRLU560T373, TAN338T373, MO339T373, spirit); Torotorofotsy, 954 m, Oct. 2020, *Ramandimbisoa et al.*

515 (BRLU, MO, TAN); Ambalabe, 625 m, March 2019, *Antananarivo Spirit* 560T373 (BRLU, MO, P, TAN); Fianarantsoa, Atsimo-Atsinanana, 614 m, June 2019, *Antananarivo Shade House* 748 (TAN); Ambalabe, 625 m, March 2020, *Antananarivo Spirit* 696T373 (BRLU); Torotorofotsy, 980 m, Oct. 2020, *Ramandimbisoa et al.* 491 (BRLU, MO, P, TAN); Aloatra-Mangoro, 995 m, Oct. 2020, *Ramandimbisoa et al.* 518 (MO, TAN); Toamasina, Antsinanana, 653 m, April 2021, *Antananarivo Shade House* 1212 (TAN); Ambila Lemaintso, *François* 5 (P00099104); Mandraka, *Inst.Sci. Mad.* 11 (TAN); Tsaratanana, *Inst.Sci.Mad.* 13 (TAN); Tampoketsa, *Inst.Sci.Mad.* 17 (TAN); Fort Dauphin, *Herb.Inst.Sci.* 79 (TAN). **Without Exact Provenance:** recd. July 1880, *Baron* s.n. (K, K spirit); cult. Low s.n. (W-R39517); cult. Low s.n. (W- R39517 & R39516); 1881, *Humboldt* s.n. (W-R9695); cult. Kew (K); comm. O'Brien. Between 1880 and 1888 (BM000540109); 1884, cult. Veitch s.n. (BM540106); Sept. 1884, *T. Moore* s.n. (K); cult. Aug. 1890, *A. Veitch* s.n. (K); cult. Firenze, Oct. 1890, *Guerrardo* s.n. (K); Aug. 1891, cult. *Veitch* s.n. (K); Nov. 1893, Mt St Amand, Gand, cult. Van Imschoot s.n. (K); 1897 comm. J. Veitch & Sons 1897 *Curtis* s.n. (K000306362); Sept. 1894, cult. *Godefroy-Lebeuf* s.n. (K); 1898, cult. Kew (K); cult. Peeters, St. Gilles, April 1899, *Herb. Cogniaux* s.n. (BR); Oct. 1899, cult. Edinburgh s.n. (K); Aug. 1908, cult. *Döring* s.n. (M); April 2000, *Lecoufle* s.n. (P06796615); cult. Andriamaharo, 2002, *Hermans* 6516 (K); cult. De Wilg, 2002, *Hermans* 6512 (K); ex. cult. (BM000540107); cult. *Hillerman* 3, 16 (K); cult. *Dixon* s.n. (K); cult. *Hillerman* I, II (P); cult. *Lecoufle* s.n. (P); spirit 25914.000, 63584.000, 63610.000 (K); s. loc. *Inst.Sci.Mad.* 10 (TAN); cult. Glasnevin (DBN); Low s.n. W-R39521); *Ellis* s.n. (W-R39522, R39523); W-R39505.

HABITAT. Mainly medium altitude moist evergreen forest, rarely moist semi-deciduous forest and littoral forest, forest remnants. On trunks or thicker branches of trees, generally in shade. Altitude 10 – 2000 m.

CONSERVATION STATUS. *Aerangis articulata* is a native, widespread orchid, distributed in Northern, Eastern and Southern Madagascar in Antsiranana, Toamasina, Antananarivo, Fianarantsoa and Toliara provinces in Madagascar. The extent of occurrence (EOO) of *Aerangis articulata* is estimated to be more than 20,000 km². The species is known from more than 18 threatened locations. In addition, it is recorded in many protected areas such as Tsaratanana, Marojejy, Anjanaharibe, Ambohitantely, Ranomafana, Andringitra, Vohibe-Ambalabe, Torotorofotsy, Andohahela, Analavelona in Madagascar. Although there are some subpopulations (eight occurrences) that are facing a continuing decline due to habitat destruction, the overall population is believed to be stable and not at immediate risk of extinction. Therefore, *Aerangis articulata* is assessed as Least Concern (LC).

PHENOLOGY. September to April but mainly October to March.

POLLINATION. The pollinator of the species remains unknown since no pollen vector has been observed so far; it was included in studies by Nilsson *et al.* (1987) and summarised in Arditti (1992: 476). The flowers are likely to be pollinated by long-tongued hawkmoths.

ETYMOLOGY. From the Latin ‘*articulata*’: referring to the thickened nodes of the rachis; ‘*descendens*’: referring to the drooping habit of the inflorescence; ‘*calligera*’: referring to the callus-like appearance of the nodes of the rachis.

NOTES. Reichenbach (1872a) described it as *Angraecum articulatum* but did not specify in the description which material was examined. He mentioned only two living plants in Europe but acknowledged the kindness of Rev. William Ellis for introducing it. In the Reichenbach herbarium there are two sheets: R39522 with an amalgam of drawings, description and flowers from Day and from Ellis, the latter being illustrated in Day’s Scrapbooks (Day 1887: 17, 35) having been bought from Ellis’s collection following his death in June 1872; the second sheet R39523 has an inflorescence, description and individual flowers from ‘Sept. 26, 1871, coll. Rev. Ellis’ and is chosen here as the type as it is from a single collection and closest to the protologue. At first the species was confused with and illustrated as *Aerangis ellisii* (Warner & Williams 1878: t.28), also introduced by Ellis and described by Reichenbach in the same year (1872b: 278).

In 1882 Reichenbach described *Angraecum descendens*: he failed to specify which material his description was based on but mentioned inflorescences sent by the nursery of Stuart Low. Two mixed sheets in the Reichenbach herbarium, labelled by him as *Angraecum descendens*, contain a mixture of letters and drawings (R39516), another has an unattributed inflorescence and a few flowers (R39517). There is a watercolour in Day’s Scrapbooks (Day 1887: 42: 19; Cribb & Tibbs 2004: 240) (Fig. 1) identified by Reichenbach as *Angraecum dependens*, a name he at first proposed for *A. descendens*, but later rejected. Reichenbach thought his new species to be an aberrant form of *A. ellisii* (“a larval state of *A. ellisii*, which lost its temper from travelling”) but there is no doubt that all this material refers to *Aerangis articulata*.

Reichenbach (1887a, b, c, d) described *Angraecum calligerum* based on cultivated material from Bull and Low. A herbarium sheet in the Reichenbach herbarium (R39521) has a drawing, several flowers and manuscript description of the new species; the flowers may belong to the specimen from Bull mentioned in the description. Neither Schlechter (1925) or Perrier (1941) included the name. Garay (1973: 506) initially considered it a synonym of *Aerangis ellisii* but, based on cultivated material from Hillerman, considered it

distinct (Garay 1974: 373), including a description, photographs and drawings of what appears to be *A. ellisii*. After examination of the type material we have no hesitation in following Stewart (1986a: 800) in placing it in the synonymy of *Aerangis articulata*.

Recent authors, following Stewart (2006: 200), have considered *Aerangis venusta* a synonym of *Aerangis articulata* but further evidence suggests that it is referable to *A. modesta*, as explained under that species.

Perrier (1938a: 39) initially did not consider *Aerangis articulata* to exist in Madagascar and, based on annotations by Finet, confused it with a *Lavanchie* (P00099095) plant from Anjouan, which is in fact the type of *A. anjouanensis*. In the orchid part of the *Flore de Madagascar*, Perrier (1941: 116) correctly understood it to be based on a Madagascan species, introduced by Ellis; but considered it an incompletely known entity of possible hybrid origin. Meanwhile, Perrier (1938a: 37; 1941: 109) misinterpreted the identity of *Aerangis stylosa*: it is clear that his descriptions and virtually all the specimens cited refer to *A. articulata*. The description and type material of Rolfe’s *Angraecum stylosa* at K is well documented and represents quite a different species. In addition, Perrier incorrectly placed *Aerangis venusta* and *A. crassipes* as synonyms of his interpretation of *A. stylosa*.

Aerangis articulata is quite variable in plant and flower shape and size; the flowers are sometimes deformed. Some of this variability may be explained by the possible existence of natural hybrids with *Aerangis modesta*: both species are recorded from the same areas and habitats and have a very similar gynostemium structure. Further investigation of herbarium material (e.g. *Ravenolarivo* 422 (K); *Humbert* 25008 (P); *Malcomber* 1302 (MO)), genetic analysis and further field observation are necessary to confirm this supposition.

It is different from *Aerangis modesta* by its more erect habit and in having flowers larger in all aspects, the apical flowers on the inflorescence being larger than the basal ones (vs similar), the lip having two shallow ridges at the base (vs flat) and the anther cap that is distinctly rostrate (vs rounded).

***Aerangis bovicornu* Hermans** (in J. Hermans *et al.* 2021: 40); Hervouet (2021: 337); la Croix (2021: 175); la Croix (2022: 148). Type: Madagascar, Fianarantsoa prov., near Ankazomivady, 1800 m, Dec. 1997, *Hermans* 8179 (holotype K).

Small monopodial epiphytic herb up to 5 × 6.5 cm, with a short woody stem c. 8 mm in diam., covered by brown corrugate sheaths, bearing numerous somewhat hirsute orange-brown roots becoming grey with age, c. 1.5 mm in diam. *Leaves* 2 – 5, leathery, on a short 3 – 5 mm conduplicate petiole, ovate to elliptic,

20 – 33 × 14 – 22 mm, somewhat convex, emarginate at the tip, laevigate, more or less brownish-orange on the upper surface, greyish-green, punctate underneath with the central vein darker. *Inflorescence* very short, up to 3.5 cm long, bearing 2 – 3 flowers and an aborted bud. *Rachis* 3 – 5 mm in diam., orange-brown, almost entirely covered with 2 – 3 conduplicate to almost tubular bracts, 3.4 – 4.8 × 1.8 – 2.1 mm. *Floral bracts* thin, amplexicaul, 1.8 – 2.3 × 1.8 – 2 mm. *Flowers* small c. 10 × 10 mm without the spur, about 10 mm apart, stellate, not opening fully; petals, sepals and lip white with the tips sometimes tinged with orange, the ovary and spur orange-brown, the buds green. *Pedice*l and *ovary* straight, rounded, slightly ridged, 8 – 12 × 1.9 – 2.3 mm. *Dorsal sepal* ovate-elliptic, acuminate, 7.4 – 8.6 × 2.6 – 3.9 mm, narrowed, reflexed towards the base; *lateral sepals* obliquely lanceolate, acuminate, 8.2 – 8.9 × 3.1 – 3.7 mm. *Petals* ovate elliptic, obtuse, 7.3 – 8.6 × 2.8 – 4.1 mm. *Lip* ovate-lanceolate, attenuate, 7.5 – 8.2 × 3.9 – 4.1 mm; *spur* slender, horn-shaped, terete at the tip, slightly broadened towards the base, 20 – 34 × 0.9 – 1.3 mm. *Column* short, stout, slightly winged, broadly mucronate at the apex, rostellum ligulate-ensiform, up to 5 mm long; *anther* broadly obovoid with a small, rounded swelling at the apex, up to 1.4 × 1.6 mm; *pollinia* globose c. 0.8 × 0.6 mm, stipes short and slender, viscidium elongate, narrow. *Seed-capsule* fusiform, glabrous, brown, 16 × 5 mm. Figs 3, 4.

RECOGNITION. *Aerangis bovicornu* is a few-flowered compact plant with small flowers that do not open fully, ovate to elliptic leaves which are brownish-orange on top and greyish-green underneath; the flowers have a short horn-shaped spur and white perianth with an orange-brown ovary and spur and long rostellum and anther cap with a small, rounded swelling at the apex.

DISTRIBUTION. Madagascar: Antsiranana and Fianarantsoa provinces (Map 5).

SPECIMENS EXAMINED. MADAGASCAR. Fianarantsoa prov., near Ankazomivady, 1800 m, Dec. 1997, *Hermans* 8179 (K). Without exact provenance: Antsiranana, cult. Pronk, Oct. 2006, *Hermans* 6699 (K).

HABITAT. Epiphyte on small moss- and lichen-covered trees in remnants of forest on granite inselberg. Elevation c. 1800 m.

CONSERVATION STATUS. Recent observations by one of the authors (J.H.) found only six plants remaining in the type locality, one bearing an immature seed capsule. The species and its host tree have now disappeared in the type locality (pers. comm. J.-M. Hervouet Jan. 2022). The area has been cleared for cultivation of *Pelargonium*, grown increasingly in the region to produce essential oils. The occurrence in Fianarantsoa could be extirpated and/or may have disappeared within ten years. Therefore, *Aerangis*

bovicornu is only known from one threatened location, has an EOO less than 100 km² and an AOO less than 10 km². In addition, the number of mature individuals is estimated to be less than 50. The species is therefore assessed as Critically Endangered **CR**.

PHENOLOGY. December to January.

ETYMOLOGY. The epithet name refers to the typical shape of the spur, resembling a bull's horn, especially that of the local Madagascan zebu cattle.

NOTES. *Aerangis bovicornu* is undoubtedly most closely related to *A. fastuosa* but differs substantially in its flowers which are consistently a third of the size, its spur which is consistently much shorter (vs a minimum of 76 mm in *A. fastuosa*), the perianth tips and spur coloured brownish-orange (vs generally white), the narrower column apex and the obovoid anther with a small, rounded swelling at the apex (vs conical with a long beak). It flowers from December to January whilst *A. fastuosa* flowers earlier from June to November. A detailed comparison is provided by J. Hermans (in J. Hermans *et al.* 2021: 43).

***Aerangis bursiculata* Hermans sp. nov.** Types: Comoros, Grande Comore [Ngazidja], Maouéni, Forêt de la Grille, Maouéni vers Oussoudjou, 885 m, Aug. 2000, *Brionnaud, Yahaya & Boulongne* 48 (holotype BR0000009211247; isotypes CNDRS; K000718804, MO-3260474, P00216039).

<http://www.ipni.org/urn:lsid:ipni.org:names:77340869-1>

Small to medium-sized, 5 – 8.5 cm tall, epiphytic *herb* on a short 1.5 – 3 cm stem covered by several membranous striate sheaths and withered leaf petioles at the base, roots fleshy, greyish-white, glabrous, 1.5 – 2.5 mm in diam. *Leaves* 3 – 4, more or less undulate, narrowly elliptic to narrowly obovate, 2.5 – 7 × 1.2 – 2.2 cm, narrowing towards the base into a short petiole, the margins undulate, unequally bilobed at the apex, pale to dark green, fleshy. *Inflorescences* suberect or arching, several clustered at the base of the leaves, up to 5.5 cm long but generally shorter, 1 – 2.5 mm in diam., with 10 – 30 flowers; peduncle short, with 2 – 3 amplexant sheaths; rachis racemose, club-shaped, floral bracts broad, triangular, acuminate at the apex, 1.5 – 2.1 × 0.9 – 1.3 mm. *Flowers* very small, not opening completely, up to 3.5 × 4.2 mm, greenish-white, paler towards the column. *Pedice*l and *ovary* sub-fusiform, slightly arched, glabrous, slightly erose towards the apex, along the ridges, 3.5 – 5 × 0.5 – 0.8 mm. *Dorsal sepal* ovate, slightly concave, apex acute, sub-cucullate, 1.5 – 2 × 0.8 – 0.9 mm; *lateral sepals* elliptic, obtuse, 1.4 – 2.4 × 0.9 – 1.1 mm. *Petals* elliptic, acute, 1.5 – 2.3 × 0.9 – 1 mm. *Lip* broadly obovate, the base lobulate along the column, the apex obtuse, 1.7 – 2.1 × 1 – 1.7 mm; *spur* narrowed

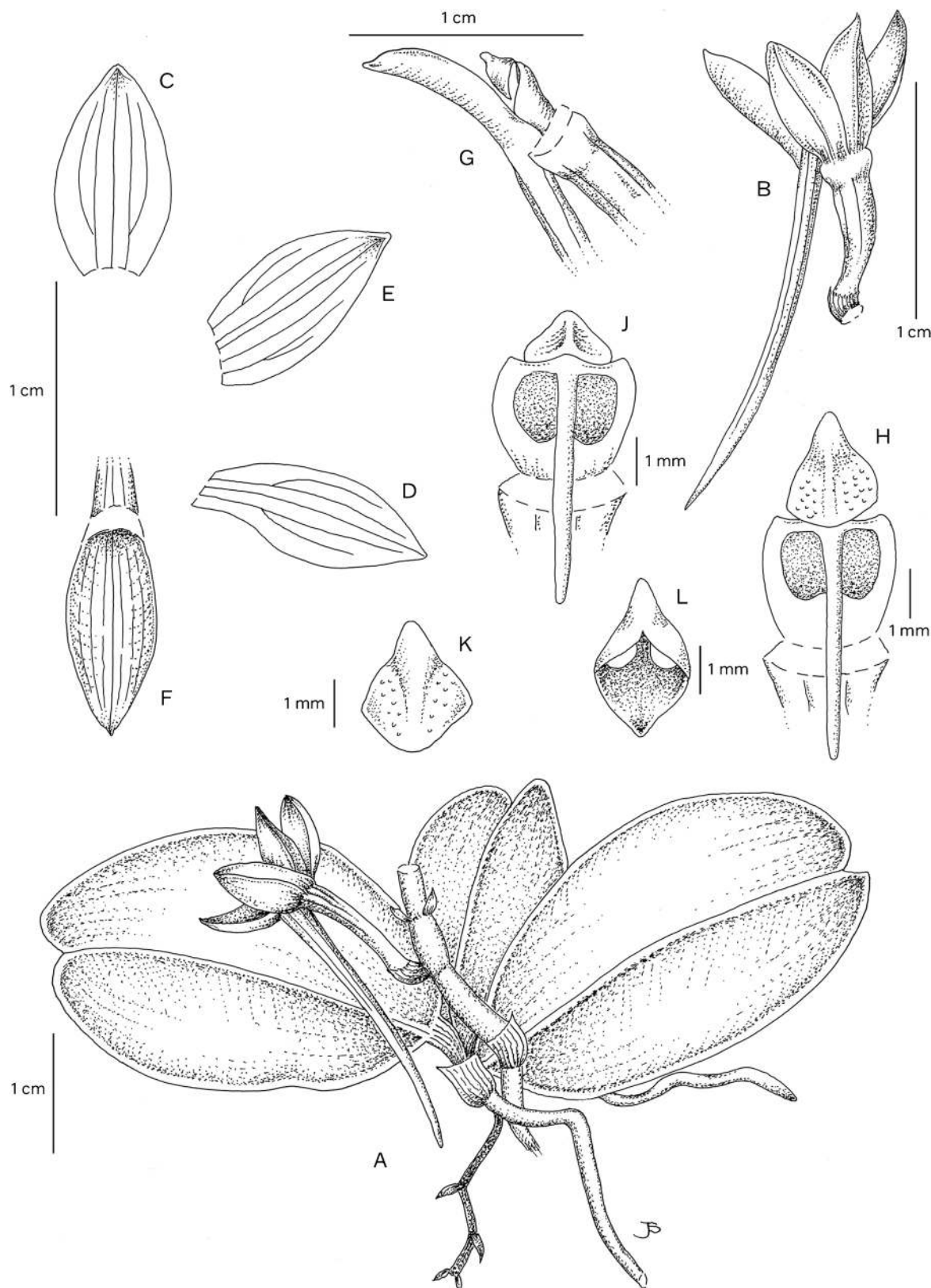


Fig. 3. *Aerangis bovicornu*. **A** habit; **B** flower; **C** dorsal sepal; **D** lateral sepal; **E** petal; **F** lip; **G** column and lip side view; **H** column, front view; **J** column, front view, anther cap removed; **K** anther cap, dorsal view; **L** anther cap, ventral view. DRAWN BY JUDI STONE FROM SPIRIT MATERIAL.



Fig. 4. *Aerangis bovicornu*. **A, B** in habitat, Madagascar. PHOTOS: J. HERMANS.



Map 5. Distribution of *Aerangis bovicornu*.

at the base, then strongly expanded-clavate, slightly flattened, $3.3 - 4 \times 0.4 - 1.3$ mm, translucent with the nectar obvious. *Column* short and stout, short roundly winged, obtuse at the apex, stigma oval, $1 - 1.1 \times 0.7 - 1$ mm; anther cap ellipsoid, pouch-shaped, with a short, rounded beak at the apex, c. 0.5×0.6 mm; pollinia 2, c. 0.2×0.3 mm, sessile on a single linear stipe, c. 0.2 mm. *Seed-capsule* not known. Fig. 5.

RECOGNITION. *Aerangis bursiculata* is distinct in being a small plant with undulate leaf margins, its clustered, densely-flowered inflorescence about as long as the leaf, its clavate rachis, and very small greenish-white flowers with a broad lip lobulate at the base and obtuse at the apex, and a distinctly inflated clavate spur about as long as the ovary. It belongs in sect. *Microterangis*.

DISTRIBUTION. COMOROS. Grande Comore [Ngazidja]. (Map 6).

SPECIMENS EXAMINED. COMOROS. Grande Comore [Ngazidja], forêt de la Grille, May 1963, Bosser 17236 (P00701815); Maouéni, Forêt de la Grille, 885 – 930 m, Aug. 2000, Brionnaud *et al.* 43 (P00216031); Maouéni, Forêt de la Grille, 885 m, Aug. 2000, Brionnaud *et al.* 48 (BR0000009211247, CNDRS; K000718804, MO-3260474, P00216039).

HABITAT. Medium elevation moist evergreen forest, forest remnants, plantations, on *Teclea unifoliata*, on orange trees, 900 – 950 m.

CONSERVATION STATUS. *Aerangis bursiculata* is an epiphytic, endemic orchid, restricted to the la Grille protected area in Comoros. The extent of occurrence (EOO) and the area of occupancy are estimated to be 4 km^2 (under the threshold of threatened category), and only one threatened location is identified. We infer that the population size of the species consists of less than 50 mature individuals. *Aerangis bursiculata* *sp. nov.* is therefore assigned as Critically Endangered (CR) B1B2ab(i, ii, iii, iv, v).

PHENOLOGY. May, August.

ETYMOLOGY. Referring to the purse-like shape of the spur, pouch-like anther cap and the bursitis affecting the author during the revision of the genus.

NOTES. The new species has only been recorded from the la Grille forest on Grande Comore, most recently in 2000, by Brionnaud *et al.* who deposited herbarium material in several herbaria. The collection Brionnaud *et al.* 43 is chosen as the type material, with the BR specimen as the holotype as it is most representative and complete. Brionnaud *et al.* 48 was collected at the same time in the same area. It is noted that both collecting numbers were also assigned to specimens of *Jumellea* *sp.* from the same area.

In sect. *Microterangis* it is closest to *Aerangis coursiana* and *A. divitiflora* from Madagascar but differs in having narrower leaves with undulate margins (vs flat) and flowers with a longer and consistently much more inflated spur. It shares the small flowers and greatly inflated spur of *Angraecopsis pobeguini* (Finet) H.Perrier, also from the Comoros, but that species differs by its longer inflorescence, three-lobed lip (vs entire) and its more acuminate sepals and sepals. The exact posture of the inflorescence and flowers cannot be ascertained from the herbarium material: the description by Brionnaud *et al.* mentioned non-resupinate flowers with the spur alongside the pedicel.

***Aerangis citrata* (Thouars) Schltr.** (Schlechter 1914: 598, 1915: 427, 1918: 115, 1925: 383, 1927: 590); Perrier (1930: 59, 1941: 104); Hawkes (1953: 177); Bowers (1961: 266); Hawkes (1965: 34); Stewart & Campbell (1970: 29); Tysen Northen (1980: 33); Stewart (1986b: 903); Hillerman & Holst (1986: 116); Senghas (1986: 1056); Baumann (1991: 659); Hillerman (1992: 29); Pridgeon (1992: 26); Karasawa (1992: 156); Chiron (1994: 23); Lecoufle (1996: 26); Bowers (1997: 328); Hermans & Hermans (1998: 112); Du Puy *et al.* (1999: 5); Petitjean & Petitjean (2003: 20); la Croix (2004: 136); Cribb & Tibbs (2004: 242); Lecoufle (2005: 16); Stewart (2006: 202); Stewart *et al.* (2006: 224); Hermans *et al.* (2007: 10); la Croix

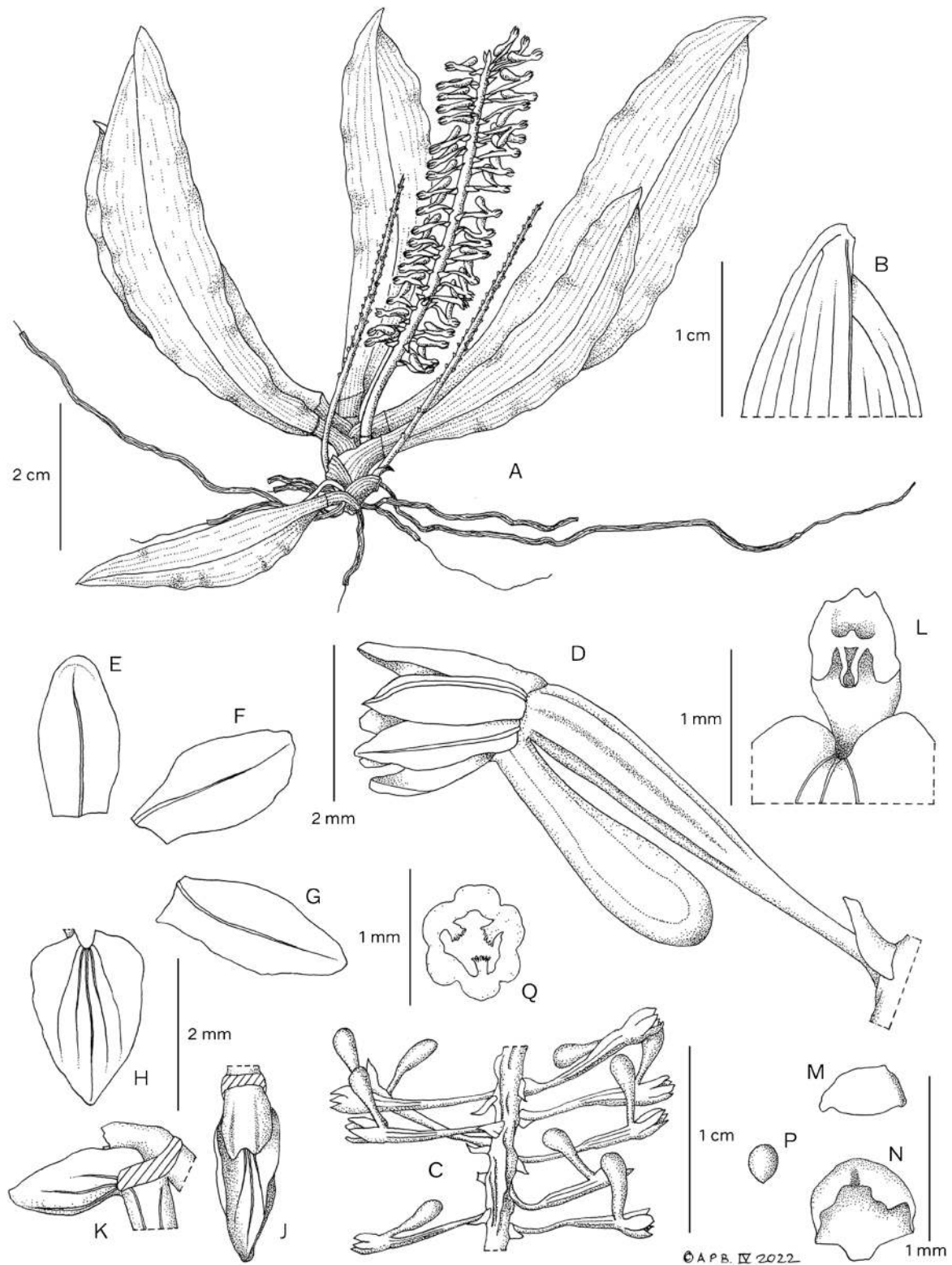
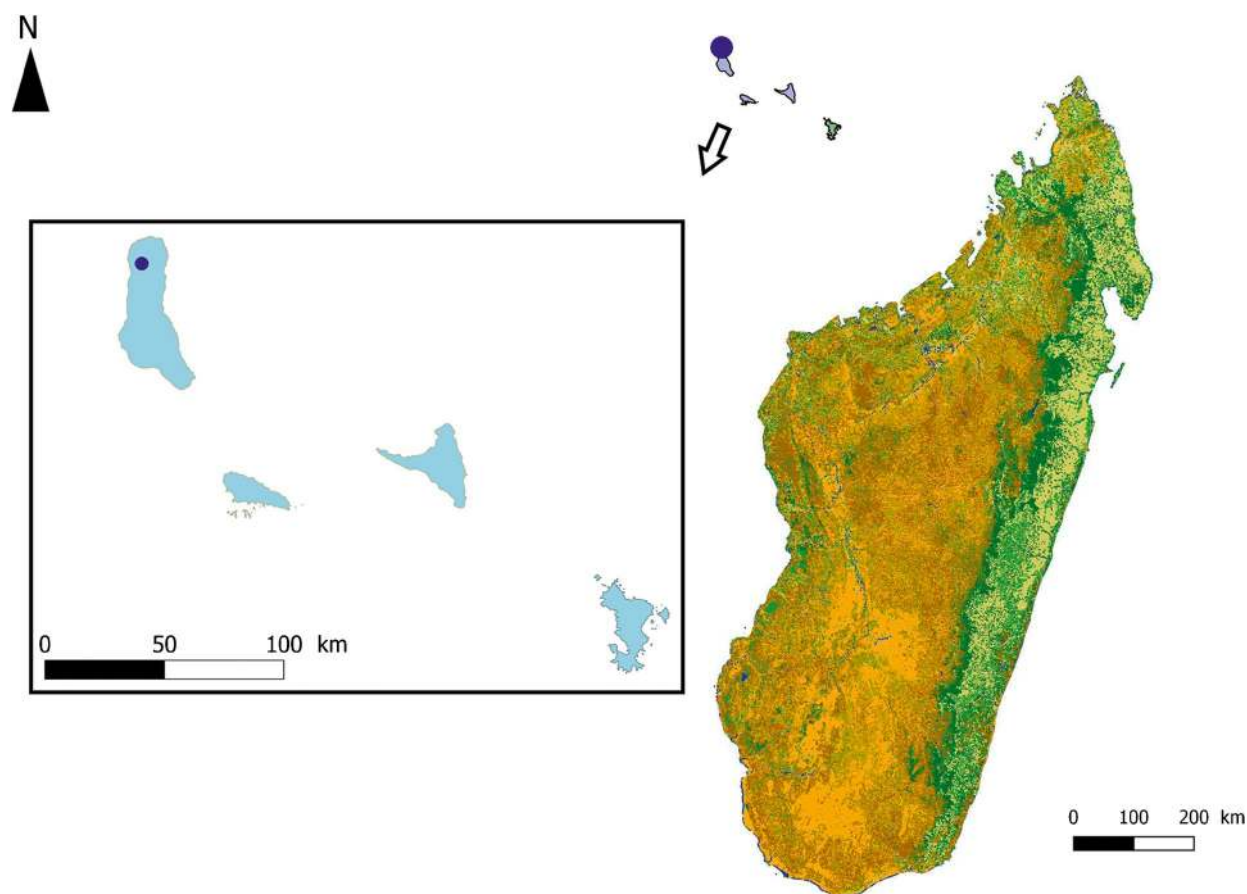


Fig. 5. *Aerangis bursiculata*. **A** habit; **B** underside of leaf apex; **C** part of inflorescence, apex uppermost; **D** flower, lateral view; **E** dorsal sepal; **F** petal; **G** lateral sepal; **H** lip; **J** column and lip, view from above; **K** column and lip, view from side; **L** view of column and base of lip, showing opening to the spur (anther cap missing); **M** anther cap, side view, anterior to left; **N** anther cap, ventral view, anterior to base; **P** pollinium; **Q** T.S. ovary, dorsal uppermost. **A – C** from *Brionnaud et al.* 48; **D – Q** from *Bosser* 17328. DRAWN BY ANDREW BROWN.



Map 6. Distribution of *Aerangis bursiculata*.

(2008: 32); Cribb & Hermans (2009: 274); Bosser & Lecoufle (2011: 66); la Croix (2014: 136); Hervouet (2018: 68); Cribb (2021: 31); Junginger (2022: 188); la Croix (2022: 150). Type: Madagascar, *Thouars* s.n. (holotype P00099114; isotype BM000540192).

Angraecum citratum Thouars (1809: Tabl. *Angorkis*); Thouars (1822: tabl. 2, O. 13, t. 61; Beer (1854: 190); Hooker (1867: t.5614); Ridley (1883: 331, 1885: 481); Rodigas (1886: t.592); Warner *et al.* (1897: t.300); Rolfe (1890a: pl. 238, 1891: 54); Veitch (1891: 130); Bois (1893: 191); Linden (1894: 579); Williams (1894: 97); Durand & Schinz (1895: 41); Sander (1901: 10); Baron (1901: 718); Palacky (1906: 9); Veitch (1906: 112); Schlechter (1913: 47); Wilson (1914: 152, 1926: 318); Arnold (1935: 273).

Angorkis citrangis Thouars (1809: Tabl. *Angorkis*); (1822: tabl. 2, t. 61) as *Angorchis*.

Aerobion citratum (Thouars) Spreng. (Sprengel 1826: 718).

Mystacidium citratum (Thouars) Baron (1881: 114).

Angorchis citrata (Thouars) Kuntze (1891: 651).

Rhaphidorhynchus citratus (Thouars) Finet (1907: 35); Poisson (1912: 185); Costantin (1913: pl.7).

Small to medium-sized monopodial or rarely tufted epiphytic *herb* up to 8 × 30 cm, with a short woody stem c. 5 mm in diam., covered in corrugate sheaths, bearing numerous greyish-green wiry roots becoming silvery grey with age, 1 – 2 mm in diam. *Leaves* distichous, 3 – 9, thin, leathery, on a short 3 – 5 mm conduplicate petiole, elliptic to obovate, 4 – 15 × 1.5 – 4.5 cm, flat, very unequally bilobed at the apex, the shorter lobe often absent, pale to dark green, the upper surface lustrous. *Inflorescence* arching to pendent, arising below the leaves or in the axils of the lower leaves, up to 55 cm long but generally shorter, green, bearing 10 – 60 flowers. Peduncle 1.5 – 4.5 cm, with 1 – 2 short sheaths; rachis racemose, straight, sometimes zig-zag in the apical part, flowers 10 – 20 mm apart. *Floral bracts* thin, amplexicaul, membranous, brown, 1 – 2.1 × 1 – 1.3 mm. *Flowers* small, c. 15 × 30 mm without the spur, very variable in size, all segments crystalline white, cream to pale lemon yellow, the spur pale green. *Pedice*l and *ovary* straight or a little curved, rounded, slightly ridged, 6.5 – 15 × 0.8 – 1.3 mm. *Dorsal sepal* ovate, acute to attenuate, arching forward above the column, 4.4 – 7 × 2.6 – 6 mm; *lateral sepals* spreading, slightly recurved,

obliquely obovate or oblanceolate, obtuse, 6.7 – 12 × 4.1 – 7.2 mm. *Petals* spreading, recurved, broadly elliptic to broadly obovate, obtuse, 7.3 – 19 × 4 – 10.9 mm. *Lip* broadly ovate to orbicular with the narrow base forming a funnel around the spur entrance, the apical margin emarginate or retuse, 7.6 – 13 × 7.5 – 13.3 mm; *spur* at first parallel with the ovary then characteristically angular, pendent, the apical third incurved and more or less inflated, 20 – 25 × 0.9 – 1.6 mm. *Column* short, stout, projecting forward, roundly winged, 1.8 – 2.6 × 1.4 – 2.2 mm, rostellum short, hook-shaped, up to 1 mm long; *anther* cap rounded or minutely beaked near the top 0.8 – 1.3 × 1.5 – 2 mm; *pollinia* obovoid c. 0.7 × 0.5 mm, stipe expanded near the pollinia but narrow below, viscidium ovate; stigmatic surface short and broad. *Seed-capsule* fusiform, glabrous, c. 12 × 8 mm. Figs 6, 7.

RECOGNITION. *Aerangis citrata* is a small to medium-sized plant with a long raceme of small flowers that are often tinted yellow. The dorsal sepal is very small compared with the other segments and arched forward, the spur is abruptly angled downwards around the middle and thickened towards the apex.

DISTRIBUTION. Endemic and widespread in Madagascar, in all provinces except Mahajanga (Map 7).

SPECIMENS EXAMINED. MADAGASCAR. Fito, Ambanivoula?, 1833, *Goudot* s.n. (G); Nossi-be, Lokobe forest, Jan. 1850, *Boivin* 2016bis (P00099118); Imerina nr Lakafotsy, 1000 – 1100 m, May 1871, *Lantz* s.n. (P00099198); between Tamatave and Antananarivo, Jan. 1872, *Mellers* s.n. (K); Ankeramadinika, 1880, *Scott Elliot* s.n. (BM); Central, Aug. 1880? *Parker* s.n. (K); Ankafina, 1880 or 1881, *Deans Cowan* s.n. (K, BM000540195-6); S Betsileo, Ankafina forest, Herb. Candolle, & Herb. Boissier, March 1881, *Hildebrandt* 3987 (G); Imerina, 1881, *Deans Cowan* s.n. (B000M540192, P00099126); Betsileo, Ankafina, March 1881, *Hildebrandt* 3987 (BM000540194, HARV, MO-3129909 458616, P00099153, W-R8637 & R14890, WU040394); Farafangana, Sept. 1881, *Lantz* s.n. (P00099169-70); Central, Jan. 1882, *Baron* 1230 (K); Nossy Ve, Oct. 1882, *Humboldt* 276 (P); Central, rec. Dec. 1883 *Baron* 2187, 2730, 4646 (K); NW, rec. Dec. 1883 *Baron* 5449, 5804, 5807 (K); SW, rec. Dec. 1883 *Baron* 5804 (K); Faravohitra, Feb. 1887, *J. T. Fox* 83 (K ex LDS); road to Mandritsara, Sept. 1889, *Catalt* 3205-6 (P00099122-3); NW, source of Sambirano R., 1889 – 1890, *Last* s.n. (BM000038650); Ankeramadinika forest, rec. 1890, *Scott Elliott* 1550 (K); near Ankeramadinika, 1880, *Scott Elliott* 1880 (BM000540194, P00099190); Ivohimonitra? forest, Nov. 1894, *Forsyth Major* 114 (BM000540197); Analamazaotra, Dec. 1905, *d'Alleizette* 6958, 706M (L0265082, P00099115); Matitanana valley, c. 1000 m, Oct. 1911, *Perrier* 1922 (P00099174); Pic

Vohilonjo, 400 m, Oct. 1912, *Viguier & Humbert* 524 (K, P00099191-2); Analamazaotra, 800 m, Oct. 1912, *Perrier* 8044, 11867 (P00099175-6); Mananara R., 200 m, Oct. 1912, *Perrier* 11347 (P00099195); S of Anivorano, Oct. 1912, *Viguier & Humbert* 579 (P00099193); Mananara, Ranolalina, Sept. 1920, *Decary* 67, 71, 90, 97 (P00099127-30); Ankaizina, April 1923, *Decary* 1991 (P00099131); Mandraka, cult. Tana, Feb. 1925, *François* in Herb. *Perrier* 17131 (P00099178-9); Tsinjoarivo, 1400 m, Feb. 1925, *Perrier* 12131 (P); Andasibe forest, c. 1000 m, Feb. 1925, *Perrier* 17130 (P0009917); Vondrozo, Sept. 1926, *Decary* 4859, 4873 (P00099132-3); Vondrozo, Aug. 1926, *Decary* 4927 (P0009913); Vondrozo, Sept. 1926, *Decary* 5254, 5374 (P00099135-6); Karianga, Oct. 1926, *Decary* 5553 (P00099137); Analabe, Feb. 1928, *Perrier* 18461 (P00099180); Fort Dauphin, Manantantely forest, 60 – 300 m, Sept. 1928, *Humbert & Swingle* 5732 (P00099157-8); N of Anosibe, Feb. 1930, *Decary* 7199 (P00099138); Moramanga area, Feb. 1930, *Decary* 7266 (P00099139); N of Ankazobe, March 1930, *Decary* 7494 (P00099140); Col de Tanantana, 600 – 800 m, Aug. 1932, *Decary* 10377 (P00099141); coll. Leongato, Sept. 1932, *Decary* 10607 (P00099144); Col de Ivolo, 500 m, Sept. 1932, *Decary* 10563 (P00099142-3); Manampanihy valley, Feb. 1934, c. 600 m, *Humbert* 14033 (G, P00099159); Matitanana basin, Sept. 1934, *Heim* s.n. (P00099152); Mandraka, Feb. 1937, *Herb. Jard. Bot.* 2384 (TAN); Zahamena, March 1941, *Decary* 16539, 16701, 16725, 16728 (P00099145-8); Ambohimahaso, Feb. 1942, *Decary* 17539 (G, P00099149, TAN); Lac Alaotra, Dec. 1944, *Homolle* 523, 540 (P00099154-5); Mts N of Mangindrano valley, 1200 m, Jan. 1951, *Humbert & Capuron* 25343 (BR0000020220358, K, MO-324865-6, P00099160-74); Ambatoharanara 1000 m, March 1951, *Cours* 4133 (P00099125); Ambositra area, 1953, *Lecoufle* s.n. (P00099171); Ambalavao, Feb. 1953, *Henri* 5558RN (P00099181); Sahatavy valley, April 1953, *Michel* 6086RN (P00099182); Ambalavao, Feb. 1954, *Rakoto* 6479RN (P00099183); Ambatoharanana, 1000 m, May 1957, *Herb. Inst. Sci. Mad.* 4133 (TAN); Fort Dauphin, Sept. 1958, *Rakotoson* 10033RN (P00099184); Anjozorobe, March 1959, *Bosser* 12837 (TAN); E of Antananarivo, 1200 m, Sept. 1959, *Rauh* M103. (HEID250067-spirit); Soanierana-Ivongo, 50 m, Sept. 1959, *Rauh* M225 (HEID250066, HEID741641, HEID744394-spirit); Ankerana, March 1960, *J. Peltier & M. Peltier* 2304 (P00099173); Mandraka, 1200 m, Jan. 1961, *Bosser* 14835 (P00099119); Ambaton-drazaka, Jan. 1961, 11768RN (P00099186); Mt d'Ambre, Nov. 1961, *Rauh* 7968 (Spirit HEID250064); Ambodiriana, Jan. 1962, 11998RN (P00099187); Ambohitantely, Jan. 1964, *Chabonis* s.n. (P00099124); Androrangabe, Oct. 1966, *Rakatozafy* 658 (TAN); Maroantsetra, Nossy Mangabe, Oct. 1970,



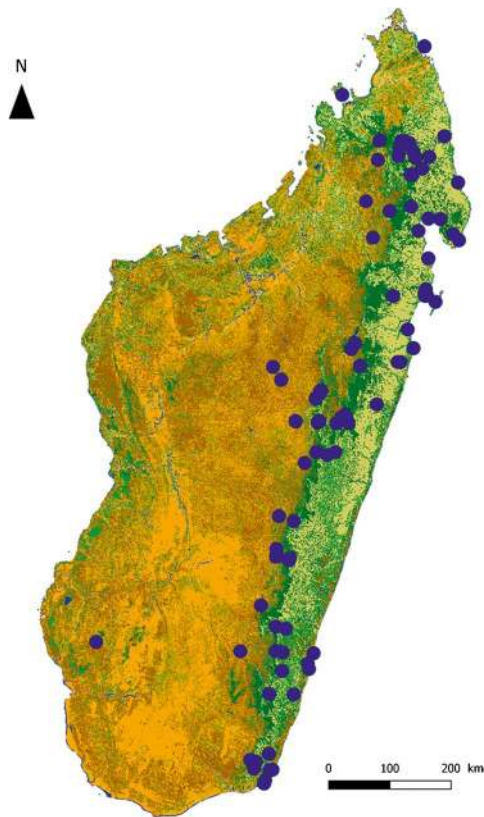
Fig. 6. Thouars's (1822) plate of *Angraecum citratum*, a unique version in the Jussieu herbarium (P00672816) printed in colour à la poupée.



Fig. 7. *Aerangis citrata*. **A** in habitat, eastern Madagascar; **B** part of inflorescence; **C** close-up of flowers. PHOTOS: J. HERMANS.

Keraudren-Aymonin & Aymonin 24531 (P00099167); Périnet, March 1971, *Cremers* 1486 (TAN); to Iakora, 1000 m, Jan. 1974, *Morat* 4254 (P00099172); Mandraka, Feb. 1985, *Barnett et al.* 446 (K, MO-2856067 3334317, P00099116, TAN); Maroantsetra, 50 – 65 m, Oct. 1986, *Lowry et al.* 4003 (MO-2856065 3437297, P00754917, TAN); Marojejy Massif, 100 – 200 m, Sept. 1987, *Schatz et al.* 1563 (MO-2856046 3592280, P00099189, TAN); Nosy Boraha, Sept. 1987, *Phillipson* 2289 (MO-2856073 431196); Nosy Mangabe, Oct. 1987, *Schatz* 1639 (MO-2856069 3589599, TAN); Baie d'Antongil, near to Ambanizana, 100 – 150 m, May

1988, *Floret et al.* 1999 (MO-2856068, P00550746-7, WAG1129936); between Mandena & Marojejy, 100 – 200 m, Sept. 1988, *Miller et al.* (K, MO, P00375470); Mandena, Andapa, Sept. 1988, *Rakotozafy & Rakarilala* 2192 (TAN); Marojejy, 830 – 1210 m, Oct. 1989, *Miller & Randrianasolo* 4444 (MO-2856071 3759167); E coast of Masoala, c. 55 m, Sept. 1991 *Lance* 51 (K); Masoala c. 15 m, Oct. 1991 *Lance* 59 (K); Ranomafana, 800 – 1000 m, March 1992, *Rakoto* 1 (BR0000020220365, K, MO-3011470 4870489, P, TAN, WAG1129934); Andohahela, Feb. 1993, *Malcomber* 2124. (K, MO-2856077, TAN); between



Map 7. Distribution of *Aerangis citrata*.

Ambodiamontana and Ambatolaky, 800 m, March 1993, *Turk & Randriamanatena* 329 (MO-2856048, P00375463, TAN); Mt d'Ambre, 935 m, April 1993, *Harder et al.* 1585 (MO-2856066); Masoala, 0 m, June – Aug. 1993, *Zjhra & Hutcheon* 299 (MO-2856072); Betampona, 275 – 650 m, Sept. 1993, *Lewis & Razafimandibison* 627 (G, K, MO-2856064, P00215387); Andohahela, Sept. 1993, *Randriamampionona* 634 (MO-2856062, P00550740, TAN001149); Anjanaharibe-Sud, 1106 – 1400 m, March – April 1994, *Ravelonarivo et al.* 1 (MO-3011471); Masoala, c. 0 m, May 1994, *Lance* 102 (K); Masoala, Oct. 1994, *Rahajasoa et al.* 748 (MO-2856044, P00107385, TAN); Anjanaharibe Sud, 850 m, Oct. 1994, *Rakotondrinibe* 2089 (P00513707); Anjanaharibe Sud, 875 m, Oct. 1994, *Ravelonarivo et al.* 424 (MO-2856047, P00326090, TAN, WAG0073055); Andapa, 600 m, Nov. 1994, *Hermans* (K 61126.000-spirit); Marojejy, 150 – 265 m, Nov. 1994, *Rasoavimbahoaka* 426 (MO-2856074, TAN001148); Sambava, 590 m, Nov. 1995, *Rasoavimbahoaka* 777 (MO2368025, P02222757); Cap Ste Luce, 630 m, Feb. 1995, *David DuPuy et al.* M868 (K, P00059582, TAN); Anjanaharibe Sud, March 1995, *Ravelonarivo & Rabesonina* 683 (K, MO-2856049, P00326089, TAN); N of Marojejy, 920 m, May 1995,

Rasoavimbahoaka 700 (K, MO-2856075, P00107368, TAN); Ranomafana, 850 m, March 1996, *Kotozafy* 992 (G, MO-2856063); Marojejy, 480 m, Oct. 1996, *Rakotondrainibe* 3291 (P06796660-1); Ambatovy, 1050 m, Feb. 1998, *McPherson* 17515 (MO, TAN); Ste. Luce, *Lowry et al.* 5006 (MO-2856076); Andohahela, c. 85 m, Jan. 2000, *Hermans* 5230 (K); Marojejy, Oct. 2001, *Gautier et al.* LG3827 (G00163179, MO, P06797511, TEF); Tsaratanana, 1240 m, Feb. 2003, *Birkinshaw* 1247 (G, MO, P00593235); Forêt d'Andakibe, 3 m, Oct. 2003, *Rabehevitra* 615 (MO-2856080, P00932407, TEF); Ambatovaky, 513 m, Dec. 2003, *Britt et al.* AB40 (K); Maroantsetra, 690 m, Sept. 2004, *Antilahimena* 2898 (MO2856097); forêt d'Anamangy, 640 m, Sept. 2005, *Andrianjafy et al.* 1204 (MO, P, TAN); Ambatovy, 1044 m, Feb. 2005, *Razanatsoa et al.* 288, 336, 341 (MO-2856050, TAN); Ambatovy, 1030 m, Feb. 2005, *Rakotovoao et al.* 1252, 1253 (MO-2856054, TAN); Ambatovy, 1070 m, March 2005, *Antilahimena & Razafindasy* 3541 (TAN); Manompana, 50 m, March 2005, *Fournel* 212 (REU017555); Anjozorobe, 1436 m, March 2005, *Razakamalala et al.* 1937 (TAN); Ambatovy, 1027 m, March 2005, *Rakotovoao et al.* 1550 (TAN); Ambogabe, 1300 m, April 2005, *Andrianasolo et al.* 62 (TAN); Ambohibato, 1200 m, April 2005, *Faranirina et al.* 32 (TAN); Manonbo, 16 m, Sept. 2005, *Rabari-manarivo et al.* 37 (MO-2856052, P00755081, TAN); Manombo, 11 m, Sept. 2005, *Rakotonirina et al.* 404 (MO, P, TAN); Anamangy, 640 m, Sept. 2005, *Andrianjafy et al.* 1204, 1298, 1436 (MO, P00932433, TAN); Belava, 239 m, Sept. 2005, *Randriatsivory et al.* 33 (MO, P00932435, TAN); N of Anjalavahely, 1100 m, Feb. 2006, *Rakotovoao et al.* 2751 (MO-2856053, P00755110, TAN); Antsahabalika, Feb. 2006, *Antilahimena et al.* 4576, 4598 (MO-2856055, MO-2856057, P00755103, P00755105); Andranomololo, Andramanalana, 738 m, May 2006, *Rakotovoao et al.* 3167 (MO-2856051, TAN); Vaviambe, Oct. 2006, *Ranarivelo et al.* RTI316 (TAN); Ambatovy, 1013 m, Nov. 2006, *Andriantiana* 360 (MO-301147, P06796662, TAN); Andranopositra, 840 m, Nov. 2006, *Rakotovoao et al.* 3252 (MO, TAN); Antsahandroboka, 1143 m, Feb. 2007, *Rakotovoao et al.* 3586 (MO-2856078, P, TAN); Ambatofitatra, 1567 m, Feb. 2007, *Ravelonarivo et al.* 2167 (MO-2856098, P, TAN); Ambatovy, 1149 m, March 2007, *Antilahimena et al.* 5469 (MO-2856058, P06796663); Makira, April 2007, *Bernard* 467 (MO-2856082, P00804773); Makira, 3696 ft, April 2007, *Ravelonarivo et al.* 2303 (MO 2856104, P01029829, TAN); Antsampanandrano, 1114 m, June 2007, *Miandrimanana et al.* 297 (MO-2856059-60, P, TAN); Ambatovy, 1024 m, Feb. 2008, *Rakotondrafara et al.* 636 (G, MO-2856084, TAN); Ambatovy, 1003 m, Feb. 2008, *Antilahimena et al.* 6059 (MO-2856099, P, TAN); Mt d'Ambre, 970 m, April 2008, *Ramanadimbimanana et al.* SDR083 (K, G, MO-3248651, P02139285,

WAG1129933); Ambatovy, 991 m, Sept. 2008, *Antilohimena et al.* 6451 (MO-2856081, TAN); Ambatovy, 1023 m, 2008, *Bernard et al.* 1171 (TAN); Ambatovy, 1049 m, Nov. 2008, *Rakotondrafara et al.* 847 (MO-2856012, P, TAN); Ankarabolava, 72 m, Sept. 2009, *Andriamihajarivo et al.* 1692 (MO2856105, P, TAN); Andohan'Anjombalava, 293 m, Aug. 2010, *Ludovic et al.* 1266 (TAN); Manompana 8 m, Sept. 2010, *Manjato et al.* 286 (TAN); Ambatovy, 2011–2015 *Ambatovy Shade House* 550, 631, 1345, 1447, 1634, 2737, MO1521A3234, TAN2342A4615, TAN 2313A3440/7, TAN2973A4654, TAN2324A4658, MO3037A4880, TAN3036A4880, 5110, TAN2281A5110, TAN3018A5813, TAN582A1663/7, MO582A1663/7, MO733A550/8 (BRLU, K, MO, TAN); Mt d'Ambre, 791 m, April 2012, *Ramanadimbimanana* SDR 399 (G, K, P00783730, TEF); Ankazigny, 21 m, Sept. 2012, *Ludovic* 172 (MO, P, TAN); Ambatovy, 1161 – 1186 m, 2014 – 2015, *Ambatovy Spirit* 1359A550/8, TAN1420VB821, 1443A550/3, 2281A5110, 2313A3440/2, 324A46587, 2342A4615, 2973A4654, 3018A5813, 3036A4880, 3037A4880, 304T45 (BRLU, K, TAN); Ankenjana, 1065 m, 2014, *Ambatovy Spirit* 1339AKBK5, 1346AKAK24, 1496AKB5, 1508VB2118, 1520A3234, 1521A3234, 1559VB1140 (MO, TAN); Parc de Vodibasy, 1196 m, March 2014, *Parc Vodibasy* (MO1509VB2118, TAN1517VB71, TAN1508VB2118); Takafatra, 1609 m, Dec. 2014, *Antananarivo Shade House* 30, 36, 39, 45, 186 (BRLU304T45, BRLU542T186, MO307T186, P444T45, TAN31T45, MO169T45MO549T3, TAN160T30, TAN317T36, TAN41T38, TAN171T186); Mt Vatovavy, 293 m, Dec. 2014, *Antananarivo Shade House* 190 (TAN93T190); Antsahabe, 1310 m, Jan. 2015, *Antananarivo Shade House* 236 (BRLU308T236/1, K313T236/1, MO166T236/1, P438T236/2, TAN165T236/1); Takafatra, 1631 m, Feb. 2015, *Antananarivo Spirit* 30T71, 31T45, 160T30, 170T71 (TAN); Forêt de Vohibe, 520 – 650 m, Aug. 2015, *Ambalabe Shade House* 198 (TAN201L198); Forêt de Belava, 239 m, Sept. 2015, *Randriatsivory et al.* 633 (MO, P, TAN); Analamanga, 1310 m, Feb. 2016, *Antananarivo Spirit* 165T236/1, 169T45, 171T186, 166T236/1 (MO, TAN); Ranomafana, 1014 m, March 2016, *Rabarimanarivo et al.* 771 (MO, P, TAN); Ambalabe, 770 – 780 m, April 2016, *Ambalabe Shade House* 570 (TAN18L570); Takafatra, 1609 m, Jan. 2017, *Antananarivo Spirit* 305T45, 307T186, 317T36, 444T45, 445T45, 542T186, 549T36 (BRLU, K, MO, TAN); Anjozorobe, 1310 m, Jan. 2017, *Antananarivo Spirit* 308T236/1, 313T236/1, 438T236/2 (BRLU, K, P); Vohibe, 520 – 650 m, Sept. 2017, *Ambalabe Spirit* 201L198 (TAN); Analalava, 58 m, Nov. 2018, *Antananarivo Shade House* 446, 577T446 (TAN577T446); Imerina, *Baron* 201 (K); between Tamatave and Antananarivo, *Mellers* s.n. (P); Foulpointe, *Humblot* s.n. (P00099161); Ankafana,

Deans Cowan s.n. (P); Nosy Mangabe, *Carlson* 425 (P00099121, MO-2856045, TAN).

HABITAT. Epiphyte, usually on small branches and on small trees, in low to medium elevation moist evergreen forest, littoral forest and degraded forest remnants. Elevation: sea level to 1700 m.

CONSERVATION STATUS. *Aerangis citrata* is an endemic, widespread orchid, distributed in Northern, Eastern and South-Central and Southern Madagascar in Antsiranana, Toamasina, Antananarivo, Mahajanga, Fianarantsoa and Toliara provinces in Madagascar. The extent of occurrence (EOO) of *Aerangis citrata* is estimated to be more than 20,000 km². The species is known from 33 threatened locations. In addition, *A. citrata* is recorded in many protected such as Tsaratanana, Lokobe, Montagne d'Ambre, Pointe-à-Larrée, Nosy-Mangabe, Masoala, Marojejy, Anjanaharibe-Sud, Analamazaotra, Mantadia, Zahamena, Betampona, Anjozorobe-Angavo, Ankerana (CAZ), Midongy-Sud, Manombo, Tsitongambarika. Although there are some subpopulations (16 occurrences) that are facing a continuing decline due to habitat destruction, the overall population is believed to be stable and not at immediate risk of extinction. Therefore, *Aerangis citrata* is assessed as Least Concern (LC).

PHENOLOGY. August to May but mainly from September to October and January to February.

ETYMOLOGY. The name refers to the often pale lemon-yellow colour of the flower.

VERNACULAR NAMES. *Manta* (Betsimisaraka) (Dandouau (1909), Poisson (1912: 185)); *tsiakondroakondro* (Manohiraza 11998, P); *fontsilahinjanahary Fotsy* (Miller et al. 4317, MO).

NOTES. *Aerangis citrata* was the first species in the genus to be described and illustrated by Thouars in 1809 and 1822 (Fig. 6), respectively. A herbarium sheet in P (P000991140) from the Thouars herbarium corresponds well with his description and illustration and can be assumed to be the holotype; a few flowers from the same collection are in BM and may well have been once part of the P specimen. Apart from the black and white and coloured version of Thouars' 1822 plate (t. 61) there is also a unique version in the Jussieu herbarium (P00672816) printed in colour *à la poupée*.

Its flowers are variable in size and colour but this has rarely caused confusion. It is still fairly common and widespread in Madagascar. In herbaria, and sometimes in orchid collections, it has occasionally been confused, when not in flower, with *Aerangis macrocentra*. Ever since the first importations from the 1860s, it has been a common plant in cultivation and is still popular with growers and herbarium collectors.

Its chromosome number is $2n = 50$ (Arends & Vander Laan (1983: 83); Jones (1967: 154). A form with a variegated leaf was illustrated by Lecoufle (2002: 20) and la Croix (2022: 151).

Aerangis concavipetala H.Perrier (1938a: 35, 1941: 103); Stewart (1986d: 1122); Hillerman & Holst (1986: 261); Du Puy *et al.* (1999: 6); Stewart (2006: 203) the illustration is of *A. ikopana*; Stewart *et al.* (2006: 431) the illustration is of *A. ikopana*; Cribb & Hermans (2009: 280), the illustration is of *A. ikopana*; Hermans *et al.* (2007: 10); la Croix (2014: 138, 2022: 152), the photograph is of *A. ikopana*. Type: Madagascar, Bejofo, Maromandia district, June 1923, Decary 2210 (holotype P00099113).

Medium-sized monopodial epiphytic herb up to 8 × 18 cm tall, with a short stem c. 10 mm in diam., covered in brown corrugate sheaths, roots greyish, somewhat flattened, 3 – 3.8 mm in diam. Leaves 3 – 4, leathery, on a short 3 – 5 mm conduplicate petiole, elliptic to obovate, 7.5 – 11.2 × 2.5 – 3.5 cm, slightly unequally bilobed at the apex. Inflorescence up to 30 cm long, bearing 12 – 16 flowers; peduncle short; rachis racemose, 2 – 3 mm in diam., slightly zig-zag. Floral bracts amplexicaul, broadly triangular or tubular, obtuse, 1.8 – 2.6 × 1.8 – 2 mm. Flowers small, c. 12 × 10 mm without the spur, 8 – 15 mm apart; white, all segments strongly veined with red. Pedicel and ovary strongly curved, rounded, slightly ridged, 9.5 – 14.5 × 0.9 – 1.2 mm. Dorsal sepal erect, broadly elliptic, concave, rounded, minutely apiculate, 5.8 – 7.1 × 4.8 – 5.3 mm; lateral sepals ovate, concave, acuminate, 7 – 7.9 × 3.9 – 4.5 mm. Petals elliptic to broadly elliptic, concave, obtuse, 5.8 – 6.2 × 3.8 – 4.1 mm. Lip elliptic, cucullate towards the anterior margin, cucullate, attenuate towards the base, 6.6 – 7.8 × 4.9 – 5.5 mm; spur slender, slightly curved, inflated at the apex, 60 – 83 × 0.9 – 1.5 mm. Column erect, slightly winged, emarginate at the apex, rostellum gradually tapering, c. 2.5 mm long, clinandrium with entire margins; anther truncate at the front, c. 2 mm in diam.; pollinia ovoid c. 0.8 × 0.6 mm, stipes slender, viscidium rounded. Seed-capsule not known. Fig. 8.

RECOGNITION. *Aerangis concavipetala* is distinct by its long inflorescence bearing small flowers with elliptic and concave sepals and petals, a lip cucullate towards the apex, all the segments being distinctly veined red, and its long spur inflated at the apex.

DISTRIBUTION. Endemic to Mahajanga province in NE Madagascar (Map 8).

SPECIMENS EXAMINED. MADAGASCAR. Bejofo, Maromandia distr., June 1929, Decary 2210 (P00099113).

HABITAT. Epiphyte c. 100 m.

CONSERVATION STATUS. *Aerangis concavipetala* is endemic to Western Madagascar, in the Maromandia district, Mahajanga province and is known from one collection (one occurrence). The extent of occurrence (EOO) and the area of occupancy (AOO) are both estimated to be 4 km² (under the limits for Critically Endangered status under criterion B) and the only

one occurrence represents one threatened location. The species occurs outside protected areas which are undergoing intense human pressure such as forest clearing for the expansion of crop fields. We infer that the ongoing loss of its habitat has and will induce a strong continuous decline in EOO, AOO, habitat extent and quality, the number of subpopulations and mature individuals in the next ten years. *Aerangis concavipetala* is therefore assigned a status of Critically Endangered (CR) under criteria B1B2ab (i, ii, iii, iv, iv, v).

PHENOLOGY. June.

ETYMOLOGY. The epithet refers to its concave petals.

NOTES. Perrier (1938a) first described this species, based on a specimen collected by Decary almost ten years earlier in Bejofo (Bezofa in the protologue), in the Sambirano region in NE Madagascar. It is only known from the type collection. It is quite distinctive as no other species has the same rounded concave floral segments with distinctly red veins. The remote area around the type locality has not been extensively explored and this might explain why it has remained elusive. The possibility that the type might be a deformed or peloric variant of another, more common, species should also be considered.

Aerangis coursiana (H.Perrier) P.J.Cribb & Carlswald (2012: 44); la Croix (2014: 138, 2022: 153). Type: Madagascar, Ambatodrazaka, Menaloha, Cours 744 (holotype P00095846).

Chamaeangis coursiana H.Perrier (1951: 160).

Microterangis coursiana (H.Perrier) Senghas (1985: 22);

Du Puy *et al.* (1999: 181); Stewart *et al.* (2006: 335), the plate on p. 336 as *M. divitiflora* is this species; Hermans *et al.* (2007: 230), plate 47B as *M. divitiflora* is this species; Cribb & Hermans (2009: 284), plate 38.2 as *M. divitiflora* is this species.

Small 5 – 9 cm tall, epiphytic herb with a short 1 – 2.5 cm long stem covered by 1 – 3 membranous striate sheaths at the base, roots fleshy, greyish-white, glabrous, 2 – 3 mm in diam. Leaves 3 – 4, flat, elliptic, 3.2 – 6.5 × 1.2 – 2.2 cm, narrowing towards the base into a 2 – 5 mm petiole, unequally emarginate at the apex, pale to dark green, the mid-vein darker, surface slightly glossy, margins darker green or brownish-red. Inflorescences arching to pendent, pale green, tinted brown, developing simultaneously from the base of the leaves, in a series of 3 – 10, up to 6.5 cm long but generally shorter, 1 – 2.5 mm in diam., with 15 – 35 flowers; peduncle very short, with 2 – 3 brown amplexant sheaths; rachis racemose, alternate, slightly zig-zag, with the flowers developing acropetally; floral bracts with the base almost completely enveloping the rachis, acuminate at the apex, 1 – 2 × 0.9 – 1.3 mm,



Fig. 8. The type sheet of *Aerangis concavipetala* (Decary 2210). Courtesy of the MNHN (P00099113).



Map 8. Distribution of *Aerangis concavipetala*.

dark brown to red. *Flowers* very small, up to 3.5×3.9 mm, sepals, petals, lip and spur ivory, yellowish-green to reddish-brown, the anther often a little paler. *Pedice*l and *ovary* sub-fusiform, slightly arched, glabrous, ridged towards the apex, $1.8 - 2.5 \times 0.4 - 0.8$ mm, brown to dark red. *Dorsal sepal* elliptic, slightly concave, apex rounded sub-cucullate, $1.5 - 1.9 \times 0.9 - 1.5$ mm; *lateral sepals* elliptic, obtuse, spreading, $1.3 - 1.5 \times 0.9 - 1.5$ mm. *Petals* elliptic, obtuse, $0.7 - 1.1 \times 0.9 - 1.5$ mm, slightly recurved. *Lip* broadly obovate, the base roundly curved along the column, the apex apiculate, $1.1 - 1.5 \times 1.1 - 1.5$ mm; *spur* clavate, $1.5 - 2 \times 0.3 - 0.5$ mm. *Column* short and stout, short roundly winged, slightly apiculate at the apex, stigma oval, c. 0.5×0.4 mm; anther globose to ovoid, with a short triangular beak at the apex, c. 0.3 mm in diam.; pollinia 2, sessile on a single linear stipe, c. 0.1 mm. *Seed-capsule* cylindric, c. 4×1.5 mm. Fig. 9.

RECOGNITION. *Aerangis coursiana* is characterised by its leaves with darker edges, its densely-flowered inflorescence shorter than the leaf, in multiple series, and very small green to pale brown flowers, with the lip base curved along the column, the apex apiculate, and the clavate spur about as long as the ovary.

DISTRIBUTION. Madagascar. Antananarivo and Toamasina provinces and sight records from Toliara (Zombitse N. P., Hermans Sept. 2019) (Map 9).

SPECIMENS EXAMINED. MADAGASCAR. Ambatodrazaka distr., Menaloha, mountains around lake Alaotra, c. 900 m, Sept. 1938, *Cours* 744 (P00095846); Lake Alaotra, beside the Menaloha, forest remnants, epiphyte, July 1952, *Bosser* 3060 (P00095858); Belobaka, Analandraisoa forest, July 1963, *Bosser* 17149 (P01768873); Antananarivo prov., Anjozorobe, 1997, *Hermans* 4051 (K); Ambatovy, Komy, Vahimboatany, *Ambatovy Shade House* 728, spirit 1604A728/1, 3 (BRLU, K, MO, P, TAN); Ambatotsiranana, before Moramanga, June 1979, *Tixier* 28, drawing only (P); Analavelona, Dec. 2015, Sakaraha, *Antananarivo Shade House* 710T349bis & spirit (TAN).

HABITAT. Medium altitude moist evergreen forest, forest remnants, moss forest, 900 – 950 m.

CONSERVATION STATUS. *Aerangis coursiana* is an epiphytic, endemic orchid, distributed in Antananarivo, Toamasina and Toliara provinces respectively in Analamanga (Anjozorobe), Bongolava (Belobaka Tsiroanomandidy) Alaotra- Mangoro (Ambatovy, Ambatondrazaka), Atsimo- Andrefana (Zombitse National Park, Analavelona) regions. The species is recorded from six occurrences with three within Protected Areas and one collection in the Ambatovy shade house. Two occurrences (three old collections: *Cours* 744, *Bosser* 3060 and *Bosser* 17149) could already be extirpated and/or may be disappearing soon. A reduction of 30% of the population size (two of six occurrences) will be inferred in the next ten years and will induce a continuing decline in AOO, EOO, habitat extent and quality, and the number of subpopulations and mature individuals. *Aerangis coursiana* is therefore assigned as Vulnerable (VU) A4c.

PHENOLOGY. June to September.

ETYMOLOGY. Named for Gilbert Cours-Darne (1909 – 2001), French agronomist, explorer and botanist, director of the Agronomic research station at Lake Alaotra, who collected the type material in that area.

NOTES. First described by Perrier in 1951 as *Chamaeangis coursiana* from material collected by Cours near Lake Alaotra. Perrier compared it with *Chamaeangis hariatiana* but did not take into account Schlechter's *Angraecum divitiflorum*, then placed in a different genus. It is very similar to and may be the same as *Aerangis divitiflora* and was illustrated as such in recent publications (Stewart *et al.* (2006: 336); Hermans *et al.* (2007: 230); Cribb & Hermans (2009: 284)), its identity is discussed under that species.

***Aerangis cryptodon* (Rchb.f.) Schltr.** (Schlechter 1914: 597, 1915: 427, 1918: 115, 1925: 384, 1927: 590); Perrier (1938a: 31) partly referring to *A. ellisii*;

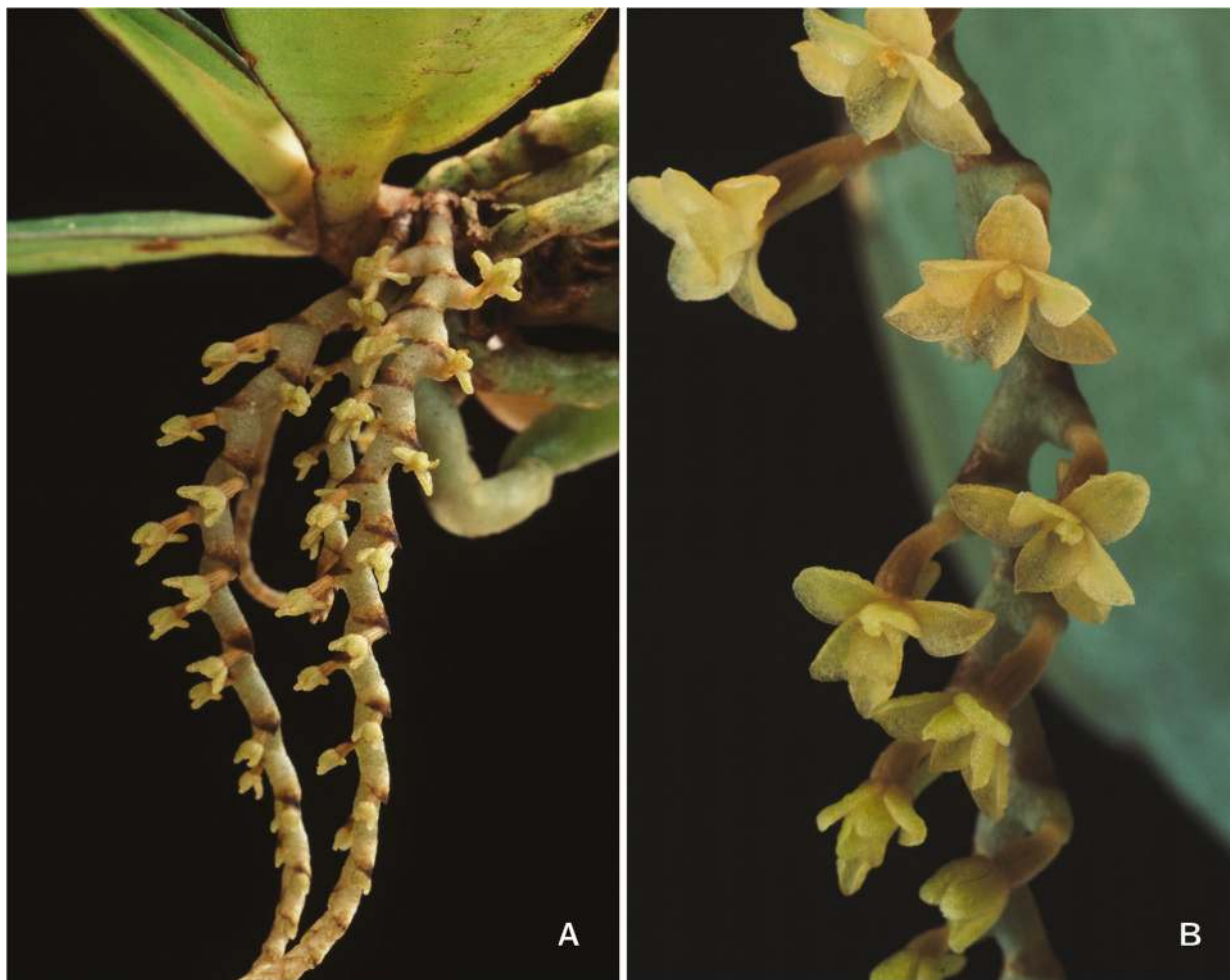


Fig. 9. *Aerangis coursiana*. **A** inflorescences; **B** part of inflorescence. PHOTOS: J. HERMANS.

Perrier (1941: 101) partly referring to *A. ellisii*; Hawkes (1953: 177, 1965: 35); Hillerman & Holst (1986: 120) the photo is *A. ellisii*; Stewart (1995: 5, 1986c: 1011, 2006: 204); Du Puy *et al.* (1999: 6); Stewart *et al.* (2006: 238); Hermans *et al.* (2007: 10); Cribb & Hermans (2009: 282); la Croix (2014: 141), the photographs are of *A. ellisii*; la Croix (2022: 155), the photographs are of *A. ellisii*. Type: Madagascar, cult. Low? s.n. (Reichenbach herbarium W, R39424), **lectotype designated here**; Madagascar, cult. Feb. 1883, Low, drawing by Rchb.f. s.n. (paratype Reichenbach herbarium W, R39425); Madagascar, Day sketchbook watercolour Feb. 22, 1883, XXXI, t. 73 (K) (Fig. 11).

Angraecum cryptodon Rchb.f. (Reichenbach f. 1883: 307); Ridley (1885: 486); (Williams (1885: 115); Veitch (1891: 130); Stein (1892: 68) as *Angraecum*; Durand & Schinz (1895: 41); Williams (1894: 97); Baron (1901: 718); Palacky (1906: 9); Poisson

(1912: 182); Sander (1927: 48); Cribb & Tibbs (2004: 244).

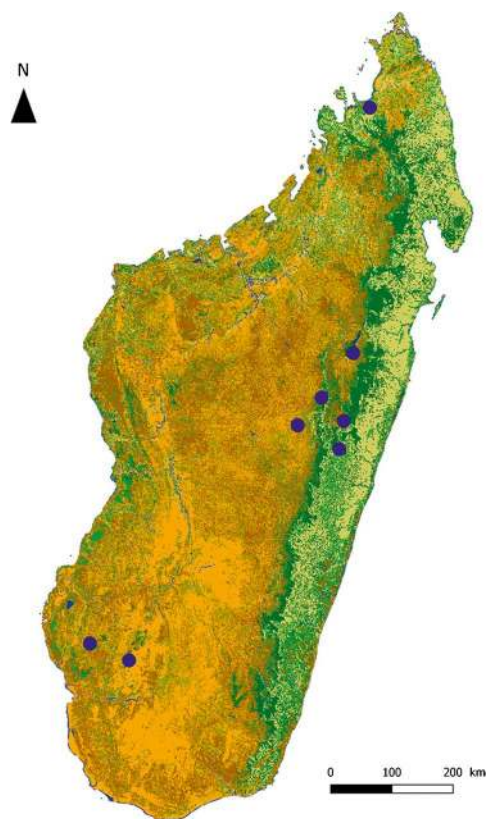
Angorchis cryptodon (Rchb.f.) Kuntze (1891: 651).

Rhaphidorhynchus stylosus sensu Finet (1907: 36). Based on Lantz s.n. (P00099194) non Schltr. non Rolfe.

Aerangis malmquistiana Schltr. (Schlechter 1925: 385); Perrier (1930: 59, 1941: 112); Hillerman & Holst (1986: 263). Type: Madagascar, Mananara, 1912, Perrier 11347 (lectotype P00099195), **lectotype designated here**.

Aerangis alata H.Perrier (1938a: 38, 1941: 112); Hillerman & Holst (1986: 261). Type: Madagascar, Manampanihy, Fitana, Oct. 1928, Humbert 6062bis (holotype P00080674) **synon. nov.**

Medium sized, 10 – 30 cm tall, epiphytic *herb* with a short stem 2 – 4 cm long and 0.5 – 1.5 cm in diam., partly covered by thick striate sheaths, roots, fleshy, greyish-white, glabrous, 2 – 4 mm in diam. *Leaves* 2 – 5, distichous, flat,



Map 9. Distribution of *Aerangis coursiana*.

fleshy, obovate to narrowly obovate, $9 - 15 \times 3 - 4.5$ cm, attenuate towards the base into a short petiole, slightly unequally bilobed at the apex, dark green. *Inflorescences* axillary, arching to pendent, up to 35 cm long, 2–4.5 mm in diam., bearing 6–15 flowers, c. 2 cm apart; peduncle 3–5.5 cm, with 1–2 tubular sheaths; rachis racemose, zig-zag. *Floral bracts* thin, amplexant, broadly triangular ovate, acute, $3.1 - 4.9 \times 3.2 - 5$ mm, almost completely enveloping the base of the pedicel and a short stem-like conical projection between the rachis and the pedicel. *Flowers* fragrant, medium in size, $28 - 35 \times 24 - 31$ mm, sepals, petals and lip white more or less tinted pink, spur white, tinted pink especially towards the base, the column ivory. *Pedicel* and *ovary* straight or a little curved, rounded, slightly ridged, $19 - 33 \times 1 - 2$ mm, green to brownish-orange. *Dorsal sepal* erect, narrowly ovate, lanceolate, attenuate, the margins and apex more or less recurved, $13 - 17.5 \times 4.1 - 5$ mm; *lateral sepals* strongly reflexed, narrowly ovate, attenuate, $15.5 - 20 \times 3.9 - 6$ mm. *Petals* strongly reflexed narrowly ovate–lanceolate, acuminate, $13.1 - 20 \times 4.1 - 6.5$ mm. *Lip* deflexed below the spur, obovate, narrowed towards the base, the apex attenuate, $14 - 19 \times 5.8 - 7.9$ mm, bearing two prominent tooth-like ridges at the entrance

to the spur; *spur* distinctly widened at the mouth then abruptly narrowing and arching, subulate, $95 - 135 \times 0.8 - 3.8$ mm, slightly inflated, flattened in the apical quarter. *Column* long and slender, $5.5 - 7.8 \times 2 - 3.5$ mm, androclinium small and surmounted by two membranous, denticulate rostellum wings at least 1 mm long and indented at the apex; stigma large, expanded, occupying the upper half of the column; anther cap rounded with a longitudinal rounded ridge $1.4 - 1.8 \times 2 - 2.8$ mm; pollinia 2, stipes strap-shaped, viscidium rectangular. *Seed-capsule* not known. Figs 10, 11, 12.

RECOGNITION. *Aerangis cryptodon* is a medium-sized plant with a short stem and obovate–cuneate leaves, a long arching inflorescence, flowers that are more or less tinted pink, medium in size and with reflexed tepals, a lip with two tooth-like ridges at the entrance, a spur inflated at the base and flattened, and a column with distinct denticulate rostellum wings, indented at the apex. **DISTRIBUTION.** Madagascar: Antananarivo, Antsiranana, Fianarantsoa and Toliara provinces (Map 10).

SPECIMENS EXAMINED. MADAGASCAR. Mananara R., c. 200 m, Aug. 1912, *Perrier* 11347 (P00099195); Manampanihy basin, Col Fitana, Oct. 1928, 300–700 m *Humbert* 6062bis (P00080674); Imerina, near Lakafotsy,



Fig. 10. Drawing by Reichenbach of *Aerangis cryptodon*, part of the type material at W (R39425).



Fig. 11. *Aerangis cryptodon* in John Day's Scrapbooks (1887: 73). Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.

c. 1000 – 1100 m, Lantz s.n. (P00099194); between Moramanga and Anosibe, March 1961, Bosser 15084 (P00080681, TAN); Diego? cult. Jard. Bot. Robinson 1221 (P spirit); Galoko, comm. Pronk, 2007, Hermans 6703 (K). **WITHOUT EXACT PROVENANCE:** Humbert 6067bis (P00095861); cult. Low? s.n. (Reichenbach herbarium W, R39424); cult. Veitch s.n. R28219, R28888 (W).

HABITAT. Low to medium altitude moist evergreen forest. Altitude 200 – 1200 m.

CONSERVATION STATUS. *Aerangis cryptodon* is an epiphytic, endemic orchid, distributed in Antsiranana, Toamasina, Antananarivo, Fianarantsoa and Toliara provinces respectively in Diana, Analamanga, Alaotra-Mangoro and Anosy regions. The species is only recorded in the Ampasindava Galoko Kalabinono Protected Area. The species is known from five locations. Four of five occurrences (Perrier 11347; Humbert 6062bis; Bosser 15084; Hermans 6703) could be extirpated or / and may have disappeared by habitat destruction due to frequent fires and shifting agriculture. *Aerangis cryptodon* is therefore assigned as Endangered (EN) B1B2ab (i, ii, iii, iv, v).

PHENOLOGY. October.

ETYMOLOGY. From the Greek '*cryptodon*': referring to the 'hidden' teeth at the base of the lip; '*malquistiana*': dedicated to Albert Frederik Malmquist (1863 – 1921), director of the Herrenhausen Botanic Garden, Hannover; '*alata*': may refer to the wing-like appearance of the lateral sepals.

NOTES. Reichenbach received a dried specimen of this species in February 1883 from Messrs. H. Low's nursery, who had imported it from Madagascar from an unspecified source. He drew a flower and annotated it as '*cryptodontum*' referring to the tooth-like extension of the basal ridges of the lip disappearing into the mouth of the spur. The same month, John Day saw probably the same plant at the Low nursery and painted it for his scrapbooks, now at K (1887: t. 73) (Fig. 11); it shows the plant and flower in detail, including distinctive features like the wing-like rostellum lobes, expanded base of the spur and pink colour. The new species was described by Reichenbach as *Angraecum cryptodon* in March 1883. The sheet R39425 in W was selected as the type of the species as it is likely to be the one used for the description.

Finet's detailed drawings, description (1907: 36) and type of *Rhaphidorrhynchus stylosus*, based on a



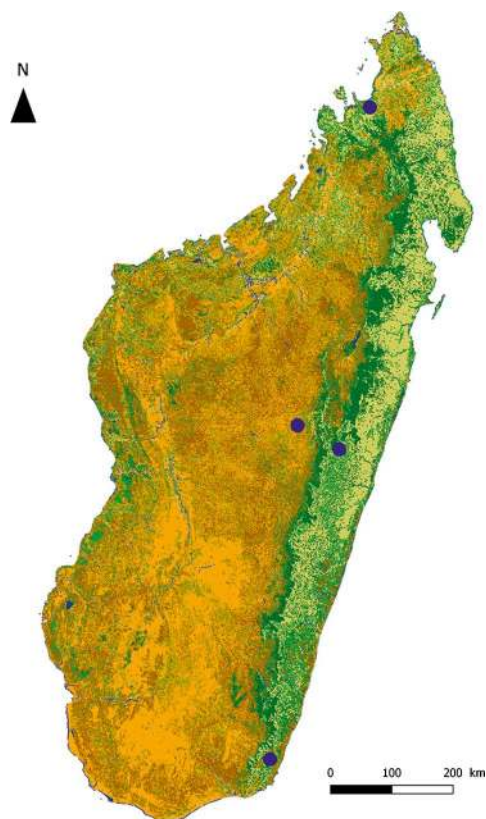
Fig. 12. *Aerangis cryptodon*. **A** in habitat, eastern Madagascar; **B** inflorescences. PHOTOS: J. HERMANS.

different type from that of Rolfe's *Angraecum stylosum*, show the features of *Aerangis cryptodon*. In the description of *Aerangis malmquistiana*, Schlechter (1925: 386) cited Perrier 11347 and also a plant cultivated at Herrenhausen garden, known to him since 1904, originally brought back by J. Braun from Madagascar. Malmquist, the director of the Berggarten in Herrenhausen sent it to him and it was named in his memory. There is no herbarium material left of the Herrenhausen material and therefore Perrier 11347 was chosen as lectotype; it has all the characteristics of *Aerangis cryptodon* and was correctly identified as a synonym of that species by Stewart (1986c: 1011).

Perrier (1938a & 1941) mistakenly used the name *Aerangis cryptodon* for the erect, long-stemmed lithophyte which was known in France at the time as *Angraecum buyssonii*, or *A. ellisii*; as a result it became known as such in horticulture. *Aerangis alata* was described in 1938 by Perrier and was considered a synonym of *A. ellisii* by Stewart (2006: 204) and this was followed by

subsequent authors but analysis of the flowers shows that it has all the characteristics of *A. cryptodon* and is, therefore, considered a synonym of the latter here.

The true *Aerangis cryptodon* has been collected rather rarely but is represented in several herbaria; it is likely that several specimens remain wrongly identified as *A. ellisii*, *A. stylosa* or *A. mooreana* as its identity can be difficult to ascertain without careful dissection of the flowers. The plant has a much shorter stem and the flowers are less substantial than those of *Aerangis ellisii* with which it shares the thickened longitudinal ridges at the base of the lip but the sepals and petals are less attenuate-caudate and the apex of the rostellum wings is more indented. It is similar in habit and flower shape and size to *Aerangis ikopana* and *A. rostellaris* but both those species lack the teeth and ridges at the base of the lip, expanded base of the spur and have a shorter spur. It is also similar to *Aerangis spiculata* but the flowers of *A. cryptodon* are more deeply coloured and its spur is about a third smaller.



Map 10. Distribution of *Aerangis cryptodon*.

Its chromosome number is $2n = 50$ (Arends & Van der Laan (1983: 83).

Aerangis decaryana H.Perrier (1938a: 34, 1941: 101); Hillerman & Holst (1986: 121); Stewart (1986c: 1014); Hillerman (1990: 13); Hermans *et al.* (1998: 22); Senghas (1999: 112); Stewart (2006: 204); Du Puy *et al.* (1999: 6); Stewart *et al.* (2006: 238); Hermans *et al.* (2007: 11); Cribb & Hermans (2009: 282); Bosser & Lecoufle (2011: 67); la Croix (2014: 143); Hervouet (2018: 70); Junginger (2022: 189); la Croix (2022: 157). Type: Madagascar, Ambovombe, 12 March 1931, *Decary* 8585 (**lectotype** P00099196) **designated here**.

Medium-sized, 10–20 cm tall, epiphytic *herb* on a short stem 2–4 cm long and 0.5–1.5 cm in diam., sometimes forming a 3–4 cm pseudo-stem, partly covered by thick sheaths, bearing numerous fleshy roots, silvery-white, glabrous, 5–9 mm in diam. *Leaves* 3–6, succulent, elliptic, 3.5–11 × 0.8–2 cm, attenuate towards the base ending in a short petiole, unequally bilobed at the apex, the margins distinctly undulate, green to orange-brown. *Inflorescences* axillary, arching to pendent below the leaves, up to 30 cm long, 2–4.5 mm in diam., bearing 7–20 flowers, c. 1.5 cm apart; peduncle terete, 3

– 4.5 cm, with 3–5 tubular sheaths; rachis racemose, somewhat zig-zag, a little thickened at the base of the pedicel, greyish-green. *Floral bracts* thin, amplexant, broadly ovate, acute, 2.5–3.2 × 2–2.2 mm, annular and darker at the base, almost completely enveloping the base of the pedicel. *Flowers* small, 29–35 × 17–25 mm, sepals, petals and lip white but sometime tinted pink, spur greenish-white towards the base, becoming orange-brown towards the apex, the anther ivory. *Pedicel* and *ovary* straight, rounded, slightly ridged, thicker at the base, 14–17.5 × 0.8–1.2 mm, pale green to brownish-grey. *Dorsal sepal* erect, then inflexed toward the apex, ovate, attenuate, the margins recurved, 7.2–15.5 × 2.7–5.8 mm; *lateral sepals* reflexed, narrowly elliptic, attenuate, 8.5–16.3 × 3.1–5.6 mm. *Petals* strongly recurved, inflexed at the apex, narrowly obovate–lanceolate, acuminate, 9.3–16.5 × 3.1–5.5 mm. *Lip* recurved, narrowly elliptic to elliptic, sub-auriculate at the base, 9.5–12.5 × 3.1–5.5 mm, the margins recurved, shortly acuminate, the apex often convex and appearing twisted; *spur* slightly widened at the mouth, 65–115 × 0.8–1.5 mm, flattened and inflated in the apical quarter. *Column* short and thick, 4.7–5.8 × 2–2.5 mm, clinandrium minutely denticulate at the margins; rostellum slender and curving forward; anther cap, c. 2.5 × 1.5 mm, with a small acicular median tooth; pollinia ovoid-oblong, c. 0.8 × 0.9 mm, stipes slender but widened below the pollinia, viscidium diamond-shaped. *Seed-capsule* fusiform, 25–42 × 4–8 mm. Fig. 13.

RECOGNITION. *Aerangis decaryana* is a medium-sized plant with a short stem and a dense root mass, long succulent narrow leaves with an undulate margin, the leaves and peduncle often brownish-grey, and small flowers with an erect dorsal sepal, which later reflexes, reflexed lateral sepals, petals and lip, and brownish-orange spur, flattened and inflated in the apical part. **DISTRIBUTION.** Madagascar: Fianarantsoa and Toliara provinces (Map 11).

SPECIMENS EXAMINED. MADAGASCAR. Ambovombe, July 1924, *Decary* 2898 (P0080665); Ambovombe, Feb. 1931, *Decary* 8475 (P0080666); Ambovombe area, March 1931, *Decary* 8585 (P00099196); Manambolo, Mandrare basin, 400–900 m, Dec. 1933, *Humbert* 13069 (P00080667); Ihosy, 1950, *Begué* 883 (TAN); Ifataka, Nov. 1952, *Bosser* 4244 (TAN); Bevoalava-Ankazondranto, 1–150 m, March 1955, *Humbert & Capuron* 29380 (P0679666); near Antanimoro, 1955, *Humbert & Capuron* 28895 (P); Ambovombe, Jan. 1956, *Descouings* 1349 (TAN001162); Iv(r)andrika, Feb. 1963, *Bosser* 16767 (P0080663); Ankazoabo area, Feb. 1964, *Bosser* 17736 (P00080664, TAN); Haute Bassin de Mananare. 400–1000 m, Dec. 1968 *Leandri & Saboureaux* 4425 (P); Faux-Cap, Tsihombe, April 1969, *Rauh* 22050 (HEID 250080 spirit); Fort Dauphin, Ambatosary-Behara, Nov. 1975, *Rakotozafy* 1781 (TAN); SW, cult. Stewart, Oct.

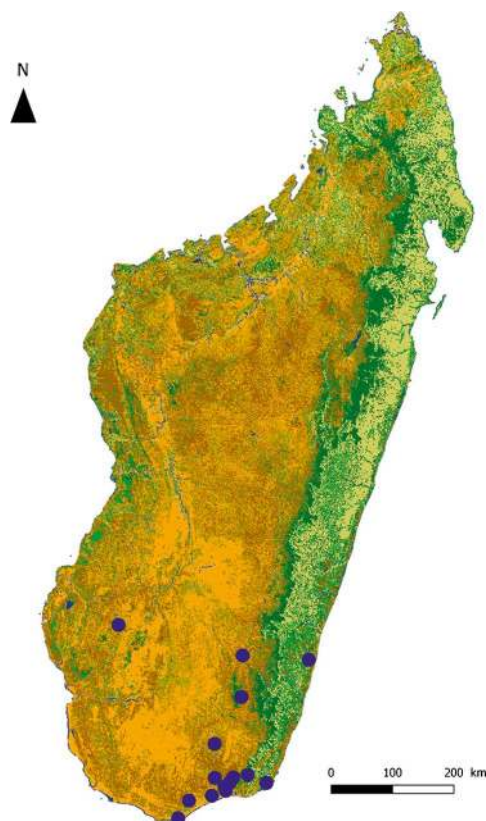


Fig. 13. *Aerangis decaryana*. **A** in habitat, southern Madagascar; **B**, **C** parts of inflorescence. PHOTOS: J. HERMANS.

1983, *Hardy* 47169 (K-spirit); Fort Dauphin. Forêt de Mandena, 10 m, March 1985, *Dorr et al.* 3984 (MO); W of Ambovombe, 120 m, Feb. 1990, *Phillipson* 3590 (MO-2856090); Ambovombe, Feb. 1990, *Phillipson* 3573 (MO-2856030); Hazafotsy, 90 m, Nov. 1994, *Hermans* 6815 (K); Andranovory, area, 540 m, Jan. 1996 (K-spirit 61130.000); Antananimora, March 1997, *David DuPuy* M997 (K); Ankotsy, 428 m, Nov. 2008, *Andriamihajarivo et al.* 1540 (MO-2856005, P00983428, TAN); Ambovombe, Jan. 2010, *Rakotonasolo et al.* RNF1617 (BR, K, TAN); Ambavabato, *Humbert* 883 (P00099197). **WITHOUT EXACT PROVENANCE:** *Cours* 4373 (P); cult. *Hillerman* 9 (K, P).

HABITAT. Dry spiny thicket, littoral forest, transition forest. Altitude: sea level to 550 m.

CONSERVATION STATUS. *Aerangis decaryana* is an endemic, widespread orchid, distributed in Central, South-Central and Southern Madagascar, respectively in Antananarivo, Fianarantsoa and Toliara provinces. The extent of occurrence (EOO) of *Aerangis decaryana* is estimated to be more than 20,000 km². The species is known from 11 threatened locations. In addition, it is recorded in protected areas such as Petriky, Mandena, Andohahela and Berenty. In addition, the overall population is facing a continuing decline due to habitat destruction because there are some subpopulations (eight occurrences) already extirpated or may disappear in the next ten years. Therefore, *Aerangis decaryana* is assessed as Vulnerable (VU) B1B2ab (i, ii, iii, iv, v).



Map 11. Distribution of *Aerangis decaryana*.

PHENOLOGY. November to April but mainly from November to February.

ETYMOLOGY. Named for Raymond Decary (1891–1973), administrator of French Overseas Territories and head of the Institute of Scientific Research for the Madagascar colony. He supplied a large quantity of herbarium material to Perrier.

NOTES. In the protologue, Perrier (1938a: 35) cited ‘Decary 8585, mars 1931’ from Ambovombe and ‘Decary 2398’ in fruit; from the same locality. Both sheets are in P, together with Decary 8474 collected in February 1931 (P00080666) which is cross-referenced as being the same as Decary 8585 by Perrier but with ‘type’ crossed out. The sheet Decary 8585 (P00099196) is clearly the most representative and is designated here as the lectotype. It is one of the few epiphytic orchids found in the xerophytic ‘spiny’ forest of southern Madagascar where it has been recorded growing on *Alluaudia procera* Drake, *Euphorbia plagiantha* Drake and *Euphorbia stenoclada* Baillon and also on tamarind trees.

The flowers are variable in size and tend to be larger when growing in more sheltered spots or in cultivation.

It shares the shape of the spur with *Aerangis concavipetala* but the margins of the leaves of that species are

not undulate and the tepals and lip are more rounded. It is most similar to *A. rostellaris* which can also have leaves with undulate margins but that species is generally more robust with the leaves much broader, and the flowers at least a third larger and the column longer.

Aerangis divitiflora (Schltr.) P.J.Cribb & Carlsward (2012: 44); la Croix (2014: 145, 2022: 159). Type: Madagascar, W, Tampoketsa, Ambongo, Sept. 1904, Perrier 1774 (lectotype P00095855, isolectotype P00095856), lectotypes designated here).

Angraecum divitiflorum Schltr. (Schlechter 1913: 192, t. 22) (Fig. 14).

Chamaeangis divitiflora (Schltr.) Schltr. (Schlechter 1915: 426, 1918: 110, 1925: 381); Perrier (1930: 58, 1941: 89); Tyson Northen (1980: 52).

Chamaeangis boutonii (Rchb.f.) sensu Garay (1973: 507).

Microterangis divitiflora (Schltr.) Senghas (1985: 22);

Stewart *et al.* (2006: 336); Du Puy *et al.* (1999: 181);

Hermans *et al.* (2007: 230); Cribb & Hermans

(2009: 284).

Small, 8–10 cm tall, epiphytic herb on a short 1.5–2 cm stem covered by 2–3 membranous sheaths at the base, roots fleshy, greyish-white, glabrous green, 2–3 mm in diam. *Leaves* 2, flat, narrowly elliptic, 3.5–7.5 × 1.5–2.5 cm, narrowing towards the base into a short petiole, unequally emarginate at the apex. *Inflorescences*, about as long as, or a little longer than the leaves, developing simultaneously from the base of the leaves, in a series of 2–5, up to 10 cm long but generally shorter, 1–2.5 mm in diam., with 10–35 flowers; peduncle very short, with 2–3 amplexant sheaths; rachis racemose, alternate, the flowers developing acropetally; floral bracts with the base almost completely enveloping the rachis, acuminate at the apex, 1–1.2 × 0.5–0.8 mm. *Flowers* very small, up to 3 × 3.5 mm, brownish. *Pedicel* and *ovary* sub-fusiform, slightly arched, glabrous, ridged towards the apex, 2–2.9 × 0.3–0.5 mm. *Dorsal sepal* obovate, slightly concave, apex rounded sub-cucullate, 1.6–1.8 × 0.9–1.4 mm; *lateral sepals* elliptic, obtuse, 1.8–2 × 0.9–1.2 mm. *Petals* elliptic, obtuse, 1.3–1.5 × 0.8–1 mm. *Lip* broadly obovate, roundly winged at the base, the apex rounded, 1.5–1.6 × 1.2–1.3 mm; *spur* cylindrical, inflated at the apex, obtuse, 1.8–2.1 × 0.2–0.4 mm. *Column* short and stout, short roundly winged, slightly apiculate at the apex, stigma oval, c. 0.4 × 0.3 mm; anther ellipsoid, with a short triangular beak at the apex, c. 0.2 mm in diam.; pollinia c. 0.1 mm. *Seed-capsule* cylindrical, c. 4 × 1.5 mm. Fig. 14.

RECOGNITION. *Aerangis divitiflora* is characterised by its densely-flowered inflorescences as long as or slightly longer than the leaf, in small tufts, and very small

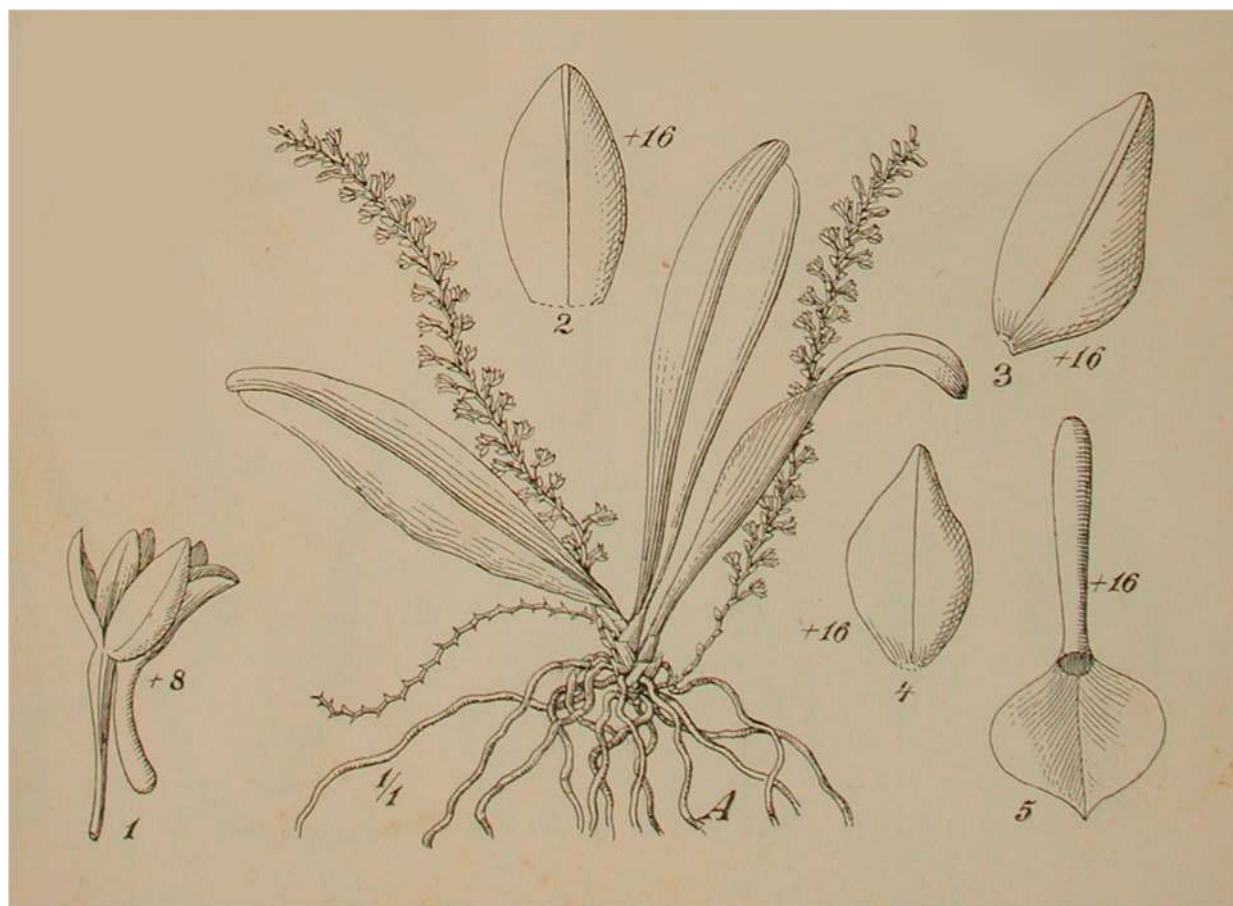


Fig. 14. *Aerangis divitiflora*, in Schlechter (1913: t. 22).

brownish flowers, with the lip apex rounded, and the cylindrical spur about as long as the ovary and inflated at the apex.

DISTRIBUTION. Madagascar: West, Mahajanga province only (Map 12).

SPECIMENS EXAMINED. MADAGASCAR. West, Tampoketsa (Ambongo), Sept. 1904, *Perrier* 1774 (P00095855); Ambongo, received July 1913, *Perrier* 1774 (P00095856).

HABITAT. Medium altitude forest on limestone, on tree trunks, c. 600 m.

CONSERVATION STATUS. *Aerangis divitiflora* is an epiphytic, endemic orchid, restricted to Antananarivo province in Analamanga region (Tampoketsa). The species is known from two collections which were recorded in unprotected areas subject to forest destruction and frequent fire. The area of occupancy is estimated to be 8 km² and only one threatened location is identified. The species is facing a continuing decline in AOO, habitat extent and quality, and the number of subpopulations and mature individuals.

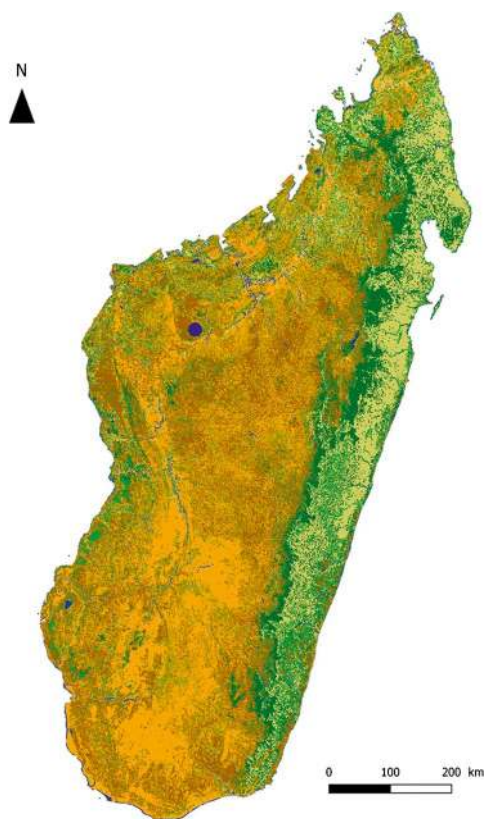
Aerangis divitiflora is therefore assigned as Critically Endangered (CR) B2ab (i, ii, iii, iv, v).

PHENOLOGY. September.

ETYMOLOGY. Referring to its many-flowered inflorescence (from the Latin *dives*, rich).

NOTES. Schlechter (1913) first described and illustrated it as *Angraecum divitiflorum*, based on a Perrier collection, of which two herbarium sheets are known and the most complete and representative (P00095855) is chosen here as the lectotype. It was placed in *Chamaeangis*, *Microterangis* and most recently in *Aerangis*. Garay (1973: 507) considered it a synonym of *Chamaeangis boutonii*, a very different species from the Comoros, considered here as a synonym of *Aerangis hildebrandtii*. Records from the Comoros (Pignal 814, Millot 1037, Muller 15628) are *Aerangis hildebrandtii*.

It is likely that *Aerangis divitiflora* and *A. coursiana* are the same species but due to the lack of good herbarium material and field observations they are treated separately in this revision. The type material of *Aerangis coursiana* may just be a more mature plant or a local



Map 12. Distribution of *Aerangis divitiflora*.

ecotype. Based on the type material, *Aerangis divitiflora* (Perrier 1774) has narrower and more bilobed leaves than *A. coursiana*, its inflorescences are less tufted and as long as or longer than the leaves (vs shorter), and brown (vs green) flowers more unilateral on the rachis, with a spur that is slightly thinner and longer, a lip with an acute-rounded apex (vs acuminate). Perrier, in his description of *Chamaeangis coursiana* compared it with Reichenbach's *C. hariatiana* but not with Schlechter's *Angraecum divitiflorum*. Distribution and flowering time of the two species seems to overlap and further research may clarify their identity. The name *Aerangis divitiflora* has commonly been used in the literature (Stewart *et al.* (2006: 336), Hermans *et al.* (2007: 230), Cribb & Hermans (2009: 284), for plants corresponding more closely with the type of *A. coursiana*.

Aerangis ellisii (B.S.Williams) Schltr. (Schlechter 1914: 598, 1915: 427, 1918: 115, 1927: 590); Perrier (1930: 59, 1941: 108); Hawkes (1953: 177); Moir (1963b: 823); Hawkes (1965: 35); Sanford (1968: 490); Hillerman & Holst (1986: 125); Stewart (1986a: 798); Pridgeon (1992: 26); Chiron (1994: 22); Lecoufle (1996: 26); Hermans & Hermans (1998: 112); Hermans *et al.*

(1998: 14); Du Puy *et al.* (1999: 7); Hermans (2002: 178); Hermans & Cribb (2005: 845); Cribb & Tibbs (2004: 239); Cribb *et al.* (2005: 130); Lecoufle (2005: 16); Stewart (2006: 205); Stewart *et al.* (2006: 239); Hermans *et al.* (2007: 11); la Croix (2008: 32); Cribb & Hermans (2009: 273); Bosser & Lecoufle (2011: 68); la Croix (2014: 147); Hervouet (2018: 71); Kendon *et al.* (2020: 567); Cribb (2021: 29); Junginger (2022: 189); la Croix (2022: 161). Type: Madagascar, Ellis ex cult. Williams, ex cult. Day, 1870 (Reichenbach herbarium W, R39507), **lectotype designated here**; para. K: Madagascar, Day sketchbook watercolour April 13, 1870, XV, t. 57.

Angraecum ellisii B.S.Williams (1871: 87); Reichenbach (1872b: 278); Masters (1874: 446, 1875: 278); Smith (1875: t.191); Williams (1877: 89); Warner & Williams (1878: t.26) the illustration is of *A. articulata*; Pfitzer (1882: 12) as *Angrecum*; Williams (1885: 117); Linden *et al.* (1886: 91) the illustration is of *A. articulata*; Ridley (1885: 483); Veitch (1891: 127); Stein (1892: 70) as *Angrecum*; Bois (1893: 192); Watson & Bean (1890: 45); Williams (1894: 98); Durand & Schinz (1895: 42); Rolfe (1899: 81); Watson & Bean (1893: 45); Sander (1901: 10); Baron (1901: 719); Watson & Chapman (1903: 50); Palacky (1906: 9); Costantin (1913: pl.7); Rolfe (1918: 81); Sander (1927: 47); Burrage (1930: 4); Curtis (1942: 2, 1950: 60); Arnold (1950: 123).

Angorchis ellisii (Rchb.f.) Kuntze (1891: 651).

Angraecum dubuyssonii God.-Leb. (Godefroy-Lebeuf 1887: 280, 1891a: 255. Type: Madagascar, Feb. 1891, cult. Lebeuf, Godefroy-Lebeuf s.n. (K), **lectotype designated here**.

Angraecum buyssonii God.-Leb. (Godefroy-Lebeuf 1891b: 282); *Kew Bulletin* ed. (1908: 78); Poisson (1912: 183); Schlechter (1915: 431); Perrier (1930: 49). Type as *A. dubuyssonii*.

Aerangis caulescens Schltr. (Schlechter 1916: 334); Schlechter (1925: 383); Perrier (1930: 59); Schlechter (1932: pl.100). Types: Madagascar, Central, Betafo, Perrier (II) 8093 (holotype B, lost; isotype P00080672-3).

Aerangis platyphylla Schltr. (Schlechter 1925: 387); Perrier (1930: 60, 1941: 106); Hillerman & Holst (1986: 133); Karasawa (1992: 162). Types: Madagascar, centre, massif du Manongarivo, Perrier 8038 (holotype B lost; isotype P00080675-6).

Aerangis cryptodon sensu H.Perrier (1938a: 31, 1941: 101), non Schltr. (Schlechter 1914).

Aerangis cryptodon var. *caulescens* Schltr. in sched. Decary 7461 (P00080688-9) *nom. invalid.*

Aerangis platyphylla var. *milloti* in sched. Millot 22 (P06796639). *nom. invalid.*

Aerangis ellisii var. *grandiflora* J.Stewart (1986a: 798); Du Puy *et al.* (1999: 7); Hermans (2002: 178); Rajeriarison (2004: 18); Stewart (2006: 205); Stewart

et al. (2006: 239). Type: Madagascar, Tampoketsa d'Ankazobe, *Malzy* s.n. (holotype P00080716). *Aerangis ellisii* var. *grandifolia* Hillerman (1990: 13) *nom. nud.*

Large, epilithic or rarely epiphytic plant; stem woody, erect to slightly arching, up to 65 cm long, 10–15 mm in diam., covered by stem sheaths at the base, copious silvery-white roots emerging from the basal half, 4–5 mm in diam. *Leaves* 6–18 towards the apex, distichous, flat, narrowly elliptic–ligulate to narrowly obovate, 8–28 × 1.5–5.5 cm, attenuate towards the base into a 1–2.5 cm petiole, unequally bilobed at the tip, the longer lobe protruding by 5–10 mm, more succulent and conduplicate in more exposed areas, pale to dark green, sometimes suffused with orange throughout or at the margins, paler underneath, the mid-vein a little darker, surface slightly glossy. *Inflorescences* axillary, erect to suberect, pale green to brownish-yellow up to 65 cm long but generally shorter, 5–8 mm in diam., increasing in thickness from the base, bearing 8–20 flowers, 10–20 mm apart; peduncle 0.5–1.5 cm, covered by 2–3 broad brown sheaths; rachis racemose. *Floral bracts* thin, amplexant (funnel-shaped in the herbarium), broadly triangular ovate, acute, green becoming ochre-brown, 5.5–15 × 2.2–9 mm, almost completely enveloping the base of the pedicel and a short stem-like projection between the rachis and the pedicel, 0.4–1.2 × 0.3–0.6 mm. *Flowers* fleshy, medium to large, very variable in size, the perianth up to 45 × 35 mm, sepals, petals and lip white, often tinted pinkish-brown or green, especially towards the apex, the spur greenish-white to yellow, the column ivory, strongly evening-night scented. *Pedicel* and *ovary* narrowly turbinate, slightly curved, thicker at the base, glabrous and shallowly ridged, 20–57 × 1–2 mm, whitish-green to brownish-green. *Dorsal sepal* erect, narrowly ovate to ovate, the base attenuate, the margins strongly recurved, the apex incurved, 12.5–26 × 4.9–9 mm; *lateral sepals* strongly reflexed, elliptic, concave, acuminate to caudate at the apex, dorsally ridged along the mid-vein, 14.5–31 × 5.2–9 mm. *Petals* strongly reflexed, obovate to elliptic, acuminate to caudate at the apex, 14.1–28 × 4.8–9.5 mm. *Lip* deflexed parallel with the spur, oblanceolate or obovate, the margins reflexed in the basal half, apex acute or cuspidate, 13.5–28 × 6.5–12 mm, with 2 conspicuous ridges at the base, disappearing into the mouth of the spur; *spur* slightly widened at the base, first arching along the ovary then pendent, subulate, narrowing at the apex, 90–270 × 0.8–2.5 mm. *Column* stout, porrect or semi-erect, often fused to the dorsal sepal for part of its length, 6–23 × 1–2.5 mm, slightly papillose or hairy on the sides and upper surface and around the short clinandrium; anther cap shortly beaked, c. 2 mm in diam., rostellum broadened at first, the porrect

part narrowed, pollinia globose, yellow, c. 2.5 × 2 mm, stipes slender, common viscidium elliptic. *Seed-capsule* fusiform, c. 6 × 1 cm. Figs 15, 16.

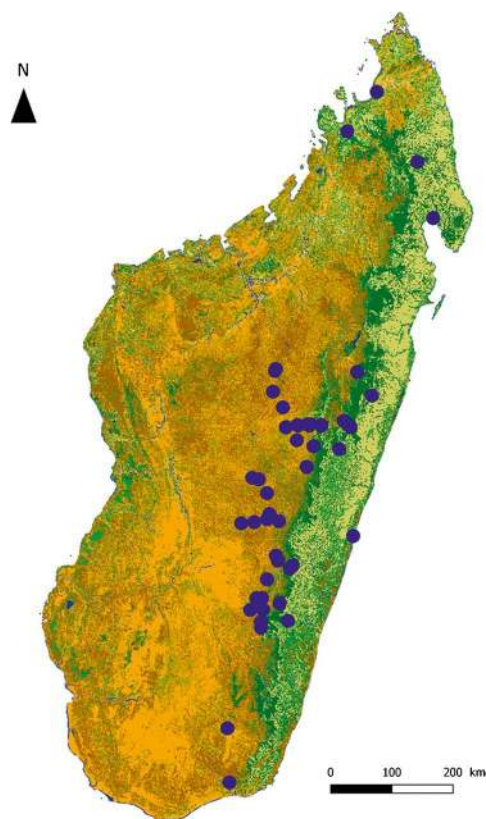
RECOGNITION. Although variable in size, *Aerangis ellisii* is recognised by its generally lithophytic habit, long thick stem, succulent widely-spaced leaves and long erect or suberect inflorescences with large flowers. The flowers have most of their perianth parts strongly reflexed, with the lip having recurved margins and two prominent longitudinal ridges at the base, a long spur and a column that is hairy-denticulate at the margins.

DISTRIBUTION. Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Toamasina and Toliara provinces (Map 13).

SPECIMENS EXAMINED. MADAGASCAR. Ankafana, 1880, *Deans Cowan* s.n. (BM000540200); Central, rec. Oct. 1881, *Baron* 841 (K); Central, Oct. 1882?, *Baron* 2116 (K, NY039997047); Imerina, 1885, *J. T. Fox* 36 (BM000540199, K, K ex LDS); Tamatave-Antananarivo, Sept. 1891 *Baron* 6031 (K); near Ambositra, *Herb de Candolle & Barbey-Boissier*, Feb. 1895, *Forsyth Major* s.n. (G); Ambatovory, July 1906, *d'Alleizette* 958 (L0265086); Manongarivo, c. 1600 m, May 1909, *Perrier* 8038 (P00080675-6); Belambana, June 1912, 1000 m, *Perrier* 8025 (P00080699-700); Betafo, 1200 m, Oct. 1913, *Perrier* (II) 8093 (P00080672-3); Anbatofangena, 1700 m, Feb. 1919, *Perrier* 12404 (P00080701); Ankatso, Feb. 1921, *Decary* 309 (L0265085, MO-3129910, P00080685-6); Antube, below 2000 m, 1600 m, Feb. 1921, *Perrier* 14575 (P00080702-3); Ankatso, March 1921, *Decary* s.n. (P00080684); Ankatso, March 1921, *Waterlot* 45 (P00080715); Andasibe, c. 1000 m, Feb. 1925, *Perrier* 16902 (P00080705); Carion, 1100 m, Oct. 1927, *Decary* 6063 (P00080687); Mt Antongona, Feb. 1928, *Perrier* 18468 (P00080707-8); N of Ankazobe, March 1930, *Decary* 7461, 7500, 7701 (BM000540198, P00080688-90, P00094234-5 in part); Ivakoany, 1250–1550 m, Dec. 1933, *Humbert* 12212 (P00080696); near Ambatofinandrahana, 1600–1800 m, Feb. 1938, *Decary* 12930, 12967, 13163bis (P00080692-4, TAN); Antangona 1500 m, April 1938, *Decary* 13325 (K, P00080695); Ambondrombe, April 1941, *Herb. Jard. Bot. Tan.* 4573 (MO-3129916, TAN); Ambalavao, Jan. 1953, *Survallany* 5540RN (P00080710); Ambalavao, Sendrisoa, Jan. 1955, *Rakodovao* 7266RN (P00080711); Ambalavao, April 1955, *Rakoto* 7331RN (P00080712-3); Route to Majunga, April 1955, *Bosser* 7981 (TAN); W of Ambatofinandrahana, Jan. 1957, *Descouings* BD2070 (TAN); Ambatovory, April 1957, *Bosser* 11049 (MO-3129911, TAN); Carion, Angavokely, March 1959, *Bosser* 12853 (TAN); Faritany, Fianarantsoa, Dec. 1959, *Rauh* M1625 (HEID250056-spirit); Amboasary, Feb. 1960, *J. Peltier & M. Peltier* 1896 (P00080709); Soavina, March 1960, *Bosser* 13812 (P00080680); Antongona, 1200 m, March 1960, *Cours & Peltier* 5719 (P00080683); between Tana



Fig. 16. *Aerangis ellisii*. **A** in habitat, central Madagascar; **B** inflorescence, **C**, **D** close-ups of flower, side and front view. PHOTOS: **A** P. CRIBB; **B** – **D** J. HERMANS.



Map 13. Distribution of *Aerangis ellisii*.

and Carion, 1960, *Keraudren-Aymonin & Aymonin* 1563 (P00080698); Ambalavao, *Rakotoson* 11680RN (P00080714); Tsinjoarivo, March 1962, *Bosser* 15599 (P00080717); Amboasary Sud, March 1962, *Rabevazaha* 12167 (P06796631); Ankazobe, boulders, March 1963, *Malzy* s.n. (P00080716); Ankazobe, Feb. 1963, *Bosser* 17586 (P00080682); S of Antananarivo, Feb. 1970, Sept. 1969, *Stewart* 1109 (K); between Ambohimana-Androtra and Tsiazomborona, April 1970, *Boiteau* 2069 (P00080678); Angavokely, 1600 m, Nov. 1988, *Pettersson & Nilsson* 135 (K-spirit 55108); Ranomafana NP, Maharira, 1374 m, March 1992, *Malcomber & Rakoto* 1357 (MO-2856033, P00754903, TAN); Vatovavy-Fitovinany, 1100 m, Oct. 1992, *Rakoto* 274 (MO-2856031); Andringitra, cult., Feb. 1995, *David Du Puy et al.* M883, M905 (K-spirit 59057.000, P00059604, TAN); Tampoketsa d'Ankazobe, 1530 m, March 1999, *Labat et al.* 2975 (G, K, MO-3129913, P00160055-7, TAN001161); Ibity, 1700 m, Feb. 2003, *Schatz et al.* 4053 MO-2856087, P00334008TAN001152); Ibity, 1700 – 1800 m, Feb. 2003, *Hanes & Andriamihajarivo* 177 (MO2856086); Ambohibary, massif d'Ambatolahinanahary, 1838 m, Jan. 2005, *Andriamihajarivo et al.* (MO-2856040, P, TAN001151); Haute Matsiatra, 1327 m, March 2010, *Rabarimanarivo et al.* 180 (MO-2856035, TAN); Haute

Matsiatra, Iarintsena, 1124 m, March 2010, *Rakotoarivelo et al.* 266 (MO-2856036, P06796657); Haute Matsiatra, Ambalavao, Iarintsena, 1275 m, March 2010, *Razafindraibe et al.* 289 (MO-2856034, P06796656, TAN); Ankazomivady, 1706 m, March 2016, *Rabarimanarivo et al.* 731 (MO, P, TAN); Ambalavao, Anja Parc, 1155 m, Dec. 2020, Antananarivo Spirit 749T114 (TAN); Marojejy, Androranga, Sept. – Oct. 19? *Humbert & Capuron* 976 (P06796655); Mandraka, *Perrier* 17294 (P00080706); Andringitra, *Millot* 22 (P06796639); Tsaratanana, *Herb.Jard.Bot.Tan.* 746 (TAN); Périnet, *DeDieu* 263 (TAN); Mandraka. *Inst.Sci.Mad.* 43, left plant only (TAN). **WITHOUT EXACT PROVENANCE:** Herb. W. H. Gower, purchased 1895, Ellis ex Hort. (K000306368); rec. Oct. 1881, *Baron* 848 (K); *Cult.* s.n. (P00080677); cult. 1970, fl. 1992, *Bosser* 22590 (P06796658 & spirit); *Homolle* 1251 (P00080691); *Hildebrandt* 4201 (W-R14928); cult. *Hillerman* 45101, 45097, 45109, 45116, 52230 (K); cult. *Hillerman* 1, 2, 4, 5, 7, 8, 10, 11, 18, 19, 20 (P); *Mason* s.n. (K-spirit 32039); *Inst.Sci.Mad.* 740a (TAN); *Lecoufle* s.n. (P); cult. *Hermans* 3360, 3899, 5439, 5455, 6507 (K); Ellis ex cult. *Day*, 1870 (W-R39507); rec. July 1880, *Baron* s.n. (K); cult. *Veitch* 1881 (W-R28817); cult. *Veitch* 1887 (K); Feb. 1891, cult. *G.-Lebeuf* (K); Sept. 1921, cult. *Döring* (M); cult. Nov. 1893 (M); 1943, cult. *L. Rothschild* 268/40 (K); cult. *Mason* 2131 (K); cult. June 1979, *Piers* 1202 (K); Oct. 1973, *Peyrot* s.n. (P); Sept. 1979, cult. *Kanzer* (K); *Cult. Stewart*, 2000 (K).

HABITAT. Montane ericoid thicket and sclerophyllous woodland, on rock. Altitude 1000 – 1800 m.

CONSERVATION STATUS. *Aerangis ellisii* is an endemic, widespread orchid, largely distributed in Northern, Eastern, Central and Southern Madagascar in Antsiranana, Toamasina, Antananarivo, Fianarantsoa and Toliara provinces. The extent of occurrence (EOO) of *Aerangis ellisii* is estimated to be more than 20,000 km². The species is known from 29 threatened locations. In addition, it is recorded in many protected areas such as COMATSA Nord (Corridor forestier Marojejy- Anjanaharibe Sud-Tsaratanana), Tsaratanana, Manongarivo, Ambatovy, Analamazaotra, Andringitra, CAZ - Vohibe Forest (Corridor Ankeniheny Zahamena), Ibity, Itremo, Ranomafana, Tsitongambarika. However, many subpopulations (18 occurrences of 29) are recorded in unprotected areas (Maroantsetra, Anosibeana'ala, Ankazobe, Tampoketsa, Mandraka, Antongona, Carion, Soavina, Angavokely, Manjakandriana, Arivomamo, Ambohimadana, Ambatolampy, Tsinjoarivo, Behara, Ambositra, Ambatofinandrahana, Ambalavao) that are facing a continuing decline due to habitat destruction. The overall population is believed to be decreasing even though not exposed to immediate risk of extinction. Therefore, *Aerangis ellisii* is assessed as Near Threatened (NT).

PHENOLOGY. September to July but mainly October and January to April.

POLLINATION. Nilsson & Rabakonandrianina (1988: 145) and Nilsson *et al.* (1992: 666) concluded that hawkmoths of the genera *Agrius* and *Panogena*, with the right length of proboscis to reach the nectar at the base of the spur were the most likely pollinators.

ETYMOLOGY. Named for the Rev. William Ellis (1794 – 1872), of the London Missionary Society who introduced several new orchids into cultivation (Hermans & Hermans 1998: 112).

NOTES. Plants of the species were first brought to Europe in the 1860's from Madagascar and cultivated by the Rev. W. Ellis. According to John Day's sketchbook (April 13, 1870, t. 57), Ellis sold the plant to the nurseryman B. S. Williams "from whom I (Day) bought it in flower". Day painted it in his sketchbook and sent an inflorescence to Reichenbach who described it in 1872 as *Angraecum ellisii*. Meanwhile, in 1871, it had been informally, but validly, described as *Angraecum ellisii* by Williams in the 4th edition of his *Orchid Growers Manual*. The Kew herbarium (ex Herb. W. H. Gower) has a sheet with three flowers, purchased in 1895 and annotated "*Angraecum ellisii* from the original plant in the Hoddesdon (Ellis) collection". Another herbarium sheet in the Reichenbach herbarium at W has the inflorescence and flowers sent by Day. The latter is selected as the lectotype of the species as it is more complete and its origin can be traced to B. S. Williams. In subsequent years, several importations of the plant reached Europe and it became popular in cultivation. Based on one of these plants, Godefroy-Lebeuf (1887) described and illustrated '*Angraecum du buyssonii*' and four years later, in consultation with Rolfe at Kew he more formally described it as *A. buyssonii*, considering it a more robust form of *A. ellisii*; it clearly is one of the many variants of the species.

Schlechter (1925: 387), although transferring the species to *Aerangis*, may not have seen the type material and therefore misinterpreted it, and described *A. caulescens* (1916: 334) and *A. platyphylla*, both based on plants collected by Perrier; they show all the characteristics of *Aerangis ellisii*. Perrier (1941: 108), partly following Schlechter and equally misunderstanding the species, thought it to be a more luxuriant cultivated plant of *Aerangis stylosa*. He also confused it with *A. cryptodon* and most of the names proposed by him as synonyms of *A. cryptodon* refer to *A. ellisii*. This misconception led to several misidentifications in herbaria and in the literature (e.g. Hillerman & Holst 1986; Garay 1973).

Stewart (1986a, 2006) established the true identity of the species but incorrectly included *Aerangis alata* as a synonym; she also established *Aerangis ellisii* var. *grandiflora* (1986a: 798) to recognise the larger-flowered forms of the species but admitted that

separation of the two varieties may not always be possible. Hillerman (1990: 13) illustrated *Aerangis ellisii* var. *grandifolia* and described it as a larger plant with long spikes; it is an elongate old plant of the species.

Angraecum ellisii var. *occidentale* Kraenzl. is a synonym of *Aerangis gravenreuthii* (Kraenzl.) Schltr. from mainland Africa.

Day (1887) in his sketchbook commented that the flowers were strongly scented of *Gardenia*, "so much so that a single flower is more than one can bear in a room." The *Gardeners' Chronicle* (Masters 1875: 278) noted that it had a perfume of sherry, and "the nectar, on the authority of W. G. Smith (the botanical illustrator), a taste like that of the berries of *Solanum dulcamara*."

Plants and general habit of *Aerangis ellisii* can be confused with some forms of *A. articulata* but the flowers of that species do not have strongly reflexed segments and are variable in size (vs the same). The flowers are similar in shape to those of *Aerangis rostellaris* and *A. spiculata* but those have a shorter stem and a pendent inflorescence (vs ascending), furthermore, there are differences in flower shape and size.

Mycorrhiza associated with the species were discussed by Kendon *et al.* (2020: 567).

***Aerangis fastuosa* (Rchb.f.) Schltr.** (Schlechter 1914: 598, 1915: 427, 1918: 116); Perrier (1930: 59, 1938a: 32, 1941: 93); Curtis (1950: 61); Hawkes (1953: 177, 1965: 35); Tysen Northen (1980: 33); Pottinger (1983: 14); Hillerman & Holst (1986: 123); Senghas (1986: 1055); Stewart (1986b: 905); Hillerman (1990: 16, 1992: 14); Bechtel *et al.* (1992: 49); Pridgeon (1992: 26); Dacco Hensemberger (1992: 88); Chiron (1994: 22); Karasawa (1992: 155); Rose (1996: 287); Taylor, P. (1996: 23); Du Puy *et al.* (1999: 7); Petitjean & Petitjean (2003: 24); Stewart (2006: 206); Stewart *et al.* (2006: 245); la Croix (2008: 32); Cribb & Hermans (2009: 276); Bosser & Lecoufle (2011: 69); Parsons & Gerritsen (2013: 113); la Croix (2014: 149); Hervouet (2018: 73); Hermans (2021a: 12, 2021b: 49); Junginger (2022: 186); la Croix (2022: 164). Type: Madagascar, Humblot s.n. (W-R46259), **lectotype designated here.**

Angraecum fastuosum Rchb.f. (Reichenbach 1881d: 748, 1881b: 844); Godefroy-Lebeuf (1881a: 120; 1881b: 147); Masters (1885: 533); Williams (1885: 117); Ridley (1885: 483); Hooker (1891: t. 7204); Veitch (1891: 130); Stein (1892: 70) as *Angrecum*; de Kerckhove (1894: 293); Williams (1894: 98); Durand & Schinz (1894: 42); Sander (1901: 10); Baron (1901: 719); Watson & Chapman (1903: 50); Palacky (1906: 9); Journal of Horticulture (1901a: 297); Sander (1927: 49).

Angorchis fastuosa (Rchb.f.) Kuntze (1891: 651).

Rhaphidorrhynchus fastuosus (Rchb.f.) Finet (1907: 38); Poisson (1912: 185).

Aerangis fastuosa var. *francoisii* H.Perrier in Humbert (1941: 93); Perrier (1938a: 32), *nom. nud.* Based upon: Madagascar, Mandraka valley, c. 1400 m, cult. Jard. Bot. Tan., François 12bis in herb. Perrier s.n. (P0080727).

Aerangis fastuosa var. *grandidieri* Perrier in Humbert (1941: 93); Hillerman & Holst (1986: 262), *nom. nud.* Based upon: Madagascar, SW coast, Grandidier s.n. (P0080728), type of *Rhaphidorrhynchus fastuosus* Finet.

Aerangis fastuosa var. *rotundifolia* H.Perrier in Humbert (1941: 94); Perrier (1938a: 33); Hillerman & Holst (1986: 262), *nom. nud.* Based upon: Madagascar, Ivohibe, Decary 5700 (P00080725) as *A. rotundifolia* in sched. & Millot 168 (TAN).

Aerangis fastuosa var. *vondrozensis* H.Perrier in Humbert (1941: 94); Perrier (1938a: 33); Hillerman & Holst (1986: 262), *nom. nud.* Based upon: Madagascar, Vondrozo, Decary 5188 (P0080726).

Small to medium-sized monopodial epiphytic herb up to 10 × 15 cm, with a short fleshy stem c. 8 mm in diam., covered with a few brown corrugate sheaths and remnants of the leaf petioles, bearing numerous wiry brown to greyish roots 0.5–0.8 mm in diam. *Leaves* 2–10, fleshy, on a short 3–5 mm conduplicate petiole, narrowly elliptic to elliptic, 1.8–8 × 1–3.5 cm, flat to revolute, marginate, unequally emarginate at the apex, laevigate, pale greyish-green to orange-brown, often rugose on the upper surface. *Inflorescence* very short, up to 6 cm long, bearing 1–5 flowers and an aborted bud. *Rachis* straight, 0.5–2 cm long, 3–5 mm in diam., orange-brown, almost entirely covered with 2–3 conduplicate to almost tubular bracts, 4–6 × 1.5–3 mm. *Floral bracts* amplexicaul, ovate to tubular, 2.8–8 × 2.2–3.5 mm. *Flowers* medium to large, variable in shape and size, up to 50 × 55 mm without the spur, about 10 mm apart, not opening fully; petals, sepals and lip white to ivory-white, becoming cream towards the base, anther and pollen pale yellow, the spur white to cream, ovary pale green, evening scented. *Pedicel* and *ovary* straight rounded, slightly ridged, 12–23 × 1.5–25 mm. *Dorsal sepal* slightly recurved, ovate-elliptic, obtuse, 15–31 × 5.5–9 mm, narrowed; *lateral sepals* spreading, obliquely lanceolate, acuminate to obtuse, 17.5–36 × 5.5–8.5 mm. *Petals* recurved toward the apex, ovate elliptic, acute, 20–36 × 6.5–10 mm. *Lip* narrowly elliptic to elliptic or ovate, more or less convex, the apex often slightly recurved, attenuate, 15–34 × 5.5–13 mm; *spur* divergent from the ovary then pendent, slender, often somewhat coiled, 65–95 × 0.9–1.3 mm. *Column* short, stout 3–4 × 2–3 mm, roundly winged, mucronate at the apex, rostellum ligulate-ensiform, up to 6 mm long, stigmatic surface much

longer than the anther, rostellum extending across the stigmatic surface with its tip tucked into the mouth of the spur; *anther* broadly obovoid with a long pointed beak at the apex, up to 1.3–3.5 × 1.6–2.2 mm; *pollinia* globose c. 0.8 × 0.6 mm, stipes short and slender, viscidium elongate, narrow. *Seed-capsule* fusiform, glabrous, green to brown, c. 20 × 5 mm. Figs 17, 18.

RECOGNITION. *Aerangis fastuosa* is a short-stemmed, few-flowered compact plant with relatively large flowers, ovate to elliptic leaves; similar petals, sepals and lip, long rostellum and anther with a small, long beak at the apex.

DISTRIBUTION. Endemic to Madagascar; widespread in Antananarivo, Antsiranana, Fianarantsoa and Toamasina provinces (Map 14).

SPECIMENS EXAMINED. MADAGASCAR. Ankeramadinika, Nov. 1885, Fox 51, 64 (K ex LDS); Vondrozo, Sept. 1926, Decary 5188 (P0080726); Ivohibe, Sept. 1926, Decary 5700 (P00080725); Andragoval, 1200 m, Oct. 1937, Humbert & Cours 17779 (P00080722, TAN); S of Moramanga, Sept. 1942, Decary 18402 (P00080718); Mandraka, Sept. 1948, Jard. Bot. Tan. 304 (P); Andasibe, 1200 m, Sept. 1959, Rauh M447 (HEID 250074-5- spirit); Anjozorobe, 1200 m, 1960, Bosser 14643

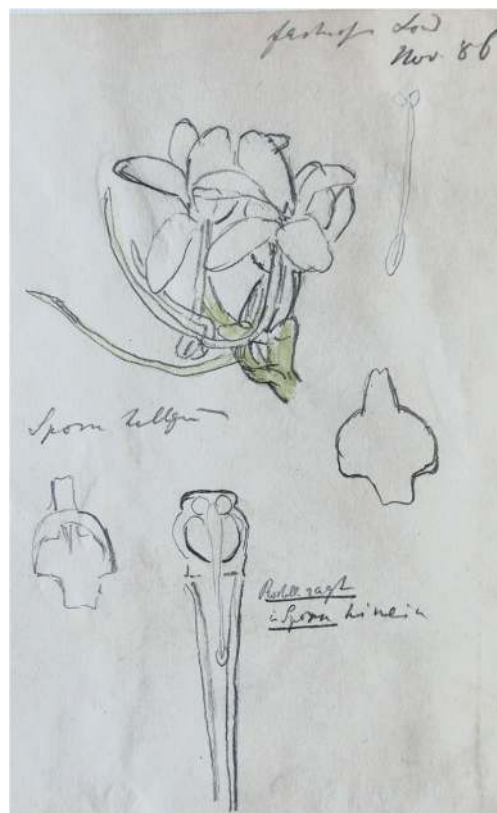


Fig. 17. Drawing by Reichenbach of *Aerangis fastuosa*, at W (R46260).



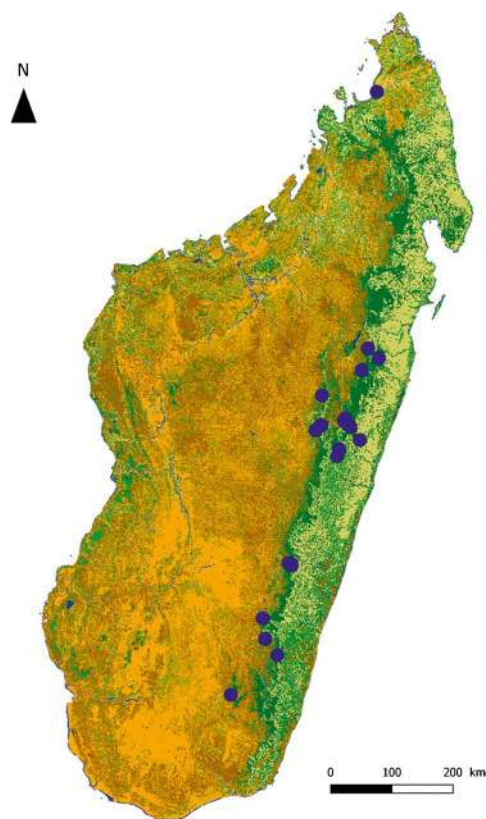
Fig. 18. *Aerangis fastuosa*. **A** in habitat; **B** flowers. PHOTOS: J. HERMANS.

(P00080720 & spirit); Moramanga-Anosibe, Aug. 1962, *Bosser* 16440 (TAN); Lac Mantasoa, 1500 m, Sept. 1962, *Bosser* 16423 (P00080719); Ivohibe, Ivongo, Sept. 1962, *Rakotoson* 12418RN (P00080721, TAN); road to Anjozorobe, Nov. 1962, *Bosser* 17094 (MO-3129920, TAN); Anjozorobe, 1400 – 1500 m, Nov. 1967, *Bernardi* 11128 (G, K, P00099093); Tsaratanana Massif, 2500 m, May 1974, *Gentry* 11655 (MO-3129921); W Ranomafana, 700 – 1000 m, Oct. 1989, *Pettersson & Nilsson* 380 (MO, UPS); Ranomafana autour de Ranomena, 1100 m, Oct. 1992, *Rakoto* 268 (K, MO-2856028, P00215381); Ranomafana E of Vohiparara, 1100 – 1200 m, Oct. 1993, *Kotozafy* 334 (K, MO-2856029, TAN001160); Maromiza, 1180 m, Jan. 2000, *Hermans* 5169 (K); Zahamena, 975 m, Sept. 2001, *Ratovoson et al.* 509 (MO-2856096); Kalambatriotra, 1320 m, Nov. 2004, *Andrianjafy et al.* (MO, TAN); road to Ranomafana, 1100 m, Nov. 2004, *Fischer et al.* FS1586 (WU); Ambatovy, 1020 m, Oct. 2008, *Antilahimena et al.* 6553 (MO-3129919, P, TAN); Ambatovy, 1122 m, Oct. 2011, *Antilahimena et al.* 7887 (MO, TAN); Ambatoloava, *Jean de Dieu* 366 (TAN); Mandraka, c. 1400 m, *François* 12bis in herb *Perrier* s.n. (P00080727); Périnet, *Ravelina* 852 (TAN); Mandraka, *Herb.Inst.Sci.*

170 (TAN); Andringitra, *Millot* 168 (TAN); Andringitra, *Herb.Inst.Sci.* 368 (TAN); Ambatolaona, *Jard.Bot.Tan.* 173a (TAN). **WITHOUT EXACT PROVENANCE:** *Grandidier* s.n. (P00080728); cult. F. Sander, *Humblot* s.n. (W-R46259); cult. (W-R30844); cult. *Lendy* (W-R29591); cult. *Low* (W-R28278); cult. *Lawrence* (BM000540114, W-R46260); *Rauh* 170 (P-spirit); (K-spirit 42879.000, 58469.000); cult. *Hillerman* s.n. 12, 13 (K); cult. *Hillerman* s.n. (P); cult. *Gasnevin* (DBN); purchased June 1880, *Baron* s.n. (K); rec. Dec. 1883, *Baron* 3159 (K); *Hildebrandt* 4207 (W-R14920); April 1889, cult. *Veitch* s.n. (K); 1899, *Warpurs* s.n. (K & spirit); Sept. 1890, April 1893, cult. *Sanders* s.n. (K); June 1891, cult. Kew, type of *Bot Mag.* t.7204 (K); June 1962, leg. *Müller, Renz* 16359 (RENZ); June 1992, *Renz* 15784t (RENZ); cult. *Pronk*, 1995-8, *Hermans* 3240, 3766, 4139 (K); cult. 1999, *Hermans* 4277, 5449, 5485, 6664, 6666 (K).

HABITAT. Medium altitude moist evergreen forest and sclerophyllous woodland. Epiphyte on small tree trunks, on twigs and on small branches. Elevation 900 – 1900 m.

CONSERVATION STATUS. *Aerangis fastuosa* is an epiphytic, endemic orchid, distributed in Antananarivo, Toamasina, Fianarantsoa and Toliara provinces



Map 14. Distribution of *Aerangis fastuosa*.

respectively in Analamanga, Alaotra- Mangoro, Atsinanana, Haute- Matsiatra, Vatovavy, Atsimo-Atsinanana and Androy regions. The species occurs in Alaotra- Mangoro, Anjozorobe-Angavo, Andringitra and Ranomafana protected areas. However, ten occurrences (Ambatolaona, Ankeramadinika, Mandraka, Mantasoa, Anosibe an'Ala, Analamay, Ambatovy, Farafangana, Vondrozo and Betroka) could already be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and eight locations recorded. *Aerangis fastuosa* is therefore assigned as Vulnerable (VU) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. August to January but mainly from September to November.

ETYMOLOGY. The epithet name refers to the superior – splendid flower.

NOTES. *Aerangis fastuosa* was first described by H. G. Reichenbach f. as *Angraecum fastuosum* (Reichenbach: 1881d: 748), based on a plant collected by Léon Humboldt in Madagascar and imported into England by the nurseryman Frederick Sander. The type specimen comprises two flowers and a drawing in the Reichenbach herbarium in W (R46259). Reichenbach

described it as having rugose leaves on the upper surface, a narrow lip and a long caudicula immersed in the spur. Two weeks later (Reichenbach 1881b: 844) added notes on a specimen from the same source and grown by Sir Trevor Lawrence, as equal to his type in all details, but having an obovate rounded lip, instead of a narrow acute one, and suggested either that Humboldt's plant was a peloric form, or that there were two closely allied species. Joseph Hooker (1891: t.7204) later commented on Reichenbach's confusing descriptions. He added that the rugosity of the leaf occurs only after flowering and is hardly perceptible. He referred to the 1885 illustration of a Lawrence plant in *Gardeners' Chronicle* (Masters 1885: 533) as a good likeness. There are three herbarium sheets associated with Reichenbach's description: one at K with flowers supplied by Sander in 1890 on a mixed sheet with other cultivated plants and a cutting of Reichenbach's descriptions, a second at W: a mixed sheet (R46260) with a drawing of a flower supplied by Lawrence (from Sander) and manuscript note of the *Gardeners' Chronicle* 1881 description, but no plant material, a third sheet (W-R46259) with flowers and a pencil sketch by Humboldt of a flower and notes on colour and inflorescence, but no date. The sheet W-R46259 was chosen as the lectotype of the species because of its close association with the protologue (Fig. 17).

Subsequently, a great number of plants found their way into European collections and the variability of the species became evident as recognised by Perrier (1941: 93 – 95) who described six varieties of it, none being validly published because they lacked Latin descriptions. He also mentioned that they may well be separate species, all coming from different localities, a long way from each other. All are only represented by very few herbarium specimens and it is difficult to define constant characteristics. Five of the varieties, notably var. *francoisii*, var. *grandidieriana*, var. *maculata*, var. *rotundifolia* and var. *vondrozensis* are generally accepted as local forms of one variable species (Stewart 1986b: 905; Hermans *et al.* 2007: 12; la Croix 2014: 149), the stated variation was mainly in the leaf shape and texture. The sixth, var. *maculata* (Perrier 1941: 95) was considered by Bosser (2006: 50) to be *Aerangis punctata*, a seventh, *Aerangis fastuosa* var. *angustifolia* H.Perrier was considered to be an immature form of *Aerangis modesta*.

A putative hybrid of the species is illustrated in Parsons & Gerritsen (2013: 113).

Scent analysis is discussed by Kaiser (1993: 134).

It is most closely related to *Aerangis bovicornu* but differs substantially in its flowers which are consistently over twice the size, and have a much longer spur, narrower column apex and obovoid anther with a long, rounded swelling at the apex (vs shortly beaked). A detailed comparison is given in J. Hermans *et al.* (2021: 43).



Fig. 19. Drawing by Reichenbach of *Aerangis fuscata*, at W (R39509).

***Aerangis fuscata* (Rchb.f.) Schltr.** (Schlechter 1914: 598, 1915: 427, 1918: 116, 1927: 590); Perrier (1930: 59, 1938a: 39, 1941: 114) in part; Hawkes (1953: 177, 1965: 35); Hillerman & Holst (1986: 125); Stewart (1986b: 906); Hillerman (1990: 24); Chiron (1994: 22); Hermans *et al.* (1998: 12); Du Puy *et al.* (1999: 8); Petitjean & Petitjean (2003: 26); Stewart *et al.* (2006: 246); Stewart (2006: 207); Cribb & Hermans (2009: 276); Parsons & Gerritsen (2013: 114); la Croix (2014: 151); Oviatt & Nerison (2017: 677); Junginger (2022: 189); la Croix (2022: 166, 198). Types: Madagascar, cult. *Marriott* s.n. (Reichenbach herbarium W, R39514, **lectotype designated here**; Madagascar, cult. *Low* s.n.; para. drawing by Rchb.f. Reichenbach herbarium R39509 (W); Madagascar, Day watercolour based on Low, Aug. 28, 1882, XXXI, t. 73 (K) (Fig. 20).

***Angraecum fuscatum* Rchb.f.** (Reichenbach 1882b: 488); Reichenbach (1885a: 380) refers to *A. spiculata*; Reichenbach (1885c: 726) refers to *A. spiculata*; Godefroy-Lebeuf (1885: 196) refers to *A. spiculata*; Ridley (1885: 196); Williams (1885: 117); Gartenflora (1886: t.1234) the illustration is of *A. articulata*; Veitch (1891: 130); Stein (1892: 70) as *Angraecum*; Williams (1894: 99); Durand & Schinz (1895:

113); Palacky (1906: 9); Poisson (1912: 182); Voeltzkow (1917: 433); Sander (1927: 49).

***Rhaphidorhynchus umbonatus* Finet** (1907: 37, t.7). Types: Madagascar, *Humblot* 383 (syn. K00306355, P00080730-32, W-R16562).

***Aerangis umbonata* (Finet) Schltr.** (Schlechter 1915: 428, 1918: 36); Perrier (1930: 60, 1941: 110); Hillerman & Holst (1986: 136); Stewart (1986b: 906).

Small to medium-sized, 5–10 cm tall, epiphytic herb on a short stem 0.5–3 cm long and 0.5–1.5 cm in diam., partly covered by thick sheaths, bearing numerous, glabrous fleshy roots, 3–5 mm in diam. Leaves 2–5, elliptic to narrowly obovate, 3–8.5 × 1.5–3 cm, attenuate towards the base into a short petiole, unequally bilobed at the apex, green to glaucous green. Inflorescences axillary, pendent below the leaves, up to 20 cm long, 2–3.5 mm in diam., bearing 2–5 flowers, c. 3 cm apart; peduncle terete, 3–6.5 cm, with 2–4 tubular sheaths; rachis racemose, strongly zig-zag, orange-brown. Floral bracts thin, amplexant, triangular-ovate, 2.5–4.2 × 1.5–2.1 mm, annular at the base. Flowers large, c. 50 × 45 mm without the spur, sepals and petals greenish-brown to pale salmon, lip white, spur greenish-brown to orange, often darker at the apex, column yellow, anther ivory. Pedicel and ovary straight or slightly curved, rounded, a little ridged, thicker at the base, 15–30 × 1.5–2.5 mm, brownish-green to brownish-grey. Dorsal sepal erect, the margins recurved toward the apex, narrowly ovate, attenuate, 20–30 × 2.3–4.5 mm; lateral sepals spreading, lanceolate attenuate, 23–36 × 2.5–4.2 mm. Petals slightly recurved, lanceolate, acuminate, 23–27 × 2.5–3.5 mm. Lip arched forward below the column, narrowly obovate sub-auriculate at the base, somewhat angular towards the middle, 25–33 × 6.7–8 mm, attenuate; spur widened and funnel-shaped towards the base then slender and somewhat curved, 70–115 × 0.8–1.5 mm. Column short, terete, 4.7–6.4 × 2–2.8 mm, dilated above the large stigmatic surface, clinandrium small, surrounded by an erose border; rostellum slender and curving forward and thicker-globular at the apex; anther cap, c. 1.2 × 1.5 mm, with a small acicular median tooth; pollinia oval, c. 0.8 × 0.9 mm, stipes slender and widened below the pollinia, viscidium triangular. Seed-capsule not known. Figs 19, 20, 21 and 22.

RECOGNITION. *Aerangis fuscata* is a small to medium size plant with a short stem, a strongly zig-zag rachis, the flowers wide apart, large, with the tepals and spur pale orange-brown, the lip somewhat angular towards the middle, white and funnel-shaped at the base, a large stigmatic surface, the rostellum tooth hooked and globular at the apex.

DISTRIBUTION. Madagascar: Antsiranana, Toamasina and Toliara provinces (Map 15). Records from



Fig. 20. *Aerangis fuscata* in John Day's Scrapbooks (1887: 5). Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.

Comoros are based on misidentifications in Reichenbach (1885a: 380, 1885c: 726) and Voeltzkow (1917: 433).

SPECIMENS EXAMINED. MADAGASCAR. Nossy Ve, rec. Oct. 1883, *Humblot* 383 (P00080730-2); comm. Bailion 1892, *Humblot* 383 (K000306355-6); *Humblot* 383 (W-R16562); Fort Dauphin, Mandena forest, April 1960, *Bosser* 13997 (P01800004); forêt d'Ankaramy, 952 m, Nov. 2004, *Nusbaumer et al.* 1248 (MO); Toamasina, Ambatondrazaka, Jan. 2010, *Andrianaivoravelona et al.* ANB253 (K000663209, TAN). **WITHOUT EXACT PROVENANCE:** 1883, cult. *Lawrence* (K000306453-4); cult. *Marriott* (W-R39514); cult. (W-R3306); cult. *Hillerman* 13, 14 (K); cult. *Hillerman* s.n. (P); 1982, cult. (K-spirit).

HABITAT. Medium altitude moist evergreen forest. Twig epiphyte or on small branches. Altitude 1000–1400 m.

CONSERVATION STATUS. *Aerangis fuscata* is an epiphytic, endemic orchid, distributed in Antsiranana, Toamasina, Antananarivo, Fianarantsoa and Toliara provinces respectively in Diana, Sava, Analamanga, Alaotra-Mangoro and Anosy regions. The species is recorded from three Protected Areas such as

Loky-Manambato, Ambohitantely, Itremo and Mandena. The extent of occurrence is estimated to be 156,530.736 km² (far above the threshold of threatened category) but the area of occupancy is 24 km² (under the threshold of Endangered category) and six threatened locations are identified. A reduction of 30% of the population size (two occurrences Ambatondrazaka and Nosy Be six occurrences) is inferred in the past and will induce a continuing decline in AOO, EOO, habitat extent and quality, and the number of subpopulations and mature individuals. *Aerangis fuscata* is therefore assigned as Vulnerable (VU) A2c.

PHENOLOGY. January to April.

ETYMOLOGY. Referring to the brownish colouration of the tepals.

NOTES. Reichenbach, in his 1882 description, related that the first flowers of his new species came from Mr George Marriott, Exotic Nursery, Upper Edmonton, whom he “finally persuaded ... to spare a leaf for me, which was a great sacrifice, his flowering plant having only had three such organs”. He then had it from Messrs Hugh Low and finally it came from Sir Trevor Lawrence's. The Reichenbach

herbarium has the Marriott flower and single leaf, together with manuscripts and drawings based on Low's plant (Fig. 19). The Low plant was painted by John Day in his sketchbook (1887: t.73) (Fig. 20) before it was sent to Reichenbach. An inflorescence from Lawrence is in the Kew herbarium (K000306354) but postdates the description, a painting of it was prepared for *Curtis's Botanical Magazine*, but never published (Fig. 21).

The Marriott specimen is chosen here as the lectotype as it is close to the protologue. All the early plants seem to have originated from the same importation from Madagascar together with plants of *Aerangis ellisii* and *Angraecum sesquipedale*; it is likely that they were collected by Richard Curnow (d. 1896) who collected plants in Madagascar for Low at that time. Reichenbach later (1885a: 380, 1885b: 726), translated by Godefroy-Lebeuf (1885: 196), confused specimens collected by Humblot in the Comoros (probably *Humblot* 414) with this species but these are likely to refer to *Aerangis spiculata*, which is a much larger plant with more and bigger reflexed flowers. Reichenbach (1885c: 726) mentioned further collections from Humblot which he also thought *Aerangis fuscata* but with more and bigger flowers, these (W-R39510-13) are *A. spiculata*. All this led to further confusion in the literature as in the description and illustration in *Revue Horticole* (Carrière 1887: 235) from the Comoros which is *Aerangis rostellaris*; distribution on the Comoros is therefore dubious. It was described in *Gartenflora* (1886: t. 1234) but the illustration is of *A. articulata*. Perrier (1941: 114) included the species in his orchid *Flore* but the description and illustration (Fig. 54: 1–2) are of *Aerangis rostellaris*.

The type material of Finet's *Rhaphidorrhynchus umbonatus* is identical with specimens of *Aerangis fuscata*. The drawing on the type sheet clearly shows the ovate-lanceolate lip which is funnel-shaped at the base, the obliquely beaked anther cap, and the elongated rostellum of this species.

Stewart (1986b: 906) considered *Aerangis monantha* a synonym but later (Stewart 2006: 207, Stewart *et al.* 2006: 246) conceded that they are distinct entities.

It is undoubtedly closest to *Aerangis monantha* but that species has slightly verrucose roots, a shorter inflorescence with fewer flowers (1 to rarely 2), the flowers are a little smaller, the lip less angular and the rostellum slightly longer.

Aerangis hildebrandtii (Rchb.f.) P.J.Cribb & Carlsward (2012: 44); la Croix (2014: 154); Mirenda (2020: 257); la Croix (2022: 169). Type: Comoros, *Hildebrandt* s.n. cult. Hort. Reg. Berol / Berlin Botanic Garden (holotype W, Reichenbach herbarium R46160), (Fig. 23).

Angraecum hildebrandtii Rchb.f. (Reichenbach 1878: 725); Williams (1885: 118, 1894: 99); Durand & Schinz (1895: 43); Voeltzkow (1917: 444).

Angorchis hildebrandtii (Rchb.f.) Kuntze (1891: 651).

Chamaeangis hildebrandtii (Rchb.f.) Garay (1972: 165).

Microterangis hildebrandtii (Rchb.f.) Senghas (1985: 22); Stewart (1995: 212); Du Puy *et al.* (1999: 181); Stewart *et al.* (2006: 337); Hermans *et al.* (2007: 230); Mirenda (2008: 822); Pentinsaari (2010: 31).

Angraecum boutoni Rchb.f., (Reichenbach 1881a: 87 or 117); Durand & Schinz (1895: 40); Voeltzkow (1917: 444); Summerhayes (1951: 261) **synon. nov.** Type: Comoros, *Bouton* 1837 in coll. Bojer, herb. Hooker (holotype K000396325), tracings and drawing in Reichenbach herbarium W-R46133.

Angorchis boutoni (Rchb.f.) Kuntze (1891: 651) **synon. nov.**

Angraecopsis boutoni (Rchb.f.) H.Perrier (1941: 82) **synon. nov.**

Chamaeangis boutoni (Rchb.f.) Garay (1972: 165); Stewart (1982: 55) **synon. nov.**

Microterangis boutonii (Rchb.f.) Senghas (1985: 22); Stewart (1995: 212); Stewart *et al.* (2006: 337) **synon. nov.**

Aerangis boutonii (Rchb.f.) P.J.Cribb & Carlsward (2012: 44); la Croix (2014: 134, 2022: 146) **synon. nov.**

Saccolabium humblotii Rchb.f. (Reichenbach 1885b: 537); Durand & Schinz (1894: 56); Voeltzkow (1917: 444) **synon. nov.** Type: Comoros, *Humblot* s.n. (holotype W, Reichenbach herbarium R40800).

Chamaeangis humblotii (Rchb.f.) Garay (1972: 165) **synon. nov.**

Microterangis humblotii (Rchb.f.) Senghas (1985: 22); Du Puy *et al.* (1999: 181); Stewart *et al.* (2006: 337); Hermans *et al.* (2007: 231) **synon. nov.**

Aerangis humblotii (Rchb.f.) P.J.Cribb & Carlsward (2012: 44); la Croix (2014: 154, 2022: 169) **synon. nov.**

Mystacidium hariotianum Kraenzl. (Kraenzlin 1897: 153) **synon. nov.** Type: 'Madagascar,' cult. Luxembourg Garden, Paris (*in caldariis horti Luxembourg Parisiorum*) †.

Saccolabium hariotianum (Kraenzl.) Finet (1907: 32) **synon. nov.**

Chamaeangis hariotiana (Kraenzl.) Schltr. (Schlechter 1915: 426, 1918: 110); Perrier (1941: 89); Tysen Northen (1980: 52); Hillerman & Holst (1986: pl.26) **synon. nov.**

Microterangis hariotiana (Kraenzl.) Senghas (1985: 22, 1986: 1074); Karasawa (1992: 132); Stewart (1995: 212); Du Puy *et al.* (1999: 181); Turkel & Christenson (2001: 537); Stewart *et al.* (2006: 336); Hermans *et al.* (2007: 230); la Croix (2008: 286); Bosser &

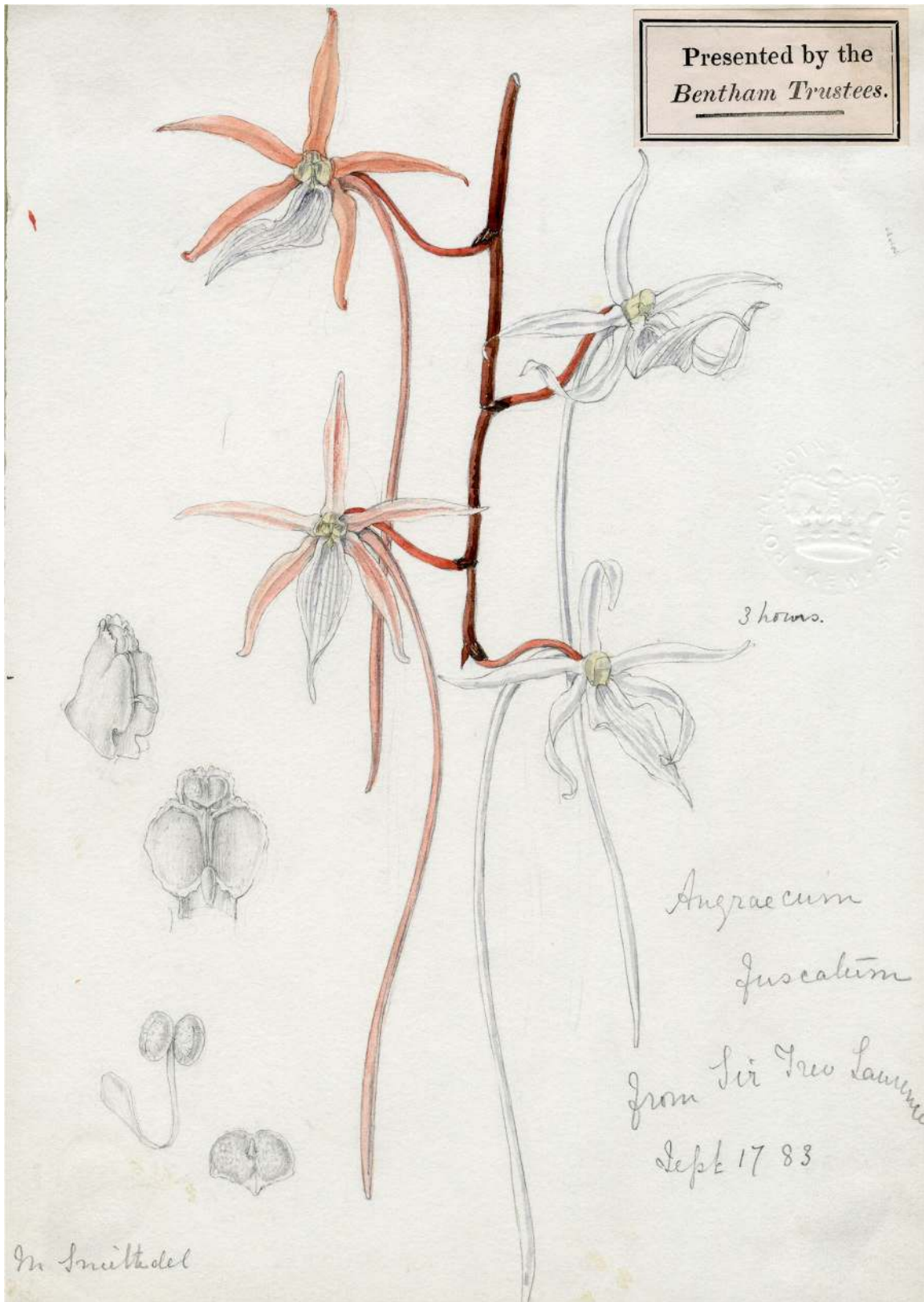


Fig. 21. *Aerangis fuscata*, watercolour by M. Smith, Sept. 1883. Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.



Fig. 22. *Aerangis fuscata*. Flowers. PHOTOS: J. HERMANS.

Lecoufle (2011: 417); Hervouet & Barthelat (2014: 262); Barthelat (2019: 417) **synon. nov.**

Aerangis harioitiana (Kraenzl.) P.J.Cribb & Carlsward (2012: 44); Pridgeon *et al.* (2014: 347); la Croix (2014: 138); Mirenda (2020: 257); Oviatt & Nerison (2016: 590); Junginger (2022: 191); la Croix (2022: 168) **synon. nov.**

Angraecum saccolabioides H.Perrier (1941: 209), *nom. nov. pro Saccolabium humblotii* **synon. nov.**

Medium sized to large, 10 – 25 cm, epiphytic *herb* on a short 2 – 4.5 cm stem partly covered by 2 to 3 membranous sheaths and disintegrating leaf petioles at the base, roots wiry, fleshy, greyish-white, glabrous, 1 – 3.5 mm in diam. *Leaves* 2 – 11, flat, obovate, 6.5 – 17.5 × 1.6 – 4.5 cm, narrowing towards the base into a 5 – 10 mm petiole, distinctly unequally bilobed at the apex, yellowish-green to dark green, upper surface lustrous, margins a little revolute and thickened. *Inflorescences* arching then pendent, glaucous green-brown, up to 40 cm long but generally shorter, 2 – 3.5 mm in

diam., with 20 – 60 flowers; peduncle short, with 3 – 6 brown amplexant sheaths; rachis segmented, slightly thickened at the base of the pedicel, racemose, alternate, the flowers developing basipetally, spaced evenly 2 – 4 mm apart; floral bracts membranous, almost completely enveloping the rachis apart from a short acumen at the apex, 0.8 – 2.1 × 0.5 – 1.5 mm, dark brown to brownish-red, and contrasting with the paler rachis. *Flowers* very small for the genus, up to 6.5 × 5.5 mm when mature, petals, sepals and lip yellow-brown to dark orange, spur greenish-yellow to pale orange, column greenish, anther ivory, pollinia yellow. *Pedicel* and *ovary* fusiform, slightly arched, glabrous, finely ridged, 2.1 – 3.3 × 0.3 – 0.6 mm, glaucous green. *Dorsal sepal* elliptic, slightly concave, the margins thickened, apex obtuse to acute, slightly recurved 1.8 – 2.5 × 0.7 – 1.2 mm; *lateral sepals* elliptic to lanceolate, acute to attenuate, spreading, 1.8 – 2.5 × 0.8 – 1.2 mm. *Petals* ovate, obtuse, acute, 1.5 – 2.3 × 0.6 – 0.9 mm, slightly recurved. *Lip* obovate, first angular to the column, then recurved, the apex obtuse to acute, 1.1 – 1.7 ×



Map 15. Distribution of *Aerangis fuscata*.



Fig. 23. Drawing by Reichenbach of *Aerangis hildebrandtii*, at W (R46160).

0.6 – 1 mm; *spur* parallel with the column, somewhat thickened at the apex to clavate, $1.5 - 2.2 \times 0.6 - 0.9$ mm. *Column* short and stout, roundly lobed, somewhat roundly apiculate at the apex, stigma transversally elliptic, $0.6 - 1.1 \times 0.3 - 0.5$ mm; anther globose to ovoid, with a sub-spatulate beak at the apex, c. 0.2 mm in diam.; pollinia 2, sessile on a single linear stipe, c. 0.1 mm in diam. *Seed-capsule* cylindrical, $6 - 12 \times 3 - 4$ mm. Figs 23, 24, 25.

RECOGNITION. *Aerangis hildebrandtii* is characterised by the large glossy leaves, the densely-flowered inflorescence longer than the leaf, not in a series, very small yellow to orange flowers developing basipetally, the lip base slightly angular to the column; spur about as long as the ovary, thickened to clavate.

DISTRIBUTION. Comoros: Anjouan [Nzwani], Grande Comore [Ngazidja], Mayotte and Moheli [Mwali] (Map 16). Records from Madagascar, including Kraenzlin's type of *Mystacidium hariatianum*, and (Stewart (1982: 55); Wubben s.n. (WAG); Renz 15628 (RENZ); spirit K-5654 & 57017 (K) are based on incorrect data. Records from Bourbon [Reunion] are incorrect and based on the labelling of *Boivin* 3081 at G, the

same collections at K and P are labelled 'Mayotte' and 'Comoros'.

SPECIMENS EXAMINED. COMOROS. Grande Comore, forêt La Grille, 850 m, July 1969, *Rauh* 23094 (HEID740747, spirit HEID250171); Anjouan, N-Hang des N'Tingui, Feb. 1974, 400 – 500 m, cult. Heidelberg, June 1969, *Rauh & Senghas* R23191 (HEID); Anjouan, W of Mamutzu, 400 – 500 m, June 1969, *Rauh & Senghas* R23191 (spirit HEID 254621); Mayotte, Convalescence, 400 m, Sept. 1996, *Pascal* 655 (K, MAO, P00144769); Moheli, Mledjele forest, 520 m, Oct. 1996, *Moulaert* 015 (P00749732); Moheli, Laurisilve, Oct. 1996, 501. *Malaisse & Moulaert* 501 (BR0000019693484); Grande Comore, Mitsoudje, Nyumbadju, 720 m, Nov. 1999, *J. N. Labat & I. Yahaya* 3137 (BR, CNDRS, G, K, MO, P00184001, P001842002); Mayotte, Grand Terre, Combani, Padza, c. 370 m, Sept. 2001, *Pignat* 1814 (K, MAO02928, P00229546); Mayotte, Grande Terre, Mt Combani, Aug. 2001, *Barthelat & Sifary* 449 / 469 (G, K, MAO, MO, P00229450). **WITHOUT EXACT PROVENANCE.** *Hildebrandt* s.n. fl. Berlin Bot. Garden (W-R46160); *Bouton* s.n. in coll. Bojer, 1837. Herb. Hooker (K000396325, tracing W-R46133); voyage de Boivin 1847 – 1852, *Boivin* 3081 (G, K, P00095851-2);

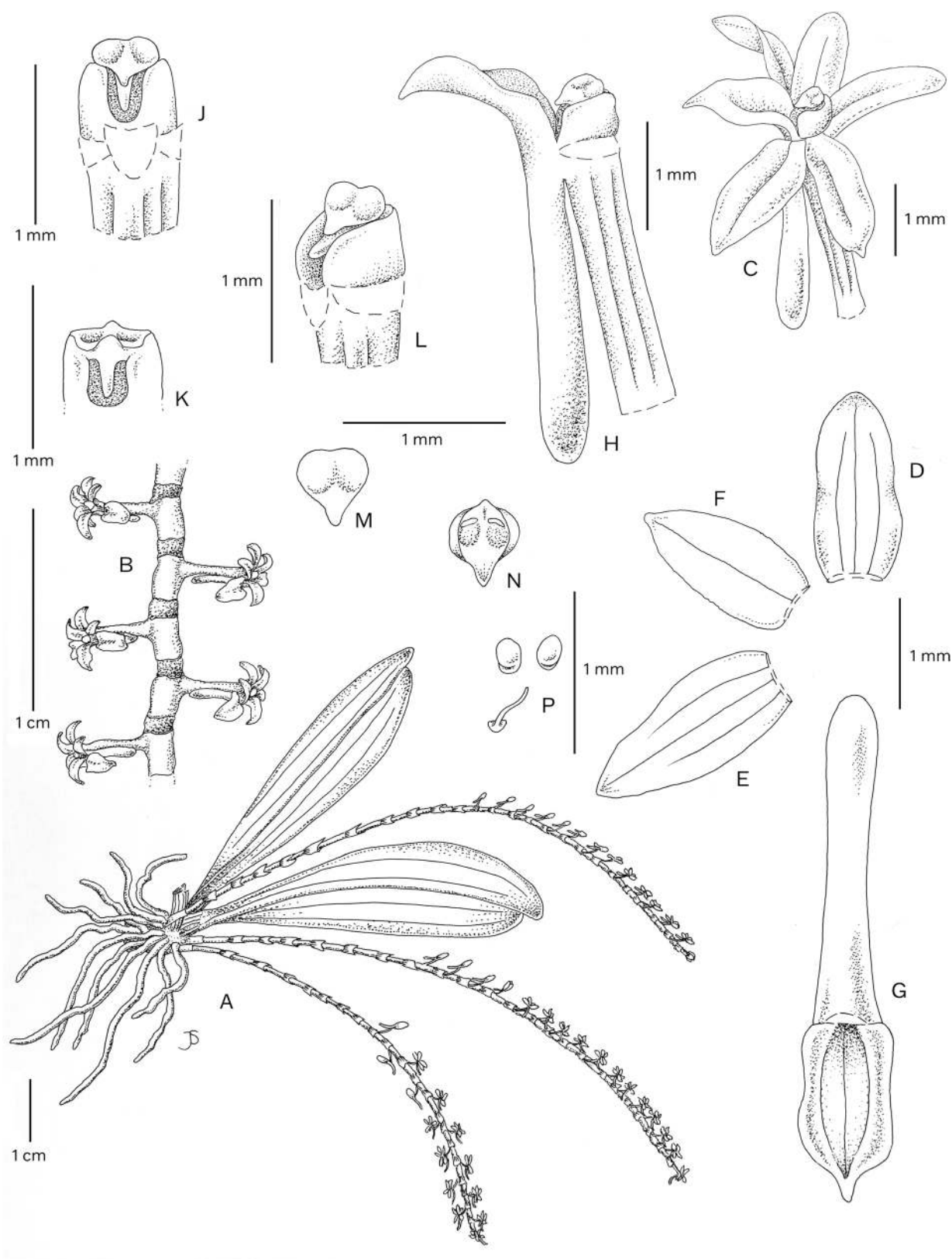


Fig. 24. *Aerangis hildebrandtii*. **A** habit; **B** part of inflorescence, enlarged; **C** flower; **D** dorsal sepal; **E** lateral sepal; **F** petal; **G** lip; **H** column and lip, side view; **J** column, front view; **K** tip of column, anther cap removed; **L** anther cap, side view; **M** anther cap, dorsal view; **N** anther cap, ventral view; **P** pollinia. From *Labat et al.* 3137. DRAWN BY JUDI STONE.

Grande Comore, 1885, *Humblot* 1 (292). (P00095847-50, W-R6535 & R5913); *Humblot* s.n. (W-R40800); Anjouan, rec. Sept. 1904, *Lavanchie* s.n. (P00095854); Anjouan, Oct. 1923, *Decary* 2661 (P00095853); s. loc. cult. Basel, Jan. 1998, *Renz* 15878, 16437 (RENZ); cult. Akerne Orchids, Nov. 2001, *Hermans* 2616 (K & spirit); s. loc. *Millot* 1037 (P00095857); hort. Redland Festival, May 2006, *Whitten* 3253 (FLAS); cult. Denver Botanic Gardens, Feb. 2008, *Von Borgen* ORC293, Kalmbach Herbarium (KHD00025050); Grande Comore, Jard. Bot., *Bosser* 1037 (P00701816); *Millot* 1037 (TAN); cult. March 1992, *M. Lecoufle* s.n. (P00209898). **WITHOUT LOCALITY.** Cult. R9916 (W); cult. *Mason*, 1966, (HEID spirit 250666, HEID O-43); *HDG* May 1887 (W-R12195); cult. Conservatoire d'Orchidées of Société Nationale Hort. France, 1897 (K); cult. (W-R16084); cult. Wubben, April 1981, Hort. Wageningen ex Wubben (WAG0137399); cult. Basel, March 1991, *Renz* 15628 (RENZ); spirit 5654, 57017 (K); cult. Stern, ex Andy's Orchids, California, *Carlsward* 227 (FLAS224961).

HABITAT. Moist evergreen forest, secondary forest, 400 – 850 m.

CONSERVATION STATUS. *Aerangis hildebrandtii* is an epiphytic, endemic orchid, distributed in Mayotte and the Comoros. The species occurs in four protected areas such as Mohéli National Park, Mount Ntringui National Park, Mount Mtsapéré and Mount Combani. The extent of occurrence (EOO) is estimated to be 7,870.559 km² (under the threshold of Vulnerable category), the area of occupancy is 24.000 km² (under the threshold of Endangered category) and six threatened locations are identified. A continuing decline in EOO, AOO, habitat extent and quality, and the number of subpopulations and mature individuals is inferred due to habitat degradation caused by forest clearing for agriculture expansion. *Aerangis hildebrandtii* is therefore assigned as Vulnerable (VU) B1B2ab(I, ii, iii, iv, v).

PHENOLOGY. July to November.

ETYMOLOGY. *Aerangis hildebrandtii* was named for Johann Hildebrandt (1847 – 1881), German explorer, plant collector and botanist. He collected in the Comoros from June to August 1875 (Dorr 1997: 206). Reichenbach, in his description (1878: 725) mentioned that “M. Hildebrandt is just now home, but only for the improvement of his health, so that he may once more brace all the dangers and perils of mysterious grand tropical Africa. Our best wishes will follow the keen traveller wherever he may wander. This little, very elegant plant, quite unique, associated to no species of the genus, may be a token of our biggest gratefulness and regard. M. J. M. Hildebrandt deserves so much.”; *boutonii* was named for Louis Bouton (1799 – 1878), administrator and botanist, based in Mauritius who also collected in the Comoros in 1837 (Dorr 1997: 62); *humblotii* was named for Léon Humblot (1852 – 1914), French adventurer, collector

and colonist who made a great number of collections in the Comoros at the end of the 19th century (C. Hermans 2020, 2021b); *hariotiana* was named for P. A. Hariot, French gardener and orchid enthusiast (Mayr 1998: 311).

VERNACULAR NAME. Kozy Kely (Kibushi) Barthelat (2019: 417).

NOTES. Described in 1878 as *Angraecum hildebrandtii* by Reichenbach from part of an inflorescence from a plant flowered at the Berlin Botanic Garden, originally collected by Hildebrandt in the Comoros. Three years later Reichenbach also described *Angraecum boutonii*, based on a collection by Bouton in the Hooker herbarium at K, he noted it to be similar to *A. hildebrandtii* but with the lip entire, this was followed in 1885 by *Saccolabium humblotii*, both collections from the Comoros. In 1897 Kraenzlin described *Saccolabium hariotianum*, based on an inflorescence of a plant flowered at the Luxembourg Gardens in Paris; a specimen at K from the President of the Conservatoire d'Orchidées of Société Nationale Hort. France may be of the same origin. The origin of the latter plant is stated to be ‘Madagascar’ but this is very likely incorrect and may well have been part of the Humblot collections from the Comoros distributed around Europe; no associated herbarium material has been located. The four entities were subsequently classified variously in *Aerangis*, *Angorchis*, *Angraecum*, *Chamaeangis*, *Microterangis*, *Mystacidium* and *Saccolabium*. Following examination of all the descriptions, the extant type material, notes, drawings (Fig. 23) and tracings by Reichenbach, other herbarium collections and photographs it is clear that they are all the same species with *Angraecum hildebrandtii* being the oldest name. This multiplication of names for the same species is undoubtedly due to the fact that flowers, especially the lip shape and size are variable and greatly depend on the stage of development on the inflorescence; the size of flower segments was found to increase by almost 50% between the mature bud and fully developed flower, the spur also greatly increases in size and becomes more inflated at the apex with age, this is especially relevant for *Aerangis humblotii* which was described from undeveloped flowers. The fact that several of these entities were originally placed in different genera meant that contemporary botanists did not include them in their comparisons. Summerhayes (1951: 261) in his review of *Angraecopsis* found *Aerangis boutonii* to be allied to, if not identical to *A. hariotiana*. La Croix (2014: 154 & 2022: 169), in her review of *Aerangis* intimated that *A. hariotiana* could be the same as *A. hildebrandtii* but that some growers claim to be able to distinguish them by the shape and size of the spur and lip; a photograph shows *A. hildebrandtii* appearing to have slightly larger flowers than *A. hariotiana* but this is opposite to the measurement of the type material.

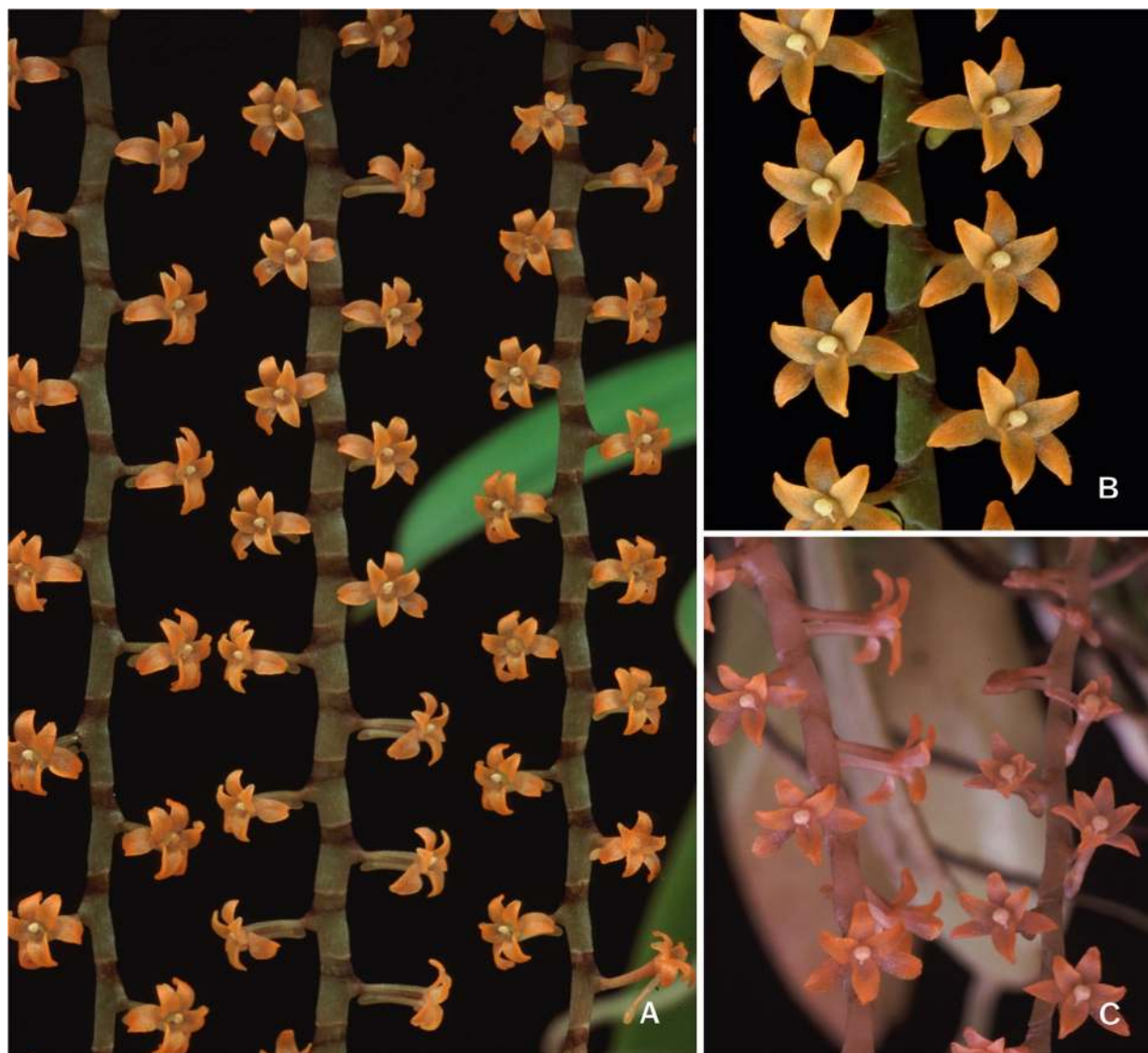


Fig. 25. *Aerangis hildebrandtii*. PHOTOS: J. HERMANS.

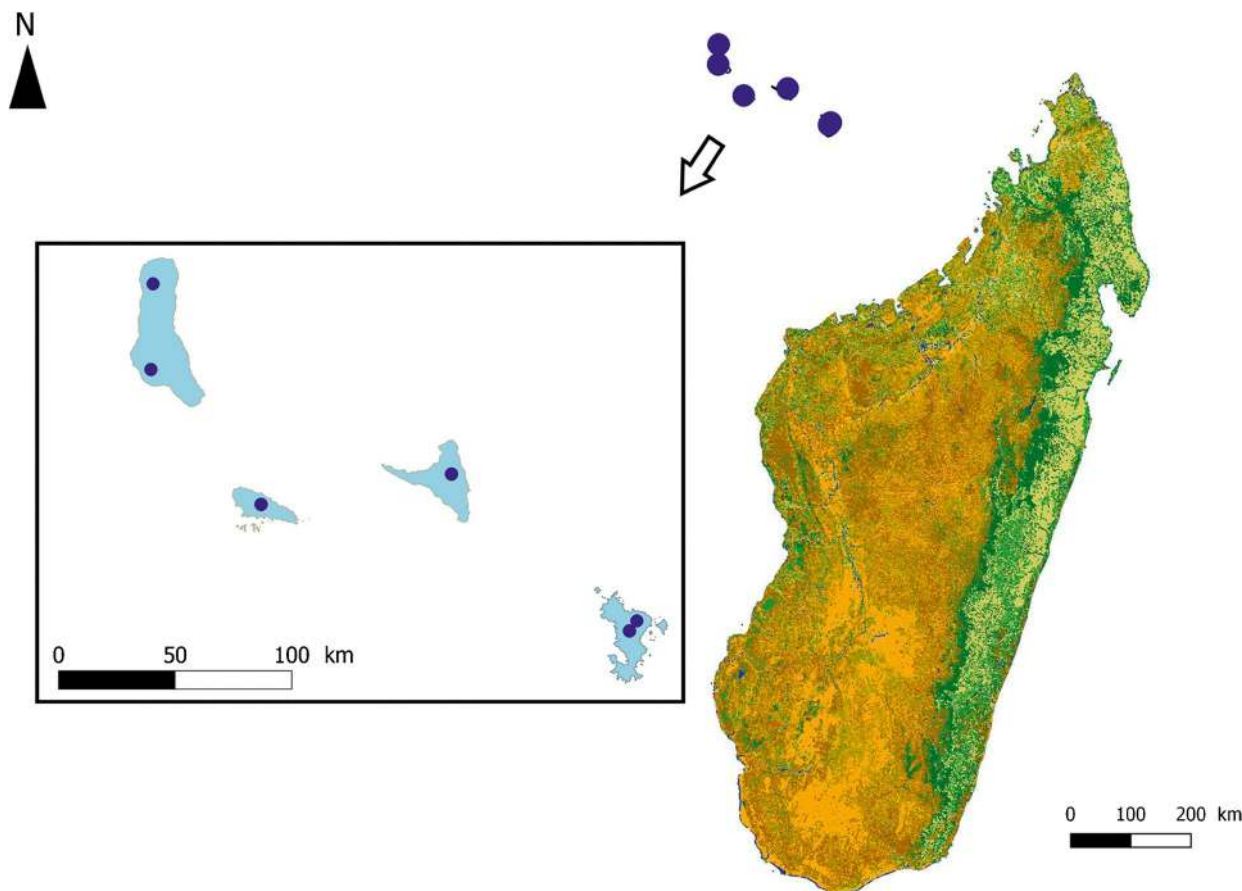
A watercolour in John Day's scrapbooks (1887: 39) at K, labelled as *Angraecum hildebrandtii* is *Aerangis seegeri* Senghas (1983: 23).

Garay (1973: 507) wrongly considered *Chamaeangis divitiflora* a synonym of *Chamaeangis boutonii*.

The species was widely grown in horticulture and is still in several collections today where it is appreciated for its compact plant and attractive, brightly coloured flowers.

Aerangis hildebrandtii is very different from the other species in sect. *Microterangis*; it has bigger leaves with the inflorescences much longer than the leaves and the flowers opening basipetally (vs acropetally).

Aerangis hyaloides (Rchb.f.) Schltr. (Schlechter 1914: 599, 1915: 427, 1918: 117, 1925: 384, 1927: 590); Perrier (1930: 59, 1941: 100); Hawkes (1953: 177, 1965: 35); Hillerman & Holst (1986: 263); Stewart (1986b: 907, 1988: 16); Hillerman (1990: 24); Chiron (1994: 22); Du Puy *et al.* (1999: 8); Petitjean & Petitjean (2003: 28); la Croix (2005: 173); Stewart (2006: 209); Stewart *et al.* (2006: 243); Hermans *et al.* (2007: 12); la Croix (2008: 32); Cribb & Hermans (2009: 274); Bosser & Lecoufle (2011: 71); Parsons & Geritson (2013: 117); la Croix (2014: 156); Junginger (2022: 190); la Croix (2022: 171). Type: Madagascar, Jan. 1880, cult. H. Veitch s.n. (holotype W-R46134 bottom left attachment on the sheet only) (Fig. 26).



Map 16. Distribution of *Aerangis hildebrandtii*.

Angraecum hyaloides Rchb.f. (Reichenbach 1880: 264, 1881c: 136); Ridley (1885: 483); Williams (1885: 117); Godefroy-Lebeuf (1889a: 347); Veitch (1891: 132); Stein (1892: 71) as *Angrecum*; Durand & Schinz (1895: 43); Williams (1894: 99); Kraenzlin (1900: t.238); Sander (1901: 10); Veitch (1906: 112); Palacky (1906: 9); Rolfe (1908: 137); Poisson (1912: 182); Sander (1927: 50); Curtis (1950: 61).

Angorchis hyaloides (Rchb.f.) Kuntze (1891: 651) as *Angorchis hyalodes*.

Aerangis pumilio Schltr. (Schlechter 1918: 334); Perrier (1930: 60); Schlechter (1932: pl.102); Perrier (1941: 100); Williams (1977: 99); Hillerman & Holst (1986: 135); Karasawa (1992: 155); Guillon (2008: 111). Type: Madagascar, s. loc., *Laggiara* s.n. (holotype B⁺), **lectotype** the drawing t.102 no. 406 in Schlechter 1932, **designated here**.

Small to medium sized, 4–9 cm epiphytic *herb* on a short stem 1–3.5 cm long and 0.5–1 cm in diam., entirely covered by membranous sheaths and disintegrating leaf petioles, bearing numerous glabrous wiry roots in the basal part, 0.5–1.5 mm in diam. *Leaves* 3

– 6, thin, narrowly elliptic to elliptic or narrowly obovate, 2–8.5 × 0.8–2.2 cm, attenuate towards the base into a petiole, unequally roundly bilobed at the apex, the short lobe often absent, pale to dark green, glossy. *Inflorescences* axillary, up to 20, erect amongst the leaves, up to 6 cm long, 1–2.5 mm in diam., bearing 6–16 flowers, close together on the terete peduncle, 3–4.5 cm, with 1–3 triangular sheaths; rachis racemose, somewhat thickened at the base of the pedicel forming a rounded annulus, green. *Floral bracts* membranous, amplexant, broadly ovate, acute, 1–1.2 × 1 mm, yellowish-green at first, becoming brown. *Flowers* very small, 10–15 × 12–15 mm without the spur, not opening completely, sepals, petals and lip diaphanous, white, spur white, the anther white becoming brown. *Pedicel* and *ovary* straight, rounded, glabrous, 5.3–7.5 × 0.3–1 mm, pale green to yellowish-green. *Dorsal sepal* arching over the column, narrowly ovate, attenuate, 5.6–7.4 × 1.5–2 mm; *lateral sepals* more or less spreading, narrowly elliptic, attenuate, 6–7.2 × 1.4–2.1 mm. *Petals* more or less spreading, narrowly obovate to narrowly elliptic, acuminate to obtuse, 5.2–7.2 × 1.8–2.9 mm. *Lip* ovate to elliptic, 5.2–6 ×

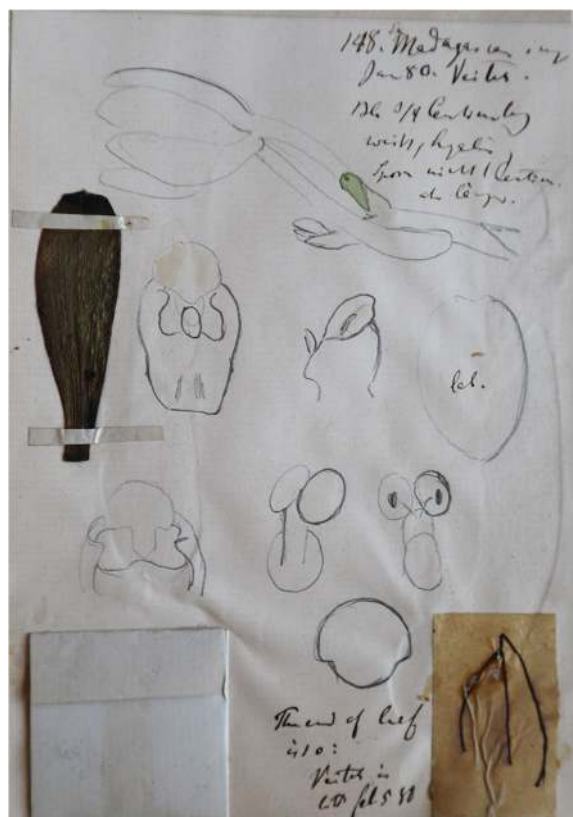


Fig. 26. Drawing by Reichenbach of *Aerangis hyaloides*, at W (R46134), part of the type material.

2.8 – 3.2 mm, flat, concave or slightly convex, obtuse or shortly acuminate; *spur* parallel with the ovary or slightly divergent, 5.4 – 8.3 × 0.9 – 1.2 mm, tubular then inflated towards the apex, nectar visible at the apex. *Column* very short and thick, 1.3 – 1.6 × 1 – 1.4 mm, rostellum short, broad, rounded, viscidium quadrate; anther cap ellipsoid to conical, 0.6 – 1 × 0.7 – 1 mm; pollinia ovoid, c. 0.5 × 0.6 mm, stipes short. Seed-capsule, fusiform, 25 – 42 × 4 – 8 mm. Figs 26, 27, 28.

RECOGNITION. *Aerangis hyaloides* is generally a small plant with a short stem, thin glossy green leaves, very small flowers, not opening completely, diaphanous-hyaline, *spur* about as long as the ovary, a little inflated towards the apex.

DISTRIBUTION. Madagascar, Antananarivo, Antsiranana and Toamasina provinces (Map 17).

SPECIMENS EXAMINED. MADAGASCAR. Mananara, 200 m, 1912, *Perrier* 11881 (P00080734); road to Betampona, 500 m, Dec. 1937? *Lam & Meeuse* 6009 (L0265089); Lakato, 631 m, Sept. 1942, *Decary* 18260 (P00080733); Maroantsetra, Sept. 1959, *Rauh* 283a (HEID, HEID250088-spirit); Mt d'Ambre, 1000 m, Sept. 1959, *Toilliez* s.n. (P00080735); Foulpointe, Sept.

1963, *Bosser* 17231 (P00080787); Mt d'Ambre, 700 m, Aug. 1995, *Daniel DuPuy* s.n. (P01084626); Ambatovy, 1041 m, Aug. 2009, *Antilahimena, et al.* 7155 (MO-2856101, P, TAN); Ambatovy, 1081 m, Sept. 2011, *Antilahimena* 7873 (TAN); Ambatovy, 989 – 1117 m, Sept. 2014, Ambatovy Shade House 4483 (BRLU1650A4483, K1651A4483, MO1649A4483, TAN1648A4483); Tamatave region, *Kiener* 637 (P00080788); near Mt d'Ambre (K-Spirit 61019.000); Ambanja, 0 – 100 m, *Duran* 637 (TAN001159); Moramanga, 1000 m, *Millot* 284 (TAN; Tsaratanana, 0 – 100 m, *Res. Nat.* 12 (TAN001159). **WITHOUT EXACT PROVENANCE:** Jan. 1880, cult. *Veitch* s.n. (W-R46134); cult. *Veitch* 1886 (BM000540115, K); Moore, Glasnevin 1888 (BM000540116); cult. Kew, 1889 (K); cult. Low, 1890 (K); cult. Barbey, Feb. 1895 (G); cult. *Veitch*, 1897, *Curtis* s.n. (K); cult. *Lecoufle*, Aug. 1979 (P06796613); cult. Wageningen Jan. 1982, *Van der Laan* 467 (MO-3129917); May 1991, *Renz* 15655t (RENZ); cult. *Hermans* 2002, *Hermans* 5451 (K); s. loc., *Thompson* s.n. (BM000540201).

HABITAT. Low to medium altitude moist evergreen forest, secondary forest, amongst mosses. Altitude 60 – 1200 m.

CONSERVATION STATUS. *Aerangis hyaloides* is an epiphytic, endemic orchid, distributed in Antsiranana, Toamasina and Antananarivo provinces respectively in Diana, Analanjirofo, Alaotra-Mangoro, Atsinanana, and Analamanga regions. The species is known from ten threatened locations. It occurs in Betampona, Tsaratanana, Montagne d'Ambre, Ambatovy, Vohibe-Ambalabe protected areas. However, five occurrences (Lakato, Maroantsetra, Foulpointe, Analamay, Mantasoa) could already be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and eight locations recorded. *Aerangis hyaloides* is therefore assigned as Vulnerable (VU) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. August to December but mainly in September.

ETYMOLOGY. Referring to the crystal-like diaphanous texture of the flowers.

NOTES. First described by Reichenbach in 1880 from a cultivated plant from Madagascar, imported by the Harry Veitch nursery. The plants were collected for Veitch in NE Madagascar by Charles Curtis (Veitch 1906: 112), who was in Madagascar from 1878 – 79. A mixed sheet in the Reichenbach herbarium (R46134) has an attachment with the single leaf, referred to by Reichenbach in his description, there are also flower fragments, plus several drawings by him (Fig. 26). There are other Veitch plants, probably from the same origin, in BM (BM000540115) and K, together with a drawing of it by Ridley, but they all postdate Reichenbach's description.

Aerangis pumilio was described in 1918 by Schlechter who compared it with *A. hyaloides* but differentiated

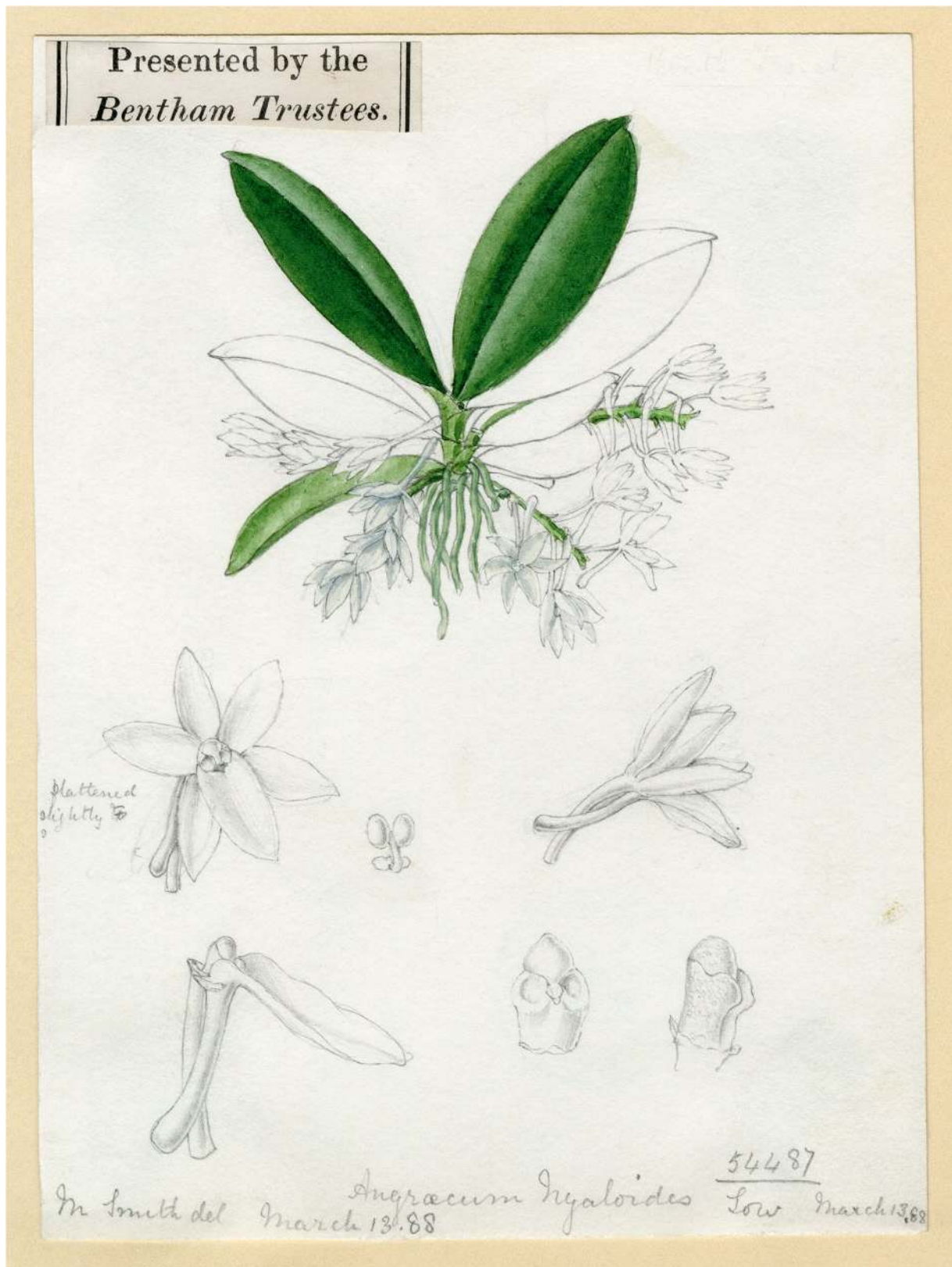


Fig. 27. *Aerangis hyaloides*, watercolour by M. Smith, March 1888. Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.



Fig. 28. *Aerangis hyaloides*. **A** in habitat, eastern Madagascar; **B** inflorescences. PHOTOS: J. HERMANS.

it by the wider leaves and abundance of flowers. The *Laggiara* type material associated with the description was destroyed during World War II (Butzin 1978, 1981) but there is a drawing by Schlechter which was chosen here as the lectotype. The description refers to slightly larger flowers, especially compared with Reichenbach's protologue of *Aerangis hyaloides* but it has since been found that it is quite variable in size; it is clear that *A. pumilio* is the same as *A. hyaloides*.

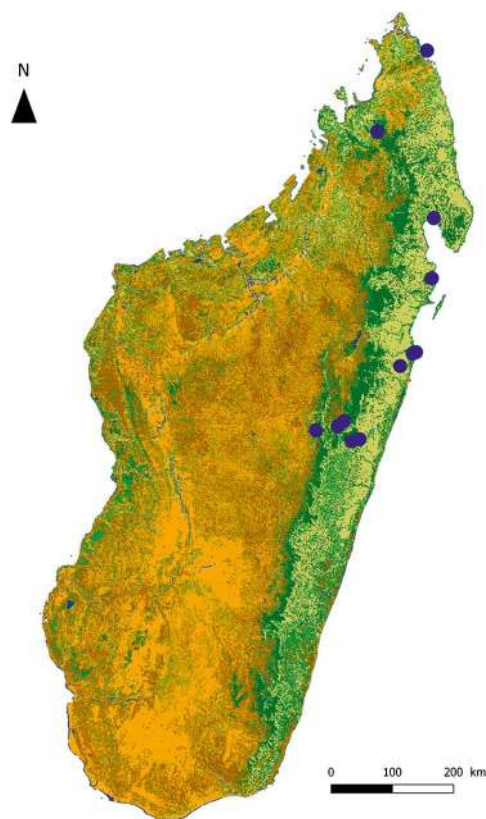
There is a watercolour of 1888, probably destined for Curtis's Botanical Magazine by Smith at K (Fig. 27).

Aerangis hyaloides is not easily confused with any other species; it is somewhat similar to *Aerangis* × *primulina*, a putative natural hybrid of it and *A. citrata*, it is distinct by the larger and broader lip and a longer spur.

***Aerangis ikopana* Schltr.** (Schlechter 1925: 384); Perrier (1930: 59, 1941: 113); Hillerman & Holst (1986: 263); Sander (1901: 10) as *Angraecum mooreanum*; Cribb & Hermans (2009: 280) as *Aerangis mooreana*.

Types: Madagascar, Firingalava, right bank of the Ikopa, July 1898, Perrier 681 (**lectotype** Herb Perrier, P00099096; isolectotypes Herb. Drake, P00099097; Herb. Drake P00099098), **lectotypes designated here**.

Medium-sized, 10 – 15 cm tall, epiphytic *herb* on a short stem 1 – 2 cm long and 0.5 – 1.5 cm in diam., partly covered by leaf petiole remnants, roots, filiform to fleshy, greyish-white, glabrous, 2 – 4 mm in diam. *Leaves* 2 – 5, distichous, flat, narrowly obovate, 6.5 – 11.5 × 2.5 – 3.5 cm, gradually attenuate towards the base into a short petiole, unequally bilobed at the apex, fleshy, dark green. *Inflorescences* pendent, up to 40 cm long, 2 – 3.5 mm in diam., laxly 7- to 18-flowered, flowers c. 1.5 cm apart; peduncle 1 – 1.5 cm, covered by 2 – 3 tubular sheaths; rachis racemose, strongly flexuose, zig-zag, green to orange-brown. *Floral bracts* thin, amplexant, broadly triangular ovate, acute, 3 – 4.9 × 1.3 – 2.5 mm, enveloping the base of the pedicel and a short annular projection between the rachis and the pedicel, yellowish-green becoming



Map 17. Distribution of *Aerangis hyaloides*.

dark brown. *Flowers* strongly fragrant, $19 - 24 \times 18 - 23$ mm, petals, sepals and lip thin in texture, white, rarely tinted pale pink, spur pale ivory to pale pink, base of the column salmon to reddish-pink, pollen yellow. *Pedicel* and *ovary* a little upcurved, rounded, slightly ridged, thickened at the base, $14 - 20 \times 0.8 - 1.3$ mm, brownish-orange. *Dorsal sepal* arching over the column, narrowly ovate, lanceolate, attenuate, the margins more or less recurved, $10.5 - 13 \times 3.2 - 4.1$ mm; *lateral sepals* spreading, recurved, narrowly ovate, attenuate, $10.9 - 16 \times 3.2 - 4.1$ mm. *Petals* recurved, narrowly ovate – spatulate, acuminate, $9.1 - 15 \times 3.9 - 5$ mm, strongly reflexed in the apical third. *Lip* obovate in outline when flattened, recurved parallel with the ovary, rolled-auriculate at the base then slightly narrowed, the blade elliptic, the apex attenuate and reflexed, $11.5 - 14 \times 4.8 - 7.5$ mm, with a short rounded longitudinal ridge at the base; *spur* somewhat widened at the mouth, then pendent, subulate, $85 - 110 \times 0.9 - 1.2$ mm, a little inflated, towards the apex. *Column* long and slender, $4 - 7.5 \times 1.8 - 2.6$ mm, rostellum lobes rounded, a little undulate at the margins; stigma large, expanded, occupying the upper half of the column; rostellum tooth long, hook shaped, anther cap ellipsoid, 1.2

$- 2 \times 1 - 1.8$ mm; pollinia 2, stipes strap-shaped, viscidium rectangular. *Seed-capsule* not known. Fig. 29.

RECOGNITION. *Aerangis ikopana* is a medium-sized plant with a short stem and narrowly obovate leaves, a long pendent inflorescence with a laxly flowered, strongly zig-zag rachis, an orange-brown ovary and pedicel, small white flowers sometimes slightly tinted pink at the base of the column, a strongly recurved lip with a short ridge at the base, and a spur lightly inflated at the apex.

DISTRIBUTION. Madagascar: Antananarivo, Antsiranana, Mahajanga, Toamasina and Toliara provinces (Map 18).

SPECIMENS EXAMINED. MADAGASCAR. Firingalava, right bank of the Ikopa, July 1898, *Perrier* 681 (P00099096-8); lac Aloatra, 1200 – 1400 m, Oct. 1937, *Humbert & Cours* 17545 (P00080763); Andranomavo, Soalala, June 1956, *Randriamora* 8000RN (P00325088); Ankazobe, Feb. 1963, *Bosser* 17386 (P06796618); S Anivorano, April 1969, *Rauh & Senghas* 22987 (Spirit HEID 250082); Ankazobe, cult. Malala Orchidées, 1999, *Hermans* 5174, 5222 (K); Antalaha, *Duran* 484 (TAN); Isalo, *Paulian* 171 (TAN). **WITHOUT EXACT PROVENANCE:** April 1895, cult. Sander (K); 'Eisgrab' 1895, cult. Lauche (W-R4639); cult. Wubben, Jan. 1982, *van der Laan* 465 (MO); Feb. 1984, cult. *Hillerman* 02671 (K); cult. Müller, *Renz* 16446 (RENZ); cult. Malala Orchidées, 1999, *Hermans* 4460 (K); cult. *Hermans* 2441 ex Akerne (K); *Rauh* O21261 (HEID); cult. Vogelsang 21261 (HEID 254142); cult. *Hillerman* 17 (K); cult. *Hillerman* (K-spirit 45124.000); cult. *Hillerman* I, II, III (P).

HABITAT. Low to medium altitude moist evergreen forest, dry deciduous forest. Altitude 300 – 1200 m.

CONSERVATION STATUS. *Aerangis ikopana* is an epiphytic, endemic orchid, distributed in Antsiranana, Mahajanga, Toamasina, Fianarantsoa and Antananarivo provinces respectively in Sava, Diana, Boeny, Betsiboka, Analamanga and Ihorombe regions. The species occurs in Isalo protected area. However, the subpopulations in the three of eight occurrences (Ankazobe, Firingalava and Anivorano) could already be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and four locations recorded. *Aerangis ikopana* is therefore assigned as Endangered (EN) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. October, February, July.

ETYMOLOGY. Referring to the Ikopa river, the second longest waterway in Madagascar, where the type material was first collected.

NOTES. *Aerangis ikopana* was first described by Schlechter in 1925, based on some of Perrier's early herbarium material, collected in NW Madagascar. Stewart (1986c:

1013) concluded that it was the same as *Aerangis mooreana* from the Comoros, this was followed by subsequent authors. As a result of further examination of all the available material we concluded that they are two distinct entities; *Aerangis mooreana* (now *A. polyura*) which is endemic to the Comoros and *A. ikopana* which has only been recorded from Madagascar. The flowers of *Aerangis ikopana* are about 1/3rd smaller than those of *A. polyura*, they are also white (vs pink – salmon coloured), the tepals are all of a similar size (vs the dorsal sepal shorter), the dorsal sepal and petals attenuate (vs obtuse) and the lip narrower with the basal ridge of the lip more pronounced, the column is longer with the rostellum lobes elongate and the rostellar tooth longer and sigmoid (vs curved). The herbarium specimen P00099096 was chosen as the lectotype of the species because it is the most complete, P00099097-8 were chosen as isoelectotypes as they were undoubtedly from the same gathering.

Aerangis lacroixiae J.M.H.Shaw (2013: 15); la Croix (2014: 98) refers to the mainland African species, *Aerangis oligantha* Schltr.; la Croix (2022: 155). Type: Madagascar, dry forests of Manongarivo, June 1909, Perrier 1862 (= Schlechter 82) (holotype P00095859).

Angraecum oliganthum Schltr. (Schlechter 1913: 197, t. 22) (Fig. 30).

Chamaeangis oligantha (Schltr.) Schltr. (Schlechter 1915: 426, 1918: 110, 1925: 381); Perrier (1930: 58); Schlechter (1932: pl.99, 395); Perrier (1941: 90); Garay (1973: 512), Tysen Northen (1980: 52).

Microterangis oligantha (Schltr.) Senghas (1985: 22); Stewart *et al.* (2006: 337); Du Puy *et al.* (1999: 181); Hermans *et al.* (2007: 231); Cribb & Hermans (2009: 284).

Aerangis oligantha (Schltr.) P.J.Cribb & Carlsward *nom. illeg.* (2012: 44); la Croix (2014: 164).

Chamaeangis rauhii Senghas *nom. nud. in sched.* (Rauh 7088 HEID).

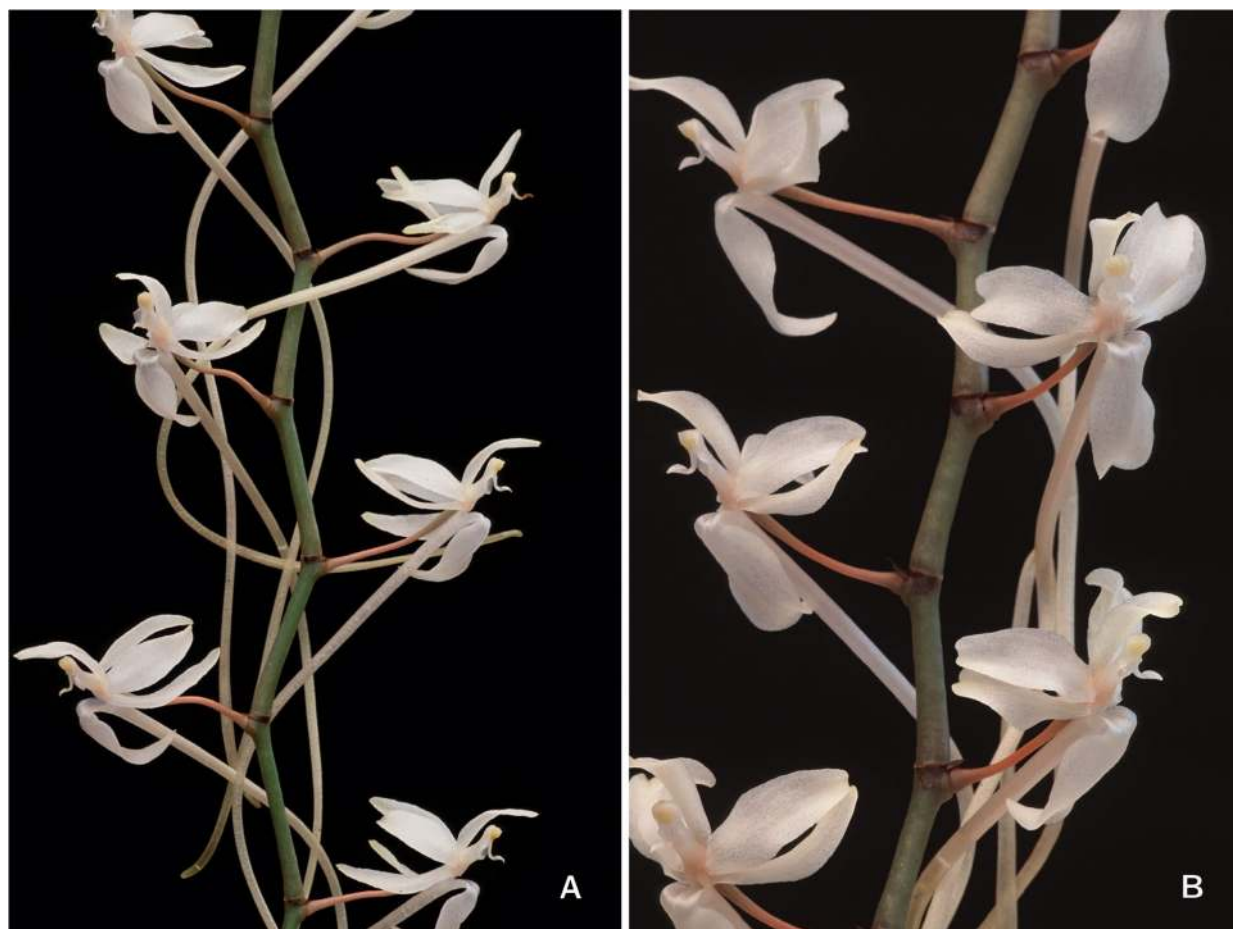
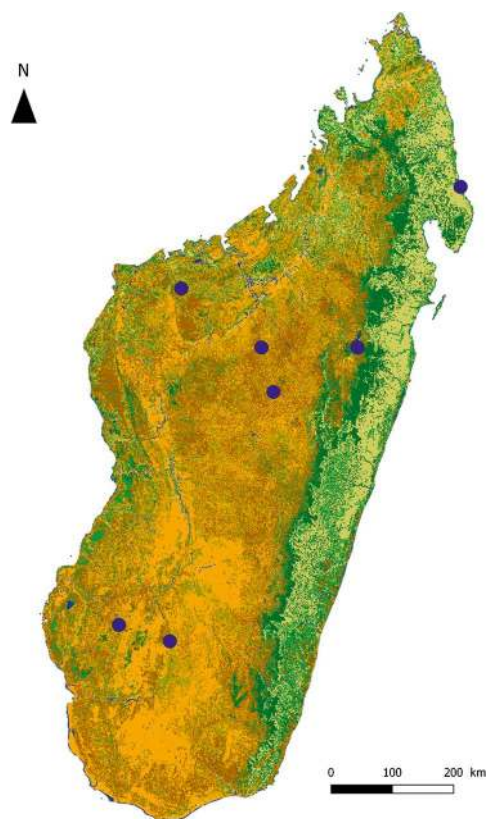


Fig. 29. *Aerangis ikopana*. PHOTOS: J. HERMANS.



Map 18. Distribution of *Aerangis ikopana*.

Small to medium sized *herb*, twig-epiphyte up to 10 cm, on a short 1 – 2.5 cm stem partly covered by 2 – 3 membranous sheaths and disintegrating leaf petioles, roots wiry, fleshy, glabrous, 1 – 3 mm in diam. *Leaves* 2 – 5, flat, fleshy, narrowly obovate, 3.5 – 6 × 1 – 2 cm, narrowing towards the base into a short petiole, unequally bilobed at the apex. *Inflorescences* pendent, up to 18 cm long, 1 – 1.5 mm in diam., with 10 – 26 flowers; peduncle short, with 1 – 3 amplexant sheaths, pinkish-green; rachis racemose, alternate, the flowers developing acropetally, spaced evenly 0.6 – 10 mm apart; with the base enveloping the rachis, acuminate at the apex, 1.4 – 1.7 × 0.4 – 0.8 mm. *Flowers* very small, up to 3.5 × 3.5 mm, yellow-orange to pinkish-orange. *Pedicel* and *ovary* fusiform, glabrous, finely ridged, 1.5 – 2.4 × 0.4 – 0.9 mm, glaucous green. *Dorsal sepal* narrowly elliptic, apex obtuse to acute, 2 – 2.5 × 0.5 – 1.2 mm; *lateral sepals* lanceolate, acute to acuminate, 1.8 – 2.9 × 0.9 – 1.5 mm. *Petals* obovate, obtuse, 2 – 2.8 × 0.8 – 1.2 mm. *Lip* obovate, naviculate, the apex acuminate, 2 – 2.5 × 1.1 – 1.8 mm; *spur* ranging from a slight swelling at the base of the lip to shortly clavate, parallel with the column, 0.6 – 1.1 × 0.3 – 0.5 mm. *Column* short and stout, roundly lobed, slightly roundly at the apex, stigma transversally elliptic, 0.5 – 1 × 0.5 – 0.7 mm;

rostellum subulate; stipe linear, narrowed at the front; anther globose, with a very short beak at the apex, c. 0.3 × 0.4 mm; pollinia 2, c. 0.2 mm in diam. *Seed-capsule* cylindric, 3 – 4 × 1.5 – 2 mm. Fig. 30.

RECOGNITION. *Aerangis lacroixiae* is a twig-epiphyte and characteristic by the laxly-flowered inflorescences longer than the leaves, small yellowish-orange flowers, naviculate lip and the spur which is shortly clavate or reduced to a rounded swelling.

DISTRIBUTION. Madagascar: mainly in the NW; in Antananarivo and Antsiranana provinces (Map 19).

SPECIMENS EXAMINED. MADAGASCAR. Ile de ‘Nossa Beh’, 1853, *Pervillé* s.n. (P00095860); Sambirano, Manongarivo, Ambongo, June 1909, *Perrier* 1862 (P00095859); Ambanja, Sept. 1961, *Rauh* 7088 & spirit 250670. (HEID250670); N of Ankarana, April 1970, *Bosser* 20215 (P01768872); N of Ankarana, May 1972, *Bosser* 21612 (P01768874); NW of Belobaka, c. 700 m, March 1990, *B. DuPuy et al.* MB702, (spirit K-72268.000, MO); Manongarivo, 350 m, June 1999, *Wohlhauser et al.* SW60167 (G, K, P00375490); Réserve Spéciale d’Ankarana, 300 m, Jan. 2003, *Bardot-Vaucoulon et al.* 1290 (P00455594, P004555945-spirit).

HABITAT. Medium altitude sclerophyllous forest and dry deciduous forest, riverine forest, 400 – 700 m.

CONSERVATION STATUS. *Aerangis lacroixiae* is an epiphytic, endemic orchid, distributed in Antsiranana, and Antananarivo provinces respectively in Diana and Bongolava regions. The species occurs in Lokobe, Ankarana and Manongarivo protected areas. However, one occurrence (Belobaka, road to Ankavandrakely) is recorded in an unprotected area, subjected to habitat destruction by frequent fires. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and six locations are identified. *Aerangis lacroixiae* is therefore assigned as Vulnerable (VU) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. April to June, September, December.

ETYMOLOGY. *Aerangis lacroixiae* is named for Isobyl la Croix (1933 –), Scottish botanist and authority on African orchids. *Angraecum oliganthum* probably refers to the lax-flowered inflorescence. *Chamaeangis rauhii* was named for Prof. Werner Rauh (1913 – 2000), German botanist, author and director of the Heidelberg Botanic Garden.

NOTES. *Angraecum oliganthum* was first described by Schlechter in 1913, based on a 1909 collection by Perrier by the Manongarivo River in northern Madagascar. At that time Schlechter named all of Perrier’s orchid material and the single type sheet (P00095859) clearly shows it as the one used by Schlechter in his description; it can therefore be considered the holotype of the species. It was subsequently transferred to *Chamaeangis* by Schlechter, *Microterangis* by Senghas

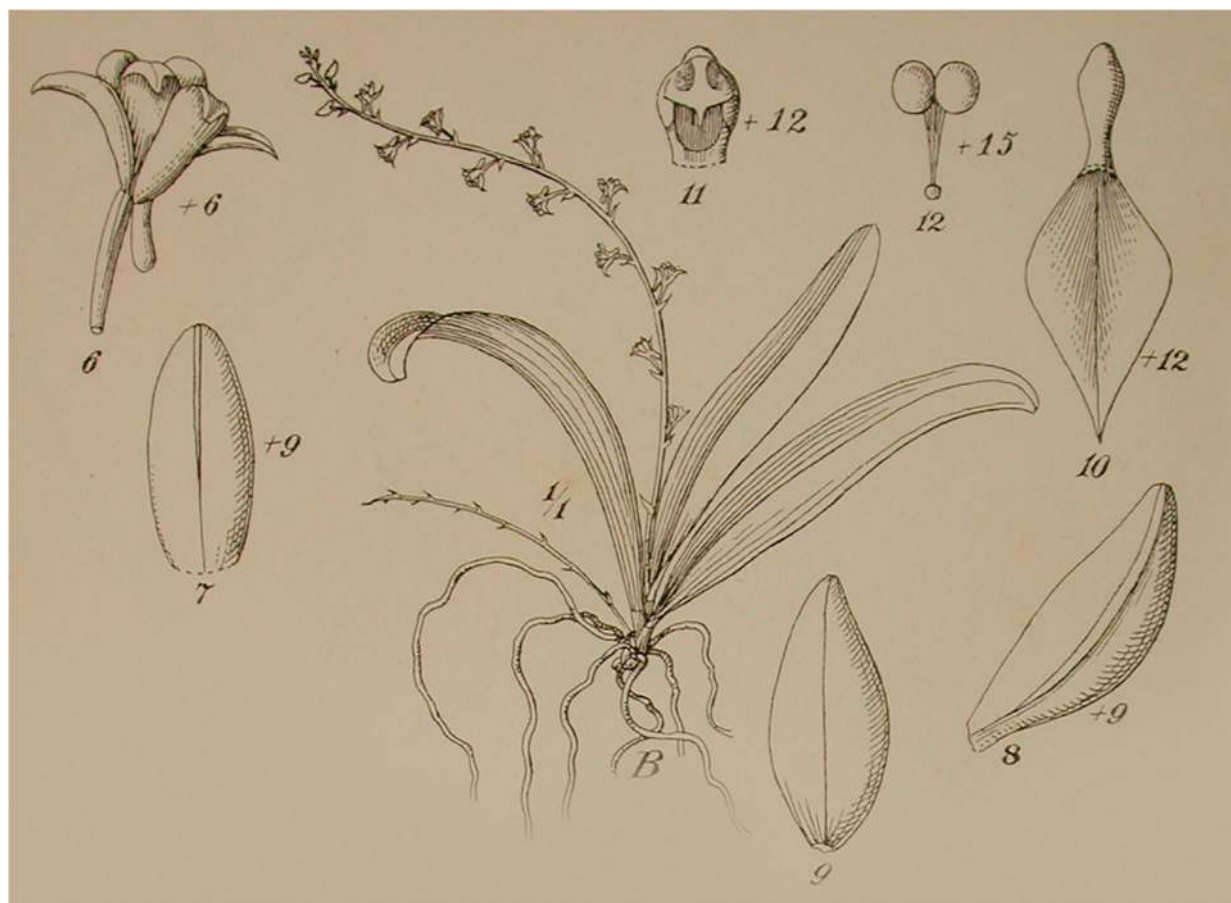


Fig. 30. *Aerangis lacroixiae*, in Schlechter (1913: t. 22).

and *Aerangis* by Cribb & Carlswald. As the epithet had been used by Schlechter in 1915 for a different *Aerangis* from Malawi and Tanzania, and it was not possible to displace an epithet already in use, the 1913 epithet had to be changed, which was done by Shaw (2013). La Croix (2014) mistakenly believed that *Aerangis lacroixii* was a replacement name for *Aerangis oligantha* Schltr. instead of *A. oligantha* (Schltr.) P.J.Cribb & Carlswald.

In overall flower shape, colour and size it is similar to *Aerangis coursiana*, *A. divitiflora* and *A. hildebrandtii* but differs consistently by the much laxer inflorescence and, in fully mature flowers, a much shorter spur.

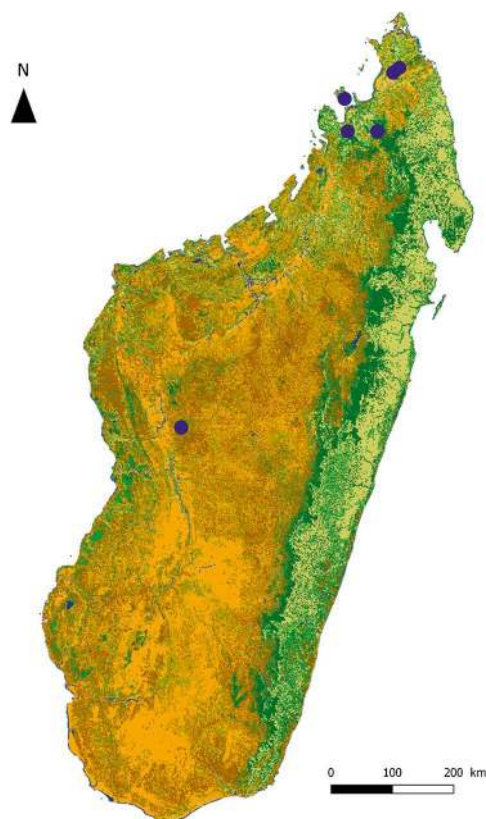
***Aerangis macrocentra* (Schltr.) Schltr.** (Schlechter 1915: 427, 1918: 118, 1925: 385, 1932: pl.101); Perrier (1930: 59, 1941: 110); Hillerman & Holst (1986: 253); Stewart (1986b: 904); Hillerman (1990: 13); Hermans *et al.* (1998: 12); Du Puy *et al.* (1999: 8); Stewart (2006: 211); Stewart *et al.* (2006: 244); Hermans *et al.* (2007: 13); la

Croix (2008: 34); Cribb & Hermans (2009: 276); Bosser & Lecoufle (2011: 72); la Croix (2014: 158, 2022: 176). Types: Madagascar, Sambirano, Manongarivo massif, c. 2000 m, April 1909, Perrier 1854 (93) (syn. B†; P00080736, **lectotype designated here**).

Angraecum macrocentrum Schltr. (Schlechter 1913: 195).

Aerangis clavigera H.Perrier (1938a: 38, 1941: 103); Hawkes (1953: 177); Tysen Northen (1980: 33); Hillerman & Holst (1986: 119); Karasawa (1992: 161); Senghas (1993: 194); Rajeriarison (2004: 18); Lecoufle (2005: 16). Type: Madagascar, Mandraka, Ankeramadinika forest, May 1928, leg. François, Perrier 18554 (holotype P00080737).

Medium-sized to rarely large 8 – 20 cm epiphytic *herb*, more or less at a right angle to the substrate, on a short stem 2 – 6.5 cm long and 0.5 – 1.5 cm in diam., covered by thick striate sheaths and remnants of the leaf petioles, roots, fleshy, greyish-white, glabrous, mostly flattened against the substrate, 2 – 4 mm in diam. *Leaves* 2 – 7, distichous, flat, elliptic or obovate



Map 19. Distribution of *Aerangis lacroixiae*.

to narrowly elliptic or narrowly obovate, $3.5 - 19.5 \times 1.5 - 5$ cm, attenuate towards the base into a short petiole, unequally bilobed at the apex, the shorter lobe often absent, glaucous green or green, glossy on the upper surface. *Inflorescences* axillary, pendent, up to 40 cm long, 1 – 2.5 mm in diam., glaucous green, bearing 6 – 32 flowers, c. 1 cm apart; peduncle 3 – 4.5 cm, with 1 – 2 tubular sheaths; rachis racemose, distichous. *Floral bracts* thin, amplexant, broadly triangular to tubular, acute, $2 - 2.9 \times 1.9 - 2$ mm, dark brown, almost completely enveloping the base of the pedicel and a short stem-like conical projection above each bract and overtopping it. *Flowers* small, $11 - 18 \times 12 - 17$ mm without the spur, sepals, petals and lip white to ivory, often brownish-pink towards the base, spur greenish-white to creamy-brown, the column ivory. *Pedicel* and *ovary* straight or slightly curved, rounded, slightly ridged, $15 - 25 \times 0.5 - 1.5$ mm, glaucous green to brown, paler towards the rachis, scurfy dark brown to black towards the base of the perianth. *Dorsal sepal* erect, narrowly elliptic, attenuate, the margins and apex more or less recurved, $5.4 - 8.3 \times 1.7 - 2.1$ mm; *lateral sepals* reflexed, narrowly ovate, acute, $6.1 - 9 \times 1.4 - 2.1$ mm. *Petals* strongly reflexed, narrowly elliptic, acute, $6.1 - 8.5 \times 1.8 - 2.4$ mm. *Lip* projecting forward

beneath the column then strongly revolute, narrowly elliptic, apex acute, $5.2 - 9 \times 2.4 - 3.8$ mm; *spur* curved through 90 degrees, tubular narrowed in the lower part and much inflated and more or less flattened in the apical third, $30 - 50 \times 0.9 - 1.8$ mm, nectar visible at apex. *Column* slender, $3.2 - 4.8 \times 1.9 - 2.5$ mm, rostellum wings undulate at the margins, indented at the apex; stigma long and slender, curved; anther cap somewhat angular with a small apical beak, $1.1 - 1.5 \times 0.9 - 1.5$ mm; pollinia 2, stipes strap-shaped, viscidium round or heart-shaped, $0.4 - 0.9 \times 0.3 - 0.5$ mm. *Seed-capsule* fusiform c. 45×5 mm. Fig. 31.

RECOGNITION. Plant medium-sized. Leaves at a right angle to substrate, often glaucous. Rachis distichous. Flowers white, with small, reflexed segments, a strongly revolute lip, a brownish spur that is at first parallel with the ovary then pendent, inflated from the apical third.

DISTRIBUTION. Madagascar: Widespread in Antananarivo, Antsiranana, Fianarantsoa, Toamasina and Toliara provinces (Map 20).

SPECIMENS EXAMINED. MADAGASCAR. coast to capital, May 1880, *Langley Kitching* s.n. (K); Ankeramadinika, June 1885, *Fox* 48 (K ex LDS); Central, rec. 1883 *Baron* 4385 (K); Ivohimanitra forest, Nov. 1894, *Forsyth Major* 114 (K); Sambirano Mts, Manongarivo massif, c. 2000 m, April 1909, *Perrier* 1854 (93) (P00080736); Ankeramadinika, May 1928, *François* legit in Herb. *Perrier* 18554 (P00080737); Ankeramadinika, June 1933, *Perrier* 19284 (P00080745); Mandraka, June 1938, *Jard. Bot. Antananarivo* 3669 (P00080743); SW of Manambato, 2000 – 2244 m, March 1951, *Humbert & Capuron* 25777 (P00080742); Manandriana area, 1953, *Lecoufle* F223 (P00080744); road Moramanga to Anosibe, June 1959, *Bosser* 13201 (P00080738, TAN); Tampoketsa d'Ankazobe, May 1960, *Bosser* 17145 (TAN); Ankadimanga, May – June 1961, *Bosser* 15387 (P00080739, TAN); Mandraka, June 1961, *Bosser* 19833 (P00080740); PK 300 S, April 1962, *Bosser* 15911 (TAN); road to Mandritsara, June 1963, *Bosser* 18464 (P00080741, TAN); Andringitra, April 1964, *Bosser* 19642 (TAN); Ambatoloana, 1250 m, May 1970, *Tixier* s.n. (P); cult. May 1970, Fianarantsoa, Ranomafana, c. 1500 m, *Stewart* 1093 (K); Ivohibe, May 1972, *Cremers* 2163 (TAN001156); S of Ambositra, 1994, *Hermans* 3455, 3489 (K); SW of Ivato, 1755 m, Nov. 1994, *Hermans* 3039 (K-Spirit 58471.000); near Andasibe, 1200 m, Nov. 1997, *Hermans* 4254 (K); W of Ranomafana, May 2001, 746 m, *Hermans* 6550 (K); Andringitra, 1835 m, Nov. 2010, *Rakotonasolo et al.* RNF1685 (K000664633, TAN); Fianarantsoa, Ambatofitorahana (K-Spirit 61432.000); Andringitra, *de Dieu* 214 (TAN); Fianarantsoa, *Herb. Inst. Sci. Ad.* 172 (TAN); Tsaratanana, cult. *Jard. Bot. Tan.* 1140 (TAN). **WITHOUT EXACT PROVENANCE:** Anon 1104 (TAN); Anon. (P00326091);

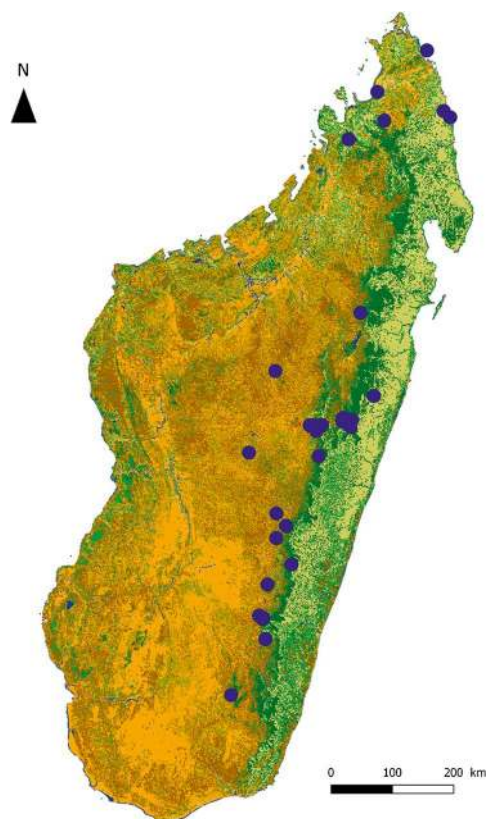


Fig. 31. *Aerangis macrocentra*. **A** in habitat, eastern Madagascar; **B** inflorescence; **C** close-up of flowers. PHOTOS: J. HERMANS.

cult. J & L. (K-Spirit 61020.000); Tsimbazaza? 1961, *Rauh* 7260a (HEID250068); Oct. 1982, cult. *Lecoufle*, (P06796665); cult. *Lecoufle* Oct. 1978, *Lecoufle* 10658 (P-spirit); cult. *Lecoufle*, Sept. 2007, *Hermans* 6762 (K); Nov. 1985, *Renz* 14437t (RENZ); Sept. 1996, Müller leg. 16415t (RENZ); cult. Malala, 1999, *Hermans* 6698 (K). **HABITAT.** Low to medium altitude moist evergreen forest, sclerophyllous woodland, forest remnants. Altitude 300 – 1200 m.

CONSERVATION STATUS. *Aerangis macrocentra* is endemic to Madagascar and distributed in Northern, Central Highlands and Eastern Madagascar, respectively in Antsiranana, Antananarivo, Toamasina, Fianarantsoa and Toliara provinces. The area of occupancy (AOO) is estimated to be less than 500 km² (under

the threshold of Endangered category). The extent of occurrence (EOO) is estimated to be more than 20,000 km² and the species is known from 25 threatened locations. *Aerangis macrocentra* is recorded in some protected areas such as Montagne d'Ambre, Tsaratanana, Manongarivo, Ankerana- Corridor Ankeniheny-Zahamena, Ambatovy, Analamazaotra, Ranomafana, Andringitra and Kalambatritra. However, many sub-populations (11 occurrences of 21) are recorded in unprotected areas (Ambilobe, Ambohimanga, Andramasina, Ambatolaona, Mandraka, Angavokely, Manjakandriana, Mantasoa, Ambatofitorahana, Ambositra, Mandritsara) that are facing a continuing decline due to habitat destruction. The overall population is believed to be decreasing even though not exposed



Map 20. Distribution of *Aerangis macrocentra*.

to immediate risk of extinction. Therefore, *Aerangis macrocentra* is assessed as Near Threatened (NT). The species was assigned to Near Threatened (NT) status in 2016.

PHENOLOGY. March to June but mainly from May to June.

ETYMOLOGY. Refers to the long, thickened spur.

NOTES. Although known from several un- or misidentified collections by Baron, Fox, Forsyth Major & Langley Kitching from 19th century, it was not described until 1915 by Schlechter, who based it on material collected in NE Madagascar by Perrier under number 93. He mentioned that his description was based upon a single leaf and an inflorescence with unopened flowers. No such herbarium material has been found and it can be presumed that Schlechter did not return it to Perrier but it was retained in Berlin where it was destroyed in World War II. There is, however, a sheet in P (Perrier 1854 with Schlechter's number 93 in brackets) annotated as 'type de l'espèce', that represents the species well and corresponds to Schlechter's protologue, which was therefore chosen as the lectotype of the species.

Aerangis clavigera was described by Perrier, based on a plant collected by François in the east of the island. He did not compare the two species and, in the key for the genus (Perrier 1941), he separated the two by the size of the dorsal sepal (7 mm in *A. clavigera* and 10 mm in *A. macrocentra*). However, in the type material of each the dorsal sepals are the same size. When comparing all the features of the types, there is no doubt that they are the same.

It shares the inflated spur and habit with *Aerangis seegeri* but in that species the flowers are brownish-green (vs white) the segments not reflexed and the spur about a third of the length. It has similar sized flowers and has been confused in herbaria with *Aerangis pallidiflora* but, in that species, the flowers are pale green (vs white) and the spur is far less, or not, inflated at the apex and about half the length.

Aerangis modesta (Hook.f.) Schltr. (Schlechter 1914: 600, 1915: 427, 1918: 119, 1927: 591); Perrier (1930: 59, 1938a: 36, 1941: 108); Hawkes (1965: 35); Perkins (1966: 364); Stewart (1986a: 799); Hillerman & Holst (1986: 129); Hillerman (1992: 29); Karasawa (1992: 159); Chiron (1994: 22); Van Zuylen (1996: 1); Du Puy *et al.* (1999: 9); Lecoufle (2006: 14); Stewart (2006: 212); Stewart *et al.* (2006: 237); Hermans *et al.* (2007: 13); Cribb & Hermans (2009: 280); Bosser & Lecoufle (2011: 73); la Croix (2014: 159); Hervouet (2018: 74); Pailler *et al.* (2018: 23); C. Hermans (2020: 358, 2021b: 50); la Croix (2022: 178). Type: Madagascar, cult. Kew, April 29, 1882, ex Lady Ashburton (holotype K000306361 top left specimen only).

Angraecum modestum Hook.f. (Hooker 1883: t.6693); Williams (1885: 118); Ridley (1885: 482); O'Brien (1888: 428); Veitch (1891: 135); Stein (1892: 71) as *Angraecum*; Bois (1893: 192); Watson & Chapman (1903: 50); Williams (1894: 99); De Kerckhove (1894: pl. 5); Durand & Schinz (1894: 44); Cogniaux & Goossens (1898: 15, 2); Rolfe (1900: 152); Baron (1901: 718); Watson & Chapman (1903: 48); Palacky (1906: 9); Sandhack (1913: 53); Voeltzkow (1917: 443); Sander (1927: 51).

Angorkis modesta (Hook.f.) Kuntze (1891: 651).

Rhaphidorhynchus modestus (Hook.f.) Finet (1907: 37); Poisson (1912: 185). Based on: Madagascar, SW coast, Grandidier (P00080759).

Angraecum sanderianum Rchb.f. (Reichenbach 1888: 168); Godefroy-Lebeuf (1881a: 120, 1881b: 147); André (1888: 516); Godefroy-Lebeuf (1889b: 101); De Kerckhove (1889: 218); Watson & Bean (1890: 45); Boyle (1893: 134); Stiles (1894: 192); Bois (1893: 192); De Kerckhove (1894: pl. 5); Rolfe (1900: 152); Journal of Horticulture (1901b: 459); Watson & Chapman (1903: 51); Rolfe (1904: 337);

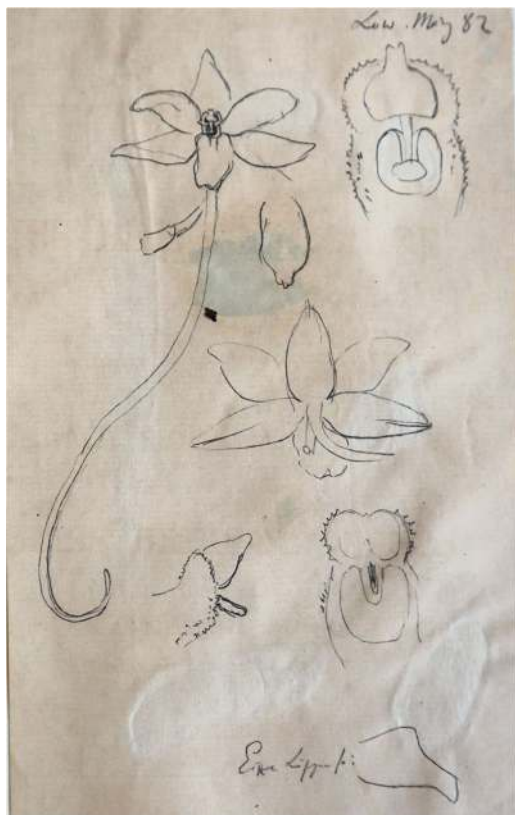


Fig. 32. Drawing by Reichenbach of *Aerangis modesta*, at W (R39518).

Sander (1901: 11); Witt (1910: 120); Sander (1927: 51); Burrage (1930: 4). Type: Comoros, ex Sander, *Humboldt* s.n. (W top left part of the sheet only), **lectotype designated here**.

Rhaphidorrhynchus modestus var. *sanderianus* (Rchb.f.) Poiss. (Poisson 1912: 186) **synon. nov.**

Aerangis modesta var. *sanderiana* (Rchb.f.) Lecoufle in Rieunier & Bailly-Pommery (1999) **synon. nov.**

Aerangis crassipes Schltr. (Schlechter 1918: 333); Perrier (1930: 59); Schlechter (1932: t.100). Type: Madagascar, *Laggiara* s.n. (holotype B†), the drawing t.100 no. 399 in Schlechter 1932, **lectotype designated here**.

Aerangis venusta Schltr. (Schlechter 1918: 334, 1925: 389); Perrier (1930: 60); Schlechter (1932: t.102, 408) **synon. nov.** Type: Madagascar, Moramanga, *Afzelius* s.n. (holotype S12-23142-3).

Aerangis fastuosa var. *angustifolia* H.Perrier (1941: 95), *nom. nud.*; Hillerman & Holst (1986: 262). Based on: Madagascar, between Moramanga and Anosibe, 600 m, Oct. 1927, Perrier 18290 (P00080729).

Medium-sized to large, 10 – 25 cm tall, epiphytic herb on an arching to pendent stem 3 – 12 cm long and

0.5 – 1.2 cm in diam., covered by thick striate sheaths, roots copious, fleshy, greyish-white, glabrous, 1.5 – 3 mm in diam. *Leaves* 2 – 10, more or less distichous, flat, narrowly obovate or elliptic to narrowly obovate or elliptic, 6 – 29 × 1.5 – 3.5 cm, gradually attenuate towards the base ending in a 0.5 – 2.5 cm petiole, unequally emarginate at the apex, the longer lobe rounded or truncate, the shorter often absent, pale to dark green, rarely glaucous, the margin and mid-vein often darker green or red, often paler underneath, the mid-vein darker, surface slightly glossy, margins a little recurved. *Inflorescences* axillary, arching to pendent, pale green to orange-brown up to 25 cm long but generally shorter, 2 – 4 mm in diam., bearing 7 – 25 flowers in parallel rows, 1 – 2.5 cm apart, peduncle 0.5 – 3 cm, covered by 2 – 4 brown amplexant sheaths; rachis racemose, more or less zig-zag. *Floral bracts* thin, amplexant, broadly triangular ovate, acute, pale to dark brown, 1.8 – 2.3 × 1 – 1.2 mm, almost completely enveloping the base of the pedicel and a short stem-like conical projection between the rachis and the pedicel, 0.3 – 1 × 0.3 – 0.5 mm. *Flowers* medium in size, somewhat variable in size, the perianth up to 35 × 43 mm, sepals, petals and lip white to pale pink, spur white to pink, or tinted brown, the column ivory. *Pedicel* and *ovary* narrowly turbinate, straight, glabrous or somewhat dark brown-scurfy and shallowly ridged towards the apex, 16 – 24 × 1 – 2.1 mm, brownish-green to orange-ochre. *Dorsal sepal* erect or arching forward, narrowly ovate to lanceolate, attenuate, acute, 12 – 18 × 2.8 – 7 mm; *lateral sepals* spreading, narrowly elliptic to narrowly ovate, acuminate, dorsally ridged along the mid-vein, reflexed towards the apex, 12 – 21 × 3.6 – 6.5 mm. *Petals* spreading, narrowly elliptic to narrowly ovate, acute to acuminate, the margins often a little undulate, the apex recurved, 11 – 21 × 3 – 8 mm. *Lip* somewhat recurved below the column, narrowly obovate to obovate, the base flat, then attenuate towards the apex and often slightly reflexed, 13.5 – 20 × 3.9 – 8.5 mm, the apex obtuse or roundly apiculate; *spur* first divergent from the ovary then pendent, slightly widened at the base, subulate, 65 – 85 × 0.7 – 1.2 mm. *Column* short, stout, 2 – 4 × 1.5 – 3 mm, emarginate at the apex, minutely toothed to shortly hairy especially around the androclinium, rostellum lobes indistinct and curved forward, the margins dentate, c. 1 mm long, stigma oval; anther cap roundly beaked, 1.2 – 2 × 1.4 – 1.8 mm.; pollinia 2, 0.6 – 1 × 0.3 – 0.8 mm, stipes strap-shaped, viscidium broadly rectangular, the lateral margins clasping the rostellum. *Seed-capsule* slender, fusiform, 25 – 42 × 4 – 8 mm. Figs 32, 33.

RECOGNITION. *Aerangis modesta* is a medium-sized to large plant with a short stem, long arching-pendent inflorescences, an often brownish-green rachis and pedicellate ovary, and medium-sized flowers with the

lip similar to the tepals, the segments not reflexed and with a long spur. The column is hairy, the rostellum lobes dentate and the rostellum hooked forward, while the anther cap is roundly lobed.

DISTRIBUTION. Madagascar: Antananarivo, Antsiranana, Fianarantsoa and Toamasina provinces. Comoros: Anjouan [Nzwani]) and Grande Comore [Ngazidja] (Map 21).

SPECIMENS EXAMINED. COMOROS: Anjouan, Oct. 1923, *Decary* 2660 (P00080757, TAN); Anjouan, Mt Remani, Oct. 1958, *Benson* 285 (BM00540202, TAN); Grande Comore, La Grille forest, Oct. 1963, *Bosser* 18409 (P00080751); Grande Comore, forêt de la Grille, Oct. 1963, *Bosser* 17253 (P00080749, TAN); Grande Comore, La Grille, 650 m, Dec. 1967, *Bernardi* 11649 (G, K, P06168538); Grande Comore, La Grille, 850 – 900 m, Dec. 1967, *Bernardi* 11666 (G, K); Anjouan, Col Patry, c. 700 – 1000 m, Oct. 1968, *Schlieben* 11115 (BR0000020220686, HEID, M, MO3129915); Grande Comore, Njommbadjou, Jan. 1968, 550 m, *Stewart* 925 (K); Anjouan, Adda-Douéni, Nov. 1970, *Rakotozafy* 1205, 1205bis (P00080774, TAN); Grande Comoros, La Grille, Nov. 1975, *Coulon* 208 (P00749801); Grande Comoro, Kartala-Niumbadjou, March 1983, (coll. *Doutrel-point* 222b) Hort. Billiet 1132 (BR0000022709196); Grand Comoro, Maoueni, La Grille, 780 m, Nov. 1999, *Labat et al.* (B, CNDRS, G, K, MO3129914, P00183925-7); Ngazidja, Tsinimouapanga, 798 m, Nov. 2008, *Rouhan et al.* 918 (HDC, P00771470). **WITHOUT EXACT PROVENANCE:** Botanic Garden, Zurich June 1889 ex *Sander* (K); Aug. 1890, cult. *Sander* s.n. (K); ex. *Sander*, *Humblot* s.n. (K, W-R39519); cult. *Lawrence* (W); cult. Tsimbazaza, Oct. 1970, *Cabanis* in *Herb. Jard. Bot. Tan.* 1406-7 (P00080753-5, TAN). **MADAGASCAR:** S Betsileo, Ankafana, March 1881, *Hildebrandt* 4201a (W-R14922); Ambatovory, July 1906, *d'Alleizette* 6958 (L0265093); E, Tamatave, Nov. 1906, *d'Alleizette* 1298 (P00080746); Mandraka, April 1907, 1907, *Herb. Rotereau* (P02222823); near Fetromby, 400 m, Oct. 1912, *Viguier & Humbert* 527 (P00080776, TAN); Analamazotra, 900 – 1000 m, Oct. 1912, *Viguier & Humbert* 846, 846a (P00080777, P00099111); Moramanga, *Afzelius* s.n. (S12-23142-3); Andringitra, 1800 m, Jan. 1923, *Perier* 14343 (P00099108); Tsinjoarivo, 1400 m, Feb. 1925, *Perier* 16963 (P00099109); Isalo, c. 900 m, Oct. 1924 *Perier* 16723 (P00080769, TAN); betw. Moramanga and Anosibe, c. 600 m, Oct. 1927, *Perier* 18290 (P00080729); Mt d'Ambre c. 1000 m, Nov. 1932, *Perier* 18881 (P00080770-2); Andrangoval, 1400 m, Oct. 1937, *Humbert & Cours* 17914 (P00080764, TAN); Andasibe, Analamazotra, Nov. 1938, *Lam & Meeuse* 5330 (L0265092); Mt d'Ambre, 1000 – 1200 m, Oct. 1944, *Homolle* s.n. (P00080762); Andringitra, Dec. 1951, *Millot* 978 (P06796628, TAN); Ambalavao, Sendrisoa, Jan. 1953, *Rés. Nat. Mad.* 5530RN (P00080775); Périnet, 1956, *de Dieu* 175a (TAN); Fianarantsoa, 1950, *Bégué* 866 (TAN); Andasibe, Sept. 1959, *Rauh* M446 (HEID-spirit 250095); Amboasary, 1000 m, Feb. 1961, *Bosser* s.n. (P00513704); Périnet, Sept. 1962, *Bosser* 16394 (P00080747); Lac Aloatra,

Oct. 1962, *Bosser* 1646 (TAN); Tampoketsa d'Ankazobe, Oct. 1963, *Bosser* 18435 (P00080752); N of Andilamena, Oct. 1963, *Bosser* 17242 (P06797095); Fanovana, Oct. 1965, *Rakotozafy* 405-6 (P00080773, TAN001158); W of Tsiroanomandidy, 1300 m, July 1969, *Morat* 3376 (P00513698, P00513700); Bongolova, cult. Tsimbazaza, Oct. 1969, *Morat* 3380 (P006796642, P06796646); Andringitra, 1500 m, Jan. 1971, *Guillaumet* 3814 (P00080761, TAN); Ankazobe, Nov. 1971, *Morat* 3909 (P00513697, P00513703); W of Tsiroanomandidy, 1250 m, Nov. 1973, *Morat* 4655 (P); Périnet, Oct. 1982, *Razakanirina* 315b (P00080799); Analamazotra- Périnet, 1000 m, Nov. 1984, *Dorr & Barnett* 3176, 3198 (MO2856085, MO285608, P00080756, TAN); Analamazotra- Périnet, 1000 m, Nov. 1985, *Dorr & Barnett* 4329 (MO-2856088, TAN); Périnet, 900 – 950 m, Nov. 1985, *Gentry et al.* 52418 (MO2856023); Mt d'Ambre, Nov. 1992, *Daniel DuPuy* 3-, 11, 17 (P06796673-5); Mantady, 930 m, Oct. 1993, *Andrianarisata et al.* (MO-285609, P00107369, TAN001155); Ivohibe, 900 m, Oct. 1997, *Messmer et al.* NM 449, 849 (G, MO, TAN); Marojejy, Oct. 2001, *Gautier et al.* LG3810, LG3840, LG3872 (G, P00679704); Col Tapia, 1700 m, Nov. 2004, *Fischer et al.* FS1477 (WU); Antserabe to Bernainty, 1150 m, Sept. 2005, *Lowry* 6580 (MO); Ankerana, 698 m, Oct. 2005, *Razakamalala et al.* 2296 (TAN); forêt de Kalabenono, 456 m, Nov. 2006, *Callmander et al.* 54 (MO, P, TAN); Ambatovy, 988 m, Oct. 2007, *Antilahimena* 5836-7 (MO-2856008-9, P, TAN); Ambatovy, 1032 m, Sept. 2008, *Andriantiana* 442 (MO3011094, P, TAN); Ambatovy, Sept. 2008, *Andriantiana et al.* 497 (MO2856019, TAN); Ambatovy, Oct. 2008, *Antilahimena et al.* 6552 (TAN); Ambatovy, Oct. 2008, *Bernard et al.* 1170 (MO2856020, TAN); Ambatovy, 987 m, Oct. 2008, *Antilahimena* 6711 (MO-2856016, P, TAN); Ambatovy, Forêt d'Analamay, Oct. 2008, *Andriantiana et al.* 515, 521, 6830 (MO2856024-5, 2856015, TAN); Forêt d'Analamay, Oct. 2008, *Randrianasol et al.* 975 (MO2856017, TAN); Ambatovy, 1080 m, Oct. 2011, *Stévant & Ramandimbisoa* 4105 (BRLU, MO); Andasibe, Lac Vert, Dec. 2013, *Razafindraibe et al.* 525 (MO, TAN); Analamazotra, 1012 m, Dec. 2013, *Razafindraibe* 564 (TAN); Analamazotra, 1008 m, Dec. 2013, *Ramandimbisoa et al.* 330 (MO, TAN); Vohipara, *Bégue* 18 (TAN); Mandraka, *Bégué* 355 (TAN); Anosibe, Sept., *Millot* 320 (TAN); SW coast, *Grandidier* s.n. (P00080759); Antalaha, *Duran* 372 (P00080765, TAN); Ankazobe, *Bosser* 18116 (P00080750, TAN); Ivohibe, *Bosser* *Jard. Bot. Tan.* 883a & b (P); Mt Tsaratanana, *Jard. Bot. Tan.* 1147 (P06796641); Périnet, *Bosser* 1303 (P0008076-7); Périnet, *Herb. Inst. Sci. Mad.* 45, 181 (TAN); Fianarantsoa, *Herb. Inst. Sci. Mad.* s.n. (TAN); Tampoketsa, *Inst. Sci. Mad.* 2, 3, 5, 6, 12, 17, 20, 355 (TAN); Périnet, *Ursch* 2 (TAN); Cult. April 1887, *Herb. Barbey-Boissier* (G); Mandraka, *Paulian* 182 (TAN); Mandraka, *Herb. Inst. Sci. Mad.* 855 (TAN); Andringitra, *Millot* 883 (TAN); Périnet, *Ursch* 171 (TAN); Mandraka, *Anon.* 183 (TAN); Ankazobe (K-Spirit 60806.000); Anjozorobe (K-Spirit 60861.000); s. loc. (K-Spirit 61004.000). **WITHOUT EXACT PROVENANCE:** Cult. *Sander*. (W-R3889); 1880, *Wibbe*



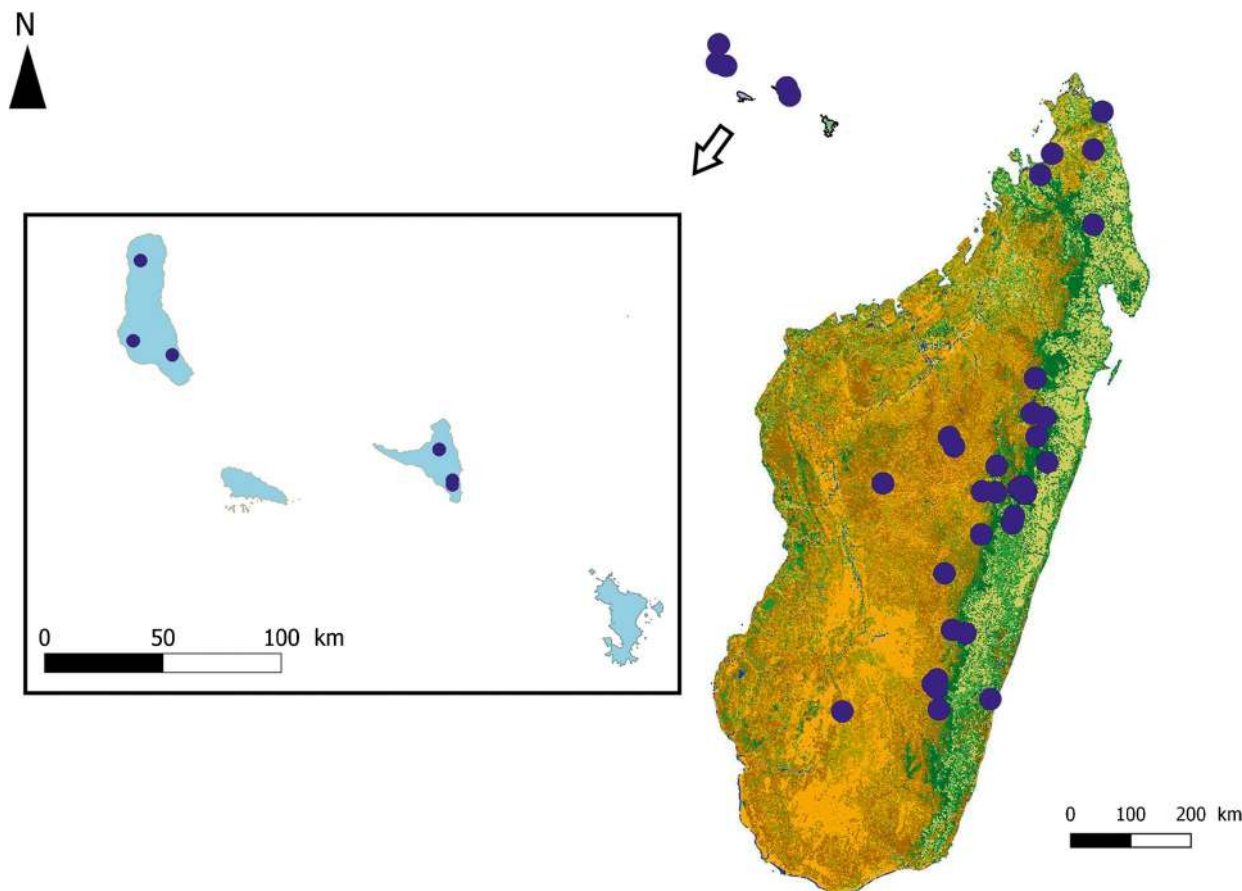
Fig. 33. *Aerangis modesta*. **A** in habitat, eastern Madagascar; **B** inflorescence. PHOTOS: **A** P. CRIBB; **B** J. HERMANS.

9085 (BR0000020220631); rec. July 1880, *Baron* s.n. (K); Aug. 1888, cult. O'Brien (K); cult. Kew, April 1882, *Ashburton* (K306361); April 1888 – 9 etc., cult. Kew (K306359-60); 1888, Low (BM); cult. 1888, O'Brien (BM00540119, BM00540121); 1894, cult. Eisgrab (W); Weathers comm., rec. 1896 (BM000540120); June 1945 (RENZ16414); cult. Young, March 1898, rec. from Goossens, April 1898, Herb. Alfred *Cogniaux* (BR); May 1920, *Döring* 4768 (M); cult. Buller, 1920 (K); Oct. 1963, *Jard. Bot. Tan., Malazy* 1304 (P00080767); s. loc. 1939, *François* s.n. (P00080758); Missouri, cult. July 1996 (K); Sept. 1975, *Jard. Bot. Tan.* s.n. (P); cult. De Wilg, *Hermans* 4118, 5069, 5115 (K); cult. *Lecoufle*, 2001, *Hermans* 5339 (K); cult. 2002, *Sieder* 000B714 (WU0063664); cult. (M); *Deans Cowan* s.n. (BM000038651, BM000540203); *Last* s.n. (BM000038650); cult. *Hillerman* s.n. (K-spirit 45099.000, 45110.000, 5107.000); cult. *Hillerman* 1, 2, 12-3, 21-4, 26 (K); cult. *Hillerman* 1, 2 (P); cult. Bull (W); cult. Glasnevin (DBN); cult. Wageningen (WAG0351220); *Inst. Sci. Mad.* 189, 355 (TAN). **WITHOUT LOCATION:** Nov. 1890, cult. *Sanders* s.n. (K); cult. April 1890, *Veitch* (K000306358); cult. F. Sander & Co (K); ex Cons.

Bot. Genavensis 91649 (P); Nov. 1980, cult. *Lecoufle* s.n. (P06796612).

HABITAT. Medium altitude moist evergreen forest and forest remnants. On trunks or thicker branches of trees, generally in shade. Altitude: 400 – 1800 m in Madagascar, 550 – 900 m in the Comoros.

CONSERVATION STATUS. *Aerangis modesta* is a native, widespread orchid, distributed in the Comoros (Grand Comores and Anjouan) and Madagascar in Antsiranana, Antananarivo, Toamasina and Fianarantsoa provinces. The extent of occurrence (EOO) of *Aerangis modesta* is estimated to be more than 20,000 km². The species is known from 27 threatened locations. In addition, it is recorded in many protected such as Marojejy, Loky-Manambato, Galoko-Kalobinono, Tsaratanana, Montagne d'Ambre, Ambohilero, Zahamena, Ambatovy, Analamazaotra, Mantadia, Vohimana, Andringitra, Isalo, Ivohibe, Anjozorobe-Angavo in Madagascar. Although there are some subpopulations (twelve occurrences) found in unprotected areas that are facing a continuing decline due to habitat destruction.



Map 21. Distribution of *Aerangis modesta*.

However, the overall population is believed to be stable and not at immediate risk of extinction. Therefore, *Aerangis modesta* is assessed as Least Concern (LC).

PHENOLOGY. July to April but mainly October to November.

ETYMOLOGY. From the Latin ‘*modesta*’: referring to the relatively modest flowers; ‘*sanderianum*’: referring to the Sander Nurseries in St. Albans, UK, who imported and cultivated many new plant introductions from around the world; ‘*crassipes*’: referring to a thick stem; ‘*venusta*’: referring to the attractive flowers.

NOTES. First described and illustrated by Joseph Hooker (1883) from a cultivated plant from Madagascar, given to Kew by Lady Ashburton and flowered there in April 1882; the material used is at K and clearly indicated by Hooker as the “type specimen of Bot. Mag. t.6673!.” There is no indication of the exact origin of the plant.

Angraecum sanderianum was first mentioned by Godefroy-Lebeuf (1881a: 120, 1881b: 147) from an importation collected by Humblot; correspondence from Humblot to Sander also mentioned the name (Humblot letters at K, 1881: 281). It was formally

described by Reichenbach in 1888, from a Humblot specimen from the Comoros provided by Sander. Reichenbach was aware of Hooker’s *Angraecum modestum* (see W-R39515) but compared it with *A. dependens* / *descendens* (= *A. articulata*, as discussed under that species). The type sheet (R39519) in the Reichenbach herbarium in W is an amalgam containing a drawing by Reichenbach, envelopes with flower fragments, his description and an inflorescence. The top left part of the sheet was chosen as the lectotype as the inflorescence on the lower part of the sheet resembles *A. mooreana*. There are several specimens at K which are probably from the same Humblot / Sander source but all post-date Reichenbach’s description. The description, with great emphasis on the orange-brown pedicel and ovary, and dissection of the type material showed it to be identical to the somewhat variable *Aerangis modesta*, a conclusion already reached by Veitch (1891: 135) and Rolfe (1900: 152), who considered it a variant of *A. modesta* from the Comoros. Although some plants from the Comoros have larger flowers than those from Madagascar, there are others that are identical, as discussed below.

Type material (*Laggiara* s.n.) of Schlechter's *Aerangis crassipes* is no longer extant but it was illustrated by him (1932: t.100); the description referred to a short-stemmed plant with $7 - 9 \times 2.3 - 3.2$ cm leaves, 16 mm long sepals and a c. 7 cm long spur that he compared with *A. stylosa* but distinguished by its thicker stem, smaller flowers and more attenuate sepals and lip. Perrier (1938a: 37, 1941: 109) considered it the same as *Aerangis stylosa* but, following examination of the Schlechter drawing and his description and following Stewart (2006: 237), we consider it the same as *A. modesta*.

Aerangis venusta was described by Schlechter (1918), based on an Afzelius specimen collected in eastern Madagascar. Schlechter considered it to be similar to *Aerangis modesta* but differing in its smaller leaves, shorter inflorescence and shape of the lip and pollinarium. The type specimen in S is currently not accessible but Schlechter's drawing (1925: t.102) of the flower clearly shows that it does not differ from *A. modesta*. Contemporary herbarium sheets seen by Schlechter and annotated as *A. venusta* by Perrier in P are either *A. articulata* (Perrier 11308,) or *A. modesta* (Perrier 14343, Viguier & Humbert 846). Stewart (2006: 200 & ms.) considered it to be a synonym of *Aerangis articulata*, based on the Perrier herbarium material, but she did not mention the Schlechter drawing which clearly shows a flower of *A. modesta*, as does his description.

Aerangis fastuosa var. *angustifolia* has been considered an immature form of *Aerangis modesta* (Stewart ms; Du Puy *et al.* (1999: 9)).

The flowers of *Aerangis modesta* are quite variable in size: with flowers from northern Madagascar (Perrier 18881 (P), Du Puy 3 (P)) being about 10 % smaller than the average and some from the Comoros (Bernardi 11649, Bosser 18409, Decary 12660, Labat 3082 all at P), over 10% larger but others there are well within the average for the species.

Chromosome number is $2n = 50$: fide Jones (1967: 154) and Arends & Vander Laan (1983: 58).

Pollination is thought to be by the sphingid moth *Theretra orpheus* subsp. *malagassica* (Lecoufle 1997: 39).

The species has not only been confused with *Aerangis articulata* but also with *A. ellisii*, both of which had been imported in some quantity at the same time. Regel's *Gartenflora* (1886: t. 1234) described *Angraecum fuscatum* but illustrated *Aerangis modesta*, Linden (in Linden *et al.* 1886: pl. 92) described *A. ellisii* but illustrated *A. modesta* and Cogniaux & Goossens (1898:15, 2) considered *A. ellisii* a synonym of *A. modesta*.

The species is most similar to *Aerangis articulata* but differs by the more arching to pendent (vs erect) plant, the smaller flowers with the petals 11 – 21 mm

long (vs 16 – 24), the lip 11 – 20 mm (vs 15 – 126 mm) and the spur 4.5 – 8 cm (vs 7.5 – 12 cm). The flowers are a similar size along the inflorescence (vs bigger towards the apex), but the flowers have a lip lacking distinct ridges at the base, less distinct rostellum lobes and an anther cap with a rounded lobe (vs distinctly rostrate).

***Aerangis monantha* Schltr.** (Schlechter 1925: 386); Perrier (1930: 59, 1941: 96); Hillerman & Holst (1986: 264); Hermans *et al.* (1998: 14); Stewart (2006: 212); Du Puy *et al.* (1999: 9); Stewart *et al.* (2006: 246); Cribb & Hermans (2009: 278); Bosser & Lecoufle (2011: 74); Parsons & Gerritson (2013: 118); la Croix (2014: 160); Pridgeon *et al.* (2014: pl.136); Oviatt & Nerison (2017: 670); Hervouet (2018: 75); Junginger (2022: 1981); la Croix (2022: 180, 198). Type: Madagascar, Analamanga, Manankazo, N.E. of Ankazobe, 1500 m, Nov. 1913, Perrier 11321 (holotype P00080778).

Rhaphidorrhynchus curnowianus auct. non (Rchb.f) Finet (1907: 37). Based on: Madagascar, Campenon s.n. (P00080779-80), non *Aeranthus curnowianus* Rchb.f. (Reichenbach 1883: 306) = *Angraecum curnowianum* (Rchb.f.) T.Durand & Schinz (1894: 41).

Aerangis curnowiana auct. non (Rchb.f.) H.Perrier (1938a: 34); Perrier (1941: 95, fig. VII, 10 – 16; Hesse (1977: 211); Stewart, (1986d: 1118); Senghas (1986: 1055); Hillerman & Holst (1986: 120), Hillerman (1990: 9); Pridgeon (1992: 86) photo of *A. fuscata*; Cavestro (1995: 54); Du Puy *et al.* (1999: 6), *quoad specim, et descript.*

Small to medium-sized, 5 – 7 cm tall epiphytic herb on a short stem 0.5 – 2 cm long and 0.5 – 1.5 cm in diam., partly covered by thick sheaths, bearing numerous, glabrous or slightly verrucose, flattened fleshy roots, 1.5 – 2.5 mm in diam., silvery when young. Leaves 2 – 6, elliptic to narrowly obovate, $3 - 7.5 \times 1.4 - 2.5$ cm, attenuate towards the base into a very short petiole, emarginate or unequally bilobed at the apex, green to brownish-red, darker around the midvein and margins, glossy when young, becoming dull. Inflorescences axillary, pendent below the leaves, up to 7 cm long, 1 – 2.5 mm in diam., bearing 1 – 2 flowers, up to 2.5 cm apart; peduncle terete, 1 – 2.5 cm, with 1 – 2 tubular sheaths; rachis, zig-zag, greenish-brown. Floral bracts thin, amplexant, triangular-ovate, acute, $2 - 2.8 \times 1 - 1.2$ mm, pale brown. Flowers medium in size, c. 40×45 mm without the spur, sepals and petals greenish-brown to brownish-pink, lip white, the apex often green, spur greenish-brown to dark pink, often darker at the apex, column ivory, anther yellow. Pedicel and ovary straight or slightly curved, rounded, slightly ridged, thicker at the base, $20 - 45 \times 1 - 1.5$ mm, pale brownish-green to orange. Dorsal sepal arching

forward, narrowly ovate, attenuate, $15 - 25 \times 2.5 - 5.5$ mm; *lateral sepals* spreading, narrowly lanceolate attenuate, the margins incurved at the apex, $15 - 24 \times 2.5 - 4.5$ mm. *Petals* spreading, slightly recurved, narrowly lanceolate, acuminate, $14 - 22 \times 2.5 - 3.5$ mm. *Lip* pendent below the column, obovate to narrowly obovate, sub-auriculate at the base around the spur orifice, $18 - 25 \times 6 - 8$ mm, apex attenuate; *spur* widened and funnel-shaped at the base then slender sigmoid, curled or curved, $80 - 120 \times 0.8 - 1.2$ mm. *Column* short, $4.8 - 5.4 \times 2.2 - 2.8$ mm, dilated above the large stigmatic surface, clinandrium small surrounded by an undulate border; rostellum lobes slender, rostellum, up to 3 mm long, tooth-like but sigmoid later; anther cap ovoid, c. 1.2×1.8 mm, slightly swollen at the apex; pollinia ovate, c. 0.5×0.7 mm, stipes slender and widened below the pollinia, viscidium triangular. *Seed-capsule*, not known. Fig. 34.

RECOGNITION. *Aerangis monantha* is a small to medium-sized plant with a short stem, a zig-zag rachis, one or two medium-sized flowers, with pale orange-brown

tepals and spur, narrow, lanceolate sepals and petals, a long and thin, obovate, white lip, funnel-shaped at the base, and a long and tooth-like rostellum.

DISTRIBUTION. Madagascar, Antananarivo, Fianarantsoa and Toamasina provinces (Map 22).

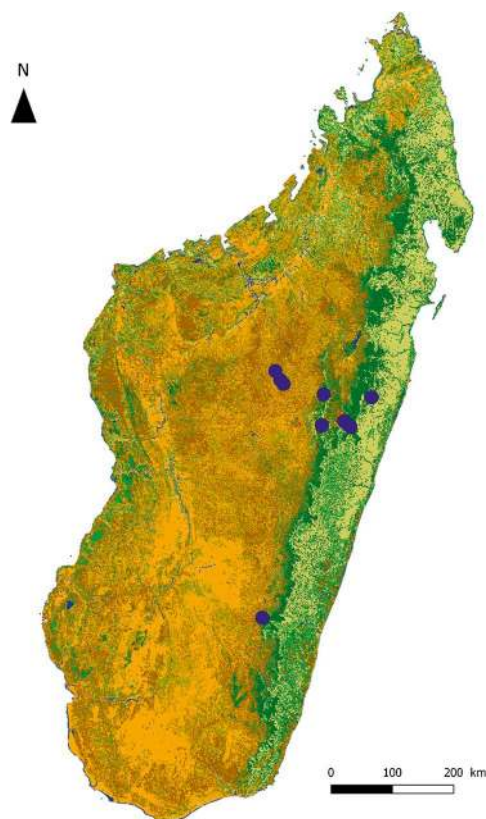
SPECIMENS EXAMINED. MADAGASCAR: Analamanga, Manankazo, 1500 m, Nov. 1913, *Perrier* 11321 (P00080778); Analamanga, Tampoketsa d'Ankazobe, Aug. 1962, *Bosser* 16415 (P01800005); Analamanga, Anjozorobe, Feb. 1987, *Rakotozafy & Raharilala* 1835 (TAN001157); Analamazaotra forest, 930 – 1040 m, March 1988, *Pettersson & Nilsson* 246 (K, UPS); Analamanga, Mandraka, 1200 m, *Res.Nat.* 183 (P); Ankazobe (K-Spirit 61007.000). **WITHOUT EXACT PROVENANCE:** ex Baillon, rec. Nov. 1889, *Campanon* s.n. (P00080779); s. loc. JB365 (P06796666); s. loc. *Bosser* 22719 (P06796626); s. loc., anon 662a (TAN); s. loc. 1984 (HEID250071).

HABITAT. Medium altitude moist evergreen forest. Twig epiphyte or on small branches. Altitude 950 – 1600 m.

CONSERVATION STATUS. *Aerangis monantha* is an epiphytic, endemic orchid, distributed in Toamasina,



Fig. 34. *Aerangis monantha*. PHOTOS: J. HERMANS.



Map 22. Distribution of *Aerangis monantha*.

Antananarivo and Fianarantsoa provinces respectively in Alaotra- Mangoro, Analamanga and Haute- Matsiatra regions. The species occurs in the Corridor Ankeniheny- Zahamena, Analamazaotra- Mantadia, Anjozorobe- Angavo, Ambohitantely and Andringitra protected areas. However, three occurrences (Manankazo, Tampoketsan'Ankazobe and Mandraka) could be extirpated due to frequent fires and forest clearing for agriculture. The extent of occurrence is estimated to be 38,960.412 km² (for the threshold of threatened category) but the area of occupancy is 32 km² (under the threshold of Endangered category) and five threatened locations are identified. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals. *Aerangis monantha* is therefore assigned as Endangered (EN) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. November to February.

ETYMOLOGY. Referring to the single-flowered inflorescence of the type.

NOTES. There has been some confusion in the literature over the identity of this species caused by Finet (1907: 37), when transferring it to his new genus *Rhaphidorrhynchus*, linking the herbarium specimens

Campepon s.n. (P00080779-80) to Reichenbach's *Aeranthus curnowianus* (1883: 306), a very different plant placed in the genus *Angraecum* by Durand & Schinz (1894: 41). Finet had clearly misinterpreted Reichenbach's description, had not seen the *Curnow* / *Low* type material but believed them to be the same. He included it as "*Rhaphidorrhynchus curnowianus* A.Finet (nomen)" but cited Reichenbach and Ridley's (1885: 486) *Aeranthus curnowianus*, and as his description and cited specimen did not correspond with the Reichenbach name, he did not intend to name a new species; this was Finet's usual method of making new combinations, novelties were indicated by him as 'nov. sp.'. Perrier (1938a: 34) added to the confusion when he made the new combination of *Aerangis curnowiana* and based it on Reichenbach and Ridley's *Aeranthus* and Finet's *Rhaphidorrhynchus* but indicated that he had not seen the Reichenbach type and that they may not be identical (Perrier 1941: 95). These interpretations were perpetuated by Stewart (1986d: 1118), Hillerman & Holst (1986: 120), Du Puy *et al.* (1999: 6) and others.

Meanwhile Schlechter (1925: 386) had described *Aerangis monantha*, based on a Perrier specimen from central Madagascar and this is the earliest valid name available for the species. Perrier 11321 (holotype P00080778) is the only specimen cited and available.

Bosser (2006: 49) included the Finet and Perrier combination to the synonymy of *Aerangis punctata* J.Stewart, but both are taxonomically applicable to Reichenbach's *Aeranthus curnowianus* whilst the description and herbarium material associated with them are of *Aerangis monantha*.

Stewart (1986b: 906) considered *Aerangis monantha* to be a synonym of *A. fuscata* but later (Stewart 2006: 207, Stewart *et al.* 2006: 246) accepted them as distinct taxa.

It is undoubtedly closest to *Aerangis fuscata* but has a shorter inflorescence with one to rarely two flowers (vs two to five), the flowers are a little smaller, the lip more distinctly obovate and less angular and the rostellum slightly longer. It is different from *Aerangis punctata* which has wider roots which are normally glabrous (vs distinctly verrucose), the leaf surface is dotted with small silvery dots (vs unspotted), and the flowers have petals and sepals of the same size (vs the petals shorter and narrower than the sepals) and a narrower lip.

Pollination (as *Aerangis fuscata*) by hawkmoths (*Panogena*) is discussed by Nilsson *et al.* (1987), this is repeated by Arditti (1992: 474).

Aerangis pallidiflora H.Perrier (1938a: 36, 1941: 106); Hillerman & Holst (1986: 264); Stewart (1986b: 907); Du Puy *et al.* (1999: 9); Hervouet (2003: 254) as *A. macrocentra*; Stewart (2006: 214); Stewart *et al.* (2006: 248); Hermans *et al.* (2007: 14); Cribb & Hermans (2009:

276); Bosser & Lecoufle (2011: 77); Parsons & Gerritsen (2013: 119); la Croix (2014: 166); Hervouet (2018: 76); la Croix (2022: 184). Type: Madagascar, Analamanga, Mandraka forest, 1900 m, March 1925, François leg., Perrier 17207 (holotype P00115672).

Angraecum ramulicola H.Perrier (1938b: 123) (as “*ramulicolum*”); Perrier (1941: 216); Garay (1973: 513); Hillerman & Holst (1986: 259). Type: Madagascar, Ankeramadinika forest, 1400 m, March 1928, François leg., Perrier 18543 (holotype P00115668).

Boryangraecum ramulicola (H.Perrier) Szlach., Mytnik & Grochowska (in Szlachetko *et al.* 2013: 12).

Small to medium-sized epiphytic *herb* up to 10 cm tall, on a very short stem 1–2.5 cm long and 0.5–1.5 cm in diam., covered by thick striate sheaths and remnants of the leaf petioles, with a few slender fleshy roots greyish-white, glabrous, mostly flattened against the substrate, 1.5–3 mm in diam. *Leaves* 2–6, at an horizontal plane to the substrate, distichous, flat, elliptic or obovate to narrowly elliptic or narrowly obovate, 1.5–7.5 × 1–2.5 cm, attenuate towards the base into a short but distinct petiole 0.5–1.5 cm long, unequally bilobed at the apex, the shorter lobe often absent, green to glaucous green, a little paler underneath, glossy on the upper surface. *Inflorescences* axillary, pendent, up to 25 cm long but generally much shorter, 1–2 mm in diam., green, bearing 6–12 flowers, 1–1.5 cm apart; peduncle 3–8.5 cm, with 1–3 tubular sheaths; rachis racemose, distichous, hardly zig-zag but each segment thickened towards the base of each flower. *Floral bracts* thin, amplexant, broadly triangular to tubular, acute, 1.8–2.3 × 1.2–1.8 mm, dark brown at the base, almost completely enveloping the base of the pedicel and a short conical projection above each bract. *Flowers* small, 12–16 × 12–15.5 mm without the spur, sepals, petals, lip and spur pale greenish-yellow to pale green, the column and anther pale yellow-ivory. *Pedicel* and *ovary* straight or a little curved, at right angles to the rachis, rounded, slightly ridged, 6.5–9.3 × 0.6–1 mm pale green, often slightly scurfy dark brown towards the base of the perianth. *Dorsal sepal* erect, narrowly ovate to narrowly elliptic, attenuate, the apex becoming recurved, 6.2–8 × 0.9–1.8 mm; *lateral sepals* spreading, becoming more or less reflexed, narrowly elliptic, the margins recurved towards the base, attenuate towards the apex, 6.2–7.2 × 1.4–1.8 mm. *Petals* spreading, becoming more or less reflexed, narrowly elliptic, attenuate, 5.6–7.8 × 0.9–1.5 mm. *Lip* projecting forward beneath the column then more or less arching, narrowly obovate, acuminate, 6.2–8.8 × 1.2–2.2 mm, the margins of the apex often incurved; *spur* pendent-arching, tubular, sometimes slightly inflated towards the apex, 18–27 × 0.6–1.2 mm. *Column* short and thick, 1.5–2 × 1–1.4 mm, rostellum wings undulate at the margins, emarginate at the apex; stigma broad, rostellum slender, hook-shaped; anther

cap broadly obovate in outline, with a small distinct apical beak, 0.8–1 × 0.5–0.7 mm; pollinia 2, stipes strap-shaped, viscidium round, c. 0.3 × 0.3 mm. *Seed-capsule* fusiform 16–22 × 2–4 mm. Fig. 35.

RECOGNITION. Plant small to medium in size. Pedicel and ovary at right angles to the rachis. Flowers pale green, small, segments narrow, spreading and becoming reflexed, the lip narrow, acuminate, similar to the tepals, the spur pendent-arching, with the apex sometimes slightly thickened, the column short and stout, and the anther cap with a distinct apical beak.

DISTRIBUTION. Madagascar: Antananarivo, Fianarantsoa and Toamasina provinces (Map 23).

SPECIMENS EXAMINED. MADAGASCAR. Analamanga, Mandraka, 1900 m, March 1925, Perrier 17207 (P00115672); Mt Maromizaha, c. 1000 m, Feb. 1924, Perrier 16048 (P00115671); Analamanga, Ankeramadinika forest, 1400 m, Perrier 18543 (P00011566); Mandraka, 1200–1300 m, March 1961, Bosser 15008 (P00080782); Chute de la Namorona, 1150 m, Sept. 1969, cult. Feb. 1970, Stewart 1068 (K); Tsiazompaniry, March 1970, Bosser 20013 (P00115669); Ranomafana, 1100–1250 m, March 1993, Turk *et al.* 339 (K, MO3011519, TAN); Lake Mantasoa, Jan. 1996, Hermans 3581 (K, K-spirit 61122.000), July 2007, Ambatovy, 1200 m, March 2011, Stévant *et al.* 4121. Photos (BRLU, K, MO-3060443, TAN); Mandraka, 1200–1300 m, Bosser 13586 (P00080781); Analamanga, Mandraka, *Herb. Bot. Tan.* 172 (P00080784); Pic Ivohibe, 1500–2000 m, Jard. Bot. Tan. Millot 172bis (P00080785); Ambohitantely, Lecoufle 16257 (P-spirit). **WITHOUT EXACT PROVENANCE:** cult. Glasnevin, F.W. Moore (BM000540124); Oct. 1969, Bosser s.n. (P02101906); Andriamaharo, cult. 1993, Hermans 2565 (K); Nov. 1995, Renz 16400t (RENZ); (K-spirit 32564.000); cult. Hillerman 23, 159 (K-spirit 48918.000, 44290.000); (K-spirit 61050.000).

HABITAT. Medium to high altitude moist evergreen forest, forest remnants, twig epiphyte or on small branches. Altitude 1000–1900 m.

CONSERVATION STATUS. *Aerangis pallidiflora* is an epiphytic, endemic orchid, distributed in Antananarivo, Toamasina and Fianarantsoa provinces respectively in Analamanga, Alaotra-Mangoro, Vatovavy, Ihorombe regions. The species occurs in Maromizaha, Ranomafana, Analamazaotra, Ambatovy, Anjozorobe-Angavo, Ivohibe, Ambohitantely protected areas. However, six occurrences (Mandraka, Ankeramadinika, Ifanadiana, Tsiazompaniry, Mantasoa, Andramasina) could already be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and eight locations recorded. *Aerangis pallidiflora* is therefore assigned as Vulnerable (VU) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. October and mainly February to March.



Fig. 35. *Aerangis pallidiflora*. PHOTOS: J. HERMANS.

ETYMOLOGY. ‘*Pallidiflora*’ refers the pale green flowers; ‘*ramulicola*’ refers to its habit as a twig epiphyte, ‘*épiphyte des ramilles*’ in Perrier’s description.

NOTES. *Aerangis pallidiflora* was first described by Perrier (1938a), based on a specimen collected by François in eastern Madagascar in 1925, a sheet of the single collection being at P (P00115672).

Later in the same year Perrier also described *Angraecum ramulicola*, also collected by François in the eastern forest and cited Perrier 18543 as the holotype. Szlachetko *et al.* (2013: 12) transferred it into *Boryan-graecum* as part of their fragmentation of *Angraecum*. Examination of the type material shows it to be the same as *Aerangis pallidiflora*.

Stewart (1986b: 909) initially thought *Aerangis seegeri* to be the same as this species but considered them distinct in later publications. The two species are certainly quite similar but *Aerangis seegeri* has a distinct spur which is inflated and flattened at the apex (vs tubular or slightly inflated), flowers that are orange-brown (vs green) and sepals and petals that are never strongly

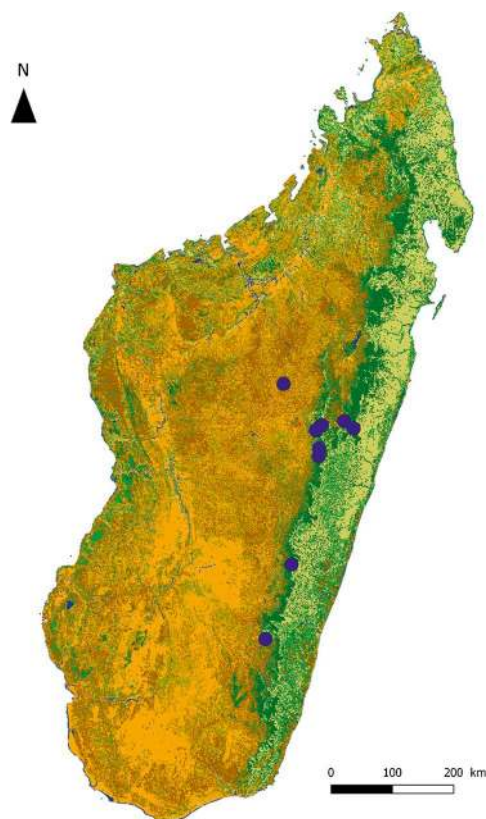
reflexed. *Aerangis pallidiflora* has similar sized flowers and has been confused in herbaria with *Aerangis macrocentra* but, in that species, the flowers are white, the petals and sepals narrower, the spur far less, or not, inflated at the apex and the column shorter.

***Aerangis polyura* (Sander ex Mast.) Hermans comb. nov.**

<http://www.ipni.org/urn:lsid:ipni.org:names:77341301-1>

Basionym *Angraecum polyurum* Sander ex Mast., Masters in *Gard. Chron. Ser. 3*, 11: 88 (1892); (Wynne 1892: 328); (Warner *et al.* 1893: sub. pl.454); (Wilkes 1892: cxlv); Charlesworth (1903: 4) (Dept. Agriculture Ireland 1906: 448). Type: F. Sander cult. s.n., 12 Jan. 1892 (probably not preserved). **Neotype:** Hort. Glasnevin s.n., Aug. 1892 (**neotype** K), probably obtained from Sander as *Angraecum polyurum* and labelled as such.

Angraecum mooreanum T.Lawr. ex Mast., Masters in *Gard. Chron. Ser. 3*, 21: 1897: 210, nom. invalid;



Map 23. Distribution of *Aerangis pallidiflora*.

Angraecum mooreanum Wynne (1897: 486); *Angraecum mooreanum* Rolfe (1897: 126), isonym; *Kew Bull.* (1898: 39); Sander (1901: 10); Poisson (1912: 187); Sander (1927: 51). Type: [Comoro Islands], March 1897, *cult. Lawrence* s.n. (lectotype BM00054012), **lectotype designated here**.

Aerangis mooreana (Wynne) P.J.Cribb & J.Stewart as *Aerangis mooreana* (Rolfe) P.J.Cribb & J.Stewart (1983: 218) **synon. nov.**; Stewart (1986c: 1013); Du Puy *et al.* (1999: 9); Lecoufle (2005: 17); Stewart (2006: 213); Stewart *et al.* (2006: 240); Hermans *et al.* (2007: 14); Cribb & Hermans (2009: 280) in part, illustration of *A. ikopana*; Bosser & Lecoufle (2011: 75); la Croix (2014: 162); Sayers (2018: 23); Sayers & Pertl (2018: 22); la Croix (2022: 182).

Aerangis anjoanensis H.Perrier in Humbert (1941: 104), *nom. invalid.* Hillerman & Holst (1986: 261). Type: *Lavanchie*, *cult.* Paris (P00099095).

Aerangis karthalensis Neiryck & Herremans (2006: 1). Type: Comoro Islands, Grand Comore (Ngazidja), Mt Karthala, 1350 m, 1989, *Herremans* s.n. (holotype GENT).

Medium-sized, 8–12 cm tall epiphytic *herb* on a short stem 1–2 cm long and 0.5–1.5 cm in diam., partly covered by ridged leaf petiole remnants, roots, filiform

to fleshy, greyish-white, glabrous, 2–3 mm in diam. *Leaves* 3–6, flat, narrowly obovate, 6–11 × 2–4.5 cm, gradually attenuate from the middle towards the base into a short petiole, unequally bilobed at the apex, the shorter lobe often absent, fleshy, dark green to glaucous green. *Inflorescences* pendent, up to 30 cm long, 2–2.5 mm in diam., laxly 6–22 flowered, flowers c. 1.5 cm apart; peduncle 4–4.5 cm, covered with 2–3 tubular sheaths; rachis racemose, hardly zig-zag, pale greenish-brown to orange-brown. *Floral bracts* thin, amplexant, broadly ovate, acute, 3.4–4.2 × 2.3–2.5 mm, enveloping the base of the pedicel and a short callus between the rachis and the pedicel, dark brown. *Flowers* medium in size, 18–25 × 16–25 mm without the spur, petals, sepals, lip and column, pinkish-white to pale salmon, becoming darker with age, spur pale pink to salmon, the apex darker when mature, even in the herbarium, base of the column salmon to dark-pink, pollen yellow. *Pedicel* and *ovary* somewhat upcurved from the middle, rounded, slightly ridged, thickened at the base, 15–20 × 1–1.5 mm, pale pink to brownish-orange. *Dorsal sepal* erect to slightly arching over the column, narrowly ovate to ovate, acute to obtuse, the margins and apex somewhat recurved, 9.3–11.5 × 4.2–5.2 mm; *lateral sepals* spreading horizontally, narrowly obovate to obovate to spatulate, the margins recurved towards the base, obtuse, 11.5–12.8 × 4.3–6.8 mm. *Petals* erectly spreading, lanceolate–spatulate, acute, 10.5–14 × 3.9–6 mm. *Lip* ovate, broader in the apical half, slightly arched, flat, the apex obtuse, 14–16 × 5.2–7.5 mm, with a broad, rounded longitudinal ridge from the base; *spur* slightly widened and arching towards the base, then pendent, subulate, 110–150 × 1–1.25 mm, often a little flattened, towards the apex. *Column* short, 5–5.9 × 2–3 mm, rostellum lobes short, rounded; stigma large, expanded, in the apical half of the column; rostellum, hook shaped, anther cap ellipsoid, 1.6–2.2 × 1–1.7 mm; pollinia 2, stipes strap-shaped, viscidium rectangular. *Seed-capsule* c. 4 cm long. Figs 36, 37.

RECOGNITION. *Aerangis polyura* is a medium-sized plant with a short stem and narrowly obovate leaves narrowing from the middle, a long lax inflorescence with a slightly zig-zag rachis, the medium-sized, pale pink to salmon flowers, with an orange-brown ovary and pedicel, a flat lip with a broad ridge at the base, and a spur slightly inflated at the apex and darker in colour.

DISTRIBUTION. Comoros: Grande Comore [Ngazidja] and Anjouan [Nzwani] (Map 24).

SPECIMENS EXAMINED. COMOROS. Grande Comore, Nioumbadjou, 600 m, Dec. 1968, *Stewart* 904 (P); Grande Comore, Nioumbadjou, Mt Karthala, 550 m, 1968, *Stewart* 1166 (K); Grande Comore, Mt Karthala, 1350 m, 1989, *Herremans* s.n. (GENT); Grand Comore, Mt Karthala, 950 m, 1989, *Herremans* 90-003. (BR);



Fig. 36. *Aerangis polyura*, watercolour by L. Shackleton, probably part of the original imported plants. National Botanic Gardens, Glasnevin/OPW.

Anjouan, above Moya, April 2011, *Loup et al.* 631 (P00085269). **WITHOUT EXACT PROVENANCE:** ex Hort. Lawrence, March 1897 (BM005401123); Hort. Aug. 1890, *Sander* (K000306363); Anjouan, cult. Paris, 1908, *Lavanchie* s.n. 1908 (P00099095); Grande Comoro, cult. *Lecoufle* 1990, *Monnerat* 26 (P00209810); cult. ex Neiryneck, 1999, *Hermans* 3967, 5170 (K); cult. (K-spirit 46183.000). **WITHOUT LOCATION:** Nov. 1890, cult. *Sander* (K, K000306366); Dec. 1891, cult. Glasnevin (K, K000306364-5); Cult. (DBN).

HABITAT. Low to medium altitude moist evergreen forest, degraded forest. Altitude 550 – 1350 m.

CONSERVATION STATUS. *Aerangis polyura* is an epiphytic, endemic orchid, distributed in the Comoros, respectively in Mt Karthala and Anjouan. The species occurs in the Mt Karthala protected area and is recorded in degraded forest above Moya and two locations are identified. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and eight locations recorded. *Aerangis polyura* is therefore assigned as Endangered (EN) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. October, December, April.

ETYMOLOGY. *Polyura* (“many tails”) refers to the tail-like spurs; *mooreana*: dedicated to Sir Frederick William

Moore (1857 – 1949), curator and keeper of the Royal Botanic Gardens, Glasnevin, Ireland; *anjouanensis* refers to the island of Anjouan in the Comoro archipelago where the type specimen was found; *karthalensis* refers to the active volcanic Mt Karthala in the centre of Grande Comoro.

NOTES. *Angraecum polyurum* appeared for the first time in the *Gardeners’ Chronicle*, on the 16th of Jan. 1892, in a report (Masters 1892: 88 –) on a plant being awarded by the RHS Orchid Committee on the 12th of Jan. of the same year, where it was exhibited by Messrs Sander and noted as “... A new *Angraecum*, *A. polyurum* with white flowers with long curiously twisted tails...”, and “Botanical Certificate to Messrs. F. Sander & Co, St. Albans, for *Angraecum polyurum*”. Although not directly signed, it should be assumed that the description was by the editor, Maxwell Tylden Masters (Britten 1907: 257). On the 23rd of January 1892, *Gardening World* reported on the same plant (Wynne 1892: 328) with a more elaborate description: “Flowers only of this plant were exhibited owing to the cold, frosty weather. Twelve of them were borne on an arching raceme, and they were in two evident ranks as in the case of most species of *Angraecum*. The sepals and petals are oblong, the lateral sepals spatulate, deflexed and white. The lip is elliptic, slightly larger and of the same colour, while its spur is slender, cylindrical, reddish-amber, and about 2 in. or 2.5 in. long. The flowers were exhibited at the Drill Hall, Westminster, on the 12th inst., by Messrs. F. Sander & Co., St. Albans, and were awarded a Botanical Certificate”. The same plant was also recorded in the *Proceedings of the RHS* (Wilkes 1892: cxlv) as “Botanical Certificate. To *Angraecum polyurum* (votes, unanimous), from Messrs. F. Sander & Co., St. Albans. One of the *A. bilobum* section, with nearly equal ovate-lanceolate white sepals and petals, and curiously interlacing cinnamon-coloured tails 3 inches long” and in *The Orchid Album* (Warner *et al.* 1893: sub. pl.454). The only subsequent mention of the name was in a Charlesworth Catalogue (1903: 4) and in a report on rare plants purchased by the Royal Botanic Garden Glasnevin, probably by Moore (Department of Agriculture Ireland 1906: 448). A herbarium specimen at K, labelled ‘*Angraecum polyurum*, Hort. Glasnevin, Aug. 1892’ is annotated “Pedicel and spur salmon pink, spur 4 in. long, dorsal sepal 5 lines long when fresh”. The description of *Angraecum polyurum* in *Gardeners’ Chronicle*, *Gardening World* etc., and the herbarium specimen all refer to what has, so far, been considered *Angraecum mooreanum*.

Angraecum mooreanum first appeared in a letter of December 1891, from Rolfe to Sir Frederick Moore at Glasnevin, which referred to: “*Angraecum mooreanum* Sander & Co. (provisional name)” and in October 1892 a specimen was identified by Rolfe as “*Angraecum Mooreanum*, Rolfe, n. sp.”, Moore annotated this entry

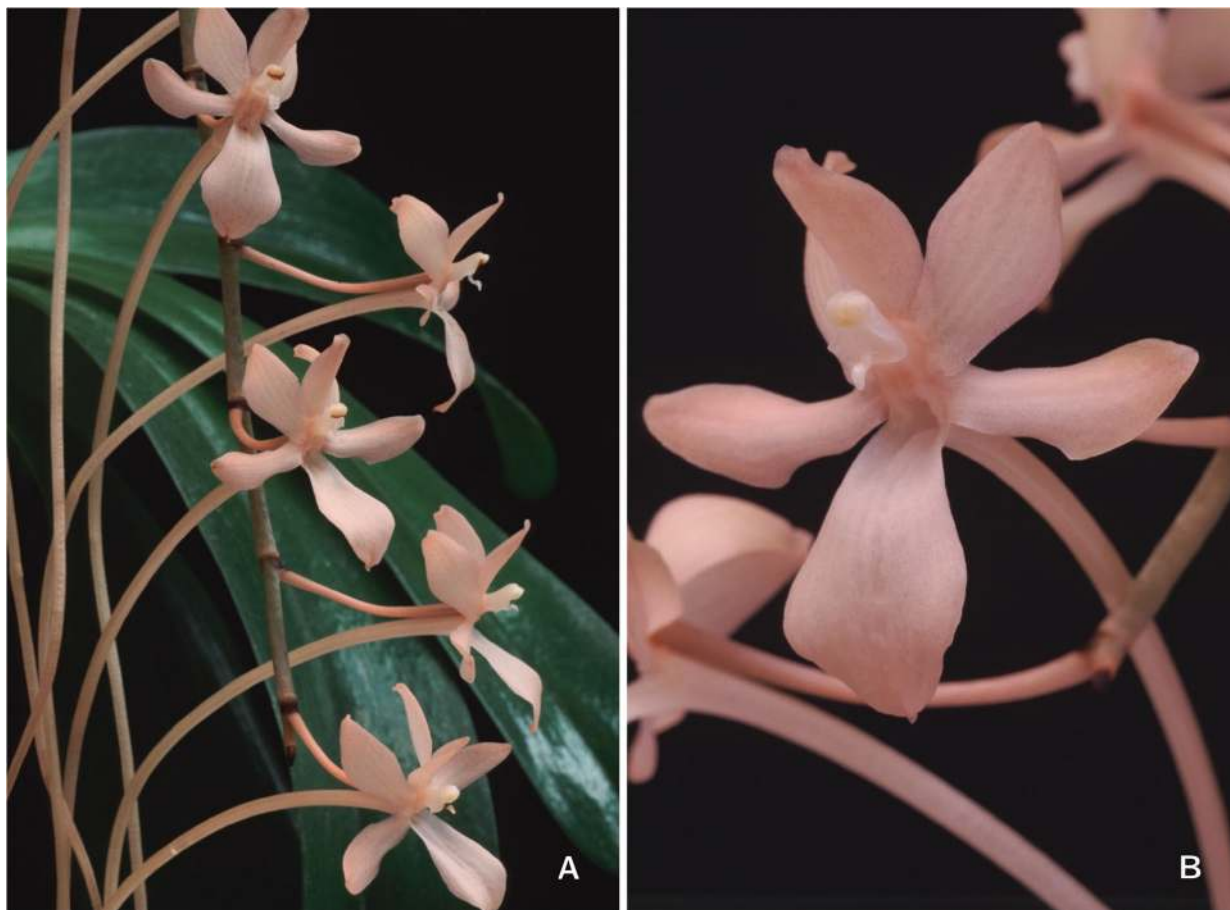
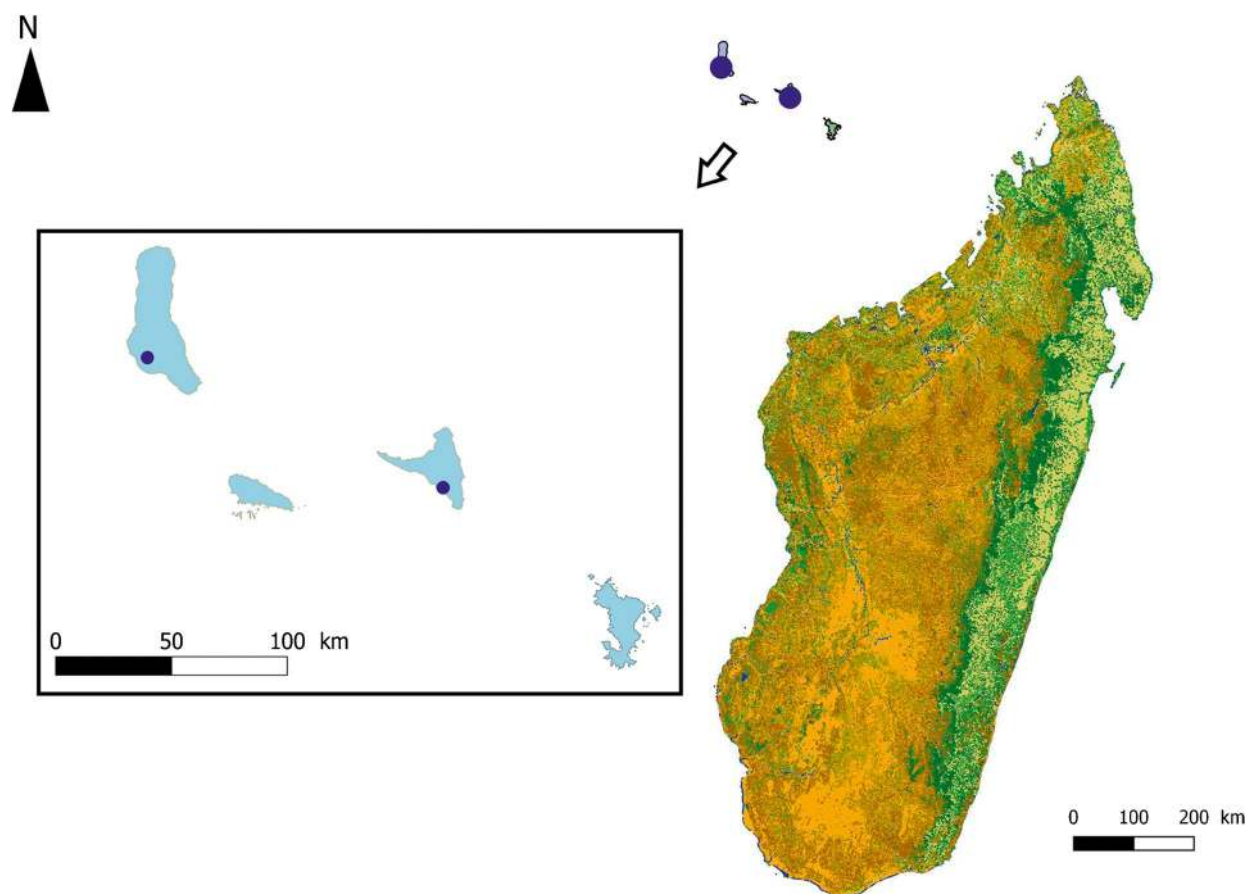


Fig. 37. *Aerangis polyura*. PHOTOS: J. HERMANS.

with “S. 91”, identifying it as a plant that came from Sander (Sayers 2018: 22). The name first appeared in print on the 27th of March 1897, in a short report by Masters (1897: 210), the editor of the *Gardeners’ Chronicle*, on a list of Sir Trevor Lawrence’s plants awarded on the 23rd of March by the RHS Orchid Committee, as “a pretty little species, with salmon-coloured flowers”, which we believe does not constitute a validating description. The same Lawrence plant is described in some detail in *Gardening World* (Wynne 1897: 486) on 3 April 1897, as follows: “*Angraecum mooreanum*. This may be described as one of the small gems of the genus, for it has small and pretty creamy pink or flesh-coloured flowers. The spur is slender, of a deep amber yellow, and 3in. to 4in. in length” and by Rolfe in April in the *Orchid Review* as “*Angraecum Mooreanum* (Rolfe) a pretty little plant with the habit of *A. Sanderianum*, and flowers lightly suffused with salmon colour” (Rolfe 1897: 126). From this, it seems, that Rolfe intended to describe and name the species. It is not known on which day in April Rolfe’s note was published but on balance of probability we assume

that Wynne has priority. There are flowers, likely from the same Lawrence plant, dated March 1897, at BM (BM00054012), there are also several cultivated Sander and Glasnevin specimens labelled by Rolfe as *A. mooreanum* at K (K0003063-6). The Sander specimen, ‘Aug. 1890’ (K000306363) was designated as the lectotype of *A. mooreanum* by Cribb & Stewart (1983: 218). However, only the Lawrence specimen (BM000540123) is associated with the original description, and Wynne does not mention and may not have seen the Sander specimen, so that only the Lawrence specimen could qualify as a lectotype. It was transferred to the genus *Aerangis* by Cribb & Stewart (1983: 218) who misinterpreted Sander’s (1901: 10) catalogue description as the earliest valid publication. Garay (1973: 511) considered it to be conspecific with *Aerangis modesta*, but it is quite different. Hillerman & Holst (1986: 135) recorded that according to recent taxonomic work by Joyce Stewart, *Aerangis stylosa* would be known as *A. mooreana*; this is not supported in Stewart’s ms. notes.

It seems that neither *Aerangis polyura* or *A. mooreana* were ever formally described (Wynne’s note



Map 24. Distribution of *Aerangis polyura*.

comes closest to a description); this was the ‘interregnum’ period for naming imported novelties between Reichenbach in Vienna and Rolfe at Kew, and both names were obviously intended to be used but somehow the earlier name of *Angraecum polyurum* was superseded by the equally non-descript *Angraecum mooreanum*. All the herbarium material is likely to have originated from the Comoro collections by Humblot, who at that time, supplied many plants to the Sander nursery who in turn sold them to Lawrence, Glasnevin etc., and sent specimens to Kew (Hermans 2021b), they cover the colour variation of the species which can have white flowers tinted pink with a darker spur apex or can be entirely salmon-coloured.

The descriptions of *Angraecum polyurum* in *Gardeners’ Chronicle* and of *Angraecum mooreanum* in the same journal and *The Gardening World*, although sparse, both have herbarium material associated with them and enabled the identification of this species. Both constitute a published statement of a feature or features of an individual taxon, published before 1935, as required under of the Botanical Code (Wiersema *et al.* 2018: art. 38 & Glossary), Rolfe assigned his epithet to himself

as author but both epithets can be attributed to the editor and author of the publication (Masters 1892: 88 and Wynne 1897: 486). It is, therefore, concluded that *Angraecum polyurum* Sander ex Mast. is the earliest name for the species and needed to be transferred to the genus *Aerangis*. The top right specimen ‘Hort. Glasnevin, Aug. 1892’ on a mixed sheet at K is chosen as the neotype as there is no extant verifiable original material and it is the only one directly connected to the epithet.

In 1941 Perrier described *Aerangis anjoanensis*, based on a cultivated plant, collected by Lavanchie in Anjouan in 1908, but did not include a Latin diagnosis as then required under the Botanical Code (Wiersema *et al.* 2018: art. 39.1). *Aerangis karthalensis* was described by Neirynck & Herremans (2006) from Grande Comore, both have all the characteristics of *Aerangis polyura*.

Aerangis ikopana was described by Schlechter (1925), based on some of his early herbarium material collected in NW Madagascar. Stewart (1986c: 1013) concluded that it was conspecific with *Aerangis mooreana* from the Comoros and this was followed by

subsequent authors. Following further examination of all the available material we conclude that they are two distinct entities; with *Aerangis mooreana* endemic to the Comoros and *A. ikopana* only recorded from Madagascar. The rachis of *Aerangis mooreana* is less zig-zag, the flowers are about a third larger, and are pink-salmon in colour (vs white) with the spur apex always coloured, the dorsal sepal is shorter than the lateral sepals and petals (vs the same size), the dorsal sepal and petals are obtuse (vs attenuate), the lip is broader with the basal ridge of the lip less pronounced, the column is shorter with the rostellum lobes less elongate and the rostellar tooth shorter and less sigmoid.

Aerangis xprimulina (Rolfe) H. Perrier (1941: 116); Hawkes (1965: 34); Stewart (1986d: 1124); Du Puy *et al.* (1999: 10); Stewart (2006: 221); Stewart *et al.* (2006: 244); Hermans *et al.* (2007: 15); la Croix (2014: 186, 2022: 212). Type: Madagascar, s. loc., cult. H. Low & Co. (holotype K). *Angraecum primulinum* Rolfe (1890b: 388); Rolfe in Linden (1890a: sub. pl. 238); Rolfe (1890c: 71); Goeze (1890: 223); *Kew Bulletin* (1891: 35); Williams (1894: 100); Hansen (1895: 81); Palacky (1906: 9); Poisson (1912: 182); Schlechter (1915: 437).

Small epiphytic *herb* with a short stem 1–1.5 cm long and c. 0.5 cm in diam., covered by disintegrated leaf petioles, bearing numerous glabrous wiry roots in the basal part. *Leaves* 3–5, narrowly elliptic to elliptic, 4–5.5 × 1.8–2.2 cm, attenuate towards the base into a petiole, unequally roundly bilobed at the apex, the short lobe often absent, pale to dark green, glossy. *Inflorescences* axillary, 1–2, suberect amongst the leaves, up to 9 cm long, 1–2 mm in diam., bearing 6–17 flowers, close together on the terete peduncle, 2–3 cm, with 1–3 triangular sheaths; rachis racemose, a little thickened at the base of the pedicel forming a rounded annulus, green. *Floral bracts* membranous, amplexant, broadly ovate, acute, 1–1.3 × 1 mm, pale to dark brown. *Flowers* very small, c. 10 × 12 mm without the spur, sepals, petals, lip and spur diaphanous, white to pale yellow. *Pedicel* and *ovary* straight, rounded, glabrous, 5.8–6 × 0.8–1 mm, pale green to yellowish-green. *Dorsal sepal* erect, narrowly elliptic, attenuate, obtuse, 6.6–7.2 × 2–2.2 mm; *lateral sepals* spreading, elliptic, attenuate, acute, 6–6.2 × 3.4–3.5 mm. *Petals* spreading, obovate, obtuse, 5.2–5.3 × 2.1–2.2 mm. *Lip* elliptic to ovate, 6.8–7.1 × 4.8–5.2 mm, flat, concave or slightly convex, obtuse or shortly acuminate; *spur* parallel with the ovary, 14–16.5 × 1.2–1.6 mm, tubular then inflated towards the apex. *Column* short and thick, 1.8–2 × 1.2–1.3 mm, rostellum short, broad, rounded, viscidium triangular; anther

cap ellipsoid, c. 1 × 1 mm; pollinia ovoid, c. 0.5 × 0.6 mm, stipes short. Seed-capsule, not known. Fig. 38.

RECOGNITION. Small plant with a short stem, glossy green leaves, the inflorescence short, the flowers small, diaphanous-hyaline, lip ovate-elliptic, spur shorter than the ovary, inflated towards the apex.

DISTRIBUTION. Madagascar. Not known, but likely from the eastern forest.

SPECIMENS EXAMINED. MADAGASCAR. Without locality, March 1990, cult. H. Low & Co. (holotype K).

HABITAT. Low to medium altitude moist evergreen forest.

CONSERVATION STATUS. *Aerangis xprimulina* is only known from the type specimen without precise locality and coordinates are missing. It is assessed as Data Deficient (DD).

PHENOLOGY. March, in cultivation in Europe.

ETYMOLOGY. Referring to the pale primrose yellow of the flowers in the type specimen.

NOTES. *Angraecum primulinum* was described by Rolfe, as a possible natural hybrid between *A. citratum* and *A. hyaloides*, as suggested by Hugh Low in two letters accompanying the type material, dated March 1890. The plant flowered amongst a batch imported from Madagascar by Messrs Hugh Low & Co. There is a specimen at K of the inflorescence, a cutting of the original description and a letter from Hugh Low, dated March 1887, to Rolfe regarding the plant, that can be considered the holotype. There is little doubt that it is a natural hybrid of the two species which have been recorded growing in the same area and habitat. It has intermediate features of the purported parents. It has the leaf shape and plant habit of both but with slightly larger flowers than *Aerangis hyaloides*, with the spur a similar shape but longer; it has smaller flowers and a shorter inflorescence than *A. citrata* and the dorsal sepal is not arching nor disproportionate to the other segments while the spur is much shorter. Recent photographs (cf. Grunewald, Krogsgaard) have confirmed that there are other plants of this natural hybrid in cultivation. It is likely that herbarium material of this hybrid has remained unrecognised amongst *Aerangis hyaloides* in herbaria.

Aerangis pulchella (Schltr.) Schltr. (Schlechter 1915: 427, 1918: 119, 1925: 389); Perrier (1930: 60); Schlechter (1932: pl. 102, 405); Perrier (1941: 11); Stewart (1986d: 1122); Hillerman & Holst (1986: 264); Du Puy *et al.* (1999: 10); Stewart (2006: 215); Stewart *et al.* (2006: 244); Hermans *et al.* (2007: 15); Cribb & Hermans (2009: 278); la Croix (2014: 167, 2022: 185). Type: Madagascar, Antanimena plateau (Boina), June 1906, Perrier 1893 (59 of Jumelle to Schlechter) (holotype P00080786).

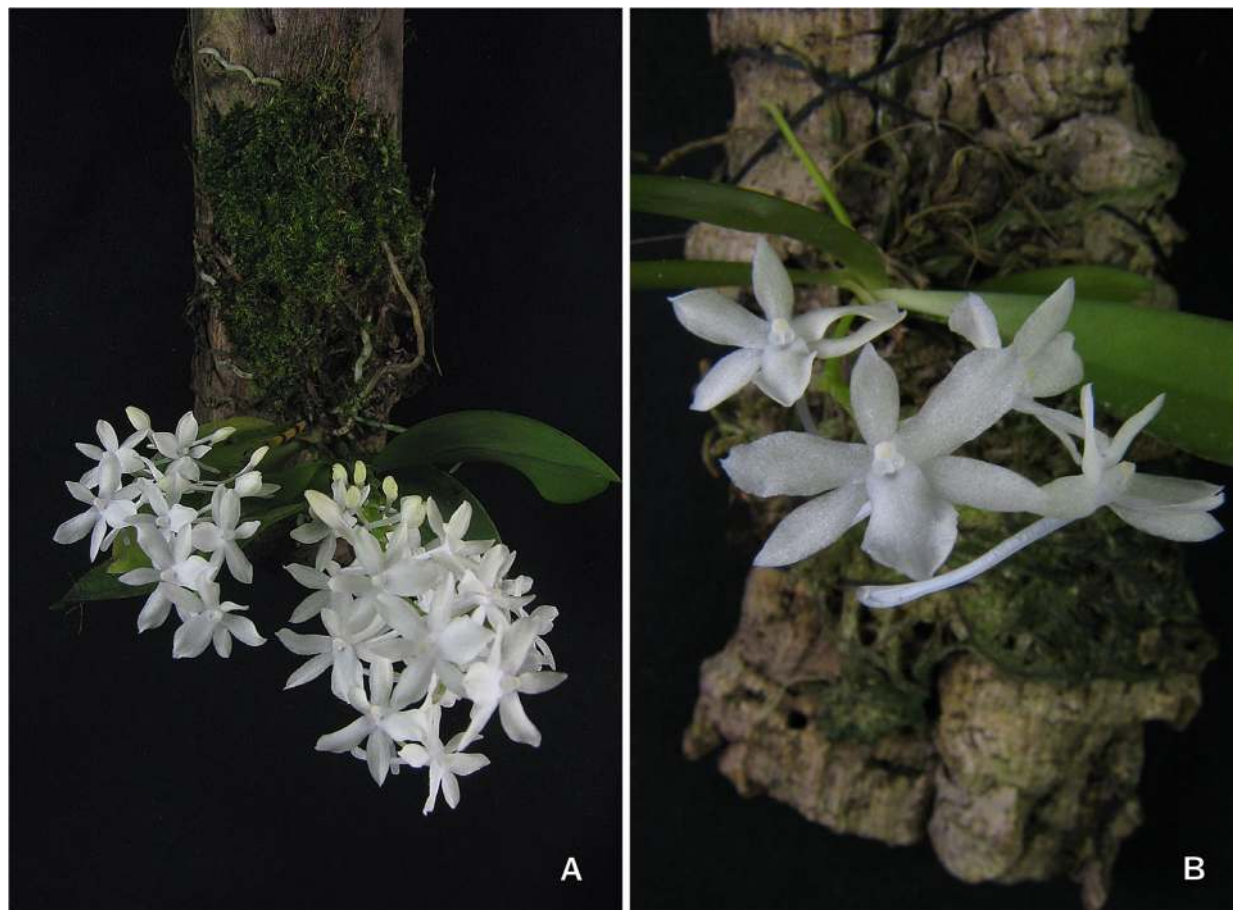


Fig. 38. *Aerangis xprimulina*. PHOTOS: G. GRUNENWALD.

Angraecum pulchellum Schltr. (Schlechter 1913: 200 or 57 of extract, t.23).

Medium-sized to large, 10 – 20 cm tall, epiphytic *herb* on a stem 1 – 4 cm long and 0.4 – 0.9 cm in diam., partly covered by leaf petiole remnants, roots, fleshy, greyish-white, glabrous, 1 – 2.5 mm in diam. *Leaves* 4 – 7, distichous, flat, slightly undulate at the margins, arching, narrowly obovate, 6.5 – 16.5 × 2.5 – 4.5 cm, gradually narrowing towards the base into a petiole, unequally bilobed at the apex, fleshy, dark green, glossy. *Inflorescences* pendent, up to 40 cm long, 2 – 2.5 mm in diam., 12 – 45-flowered, flowers 0.5 – 1.5 cm apart; peduncle 2 – 3.5 cm, with 2 – 3 tubular sheaths; rachis racemose, slightly zig-zag toward the apex, green to greenish-purple. *Floral bracts* thin, amplexant, triangular obtuse, 3 – 4 × 1.5 – 2.1 mm, pale yellow-green, enveloping the base of the pedicel and a 2 – 4 mm stalk-like projection between the rachis and the pedicel. *Flowers* small to medium in size, 22 – 24 × 22 – 24 mm without the spur, petals, sepals and lip thin in

texture, white, spur white to pale ivory, column slightly pink towards the base; appearing thin and pale yellow-white in the herbarium. *Pedicel* and *ovary* somewhat fusiform, rounded, slightly ridged, thickened at the base, 10 – 13 × 0.7 – 1.2 mm, green, more or less tinted dark purple towards the base. *Dorsal sepal* arching forward, narrowly elliptic, attenuate, the margins more or less recurved, 8.5 – 12 × 3.2 – 3.5 mm; *lateral sepals* divergent, narrowly obovate to oblanceolate, obtuse, 10 – 13.5 × 3.3 – 4.1 mm. *Petals* somewhat divergent at about 45 degrees to the column, narrowly ovate, acuminate, 8.4 – 11 × 3.2 – 4.2 mm. *Lip* narrowly elliptic, a little concave, narrowing towards the apex, attenuate, 11 – 12.2 × 3.3 – 4.5 mm, the margins slightly incurved when mature, with a short shallow longitudinal ridge at the base; *spur* slightly widened at the mouth, then pendent, subulate, 30 – 42 × 0.9 – 1.2 mm, hardly inflated, towards the apex. *Column* stout, 4 – 5 × 1.8 – 2 mm, rostellum lobes rounded; stigma large, expanded; rostellum tooth long, hook shaped, anther cap ellipsoid, truncate at the front, c. 2 × 2.1

mm; pollinia 2, stipes strap-shaped, viscidium rectangular. *Seed-capsule* not known. Figs 39, 40.

RECOGNITION. *Aerangis pulchella* is a medium-sized to large plant with a short but distinct stem and narrowly obovate leaves, a long pendent, many-flowered, inflorescence, a rachis zig-zag at the apex only, and completely white flowers, with its petals angular to the column, and a concave – spoon-shaped lip similar to the other tepals, with a short ridge at the base.

DISTRIBUTION. Madagascar: Antsiranana and Mahajanga provinces (Map 25).

SPECIMENS EXAMINED. MADAGASCAR. Antanimena plateau (Boina), June 1906 *Perrier* 1893 (P00080786); E of Maromandia, Oct. 1908, *Perrier* 1933 (P00080768); Ampasindava, 342 m, Nov. 2009, *Gautier et al.* LG5363 (G00181944, TEF); Ampasindava, Nov. 2009, 306 m, *Gautier et al.* 5359 (G0018194, TEF).

HABITAT. Dry deciduous forest and low elevation humid evergreen forest. Altitude 350 – 750 m.

CONSERVATION STATUS. *Aerangis pulchella* is an epiphytic, endemic orchid, distributed in Antsiranana and Mahajanga provinces respectively in Diana, Sofia and Boina regions. The species occurs in Ampasindava Galoko protected area. However, two occurrences (Antanimena plateau and Analalava) could already

be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and four locations recorded. *Aerangis pulchella* is therefore assigned as Endangered (**EN**) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. June to November.

ETYMOLOGY. Referring to the attractive flowers.

NOTES. Described and illustrated by Schlechter (1913) as *Angraecum pulchellum* (Fig. 39), based on a collection by Perrier in Madagascar. Schlechter cited two gatherings: '59' from Antanimena in the southwest and '38' from Analalava in the northwest, the latter is indicated as 'Type'. In his early descriptions, Schlechter used his own or Jumelle's numbering rather than Perrier's. Almost all of the Schlechter herbarium was destroyed by the bombing of the Berlin herbarium during World War II (Butzin 1978, 1981) but annotations on Perrier's orchid herbarium specimens indicate that his material was returned to P. A single herbarium sheet, *Perrier* 1893 in P, is cross-referenced to Schlechter's number 59 (P00080786) which is annotated with field-notes by Perrier and it is clearly the collection used by Schlechter and the holotype. The inflorescence consists of buds only. Schlechter's number 38 is also in P as *Perrier* 1933 (P00080768) with very immature buds only. Therefore, the species, including Schlechter's description and illustration, is only known from immature flowers, and the mature flower size and shape are unknown. This resulted in later authors considering it to be a somewhat ambiguous species related to, or conspecific with, *Aerangis concavipetala*, *A. modesta* or *A. mooreana* (Stewart 1986d: 1122; Stewart *et al.* 2006: 244; Hermans *et al.* 2007: 15; la Croix 2014: 167). Dissection reveals that its floral morphology and column structure are distinct from these. Recent collections by Gautier *et al.* in NW Madagascar have confirmed it as a distinct entity and allowed the shape and measurements of the mature flowers to be circumscribed more accurately.

It is similar to *Aerangis concavipetala* but has slightly larger flowers, a shorter spur and lacks the red venation of the tepals. It differs from *Aerangis modesta* by its much smaller flowers, shorter spur and entire (vs dentate) column. It is close in habit to *Aerangis rostellaris* but differs by its smaller flowers, with spreading petals and sepals (vs reflexed) that are more obtuse. It is closest to *Aerangis ikopana* but differs by its spreading petals and sepals (vs strongly reflexed), and its flat spoon-shaped lip (vs recurved parallel, rolled-auriculate).

Aerangis punctata *J. Stewart* (1986d: 1120); Hillerman (1990: 20); Pridgeon (1992: 26); Knight (1994); Du Puy *et al.* (1999: 10); Castillon (1990) photo of *A. monantha*; la Croix (2005: 111); Stewart *et al.* (2006: 246); Frantz & Le Bars (2005: 104) as *Aerangis* sp.; Bosser (2006:

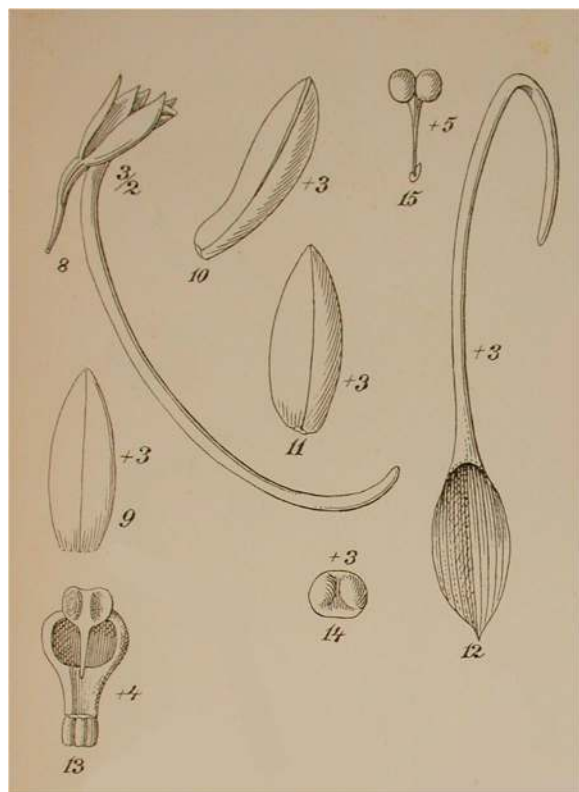


Fig. 39. *Aerangis pulchella*, in Schlechter (1913: t. 23).



Fig. 40. *Aerangis pulchella*. **A** in habitat, NE Madagascar; **B** inflorescence, NE Madagascar. PHOTOS: L. GAUTIER.

50); Hermans *et al.* (2007: 15); Oviatt & Nerison (2017: 670). la Croix (2008: 34); Cribb & Hermans (2009: 278); Bernet (2010: 232); Bosser & Lecoufle (2011: 78); Parsons & Gerritsen (2013: 120). Pailler *et al.* (2013: 43); Szelengowicz & Tamon (2013: 43); la Croix (2014: 170); Pentinsaari (2015: 20); Pailler *et al.* (2018: 24); Pailler & Henze (2020: 30); Rapacz-Hasler (2021: 578); Junginger (2022: 191); la Croix (2022: 187, 198). Types: Madagascar, Tsinoarivo, 1400 m, Feb. 1925, Perrier 16961 (holotype P00080790); Fianarantsoa, Ifanadiana, 462 m, Bégue leg., Herb. Jard. Bot. Tan. 754 (paratype P00080789).

Aerangis fastuosa (Rchb.f.) Schltr. var. *maculata* H. Perrier (1941: 95), *nom. invalid*; Hillerman & Holst (1986: 262). Based on: Madagascar, Mt Kalambatitra, 1550 m, 1933, Humbert 11845 (P00080723).

Small to medium-sized epiphytic herb, on a short stem 0.5–2 cm long, and 0.5–1.5 cm in diam., partly covered by thick sheaths, roots greyish, 2–6 mm wide, flattened against the substrate, surface conspicuously

verrucose, especially on the newer roots. Leaves 2–5, sessile, fleshy, flat, elliptic, oblong or oblong-elliptic, the upper surface dull greyish-green, punctate with minute dark green dots, the midrib darker, apex obtusely bilobed, 1.5–3.9 × 0.5–1.5 cm; leaf sheaths short, covering the stem. Inflorescences arising from below the leaves and bearing 1–3 flowers; peduncle 1–2.5 cm long, floral bracts narrowly triangular, 2–2.9 × 1.9–3.1 mm. Pedicel and ovary slender, 20–38 mm long. Flower, up to 5 cm in diam., the lip white, sepals and petals greenish or pale brownish, spur and ovary pale brown. Dorsal sepal narrowly lanceolate, 13–22 × 3.5–5 mm; lateral sepals narrowly lanceolate, 11–20 × 3–5 mm. Petals ligulate-lanceolate, 10–1.8 × 2–3.5 mm, recurved at the tip. Lip narrowly ovate to ovate, acuminate, slightly recurved in the apical half, with a wide entrance to the spur at its base, 12–24 × 7–18 mm, spur funnel-shaped where it meets the lip then narrowing abruptly and becoming very slender-filiform, 8–14.5 cm long, often forming a loop. Column short, broad, 3–5.5 mm high; clinandrium small, denticulate at margins, anther cap with a small beak,



Map 25. Distribution of *Aerangis pulchella*.

rostellum long and narrow, up to 5 mm; stigmatic surface large. *Seed-capsule* ellipsoid, strongly ridged, c. 25 × 5 mm. Figs 41, 42.

RECOGNITION. *Aerangis punctata* is a small to medium-sized plant with a short stem and verrucose roots with the upper surface of the leaves punctate. It has one to three medium-sized flowers, with a white lip, greenish or pale brownish sepals and petals, pale brown spur and ovary, very slender-filiform ovate lip, often forming a loop, and a long and tooth-like rostellum.

DISTRIBUTION. Madagascar: Antananarivo, Fianarantsoa, Mahajanga and Toamasina provinces. Réunion, central (Map 26).

SPECIMENS EXAMINED. MADAGASCAR: Ankeramadinika, Nov. 1885, *Fox* 50 (ex LDS); Mt Kalambatittra, Decary leg., Nov. 1922, *d'Alleizette* s.n. (L0265087); Tsinjoarivo, 1400 m, Feb. 1925, *Perrier* 16961 (P00080790); Bealanana, forest, 1447 m, Nov. 1932, *Con. Res. Nat.* 4517RN (P02101913-4); Mt Kalambatittra, 1550 m, Nov. 1933, *Humbert* 11845 (G, P00080723); Analamanga, Ambatolampy, 1378 m, March 1961, *Bosser* 14852 (P02101908-9); Analamanga, 1200 m, Nov. 1962, *Bosser* 17074 (P02101912); Ambatovory, 1378 m, Feb. 1964,

Bosser 19138 (P02101911); between Moramanga and Périnet, 800 m, Feb. 1972, *Bosser* 21139 (P02101907); Ambatovy, 1035 m, Oct. 2008, *Antilahimena et al.* 6571 (MO, P, TAN); Ifanadiana, 462 m, *Bégué* leg. Herb. Jard. Bot. Tan. 754. (P00080789); La Mandraka, 1200 m, Jard. Bot. Tan. *Rakato* 162 (P02101915); Anjozorobe (K-Spirit 61430.000). **WITHOUT EXACT PROVINCE.** s. loc. *Bosser* 22720 (P02101910); cult. Univ. Florida, Aug. 1993, *Whitten* 93159 (FLAS); cult. 2001, Doll (HEID254143). **RÉUNION:** Cirque de Salazie, May 1990, *Castillon* s.n. (P00701632); Hell-Bourg, 1250 m, Feb. 2003, *Bernet et al.* s.n. (P); Hell-Bourg, 948 m, Feb. 2003, *Szelengowicz* s.n. (P); *Bernet* s.n. (P-spirit).

HABITAT. Wet evergreen forest, on lower branches and tree-trunks; between 800 and 1400 m in Madagascar, 950 – 1250 m in Réunion.

CONSERVATION STATUS. Endemic to Madagascar (uncommon) & Réunion (three recent, collections-based locations) and threatened forest habitat. VU (Picot 2013).

Aerangis punctata is an epiphytic, native orchid, distributed in Central Reunion and found in Mahajanga, Toamasina, Antananarivo, and Fianarantsoa provinces respectively in Sofia, Alaotra- Mangoro, Analamanga, Vakinankaratra, and Ihorombe regions. The species occurs in Analamazaotra, Ambatovy, Kalambatritra protected areas. However, seven occurrences (Bealanana, Ankeramadinika, Ambatovory, Mantasoa, Angavokely, Tsinjoarivo, Ifanadiana) could already be extirpated and/or may disappear. The latter will induce a continuing decline in AOO, EOO, habitat extent and quality, the number of subpopulations and mature individuals and eight locations recorded. *Aerangis punctata* is therefore assigned as Vulnerable (VU) B1 B2ab (i, ii, iii, iv, v).

PHENOLOGY. Flowering from November to March in Madagascar, January to March in Réunion.

ETYMOLOGY. Referring to the ‘pricked’ or ‘spotted’ markings on the leaves.

NOTES. The species has been known from Madagascar since the 1880’s (*Fox* 50 at K) but was confused with *Aerangis monantha* (as *A. curnowiana*) until it was recognised as distinct by Stewart in 1986. It was also found on Réunion in 1989. Its taxonomic history is discussed under *Aerangis monantha*.

Perrier (1941) described *Aerangis fastuosa* var. *maculata*, based on a collection by Humbert in SE Madagascar, but did not include a Latin diagnosis as then required under the International Botanical Code (Wiersema *et al.* 2018: art. 39.1); there are two sheets of *Aerangis fastuosa* var. *maculata*, the more complete one (P00080723) is chosen as the lectotype.

It has been observed that some flowers have an abnormal column, with a deformed rostellum and pollinarium which allows the pollinia to descend directly on the stigma and therefore allowing

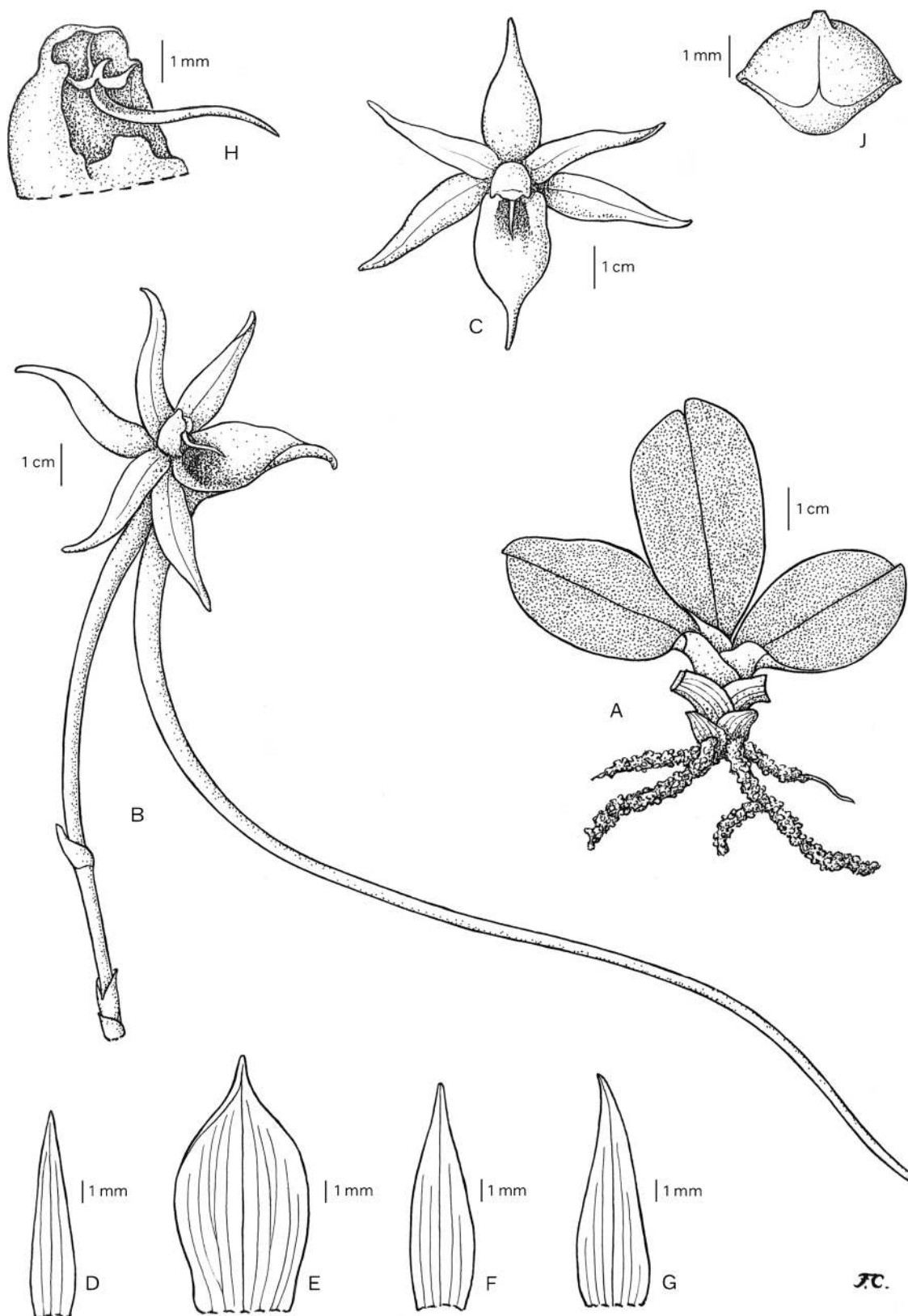


Fig. 41. *Aerangis punctata*. **A** plant; **B** inflorescence; **C** flower front view; **D** petal; **E** lip; **F** dorsal sepal; **G** lateral sepal; **H** column; **J** anther cap. From the Bosser archive. DRAWN BY FRANÇOISE CROZIER.



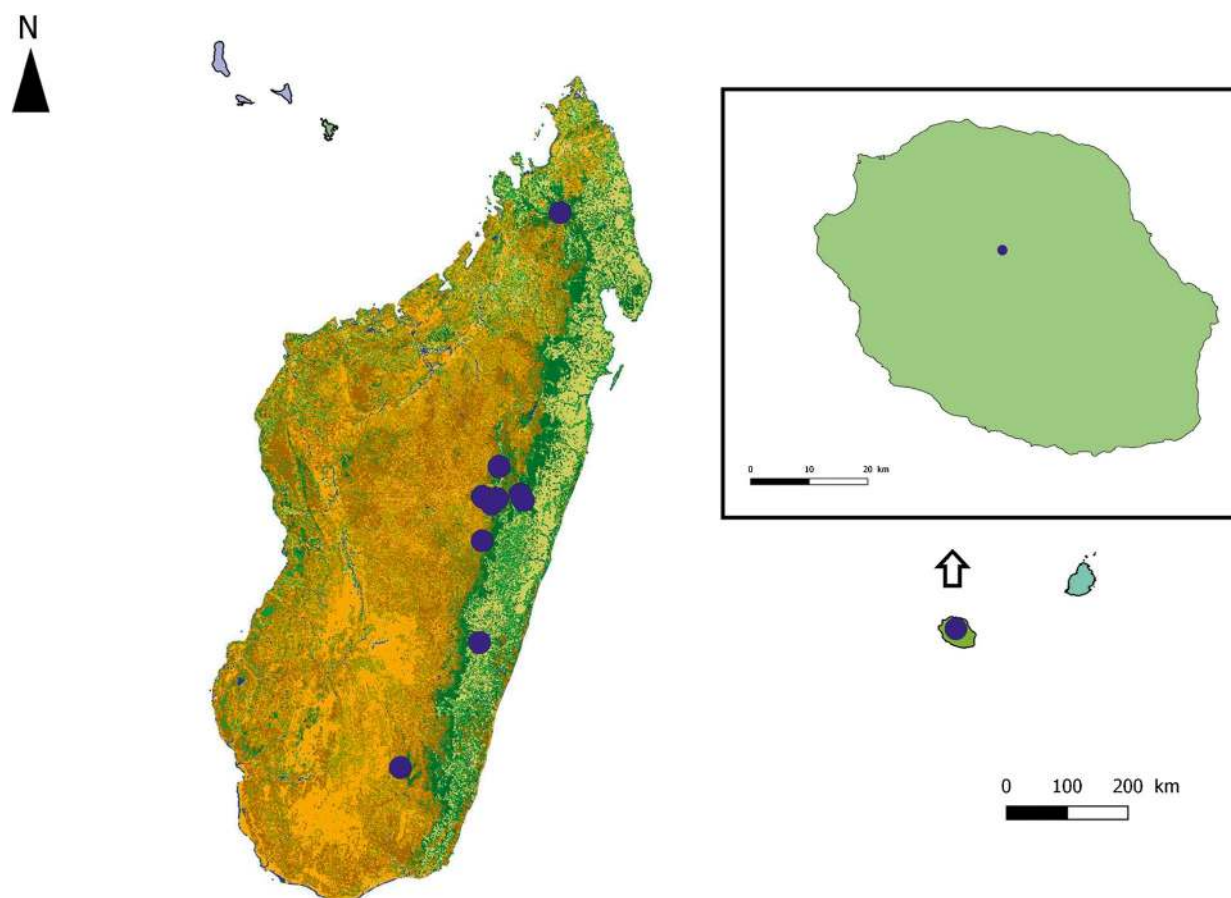
Fig. 42. *Aerangis punctata*. **A** in habitat, eastern Madagascar; **B** in habitat, Réunion; **C** flower. PHOTOS: **A** P. CRIBB; **B** F. VANDE-SCHRICKE; **C** J. HERMANS.

self-fertilisation. This seems to be the normal form in Réunion but unusual in Madagascar.

It differs from *Aerangis monantha* by its verrucose roots, the leaf-surface which is dotted with small silvery dots (vs without dots), the petals that are shorter and narrower than the sepals (vs the same size) and the broader lip. Bosser (2006: 50) stated that the dots on the leaves were only present when young and disappeared on ageing, but this has not been observed in cultivated plants.

Aerangis rostellaris (Rchb.f.) H.Perrier (1941: 116). Stewart (1986c: 1011, 2006: 216); Du Puy *et al.* (1999: 10); Stewart *et al.* (2006: 240); Hermans *et al.* (2007: 16); Cribb & Hermans (2009: 282); la Croix (2014: 171, 2022: 189). Type: Comoros, 1885, *Humblot* s.n. (holotype W-R39508).

Angraecum rostellare Rchb.f. (Reichenbach 1885c: 726, 1885a: 380); André (1885: 294); Godefroy-Lebeuf (1885: 193); Uhlworm & Behrens (1885: 23); Carrière (1887: 235) as *A. fuscatum*; Durand



Map 26. Distribution of *Aerangis punctata*.

& Schinz (1894: 45); Palacky (1906: 10); Poisson (1912: 182); Schlechter (1915: 437); Voeltzkow (1917: 443).

Angraecum avicularium Rchb.f. (Reichenbach 1887a: 40, 1887c). Type: cult. 1886, Lawrence (holotype W-R39525).

Aerangis avicularia (Rchb.f.) Schltr. (Schlechter 1918: 114); Stewart (1979: 314).

Angraecum stylosum Rolfe (1895: 194), **synon. nov.**; Rolfe (1896a: 196); Cogniaux & Goossens (1901: pl.15.6) the illustration is of *A. ellisii*; Palacky (1906: 10); Rolfe (1909: 306).

Rhaphidorrhynchus stylosus (Rolfe) Finet (1907: 36) but based on a different specimen; Poisson (1912: 185).

Aerangis stylosa (Rolfe) Schltr. (Schlechter 1915: 428), **synon. nov.**; Schlechter (1918: 120); Perrier (1930: 60, 1938a: 37, 1941: 109); Tyson Northen (1980: 33) photo is *A. modesta*; Vaschalde (1981: 1803); Stewart (1982: 48); Hillerman & Holst (1986: 135); Stewart (1986c: 1010); Senghas (1986: 1055); Bechtel *et al.* (1992: 50); Karasawa (1992: 161); Chiron (1994: 22); Stewart (2006: 219); Du Puy *et al.* (1999: 11); Stewart

et al. (2006: 241); Lecoufle (2006: 16); Hermans *et al.* (2007: 16); Cribb & Hermans (2009: 282); la Croix (2014: 176, 2022: 195). Type: Madagascar, July 1893, cult. F. Sander & Co (holotype K000306353).

Angraecum fournierae André (1896: 256), **synon. nov.**; (Rolfe 1896a: 196). Type: Madagascar, cult. Fournier (probably not preserved). Plate 256 in André (1896), **neotype designated here**.

Rhaphidorrhynchus stylosus var. *fournierae* (André) Costantin & Poiss. (Costantin & Poisson 1913: 532) **synon. nov.**

Angraecum metallicum J.H.Veitch ex Wynne (1896: 558), **synon. nov.**; Wilkes (1896: cxiii); Sander (1901: 10); Rolfe (1896b: 160). Type not designated.

Aerangis fuscata sensu H.Perrier (1941: 114, pl. LIV).

Aerangis buchlohii Senghas (1969: 16, 1986: 1058, 1993: pl. 91, 2006: 257). Type: Madagascar, Mt d'Ambre, Nov. 1961, *Rauh & Buchloh* 8025 (holotype HEID250053-spirit R21914; clonotypes cult. Heidelberg Bot. Gard. HEID70290-1).

Medium-sized to large, 10 – 18 cm tall, epiphytic herb on a short stem 1 – 4.5 cm long and 1.5 – 4.5 cm in diam., partly covered by leaf petiole remnants, roots,

fleshy, greyish-white, glabrous, 2 – 4 mm in diam. *Leaves* 2 – 6, distichous, flat or undulate, 8.5 – 18.5 × 3.5 – 5.5 cm, elliptic or oblong-elliptic or obovate, cuneate to the sheathing base, the margins sometimes undulate, apex unequally bilobed, the longer lobe 1 – 2 mm long, blueish-green or dull green, often with a red margin, fleshy and with a shiny surface. *Inflorescences* pendent, up to 57 cm long, 2 – 3.5 mm in diam., laxly 8 – 18-flowered in 2 parallel rows, flowers 2 – 3.5 cm apart; peduncle 3 – 3.5 cm, with 2 – 3 tubular sheaths; rachis racemose, slightly zig-zag, pale brown to brownish-orange. *Floral bracts* at a right angle to the rachis, amplexant at the base, broadly ovate, acute to obtuse, 3 – 7.2 × 2 – 3.8 mm, encapsulating the base of the pedicel, yellowish-green becoming dark brown, with a 3 – 8 mm long peg-like projection between the rachis and the pedicel, forming a distinct pseudo-pedicel. *Flowers* medium in size, 26 – 34 × 23 – 28 mm, petals, sepals and lip, white, rarely tinted pale pink, spur greenish-brown to orange-yellow, base of the column sometimes reddish-pink, pollen yellow. *Pedicel* and *ovary* a little curved, rounded-terete, slightly ridged, slightly thickened at the base, 17 – 28 × 0.8 – 1.8 mm, brownish-orange. *Dorsal sepal* erect at the base then arching over the column, narrowly elliptic, attenuate, the margins more or less recurved, 13.4 – 17 × 3.2 – 6.1 mm; *lateral sepals* strongly reflexed on maturity, narrowly elliptic to ovate, attenuate, 12 – 18 × 3.1 – 5.1 mm. *Petals* strongly reflexed, narrowly ovate – spatulate, acuminate or caudate, 12 – 17 × 3.6 – 5 mm. *Lip* narrowly elliptic or ovate in outline when flattened, strongly reflexed parallel with the spur and ovary, rolled-auriculate at the base then narrowed, the apex attenuate to caudate and reflexed, 13 – 17.1 × 3.5 – 6 mm; *spur* arching-pendent, very slightly widened at the base, then subulate, 65 – 110 × 1 – 1.5 mm, more or less inflated, in the apical part. *Column* porrect, slender, 3 – 7 × 1.5 – 3.2 mm, expanded above the large stigmatic surface, rostellum lobes rounded, the margins more or less dentate-undulate, with a few inconspicuous short hairs at the entrance of the spur; rostellum tooth 1 – 1.5 mm long, acicular, anther cap broadly ellipsoid, 1.5 – 2.2 × 0.9 – 1.5 mm; pollinia 2, stipes strap-shaped, viscidium rectangular. *Seed-capsule* not known. Fig. 43.

RECOGNITION. *Aerangis rostellaris* is a medium-sized to large plant with a short stem, long pendent inflorescences and a many-flowered, scarcely zig-zag rachis, with distinct peg-like extension at the base of the pedicel, and medium-sized, white or slightly tinted pink at the base of the column flowers with an orange-brown ovary, pedicel and spur, the flowers, all segments being strongly reflexed, the lip narrow with the margins recurved towards the middle and the apex attenuate to caudate, a spur that is more or less inflated at the apex, and a column with a long acicular tooth.

DISTRIBUTION. Comoros: Ngazidja (Grande Comore). Madagascar: widespread in Antsiranana, Mahajanga, Toamasina and Toliara provinces but there are two main distribution centres in Madagascar: one in the north on Mt d'Ambre and surrounding areas and in the Zombitse forest in the SW. There are no recent records from the Comoros and the Humblot collections may have come from Madagascar (Map 27).

SPECIMENS EXAMINED. COMORES. WITHOUT EXACT PROVENANCE: 1885, *Humblot* s.n. (W-R39508); cult. *Sander*, Nov. 1890, *Humblot* s.n. (K); 1895, *Humblot* s.n. (P-spirit); cult. *Weathers* 1896, *Humblot* s.n. (BM000540191). **MADAGASCAR.** Mt Tsaratanana, 1500 m, April 1925, *Perrier* 16481. (P0008070); Mt d'Ambre, 600 – 1000 m, Nov. 1932, *Perrier* 18833 (P00080797); Mt d'Ambre, c. 1000 m, Nov. 1932, *Perrier* 18879. (P00080796); Mt d'Ambre, Aug. 1951, *Paulian* 961 (P); Sakaraha, Nov. 1955, *Humbert* 1077 (TAN); Sakaraha, Oct. 1959, *Rauh* M993 (HEID-Spirit, 250077, HEID741642); Mt d'Ambre, 1956, *Bosser* *Jard. Bot. Tan* 410 (P0679660, TAN); Soalala, May 1960, *Randriamierara* 11595 (P06796622); Sakaraha, Zombitsi forest, Dec. 1960, *Bosser* 14734 (P); Mt Ambre, Nov. 1961, *Rauh & Buchloh* 8025 (HEID702490-1); Mt d'Ambre, Nov. 1961, *Rauh* 7967 (HEID); Sakaraha, July 1963, *Rauh* 10427 (HEID250078, spirit); Sakaraha, Dec. 1963, *Bosser* 17475 (P); Nonozambo, Oct. 1966, *Rakatozafy* 661 (TAN); Mt d'Ambre, Feb. 1966, *Morat* s.n. (P); Ankarana, 1969, *Morat* 3118 (P); near Tulear, dry forest, 8 April 1969, *Rauh* 21914 (HEID); near Rataube, Sept. 1969, *Rauh* 22535 (HEID 250096 spirit); Sakaraha-Ankazobe road, Nov. 1970, *Bosser & Morat*, *Jard. Bot. Tan.* 1412 (P); Zombitsy, Nov. 1971, *Morat* 3908 (P06796621); Mt d'Ambre, Oct. – Nov. 1992, *Daniel DuPuy* 98 (P06796650-2, 3); Mt d'Ambre, Oct. 1993, *Daniel DuPuy* 98.02, 03 (P06796652, 5); Mt d'Ambre, 1993 – 1994, *Daniel DuPuy* 98.04, 5 (P06796647-8); Mt d'Ambre, May 1994 (Oct. 1993 for P06796654), *Daniel DuPuy* 98.01 (P06796649, P06796654); E of Antsiranana, ex cult. Malala Orchidées, Hort, 1999, *Hermans* 5177 (K); Joffreville, Mt d'Ambre, Nov. 2006, *Ranaivojaona* 1596 (TAN); Antsatoby, 253 m, July 2007, *Rasoafaranaivo et al.* 198 (TAN); Mt des Français, Jan. 2016, *Sieder* 7014 = *Hermans* 8056 (K, WU); near Zombitsi, Oct. 2016, *Hermans* 8051 (K); Ankarana, *Bosser* s.n. (P06796634); Sakaraha, *Humbert* 1114 (TAN); near Fort Dauphin, *Paulian* in *Jard. Bot. Tan.* 380 (P06796608); Zombitse, *Bosser* 7475 (P-spirit). **WITHOUT EXACT PROVENANCE:** Cult., *Lawrence*, Nov. 1886 (BM000540110, W0050028, R39525); *Weathers* comm, Nov. 1889 (BM000540108); cult. *F. Sander & Co*, July 1893 (K000306353); cult. *F. Sander & Co*, 1895 (K); cult. *Sander*, May 1896 (K); cult. March 1897, *Buchan Hepburn* (K); cult. 327 (W-R30893); cult. *Hillerman* 15 (K); RBG Glasnevin, Jan. 1898 (K); from O. Ames



Fig. 43. *Aerangis rostellaris*. **A, B** in habitat, SW Madagascar; **C** inflorescence. PHOTOS: J. HERMANS.

greenhouse, April 1903 (HARV); MLA, *Inst.Sci.Mad.* 14 (TAN).

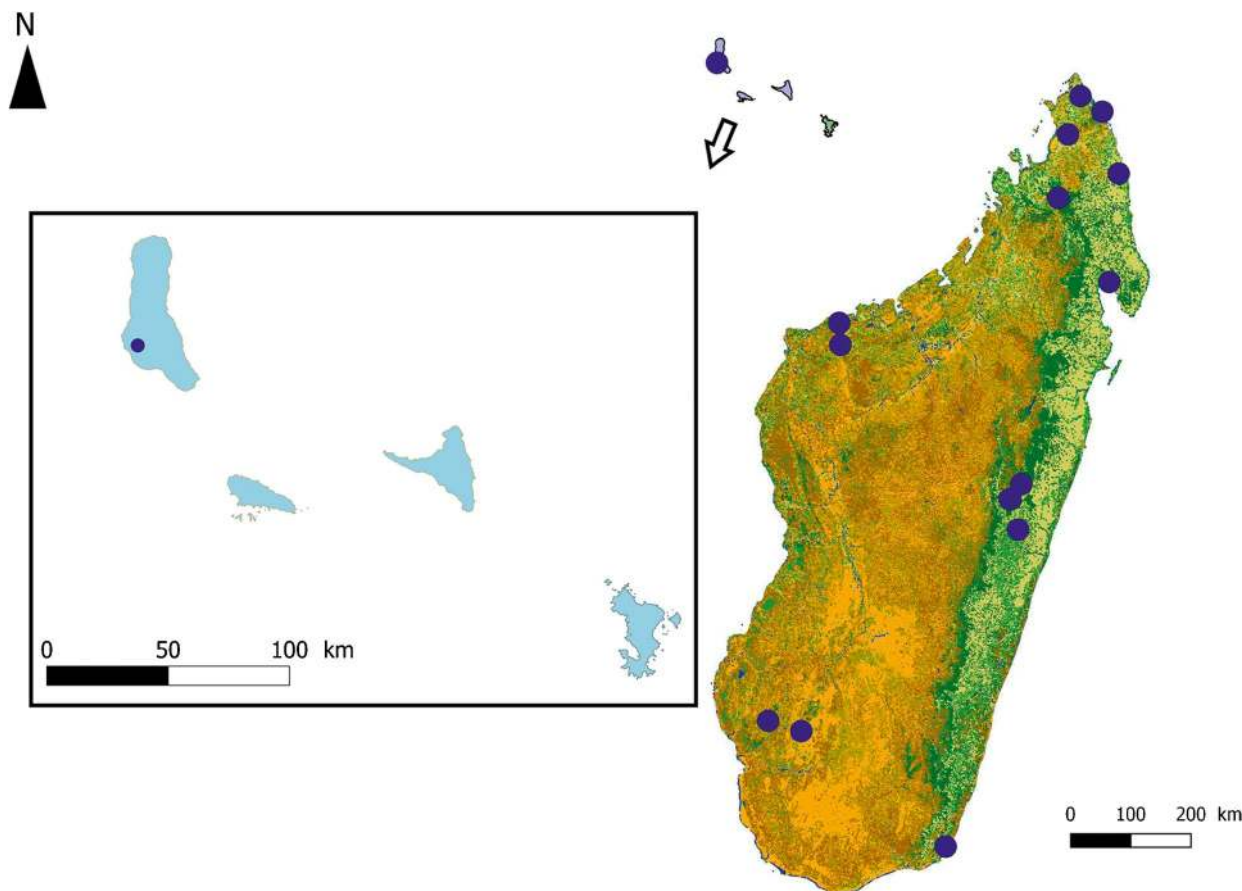
HABITAT. Low to medium altitude moist evergreen forest, dry deciduous forest. Altitude 600 – 1500 m.

CONSERVATION STATUS. *Aerangis rostellaris* is distributed in the Comoros (without precise localities) and in Antsiranana, Toamasina, Mahajanga and Toliara provinces in Madagascar. The extent of occurrence (EOO) of *Aerangis rostellaris* is estimated to be more than 20,000 km². The species is known from 12 threatened locations. It is recorded in protected such as Tsaratanana, Montagne d'Ambre, Montagne des Français, Ankarana, Namoroka, Mantadia, Zombitse, Ste Luce. In addition,

the overall population is facing a continuing decline due to habitat destruction because there are few sub-populations (three occurrences) may be extirpated or may disappear. Therefore, *Aerangis rostellaris* is assessed as Near Threatened (NT).

PHENOLOGY. July to February but mainly from October to November.

ETYMOLOGY. From the Latin *avicularium*, in reference to the bird-like appearance of the flowers in profile; *buchlohi*: named for Günther Buchloh (1923 – 1989) a German bryologist who collected plants with Werner Rauh in Madagascar; *fournierae*: named for Madame Fournier, who had a large orchid collection at La Cavalière near



Map 27. Distribution of *Aerangis rostellaris*.

Marseille; *metallicum*: referring to the shiny metallic colouring of the leaves in some forms of the species; *rostellare*: referring to the dominant rostellum of the column; *stylosum*: referring to the long, dominant column.

NOTES. *Angraecum rostellare* was first described by Reichenbach (1885c) from a collection made in the same year by Humblot. Reichenbach later mentioned its provenance from the Comoros (1885a: 380). Humblot may have sent specimens directly to Reichenbach or they may have come via Sander who had import agreements with the collector (Hermans 2021b). Specimens that are likely from the same collection can be found at BM (cult. 1896, *Weathers*) and K (cult. 1890, *Sander*). There are no other verified records from the Comoros, and it is possible that the Humblot plants may have come from Madagascar; both countries were visited by Humblot at that time.

Reichenbach also described *Angraecum avicularium* (1887a: 40), based on a cultivated plant from Lawrence, it has all the characteristics of *A. rostellaris*, although of unspecified origin, the plant may have been obtained from the same Humblot importation of 1885 from the Comoros or Madagascar.

Rolfe (1895) described *Angraecum stylosum* from a plant from Madagascar, first flowered by Sander in 1893. He likened its shape to *A. appendiculatum* from E Africa and to *A. ellisii* but did not mention Reichenbach's *A. rostellare* or *A. avicularium*. The type material at K comprises a pencil sketch of the plant and several inflorescences and flowers. A great deal of confusion over the identity of *Aerangis stylosa* can be found in the literature: the description and illustration of *Angraecum fuscatum* by Carrière (1887: 235) is *A. rostellaris*; Finet's drawings and description (1907: 36) of *Rhaphidorrhynchus stylosus* is based on a different collection from that of Rolfe's *Angraecum stylosum* and show the features of *Aerangis cryptodon*; Perrier (1941: 114) included *Aerangis fuscata* but the description and illustration are of *Aerangis rostellaris* Perrier (1941: 108), following Schlechter he thought *A. ellisii* to be a more luxuriant cultivated plant of *Aerangis stylosa*; Perrier (1938a: 37, 1941: 109) also thought *A. crassipes* (= *A. modesta*) and *A. articulata* to be conspecific with it. More recent literature (Stewart 1986c: 1010, 2006: 219; la Croix 2014: 176, 2022: 195) considered

it to be a valid species but, after examination of the descriptions, type material and all other available herbarium specimens, photographs and illustrations, we conclude that it is the same as the earlier *Aerangis rostellaris*; a widespread species, variable in size of plant and flowers.

Angraecum fournierae was described and illustrated by André (1896: 256) from a cultivated plant and is obviously the same as *Aerangis stylosa* (as explained by Rolfe 1896a: 196) and therefore *A. rostellaris*. It should not be confused with *Angraecum fournierianum* Kraenzl. (Kraenzlin 1894: 808) which is *Sobennikoffia fournieriana* (Kraenzl.) Schltr. Costantin & Poisson (1913: 532) thought it a variety of *Raphidorhynchus stylosus*.

Wynne (1896: 558) provided a short description of *Angraecum metallicum* in *Gardening World* when it received a Botanical Certificate from the RHS for Messrs J. Veitch & Sons. The same award is also mentioned in the *Proceedings of the RHS* (Wilkes 1896: cxiii), *The Orchid Review* (Rolfe 1896b: 160) and a Sander's Catalogue (1901: 10) but without description. The herbarium at Kew has two contemporary cultivated collections labelled as *Angraecum metallicum* (Buchanan Hepburn s.n. & cult. Glasnevin s.n.) but identified as *A. stylosa* by Rolfe and Stewart. Plants seem to have originated from the Veitch Nursery or from the Protheroe & Morris auction house where it was sold as *Angraecum 'metallique'*. From the short description and herbarium material it is clear that it is the same as *Aerangis rostellaris*.

Aerangis buchlohii was described by Senghas in 1969 from a Rauh & Buchloh collection from Mt d'Ambre in N Madagascar; it has distinctly undulate leaves but the flowers and plant are well within the variability of *A. rostellaris*.

The flower shape of *Aerangis rostellaris* is similar to that of *A. ellisii* and *A. spiculata*, but it does not have the distinct stem of the former, the flowers are around a third smaller than both and the ovary, rachis and spur are orange-brown (vs green-white). It is similar to *Aerangis cryptodon* but lacks the teeth and ridges at the base of the lip, the expanded base of the spur and also has a shorter spur. It is also close to *Aerangis ikopana*, but that species has a shorter and more strongly zig-zag rachis, the flowers about a third smaller, and the lip has a short ridge at the base.

Aerangis seegeri Senghas (1983: 23); Stewart (2006: 216); Stewart *et al.* (2006: 248); Hermans *et al.* (2007: 16); Cribb & Hermans (2009: 276); Bosser & Lecoufle (2011: 79); la Croix (2014: 173); Hervouet (2018: 77); la Croix (2022: 191). Type: Madagascar, île Sainte Marie [Nosy Boraha], June 1969, Rauh & Senghas R22723 (holotype HEID250090, HEID254464 spirit).

Angraecum nummularium in sched. Nov. 1888, Hugh Low & Sons (K); 1888, R.B.G. Glasnevin, Moore (K), *nom. invalid.*

Small to medium-sized epiphytic *herb* up to 5 cm tall, on a very short stem 1–2 cm long and 0.5–1.5 cm in diam., covered at the base by the disintegrating remnants of the leaf petioles, with a few slender fleshy roots greyish-white, glabrous to slightly verrucose, mostly flattened against the substrate, 1.2–2 mm in diam. *Leaves* 2–5, at an horizontal plane to the substrate, distichous, flat, elliptic or obovate, 2.5–5.5 × 1.8–2.9 cm, attenuate towards the base into a short petiole 0.5–1 cm long, unequally bilobed at the apex, the shorter lobe often absent, green to brownish-green, with the margins darker, glossy to slightly lustrous on the upper surface. *Inflorescences* axillary, pendent, up to 25 cm long but generally shorter, 1–2 mm in diam., green to brownish-green, bearing 6–18 flowers, 0.8–1 cm apart; peduncle 3–6.5 cm, with 1–3 tubular sheaths; rachis racemose, distichous, hardly zig-zag but each segment thickened towards the base of each flower. *Floral bracts* thin, amplexant, reduced to a tubular lobule, acute, 1.8–2.3 × 1.2–1.8 mm, dark brown at the base, almost completely enveloping the base of the pedicel and a small conical projection above each bract. *Flowers* scented of sandalwood, small, stellate, 12–18 × 12.5–17.5 mm without the spur, sepals, petals, lip and spur pale yellowish-brown to dark bronze, the column and anther pale yellow-ivory. *Pedicel* and *ovary* straight or a little curved, at right angles to the rachis, rounded, slightly ridged, 6.5–9.3 × 0.6–1 mm pale green. *Dorsal sepal* semi-erect, narrowly ovate, attenuate, 6.5–9.6 × 1.5–2 mm; *lateral sepals* spreading, narrowly elliptic to narrowly, slightly curved, attenuate towards the apex, 6–9.2 × 1.1–1.7 mm. *Petals* spreading, narrowly ovate, attenuate, 6.3–9.8 × 1–1.5 mm. *Lip* slightly auriculate at the base and projecting forward beneath the column then strongly arching, narrowly obovate, acuminate, 7–8.8 × 1.8–2.4 mm, the margins of the apex often incurved, the apex reflexed; *spur* divergent-parallel with the ovary then pendent, tubular, inflated and more or less flattened in the apical quarter, 18–21 × 0.9–1.4 mm. *Column* short and broad, 1.6–2.1 × 0.8–1.2 mm, rostellum wings finely denticulate at the apex and at the margins, emarginate at the apex; stigma broad, rostellum short, slender, hook-shaped; anther cap broadly obovate in outline, with a distinct apical beak, 0.8–1 × 0.5–0.7 mm; pollinia 2, stipes strap-shaped, viscidium thin, c. 0.5 × 0.6 mm. *Seed-capsule* fusiform 12–21 × 2.5–3.5 mm. Figs 44, 45.

RECOGNITION. Plant small, pedicel and ovary borne at right angles to the rachis. Flowers stellate, yellowish-brown to bronze, small, segments narrow, with a

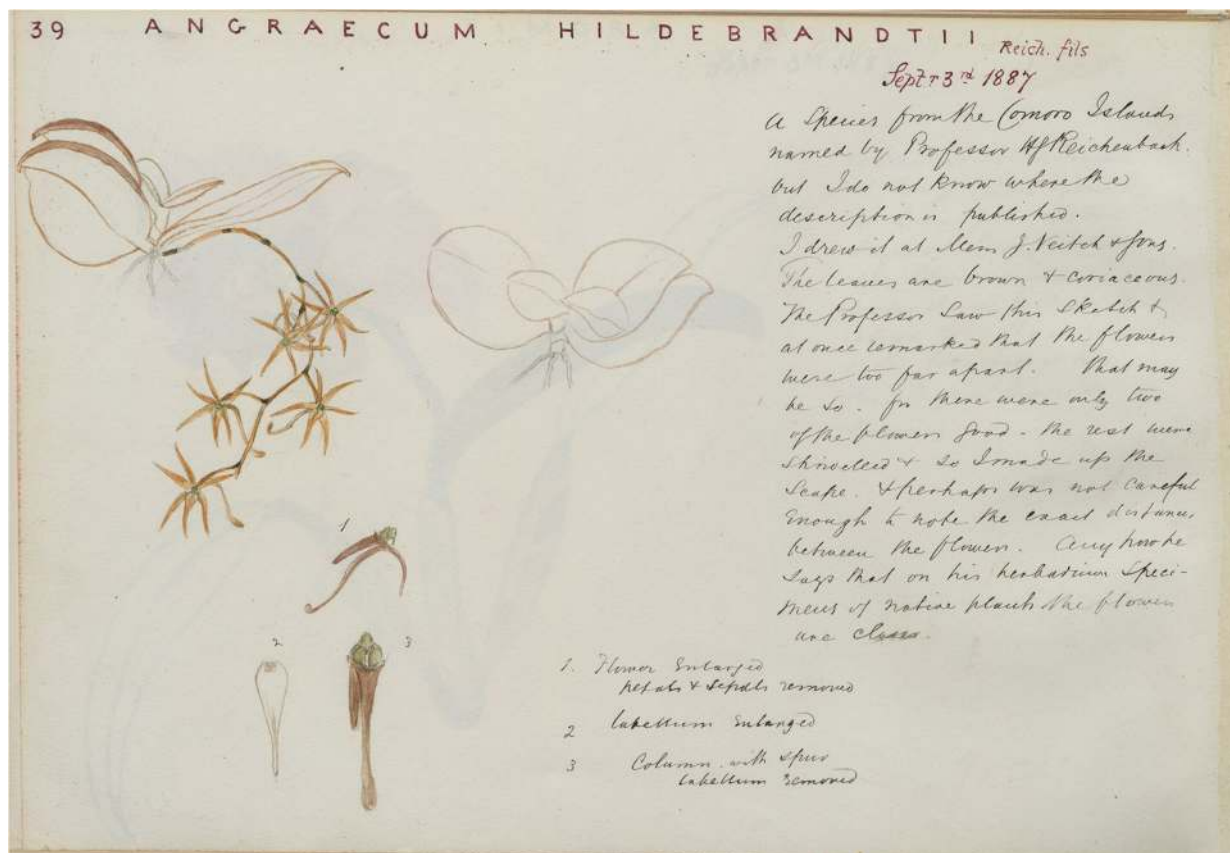


Fig. 44. *Aerangis seegeri* (as *A. hildebrandtii*) in John Day's Scrapbooks (1887: 39). Reproduced with the permission of the Trustees of the Royal Botanic Gardens, Kew.

narrow, acuminate lip, similar to the tepals, a pendent-arching spur, with the apical quarter inflated and flattened, and an anther cap with a distinct apical beak.

DISTRIBUTION. Madagascar: Antsiranana, Fianarantsoa, Mahajanga and Toamasina provinces (Map 28).

SPECIMENS EXAMINED. MADAGASCAR. Analamahitso, c. 1000 m, Aug. 1909, Perrier 1881 (P00080780); Betampona, Dec. 1962, Bosser 16857 (P06796633); Périnet, 900 m, March 1963, Bosser 16808 (P00115670); île Sainte Marie, June 1969, Rauh & Senghas 22723 (HEID254464, HEID250090 Spirit); île Sainte Marie, 80 m, Nov. 2003, Cribb *et al.* s.n. (RENZ TPPO205); Antsatoby, 206 m, July 2007, Rasoafaranaivo *et al.* 200 (TAN); Antsatoby, 117 m, July 2007, Rasoafaranaivo *et al.* 219 (TAN); Ambatovy, 987 m, Sept. 2008, Andriantiana 448 (MO3011093, P, TAN); Ambatovy, 1087 m, Oct. 2011, Antilahimena *et al.* 7891 (MO2856021, P, TAN); Ambatovy, 1087 m, Oct. 2011, Ramahenina 53 (MO3060451, P, TAN); Andasibe, Analamazaotra, 944 m, Dec. 2013, Razafindraibe *et al.* 533, 588 (TAN); Ankarabolava, 90 m, Oct. 2016, Ratovoson *et al.* 2365 (TAN); Torotorofotsy, 1007 m, Oct. 2020, Ramandimbisoa *et al.*

506 (BRLU, MO, P, TAN); Ambodilendemy, Nov. 2020, Ramandimbisoa *et al.* 554, 559 (MO, TAN); Mt Ivohibe, Herb. Bot. Tana Millot 172bis (P00080785); Anjozorobe area, 1500 – 1600 m, Hermans 5386 (K). **WITHOUT EXACT PROVENANCE:** Nov. 1888 cult. Low (K); cult. Glasnevin, June 1889, cult. F. W. Moore (K); 2014, Hermans 7018 ex Sieder 6508 (K); Humblot s.n. (W); anon. (P).

HABITAT. Low and Medium altitude moist evergreen forest. Altitude 80 – 1500 m.

CONSERVATION STATUS. *Aerangis seegeri* is an endemic orchid, distributed in Antsiranana, Mahajanga, Toamasina, Fianarantsoa provinces in Madagascar. The extent of occurrence (EOO) of *Aerangis seegeri* is estimated to be more than 20,000 km². The species is known from 12 threatened locations. It is recorded in protected areas such as Nosy Boraha, Analamazaotra, Mantadia, Betampona, Ambatovy, Ankerana, Ivohibe and Ankarabolava. In addition, the overall population is facing a continuing decline due to habitat destruction because there are few subpopulations (four occurrences) may be extirpated or may disappear. Therefore, *Aerangis seegeri* is assessed as Near Threatened (NT).



Fig. 45. *Aerangis seegeri*. **A** in habitat, E Madagascar; **B** inflorescence. PHOTOS: J. HERMANS.

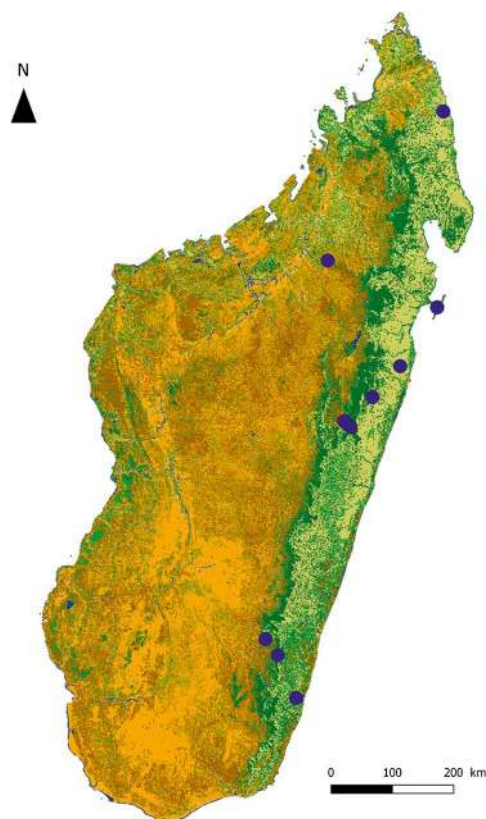
PHENOLOGY. June to December but mainly October to December.

ETYMOLOGY. Named for Hans Gerhardt Seeger (1939 – 2016): *vide* Senger (2017: 19).

NOTES. *Aerangis seegeri* was described by Senghas in 1983 from NE Madagascar but was in cultivation in Europe well before then; John Day illustrated it in his sketchbook (1887: 53, t.39) (Fig. 44) from a plant at the Veitch nursery and labelled it as *Angraecum hildebrandtii* Rchb.f., a very different species from the Comoros described ten years earlier. Reichenbach, on seeing the sketch, had doubted its identity. Two herbarium specimens from Low and Glasnevin at K were named *Angraecum nummularium* but this name was never published. Historically it has been confused with *Aerangis pallidiflora* in herbaria (Perrier 1881, Bosser 16857 in P, etc). Stewart (1986b: 909) initially thought *Aerangis seegeri* to be the same as *A. pallidiflora* but considered them distinct in later publications. The two species are certainly very similar but *Aerangis seegeri* has a spur which is distinctly inflated and flattened at the

apex (vs tubular or slightly inflated), the flowers are orange-brown (vs green) and the sepals and petals are never strongly reflexed. It has similar size flowers and has been confused in herbaria with *Aerangis macrocentra* but in that species the flowers are white, the petals and sepals broader and reflexed and the spur longer.

***Aerangis spiculata* (Finet) Senghas** (1972: 226); Stewart (1986c: 1008, 1987: 69); Hillerman (1990: 13); Stewart (2006: 217); Du Puy *et al.* (1999: 10); Stewart *et al.* (2006: 241); Hermans *et al.* (2007: 16); Cribb & Hermans (2009: 282); la Croix (2014: 174); Hervouet & Barthelat (2014: 265); C. Hermans (2020: 359, 2021b: 50); la Croix (2022: 192). Types: Comoros, rec. 20 June 1885, Humblot 414 (**lectotype designated here** (P00080791); **isolectotypes** (P00080792); rec. 20 June 1885, (P00080793); Herb. Drake, (P00080794); Finet drawing June 1885, (P00080795); 1884, (BM000540204); forêt de Combani, col. 1883 – 85, rec. 1887, (LG00000900336668); 1885 (W-R39510-12);



Map 28. Distribution of *Aerangis seegeri*.

(W-R39513); purchased Aug. 1885, (W-R5343); (W-R7907)).

Rhaphidorrhynchus spiculatus Finet (1907: 40).

Leptocentrum spiculatum (Finet) Schltr. (Schlechter 1915: 426, 1918: 112); Perrier (1941: 86).

Plectrelminthus spiculatus (Finet) Summerh. (Summerhayes 1949: 442).

Angraecum fuscatum sensu Reichenbach (1885a: 380, 1885c: 726); Godefroy-Lebeuf (1885: 196); *non* Rchb.f. (Reichenbach 1882b).

Medium-sized to large, 20–40 cm tall, epiphytic *herb* on a short stem 3–10.5 cm long and 1–1.5 cm in diam., covered by blackened leaf petiole remnants, roots, very fleshy, greyish-white, glabrous, 1.5–5.5 mm in diam. *Leaves* 3–7, distichous, undulate or rarely flat, 9.5–22.5 × 4.5–7.5 cm, elliptic or oblong-elliptic or obovate to cuneate to the base, the margins generally undulate, apex unequally bilobed, blueish-green or dull green, fleshy and with a shiny surface, the margins brownish. *Inflorescences* pendent, up to 75 cm long, 2–3.5 mm in diam., laxly 8–22-flowered in 2 rows, flowers c. 2 cm apart; peduncle terete, up to 8 cm, with 2–3 tubular sheaths; rachis, hardly

zig-zag, pale green. *Floral bracts* divergent to the rachis, amplexant at the base, broadly triangular, acute, 8–10 × 3–5 mm, yellowish-green becoming pale brown, with a 4–7 mm long peg-like projection between the rachis and the pedicel, forming a distinct pseudo-pedicel. *Flowers* large, 36–48 × 28–35 mm, petals, sepals and lip, white, or tinted pale salmon, with the base and apex a little darker, spur green to pale salmon, column pale ochre, pollen yellow. *Pedicel* and *ovary* somewhat curved, rounded-terete, somewhat ridged, thickened at the base, 23–55 × 1.2–2 mm, brownish-orange, darker towards the base. *Dorsal sepal* erect with the apex incurved, narrowly ovate to ovate, attenuate, the margins more or less recurved, 25–31 × 5.2–11 mm; *lateral sepals* strongly reflexed, narrowly elliptic to ovate, attenuate, 23–30 × 5–10 mm. *Petals* strongly reflexed, narrowly ovate to ovate, acuminate, 21–29 × 5–10 mm. *Lip* elliptic or ovate in outline when flattened, strongly reflexed parallel with the spur and ovary, with 2 shallow parallel ridges at the base, the apex attenuate to caudate and reflexed, 13–17.1 × 3.5–6 mm; *spur* first arching then pendent, very slightly broadened at the base, then subulate, 160–265 × 1.5–2.5 mm, slightly inflated in the apical part. *Column* porrect, slender, 6–14 × 3–6 mm, more or less hairy on the exterior, rostellum lobes rounded, the margins dentate, with several conspicuous hooked thorns at the entrance of the spur; rostellum tooth curved, 1.5–2 mm long, anther cap conical, angular-winged at the base, distinctly beaked, 3.8–4.1 × 1.9–2.5 mm; pollinia 2, c. 1.5 mm in diam., stipes narrow, viscidium near its apex. *Seed-capsule* not known. Fig. 46.

RECOGNITION. *Aerangis spiculata* is a large plant with a short stem, undulate leaves, very long, pendent, many-flowered inflorescences with a scarcely zig-zag rachis, distinct peg-like extension at the base of the pedicel, and large, white or slightly tinged pink flowers with all segments strongly reflexed, a lip with two parallel ridges at the base, a spur more or less inflated at the apex with distinct hooked thorns, a column hairy on the exterior, with a curved rostellum tooth, and a conical anther-cap.

DISTRIBUTION. Comoros: Anjouan [Nzwani], Grande Comore? [Ngazidja], but there are no recent records from the Comoros and the Humblot collections may have come from Madagascar. Madagascar: Antsiranana province (Map 29).

SPECIMENS EXAMINED. COMOROS. forêt de Combani, col. 1883–85, rec. 1887, *Humblot* 414 (LG00000900336668). **WITHOUT EXACT PROVENANCE.** Comoros, rec. June 1885, *Humblot* 414 (P00080791-3); Herb. Drake, *Humblot* 414 (P00080794); 1884 *Humblot* 414 (BM000540204); 1885 *Humblot* 414 (W-R39510, 13); purchased Aug. 1885, *Humblot* 414 (W-R5343);



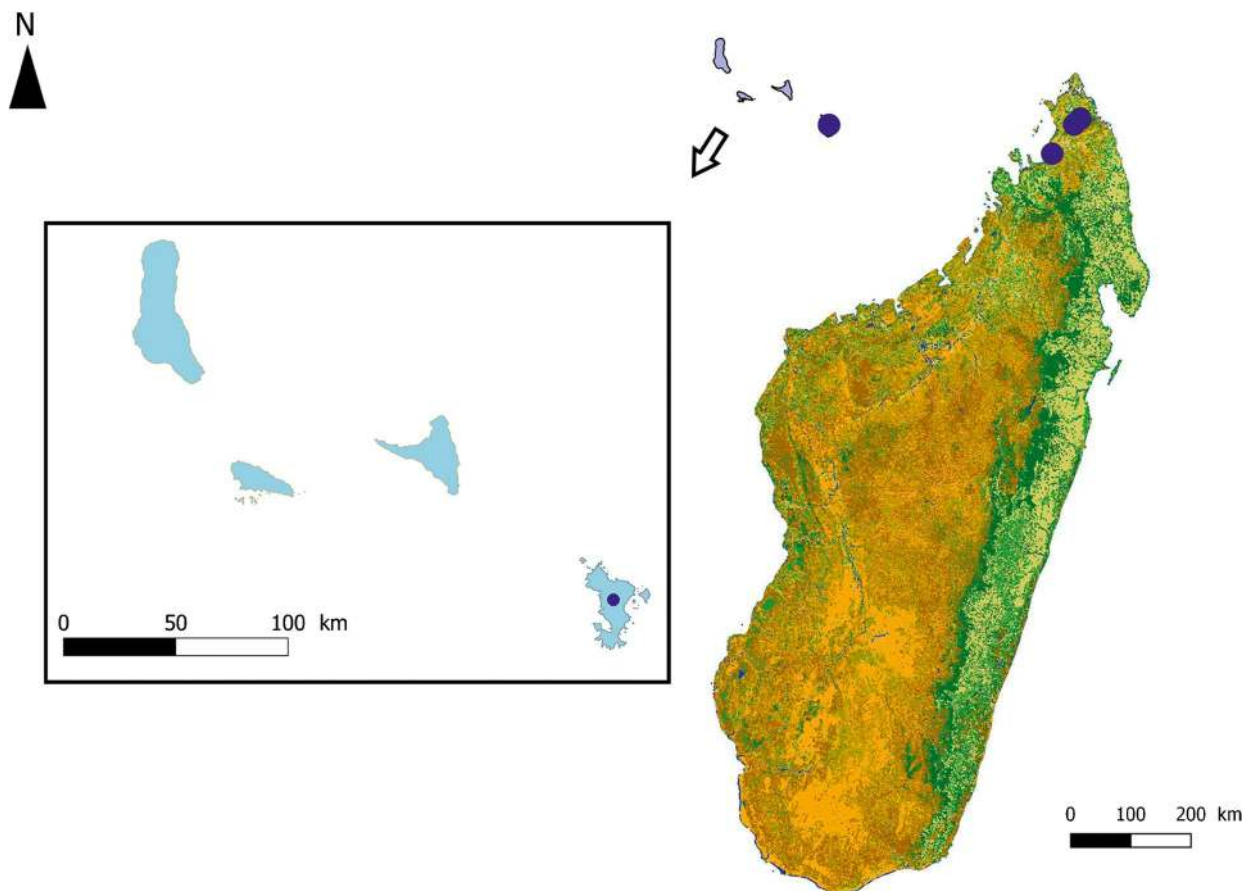
Fig. 46. *Aerangis spiculata*. **A** in habitat, northern Madagascar; **B** inflorescence; **C** close-up of flowers. PHOTOS: **A** P. CRIBB; **B, C** J. HERMANS.

Humblot 414 (W-R7907); Weathers, *Humblot* s.n. (BM000540205); Messrs Sander 1890, *Humblot* s.n. (K); 1885, *Humblot* s.n. (W-R6511-2). **MADAGASCAR.** Tsaratanana, April 1952, *Paulian* 221 (P); Tsaratanana, May 1952, *Sajy*, *Jard.Bot.Tan.* 221 (P); Analamera forest, 80 m, Aug. 1973, *Cremers* 2487 (TAN001153); S of Anviroano, 300 – 400 m, March 1988, *Cheek et al* 1442 (K, Spirit 58727); Analamera, 5 m, March 1994, *David DuPuy et al.* M724 (K, spirit 72581.000, 72583.000, MO3248658, P00059454, TAN001154); Analamera, *Jard.Bot.Tan*, *Rabiason* 1225, 1295 (TAN). **WITHOUT**

ORIGIN. cult. *Hillerman* 27 (K); anon. (TAN); cult. *Hermans* 3139 (K); cult. *De Wilg*, 2001, *Hermans* 5366 (K).

HABITAT. Dry deciduous forest. Altitude 80 – 400 m.

CONSERVATION STATUS. *Aerangis spiculata* is an epiphytic orchid, possibly distributed in the Comoros (Anjouan, Mayotte and Grande Comore) and Madagascar in Antsiranana province. The species is recorded in the Tsaratanana, Analamera Protected Area in Madagascar. The species is known from six locations. We infer a continuing decline in the extent of occurrence, the area of occupancy and the quality of the habitat due to



Map 29. Distribution of *Aerangis spiculata*.

forest logging and the number of mature individuals is estimated to be less than 1000. *Aerangis spiculata* is therefore assigned as Vulnerable (VU) B1B2ab (i, ii, iii, iv, v) D1.

PHENOLOGY. March to May.

ETYMOLOGY. Referring to the spike-like protrusion at the base of the pedicel which remains after the flower falls off.

NOTES. The species was first collected by Humblot in the forêt de Combani on Mayotte in December 1884. Perrier (1939: 87) gave ‘Grande Comore, forêt de Combani’ as the locality of this species but Humblot’s Field Notebooks in P (1882 – 1885) clearly list it from Mayotte, together with a several other novelties. It is a common mistake to confuse Combani forest of Grande Comore with Combani on the island of Mayotte (Hervouet & Barthelat 2014: 268). Plants and herbarium specimens reached several European collections and herbaria: Reichenbach misidentified it as

Angraecum fuscatum (*Aerangis fuscata*), quite a different species endemic to Madagascar that he had described in 1882 and this was followed by other authors as listed above. It was recognised as distinct by Finet (1907: 40) who described and illustrated it as *Rhaphidorhynchus spiculatus*, he cited Humblot 414 as the type and the most complete specimen at P is designated here as the lectotype while other sheets at BM, LG, P and W are isolectotypes.

It was transferred to *Leptocentrum* by Schlechter (1915: 426), to *Plectrelminthus* by Summerhayes (1949: 442) and to *Aerangis* by Senghas (1972: 226).

In general flower shape *Aerangis spiculata* is similar to *A. ellisii* and *A. rostellaris* but it does not have the distinct stem of the former and the inflorescence is pendent (vs suberect) and the flowers are almost double the size of the latter. It is closest to *Aerangis cryptodon* but has flowers and a spur about third larger, a broader lip and lacks the distinct pink colouration.

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