Malaxideae (Orchidaceae) in Madagascar, the Mascarenes, Seychelles and Comoro Islands

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Summary. The tribe Malaxideae (Orchidaceae, subfamily Epidendroideae) (*sensu* Pridgeon *et al.* 2005: 453) in Madagascar and adjacent archipelagos is revised. In this region it comprises the four genera: *Liparis*, *Malaxis*, *Oberonia* and *Stichorkis*. All of the species are described and their typification, history, identification, distribution and habitat are discussed. Conservation assessments and distribution maps are included. A checklist of the genera and species and a key to their identification are provided. Six new species: *Liparis bemarahensis*, *L. bosseri*, *L. chantaliae*, *L. laurentii*, *L. magnifica* and *L. superclareae* are described.

Key Words. Conservation assessments, *Liparis*, *Malaxis*, new species, *Oberonia*, revision, taxonomy, *Stichorkis*.

Introduction

This is the first review of the tribe Malaxideae (Orchidaceae, subfamily Epidendroideae) from the Madagascar region since 1936 when Henri Perrier de la Bâthie (henceforth Perrier) published his *Les Liparidées de Madagascar*, which was later summarised in his treatment of the Orchidaceae in the *Flore de Madagascar* (Perrier 1939). His work covered the same genera but only from Madagascar and the Comoros, the present revision also adds the adjoining archipelagos of the Mascarenes (Réunion, Mauritius, Rodrigues) and the Seychelles.

Historically, accounts of the orchids of the area under consideration have been fragmented with revisions being undertaken separately for Madagascar, the Comoros, the Mascarenes and the Seychelles. This sometimes resulted in confusion with the same species being known under different names within its range: thus *Liparis scaposa* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 183) described from Réunion is identical to *Liparis microcharis* Schltr. (Schlechter 1924: 144) from Madagascar, as shown below.

This account is also the first since Ridley's monographs (1887 & 1888) where the species from the region were compared with those from mainland Africa and elsewhere. Increased collecting in some parts of Madagascar and improved communication have meant that today much more material is available

for research in herbaria around the world. This is in contrast to the time of Perrier's revision when many of the species were only known from their type collection.

The large genus *Liparis* has caused problems for earlier authors and disproportionate numbers of plants have been either misidentified or left unidentified in herbaria. This is not surprising as many of the species have few good and consistent characteristics. Plant habit, lip morphology, shape of the column and shape of the anther can all vary to some extent within a species but rarely are any of their individual characteristics unique to a single species. Therefore, one must often rely on a combination of features that are not always obvious. Frustratingly, in herbarium specimens the lip of the flower is often damaged, distorted or has lost some of its defining characters, the anther cap is also frequently missing.

The typification of 18th and early 19th century species can be challenging because specimens were commonly moved or incorporated into other herbaria. Frappier (1880) and Frappier in Cordemoy (1895), working on the orchid flora of Réunion, was vague as to which collection or collections were the basis for his new species. Schlechter and Perrier, in their descriptions, frequently cited several collections, each often comprising several herbarium sheets.

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Therefore, where necessary, a careful selection has been made in this paper to assign a lectotype or new material was assigned as a neotype to best reflect their descriptions. Some of Perrier's earlier collections followed a different numbering system from that used by Schlechter for the same specimens. In addition it was once thought that the material sent by Perrier to Schlechter in Germany was not returned and was lost during World War II and therefore most of the Paris specimens would have been isotypes. However, the loan and return dates of herbarium sheets are indicated very clearly on various herbarium labels and it is therefore certain that the holotypes and other material was returned to Paris (e.g. *Perrier* 14358, 16485, 15336 etc. in P). For clarity and following the International Code of Nomenclature (Turland *et al.* 2018) and also taking into account McNeill (2014: 1112) for species described prior to 1958, holotypes were 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 (article 9.1); for example Perrier and Schlechter generally annotated the Paris (P) herbarium specimens as 'type', thereby clearly indicating the particular original material used by them (article 9.4). In the case of more than one sheet of original material with the same collecting number being available, the identity was checked and the most representative sheet designated as lectotype and the others as isolectotypes or isotypes (article 9.5). If additional collections of original material were mentioned in the protologue and found to be correctly identified and used by the author they were considered syntypes (article 9.6) or lectoparatypes following the instructions for this journal. On a few occasions neotypes had to be selected when original material is missing or destroyed (article 9.8).

Methods

This revision is based on detailed work during the last 25 years on the orchid flora of Madagascar and neighbouring islands. J. & C. Hermans (in Du Puy *et al.* 1999) published a comprehensive bibliography which was revised (Hermans in Hermans *et al.* 2007) and has been kept up-to-date since then. At the same time, photographs, drawings and data were assembled from herbaria (including BM, BR, BRLU, CGE, DUB, G, HEID, K, M, MO, P, SZU, TAN, TEF, W, WU, M, SZL, ZSS). The authors visited many type and other localities during extensive fieldwork and visits to Madagascar and Réunion.

A new checklist was compiled, based upon examination of herbarium and photographic material in all the major collections. Species were typified or re-typified as necessary, a provisional key to the species was also prepared. All the unidentified herbarium

specimens and photographic records were then attempted to be identified and named, some being recognised as novelties. A few proved to be impossible to identify because of their poor condition or missing parts. New descriptions, including information on distribution, habitat, elevation etc. were prepared for all the species. The keys were tested on further herbarium and spirit material made available by Patrice Bernet and others from Réunion and on the extensive collections provided by Simon Verlynde and Tariq Stévant from the Ambatovy orchid conservation project in Madagascar. Meanwhile, new botanical drawings were commissioned by the Royal Botanic Gardens Kew to illustrate novelties and other significant species not illustrated before. Simon Verlynde with input from Brigitte Ramandimbisoa provided the detailed preliminary Conservation assessments. Jean-Michel Hervouet extracted the locality information and constructed distribution maps for each species.

As mentioned above, it was often necessary to rely on a combination of characters to identify many of the species in this tribe: plant habit, shape and features of the lip, shape of the column wings and anther cap are only reliable characteristics for species when used in combination. The key features for each species are emphasised in the descriptions and especially in comparison with similar species. Many *Liparis* are very variable in respect of the number and lay-out of the floral veins and these characteristics were therefore not included unless significant or unusual. The shape and size of the lip and the calli on the surface can also be variable. These variations are both within individual plants and between different plants; for example, in *Liparis ochracea* Ridl. (Ridley 1885: 461) the upper flowers are sometimes incomplete, irregular and misshapen. A species can vary locally but the differences are not enough to recognise them as distinct taxa. In some cases it is possible that they are developing into new species but it is difficult to be certain how these sporadic, isolated variations have evolved.

Only the most relevant illustrations and literature are mentioned in this revision. References to additional literature and illustrations for all the species can be found in the annotated bibliography in Hermans *et al.* (2007). Photographs and / or drawings or references are provided for all species accepted in this revision. Because of the general confusion and often misidentification of specimens of Malaxideae in herbaria, all specimens that we have examined are listed.

Type specimens are only indicated for those names from the region under review and not for synonyms from elsewhere. Most of the Cordemoy herbarium material has been on long-term loan to P and later to REU but belongs to the Herbarium at the St. Charles

University, Marseille (MARS), it has therefore been indicated as such (also see Bosser 2011: 118).

Since there is a lack of detailed genetic research, no distinct sections in the genus *Liparis* are accepted in this paper. It is evident that some species cannot be assigned easily to the sections designated by previous authors. They overlap with the classical sections *Mollifoliae* and *Coriifoliae* used for *Liparis* in Africa and Asia. For identification purposes (and in the key) three broad, overlapping groups are recognised for *Liparis*:

1. Species with pseudobulbs often caespitose, the older ones retaining their leaves. Leaf blade more or less flat, rigid or leathery.
2. Species with few (one to two) pseudobulbs, the older ones disintegrating. Only the newest growth bears leaves; leaves plicate and thin.
3. Species with very small, often clustered pseudobulbs. Plants very small to small. With small rounded pseudobulbs and ligulate-lanceolate leaves.

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

Measurements definitions used for plants are as follows: very small < 8 cm; small > 8 cm < 15 cm; medium > 15 cm < 20 cm; large > 20 cm. For flowers: very small < 5 mm; small > 5 mm < 10 mm; medium > 10 mm < 15 mm; large > 15 mm.

Unless otherwise stated, all cited specimens have been seen by the first author. Herbarium barcodes (if existing) were only indicated if no collection numbers were available or if there was a possibility of confusion.

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 the dedicated R package, *ConR* (Dauby *et al.* 2017) to calculate the Extent of Occurrence (EOO) and Area of Occurrence (AOO). Minimal AOO was calculated using a cell area set to 4 km² (cell size = 2 × 2 km) as recommended by IUCN (2017). 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. (S. V.).

The assessments showed a considerable number (15%) of Malaxideae species in the area are Critically Endangered (CR), the vast majority (47%) are Endangered (EN), 18% are Vulnerable (VU) and only 18% are of Least Concern (LC). The main threats are habitat loss through slash-and-burn farming, logging, charcoal production and mining.

History

The earliest collections of Malaxideae in the region were made in the Mascarene Islands. Jean-Baptiste Lamarck described the first two species in 1783, namely, *Epidendrum cespitosum* Lam. (Lamarck 1783: 187) (now *Liparis cespitosa* (Lam.) Lindl. (Lindley 1825: sub t. 882) and *Epidendrum distichum* Lam. (Lamarck 1783: 189) (now *Oberonia disticha* (Lam.) Schltr. (Schlechter 1924: 132)). They were likely collected, respectively on Réunion and Mauritius, by Philibert Commerson who explored the region from 1768, dying on Mauritius in 1773 (Dorr 1997: 93). His collections were incorporated into various herbaria, including those of Lamarck and Antoine-Laurent de Jussieu in P. In 1807 Christiaan Persoon described *Epipactis salassia* (*Liparis salassia* (Pers.) Summerh. (Summerhayes 1953: 133)) collected by Commerson on Réunion and now in the Jussieu herbarium in P.

Louis Marie Aubert-Aubert du Petit-Thouars was the first to collect and describe plants himself from the area which he visited mainly from 1795 to 1798. In 1809 he described *Leptorkis* Thouars (1809: 317) and *Stichorkis* Thouars (1809: 318) as distinct genera but it was not until 1822 in his *Histoire Particulière des Plantes Orchidées Recueillies sur les Trois Iles Australes D'Afrique* that he described and illustrated new species, namely, *Malaxis flavescens* Thouars (1822: t.25) (now *Liparis flavescens* (Thouars) Lindl. (Lindley 1825: sub t.882)) and *Malaxis disticha* Thouars (1822 t.89) (now *Stichorkis disticha* (Thouars) Pfitzer (1897: 103)). Du Petit-Thouars used both his own peculiar formulation of names and those more akin to the Linnaean system; this way he has both *Leptorkis purpureolepis* and *Malaxis purpurascens* (now *Liparis salassia*), the latter names were adopted by subsequent authors.

The genus *Liparis* was established in 1817 by Louis-Claude Richard based upon two species: *L. loeselii* (L.) Rich. (Richard 1817: 38) with a Northern temperate distribution and *L. liliiflora* (L.) Rich. ex Lindl. (Lindley 1825: sub. t.882) from N America. The former was selected as the type species for the genus. *Liparis* was conserved over Thouars' *Leptorkis* / *Leptorchis* as was *Oberonia* over *Iridorkis* / *Iridorchis*.

John Lindley (1825) described *Liparis foliosa* Lindl. (Lindley 1825: t.882), based on a cultivated plant supplied by Robert Barclay and originating from Charles Telfair who collected it on Mauritius. Lindley (1830a), in his *Genera and Species of Orchidaceous Plants*, also produced the first account of the tribe and included five species from the region.

Heinrich Gustav Reichenbach (1826) proposed to replace *Liparis* with his new genus *Sturmia* Rchb. (Reichenbach 1826: 39), claiming invalidly that the name had already been used for a genus of moths. To be valid generic names only have to be unique within Kingdom Plantae and Animalia; it is interesting to note that *Liparis* Scopoli (1777: 453) is also a genus of fish from the Northern Hemisphere. Reichenbach's son, also Heinrich Gustav (Reichenbach f. 1885), added two species: *Liparis polycardia* Rchb.f. (Reichenbach f. 1885: 543) and *Malaxis cardiophylla*, both collected by Léon Humboldt in the Comoro Islands.

Henry Ridley was the first to produce monographs of *Liparis*, *Microstylis* and *Malaxis* (Ridley 1886b, 1888). Ridley (1886b) provided a key to *Liparis* and also described nine new species from Madagascar (*Liparis bicornis* Ridl. (Ridley 1885: 458), *L. connata* Ridl. (Ridley 1885: 462), *L. longicaulis* Ridl. (Ridley 1885: 461), *L. lutea* Ridl. (Ridley 1885: 458), *L. ochracea*, *L. ornithorrhynchos* Ridl. (Ridley 1885: 460), *L. puncticulata* Ridl. (Ridley 1886b: 119) and *L. xanthina* Ridl. (Ridley 1886b: 275)). The majority of his types were collected in Madagascar by the missionary William Deans Cowan and the rest by another missionary Richard Baron and the German collector Johann Hildebrandt. Deans Cowan's sketchbook at the London Natural History Museum, London (Cowan 1880) features some of the orchids discovered by him and are sometimes the only record.

At about the same time Charles Frappier was working on the orchids of Réunion. He produced a checklist in 1880 and, after his death in 1885, his work was incorporated in Eugène de Cordemoy's *Flore de l'Île de la Réunion* of 1895. Twelve species of Malaxideae were included, of which seven were new (*Liparis bernieri* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 185), *L. caulescens* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 186), *L. flammula* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 183), *L. nectarina* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 184), *L. punctilabris* Frapp. ex Cordem. (Frappier in Cordemoy 1895: 184), *L. scaposa*, *L. verrucosa* Frapp. ex Cordem. (Frappier in Cordemoy 1895)). Plants were mainly collected by Frappier and Cordemoy but some also by Louis Boivin.

There then followed a period with very few new species emerging from the Madagascar region: Johannes Klinge (1898) added *Microstylis madagascariensis* (*Malaxis madagascariensis* (Klinge)

Summerh. (Summerhayes 1954: 578)) to the list from a collection by L. Hamelin. Fritz Kraenzlin (1902) described *Liparis seychellarum* Kraenzl. (Kraenzlin 1902: 60) (now *Malaxis seychellarum* (Kraenzl.) Summerh. (Summerhayes 1954: 578)), collected by Schimper. Robert Allan Rolfe (1908) described *Liparis warpurii* Rolfe (1908: 69), named for its collector G. Warpur.

A great resurgence of botanical activity took place during the height of French colonial rule of Madagascar during the first half of the 20th century. Most of the work was done by Perrier who explored the island extensively between 1913 and 1932, initially as a mining prospector and later on behalf of the Paris Museum (P) where his extensive collections are now housed. Initially, the German botanist Rudolf Schlechter described the plants found by Perrier, starting in 1913 and 1916 but culminating in 1924 – 1925 with his *Orchidaceae Perrierianae*, where he named fourteen new *Liparis* from the island, all collected by Perrier. Schlechter added a total of 18 new Malaxideae to the flora of Madagascar (*Liparis andringitrana* Schltr. (Schlechter 1924: 135), *L. bathiei* Schltr. (Schlechter 1924: 135), *L. cladophyllax* Schltr. (Schlechter 1916: 321), *L. densa* Schltr. (Schlechter 1924: 137), *L. dryadum* Schltr. (Schlechter 1924: 138), *L. gracilipes* Schltr. (Schlechter 1924: 138), *L. henrici* Schltr. (Schlechter 1924: 139), *L. hildebrandtiana* Schltr. (Schlechter 1924: 140), *L. imerinensis* Schltr. (Schlechter 1924: 141), *L. jumelleana* Schltr. (Schlechter 1916: 320), *L. latilabris* Schltr. (Schlechter 1924: 142), *L. listeroides* Schltr. (Schlechter 1924: 143), *L. microcharis*, *L. perrieri* Schltr. (Schlechter 1913: 164), *L. rivalis* Schltr. (Schlechter 1924: 146), *L. sambiranoensis* Schltr. (Schlechter 1924: 147), *L. stenophylla* Schltr. (Schlechter 1924: 148) and *Malaxis physuroides* (Schltr.) Summerh. (Summerhayes 1954: 578)).

Following Schlechter's death in 1925, Perrier assumed the taxonomic work, describing several new species and in 1936 published *Les Liparidiniées de Madagascar*, a major revision of the Malaxideae of Madagascar including *Oberonia*, *Microstylis* and *Liparis*. He added six new species to the tribe (*Liparis anthericoides* H.Perrier (1936: 243), *L. bulbophylloides* H.Perrier (1936: 242), *L. cardiophylla* H.Perrier (1936: 244), *L. danguyana* H.Perrier (1936: 248), *Malaxis atrorubra* (H.Perrier) Summerh. (Summerhayes 1954: 578) and *M. francoisii* (H.Perrier) Summerh. (Summerhayes 1954: 578)), all except one collected by himself, the other by Raymond Decary. In addition to several other works on the flora he also produced the family account for Henri Humbert's *Flore de Madagascar* (Perrier 1939).

Little more appeared until 2014 when *Liparis vulturiceps* Hermans & P.J.Cribb (2014: 9517: 4) was described. In the present work six new species (*Liparis bemarahensis*, *L. bossieri*, *L. chantaliae*, *L. laurentii*, *L.*

magnifica, *L. superclareae*) are added and several other adjustments to the Malaxideae of the area are made. A total of 54 species are now recognised in the Tribe: 46 in *Liparis*, six in *Malaxis*, and one each in *Oberonia* and *Stichorkis*.

Distribution

In the Madagascar – Africa region *Liparis* is widespread in Madagascar, Mascarenes, Comoros and Seychelles but the species are largely endemic, only *L. cespitosa* has a broader distribution. *Malaxis* is only found on Madagascar and the Comoros with one species also occurring on mainland Africa. *Oberonia* is found throughout the area except for the Seychelles and is also widespread on mainland Africa. *Stichorkis* is only known from the Comoros and the Mascarenes.

A number of species from our area have sister species outside the region, namely: *Liparis perrieri* from Madagascar vs *L. nervosa* (Thunb.) Lindl. (Lindley 1830a: 26) with a widespread tropical and subtropical distribution, *L. flavescens* from the Mascarenes vs *L. bowkeri* Harv. (Harvey 1863: 6) from Southern Africa, *L. foliosa* almost exclusively from the Mascarenes vs *L. reflexa* (R.Br.) Lindl. (Lindley 1825: t.882) from Australia and *Malaxis atrorubra* from Madagascar vs *M. welwitschii* (Rchb.f.) Hermans from SW Africa. Although they may share some characteristics, it is evident that isolated evolution and possible pollination adaptation have meant that these can be recognised as distinct species.

Malaxideae are predominantly plants of the wet and shaded forest at elevations between sea level and 2500 m but generally between 500 and 1800 m, very few are found in warmer lower elevations and those tend to be widespread species, such as *Liparis cespitosa*, *L. sambiranoensis* and *Oberonia disticha*. Two new discoveries, *Liparis bemarahrensis* and *L. superclareae* also come from lower elevations. The flowering season is between October and August with the main season during the rainy season between January and May.

Most species are terrestrials or moss-humus dwellers but many can also grow as epiphytes, generally at the base of trees or on lower branches. The only exclusive epiphytes are *Liparis bulbophylloides*, *L. cladophylax*, *L. dryadum*, *L. foliosa*, *L. parva* (Kuntze) Ridl. (Ridley 1885: 462) and *Oberonia disticha*. All true epiphytes, except *Oberonia disticha*, are only recorded from the lower parts of trees. None are true lithophytes except perhaps *Liparis andringitrana* which has watery young pseudobulbs as a xerophytic adaptation to its environment. Several species can be found on rocks but are usually rooted in the humus-rich and mossy substrate and not onto the rock itself.

The vast majority are found in the Eastern forests of Madagascar and the higher elevation forests of the Comoros and Réunion. A few species are widespread

on Madagascar, including: *Liparis chantaliae*, *L. clareae* Hermans (in Hermans *et al.* 2007: 216), *L. longipetala* Ridl. (Ridley 1885: 459), *L. ochracea*, *L. salassia* and *Oberonia disticha*. Others are exclusively from the West of Madagascar, including *Liparis bemarahrensis*, or from the South: *L. bosseri*, *L. densa* and a few from the North to North-West: *L. perrieri*, *L. sambiranoensis*.

A number of species are relatively common (i.e. known from ten or more different collections) but others are quite rare and localised (fewer than ten collections): including *Liparis ambohimangana* Hermans (Hermans *et al.* 2007: 214), *L. bathiei*, *L. bemarahrensis*, *L. bosseri*, *L. cladophylax*, *L. danguyana*, *L. densa*, *L. gracilipes*, *L. laurentii*, *L. lutea*, *L. magnifica*, *L. parva*, *L. vulturiceps*, *L. zaratananae* Schltr. (Schlechter 1924: 151) and all *Malaxis* except *M. seychellarum*. A few are known from the type specimen only: *Liparis trulliformis* Schltr. (Schlechter 1924: 149) and *Malaxis madagascariensis*, they may well be reassigned to other species when more thoroughly studied using better material. The newly described *Liparis superclareae* is only known from the type collection which comes from a remote area. The overall distribution of the Tribe is shown in Map 4.

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> (Mayotte and Réunion islands), <https://gadm.org> (country outlines of Comoros, Mauritius and Seychelles). Similar data can be found at www.diva-gis.org. The locality coordinates come from the authors' own observations, made with Garmin etrex 10 GPS using the WGS 84 projection, or from the Tropicos website gazetteer to Malagasy botanical collecting localities: www.tropicos.org. All the positions of specimens have been double-checked with Google Earth: <https://earth.google.com>.

A relational database with two tables: localities and observed species, has been built with the database management system 4D version 11 (www.4d.com), storing a total of about 500 observations or collected specimens. 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 pictures 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 Malaxideae, as well as maps showing the different provinces and regions of Madagascar are included for reference (Maps 1, 2, 3 and 4).

Phylogenetics & Cytology

The Malaxideae tribe has always been difficult to place within the Epidendroideae subfamily because the included taxa lack typical appendages on their pollinia (e.g. they are 'naked', although they appear to have small viscidia in most cases). Column morphology, particularly the structure of pollinia and associated appendages, has always been given pre-eminence in traditional orchid classification, so ideas about relationships within this 'nearly naked' tribe have been limited. In all other aspects Malaxideae are more or less typical epidendroid orchids without any clear evidence for any relationship to any other tribe. In

the morphological analysis of Freudenstein & Rasmussen (1999), two species of *Liparis* were among a large number of Epidendroideae on a polytomy, whereas in the Cameron *et al.* (1999) analysis of *rbcL* data, *Liparis* and *Malaxis* were sister to Dendrobieae but without bootstrap support greater than 50%. This placement is noteworthy because both groups have more or less naked pollinia, but Dressler (1993) hypothesised that whereas Dendrobieae appear to be secondarily naked, Malaxideae may be primitively so. As in the case for most clades of Epidendroideae, more data are required before a clearer picture of the relationships of Malaxideae is achieved.

A comprehensive account of Malaxideae has yet to be published although an up-to-date assessment of its phylogeny and classification was provided by Chase & Cribb in *Genera Orchidacearum* (Pridgeon *et al.* 2005). Cameron (2005) examined a selection of species and produced a cladogram which shows that both *Liparis* s.l. and *Malaxis* s.l. are polyphyletic. Very few plants from Africa and the

0 250 500 km

Map 1. Madagascar and the surrounding Islands.

Legend

- Post-flooding or irrigated shrub or crops
- Rainfed shrub or crops
- Mosaic cropland (50-70%) / vegetation (grassland/shrubland/forest) (20-50%)
- Mosaic vegetation (grassland/shrubland/forest) (50-70%) / cropland (20-50%)
- Closed (>40%) broadleaved deciduous forest (>5m)
- Open (15-40%) broadleaved deciduous forest/woodland (>5m)
- Closed (>40%) needleleaved evergreen forest (>5m)
- Open (15-40%) needleleaved deciduous or evergreen forest (>5m)
- Closed to open (>15%) mixed broadleaved and needleleaved forest (>5m)
- Mosaic forest or shrubland (50-70%) / grassland (20-50%)
- Mosaic grassland (50-70%) / forest or shrubland (20-50%)
- Closed to open (>15%) (broadleaved or needleleaved, evergreen or deciduous) shrubland (<5m)
- Closed to open (>15%) herbaceous vegetation (grassland, savannas or lichens/mosses)
- Sparse (<15%) vegetation
- Closed to open (>15%) broadleaved forest regularly flooded (semi-permanently or temporarily)
- Closed (>40%) broadleaved forest or shrubland permanently flooded - Saline or brackish water
- Closed to open (>15%) grassland or woody vegetation on regularly flooded or waterlogged soil
- Artificial surfaces and associated areas (Urban areas >50%)
- Water bodies
- Mosaic cropland (50-70%) / grassland or shrubland (20-50%)
- Mosaic vegetation (grassland/shrubland/forest) (50-70%) / cropland (20-50%)
- Mosaic forest (50-70%) / cropland (20-50%)
- Closed or open broadleaved evergreen and/or semi-deciduous forest (>5m)

Map 2. Vegetation map and Provinces of Madagascar.

Map 3. Regions of Madagascar.

Map 4. Distribution of the genera Malaxideae in Madagascar and the surrounding Islands.

Madagascar region were included in this study and this was recognised by the author: 'Eventually, the tribe will need to be reclassified, but it may be premature to carve Malaxideae into more genera at the present time because fewer than 10% of the tribe's species have been sampled, and the circumscription of new genera would be somewhat speculative. Substantially more taxa (especially from Africa and the Neotropics) should be sequenced before a thorough revision of this troubled tribe's taxonomy is attempted. Nevertheless, if the current well-supported pattern of species relationships continues to be recovered in larger analysis, it may be that Malaxideae can be reclassified at the genus level based first on habit and vegetative features, with floral characters playing a secondary role. If this is ultimately found to be the case, it will be a remarkable exception within Orchidaceae and angiosperm taxonomy, in general, where the flower above all other organs reigns supreme.'

Szlachetko (1995) recognised 16 genera in subtribe Malaxidinae, seven newly described by him. Szlachetko & Margonska (2002) accepted 15 genera in the subtribe, two of them new, in their subtribe Oberoniinae. They provided detailed drawings of the gynostemium structure of representatives of these genera. Senghas (2002: 2710) added new genera to his treatment in the third edition of Schlechter's *Die*

Orchideen and provided a tabular comparison of some of the segregate genera of *Malaxis* recognised by Szlachetko & Margonska. Margonska & Szlachetko (2004) established another segregate genus, *Disticholiparis*, for those species previously referred to *Liparis* sect. *Distichae*.

We remain to be convinced that all the new segregate genera of *Malaxis* and *Liparis* warrant recognition at more than infra-generic rank, as already recommended by Ridley (1888), Smith (1909, 1913), Schlechter (1911a, 1915b) and Seidenfaden (1978). Salazar (personal communication) and Cameron (2005) have suggested on the basis of DNA sequences that the New World taxa of *Malaxis* and *Liparis* may be more closely related to each other than to the Old World species in those respective genera. Cameron (2005) identified four major clades in the tribe that are characterised by their habit and leaf type:

1. Epiphytes with a fan of unifacial leaves.
2. Epiphytes with bifacial, linear, conduplicate leaves.
3. Terrestrials with plicate leaves.
4. Terrestrials with one or two, usually rounded, conduplicate leaves.

Results to date support the retention of some segregate genera but not all. Margonska *et al.* (2012)

recognise 23 genera within two subtribes in Malaxideae. (Adapted from Cribb & Chase in Pridgeon *et al.* 2005: 453)

According to Felix & Guerra (2010: 245) the Malaxideae tribe has a great diversity in chromosome numbers, with $n = 21$ predominating in *Liparis* and *Malaxis* and $n = 15$ in *Oberonia*. The most probable basic numbers for the tribe are $x = 15$ and $x = 21$, $n = 21$ being the most frequent haploid number and $n = 15$ the second most frequent and the only one that occurs in all three genera. The occurrence of $n = 14$ in some species of *Liparis* and *Malaxis*, and the high frequency of $n = 21$ in these two genera, suggest that these numbers may be related to the polyploid series $x = 7, 14, 21$ that is quite common in orchids. *Oberonia* has $n = 15$ or 30. The occurrence of $n = 15$ in Malaxideae further supports the hypothesis that the karyological evolution of the family was principally through dysploidy of approximately one chromosome in the three principal ploidy levels, $n = 7, 14, 21 \pm 1$.

Pollination and Scent

There are only limited records of pollination or scent analysis of the Malaxideae. Ridley (1887: 250) mentioned *Liparis longipes* Lindl. (now *L. viridiflora* (Blume) Lindl.) (Lindley 1830a: 31) from Asia as having an unpleasant scent. Both *Liparis longicaulis* and *L. chantaliae* are pleasantly fragrant (Hermans, pers. comm.). Kaiser (1993: 173) mentioned small flies and midges and Feldmann & Barré (2004: 228) observed fruit flies as pollinators of *Liparis*.

Kowalkowska & Margonska (2008) studied the micromorphology of the lip and its connection with pollination in several *Liparis* species, including *L. cespitosa*.

Some species, like *Liparis nectarina*, exude a nectar-like substance on the lip; Margonska *et al.* (2018: 88) analysed the lip secretions of Asian *Liparis* and its attraction to insects. It has been observed in other genera (*Neottia ovata* (L.) Bluff & Fingerh. (Bluff & Fingerhuth 1838: 435)) that this nectar is harvested / licked by insects including *Ichneumon* wasps (Claessens & Kleynen 2017: 130).

Recent observations by one of the authors (J.H.) in the Mantadia reserve in the Eastern forest of Madagascar recorded the interaction of ants with *Liparis chantaliae*. Large endemic ants, *Tetraponera grandidieri* Forel (1891: 203), were seen to visit the flowers and eat or harvest a substance from the dark disk of the lip. The anther was partly dislodged by the ant but the pollen stayed in-situ, considering the shape and size of the insect, it could easily have effected pollination (Fig. 15D).

Pollination of orchids by ants is a rare event, they more commonly behave as nectar thieves but in some species they can act as additional pollinators (Claessens & Seifert 2018: 155).

Taxonomy

Tribe MALAXIDEAE

Malaxideae Lindl., *Coll. Bot., App.* (Lindley 1821: app. 3). Type: *Malaxis* Sol. ex Sw. (Swartz 1788: 119).

Liparidinae Lindl. ex Miq. (Miquel 1855: 618), as '*Liparidae*'.

Microstylidinae Benth. (Bentham 1881: 287), as '*Microstyleae*'.

Malaxidinae Benth. & Hook.f. (Bentham & Hooker 1883: 463).

Liparideae Pfitzer (1887: 100).

Oberoniinae Aver. (Averyanov 1991: 121).

Terrestrial or epiphytic, autotrophic or rarely holomycotrophic *herbs*, usually with creeping rhizomes. *Roots* with a velamen. *Stem* cylindrical to swollen and cormous or pseudobulbous. *Leaves* one to several, thin-textured to fleshy, plicate or conduplicate, dorsiventrally flattened or iridiform, rarely terete, alternate or distichous, sheathing at base, articulated or not near base, rarely reduced to basal sheaths. *Inflorescence* terminal, flowers in spirals, whorls or distichously arranged, racemose or sub-umbellate, unbranched; peduncle and rachis cylindrical to markedly winged or angled, glabrous or hairy; floral bracts usually lanceolate, persistent. *Flowers* thin-textured, resupinate or apparently non-resupinate, often translucent. *Sepals* free or sometimes lateral sepals more or less fused, entire, usually spreading. *Petals* free, often smaller than the sepals, linear, often reflexed. *Lip* entire to lobed, recurved, lacking a spur, usually bearing a callus or ridges or mounds, often auriculate at base. *Column* often winged at apex, less frequently with lateral or basal wings, lacking a foot; anther terminal or sub dorsal, two-celled, motile, apical or dorsal, pollinia four in two pairs, often of unequal size, rarely two and deeply divided, laterally compressed, lacking a viscidium or with one or two minute viscidia; stigma entire, ventral; rostellum flap-like, often emarginated, seldom elongated. *Ovary* cylindrical, rarely papillose or winged. *Cap-sule* fusiform to suborbicular. (Adapted from Cribb in Pridgeon *et al.* 2005: 453)

DISTRIBUTION. A tribe of 13 genera widely distributed in the Old and New World tropics and subtropics with a few representatives extending into North Temperate regions.

Artificial key to the Malaxideae in Madagascar, Mascarenes, Comoros and Seychelles

1. Plant bilaterally compressed; leaves iridiform **Oberonia**
- 1'. Plant not bilaterally compressed, with a distinguishable stem, pseudobulb or corm; leaves not iridiform. 2
2. Rachis bilaterally flattened; floral bracts distichous and imbricate **Stichorkis**
- 2'. Rachis not bilaterally flattened; floral bracts not distinctly distichous and not imbricate 3
3. Column very short, less than $\frac{1}{6}$ the length of the lip; lip basal auricles erect around sides of column **Malaxis**
- 3'. Column slender and often arching, often winged towards apex, more than $\frac{1}{3}$ the length of the lip; lip lacking basal auricles, entire to 3-lobed, often with a basal callus, the sides erect on each side of the column **Liparis**

Liparis Rich. (Richard 1817: 21) nom. cons. Type species: *Liparis loeselii* (L.) Rich. (Richard 1817: 38), (basonym: *Ophrys loeselii* L. (Linné 1753: 947).

Leptorkis Thouars (1809: 317).

Leptorchis Thouars (1822: t.25).

Pseudorchis Gray (1822: 199).

Empusa Lindl. (Lindley 1824 sub t.825).

Anistylis Raf. (Rafinesque 1825: 4).

Sturmia Rchb. (Reichenbach 1826: 39).

Paliris Dumort. (Dumortier 1827: 134).

Empusaria Rchb. (Reichenbach 1828: 69).

Platystylis Lindl. (Lindley 1830a: 18).

Diteilis Raf. Herb. Raf. (Rafinesque 1833).

Mesoptera Raf. (Rafinesque 1838: 73).

Dituilis Raf. (Rafinesque 1838: 49).

Iebine Raf. (Rafinesque 1838: 39).

Alipsa Hoffmanns. (Hoffmannsegg 1842b: 228).

Apation Blume ex Ridl. (Ridley 1886b: 279).

Cestichis Thouars ex Pfitzer (1887: 56).

Platystyliparis Marg. (Margonska 2006: 35).

Ypsilorchis Z.J.Liu, S.C.Chen & L.J.Chen (2008: 623)

Terrestrial, lithophytic, or epiphytic rhizomatous *herbs*. *Stem* pseudobulbous, clustered or not, covered with sterile bracts, especially when young. *Leaves* one to several, linear to ovate or elliptical, pleated or not, thin-textured to coriaceous. *Inflorescence* erect or arching, racemose. *Flowers* yellow, green, orange or purple, often translucent, usually resupinate. *Sepals* spreading, dorsal sepal free, lateral sepals sometimes fused for part or all of their length. *Petals* free, often linear and unlike sepals, often reflexed. *Lip* often reflexed, ovate, oblong or flabellate, entire or lobed, usually with a basal callus or swelling, lacking a spur. *Column* incurved-arcuate, clavate, winged towards apex and sometimes at base; anther attached by a slender filament, biloculate, pollinia waxy, ovoid, bilaterally flattened, four in two pairs, each with a small viscidium; rostellum thin-textured, blunt. (Adapted from Cribb in Pridgeon *et al.* 2005: 467).

ETYMOLOGY. From the Greek *liparos*, shiny or greasy, in allusion to the shiny leaves of the type species *Liparis loeselii*.

TAXONOMIC HISTORY. The genus has a complex history. Du Petit-Thouars (1809) described *Leptorkis* and *Stichorkis* as distinct from *Malaxis*. He remarked

that *Leptorkis* would include species such as *Malaxis loeselii* (now *Liparis loeselii*). Du Petit-Thouars (1822) used the alternative spelling '*Leptorchis*' (t.25) and also described the first *Liparis* from Madagascar as *Liparis flavileptis* and *L. purpureoleptis* Thouars, named using Du Petit-Thouars' peculiar method of forming plant names (see Friis & Rasmussen 1975; Rasmussen 1979; Stafleu & Cowan 1976). The traditional names *Malaxis flavescens* and *M. purpurascens* were presented as alternatives, and later authors have invariably chosen the traditional epithets.

Stichorkis is here recognised as distinct, but *Leptorkis* is considered to refer to species currently placed in *Liparis*. *Liparis* Rich. (Richard 1817: 21), has been conserved over *Leptorkis* but not *Stichorkis*. *Leptorkis* is available if *Liparis* is split up following reassessment of the generic limits within Malaxideae. Kuntze (1891) made the combinations of many species in *Leptorchis* (an unnecessary orthographic variant of *Leptorkis*). *Liparis*, as it has been understood historically, is readily characterised by its slender, arcuate, winged column, linear petals, and more or less entire lip, reflexed in the middle and usually bearing a basal bilobed callus. Ridley (1886b) recognised two sections in the genus, *Mollifoliae* and *Coriifoliae*, the former with three, the latter with three or four subsections.

Hooker (1888) and Seidenfaden (1978) both recognised three sections: (1) *Liparis* (*Mollifoliae*), mostly terrestrial with non-jointed, thin membranous leaves; (2) *Coriifoliae*, usually epiphytes with jointed, often coriaceous leaves and lax inflorescences lacking imbricating bracts; and (3) *Distichae* Seidenf. ex Aver. with similar habits and leaves but with distichous, imbricate bracts. Schlechter (1911a) proposed a new system with four subgenera and 12 sections. However, he admitted that circumscriptions of some of his subgenera and sections were poorly defined. Furthermore, by ignoring earlier sectional names his treatment led to confusion.

Ames (1905, 1908) took up *Cestichis* Thouars ex Pfitzer, based on the Madagascan species, for some Asiatic species, but it was not widely followed.

Garay & Romero-Gonzales (1999) established three more sections in *Liparis*: *Decumbentes*, *Aphyllae* and *Tipuloidea*. They also provided a key to the 19 accepted sections of *Liparis*. Margonska *et al.* (2012), in an Appendix, includes a listing of the subgeneric divisions of *Liparis* and their types.

PHYLOGENETICS. Preliminary molecular studies by Cameron (2005) indicate that *Liparis* in the traditional broad sense is polyphyletic. Some clades are well resolved and can be diagnosed morphologically, others less so, requiring further sampling to produce a more robust classification. Several clades are clearly defined, but as sampling, so far, has largely excluded plants from the African and Madagascan region, results concentrate on Asian species. Fortunately, the species of *Liparis* sect. *Distichae* (*Stichorkis* Thouars (1809)) comprise a well-supported clade sister to that including both *Oberonia* and the Asiatic/Pacific clade. Margonska & Szlachetko (2004) established the superfluous generic name *Disticholabris* for this group. *Liparis cespitosa* and its allies: small species with ovoid, one-leaved pseudobulbs and articulate leaves, form a clade that is sister to an Asiatic/Pacific clade of small-flowered lanceolate-leaved species. *Liparis cespitosa* was actually included in *Stichorkis* by Du Petit-Thouars (Thouars 1822) as *S. cestichis* Thouars (alternative name: *Malaxis cespitosa*; see Rasmussen

1979). The generic name *Cestichis* Lindl. ex Pfitzer is based on a misunderstanding of Du Petit-Thouars' way of presenting his new epithets (Friis & Rasmussen 1975). (Adapted from Cribb & Rasmussen in Pridgeon *et al.* 2005: 470)

DISTRIBUTION. *Liparis* is a large cosmopolitan genus of over 460 (Govaerts WCSP 2017) species, subspecies and varieties with a significant representation in Australasia, subtropical and tropical Americas, Africa and a few species in Europe and North America. 46 species are currently recognised in the Madagascar region of which 36 (c. 80%) are endemic. Réunion has 10 species, three of them endemic, Mauritius has four species, the Comoros four species and the Seychelles one. Although some have close relatives further afield, *Liparis cespitosa* is the only species with a much wider distribution in Africa and Australasia.

Taxonomy of *Liparis*

Artificial key to *Liparis* in Madagascar, the Mascarenes, Comoros and Seychelles

Notes: Key features and measurements are based on mature plants with all segments flattened.

If only one growth is available or in case of uncertainty: use keys starting at both 1 and 23.

1. Pseudobulbs 1 – 2; leaves plicate and thin-textured, disintegrating on previous year's growth. 2
- 1'. Pseudobulbs several, clustered, the older ones retaining their leaves. 23
2. Pseudobulbs bulbous or short, less than four times as long as broad, covered by leaf-like sheaths 3
- 2'. Pseudobulbs elongate, at least four times as long as broad, often much longer, covered by sterile sheaths and petioles 16
3. Plants compact, less than 8 cm tall; leaf blade less than 5 cm long 4
- 3'. Plants elongate, more than 8 cm tall; leaf blade more than 5 cm long 11
4. Lip transversely elliptic, distinctly wider than long **L. punctilabris**
- 4'. Lip ovate, about as long as wide 5
5. Lip less than 4 mm long 6
- 5'. Lip more than 5 mm long 8
6. Leaf margins undulate; lip with a bilobed basal callus **L. dryadum**
- 6'. Leaf margins entire; lip lacking a distinct basal callus. 7
7. Floral bracts large, over 4 mm long; anther with a distinct spatulate beak; column scarcely winged . . . **L. bathiei**
- 7'. Floral bracts small, less than 4 mm long; anther cordiform; column winged **L. lutea**
8. Lip ovate-trullate, almost twice as long as broad **L. trulliformis**
- 8'. Lip broadly ovate to orbicular when flattened 9
9. Lip lacking a distinct callus; anther with a spatulate beak **L. bosseri**
- 9'. Lip with a distinctly bilobed basal callus; anther with a short sharp tip 10
10. Leaves papery in texture; lateral sepals overlapping; lip with an entire margin, lacking viscous droplets on the lip **L. flavescens**
- 10'. Leaves leathery; lateral sepals separate; lip margin emarginate at tip **L. nectarina**
11. Lip with a distinct basal callus 12
- 11'. Lip lacking a basal callus, occasionally with a fleshy basal vein **L. densa**
12. Lip with an entire callus at the base 13
- 12'. Lip with a bilobed callus at the base 14
13. Lip with an entire sub-angular callus **L. andringitrana**
- 13'. Lip with a crescent or M-shaped callus. **L. nephrocardia**
14. Leaves suberect, lanceolate; lip margin entire **L. bicornis**
- 14'. Leaves spreading, elliptic; lip margin denticulate 15
15. Inflorescence laxly flowered; flowers c. 15 mm across; anther with a sharp beak **L. bemarahrensis**

- 15'. Inflorescence sub-densely flowered; flowers c. 10 mm across **L. perrieri**
16. Pseudobulbs one-leafed. 17
- 16'. Pseudobulbs two-or more leaved 18
17. Flowers c. 18 mm across; lip transversely elliptic, with a 2-horned basal callus **L. laurentii**
- 17'. Flowers large, 25 mm across; lip elliptic, lacking a basal callus **L. superclareae**
18. Lip transversely elliptic, almost twice as broad as long'. **L. jumelleana**
- 18'. Lip longer than wide. 19
19. Lip twice as long as broad. 20
- 19'. Lip about as long as broad 21
20. Pseudobulbs c. 6 cm long; lip elliptic; column with long rounded wings **L. ochracea**
- 20'. Pseudobulbs 7 – 18 cm long; lip with a small distinct basal callus; column with angular wings. . . **L. sambiranoensis**
21. Lip with a distinctly 2-horned callus at the base 22
- 21'. Lip with an indistinct swelling rather than a callus at the base **L. ornithorrhynchos**
- 22'. Anther lacking a beak; column small with triangular wings. **L. caulescens**
- 22'. Anther beaked; column with elongate wings **L. imerinensis**
23. Pseudobulbs clustered, with the older ones leafy; leaf blade more or less flat, rigid or leathery 24
- 23'. Pseudobulbs very small, globose or ovoid, often clustered; leaves ligulate-lanceolate, thin-textured. 41
24. Pseudobulb or stem at least twice as long as the leaf 25
- 24'. Pseudobulbs less than twice as long as the leaf. 33
25. Leaves ovate to elliptic-lanceolate, less than 4 times as long as broad 26
- 25'. Leaves narrowly lanceolate to ligulate, more than 4 times as long as broad. **L. punctulata**
26. Leaves ovate, less than 2.5 times as long as broad 27
- 26'. Leaves elliptic-lanceolate, 2.5 – 4 times as long as broad. 30
27. Plant 12 – 40 cm tall; lip more than 10 × 5.5 mm, with a dentate margin 28
- 27'. Plant 8 – 18 cm tall; lip less than 8 × 5 mm, with an entire or slightly sinuate margin 29
28. Pseudobulbs round in cross-section; lip triangular at tip, with an indistinct bilobed-rounded callus at the base; anther with a long beak **L. chantaliae**
- 28'. Pseudobulbs angular in cross-section; lip obtuse at tip; callus bilamellar-triangular; anther shortly beaked **L. longicaulis**
29. Lip with a small cushion-shaped callus at the base; anther rounded with a small angular beak . . **L. bernieri**
- 29'. Lip with two distinct rounded calli at the base; anther with a distinctly rounded beak. **L. danguyana**
30. Plant 25 – 30 cm tall, with 3 – 5 asymmetrical leaves; inflorescence with up to 30 flowers **L. rivalis**
- 30'. Plant 15 – 22 cm tall, with 2 – 3 symmetrical leaves; inflorescence up to 15-flowered 31
31. Stem very slender; leaves distinctly petiolate; lip suborbicular with a rounded tridentate basal callus. . **L. gracilipes**
- 31'. Stem relatively stout; leaves lacking petioles; lip auriculate at the base, with a tridentate but not rounded callus at the base 32
32. Lateral sepals folded beneath the lip; lip orbiculate, with a distinct 2-horned basal callus **L. listeroides**
- 32'. Lateral sepals in a vertical plane with the lip; lip pandurate with an elongated rounded callus and two small ones either side **L. vulturiceps**
33. Pseudobulbs one-leafed. 34
- 33'. Pseudobulbs 2- or more -leaved 36
34. Leaf base subcordate; lip with an indistinct basal callus **L. clareae**
- 34'. Leaf base attenuate; lip with a distinct basal callus 35
35. Leaf lanceolate with longitudinal silvery bands; peduncle sheaths and floral bracts lanceolate; lip with an undulate margin. **L. magnifica**
- 35'. Leaf narrowly ovate, lacking silvery bands; peduncle sheaths and floral bracts cordate; lip with a serrate margin **L. warpurii**
36. Leaves ovate, about twice as long as broad. 37
- 36'. Leaves oblong to ligulate, more than four times as long as wide. 38
37. Leaves somewhat fleshy-coriaceous, with undulate margins, purple; lip with a serrate margin; anther sharply beaked **L. salassia**
- 37'. Leaves rather papery, green; lip with subdentate margins; anther with a spatulate beak . . . **L. zaratananae**
38. Pseudobulbs bulbous, less than twice as long as wide 39
- 38'. Pseudobulbs stem-like, at least four times as long as broad. 40
39. Leaves leathery, longly attenuate at the base; lip with callus-like ridges at the base; anther roundly beaked. **L. foliosa**

- 39'. Leaves papery, shortly conduplicate at the base; lip with a distinctly rounded callus; anther sharply beaked **L. longipetala**
40. Rhizome elongate, ascending; leaves lanceolate, less than 5 times as long as broad; lip obcordate-cuneate, with undulate margins **L. polycardia**
- 40'. Plant caespitose; leaves narrowly lanceolate, about eight times as long as broad; lip obovate, serrate on the margins **L. stenophylla**
41. Plant with one-leaved pseudobulbs 42
- 41'. Plant with two-leaved pseudobulbs 44
42. Plant with stolons, lip with a distinct conical callus **L. ambohimangana**
- 42'. Plant lacking stolons, lip callus not conical 43
43. Flowers very small c. 5×4 mm; lip lacking a distinct callus **L. cespitosa**
- 43'. Flowers small c. 8×6 mm; lip with a distinct bilobed callus **L. scaposa**
44. Plant with a distinct elongate rhizome; leaves ovate, less than twice as long as wide **L. bulbophylloides**
- 44'. Plant with a very short rhizome; leaves oblong-lanceolate, more than twice as long as wide 45
45. Column wings short, lobular, lip callus distinct, bilobed **L. scaposa**
- 45'. Column wings long, angular, lip callus indistinct 46
46. Pseudobulbs globular, inflorescence laxly flowered, lip callus a slightly raised disk **L. parva**
- 46' Pseudobulbs elongate; inflorescence densely flowered towards the apex, lip callus 'M'-shaped . . . **L. cladophylax**

Liparis ambohimangana Hermans (in Hermans *et al.* 2007: 214); Cribb & Hermans (2009: 153). Type: Madagascar, Ankeramadinika forest, *François* 4 in herb. Perrier 18548bis (three small plants with stolons selected here, excluding the larger plant without stolon which is *L. scaposa*, lectotype P designated here).

Liparis monophylla H.Perrier (1936: 248) non Ames (1920: 294); Perrier (1939: 276). Type as above. The cited syntypes, Decary 6222 and Perrier 18548, are *Liparis scaposa*.

Dwarf epiphytic or terrestrial *plant*, 1.5 – 5 cm tall at most, with long, slender, pale stolons 0.8 – 1.4 mm diam., up to 9 cm long but often shorter, carrying intermittent scale-like bracteoles, the new pseudobulbs emerging from the extremities. *Pseudobulbs* conical or globular, single-leaved, $3 - 12 \times 2.8 - 7$ mm, more or less covered with thin white sheaths. *Leaf* emerging from the apex of the pseudobulb, lanceolate to narrowly lanceolate, acute, $1.5 - 4.8 \times 0.5 - 1.4$ cm, with a distinct central vein, petiole narrow, c. 10 mm long. *Inflorescence* a little longer than the leaf, up to 7 cm long, c. 1 mm diam., carrying an occasional sterile scale, with 1 – 8 flowers towards the apex but generally fewer. *Peduncle* wiry, $\frac{3}{4}$ of the inflorescence. *Rachis* densely racemose. *Floral bracts* $\frac{1}{3}$ the length of the ovary, ovate, acute, $1.4 - 2.3 \times 0.7 - 1.2$ mm. *Flowers* small, c. 8×6 mm pale yellowish-green to pale yellow, the column and lip a little darker, the disk and callus more yellow, anther greenish-white. *Pedicel* and *ovary* fusiform, $4.5 - 6.9 \times 0.3 - 1.5$ mm. *Dorsal sepal* lanceolate to ligulate, $4 - 6.9 \times 1 - 1.8$ mm. *Lateral sepals* oblong-falcate, $3.2 - 5.1 \times 1.5 - 2.4$ mm. *Petals* linear, $4.1 - 6 \times 0.2 - 0.3$ mm. *Lip* broadly oval to suborbicular, $2.3 - 3.7 \times 2.2 - 3.2$ mm, broadly winged at the base, more or less sinuate at the margins, with a

large (1.7 – 2.1 mm) conical callus at the base, callus convex at the anterior margin. *Column* arched, with characteristic auriculate wings just below the apex, $3.2 - 4 \times 0.2 - 1.2$ mm. *Anther* very small, $0.4 - 0.6 \times 0.3 - 0.6$ mm, truncate at the anterior margin. *Pollinia* two pairs, $0.2 - 0.4 \times 0.15 - 0.3$ mm. *Seed capsule* oblong or oblanceolate, $7 - 10 \times 3.5 - 4$ mm.

RECOGNITION. A very small plant with prominent stolons, a single lanceolate leaf, a peduncle about $\frac{3}{4}$ of the few-flowered inflorescence and small flowers with a wide lip with a large conical callus at base, appearing as a single swelling in herbarium material, a column with distinct auriculate wings at the apex, and an anther lacking a distinct beak.

Liparis ambohimangana is similar to *L. scaposa* (Table 1) with which it has an overlapping distribution but *L. scaposa* does not produce stolons, the plant is larger with a conical pseudobulb, a shorter and narrower leaf (sometimes two), the inflorescence generally longer, slightly larger flowers and smaller and more roundly lobed callus at the base of the lip. It is also similar to *L. cespitosa* which lacks stolons and has a broadly oval to suborbicular lip (vs oblong-obtuse in *L. cespitosa*) and lacks a distinct callus.

DISTRIBUTION. Endemic to Madagascar: Antananarivo, Fianarantsoa and Toamasina provinces. Map 5. Records from Réunion (Szelengowicz *et al.* 2011: 11 and Szelengowicz & Tamon 2013: 350 – 351) are referable to *Liparis scaposa*.

SPECIMENS EXAMINED. MADAGASCAR. Ankeramadinika forest, May 1928, *François* 4 in Herb. Perrier 17548bis (in part, P) lectotype; s. loc., May 1970, Bosser 20317 (P); Fivondronana Moramanga, Ambatovy, 1106 m, June 2008, Antilahimena 6292 (MO, P, TAN); Ambatovy, 1124 m, May 2010, Ramahenina & Ratodimanana 32 (K, MO, P); Ambatovy, 1080 – 1098

Table 1. Comparison of *Liparis ambohimangana*, *L. cespitosa*, *L. parva* and *L. scaposa*.

	<i>L. ambohimangana</i>	<i>L. cespitosa</i>	<i>L. parva</i>	<i>L. scaposa</i>
Plant	up to 5 cm, clear stolon	up to 8 cm, no stolon	2 – 3 cm, no stolon	up to 8 cm, no stolon
Pseudobulb	globular to conical	ovoid	globular	conical
Leaves	1, lanceolate	1 (rarely 2), lanceolate	2, lanceolate	1 or 2, lanceolate
Inflorescence	up to 7 cm, 1 – 8 flowers, dense raceme	up to 8 cm, 5 – 20 flowers, dense raceme	c. 6 cm zig-zag, 6 – 12 flowers, loose raceme	up to 14 cm, 3 – 7 flowers, dense raceme
Dorsal sepal (mm)	4 – 6.9 × 1 – 1.8	1.5 – 2.5 × 0.8 – 1.2	c. 6 × 0.8	5 – 7 × 1.2 – 1.6
Lateral sepals (mm)	3.2 – 5.1 × 1.5 – 2.4	1.9 – 2.5 × 0.9 – 1.25	c. 5.5 × 2	3.5 – 5.1 × 1.8 – 2.5
Petals (mm)	4.1 – 6 × 0.2 – 0.3	1.5 – 2.5 × 0.3 – 0.5	c. 7 × 0.5	5.5 – 6.7 × 0.3 – 0.4
Lip (mm)	2.3 – 3.7 × 2.2 – 3.2	1.9 – 2.5 × 1.1 – 1.75	c. 5 × 3.6	3.9 – 5.5 × 4.2 – 5.5
Lip callus	large, conical	small swelling	small swelling	medium, rounded lobes
Column (mm)	3.2 – 4 × 0.2 – 1.2	1.1 – 1.6 × 0.5	4 × 1	3 – 4 × 0.8 – 1
Distribution	Madagascar: Antananarivo, Fianarantsoa and Toamasina prov.	Global	Madagascar: Fianarantsoa & Toamasina prov.	Madagascar: Antananarivo, Toamasina prov. & Réunion
Altitude (m)	1000 – 1200	400 – 1400	1000?	1000 – 1600

m, May 2012, *Ambatovy Shade House* 816 (BRLU, K, MO, P, TAN); Ambatovy, May 2012, 1080 – 1098 m, *Ambatovy Shade House* 1177 (BRLU, K, MO, P, TAN); Ambatovy, 1100 m, Aug. 2012, *Stévant et al.* 4605

0 100 200 km

Map 5. Distribution of *Liparis ambohimangana*.

(BRLU, K, MO, P); Fianarantsoa, Ranomafana area, April 2018, *Hermans* 8211, 8212, 8216.

HABITAT. Mainly epiphytic on branches and at the base of trees, in moss. On tree ferns (*Cyathea*), on *Harungana madagascariensis* Lam. ex Poir. (Lamarck 1804: 314). Terrestrial in humus or moss, moss-covered rocks and on the forest floor. Altitude: 1000 – 1200 m.

CONSERVATION STATUS. Category **EN**: The extent of occurrence (EOO) of *Liparis ambohimangana* is estimated to be 5,320 km² (which exceeds the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 12 km² (which falls within the limits for Endangered status under the criterion B2). With only three known subpopulations representing three locations (sensu IUCN), this rare species has been preliminarily assessed as EN using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. April to August.

ETYMOLOGY. The species name refers to the Ambohimanga area in the Madagascan Highlands and the origin of Raymond Decary's 1928 collection that was once associated with the type material. Perrier's name *Liparis monophylla* refers to the single leaf of the plant.

NOTES. This species was described by Perrier in 1936 but the name had already been used in 1920 by Ames for a plant from the Philippines, it was re-named in 2007 (Hermans *et al.* 2007: 214).

Perrier (1936: 249) listed three collections in his description of *Liparis monophylla*: Ambohimanga, near Tananarive (Decary 6222, April 1928); Ankeramadinika

forest (Perrier 18548, May 1928); same locality (*François* 4). As often the case, he did not designate a type specimen let alone a holotype. A number of sheets are annotated as 'types' by him in the Paris herbarium:

1. Two sheets of Decary 6222 (P00095463 and P00095464), they contain several flowering plants and dissections of Decary '6422' (in error for 6222, Decary 6422 is a plant of the Fabaceae family) and of Perrier 18548, the label is annotated in Perrier's hand as 'Type'.
2. One sheet of *François* 4 (numbered 18548bis in Perrier's herbarium P00095466), this also is annotated as 'Type'.
3. One sheet of Perrier 18548 (P00095465), this is not indicated as 'Type' but as 'sp. n'.

During field observations two of the authors (J.H. and J.-M.H.) realised that there were two distinct species within the dwarf Madagascan *Liparis* with a single leaf and a distinct callus at the base of the lip. One is generally terrestrial with a relatively short leaf, an inflorescence invariably much longer than the leaf, without stolon and with a roundly lobed callus at the base of the lip. A second is generally epiphytic, with an inflorescence hardly longer than the leaf, with a distinct stolon and with a much larger conical callus at the base of the lip.

Perrier's descriptions (1936: 248 – 249) and (1939: 276) could apply to both these species but he was very clear that his *Liparis monophylla* had pale filiform stolons and he also used this characteristic to compare it with *L. cespitosa*, in addition he mentioned a prominent callus. His illustration (1939: 283) also shows long thin stolons. Although not obvious in the type material, the only other *Liparis* in the region reported (Perrier 1939: 283) to have a stolon is *L. parva* which has two leaves, flowers a third larger and a differently shaped anther and column (see Table 1).

Detailed analysis of the material indicated as types by Perrier clearly shows that they contain a mixture of two different species and this has been the cause of much confusion: all the plants on Decary 6222 and on Perrier 18548 have no stolons and habit and flowers that correspond clearly with *Liparis scaposa* which, during Perrier's time, was only recognised from Réunion. The sheet of *François* 4 (= Perrier 18548bis) has one flowering plant of *L. scaposa* but three plants with flower fragments and buds only but with clear stolons that correspond well with Perrier's description of *L. monophylla*. It is likely that Perrier assembled all plants with a single leaf that were not *L. cespitosa* as his new species, they may even have become mixed up, especially in specimen Perrier 18548bis.

The stoloniferous plants in *François* 4 (= Perrier 18548bis) are here designated as the lectotype of *Liparis ambohimangana* and the other collections

(Decary 6222, Perrier 18548 and the large plant without stolon in Perrier 18548bis) are classified as *L. scaposa*. Perrier's description combined with the newly selected lectotype allow precise identification and should avoid any future ambiguity.

ILLUSTRATIONS. Figs 1, 2; Perrier (1939: 283); the illustrations in Cribb & Hermans (2009: 157) from Madagascar and Szelengowicz *et al.* (2011: 11); Szelengowicz & Tamon (2013, 350 – 1) from Réunion are *Liparis scaposa*.

***Liparis andringitrana* Schltr.** (Schlechter 1924: 135); Perrier (1939: 287); Hermans *et al.* (2007: 215); Cribb & Hermans (2009: 153); Hervouet (2018: 404). Types: Madagascar, Andringitra massif, c. 1800 m, Feb. 1922, Perrier 14396 (P00094939) Lectotype P designated here; Perrier 14396 (P00094940) islectotype.

***Liparis henrici* Schltr.** (Schlechter 1924: 139) **synon. nov.**; Perrier (1936: 255); Perrier (1939: 292); Hermans *et al.* (2007: 219); Cribb & Hermans (2009: 154). Types: Madagascar, Andringitra massif, Feb. 1922, c. 1800 m, Perrier 14395 (P00094983) lectotype P, designated here; Perrier 14395 (P00094982) islectotype.

***Liparis latilabris* Schltr.** (Schlechter 1924: 142) non Rolfe (1903: 6) **synon. nov.** Type: Madagascar, Andringitra massif, Feb. 1922, c. 1800 m, Perrier 14394 (holotype P).

***Liparis verecunda* Schltr.** (Schlechter 1924: 150) **synon. nov.** Types: Madagascar, Feb. 1919, Ambatofinandrahana, Perrier 12420 (P00094985) lectotype P, designated here; Perrier 12420 (P00094986) islectotype.

***Liparis rectangularis* H. Perrier** (1936: 254) **synon. nov.**; Perrier (1936: 254); Hermans *et al.* (2007: 222); Cribb & Hermans (2009: 154). Type: Madagascar, Mt Maromizaha, near Analamazoatra, Perrier 16043 (holotype P).

Small to medium size, erect terrestrial or lithophytic plant, 6 – 16 cm tall on a short rhizome, the older pseudobulbs not retaining their leaves, roots filiform, flexuose, minutely pilose. *Pseudobulbs* cylindrical to oblong, more or less compressed-angular, sometimes watery in substance when young, enveloped by 2 – 3 sheaths plus often carrying one to two leaf-like sheaths, 2 – 7.5 cm long, c. 1 – 1.5 cm diam., the flowering growth carrying 2 – 3 erectly-spreading leaves, the older ones erect or oblique, covered by papery sheaths. *Leaves* oval to elliptic, apiculate or shortly acuminate, thin, sometimes margins sub-crenulate, more or less narrowed into a short petiole (1.3 – 3 cm), blade 4.5 – 15 × 2 – 5 cm, with prominent veins. *Inflorescence* the same length as or exceeding the leaves, up to 12 cm long carrying 3 – 12 flowers. *Peduncle* with 1 – 2 lanceolate sheaths, acuminate.

Fig. 1. *Liparis ambohimangana*. A habit; B inflorescence; C flower; D floral bract; E dorsal sepal; F lateral sepal; G petal; H lip from above; J lip, oblique view; K column and lip, side view; L column, front view, anther cap removed; M anther cap, dorsal view; N anther cap, ventral view; P pollinia. From *Hermans* 8211 (K). DRAWN BY JUDI STONE.

Fig. 2. *Liparis ambohimangana*. **A** habit; **B** habit showing stolon; **C** flower. PHOTOS: **A, B** JOHAN HERMANS; **C** JEAN-MICHEL HERVOUET.

Rachis sub-densely racemose, up to 7 cm long. *Floral bracts* erectly spreading, lanceolate, acute, the lower ones as long as the ovary, the higher ones shorter, $4.5 - 7.1 \times 1.9 - 2.1$ mm. *Flowers* small to medium size, erectly spreading to suberect, av. 10×8 mm, yellowish or pale yellow-brown, greenish yellow, becoming more orange, column yellow towards the apex, anther white.

Pedicel and *ovary* $6 - 9 \times 1.2 - 4$ mm, glabrous, strongly winged to slightly ridged, new flowers opening whilst seed pods develop below. *Dorsal sepal* erect to arching, narrowly lanceolate, somewhat obtuse, base cordate-auriculate, $5.6 - 9.5 \times 0.9 - 2.1$ mm. *Lateral sepals* semi-oval to oblong, folded beneath the lip, $4.5 - 7 \times 2.1 - 3.2$ mm. *Petals* linear, slightly broader at the base, $5.9 -$

$8 \times 0.3 - 0.9$ mm. *Lip* somewhat curved, broadly oval to flabellate, the blade suborbiculate to obovate but occasionally broader than long, widest towards the middle, base slightly narrowed with the basal auricles fairly long (c. 1 mm) and obtuse, the front margin rounded and more or less subcrenulate, basal callus sub-angular to transversally oblong, truncate, at the base partly extending into 2 keels and merging with the outer veins, often quite obsolete in dried specimens, $4.1 - 6.8 \times 3.5 - 6.2$ mm. *Column* slightly incurved, $2.6 - 3.9 \times 0.7 - 1.2$ mm, with small rounded wings protruding by the stigma. *Anther* with a short triangular beak c. 0.6×1 mm. *Pollinia* in two pairs, oval, av. 0.4×0.6 mm. *Seed capsule* somewhat ridged, av. 15×5 mm.

RECOGNITION. *Liparis andringitrana* is characterised by the 2 – 3-leaved plant on a somewhat elongate, more or less flattened, pseudobulb, with thin strongly veined leaves on a 1.5 – 3 cm petiole. Medium sized flowers with the lip rounded and generally subcrenulate at the front, distinct wings at the base and an angular callus at the base. Anther slightly beaked. The seed capsules are often semi-erect and persistent.

It is similar to *Liparis nephrocardia* Schltr. (Schlechter 1924: 145) both in habit, inflorescence and flower but *L. andringitrana* is generally larger and taller, the lip shape is slightly different (broadly oval vs obcordate) and the callus is much less obvious and not 'V'-shaped, the anther beak is angular vs obtuse. Similar to *L. flavescens* but differs by the more elongate pseudobulb and leaf petiole, slightly larger flowers and lip callus (Table 2).

It resembles *Liparis bosseri*, described below, but that species is much shorter and smaller, with a shorter inflorescence and has flowers with the anther with a spatulate beak (vs short and rounded). It differs from the mainland African *L. bowkeri* by the smaller plant and flowers with a different lip and column (Table 3). **DISTRIBUTION.** Probably endemic to Madagascar in Antananarivo, Fianarantsoa, Toamasina and Toliara provinces (Map 6). Szelengowicz & Tamon (2013: 358) cite and illustrate a plant assigned to this species from Réunion but because of the lack of vouchered material and the quality of the photographs it is impossible to ascertain if this identification is correct. One of the labels on the type material (P00094939) has 'Manongarivo' massif crossed out by Perrier and changed to 'Andringitra' massif. Manongarivo is in Northern Madagascar in the Tsaratanana mountain range. The Andringitra location fits with Perrier's collection numbers in that area and is therefore correct.

SPECIMENS EXAMINED. MADAGASCAR. Andringitra massif, c. 1800 m, Feb. 1922, *Perrier* 14396 (P00094939) lectotype P; *Perrier* 14396 (P00094940); Andringitra massif, Feb. 1922, c. 1800 m, *Perrier* 14395 (P00094983)

(lectotype P); *Perrier* 14395 (P00094982) (isolectotype P); Andringitra massif, Feb. 1922, c. 1800 m, *Perrier* 14394 (holotype P in part); Ambatofinandrahana, Feb. 1919, *Perrier* 12420 (P00094985) (lectotype P); *Perrier* 12420 (P00094985) (isolectotype P); Mt Maromizaha near Analamazoatra, c. 1000 m, Feb. 1924, *Perrier* 16043 (holotype P); Central, Mt Ibity, c. 800 m, Feb. 1914, *Perrier* 7039ter (P); Ambohimanga forest, June 1915, *Alleizette* s.n. (P); Anjavidilana, Andringitra, Jan. 1950, *Guillaumet* 3720 (P, TAN); Andringitra, Jan. 1971, *Guillaumet* 3815 (TAN); High valley of the Menarakaka, E of Ihosy, 100 – 800 m, Jan. 1955, *Humbert* 28550 (P); Fianarantsoa, 39 km N of Ambositra, 1250 – 1350 m, Jan. 1974, *Croat* 29475 (K, MO); Toliara, road from Ifarantsa to Enaniliha, 630 m, Feb. 1995, *D. DuPuy et al.* M869 (K); Kitsamby forest, near Soavinandriana, 1997, *Hermans* 3553 (K); Antananarivo, near Angavokely forestry station, Dec. 1997, *Hermans* 2107 (K); along RN4 to Mahajunga, Dec. 1997, *Hermans* 3941 (K); Fianarantsoa, Andringitra foothills, near Soavihiny, May 2001, 1095 m, *Hermans* 2860; Toamasina, Moramanga, Andasibe, Menalamba, April 2005, 960 m, *Rakotovoao & Edmond* 1868 (TAN); Andringitra, Ambarafaranditra, 1770 m, Jan. 2005, *Fischer & Andriantiana* 2095 (WU); Toamasina, fokontany Ampitabe, Ambatovy, 1193 m, May 2008, *Rakotondrafara* 741 (MO, P, TAN); Toamasina, Alaotra Mangoro, Sahavaharina forest, 1012 m, April 2009, *Antilahimena* 7053 (MO, P, TAN); Toamasina, Andasibe, Eulophiella Lodge forest, May 2018, *Hermans* 8215 (K).

HABITAT. Montane forest remnants. Amongst rock, in shade beneath shrubby undergrowth, in leaf litter, moss forest. Altitude: 600 – 1800 m.

CONSERVATION STATUS. Category **VU**: The extent of occurrence (EOO) of *Liparis andringitrana* is estimated to be 38,418 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 32 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis andringitrana* is known from six subpopulations representing eight locations (sensu IUCN), and has this rare species has thus been preliminarily assessed as VU using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. Annual fires in the Ambatofinandrahana and Ibity areas have affected several colonies of the species. Its habitat is also affected by harvesting of wood for charcoal production in the Maromizaha reserve.

FLOWERING TIME. December to May.

ETYMOLOGY. Refers to the type locality of the Andringitra mountain range in SE Madagascar, now

Table 2. Comparison of the type specimens of: *Liparis andringitrana*, *L. flavescens*, *L. henrici*, *L. nephrocardia* and *L. rectangularis*, based on average measurements.

	<i>L. andringitrana</i>	<i>L. flavescens</i>	<i>L. henrici</i>	<i>L. nephrocardia</i>	<i>L. rectangularis</i>
Specimen	Perrier 14396 (P)	Thouars & Bory s.n. (P)	Perrier 14395 (P)	Perrier 15746 (P)	Perrier 16043 (P)
Plant height (cm)	12	9	11	8	12
Pseudobulb (cm)	2.5 × 1.5	2.5 × 1.3	4 × 1	2 × 0.8	3 × 0.7
Leaves	12 × 4.5 cm	8 × 3 mm	9 × 4 cm	7 × 2.5 cm	10.5 × 3.2 cm
Inflorescence (cm)	13	15	15	5.5	13
No of flowers	c. 12	c. 10	c. 14	c. 8	c. 12
Dorsal sepal (mm)	8.5 × 1.1	7 × 0.7	8.5 × 1.8	6.5 × 1.1	7.3 × 0.8
Lateral sepals (mm)	6 × 2.2	6.5 × 2.7	7 × 3.2	6.5 × 2.3	6 × 2.4
Petal (mm)	7 × 1	7 × 0.3	7.5 × 0.8	5 × 0.3	5.5 × 0.3
Lip (mm)	4.2 × 3.5	5.3 × 5	5.5 × 4.5	4 × 3.5	5 × 4
Lip callus	indistinct	bi-lobed ridge	obscure, bi-lobed	bi-lobed	indistinct ridges
Column	transversal 2.5 × 0.8 mm, small round wings	4 × 0.8 mm, roundly winged	3.5 × 1.3 mm, roundly winged	2 × 0.6 mm, triangular wings	2.5 × 0.6 mm, roundly winged
Anther	sharply beaked	sharply beaked	short sharply beaked	sharply beaked	sharply or roundly beaked?
Distribution	Madagascar, E-Central	Mascarenes, Seychelles (Madagascar?)	Madagascar: Fianarantsoa prov., Andringitra	Madagascar: Antsiranana, Toamasina prov	Madagascar: Toamasina prov.
Altitude (m)	c. 1800	400 – 1500	c. 1800	600 – 1800	c. 1000
Flowering	Jan. – Feb.	March – June	Feb.	Dec. – March	Feb.

a National Park. *Liparis henrici* was named by Rudolf Schlechter for Henri Perrier de la Bâthie (1873 – 1958), *L. latilabris* refers to the broad lip, *L. rectangularis* presumably refers to the angles of the lip and *L. verecunda* probably refers to the diminutive nature of plant and flower.

NOTES. Schlechter's descriptions of *Liparis andringitrana*, *L. henrici*, *L. latilabris* and *L. verecunda* are just a few pages apart and could easily apply to all four species; strangely he does not compare them with each other but does so with other species. In the descriptions there are differences in the shape of the lip callus and curvature of the column which are never very clear in dried material. *Liparis andringitrana*, *L. henrici* and *L. latilabris* were collected by Perrier in the Andringitra mountains, presumably from almost the

same spot with only one number difference in collecting code. Schlechter also illustrated all four species in 1932. Perrier in his revision of *Liparis* from Madagascar (1936: 242) made *L. latilabris* and *L. verecunda* synonyms of *L. henrici*, he did not explain the reasons. He first mentioned them under 'species not satisfactorily known' and then listed them as synonyms of *L. henrici* further in the text. In addition Schlechter was unaware that the name *L. latilabris* had previously been used by Rolfe (1903: 6) for an Indochina/Vietnam species.

On examination of herbarium material of *Liparis andringitrana*, *L. henrici*, *L. latilabris*, *L. verecunda* and *L. rectangularis* (Table 2) it becomes obvious that they consist of one, variable species. They all share the same plant habit, leaf-shape, lip, lip callus, column and

Table 3. Comparison of *Liparis andringitrana*, *L. bowkeri* and *L. flavescens*.

	<i>L. andringitrana</i>	<i>L. bowkeri</i> (mainland Africa)	<i>L. flavescens</i>
Plant height (cm)	up to 16	up to 30	up to 11
Pseudobulb (cm)	2 – 7.5	7 × 5	1 – 5
Leaf shape	oval to elliptic	lanceolate to ovate	lanceolate or ovate
Leaf size (cm)	4.5 – 15 × 2 – 5	5 – 14 × 2 – 7.5	5.6 – 6.5 × 1.2 – 3.9
Inflorescence (cm)	up to 12	up to 20	up to 22 (generally much shorter)
Floral bract (mm)	up to 4.5 – 7.1 × 1.9 – 2.1	10 – 15	2.5 – 5 × 1.2 – 1.8
Dorsal sepal (mm)	5.6 – 9.5 × 0.9 – 2.1	8 – 11 × 1 – 2.5	4.7 – 8 × 0.9 – 1.4
Lateral sepals (mm)	4.5 – 7 × 2.1 – 3.2	6 – 9 × 2.5 – 4	4.8 – 7.1 × 2.7 – 3
Petal (mm)	5.9 – 8 × 0.3 – 0.9	5 – 12 × c. 0.5	5.8 – 7.6 × 0.3 – 0.5
Lip (mm)	4.1 – 6.8 × 3.5 – 6.2	5 – 7 × 6 – 8	5 – 6.3 × 4.9 – 5.5
Column (mm)	3 – 3.5 × 1.2 – 2	3 – 4	1.8 – 3.9 × 0.8 – 1.2
Distribution	Madagascar, E-Central	Mainland Africa, Ethiopia to S Africa	Mascarenes, Seychelles (Madagascar?)

0 100 200 km

Map 6. Distribution of *Liparis andringitrana*.

anther. There is a great variance in pseudobulb, leaf size and lip shape but there are a number of intermediate forms.

In plant and flower habit *Liparis latilabris* corresponds well with the typical form of *L. andringitrana* but the shape of the lip is puzzling: in his description Schlechter describes it as reniform and wider than long, this is reflected in his drawing and also in the type material but Perrier's drawing of the lip kept with the type shows a more typical oval form. On examining the type sheet of *L. latilabris* (Perrier 14394) the left hand plant has a lip that is broader than long whilst the other plants have a more typical oval lip of *L. andringitrana*. *Liparis latilabris* is therefore kept as a synonym.

Liparis verecunda is identical in plant habit, lip shape, column and anther to *L. andringitrana* and is also kept as a synonym.

Liparis rectangularis is known only from the holotype and consists of two plants collected in the Maromizaha forest in the east of Madagascar. The type is accompanied by a drawing by Perrier of the lip and anther. On dissecting the flowers it is obvious that his drawing somewhat exaggerates the size of the basal wings and the rectangular angles of the blade. This exaggeration

is repeated in the original description and in his key (Perrier 1939: 284). It is a local variant of *L. andringitrana* with which it shares the same habit, flower size, lip and column, it is therefore considered a synonym (Table 2).

The lectotype material of *Liparis henrici* consists of generally bigger plants and a longer stem than those of the type of *L. andringitrana* (Table 2). The flowers however, are of a similar size and shape, the lip, lip callus, column and anther shape are identical to those of *L. andringitrana*. In his description and key Perrier (1939: 288) follows Schlechter's flawed description and singles out the flattened watery bulbs and obtuse rounded anther to differentiate *L. andringitrana* from the other species. The flattened bulbs are not uncommon in plants labelled as *L. henrici*, the pseudobulb shape is generally somewhat indistinct in dried material and their soft watery nature is likely to be environmental and has been observed in young pseudobulbs of other species, including *L. densa*. Perrier is adamant that the anther of *L. andringitrana* is rounded at the front (tout à fait arrondie en avant) but on dissecting the type material it is clear that the anther is shortly beaked as in the type of *L. henrici*. Lip and callus shape are also used as distinguishing characters between the different species but herbarium material has confirmed a great variety of lip shapes, even within a single collection. When dried, the shape of the callus remains as somewhat indistinct raised ridges only.

Extensive field observations by two of the authors (J.H. & J-M.H.) confirmed the great variability within the species: mature flowering plants within different colonies varied from six cm to more than 15 cm, some with distinct pseudobulbs and large leaves, others were more diminutive. Length of inflorescence was also found to be variable but the size and shape of the flowers was consistent. The callus of the lip was always prominent as was the anther beak. It was generally impossible to key-out or differentiate between the different populations in Andringitra and the Eastern forest around Andasibe.

Based on these observations it was decided to treat *Liparis andringitrana*, *L. henrici*, *L. latilabris*, *L. verecunda* and *L. rectangularis* as one, variable species. *Liparis andringitrana*, based on Perrier 14396 (P00094939), was chosen as the most representative and complete. The type material of *L. henrici* is less representative of the typical form and has a few deformed flowers.

There are two herbarium sheets of the type of *Liparis andringitrana* (Perrier 14396); sheet P0094939 has the most representative plants and was therefore chosen as the lectotype, sheet P0094940 has a single plant and the label has 'Manongarivo' as the collecting locality on sheet P0094939, this is an error corrected by Perrier, it is chosen as an isolectotype. There are two herbarium sheets of the type of *L. henrici* (Perrier

14395); sheet P0094983 has the most representative plants and was therefore chosen as the lectotype, sheet P0094982 is an isolectotype. The same was done with the type material of *Liparis verecunda*. The type sheet Perrier 14394 of *L. latilabris* in P has three plants and there seems to be considerable variability in the flower, some flowers show the typical *L. henrici* lip but others have a somewhat deformed lip that is wider than long.

ILLUSTRATIONS. Figs 3, 4; Schlechter (1932: T.51, T.53-4, 56); Hervouet (2018: 404).

***Liparis bathiei* Schltr.** (Schlechter 1924: 135); Perrier (1939: 291); Hermans *et al.* (2007: 215); Cribb & Hermans (2009: 152). Types: Madagascar, Ambatolampy (Ankaratra), 1500 m, March 1921, Perrier 13548 (P00094950) (holotype P); Ambatolampy, Feb. 1925, Perrier 13548 (topotypes G (G00354728), K (K000242139) P (P000951-2)).

Very small to small, erect, terrestrial *plant*, 6 – 11.5 cm high; rhizome short, roots, filiform, flexuose, more or less villous. *Pseudobulbs* short, 7 – 10 mm high, 5 – 9 mm diam. in the middle, sub-globular. *Leaves* soft, generally 2 – 3, rarely 4, erect-spreading from the flowering pseudobulbs, oblong or elliptic-acute to somewhat obtuse, 4.2 – 6.1 × 2.2 – 3.2 cm, gradually narrowed into a petiole towards the base. *Inflorescence* erect, sub-flexuose, about the same length as the leaves, carrying a few basal sheaths, up to 10 cm long. Raceme densely flowered, elongate, up to 7 cm, carrying 10 – 20 flowers. *Floral bracts* leaf-like, erectly spreading, lanceolate, acuminate, the lower ones often a little longer than the ovary, 4 – 7 × 3.5 – 4 mm, the higher ones a little shorter, 4 × 2.5 mm. *Flowers* very small to small, erectly spreading, overall c. 4 × 5 mm, yellow green. *Pedice*l and *ovary* 4 – 5 mm, glabrous, roundly ridged. *Dorsal sepal* erect, narrowly lanceolate, obtuse, 4.5 – 5.2 × 0.5 – 1.8 mm, the base cordate-auriculate. *Lateral sepals* folded beneath the lip, strongly 3-veined, obliquely oval or oblong, 3.8 – 4.8 × 1.8 – 2.7 mm. *Petals* narrowly linear, obtuse, recurved, 4.2 – 5 × 0.3 – 0.4 mm. *Lip* oval to lozenge-shaped, obtuse, base cordate-auriculate, with the blade somewhat angular at the base, anterior margin irregular, the tip more or less apiculate and recurved, a small obsolete callus near the base, with a central gutter with radiating veins along its length, 3.1 – 4.2 × 3 – 3.8 mm. *Column* a little curved, short 1.8 – 2.4 mm and thick c. 1 mm, wings barely present. *Anther* clavate, 1 – 1.2 mm long, including the narrow rounded upturned beak, 0.6 – 0.9 mm wide. *Pollinia* oval c. 0.3 mm diam.

RECOGNITION. One of the smallest members of the genus in Madagascar. It has short and subglobose

pseudobulbs, a densely flowered rachis with 10 – 20 very small to small flowers, relatively large floral bracts, a lip lacking a prominent callus, and a small column, with an anther with a narrow upturned beak.

Liparis bathiei resembles *L. trulliformis*, having the same habit, but differs in its smaller flowers, the relatively wider, rhombic, ecallose lip and the comparatively stout column. There are similarities in habit with *L. lutea* but the lip is bigger, the floral bracts larger and the anther cap has an obtuse rather than an acute beak. It also resembles *L. bosseri*, described below, in plant habit and shape of the anther but the rachis in *L. bosseri* is less dense, the flowers are twice the size, and the lip obovate (vs oval / lozenge-shaped). It shares several characteristics with *L. xanthina* which may be the same species but there is not sufficient reliable material to support this.

DISTRIBUTION. Endemic to Madagascar: Antananarivo province in the Ankaratra Massif in and near the town of Ambatolampy, recently also found a little further South in Fianarantsoa province (Map 7). Records from Réunion are misidentifications: photographs in Szelengowicz & Tamon (2013: 351) labelled as this species show an unrecognisable but different plant, inflorescence habit and flower, the description copies that of Perrier (1939: 291) for the species.

SPECIMENS EXAMINED. MADAGASCAR. Ambatolampy, 1500 m, March 1921, Perrier 13548 (P00094950) (holotype P); Ambatolampy, Feb. 1925, Perrier 13548 (G00354728, P000951-2 & K000242139 topotypes G, P, K); Ankaratra, path to Mt Tsiafajavona, Feb. 1964, Bosser 17711 (P); Fianarantsoa, RN7, near col Tapia, Jan. 2019, Hermans 8282 (K).

HABITAT. Terrestrial on laterite clay, in the shade of *Acacia dealbata* Link (1822: 445). Amongst rock. Altitude: 1500 – 1600 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis bathiei* cannot be estimated since it is only known from two remaining subpopulations whereas its minimal area of occupancy (AOO) is estimated to be 8 km² (which falls within the limits for Critically Endangered status under the criterion B2). This species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January to March.

ETYMOLOGY. Named for Henri Perrier de la Bâthie (1873 – 1958) by Rudolf Schlechter.

NOTES. *Liparis bathiei* was first found by Perrier in March 1921 and was sent to Schlechter the following month who described it three years later. Perrier made another collection in the same locality in February 1925 and gave them the same collecting number. In his description, Schlechter cited Perrier's

Fig. 3. *Liparis andringitrana*. A habit; B dorsal sepal; C lateral sepal; D petal; E lip; F column and lip, side view; G top of column, front view; H anther cap, dorsal view; J anther cap, ventral view. From Perrier 16043 (type of *L. rectangularis*) (P). DRAWN BY JUDI STONE.

Fig. 4. *Liparis andringitrana*. A habit; B rachis; C flower. PHOTOS: JOHAN HERMANS.

specimen 13548 as the type with a collecting date of March 1921. Several sheets in G, K and P also have the number of *Perrier* 13548 but are from the later collection. As they come from the same locality as the holotype but were collected later, they can all be considered as topotypes.

Perrier in an overview of the geographical distribution of *Liparis* discussed the origin of this species (1936: 259): he first found plants in March 1921 on the immediate outskirts of the then small town of Ambatolampy, a few hundred metres South from the military barracks, at around 1500 m altitude, in an area that is now very barren, densely populated and cultivated. Further collections were made in Feb. 1925 and duplicates deposited in G and K. According to Perrier the population was still there in 1932. He wrote that the

plant grew in good numbers in the shade and in the humus of *Acacia dealbata*, introduced to Madagascar around 30 years before: "... There is no natural locality for this *Liparis*, remnants of original forest are more than 60 km away, and these remnants have been well explored by botanists. Finding this *Liparis* in these urban conditions under an introduced tree is interesting and not easy to explain except for originating from small seeds transported in the wind. It is also interesting that this species is new and has little resemblance to other *Liparis* found in the area (it is related to *L. henrici* but this species has only been found in Betsileo, i.e. more than 200 km S of Ambatolampy. It has reproduced with vigour in these conditions, very different from those where these species normally grow. Considering these circumstances it appears that this *Liparis* is a result of recent

0 100 200 km

Map 7. Distribution of *Liparis bathiei*.

evolution, resulting from a seed transported by wind into a very different environment. This example of sudden mutation is especially interesting as it occurred on one of the main link roads of the Island, it is an interesting example of local evolution.”

Extensive searches by the first author in and around the town of Ambatolampy, especially near army barracks and underneath *Acacia* trees did not find plants of this *Liparis*.

The species has now also been identified from the Mt Tsiafafaona in the Ankaratra Massif (Bossert 17711) which is only around 30 km from the type locality. A very small and vulnerable colony of plants was recently found c. 150 km S in Fianarantsoa province.

ILLUSTRATION. Fig. 5; Schlechter (1932: T.52).

***Liparis bemarkensis* Hermans sp. nov.** Type: Madagascar, near Ambodiriana, E of Antsalova, 100 – 150 m, Jan. 1960, Léandri & Saboureaux 2687 (holotype P (P01778638); isotype P (P01778635)).

<http://www.ipni.org/urn:lsid:ipni.org:names:77201709-1>

Medium size, erect terrestrial, lithophyte or rarely epiphytic *plant* 14 – 18 cm high, emerging directly from the base of the previous growth, roots filiform, more or less villous, c. 1 – 2 mm diam. *Pseudobulbs* ovoid, narrowly elongate, entirely covered by 3 – 5 brown membranous sheaths and by the sheath-like petiole of the lower leaves, with 3 – 4 leaves, new growth emerging from the previous leafless pseudobulb which is almost completely disintegrated and often divaricate, 3 – 4 × 0.5 – 1 cm. *Leaves* erectly spreading, variable in size, blade ovate to broadly elliptic-acuminate, corrugate, with 7 pronounced ridges, narrowed into a short 15 – 20 × 6 – 8 mm sheath-like petiole amplexicaul to the pseudobulb, plicate, thin textured, pale green, overall 10 – 16 × 5 – 8.5 cm. *Inflorescence* erect, up to 30 cm long, c. 2 mm diam., on maturity far exceeding the leaves, carrying up to 20 flowers. *Peduncle* costate, about ½ the length of the inflorescence, with a few lanceolate sterile bracts cordate at the base. *Rachis* laxly racemose, up to 15 cm. *Floral bracts* shorter than the pedicellate ovary, spreading, ovate-lanceolate, attenuate at the tip, somewhat cordate at the base, green, 3.5 – 9 × 2.2 – 4.1 mm, becoming smaller towards the apex. *Flowers* small to medium in size, erectly spreading, overall up to 15 × 11 mm, entirely olive green, translucent, fading to ginger-orange. *Pedicel* and *ovary* porrect, cylindrical, somewhat winged, 8 – 14 × 0.8 – 1.2 mm. *Dorsal sepal* erect to incurved, ligulate, margins more or less recurved, 8.1 – 9.9 × 0.7 – 1.8 mm. *Lateral sepals* folded beneath the lip, elliptic, a little narrowed towards the base, 6.3 – 8.1 × 2.5 – 3.1 mm. *Petals* strongly curved backwards, linear, 7 – 8.5 × 0.3 – 0.8 mm. *Lip* shortly auriculate at the base, then elliptic-rectangular, sinuate and recurved at the anterior margin, with two distinct rounded horn-like calli at the base, 6.1 – 8.2 × 5.1 – 6.5 mm. *Column* curved towards the apex, with distinct rounded wings, 3 – 5.5 × 1 – 2 mm. *Anther* ovoid with a short acute beak at the tip, 1.1 – 1.5 × 0.9 – 1.1 mm. *Pollinia* ovoid c. 0.4 × 0.6 mm.

RECOGNITION. *Liparis bemarkensis* is characterised by its ovoid pseudobulbs covered by sheaths, the deciduous previous growth, its thin-textured, ovate to elliptic leaves, long inflorescence with up to 20 flowers, the prominent floral bracts, small to medium-sized flowers with an elliptic-rectangular lip with two horn-like calli at the base, and the anther with a short acute beak.

Liparis bemarkensis is similar to several of the soft-leaved deciduous *Liparis* species of the region. It is close to *L. sambiranoensis* but it is a smaller plant with smaller flowers, a shorter stem, and a rectangular lip (vs pandurate), with sinuate anterior margin (vs serrate) region (Table 4). It is vegetatively closest to

Fig. 5. *Liparis bathiei*. **A** plant in habitat; **B** habit; **C** rachis. PHOTOS: JOHAN HERMANS.

L. perrieri but the flowers of the new species are larger, the rachis lax (vs sub-dense) and the anther distinctly beaked. There are also some similarities in habit to *L. ochracea* and *L. ornithorrhynchos* but the flowers are $\frac{1}{3}$ smaller than those of *L. ochracea*, the lip elliptic-rectangular vs twice as long as broad in *L. ochracea* and rounded to broadly cordate in *L. ornithorrhynchos* and the anther with a much shorter beak than *L. ornithorrhynchos*. It is also similar to *L. andringitrana* but the flowers are larger by $\frac{1}{3}$ and more numerous, the lip elliptic-rectangular vs oval-flabellate and the lip with two distinct calli vs sub-angular. The distinct calli and lip-shape are considerably different from all the above. It has a limited distribution in the Bemaraha area, at lower elevation.

DISTRIBUTION. Madagascar: Mahajanga province only, restricted to the Bemaraha plateau and ‘Tsingy’ limestone karst (Map 8).

SPECIMENS EXAMINED. MADAGASCAR. Near Ambodiriana, E of Antsalova, 100 – 150 m, Jan. 1960, *Léandri & Saboureaux* 2687 (holotype P (P01778638), isotype P (P01778635)); towards Ambodiriana, E of Antsalova, 100 – 150, Dec. 1952, *Léandri et al.* 2171 (P); Antsingy of Antsalavo, Bemaraha, Jan. 1975, *Morat* 4867 (P); Majunga, NW of Ambohitsaratelo-Bebao 1985, *Barnett et al.* 307 (K, MO); Bemaraha area, Tsingy, 700 m, 1999, *Hermans* 2447 (K); Tsingy of Antsalova, 30 Jan. 1990, *Bogner* 2070 (M); Antsalova, Tsingy de Bemaraha, c. 10 – 20 m, Feb. 1995, *D. DuPuy et al.* M883 (K, P, TAN).

Table 4. Comparison of *Liparis bemarahensis* and *L. sambiranoensis*, based on average measurements.

	<i>L. bemarahensis</i>	<i>L. sambiranoensis</i>
Plant height (cm)	14 – 18	15 – 40
Pseudobulb stem length (cm)	3 – 6	7 – 18
Leaves (number)	3 (rarely 4)	3 – 4 (rarely 5)
Leaf length (cm)	10 – 15 × 5 – 8	10 – 18.5 – 5 – 7.5
Inflorescence length (cm)	up to 30	up to 30
Floral bract (mm)	3.5 – 9 × 2 – 4	8 – 12 × 3.8 – 4.1
Number of flowers	up to 20	up to 25
Dorsal sepal (mm)	8 – 9 × 0.7 – 1.2	12.5 – 18 × 1.2 – 3.8
Lateral sepals (mm)	6.3 – 8 × 2.5 – 3.1	11 – 16 × 3.4 – 5.9
Petals (mm)	7 – 8.3 × 0.3 – 0.8	11.4 – 17 × 0.5 – 1.5
Lip size (mm)	6 – 7.1 × 5.1 – 7	9.1 – 14 × 5.4 – 8.8
Lip shape	elliptic-rectangular	broadly oval / suborbiculate
Lip callus	two distinct angular horns	bi-gibbose
Column size (mm)	3 – 5.5 × 1 – 2	4.1 – 6 × 1.1 – 1.5
Column wings shape	short round	wings angular
Anther	sharply beaked	acutely beaked
Distribution	Madagascar: Mahajanga prov.	Madagascar: Antsiranana, Mahajanga prov. Comoros
Altitude (m)	100 – 200	200 – 1000

HABITAT. Deciduous forest on limestone Tsingy, chalk rock, dense low deciduous forest with a canopy of

0 100 200 km

Map 8. Distribution of *Liparis bemarahensis*.

various heights between c. 10 – 20 m, limestone boulders. Altitude: 100 – 200 m

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis bemarahensis* cannot be estimated since it is only known from two remaining subpopulations whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). This species is only known from two subpopulations representing two locations (sensu IUCN), and has thus been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. December to February.

ETYMOLOGY. Referring to the Bemaraha area, a nature reserve and UNESCO World Heritage site, where this species was first found.

NOTES. Plants were first collected by Léandri, Capuron & Razafindrakoto in December 1932 during Léandri's second expedition to the West of Madagascar in the then very inaccessible limestone Tsingy area near Ambodiriana, E of Antsalova, now part of the Bemaraha National Park. The collection consisted of several plants in bud. A second collection was made by Léandri & Saboureaux during Léandri's third expedition to the same area in 1960. Since then a number of other collections from the same locality have been mis- or unidentified in herbaria. There are two sheets of the Léandri 1960 collection in P, in both the plants are somewhat damaged but the flowers are intact and therefore make suitable type material.

ILLUSTRATION. Fig. 6.

Fig. 6. *Liparis bemarahensis*. A habit; B flower, side view; flower, C dorsal sepal; D lateral sepal; E petal; F lip, front view; G lip, side view; H detail of lip calli from above; J anther cap, front view; K anther cap, back view. From Hermans 2447 & DuPuy et al. M883 (K). DRAWN BY JULIET BEENTJE.

Liparis bernieri Frapp. ex Cordem. (Frappier in Cordemoy 1895: 185); Bernet (2010a: 84). Type: Réunion, Grand Tampon, 1200 m, July 1853 in Herb Cordemoy 138 (holotype MARS).

Liparis bernieri Frappier (1880: 15) **nom. nud.**

Liparis plana Frappier in ms. in Herb. Cordemoy (MARS) **nom. nud.**

Liparis elegans Bernier in ms. in Herb. Cordemoy (MARS) **nom. nud.**

Liparis boivini Rchb.f in ms. in Herb. Reichenbach f. W (R39775) **nom. nud.**

Slender, small to medium-sized, erect, epiphytic or terrestrial *plant*, up to 16 cm tall, rhizome ascending, very short, roots wiry, more or less villous. *Pseudobulbs* stem-like, thin, erect, fleshy, enveloped by 3–5 thin grey striate sheaths, caudate at the apex, slightly overlapping each other, with two, or very rarely three leaves at the apex, the older growths retaining their leaves, up to 13 cm, c. 5 mm diam. *Leaves* sub-opposite, erectly spreading to sub-erect, flat, ovate, acute, base rounded to subcordate, sessile or with a 8–12 mm petiole, somewhat leathery, pale to dark green, glossy, the mid-vein prominent, 2.5–4 × 1.8–3.2 cm. *Inflorescence* erect, emerging from within the developing leaves, up to 14 cm long and almost as long as the pseudobulbs, sub-laxly 3–16-flowered, opening in succession. *Peduncle* longer than the raceme, slightly ridged, with one to two bract-like lanceolate sheaths, c. 11 × 3 mm. *Rachis* loosely racemose, successive flowering, up to 7.5 cm long. *Floral bracts* erectly spreading, acuminate, shorter than the pedicellate ovary, 4.1–5.5 × 1–1.7 mm. *Flowers* small to medium in size, up to 18 × 16 mm, greenish-yellow, lip green to greenish-brown with the veins and central groove darker green, column greenish-white, anther green, flowers becoming more yellow-orange with age. *Pedicel* and *ovary* fusiform, corrugate, 8–11 × 1–1.2 mm. *Dorsal sepal* inclined, oblong to lanceolate, margins slightly reflexed, obtuse, becoming wider towards the base, 7.8–9.1 × 1.6–2.1 mm. *Lateral sepals* strongly recurved beneath the lip, ovate, obtuse, 6.6–8.7 × 2.4–3.5 mm. *Petals* erectly spreading, linear, falcate, subacute, 5.6–7.7 × 0.5–1.1 mm. *Lip* curved, hardly auriculate at the base, expanded into a narrowly ovate to almost pyriform blade, with a central gutter-like depression, the front margin emarginate, slightly sinuate, with a flattened cushion-like thickening at the base, 6.1–7 × 4.2–5.1 mm. *Column* curved towards the apex, up to 4.3 × 1.1 mm, without distinct wings. *Anther* ovoid, with a short angular lobule at the anterior margin, exterior somewhat verrucose, c. 1.0 × 1.1 mm. *Pollen* ovoid in two attached parts, c. 0.6 × 0.5 mm.

RECOGNITION. A small to medium size plant, with stem-like, long pseudobulbs bearing two ovate leathery leaves with a distinct central vein. Its inflorescence is almost as long as the plant, with the small to medium-

sized flowers borne towards the apex, a relatively wide dorsal sepal, a narrowly ovate to almost pyriform, emarginate, sinuate lip, with a small cushion-shaped callus at base, a scarcely winged column, and a rounded anther with a small beak.

Liparis bernieri is similar to *L. danguyana* and *L. listeroides* which are closely allied but distinct morphologically and their distribution is disjunct (Table 5). The leaf of *L. danguyana* is thinner in texture than those of *L. bernieri* and *L. listeroides* which are more leathery with indistinct veins, the leaf shape is ovate, sessile vs more broadly oval, sub-sessile. The flowers of *L. listeroides* are generally smaller than the other two. The lip of *L. danguyana* has distinct basal lobes, that of *L. bernieri* does not and is almost pyriform, it has two small but distinct calli at the base (in *L. bernieri* the callus is indistinct and consists of a crescent-like cushion), a front margin that is slightly attenuate at the front margin vs emarginate in *L. bernieri*. The anther cap of *L. bernieri* is rounded at the front with a short angular beak, that of *L. listeroides* is longer and obtusely beaked.

DISTRIBUTION. Endemic to Réunion: in isolated localities in the interior of the Island (Map 9).

SPECIMENS EXAMINED. RÉUNION. Grand Tampon, 1200 m, July 1853 in Herb Cordemoy 138 (holotype MARS); s. loc., Cordemoy s.n. (MARS); s. loc., 1847–1852, Boivin s.n. P00738626 (P); s. loc. Boivin s.n. in Herb. Drake (P); s. loc. Boivin 1954 (K); s. loc. Boivin s.n. R39775 (W) (G); s. loc., Commerson s.n. P00112444 (P); s. loc., Delteil s.n. Herb. Drake (P); Ilet de Patience, Feb. 1971, Bosser 20779 (P); Les Masouines, 1350 m, Oct. 1973, Bernardi 14549 (G); Bébour Bélouve, 1400 m, March 2003, Bernet comm., Hermans 8154 (K); Bébour, 1200 m, March 2003, Bernet comm., Hermans 8162 (K). Plaine des Palmistes, July 2007, 1520 m, Ferard & Pause 1520 (CBNM); Plaine des Palmistes, April 2008, Fontaine 2457 (CBNM); Plaine des Lianes, Nov. 2012, 1120 m, Fontaine & Tamon 5110 (CBNM).

HABITAT. Wet forest, often on humus and moss-covered surfaces, in shade. Altitude: 800–1600 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis bernieri* cannot be estimated since it is only known from two remaining subpopulations whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only two known subpopulations representing two locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing as EN (Picot 2013: 17).

FLOWERING TIME. January to March.

ETYMOLOGY. Dedicated to Dr Charles Bernier (1802–1858), director of the Jardin Botanique de La Réunion.

Table 5. Comparison of *Liparis bernieri*, *L. danguyana* and *L. listeroides*, based on average measurements.

	<i>L. bernieri</i>	<i>L. danguyana</i>	<i>L. listeroides</i>
Plant height (cm)	up to 16	up to 18	up to 18
Stem (cm)	6 – 10	7 – 12	8 – 13
Leaf length (cm)	3 × 2.5	3.5 × 2.5	6.5 × 1.2
Leaf texture/veins	leathery, veins indistinct	thin, clearly veined	leathery, veins indistinct
Inflorescence length (cm)	up to 14	up to 7	up to 15
No. flowers per inflorescence	up to 16	up to 12	up to 15
Dorsal sepal (mm)	9 × 1.5	8 × 1.2	6.5 × 1
Lateral sepals (mm)	7 × 3	5.5 × 3	5 × 2.5
Petals (mm)	5 × 0.5	8 × 1	6 × 0.5
Lip size (mm)	6 × 4	6 × 4	6 × 5.5
Lip shape	ovate-pyriform, emarginate anterior margin	ovate-orbicular, acuminate at anterior margin	obcordate, small teeth at anterior margin
Lip callus	small crescent-like cushion	2, small but distinct	2, long
Column size (mm)	4 × 1.1	3 × 1	3.8 × 1
Column wings	no wings	wings thin and small	wings angular
Anther size (mm)	1 × 1.1	1 × 0.8	1 × 0.9
Anther shape	rounded at anterior margin	rounded at anterior margin	shortly beaked
Distribution	Réunion	Madagascar: Antananarivo prov.	Madagascar, widespread
Altitude (m)	800 – 1600	1600 – 1800	1000 – 1600

NOTES. The species was first mentioned as '*Liparis bernieri* Frappier' in his listing of the plants of Réunion (Frappier 1880: 15). It was not formally described until

1895 in Cordemoy's *Flore*, the orchid part being based on Frappier's manuscripts. The description indicated that the author knew the plants in the wild and had

Map 9. Distribution of *Liparis bernieri*.

also found herbarium material in the Réunion Museum where it was labelled as *Liparis elegans* Bernier, a name that had already been used five years earlier by Lindley for an Asian species. This group of unmounted plants, presumably collected by Bernier, found its way into the Cordemoy herbarium in Marseille where it is accompanied by labels of its origin and the same manuscript text used in Frappier's description. This is most likely the original material seen by the author; it has corresponding labelling and is close to the original description and is therefore without doubt the holotype of the species and has priority, according to ICN article 9.19, over the lectotype chosen by Margonska (2009: 92) as outlined below.

Finet (1909: 98, pl.1) included a description and illustration of the species and mentioned that the plant was found mixed with *Liparis purpurascens* (now *L. salassia*), citing both Commerson and Boivin collections.

Margonska may well have been unaware of Cordemoy's Marseille herbarium material and lectotyped the species in error using Boivin's specimens kept in P. The Cordemoy material from MARS had been on loan for many years to P and not directly accessible, lately it has been on loan to the University of Réunion (REU). In the same paper Margonska (2009: 92) also considered *Liparis danguyana* to be synonymous with *L. bernieri* citing their similar characteristics. As explained above, there is a strong case for keeping these species separate.

Boivin collections in P and W were annotated by Reichenbach f. as '*Liparis boivini*', the W sheet give 'Madagascar?' as origin; Reichenbach f. never published *L. boivini* and both are clearly *L. bernieri*.

ILLUSTRATIONS: Fig. 7; Finet (1909: 98, pl.1); Bernet (2010a: 84); Szelengowicz & Tamon (2013: 352).

***Liparis bicornis* Ridl.** (Ridley 1885: 458; 1886b: 260); Schlechter (1924: 136); Perrier (1939: 280); Hermans *et al.* (2007: 215); Cribb & Hermans (2009: 150). Type: Madagascar, Imerina, Jan. 1881, *Hildebrandt* 3849 (holotype BM; isotypes G, K, M, P, W, WU). *Leptorkis bicornis* (Ridl.) Kuntze (1891: 671).

Medium to small erect terrestrial or lithophyte *plant* 10–22 cm tall, normally consisting of a single new growth and a disintegrating short rhizome, pseudobulb and sheaths from the previous season, roots thin and soft. *Pseudobulbs* elongate-conical, 8–15 × 6–8 mm, covered by brownish-grey fibrous sheaths, generally carrying 3 leaves (rarely 2 or 4) with the base overlapping and without a distinct petiole. *Leaves* lanceolate, fairly rigid, erect, a little attenuate, plicate, contracted, acute, 6–12 × 1.5–5.2 cm. *Inflorescence* up to 28 cm long, carrying 10–25 flowers. *Peduncle* extending above the leaves, carrying 2–3 peduncle sheaths, 3–5 × 1.5 mm. *Rachis* $\frac{1}{3}$ to $\frac{1}{4}$ of the inflorescence, densely to sub-densely flowered. *Floral*

bracts linear-lanceolate acute, a little shorter than the ovary, 2–6 × 0.8–1.5 mm. *Flowers* small, overall c. 7 × 6 mm, greenish becoming reddish on wilting, petals and sepals somewhat transparent, lip reddish-brown. *Pedice* and *ovary* 6–9 × 1–1.2 mm, obscurely winged. *Dorsal sepal* oblong-lanceolate obtuse recurved at the tip, 4.2–6.5 × 1.2–2 mm. *Lateral sepals* oval-lanceolate obtuse, 3.9–4.2 × 2–2.7 mm. *Petals* linear-obtuse folded backwards, 4.5–5.3 × 0.5–0.8 mm. *Lip* ovate-obcuneate, emarginate, somewhat depressed in the centre and the margins thickened and rounded, with three distinct central veins, slightly auriculate at the base, carrying a distinct 2-horned callus near the base, flanking the column, 3.4–4 × 2.9 × 41 mm, the horn-like calli c. 0.8 mm long. *Column* thick, very slightly curved, broadened at the apex, slightly winged, 2–2.8 × 0.7–1 mm. *Anther* ovate-obtuse c. 1 × 1 mm. *Pollinia* c. 0.5 mm.

RECOGNITION. *Liparis bicornis* is distinguished by having a single flowering growth with the previous year's growth disintegrated, erect leaves, a tall inflorescence with many small flowers, with an obcuneate emarginated lip with two small but distinct calli at the base and an anther with a rounded margin.

In habit it is similar to *Liparis densa* but that differs in its lip shape (ovate-obcuneate vs obovate-oblong) and lack of distinct calli at the base of its lip. Its lip is similar to that of *L. perrieri* but the anterior lip margin in that species is dentate rather than rounded.

DISTRIBUTION. Endemic to Madagascar: mainly in the highlands of Antananarivo province with a few colonies in the Eastern forests (Map 10).

SPECIMENS EXAMINED. MADAGASCAR. Imerina, Jan. 1881, *Hildebrandt* 3849 (holotype BM; isotypes G, K, M, P, W, WU); Interior, Central, Manandona valley, Feb., *Scott Elliot* 2004 (BM, K); Central, s. loc., *Baron* 4228 (K); Ambatolaona, June 1906, *d'Alleizette* 854 (P); Central, Ankatso near Antananarivo, March 1923, *Perrier* 15753 (P); Ankazifotsy, cliff above Tsimbazaza, Antananarivo, Jan. 1960, *Bosser* 13482 (TAN); Ambohimirahavavy Mts, N of Mangindrano, 1999, *Hermans* 2448 (K); Toamasina, Périnet area, 1999, *Hermans* 2455 (K); Manjakatomp area, 1997, *Hermans* 2590 (K); Toamasina, road to Lakato 1041 m, Feb. 2000, *Hermans* 1007 (K).

HABITAT. Wet marshy slopes, rocky outcrops. Altitude: 1300–1500 m

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis bicornis* is estimated to be 32,601 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 28 km² (which falls within the limits for Endangered status under the criterion B2). With seven known subpopulations representing seven locations (sensu IUCN), this species has been preliminarily assessed as VU using the green listing method. This species is threatened by

Fig. 7. *Liparis bernieri*. A habit; B flower. PHOTOS: PATRICE BERNET.

selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality

reduction. The Ankatso habitat was destroyed for building and Eucalyptus plantations. The habitats near Ambatolaona and Lakato were burnt for cultivation.

0 100 200 km

Map 10. Distribution of *Liparis bicornis*.

FLOWERING TIME. January to June.

ETYMOLOGY. The name refers to the two distinct horns at the base of the lip.

NOTES. The species was first found on wet mountain slopes by the German collector Johann Hildebrandt in 1881, a few months before he died in Madagascar. The type locality of the 'Imerina' area normally refers to the Madagascar Highlands around the capital Antananarivo. Henry Ridley acquired some of Hildebrandt's herbarium and described the new species four years later and is clearly based on the BM specimen. In line with much of Hildebrandt's herbarium the collections were widely sold or distributed around Europe, in this instance G, K, M, P, W and WU. A detailed drawing of the flowers by Ridley is in the orchid herbarium at K (Fig. 8).

ILLUSTRATIONS. Fig. 8; Perrier (1939: 283).

***Liparis bosseri* Hermans sp. nov.** Type: Madagascar, near Betroka, Feb. 1963, Bosser 17910 (holotype P).

<http://www.ipni.org/urn:lsid:ipni.org:names:77201713-1>

Very small, squat terrestrial or lithophytic plant up to

6 cm high, on a very short to almost non-existent rhizome, roots wiry. *Pseudobulbs* turbinate, whitish, 10 – 18 × 7 – 15 mm, covered with 2 – 3 thin membranous sheaths, carrying 2 leaves, very rarely only one, the previous year's pseudobulbs without leaves. *Leaves* spreading, ovate, apex acute, base cuneate to obtuse, thin, strongly veined, 4 – 6.2 × 2.2 – 4.3 cm. *Inflorescence* erect, much taller than the leaves, up to 13 cm, c. 1.5 mm diam., with 2 – 10 flowers, opening in succession. *Peduncle* about ½ the length of the inflorescence, with 3 – 4 prominent peduncle sheaths, 6 – 9 × 2 – 3 mm. *Rachis* loosely racemose. *Floral bracts* lanceolate, decreasing in size towards the apex of the rachis, 3 – 6 × 2 – 2.9 mm. *Flowers* medium in size, 10 – 12 × 6 – 7 mm, greenish, becoming yellow with age. *Pedicel* and *ovary* slender, grooved, 7 – 12 × 0.7 – 1.6 mm. *Dorsal sepal* erect, recurved towards the apex, narrowly lanceolate, 6.1 – 9.2 × 1 – 1.9 mm. *Lateral sepals* broadly falcate, obtuse, 6.1 – 8.9 × 2.8 – 3.2 mm. *Petals* linear, obtuse, 6.3 – 9 × 0.2 – 0.3 mm. *Lip* obovate, acuminate at the tip, anterior margin a little undulate, longly auriculate at the base, thickened ridges at the base becoming a canaliculate longitudinal ridge along the disk, 6.1 – 7.5 × 4.2 – 6.1 mm. *Column* almost straight, wings longly rounded, 3.2 – 4.3 × 1.1 × 1.7 mm. *Anther* with a distinct spatulate beak, c. 0.8 mm long, rounded at the apex and narrowed towards the base, overall c. 1.7 × 0.9 mm. *Pollinia* pyriform c. 0.9 × 0.6 mm.

RECOGNITION. A very squat plant with broad, spreading leaves, a relatively long inflorescence and proportionately large flowers. Its lip is acuminate at the tip, longly auriculate at the base and lacks a distinct callus but has a thickened ridge formed of the three raised central veins.

Liparis bosseri has a number of characteristics overlapping with other species but none in the same combination. It is closest to *L. trulliformis* but the lip of *L. bosseri* is obovate (vs ovate-trullate), lacks a distinct callus at the base of the lip and has an anther with a spatulate (vs a sharp beak). In habit, flower size and lip shape it resembles *L. andringitrana* but *L. bosseri* is much squatter and smaller, the inflorescence shorter and the anther has a spatulate beak (vs short and rounded). It also resembles *L. bathiei* in habit and shape of the anther but the rachis of *L. bosseri* is less dense, the flowers are about double the size, the lip obovate (vs oval-lozenge-shaped). The habit and flowers of *L. nephrocardia* are similar in size but the inflorescence of *L. bosseri* far surpasses the leaves (vs about the same length) and lacks the distinct rounded callus of the lip. It shares the spatulate beak of the anther with *L. zaratananae* but the plant of *L. bosseri* is 1/3 the size, without a distinct stem and also has smaller flowers and an obsolete callus vs ridges at the base of the lip.

DISTRIBUTION. Endemic to Madagascar, South-Central, Toliara and Fianarantsoa provinces (Map 11).

SPECIMENS EXAMINED. MADAGASCAR. Near Betroka, Feb. 1963, Bosser 17910 (holotype P); Ihorombe Region, Ihosy

Fig. 8. Drawing by Henry Ridley of the type specimen of *Liparis bicornis*. Reproduced by kind permission of the Trustees of the Royal Botanic Gardens, Kew.

Distr., Bonnet du Pape, Ifandana, Zazafotsy, on inselberg, 1133 m, March 2010, *Ramandimbisoa et al.* 110 (MO, P, TAN). **HABITAT.** Forest remnants, in shade, in thin layer of humus and humus on inselberg. Altitude: 800 – 1100 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis bosseri* cannot be estimated since it is only known from two remaining subpopulations whereas its minimal area of occupancy

0 100 200 km

Map 11. Distribution of *Liparis bosseri*.

(AOO) is estimated to be 8 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only two known subpopulations representing two locations (sensu IUCN), this rare species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. February and March.

ETYMOLOGY. Named for Jean Bosser (1922 – 2013), a great authority on the Flora of Madagascar and the Mascarenes.

ILLUSTRATIONS. Fig. 9.

Liparis bulbophylloides H.Perrier (1936: 242; 1939: 263); Hermans *et al.* (2007: 216); Cribb & Hermans (2009: 145). Type: Madagascar, Toamasina, confl. Onive & Mangoro, 1925, Perrier 16998 (holotype P).

Very small epiphytic plant up to 2.5 cm high, caespitose, rhizomatous epiphyte up to 10 – 15 cm long, the growths 5 – 25 mm apart, rhizome 1 – 3 mm

diam. covered in brownish papery sheaths, roots 0.3 – 1 mm diam., somewhat hairy, the tips glabrous. *Pseudobulbs*, small, oval, 8 – 16 mm long, c. 5 mm diam., base covered by a membranous sheath 5 × 4 mm, carrying 2 leaves at the apex. *Leaves* ovate subsessile, rounded at the base and shortly acute at the apex, 10 – 18 × 8 – 15 mm. *Inflorescence* erect from the centre of the new growth, 3 – 10 cm tall carrying 3 – 10 flowers and buds. *Peduncle* with several bract-like sheaths. *Rachis* somewhat twisted, flowers 4 – 12 mm apart. *Floral bracts* green, with rounded wings, acute at the tip, single-veined and about $\frac{1}{3}$ the length of the pedicellate ovary, 4 – 6 × 3 – 4 mm. *Flowers* small, overall c. 8 × 5 mm, opening in succession, all segments recurved at the margins, pale yellow-green with the lip darker yellow-green, column white, pollinia yellow, flowers becoming brownish-orange with age, flower buds bulging at the base. *Pedicel* and *ovary* ridged, 5.5 – 8 × 0.6 – 1.2 mm. *Dorsal sepal* folded backwards, lanceolate, slightly acute, 4.2 – 6.8 × 1 – 1.6 mm. *Lateral sepals* folded underneath the lip, oblong to oval, obtuse 3.1 – 5 × 1.8 – 2.5 mm. *Petals* linear, single veined, 4 – 6 × 0.4 – 0.8 mm. *Lip* suborbicular, trisinate, narrowed and slightly auriculate at the base and incurved from the middle, the blade opaque with a few obscure veins, a distinct (0.5 mm) rounded cylindrical or bilobed callus at the base, 3 – 4.1 × 3.1 – 4 mm. *Column* arched, the wings strongly expanded at the side of the stigmatic surface into prominent angular membranous lobes, then decurrent lower down, rostellum with a very small central tooth, 3 – 3.8 × 1 mm. *Anther* extended at the front by a rounded semi-cylindrical beak almost the same size as the cap, 1 – 1.3 × 0.5 – 0.7 mm. *Pollinia* four, fused together in two pairs, oblong, 0.3 – 0.4 × 0.2 mm.

RECOGNITION. The species is one of the few truly epiphytic *Liparis* in the region. In habit it resembles species of *Bulbophyllum* Thouars (1822: t.3) with two small oval apical leaves and a small rounded pseudobulb on a long rhizome. The flowers are small, the lip is suborbicular with a rounded callus at the base, the column has obtuse transparent wings, the anther cap has a semi-cylindrical obtuse beak almost as large as the cap itself; somewhat resembling a baseball cap.

Liparis ambohimangana is similar but has a true stolon rather than a rhizome, a single leaf vs two and the anther is not beaked.

DISTRIBUTION. Endemic to Madagascar, fairly widespread in Eastern forests; Toamasina, Antsiranana and Toliara provinces (Map 12).

SPECIMENS EXAMINED. MADAGASCAR. Toamasina, confl. of Onive & Mangoro, 1925 Perrier 16998 (holotype P); Toliara, SE, Manampanihy basin, Mt Vohimavo, March 1947, Humbert 20693 (P); Ambatovy, March 1998, McPherson 17526 (TAN); Toamasina, road

Fig. 9. *Liparis bosseri*. A habit; B flower, side view; C dorsal sepal; D lateral sepal; E petal; F lip; G column and ovary; H anther cap from above; J anther cap, below; K pollinia. From Bosser 17910 (P). DRAWN BY JULIET BEENTJE.

to Lakato, Feb. 2000, *Hermans* 4894 & 5570 (K); Antsiranana, Vohemar, Daraina, Binara forest, 1030 m, 17 March 2003, *Gautier et al.* LG 4415 (G);

Antsiranana, Vohemar, Daraina, Antsahabe forest, 2004, *Nusbaumer* LN1034 (G, P); Toamasina, Alaotra Mangoro, Moramanga, Ambohibary, Ampitabe,

0 100 200 km

Map 12. Distribution of *Liparis bulbophylloides*.

Ambatovy, 1135 m, March 2005, *Antilahimena et al.* 6788 (MO, P, TAN); Toamasina, Ambavaniasy, Feb. 2015, *Sieder* 6759, *Hermans* 8067 (K, WU); near Carion, 1997, *Hermans* 2588 (K); Toamasina, Ambatovy, Ambohibary, Moramanga distr., *Razanatsoa* 145 (MO, TAN); Toamasina, Ampitambe, Ambatovy c. 22 km N E of Moramanga, Analamahy, 1058 m, March 2005, *Andriantiana & Razafindasy* 172 (TAN); Toamasina, Ambohibary, Ampitabe, Ambatovy, 1102 m, May 2008, *Rakotondrafara* 730 (MO, TAN); Toamasina, Andasibe, Menalamba, Ambatovy, Forêt de Berano, 1007 m, Sept. 2008, *Andriantiana* 452 (MO, TAN); Toamasina, Alaotra Mangoro, 1040 m, May 2010, *Ramahanina et al.* 28 (K, MO, P, TAN); Toamasina, Distr. Moramanga, Ambatovy, 890 – 1117 m, Sept. 2014, *Ambatovy Shade House* 4492 (TAN).

HABITAT. Exclusively as an epiphyte in humid evergreen forest, amongst mosses on tree branches. Altitude: 600 – 1100 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis bulbophylloides* is estimated to be 71,015 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 44 km² (which falls within the limits for Endangered

status under the criterion B2). With 11 known subpopulations of this species representing 11 locations (sensu IUCN), *L. bulbophylloides* has been preliminarily assessed as VU using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January to March.

ETYMOLOGY. Refers to the shape of the pseudobulbs and plant habit similar to some species of the orchid genus *Bulbophyllum*.

NOTES. The species was first described by Perrier from a collection made by Henri Humbert in Eastern Madagascar. It has since been found in a wide area along the Eastern mountain range of the Island.

ILLUSTRATIONS. Figs 10, 11; Perrier (1939: 255); Hermans *et al.* (2007: pl.45); Cribb & Hermans (2009: 147).

***Liparis caulescens* Frapp. ex Cordem.** (Frappier in Cordemoy 1895: 186). Types: Réunion, Les Hauts du Boucan Launay, 1847 – 1852, *Boivin* 1035 (P00112460) (lectotype P, designated here); Réunion, *Boivin* 1035 (P00112455), (P00112456), (P00112460) & (K000718243) (isolectotypes designated here P, K, REU). Réunion, *Boivin* s.n. (P00112461) (lectoparatype P).

Liparis caulescens Frappier (1880: 15) **nom. nud.**

Liparis vaginata in herb. Richard (K-Lindl, W) **nom. nud.**

Liparis longa Rchb.f. (Reichenbach f. 1877: 98) **synon. nov.**

Medium to large erect terrestrial or lithophytic plant, 14 – 33 cm high, rhizome short, ascending, roots wiry, more or less pilose, c. 1 mm diam. *Pseudobulbs* slender, stem-like, a little inflated at the base, up to 25 cm × 6 – 15 mm, partly covered by 4 – 5 thin amplexicaul sheaths, partly overlapping, up to 5 cm long, with 2 – 3 (rarely 4) apical sub-petiolate leaves. *Leaves* spreading, asymmetric, lanceolate to elliptical-lanceolate, acuminate, undulate, the veins obliquely convergent, more or less glossy, contracted into a 10 – 25 mm petiole at the base, overall 8 – 10 × 4 – 5.5 cm, the third leaf usually smaller, dark green. *Inflorescence* erect, a little longer than the leaves, carrying up to 15 flowers but usually fewer, up to 11 cm. *Peduncle* with a few linear-lanceolate peduncle sheaths becoming sterile bracts, 7 – 10 mm long. *Rachis* loosely racemose in the upper half of the inflorescence, up to 7 cm long. *Floral bracts* spreading, linear-lanceolate, acuminate, the lower ones considerably longer than apical ones, up to 13 × 3 mm, green. *Flowers* medium in size, up to 15 × 10 mm, ovary green, sepals and petals yellowish-brown,

~O.O. Whalley 886 Kew Dec. 2002~

Fig. 10. *Liparis bulbophylloides*. A habit $\times 3$; B flower, side/front view $\times 15$; C flower, front view $\times 15$; D dorsal sepal $\times 15$; E petal $\times 15$; F lateral sepal $\times 15$; G lip $\times 15$; H lip basal callus $\times 21$; J column, front view $\times 15$; K column, side view $\times 15$; L top of column with anther cap lifted $\times 15$; M anther cap $\times 27$; N pollinia $\times 38$. From *Hermans* 4894 (K). DRAWN BY OLIVER WHALLEY.

Fig. 11. *Liparis bulbophylloides*. **A** habit; **B** flower. PHOTOS: JOHAN HERMANS.

lip dark brown to ochre, darker towards the middle becoming a dark orange-red on the disk and base of column, column white becoming brown towards the base; the whole flower turning more orange with age. *Pedice* and *ovary* glabrous, costate, 12 – 14 × 0.8 – 1.1 mm. *Dorsal sepal* reclining, ligulate-lanceolate, 8 – 12.5 × 1.5 – 2.1 mm. *Lateral sepals* curved beneath the lip, ovate to lanceolate, 7.5 – 9.9 × 3.6 – 4.5 mm. *Petals* margins incurved, spreading and curved upwards, obliquely linear 9 – 10.5 × 1.2 – 1.6 mm. *Lip* strongly curved towards the base, broadly obovate, with very small auricles at the base, rounded to emarginate at the anterior margin, the margins undulate, with a distinct two-horned callus at the base, 7.1 – 8.9 × 6.3 – 8.6 mm. *Column* relatively short, 3 – 4.5 × 1 – 1.5 mm, curved at the apex, with small triangular wings towards the apex. *Anther* oblate, rounded at the front, c. 0.8 × 0.6 mm. *Pollinia* in 2 pairs, ovoid, c. 0.5 × 0.3 mm.

RECOGNITION. A medium-sized to large plant with a long slender pseudobulb, two to three sub-petiolate asymmetric leaves, a loosely racemose rachis and medium-sized flowers, with a brown, broadly ovate lip

with a two-horned callus at base and a rounded anther.

The species shares a similar habit, including the somewhat asymmetric leaves, its brownish-yellow flower colour and lip shape with *Liparis rivalis* from Madagascar but plants of *L. caulescens* are a little shorter, the spike habit is laxly racemose (vs densely racemose), fewer and with larger flowers, the lip with a more distinct callus, a larger, differently shaped column with angular vs rounded wings (Table 6). They may well have evolved from a common ancestor. It is somewhat similar in habit to *Liparis gracilipes* and *L. danguyana* from Madagascar but the leaves are considerably longer and asymmetric lanceolate vs elliptic-oval, while its flowers are at least $\frac{1}{3}$ larger and the lip broadly obovate vs suborbicular.

DISTRIBUTION. Réunion: all the cantons, mainly Saint-Denis (le Brûlé), Saint-Pierre (Tampon), Saint-Louis (Cilaos) (Map 13). *Humblot* s.n. P00209845 (P) from the Comoro Islands, identified as this species, is possibly a misidentification and there appear to be two different species on the sheet both bearing only seed-pods. However, a sterile plant collected on

Table 6. Comparison of *Liparis caulescens* and *L. rivalis*.

	<i>L. caulescens</i>	<i>L. rivalis</i>
Plant height (cm)	up to 33	up to 35
Leaf size (cm)	up to 10 × 5	up to 15 × 5
Leaf shape	asymmetric, lanceolate to elliptical-lanceolate	asymmetric, lanceolate to elliptical-lanceolate
Inflorescence length (cm)	up to 11	up to 15
Number of flowers per inflorescence	up to 15	up to 30
Inflorescence type	loosely racemose	densely racemose
Dorsal sepal (mm)	8 – 11 × 1.5 – 2	5.5 – 7.2 × 0.3 – 1
Lateral sepals (mm)	7.5 – 9.9 × 3.6 – 4.5	4.5 – 6.3 × 1.9 – 2.2
Petals (mm)	9 – 10.5 × 1.2 – 1.6	5.5 – 7.0 × 0.3 – 1
Lip shape	broadly obovate	broadly obovate
Lip size (mm)	7.1 – 8.9 × 6.3 – 8.6	4.1 – 5.4 × 3.8 – 4.6
Lip callus	distinct, two-horned	small thickening
Column (mm)	3 – 4.5 × 1 – 1.5	c. 2 × 0.5
Anther	rounded at anterior margin	with small obtuse beak
Distribution	Réunion	N Madagascar
Altitude (m)	800 – 1500	800 – 1600

Grande Comore by *Brionnaud et al.* (75) in 2000 seems to belong to this species. *Boivin* s.n. 1846 – 1848 (W) from Mauritius is based on a later inscription and could also be an error.

SPECIMENS EXAMINED. COMOROS. Grande Comore, Karthala, 1190 m, dense forest, Aug. 2000, *Brionnaud et al.* 75 (BR, CNDRS, K, MO, P). **MAURITIUS:?** s. loc. *Boivin*, s.n. 1846 – 1848 (W). **RÉUNION.** Les Hauts du

Map 13. Distribution of *Liparis caulescens*.

Boucan Launay, 1847 – 1852, *Boivin* 1035 (P00112460) (lectotype P); s. loc., *Boivin* 1035 (P00112455), (P00112456), (P00112460) & (K000718243) (isolectotypes P, K); s. loc., *Boivin* s.n. (P00112461) (lectoparatype P); s. loc., 1853, *Boivin* 1045 (G); s. loc. 1846–1852 *Boivin* s.n. in Herb Delessert (G); s. loc., 1837, *Richard* 402 (P); s. loc., herb. *Richard* s.n. (K-Lindl.), s. loc., herb. *Richard* 643 (W); s. loc. *Balfours* s.n. rec. Oct. 1875 (K); s. loc., *Cordemoy* s.n. (MARS); s. loc., *Armange* s.n. 1847 (P); Plaine des Cafres, March 1872, *Potier* s.n. (P); s. loc., 1875 *De L'Isle* 72 (P); Plaine des Palmistes, Aug. 1888 *Cordemoy* s.n. (MARS); Plaine des Palmistes, 1400 – 1500 m, June 1957, *Bosser* 11674 (P); Montée Plaine des Palmistes, Ilet à Patience, April 1971, *Bosser* 22470 (P); Cirque de Tacamaca, Hauts de St. Benoit, c. 800 m, April 1971, *T. Cadet* 3203 (P, REU); Montée de l'Ilet Patience, Bras Cabot path, Feb. 1971, *Bosser* 20581 (P); Plaine des Palmistes, l'Ilet Patience path, c. 1300 m, March 1973, *T. Cadet* 3173 (P); Morne des Patates à Durand, March 1974, *Bosser* 21653 (P); Les Trois Bras, Hauts de Sainte Anne, May 1974, *Bosser* 22075 (P); Takamaka, May 1974, *Bosser* 22051 & 22051bis (P); Takamaka, June 1976, *Bosser* 22112 (P); Haute de Sainte Rose, April 1978, *Bosser* 22519 (P); Petite Plaine des Palmistes, 1300 m, March 1982, *Cadet* 6359 (REU); Takamaka, 820 m, Jan. 1990, *R. Laverne* 1725 (REU); La Tanguiere, 850 m, Dec. 2003, *Ferard et al.* 982 (CBNM); Source Nouvelle Bras-Sec, 1036 m, Feb. 2004, *Grondin* 1036 (CBNM); Saint-Denis, Ravine, 1010 m, April 2006, *Hivert* 1989 (CBNM); Dimitile Bayonne, April 2009, *Martos* 629 (REU); Bois Blanc, 691 m, Sept. 2014, *Ferard & Lacoste* 4126 (CBNM); Plaine des Palmistes, Ravine seche, c. 800 m, Jan. 2007, *Martos* 19 & 20 (REU); s. loc. *Lavallée* 269 (P).

HABITAT. Terrestrial or lithophyte in forest, common on rocky cliffs of shady ravines. Usually in dark and wet places in the rainforest at medium elevation. Altitude: 800 – 1500 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis caulescens* is estimated to be 172,983 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 36 km² (which falls within the limits for Endangered status under the criterion B2). With only five known subpopulations representing five locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence, slash-and-burn farming, grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction. Previously assessed and published in the IUCN Red data listing for Réunion as LC (Picot 2013: 17).

FLOWERING TIME. February to May.

ETYMOLOGY. Refers to the stem-like pseudobulbs.

NOTES. The history of the species is complex, it appears to have been known by various botanists working at the end of the 19th century and consequently several different names have been found in herbaria. The earliest herbarium sheets referring to this species are from Achille Richard's herbarium: two sheets in Paris (*Richard* 402) labelled as '*Malaxis flavescens*', dated 1837 from Bourbon [Réunion] and one sheet in the Kew Lindley herbarium labelled as '*L. vaginata* A.R. m. sp. Sp. nova. Ile Bourbon Richard'. Most of the early collections (e.g. *Lavallée* 269, *Armange* s.n. in P) were misidentified as *M. flavescens*, now *Liparis flavescens*, which was described and illustrated by Du Petit-Thouars (Thouars 1822: t.25) and was one of the few *Liparis* then known and similar, at first sight, to *L. caulescens*. Further Richard herbarium material found its way to the Reichenbach herbarium in W (643) where it is annotated '*Liparis vaginata* nob. sp. nov.'. From the above it seems that Richard intended to describe the species as *Liparis vaginata* but never did so. The Richard specimen at K-Lindl. was traced on paper by Reichenbach f. (now in W) and the tracing is annotated '*Liparis vaginata* A. Rich. sp. nov' but additionally as '*Lip. caulescens* Boiv. Isle Bourbon' and also labelled as '*L. longa* Rchb.f cf. *Linnaea*'. *Liparis longa* was described by Reichenbach in *Linnaea* (1877: 98) at the end of a lengthy series of novelties, most with a reference to type material except for *L. longa* which was the last in the series. The description is fairly detailed and mentioned a plant with a long stem, sub-opposite leaves and a lip with two teeth at the base of the lip. It is likely that Reichenbach was referring to the Richard material and decided to apply his own epithet and not the one suggested by Richard. *Liparis longa* is an earlier name for the species but under the rules of nomenclature (ICN article 7.9) Reichenbach's name cannot be accepted as it lacks any type material. In 1887, Ridley included *L. longa* in his monograph but added no further information.

Liparis caulescens first appeared in Frappier's listing of the plants of Réunion (1880: 15) as '*Liparis caulescens* Frappier (ex. Boivin)'. It was finally validly described in 1895 by Cordemoy (1895: 186). Frappier did not specify a holotype in his description apart from indicating that it was based on a name given by Boivin on a herbarium specimen: 'Frapp, ex Boiv. hb. Mus. Réunion'. There are a number of herbarium sheets from the 1847 – 1852 Oise expedition to Réunion in P and in K: some give Les Hauts du Boucan Launay as a more specific locality, most have the collecting number '1035'. The most representative sheet of original material used by Frappier is P00112460 and was

Fig. 12. *Liparis caulescens*. A habit; B flower. PHOTOS: PATRICE BERNET.

designated here as lectotype. Sheets P00112455, P00112456 and K000718243 are islectotypes. The P

specimen P00112461 has no collecting number and is treated as a lectoparatype. A specimen in the Paris

herbarium of *Boivin* 1035 (P409214) is labelled *L. caulescens* and was annotated by Finet as *L. polycardia* Rchb.f but the plant habit and flowers are very different and it is *L. ochracea*. *Boivin* 1045 (G), identified by Kraenzlin as *L. purpurascens*, is *L. caulescens*. It is possible that it could be a transcription error of *Boivin* 1035 and therefore could be part of the type collection.

ILLUSTRATIONS. Fig. 12; Cadet (1989: 53); Bernet (2010a: 86); Szelenowicz & Tamon (2013: 354).

Liparis cespitosa (Lam.) Lindl. (Lindley 1825: sub t. 882); Moore in Baker (1877: 342); Ridley (1885: 458; 1886b: 290); Frappier in Cordemoy (1895: 180); Perrier (1936: 241; 1939: 262); Hermans *et al.* (2007: 216); Cribb & Hermans (2009: 146); Lebrun & Stork (2017: 112). Type: Réunion, Lamarck ex Herb. Jussieu s.n. (holotype P-LA P00382094; isotype: herb. Jussieu 3830 (P00672996) P).

Epidendrum cespitosum Lam. (Lamarck 1783: 187).

Stichorkis cespitosa (Lam.) Thouars (Thouars 1809: 318) referring to *Epidendrum cespitosum* of Lam.

Malaxis caespitosa (Lam.) Thouars (Thouars 1822: t.90).

Cestichis caespitosa (Lam.) Ames (Ames 1908: 132).

Leptorkis caespitosa (Lam.) Kuntze (Kuntze 1891: 671)

Liparis cespitosa var. *cleistogama* Schltr. (Schlechter 1911a: 17).

Stichorkis cespitosa (Lam.) Thouars ex Marg. (*emen* in Szlachetko *et al.* 2008: 420 & Margonska & Szlachetko 2010: 61).

Malaxis minima Blume (Blume 1825: 391).

Liparis minima (Blume) Lindl. (Lindley 1830a: 32).

Leptorkis minima (Blume) Kuntze (1891: 671).

Liparis minima var. *neoguineensis* Schltr. (Schlechter 1905a: 105).

Malaxis angustifolia Blume (Blume 1825: 393).

Liparis angustifolia (Blume) Lindl. (Lindley 1830a: 31).

Liparis revoluta Hook. & Arn. (Hooker & Arnott 1832: 70).

Leptorkis revoluta (Hook. & Arn.) Kuntze (1891: 671).

Liparis auriculata Rchb.f. (Reichenbach f. 1872: 277), non Miq.

Liparis pusilla Ridl. (Ridley 1886b: 294).

Leptorkis pusilla (Ridl.) Kuntze (1891: 671).

Stichorkis pusilla (Ridl.) Marg., Szlach. & Kułak (in Szlachetko *et al.* 2008: 39).

Liparis obscura Hook.f. (Hooker 1889: t.1886).

Leptorkis obscura (Hook.f.) Kuntze (1891: 671).

Liparis prainii Hook.f. (Hooker 1889: t.1857).

Leptorkis prainii (Hook.f.) Kuntze (1891: 671).

Liparis duthiei Hook.f. (Hooker 1889: 1857b).

Leptorkis duthiei (Hook.f.) Kuntze (1891: 671).

Liparis comosa Ridl. (Ridley 1896).

Liparis neoguineensis (Schltr.) Schltr. (Schlechter 1911b: 209).

Liparis poilanei Gagnep. (Gagnepain 1929: 514).

Very small tufted epiphyte, lithophyte or terrestrial plant, 4 – 8 cm high on a short rhizome 1 – 2 mm diam., roots wiry, whitish, 1 – 2 mm diam. *Pseudobulbs* approximate, ovoid, green when young, becoming brown and wrinkled with age, with few scarious sheaths, up to 25 mm high and 10 mm in diam., single or very rarely 2-leaved, bearing a single terminal inflorescence. *Leaf* coriaceous, lanceolate sub-spathulate, widest towards the tip, gradually tapering to a narrow base joint, apex rounded to acute, pale to dark green, 18 – 59 × 3 – 9 mm. *Inflorescence* erect, about the same length as the leaf, up to 8 cm but usually shorter, 5 – 20-flowered. *Peduncle* somewhat flattened, with 1 or 2 short, thin sheaths. *Rachis* 10 – 32 mm, densely to laxly flowered. *Floral bracts* acuminate, variable in length amongst specimens and within the inflorescence, 2.5 – 6 × 0.3 – 0.9 mm. *Flowers* very small, pale green to creamy yellow, the lip often a little darker, anther white, non resupinate, c. 4 – 5 × 2 – 3 mm. *Pedicel* and *ovary* up to 4 mm long, smooth to somewhat ridged, thickened and rounded at the base, then becoming thin. *Dorsal sepal* reflexed, ovate, obtuse, single-veined, 1.5 – 2.9 × 0.8 – 1.2 mm. *Lateral sepals* ovate, obtuse, 1.9 – 2.9 × 0.9 – 1.25 mm. *Petals* angustate, linear reflexed, 1.5 – 2.5 × 0.3 – 0.5 mm. *Lip* oblong obtuse, the base erect and slightly winged, distal part bending downwards, margins retuse to minutely denticulate, with two veins, increasing at the base sometimes becoming thicker and callus-like, 1.9 – 2.5 × 1.1 – 1.7 mm. *Column* arcuate, slender, the edges a little expanded towards the apex, 1.1 – 1.6 × c. 0.5 mm. *Anther* small, obtuse, slightly expanded at the front, 0.4 – 0.6 mm diam. *Pollinia* elliptic, 0.2 mm. *Seed capsule* globular, ovate, c. 2 mm diam. with 3 strong ridges.

RECOGNITION. A small plant with rounded-ovoid pseudobulbs, bearing a single leaf, an inflorescence generally a little longer than the leaves, with up to 20 flowers, with 3 mm long sepals, an oblong and recurved lip, lightly denticulate at the anterior margin, and lacking a distinct callus, an unwinged column only slightly expanded towards the tip and an anther obtusely expanded at the front. The length of the floral bracts is variable, sometimes exceeding the length of the flower. Seed capsules are persistent on the rachis.

It shares the small pseudobulb and leaf-shape with *Liparis ambohimangana* but is very different in lacking a stolon while its flower, lip and anther are much smaller and a different shape with a suborbicular vs oblong-obtuse lip and a distinct callus. It is similar in habit to *L. scaposa* but has considerably smaller flowers and its lip callus is less apparent (Table 1).

DISTRIBUTION. Widespread in Madagascar throughout Antananarivo, Fianarantsoa, Toamasina, Mauritius, Réunion and a few locations on the Comoro Islands (Map 14). Also in E tropical Africa (Uganda, Tanzania, Malawi, Mozambique), Sri Lanka, NE India to the Philippines, New Guinea, Solomon Islands and Fiji.

SPECIMENS EXAMINED: COMOROS. Grande Comore, Maoueni, La Grille Forest, 830 m, July 2000, *Brionnaud et al.* 11 (BRLU, CNDRS, K, MO, P). **MADAGASCAR.** Imerina, 1881, *Deans Cowan* s.n. BM0090077 (BM); s. loc., 1880's, *Fox* 28 (K ex LDS); Central, Andasibe forest, Onive valley, c. 1000 m, Feb. 1925, *Perrier* 17125 (P); Sandrangato, S of Moramanga, March 1942, *Decary* 17787 (P); Mt Andriambavibe, July 1942, *Decary* 18134 (P); Toamasina, Bay of Antongil, Nosy Mangabe, April 1989, sea level, *D. DuPuy & B. DuPuy* MB154 spirit 56130 (K); Nosy Mangabe, Island of Nosy Mangabe, 0 – 10 m, April 1990, *Carlson* 161 (MO, SZU); NE, Masoala peninsula, Ratsianarana R., Oct. 1993, *Lance* 73 (K); Masoala Peninsula, Ambanizana R., W coast of Masoala, Nov. 1993, *Lance* 78 (K); Fianarantsoa, Ranomafana, 1100 – 1250 m, March 1993, *Turk et al.* 335 (MO, P); Fianarantsoa,

1272 m, 2003, *Fischer* OR370 (SZU); Sava, Andapa, Doany, Andranomololo, May 2006, *Rakotovao et al.* 3186 (MO, TAN). **MAURITIUS.** s. loc. *Commerson* s.n. (G); s. loc. *Herb. Maire* s.n. (P); s. loc. *Bojer* BM0088118 (BM); s. loc. *Bouton* s.n. (K); s. loc. April 1946, *Edgerley* 12193 (MAU, P); Bel Ombre, Oct. 1964, *Vaughan* 11360 (MAU, P); Bel Ombre, May 1959, *Vaughan* s.n. (MAU, P); Bassin Blanc, April 1974, *Bosser* 21852-3 (P); Tampoketsa of Ankazobe, 2001, *Malala Orchidées Hort., Hermans* 5387 (K); Toliara, Alaotra Mangoro, Moramanga, Ambatovy. Sahavaharina forest, 1034 m, Sept. 2008, *Antilahimena et al.* 6541 (MO, P, TAN); Toliara, Alaotra Mangoro, Moramanga, Ambatovy. Sahavaharina forest, 1047 m, Sept. 2008, *Antilahimena et al.* 6542 & 6542bis (MO, P, TAN); s. loc., *Hermans* 8068 (K, WU). **RÉUNION.** s. loc. *Lamarck* ex *Herb. Jussieu* s.n. (holotype P00382094 (P-LA); herb. *Jussieu* 3830 isotype P00672996 (P); s. loc. *Thouars* 18 (P); s. loc. *Commerson* s.n. P112446 (P); s. loc. *Cordemoy* s.n. (MARS); s. loc. March 1875, *De L'Isle* 227 (P); s. loc. 1875, *De L'Isle* s.n. (P); *Herbier Drake* s.n. (P); s. loc. *Des Vaux* s.n. (P); s. loc. *Bernier* s.n. (K, P); s. loc. *Boivin* 1036 (P); s. loc. 1837, *Richard* 401 (P); s. loc. *Richard* s.n. (K-Lindl.); St. Philippe,

Map 14. Distribution of *Liparis cespitosa*.

high Bara valley, Feb. 1971, *T. Cadet* 3058 (P); Dos d'Âne, Feb. 1971, *ORSTOM* 142 (P); La Grande Chaloupe, La Montagne, March 1974, *Bosser* 21638 (P); Cap Noir path, Dos d'Âne, Oct. 1972, *Bosser* 21252 (P); Dos d'Âne, Cap Noir, March 1976, *Bosser* 21721-2 (P); Ravine de la Grande Chaloupe, March 1978, *Bosser* 22351 (P); Plaine des Palmistes, 1200 m, Feb. 2003, *Pailler* TP67 (P); Bétan, 1200 m, Feb. 2003, *Pailler* TP68 (P); Herbier *Cogniaux*, 597L & 948L (BR). Without Origin. Herb *de Candolle*, in part, as *Epidendrum ophioglossoides* (G).

HABITAT. Moss forest, secondary forest, humid forest. Altitude: 0 – 1400 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis cespitosa* is estimated to be 700,161 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 64 km² (which falls within the limits for Endangered status under the criterion B2). With 14 known subpopulations representing 15 locations (sensu IUCN), this widespread species has been preliminarily assessed as LC using the green listing method. In Madagascar, this species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing for Réunion as CR (Picot 2013: 11)

FLOWERING TIME. January to April.

ETYMOLOGY. Referring to the tufted habit of the plant, as first described by Lamarck.

NOTES. Lamarck (1783: 187) first described *Liparis cespitosa* as *Epidendrum cespitosum* based upon a Bourbon [Réunion] specimen from de Jussieu's herbarium: he refers to it as '*Angrec en gazon*' and likens its habit to *E. ophioglossoides* Jacq. (Jacquin 1760: 29) (= *Stelis ophioglossoides* (Jacq.) Sw. (Swartz 1800: 239)). The holotype specimen, as used by the author, is in the Lamarck Herbarium in P (P00382694), it consists of a fruiting plant. Later labelling on the sheet refers to *Stelis* and *E. ophioglossoides* and also to '*Martinica*' obviously referring to the Antillean *Stelis* species in error. In addition, the de Jussieu herbarium has a sheet with five fruiting plants and one gap with the pin-holes of a previous mounting still in place, it again is annotated *Stelis* and *E. ophioglossoides* and also as *Malaxis caespitosa* Thouars. The Lamarck holotype specimen was without much doubt removed from this de Jussieu sheet which is, therefore, considered to be an isotype. It is likely that the original material came from Commerson but it is inconclusive whether the 'Comm' annotation on the Jussieu sheet refers to Commerson or to its communication. It is also interesting to note that a specimen sheet of unknown origin in the de Candolle Herbarium in G, has a mixture of two plants labelled as *E. ophioglossoides* with

one plant of *L. cespitosa* and another of a plant similar to *S. ophioglossoides*.

In 1809 Du Petit-Thouars referred to Lamarck's description in error under his new genus '*Stichorkis*' as *Angraecum caespitosum*. In 1822 he referred to it both in the text and in the illustration as *Malaxis caespitosa*; there is no reason to believe he would not be referring to Lamarck's *Epidendrum cespitosum*. Lindley placed it in the genus *Liparis* in 1824.

Margonska (in Szlachetko *et al.* 2008: 35) rejected Rasmussen's (1979: 392) interpretation of Du Petit-Thouars' work (1809 & 1822) and re-typified and created *Stichorkis cespitosa* (Lam.) Thouars ex Marg. The nomenclature system allows a number of interpretations under the nomenclatural code (McNeill *et al.* 2012 & Turland *et al.* 2018) but this is superfluous: *Liparis cespitosa* is clearly based on Lamarck's ex de Jussieu's original material as used by the author and not on any of Du Petit-Thouars' material.

Both the epithets *caespitosa* and *cespitosa* have been used in the literature, under the rules of nomenclature and as discussed by Rasmussen (Rasmussen 1979: 392) *cespitosa* is correct, keeping Lamarck's orthography.

This is one of the few *Liparis* in the Madagascar area with small bulbous pseudobulbs and a single leaf. It was first recorded in the area from the Mascarenes but has since also been recognised from Madagascar where it seems to be fairly widespread. It is also one of the few species with a much wider distribution in Africa and in Asia. Percival (1965: 11), mentioned that it is cleistogamous in the wet and misty rainforest but chasmogamous in the drier air outside of that environment.

ILLUSTRATIONS. Fig. 13. Du Petit-Thouars (Thouars 1822: t. 90); Seidenfaden & Wood (1992: 234); Bernet (2010a: 87); Szelengowicz & Tamon (2013: 373).

***Liparis chantaliae* Hermans & Hervouet sp. nov.** Type: Madagascar, Toamasina, near Andasibe, Vakôna forest, 1020 – 1100 m, Jan. 1997, *Hermans* 3997 (holotype K).

<http://www.ipni.org/urn:lsid:ipni.org:names:77201716-1>

Large terrestrial or rarely epiphytic plant up to 26 cm tall, rhizome scrambling, sometimes new growths emerge from the stem of previous growth, roots glabrous, white, c. 2 mm diam. *Pseudobulbs* stem-like, round, up to 23 cm long, 8 – 15 mm diam., with 3 – 6 white sheaths along its length not much overlapping, attenuate at the apex, white-grey, strongly veined, dotted with ochre-brown, carrying two (rarely 3) leaves at the apex. *Leaves* broadly ovate, obtuse or shortly acute at the apex, undulate, crenulate along the

Fig. 13. *Liparis cespitosa*. **A** habit with wilting flowers; **B** rachis. PHOTOS: JOHAN HERMANS.

margins, subsessile or shortly petiolate, pale to dark green, often a little paler underneath, $5 - 8.5 \times 2 - 4.5$ cm. *Inflorescence* erect, 8 – 15 cm long, carrying up to 14 flowers but generally fewer. *Peduncle* about the same length as the rachis, with one or two peduncle sheaths enveloping the base and one or two higher up, c. 2 mm diam. *Rachis* laxly 2 – 14-flowered. *Floral bracts* lanceolate, the base somewhat cordate, $5 - 15 \times 1.5 - 3$ mm. *Flowers* large, up to 41×23 mm, pale green to viridian, the lip dark olive green with a darker longitudinal ridge, column and ovary white, anther green, pollen yellow, scented. *Pedicel* and *ovary* somewhat ridged, thickened at both ends, $11 - 16 \times 1 - 1.2$ mm. *Dorsal sepal* erect, linear, obtuse, margins recurved, $13 - 23 \times 1.1 - 2$ mm. *Lateral sepals* folded below the lip, falcate, broadly lanceolate, $13 - 19 \times 3.5 - 7.1$ mm. *Petals* narrow linear, curved downwards, the margin incurved, $13 - 19 \times 0.3 - 0.8$ mm. *Lip* broadly oval-lanceolate, the base with short rounded wings and two elongate lamellar-triangular calli, generally with a furrow of smaller, irregularly rounded calli in-between, anterior lobe almost triangular with dentate margins, $11.5 - 15 \times 5.8 - 8$ mm. *Column* slender, slightly arching, wings narrow and obtuse, $4.5 - 7 \times 1 -$

1.3 mm. *Anther* with a cuspidate to linear beak, $1.1 - 1.8 \times 0.8 - 1.3$ mm. *Pollinia* ovoid, c. 0.6×0.5 mm.

RECOGNITION. *Liparis chantaliae* is easily recognised by its tall pseudobulbs, circular in cross-section and partly covered by papery sheaths, with two broadly oval, corrugate leaves at the top. The large flowers have a characteristic broadly oval-lanceolate lip, with short rounded wings and two elongate lamellar-triangular calli at the base, and an almost triangular anterior lobe with dentate margins. The anther has a cuspidate to linear beak.

Liparis chantaliae is similar to *L. gracilipes* but the leaves are much thinner in texture and broadly oval vs elliptic, the lip broadly oval-lanceolate vs suborbicular and the callus bi-lamellar vs tridentate. There are some superficial similarities with *L. zaratananae* but the pseudobulbs are shorter, less leafy, the lip is oval-lanceolate with the anterior margin angular vs broadly oval and rounded, the anther has a shorter, less spathulate beak. It shares the tall habit, somewhat corrugate leaves, lax inflorescence and large flowers with *L. longicaulis* with which it has frequently been confused in herbaria and in field-observations

Table 7. Comparison of *Liparis chantaliae* and *L. longicaulis*.

	<i>L. chantaliae</i>	<i>L. longicaulis</i>
Plant habit	scrambling	compact
Plant height	up to 26	up to 35
Pseudobulb-stem	round in cross-section, partly covered by papery bracts	angular in cross-section, covered by papery bracts
Inflorescence height (cm)	8 – 15, shorter than the pseudobulbs	up to 10 – 24, as long as the pseudobulbs
No. flowers per inflorescence	up to 14	up to 10
Flower size (mm)	up to 41 × 23	up to 24 × 18
Lip	broadly oval-lanceolate, anterior lobe almost triangular and attenuate	oval to broadly ovate, anterior lobe obtuse
Lip callus	bi-lamellar / triangular	indistinctly bi-lobed / rounded
Flowering Time	Jan. – June	Dec. – April
Distribution	Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Mahajanga, Toamasina, Toliara prov.	Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Mahajanga, Toamasina prov.
Altitude (m)	700 – 1700	800 – 1800

(Table 7), but the latter differs by the angular stem which is completely covered by overlapping papery sheaths (vs partly covered), generally longer inflorescence, larger flowers, a lip with an attenuate anterior lobe (vs rounded), a distinct bilobed callus on the lip (vs rounded swelling) and a more acutely beaked anther. The two species have a wide and overlapping

distribution but *L. chantaliae* has been recorded from Toliara province, where *L. longicaulis* is absent. The species overlap in distribution in Andasibe (Toamasina prov.) and Ranomafana (Fianarantsoa prov.), they grow at similar elevations in wet evergreen forest, flower at similar times and both are scented.

DISTRIBUTION. Widespread and endemic to Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Mahajanga, Toamasina and Toliara provinces (Map 15).

SPECIMENS EXAMINED. MADAGASCAR. Toamasina, near Andasibe, Vakôna forest, alt. 1020 – 1100 m, Jan. 1997, *Hermans* 3997 (holotype K); Ambohimanga, June 1906, *Alleizette* 351bis (P); Andohahela massif, upper valley of the Sakamalia, 1500 – 1700 m, Jan. 1934, *Humbert* 13562 (P); Zahamena, March 1941, *Decary* 16789 (P); Atsanga, Imerimandrosa, 750 m, April 1941, *Cours* 1549 (P, TAN); Mts S of Tanandava, Manampanihy tributary, Mandrere valley, 600 – 700 m, March 1947, *Humbert* 20531 (G, P, TAN); Anjozorobe, March 1959 *Bosser* 12358 (P); Ranotsara, near Ihosy, March 1964, *Bosser* 17869 (P); Mt d'Ambre, June 1970, *Bosser* 20337 (P); Masoala, 700 m, May 1975, *Morat* 4933 (P); Mt d'Ambre, 1400 – 1475 m, April 1993, *Andrianantoanina et al.* 41 (K); SW of Antsiranana, near Joffreville, Parc National Mt d'Ambre, 1993, *Malcomber et al.* 2380 (MO); Andranotsarabe, 1050 m, Nov. 1994, *Hermans* 1002 & 2292 (K); Tanandava area, in forest, 600 m, 1999, *Hermans* 2423 (K); near Ranomafana, May 2001, 1016 m, *Hermans* 5243, 5250 & 6607 (K); Mantadia, Belakato, Nov. 2003 (in fruit), *Roberts et al.* TPPO24 (K); Toamasina, Ambohibary, Ambatovy, 1144 m, June 2008, *Antilahimena et al.* 6266 (MO, P, TAN); Toamasina, fraisana Ambohibary, fokontany Ampitabe, Ambatovy, 1026 m, June 2008, *Rakotondrajaona et al.* 448 (MO, P, TAN); Toamasina, Andasibe, Menalamba, Ambondromasay, 1016 m, April 2009, *Bernard et al.* 1416 (MO, P, TAN); Toamasina, Alaotra-Mangoro, Ambatovy, Sept. 2009, *Antilahimena et al.* 7158 (K, MO); Toamasina, Anosibe

0 100 200 km

Map 15.. Distribution of *Liparis chantaliae*.

an'ala, April 2010, *Rajavelona et al.* 235 (K, TAN); Toamasina, Ambatovy: Région Alaotra-Mangoro, Distr. Moramanga. 1161 – 1186 m, Nov. 2011, *Ambatovy Shade House* 539 (BRLU, MO, TAN); Toamasina, Moramanga, Andasibe, Bekalakody, April 2012, *Razafindrahaja & Antilahimena* 225 (MO, P, TAN); Toamasina, Andasibe, Andasifahatelo, Ambatoaranana, 1005 m, April 2012, *Rasoazanany & Ratolojanahary* 104 (MO, P, TAN); Toamasina, Ambatovy: Région Alaotra-Mangoro, Moramanga, April 2013, *Ambatovy Spirit Collection* 858 (BRLU, MO, TAN); Moramanga, Andasibe, Analamazaotra, 817 m, Dec. 2013, *Razafindraibe et al.* 633 (MO, TAN); Commune Andasibe, Réserve Spéciale Analamazaotra, site Anivokely, 1012 m, Dec. 2013, *Razafindraibe* 575 (MO, TAN); Andasibe, Fokontany Falierana, Mantadia, 915 m, Dec. 2013, *Antilahimena et al.* 8744 (MO, TAN); Fianarantsoa, Ranomafana area, April 2018, *Hermans* 8217 & 8221 (K).

HABITAT. Evergreen forest undergrowth, riverine forest. Altitude: 700 – 1700 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis chantaliae* is estimated to be 145,327 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 96 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis chantaliae* is known from 13 subpopulations representing 15 locations (sensu IUCN), this species has thus been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January to June.

ETYMOLOGY. Named in honour of Mme Chantal Hervouet, who with her husband, Jean-Michel Hervouet, is an ardent explorer of Madagascar.

ILLUSTRATIONS. Figs 14, 15. Cribb & Hermans (2009: 149 as *Liparis zaratananae*).

***Liparis cladophylax* Schltr.** (Schlechter 1916: 321; 1924: 136); Perrier (1939: 276); Hermans *et al.* (2007: 216); Cribb & Hermans (2009: 150). Type: Madagascar, High Sambirano valley, 800 m, Oct. 1912, *Perrier* 11360 (139) (holotype P).

Very small epiphytic plant 6 – 8 cm high, rhizome short, roots glabrous, filiform. *Pseudobulbs* oval, small, 8 – 10 mm high, covered in thin membranous sheaths and a leaf-like 1 cm sheath, the flowering bulb carrying 2 larger leaves. *Leaves* erect to sub-erect, soft, oblong-ligulate, subacute and narrowed towards the base, 3 – 4.5 × 0.6 – 0.8 mm. *Inflorescence* erect, slender,

a little shorter than the leaves, up to 25 mm long, subdensely 6 – 8-flowered (Schlechter's original description has 15 – 20 flowers but there is no evidence of this in the type material). *Peduncle* with a short acuminate sheath. *Floral bracts* narrow, lanceolate, acuminate, a little shorter than the ovary, 3 – 4 × 1.5 mm. *Flowers* very small, somewhat spreading, greenish at first, becoming brownish-yellow with age, c. 2.5 × 3 mm. *Pedice* and *ovary* slender, glabrous, up to 6 mm long. *Dorsal sepal* recurved, lanceolate, obtuse 2.5 – 3 × 0.4 – 0.6 mm. *Lateral sepals* oblong, obtuse, single-veined, 1.8 – 2.7 × 1.1 – 1.4 mm. *Petals* narrowly linear, obtuse, single-veined, a little rough at the apex, 1.9 – 2.3 × 0.3 mm. *Lip* slightly recurved, suborbicular without obvious veins, the base slightly auriculate, indented at the anterior margin, with a transversal 'M'-shaped callus or thickening at the base extending into two lateral keels, carrying a few horn-like protrusions on the anterior half, 1.7 – 2 × 1.4 × 2 mm. *Column* with the angular wings on each side of the stigmatic surface 1.5 – 1.8 × 0.3 mm. *Anther* truncate at the front 0.3 × 0.3 mm. *Pollinia* c. 0.2 mm diam.

RECOGNITION. The species is mainly known from Perrier's type collection from Northern Madagascar, consisting of two plants and fragments of an inflorescence and flowers. The small size of the plant and flowers combined with the lip shape, callus and tiny horn-like protrusions at the back of the lip make it distinct.

Schlechter, in his description, wrote that this species is similar to *Liparis epiphytica* Schltr. (Schlechter 1905b), from Western Africa: in several characteristics the plant and habit are similar although the leaves in *L. epiphytica* are blunter, the flowers of *L. cladophylax* are much smaller (about half the size), the lip basal formation is also different ('M'-shaped vs rectangular). There are some similarities to *L. cespitosa* but that has a single leaf, and there are also differences in the lip which is rounded in *L. cladophylax* and more expanded and dentate in *L. cespitosa*. It is also close to *L. scaposa* but the flowers are smaller, the column has smaller wings and a smaller callus on the lip. As the species is only known from limited material, it is difficult to assess its identity with any certainty. The original description calls for a dense spike of 15 – 20 flowers but the herbarium material bears no resemblance to this, this characteristic would make it very different from similar small species; with this conflict between type material and the description the species will have to remain somewhat ambiguous.

DISTRIBUTION. Endemic to Madagascar: Antsiranana province only (Map 16).

SPECIMENS EXAMINED. MADAGASCAR. Madagascar, high Sambirano Valley, 800 m, Oct. 1912, *Perrier* 11360 (139) (holotype P); Hort., 2000, *Hermans* 5308 (K).

Fig. 14. *Liparis chantaliae*. A habit $\times 1$; B flower, front view $\times 3$; C flower, side view $\times 3$; D dorsal sepal $\times 5$; E petal $\times 3$; F lateral sepal $\times 5$; G lip $\times 5$; H lip basal callus $\times 10$; J column, side view $\times 8$; K column, side view $\times 19$; L top of column with anther cap lifted $\times 15$; M anther cap $\times 15$ (digitally altered); N pollinia $\times 15$. DRAWN BY OLIVER WHALLEY.

Fig. 15. A *Liparis chantaliae* with Chantal Hervouet for whom the species was named; B habit; C rachis; D flower visited by the ant *Tetraponera grandidieri*. PHOTOS: A JEAN-MICHEL HERVOUET; B – D JOHAN HERMANS.

HABITAT. Epiphyte in humid evergreen forest. Altitude: c. 800 m

CONSERVATION STATUS. Category **CR**: the extent of occurrence (EOO) of *Liparis cladophylax* cannot be estimated since it is only known from one subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2).

The only known subpopulation represents one location (sensu IUCN). This species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. October.

0 100 200 km

Map 16. Distribution of *Liparis cladophylax*.

ETYMOLOGY. Possibly referring to the dominant leaves or to the epiphytic habit of the species.

NOTES. The holotype, collected as *Perrier* 139, was then changed to *Perrier* 11360 and is lodged in Paris; this is sometimes cited as an isotype but it is clearly marked as Schlechter's type as used for the protologue and should therefore be considered the holotype of the species, especially as any other of Schlechter's material would be likely to have been destroyed in Berlin.

ILLUSTRATIONS. Schlechter (1932: t. 52).

Liparis clareae Hermans (in Hermans *et al.* 2007: 216); Cribb & Hermans (2009: 146); Hervouet (2018: 406). Type: Madagascar, Mandraka Gorge, François in herb. *Perrier* 17797 (holotype P).

Liparis cardiophylla H.Perrier (1936: 244), non Ames (1908: 92); Perrier (1939: 268). Type as above.

Medium-sized epiphytic or terrestrial plant up to 18 cm tall, roots white c. 1.2 mm diam. Plant on a short linear rhizome, rhizome c. 5 mm diam., covered in fibrous sheaths, roots somewhat woolly. Pseudobulbs fleshy, 4 – 11 cm × 3 – 7 mm, enveloped by 2 – 3 papery sheaths, carrying a single leaf. Leaf more or less fleshy,

persistent on the older pseudobulbs, broadly ovate-cordate, acute, auriculate-imbricate at the base, blade leathery and rigid, green to blueish green, paler underneath, with several veins but mid-vein not prominent, especially in the living plant, 5.5 – 10 × 4 – 5.6 cm. Inflorescence up to 20 cm long, erect to arching from the apex of the pseudobulb, carrying up to 10 flowers but generally fewer. Peduncle enveloped at the base by a single whitish sheath and 1 – 2 bract-like sheaths similar to the floral bracts higher up. Rachis laxly flowered, successive along its length. Floral bracts cordate, a little shorter than the pedicellate ovary, 5 – 7 × 1.5 – 2.1 mm. Flowers large, overall 18 × 15 mm, olive green, the lip darker with a glossy dark green raised area from the base to the middle, column white, anther pale yellow, pollinia yellow, flowers turning yellow-orange with age, flower buds gibbose on each side of the base. Pedicel and ovary glabrous, round, 9 – 12 × 6 – 7 mm. Dorsal sepal lanceolate, subacute, narrowing towards the base faintly 3-veined, 6.5 – 11 × 1.25 – 2.5 mm. Lateral sepals oblong to oval, obtuse 6 – 9.1 × 2.2 – 4 mm. Petals linear, 7 – 13 × 0.4 – 0.9 mm. Lip ovate to sub-rectangular, base narrowed auriculate, the anterior margin denticulate, spreading into the margins, without a distinct callus but a swollen base spreading into the centre, 6.2 – 8.9 × 4.1 – 7.6 mm. Column arched, 2.5 – 4.2 × 1 – 1.5 mm, with obtuse expanded wings towards the apex just below the rostellum. Anther with a distinct subacute beak almost as long as the anther chamber, 1.1 – 1.8 × 0.7 – 1.1 mm. Pollinia one to rarely two per chamber, oval, 0.3 – 0.6 × 0.2 – 0.5 mm.

RECOGNITION. A medium-sized plant with a linear rachis and fleshy pseudobulbs and leaf. The leaf is flat, single, broadly ovate and clearly cordate at the base, the mid-vein is indistinct, the floral bracts cordate, and the flowers large for the genus, with an ovate to subrectangular lip with an indistinct callus, a column with rounded wings and an anther cap with a long sub-acute beak. It is long and successively flowering.

Liparis clareae is similar to *L. warpurii* but differs by the distinct habit with a short linear rachis (a longer scrambling habit in *L. warpurii* where new growths emerge from the lower nodes of the previous pseudobulb), the wider, flatter, heart-shaped leaf without a distinct central vein, cordate floral bracts and larger and more numerous flowers. As shown in Table 8, it has similarities with several other species, including *L. magnifica*, described below but *L. clareae* is around three times the size in both plant and flower size and its callus is indistinct (vs bidentate). It is related to *L. laurentii*, described below, but the plant of *L. laurentii* is smaller, the leaf has a more distinct central vein and the base is rounded (vs cordate), it has 1 – 5 flowers (vs 6 – 12), the transversely elliptic or

Table 8. Comparison of the larger single-leaved species: *Liparis clareae*, *L. laurentii*, *L. magnifica*, *L. superclareae* and *L. warpurii*, floral parts based on average measurements.

	<i>L. clareae</i>	<i>L. laurentii</i>	<i>L. magnifica</i>	<i>L. superclareae</i>	<i>L. warpurii</i>
Rhizome	short to medium, straight	short, ascending	short, ascending	short, ascending	short to long, scrambling
Pseudobulbs shape	erect, thin	erect, thin, short	erect	erect	sometimes from internode of previous bulb
Pseudobulbs size (cm)	4 – 11	c. 2	2 – 5	5 – 9.5	3 – 5
Sheaths	few, papery	covering pseudobulb	almost covering pseudobulb, papery	almost covering pseudobulb, with brown specks	almost covering pseudobulb, papery
Leaf shape/colour	ovate, flat mid-vein indistinct, green	broadly ovate, green	lanceolate, with silvery markings	lanceolate, strongly veined	lanceolate, distinct mid-vein, sometimes silvery
Leaf size (cm)	7 × 4.5	5 × 3	4 × 1.5	10.5 × 3.5	5 × 2
Flowers (number)	4 – 10	1 – 5	1 – 5	4 – 7	2 – 4
Floral bract shape	cordate,	lanceolate – cordate,	lanceolate,	slender,	cordate,
Floral bract size (mm)	6 × 1.8	5 × 1.5	4.5 × 1.5	8 × 1.5	7 × 2.5
Dorsal sepal (mm)	8 × 1.5	8 × 1.5	7.5 × 1.5	17 × 1.6	9.5 × 1
Lateral sepal (mm)	8 × 2.5	6.5 × 5	6 × 2.7	17 × 5.5	9.5 × 3.5
Petal (mm)	9 × 0.6	8 × 0.4	7.5 × 0.3	18 × 0.7	8.5 × 0.5
Lip size (mm)	7 × 6	5 × 6.5	5.5 × 4.4	16 × 11	8.5 × 7.5
Lip shape	ovate to subrectangular, margin denticulate	transversely elliptic to reniform, emarginated, margin entire	obovate, anterior margin undulate	angular, margin dentate	margin slightly serrate
Lip callus	indistinct swelling	two, horn-like	shortly bi-dentate	slight swelling	angular bilobed
Anther	long subacute beak	long sharp beak	short sharp beak	long sharp beak	short obtuse beak
Distribution	Madagascar: N, Central and E	Madagascar: NE	Madagascar: E	Madagascar: NE	Madagascar: E - Central

reniform lip is much wider (vs ovate), the margins are not serrate, the anterior margin is emarginate (vs entire), the basal calli consisting of horn-like calli (vs slight swellings) and the column wings are elongate (vs short and obtuse). It is also close to *L. superclareae*, described below, with which it shares its general habit and lip shape but *L. superclareae* has much longer pseudobulbs, the leaves of the previous growth disintegrate before the new ones develop (vs persistent), the leaves are lanceolate (vs ovate) and at least 2.5 – 3 times longer than wide (vs 2 times), the floral bracts are less cordate at the base, the flowers and all its segments much larger, the column shorter with broad long wings (vs short-auriculate) and the anther more sharply beaked (Table 8).

DISTRIBUTION. Endemic and widespread in Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Mahajanga & Toamasina provinces (Map 17).

SPECIMENS EXAMINED. MADAGASCAR. N & C, 1899, *Warpur* s.n. (K); Mandraka Gorge, *François* in herb. *Perrier* 17797 (holotype P); RN 1, Betampona, evergreen forest, Sept. 1963, *Bosser* 17226 (P); Antananari-

vo, NW of Ambohitsaratelo-Bebao; c. 1200 m, Jan. 1985, *Barnett et al.* 377 (MO, P, TAN); Majunga province, c. 16 km NW of Ambohitsaratelo-Bebao, Jan. 1985, *Barnett et al.* 3484 (MO, P, TAN); Majunga, 15.4 km NW of Ambohitsaratelo-Bebao, Jan. 1985, *Barnett et al.* 3510 also as *Dorr et al.* 3510 (K, MO, P, TAN); Toamasina, Masoala Peninsula, E of Ambanizana, May 1989, *Schatz et al.* 2717 (K, MO, P, TAN); Masoala peninsula, Ambanizana, 600 m, June 1993, *Zjhra & Hutcheon* 331 (K, TAN); NE, Masoala Peninsula, W coast, May 1994, *Lance* 109 (K); Antsiranana, towards Anjanaharibe, 1994, *Hermans* 6542 (K); Fianarantsoa, Ranomafana area, 2001, 1095 m, *Hermans* 5215 & 6677 (K); Antsiranana, Ambilobe, Beramanja, 617 m, Feb. 2005, *Wohlhauser et al.* 747 (P); Maroantsetra, Ambinanitelo, 224 m, May 2007, *Ranarivelo* 680 (K); Antsiranana, Bongomihiravavy forest, 700 m, Nov. 2007, *Nusbaumer* LN2558 (G); Antsiranana, Mt d'Ambre, 800 m, May 2008, *Razanajatovo et al.* MHR143 (G, P); Antsiranana, Mt d'Ambre, 833 m, April 2008, *Ramandimbimanana* 516 (G, P); Antsiranana, Mt d'Ambre, 1070 m, April 2008,

0 100 200 km

Map 17. Distribution of *Liparis clareae*.

Ramandimbimanana et al. SDR 049 (G); Mt d'Ambre, 920 m, 2012, *Ramandimbimanana* 479 (G, P); Saloka, 980 m, 2016, *Hermans* 8065 (K, WU).

HABITAT. Evergreen forest, moss-forest, on moss or moss-covered trees. Altitude: 600 – 1500 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis clareae* is estimated to be 217,057 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 44 km² (which falls within the limits for Endangered status under the criterion B2). This species is known from nine subpopulations representing 10 locations (sensu IUCN), and has thus been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January to May.

ETYMOLOGY. The original name given by Perrier refers to the heart-shaped leaf, the name now refers to 'bright-shining' and to Clare Hermans.

NOTES. The species was first described by Perrier in his monograph on the Liparidinae of Madagascar

in 1936, based on a specimen collected by Edmond François in the Mandraka Gorge. There is an earlier use of *Liparis cardiophylla* Ames (1908: 92), based on a plant from Jamaica that precludes the use of this name for the Madagascan plant, it was therefore named *L. clareae* in 2007 (Hermans *et al.* 2007: 216). *Liparis cardiophylla* var. *angustifolia* H.Perrier ex Hermans (in Hermans *et al.* 2007: 289) was described by Perrier in 1936 as a tentative variety of the species, it is only known from the type specimen which corresponds well with the characteristics of *L. warpurii* and is included and discussed under this species.

Perrier, in his description, noted that single pollinia were found in each of the two anther chambers in the type, this peculiarity seems to vary between specimens with some showing the normal two pollinia per chamber.

ILLUSTRATIONS. Fig. 16; Hermans *et al.* (2007: pl.45); Cribb & Hermans (2009: 147); Hervouet (2018: 406).

Liparis danguyana H.Perrier (1936: 248; 1939: 274); Hermans *et al.* (2007: 217); Cribb & Hermans (2009: 148); Bosser & Lecoufle (2011: 406). Type: Madagascar, Mt Angavokely, E of Antananarivo, Perrier 16064 (holotype P).

Medium-sized, erect terrestrial or epiphytic *plant*, 11 – 18 cm, rhizome ascending, c. 5 mm diam., roots fibrous, wiry. *Pseudobulbs* 1 – 2 cm apart, stem-like, 7 – 12 cm × 1.5 – 5 mm diam., carrying two leaves at the apex, enveloped by 5 – 8 scarious sheaths. *Leaves* dark green, broadly oval, subsessile, shortly acute at the apex, rounded at the base, petiole c. 8 × 1.5 mm, blade strongly veined, 2.4 – 4.5 × 1.8 – 3 cm. *Inflorescence* up to 7 cm long. *Peduncle* with 3 – 4 bract-like sheaths. *Rachis* erect, subdensely 4 – 12-flowered. *Floral bracts* acute, about $\frac{1}{3}$ of the length of the pedicellate ovary, 4 × 2.1 mm. *Flowers* small, c. 6 × 8 mm, green. *Pedicel* and *ovary* 8 – 9 × 0.8 – 1.8 mm, faintly winged. *Dorsal sepal* lanceolate, not auriculate at the base, 7 – 10 × 1.2 – 2 mm. *Lateral sepals* semi-oval, rolled below the lip, 5.5 – 7 × 3 – 3.5 mm. *Petals* linear, 3-veined at the base, 7.5 – 10 × 0.8 – 1.2 mm. *Lip* ovate to orbicular, obscurely veined, the basal wings obtuse and divaricate, slightly attenuate at the anterior margin, with 2 small but distinct rounded calli at the base, 6 – 6.5 × 4 – 5.5 mm. *Column* curved at the apex, 4 – 4 × 1 mm, wings thin and small. *Anther* suborbicular, very rounded at the front, 1 – 2 pollinia per chamber, 1 × 0.8 mm. *Pollinia* ovate, c. 0.2 mm diam.

RECOGNITION. Distinct by its long and thin stem, with two broadly oval leaves, an ovate to orbicular lip with two indistinct calli at the base and a short apicule at the anterior margin and its suborbicular, rounded anther cap.

Fig. 16. *Liparis clareae*. A habit; B flower. PHOTOS: JOHAN HERMANS.

Margonska (2009: 97) mistakenly considered this species to be conspecific with *Liparis bernieri*. As shown in Table 5, there are a number of superficially similar species with an equally long fleshy stem and two leaves from the area, including: *L. bernieri* from Réunion and *L. danguyana* and *L. listeroides* from Madagascar but there are substantial differences: The leaves of *L. danguyana* are thinner in texture and have a more cordate base than those of *L. bernieri* and *L. listeroides* which are more leathery and have indistinct veins, the leaf shape of *L. listeroides* is oval petiolate vs broadly oval and sessile. The flowers of *L. listeroides* are generally smaller than the other two. The lip of *L. danguyana* has two small but distinct calli at the base, that of *L. bernieri* is cushion-like, those of *L. listeroides* are long and tooth-like, the anterior margin of *L. danguyana* is apiculate at the anterior margin, the others have a more or less denticulate-sinuate margin. The anther of *L. danguyana* is rounded at the front and suborbicular, that of *L. listeroides* is slightly beaked. Considering these differences and specific geographical distribution it is correct to recognise all three species (Table 5).

DISTRIBUTION. Endemic to Madagascar, until recently known from the type locality of Angavokely in Antananarivo province only. It has now also been recorded from Ambondrombe in Fianarantsoa prov. (J.-M. Hervouet pers. comm.) (Map 18).

SPECIMENS EXAMINED. MADAGASCAR. Madagascar, Mt Angavokely (E of Antananarivo), *Perrier* 16064 (holotype P); Antananario, Angavokely forest reserve, March 1992, *Pettersson & Nilsson* 563 (P); Manjakandriana distr., SE of Nandihizana, Angavokely forest reserve, 1600 m, March 1992, *Pettersson & Nilsson* 586 (P, UPS).

HABITAT. Moss forest, on moss and lichen-covered trees. Altitude: 1600 – 1800 m.

CONSERVATION STATUS. Category **CR**: the extent of occurrence (EOO) of *Liparis danguyana* cannot be estimated since it is only known from one remaining subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis danguyana* is only known from one subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily

0 100 200 km

Map 18. Distribution of *Liparis danguyana*.

assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. The type locality now has only remnants of forest and little surrounding habitat.

FLOWERING TIME. February to March.

ETYMOLOGY. The name refers to Paul Auguste Danguy (1862 – 1942) who worked with Humbert and Perrier and later became deputy director of the Laboratoire de Phanérogamie at the Paris Museum, France.

ILLUSTRATIONS. Figs 17, 18; the plant labelled as *Liparis danguyana* in Bosser & Lecoufle (2011: 406) is not this species and resembles *L. imerinensis*.

***Liparis densa* Schltr.** (Schlechter 1924: 137); Perrier (1939: 281); Hermans *et al.* (2007: 217); Cribb & Hermans (2009: 152); Hervouet (2018: 408). Type: Madagascar, Andringitra massif, Perrier 14358 (P00094972) (lectotype P, designated here; isolectotype Perrier 14358 (P00094973) P).

Small, compact, erect terrestrial or lithophytic plant, 10 – 15 cm tall, rhizome very short, roots wiry,

glabrous. *Pseudobulbs* oblong, almost completely submerged in soil and humus, 2-edged, compressed, 2 – 3 × 1.2 – 1.4 cm, watery, turning into pulp under finger pressure, carrying 2 – 5 leaves, the base enveloping the pseudobulbs. *Leaves* erectly to sub-erectly spreading, oblong-ligulate, acute or somewhat obtuse, a little fleshy, 6 – 8 cm long, 1.2 – 2.5 cm wide. *Inflorescence* up to 11 cm long, with none or one thin sheath towards the base, carrying up to 15 flowers. *Peduncle* ridged, up to 6 cm, hardly longer than the leaf sheaths. *Rachis* densely flowered, cylindrical, much longer than the peduncle, up to 8 cm long, 1.7 mm diam. *Floral bracts* narrowly lanceolate, acuminate, the lower ones as long as the ovary or longer, the upper ones shorter, up to 10 × 2.1 mm. *Flowers* small, 10 × 5 mm, uniformly pale yellow to yellow. *Pedicel* and *ovary* rounded, slightly ridged, 8 × 0.8 mm. *Dorsal sepal* erect, ligulate-lanceolate, obtuse, 6.5 – 8 × 1 – 1.3 mm. *Lateral sepals* subfalcate, oblong, obtuse, spreading, curled backwards, 4.8 – 5 × 2.2 – 2.7 mm. *Petals* erect or semi-erect, linear, somewhat obtuse, 6.5 – 8 × 0.8 – 1 mm. *Lip* distinctly geniculate, recurved, obovate-oblong, very obtuse, margins sub-crenulate, basal margins minutely triangular-auriculate, creating a deep gutter at the base, without a callus on the disk and base, 4.5 – 6 × 2 – 3.7 mm when flattened. *Column* curved, wings small and rounded, 3 – 4 × 1.2 mm. *Anther* with a small triangular beak, 0.6 × 0.7 mm. *Pollinia* ovate, c. 0.2 mm diam.

RECOGNITION. The species is distinct by the compact plant and inflorescence with the rachis longer than the peduncle, the semi-erect petals and the knee-shaped lip without a callus. Schlechter pointed out in his description that this species is related to *Liparis capensis* Lindl. (Lindley 1840: 314) known from the Western and Eastern Cape of South Africa. Although related, plants of *L. capensis* are generally shorter, normally have two narrower leaves, flowers about ¼ smaller, a slightly different lip (elliptic vs obovate) with a small conical callus at its base vs ecallose. There are similarities in plant habit to *L. bathiei* but the flowers are almost double the size, the lip is obovate vs oval-lozenge shaped and the anther is triangular vs rounded. In plant habit it is similar to *L. bicornis* but the flowers are very different with the lip obovate vs ovate-obcuneate and without callus at the base vs distinctly two-horned. It is closest to *L. lutea* and they could well be the same species but the pseudobulbs are longer, the leaves bigger, the inflorescence and rachis more compact and the flower segments a little larger. Due to the limited nature of the type material of *L. lutea* it is impossible to effectively compare the two species.

DISTRIBUTION. Endemic to Madagascar: Fianarantsoa, in the Andringitra massif and Toliara province in the Andohahela massif, at a similar altitude but several hundred km South from the type locality (Map 19).

Fig. 17. *Liparis danguyana*. A habit; B flower; C dorsal sepal; D lateral sepal; E petal; F lip; G column and lip, side view; H column, anther cap removed; J anther cap, dorsal view; K anther cap, ventral view; L pollinia. From Perrier 16064 (P). DRAWN BY JUDI STONE.

Fig. 18. *Liparis danguyana*. A plant habit; B flowers; C flower detail. PHOTOS: JEAN-MICHEL HERVOUET.

SPECIMENS EXAMINED. MADAGASCAR. Ankeramadinika, Nov. 1885, *Fox* 78 (K ex LDS); Andringitra massif,

Perrier 14358 (P00094972) (lectotype P); *Perrier* 14358 (P00094973) (isolectotype P); Andohahela massif, high

0 100 200 km

Map 19. Distribution of *Liparis densa*.

valley of the Sakamalio evergreen forest, 1500 – 1900 m, Jan. 1934, *Humbert* 13559 (P); Andohahela Massif, RN11, Jan. 1974, *Morat* 4404 (P); Andohahela area, 1999, *Hermans* 2884 (K).

HABITAT. Terrestrial or lithophyte on shaded and humid rocks, partly submerged in humus. Altitude: c. 2400 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis densa* cannot be estimated since it is only known from two subpopulations whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis densa* is only known from two subpopulations representing two locations (sensu IUCN), this rare species has thus been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January.

ETYMOLOGY. Presumably refers to the compact habit of plant and inflorescence.

NOTES. The species was first collected by Perrier in the Andringitra Massif in SE Madagascar in 1922. It was

described by Schlechter in Germany two years later and the type specimens were returned to Paris. There are two herbarium sheets of *Perrier* 14358 in P marked as 'type': the sheet with barcode P00094972 is the most complete with characteristic clumps of plants and is therefore chosen here as the lectotype, with sheet P00094972 being the isolectotype.

Humbert 13559 shows some differences from the type, as noted by Perrier: its pseudobulb and leaf-shape are similar, but its lip is a little larger and has a different shape but this is difficult to confirm in the dried specimens.

ILLUSTRATIONS. Figs 19, 20. Schlechter (1932: T.52); Perrier (1939: 283); Guérin & Hervouet (2013: 326); Hervouet (2018: 408).

***Liparis dryadum* Schltr.** (Schlechter 1924: 138); Perrier (1939: 278); Hermans *et al.* (2007: 218); Cribb & Hermans (2009: 152). Type: Madagascar, Mt Tsaratanana, lichen forest, 1200 – 1600 m, Jan. 1923, *Perrier* 15245 (P00094977) (holotype P); Mt Tsaratanana, 1200 – 1600 m, Feb. 1923, *Perrier* 15245 (P00094978) (topotype P).

Platystyliparis dryadum (Schltr.) Margonska (2009: 94)
synon. nov.

Very small, erect epiphytic *plant*, up to 6 cm, forming small clumps, rhizome very short, roots rounded, filiform, glabrous, 1 – 2 mm diam. *Pseudobulbs* distinctly flattened- rounded, normally with 2 – 3 leaves, 4 – 16 × 8 – 15 mm, covered in degrading sheaths and the base of the lower leaf. *Leaves* lanceolate, erectly spreading, obtuse to subacute, more or less corrugate especially at the margins, a little narrowed at the base, forming a short petiole, overall 1.5 – 5.5 × 0.4 – 2.1 cm, the third one generally smaller. *Inflorescence* erect or arching, up to 9 cm, laxly 3 – 30-flowered. *Peduncle* winged, barbellate, with one or two sheaths 4 – 6 × 1 – 1.2 mm. *Rachis* 3 – 4 cm, costate, with the lower flowers opening before the upper ones. *Floral bracts* lanceolate to ovate, rounded at the base, about the same size as the ovary, entire to dentate at the margins, 2.1 – 4.9 × 1.8 – 2 mm. *Flowers* very small, overall 5 – 8 × 3 – 6 mm, yellow-green to yellow-brown. *Pedice*l and *ovary* rounded, winged, distinctly echinate especially towards the base, 3 – 7 × 0.3 – 0.8 mm. *Dorsal sepal* erect, lanceolate-ovate, obtuse, margins strongly recurved, 3 – 4.9 × 0.9 – 1.9 mm. *Lateral sepals* deflexed, obliquely-ovate, obtuse, 2.7 – 3.9 × 1.4 – 2.5 mm. *Petals* deflexed, narrowly subfalcate-linear, obtuse, 3.1 – 3.7 × 0.2 – 0.4 mm. *Lip* curved, very broadly suborbicular-obtrapezoid, the anterior margin with a slightly obtuse apicule, emarginate, base broadly rounded truncate, at the base with a short bilobed rounded callus at the base, partly covered by a basal lobe, 1.9 – 2.8 × 1.8 – 2.8 mm. *Column* a little curved, the margins extended into a short acute triangle alongside the

Fig. 19. *Liparis densa*. Plant habit. PHOTO: JEAN-MICHEL HERVOUET.

stigmatic surface, $2 - 3.5 \times 0.8 - 1.3$ mm. *Anther* ob-triangular with two ridges, c. 0.4 mm diam. *Pollinia* c. 0.3 mm diam.

Fig. 20. *Liparis densa*. Rachis. PHOTO: JEAN-MICHEL HERVOUET.

RECOGNITION. *Liparis dryadum* is one of the smallest species of the genus. The inflorescence is somewhat longer than the lanceolate leaves, of which it has two to three leaves with wavy margins and a short petiole. The lip disk has a short, bilobed callus at the base. The broadly inverse-trapezoid lip with rounded corners is also characteristic.

Liparis dryadum is similar to *L. xanthina* but the leaves are shorter and narrower, the differences in flower characteristics are difficult to ascertain with only Deans Cowan's rudimentary watercolour as evidence. It is somewhat different from *L. cladophylax* which has wider leaves that are not corrugate at the margins and an narrower lip with an 'M' shaped callus vs shortly bilobed. Schlechter mentioned a similarity with *L. epiphytica* Schltr. (Schlechter 1905b) from West Africa, but it is easily distinguished by being more than half the size both in plant and flower and a bilobed lip callus vs rectangular.

Perrier seems to have made another collection in the same locality one month after collecting the type specimen and gave it the same collection number. The later collection is a topotype of the species (P00094978). It is also possible that an error was made on the specimen labels. The species was re-classified as *Platystyliparis dryadum* (Schltr.) Marg. by Margonska in *Richardiana* (2009: 94) but there is no evidence or necessity for this.

DISTRIBUTION. Endemic to Madagascar: Antsiranana, Fianarantsoa, Mahajanga, Toamasina Provinces (Map 20). Confusingly Perrier indicated 'Centre' on collection labels; the Tsaratanana mountain range is in Antsiranana province in Northern Madagascar. Szelengowicz & Tamon (2013: 355); reported this species from Réunion but there is no evidence for this. Their description transcribes Perrier's original text and is accompanied by a fuzzy photograph of an unidentifiable plant.

SPECIMENS EXAMINED. MADAGASCAR. Mt Tsaratanana, 1200 – 1600 m, Jan. 1923, *Perrier* 15245 P00094977 (holotype P); Mt Tsaratanana, 1200 – 1600 m, Feb. 1923, *Perrier* 15245 P00094978 (topotype P); Mahajanga, NW of Ambohitsaratelo-Bebao, 1200 m, Jan. 1985, *Barnett et al.* 312 (MO, TAN); Mahajanga, NW of Ambohitsaratelo-Bebao, NW of Tsiroanomandidy; c. 1200 m, Jan. 1985, *Dorr et al.* 3575 (K, MO, P, TAN); Antsiranana, Sava, Sambava, Beventro, Tsaratanana, 1143 m, Feb. 2007, *Rakotovo et al.* 3560 (K, MO); Toamasina, Andrangato R., March 2011, 660 m, *Antilahimena* 7578 (MO, TAN); Toamasina, Ankerana NE, 28 Jan. 2012, *Ravelonarivo* 4215 (TAN); Mahajanga, S of Bealanana, 1307 m, Jan. 2018, *Gamisch et al.* SA7547 (WU); Fianarantsoa, Ranomafana area, Jan. 1992, 1130 m, *Hermans* 8285 (K).

0 100 200 km

Map 20. Distribution of *Liparis dryadum*.

HABITAT. Epiphyte in lichen forest, or dense humid evergreen forest, moss and lichen-covered trees. Altitude: 660 – 1600 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis dryadum* is estimated to be 151,497 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 20 km² (which falls within the limits for Endangered status under the criterion B2). With only four known subpopulations representing four locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January to March.

ETYMOLOGY. Referring to the Dryads, tree dwelling mythological nymphs.

ILLUSTRATIONS. Figs 21, 22; Perrier (1939: 283); Cribb & Hermans (2009: 151).

***Liparis flavescens* (Thouars) Lindl.** (Lindley 1825: sub t. 882); Moore in Baker (1877: 342); Ridley (1885: 460; 1886b: 271); Frappier in Cordemoy (1895: 185); Perrier (1936: 253; 1939: 287); Hermans *et al.* (2007: 218); Cribb & Hermans (2009: 154); Bernet (2010a: 84); Robert (2019: 350). Type: s. loc., Thouars s.n. (P00112469) (holotype P).

Malaxis flavescens Thouars (1822: t. 25).

Leptorkis flavescens (Thouars) Kuntze (1891: 671).

Malaxis flexuosa **nom. nud.** in ms. herb. G, Neraud s.n.

Very small to small, terrestrial or epiphytic *plant*, squat, 6 – 11 cm, rhizome very short, older pseudobulb leafless and porrect to horizontal, the flowering one erect, roots glabrous, thin and wiry. *Pseudobulbs* 1 – 5 cm, 8 – 19 mm diam., covered by membranous leaf sheaths, carrying 2 – 4 erectly-spreading leaves but generally with 2 prominent leaves. *Leaves* lanceolate or ovate, acute, 5.6 – 6.5 × 1.2 – 3.9 cm, membranous, normally strongly 7-veined, pale green. *Inflorescence* erect up to 22 cm long but usually shorter, thin, laxly 2 – 15-flowered in the upper half. *Peduncle* carrying 2 – 4 ovate-lanceolate, acuminate peduncle sheaths, slightly auriculate at the base, 3.8 – 8 × 2 – 3.1 mm. *Rachis* laxly flowered, 5 – 8 cm. *Floral bracts* ovate-lanceolate, acuminate, about ½ the length of the pedicellate ovary, 2.5 – 5 × 1.2 – 1.8 mm. *Flowers* small to medium in size, av. 11 × 8 mm, greenish-yellow, turning orange with age, the disk of the lip darker green, column paler. *Pedicel* and *ovary* 5 – 11 × 0.5 – 1.5 mm, slightly ridged, rounded. *Dorsal sepal* linear-ligulate, margins recurved, 4.7 – 8.4 × 0.9 – 1.8 mm. *Lateral sepals* broadly oblong-falcate, obtuse, 4.8 – 8.1 × 2.7 – 3 mm. *Petals* linear 5.8 – 8 × 0.3 – 0.9 mm. *Lip* broadly ovate, sinuate to

Fig. 21. *Liparis dryadum*. A habit $\times 1$ (two leaves digitally added); B flower, behind and bract $\times 12$; C flower from side $\times 12$; D flower $\frac{3}{4}$ view $\times 12$; E flower from front $\times 12$; F dorsal sepal (flattened) $\times 15$; G petal $\times 15$; H lateral sepals (joined) $\times 15$; J lip from above $\times 21$; K lip from side and above $\times 21$; L column from front $\times 15$; M column from side and behind $\times 15$; N top of column, anther cap removed $\times 36$; P top of column $\times 30$; Q anther cap top $\times 36$; R anther cap underside $\times 36$; S pollinia side/behind $\times 39$; T pollinia side view $\times 39$; U pollinia side/behind $\times 39$; V pollinia from above $\times 39$. From Hermans 5575, plant habit after Hermans drawings and description. DRAWN BY OLIVER WHALLEY.

Fig. 22. *Liparis dryadum*. A plant habit; B rachis. PHOTOS: JOHAN HERMANS.

crenate at the margins, base with two small to very small rounded calli at the base forming a saddle-shape, $5 - 6.3 \times 4.9 \times 5.5$ mm. Column strongly arched, narrowed in the middle, with the wings obtuse-triangular, $1.8 - 3.9 \times 0.8 - 1.2$ mm. Anther rounded with a small acute apicule at the anterior margin, c. 1.1×0.9 mm. Pollinia ovoid, c. 0.4×0.3 mm.

RECOGNITION. *Liparis flavescens* is a small and squat plant, with the pseudobulb covered by sheaths and leaf base, the previous year's pseudobulb being leafless and porrect. It bears three to four lanceolate to ovate, strongly veined leaves with a short petiole. Somewhat cordate, sterile bracts, auriculate at the base, are found along the lower half of spike. The medium to small flowers have a rounded lip, slightly crenate at front, with two small calli at base in a saddle shape and a short, sharply beaked anther.

Most, if not all records from Madagascar of *Liparis flavescens* are based on misidentifications. *Liparis andringitrana* seems to be its closest relative in Madagascar but generally its pseudobulbous stem is shorter and thicker, the leaf petiole longer, the flowers a little smaller and the callus more distinctly bilobed.

It is also similar to *L. nephrocardia* but it has a much longer inflorescence and rounded column wings (vs triangular in *L. nephrocardia*). It is close to *L. nectarina* in habit and lip shape but the leaves of *L. flavescens* are membranous not leathery, strongly many-veined (vs 3-veined), the lip margin is entire (vs clearly emarginate and more deeply undulate), and the lateral sepals overlap (vs spreading). It shares the habit, inflorescence and flower habit of *L. bowkeri* from Southern Africa but *L. flavescens* is considerably larger, with more and larger flowers (Tables 2 & 3).

DISTRIBUTION. Its main distribution is in Réunion and Mauritius but there is one record from the Seychelles: Moore in Baker (1877: 343) listed 'Horne!'. A specimen from Mahé at K, possibly Horne 602 is this species and is noted to be common in moist shady forest of Mahé, Praslin and Silhouette. The species is also listed by Robertson (1989: 223), Summerhayes (1931: 291) cited several specimens and recorded the species as common (Map 21). A record from the Comoros (Humboldt 1509 at BM & P) is clearly not this species but *Liparis sambiranoensis*. Collections from Madagascar are generally of other species or difficult to ascertain because of the quality of the herbarium

Map 21. Distribution of *Liparis flavescens*.

material. It is likely that much of the earlier herbarium material (e.g. *Baron* 1110 & 227, *Deans Cowan* s.n. (BM00090072), *Parker* s.n. (1880), all at K) was identified on the basis of Du Petit-Thouars' (1822: t. 25) drawing which has limited detail. Only *Pervillé* 143 from 'Nossi-Bé' bears some resemblance to the species. **SPECIMENS EXAMINED. MADAGASCAR.** Nossi- Bé Island, 1841, *Pervillé* 143 (K-Lindl.). **MAURITIUS.** s. loc. 1821, *Bory* s.n. (G); s. loc., *Bory* s.n. (G); s. loc. 1847, *Huguenin* s.n. (G); Hort. July 1863, *Blackburn* 46 (K); s. loc., *Commerson* s.n. (P); Herb. *Bescherelle* s.n (P);

Grand Bassin 1929, *Vaughan* 694 (MAU, P); s. loc., 1966, *Guého* 11715 (P); Macabé Cima forest, 1971, *Julien* s.n. (P); Macabé Cima forest, May 1972, *Vaughan* 15481 (MAU, P); Noire, 1995, *W. Page* 22609 (P); Bel Ombre forest, 1931, *Vaughan* 739 (MAU, P); Milieu path, 1999, *Poonaasamy et al.* 23285 (P); s. loc. *Neraud* s.n. (G). **RÉUNION.** s. loc. July 1837 *Gaudichaud* s.n. (P); s. loc. 1846, *Armange* 163 (P); s. loc., 1847-, *Boivin* 1034 (G, P); s. loc., *Balfour* s.n. (K); s. loc., *Richard* s.n. (K-Lidl.); s. loc., *Bory* s.n. Herb. Richard. *Rchb.f.* 15288 (W); Salazi, *Cordemoy* s.n (MARS); Ilet à Baune cliff,

Dec. 1970, *Friedmann* 804 (P); Marquat ravine, Dos d'Âne, 700 m, Feb. 1972, *Friedmann* 1542 (P); Haut de Bras Panon, 600 – 700 m, Oct. 1972, *Bosser* 21211 (P); Cirque de Cilaos, March 1974, *Bosser* 21704 (P); Bébour forest, Aug. 1975, *Bosser* 22358 (P); Basse Vallée, May 1976, *Bosser* 22180 (P); Col de Bellevue, *Bosser* 22551 (P); Oct. 1981, Renz 13026 (RENZ); Haut de Sainte-Marie, 800 m, Dec. 1971, *Bosser* 20989 (P); St Joseph, Hauts de Jacques Payet, 1300 m, March 1972, *T. Cadet* 3590 (P, REU); Ilet Solitude, Hauts de la Possession, 600 m, March 1973, *T. Cadet* 4184 (P, REU); la Nouvelle, Mafate, 1500 m, June 1980, *J. Cadet* 6157 (P, REU); Plaine des Palmistes, 1300 m, June 1980, *J. Cadet* 6162 (P, REU); Heureuse valley, 2004, *Pailler* TP134 (P); Eden, May 2004, 600 m, *Fournel* JF108 (P); Les Avirons, 1020 m, March 2004, *Fontaine & Boulet* 1065 (CBNM); Piton Textor March 2004, 1200 – 1600 m, ex Bernet, *Hermans* 8166 (K); Sainte-Marie, June 2006, 900 m, *Hivert & Grondin* 2078 (CBNM); Takamaka 900 m, Sept. 2007, ex Bernet, *Hermans* 8159 (K). **SEYCHELLES.** Mahe, 1874, *Horne* ?602 (K). **WITHOUT LOCALITY.** *Thouars* s.n. P00112469 (holotype P); ex Herb. Richard (R15287) (W); 502, (R29770) (W).

HABITAT. In moist shady places on the sides of ravines and cascades, open ground or forest. Amongst mosses, terrestrial or rarely epiphytic on large branches and tree trunks. Altitude: 400 – 1500 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis flavescens* is estimated to be 919,021 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 68 km² (which falls within the limits for Endangered status under the criterion B2). Because *L. flavescens* is known from nine subpopulations representing eight locations (sensu IUCN), this species has been preliminarily assessed as **VU** using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence slash-and-burn farming, grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction. Previously assessed and published in the IUCN Red data listing for Réunion as **LC** (Picot 2013: 17)

FLOWERING TIME. February to August.

ETYMOLOGY. Refers to the yellowish colour of the flowers.

NOTES. Du Petit-Thouars (1822) first described and illustrated *Liparis flavescens* as *Malaxis flavescens*. He was not specific as to where it was found but mentioned Îles de France [Mauritius] and Bourbon [Réunion] in his descriptive table. Du Petit Thouars' holotype in Paris has no indication of locality and is fragmentary, the flowers consisting of partly damaged parts only and it is difficult to see distinct features but is without doubt the original material used by the author. His description and illustration also provide limited infor-

mation. In 1825, Lindley transferred the species to the genus *Liparis*, Richard in 1828 also included it in *Liparis* but marked it as his own transfer, three years after Lindley's reclassification. In 1891 Kuntze placed it in *Leptorchis*. Ames (1908: 127) made the combination of *Malaxis flavescens* for an Asian species in error.

Du Petit-Thouars, in his description, indicated the width of the leaves at ¼ pouce wide (c. 6 mm), this is different from what is shown in his drawing. Perrier, in his revision of *Liparis* (1936: 256), was not certain of the existence of the species in Madagascar. He mentioned that a Lyall specimen quoted by Ridley (1885: 460) seems to be another species (this is *L. imerinensis* at K with a drawing in K-Lindl.). *Pervillé* 710 (P), identified as *L. flavescens*, is in part *L. foliosa*: it seems to be a mixed sheet of different species, with duplicates at K. A collection by *Neraud* (G) from Réunion has a contemporary label of *Malaxis flexuosa*, but this is likely to be a transcription error.

ILLUSTRATIONS. Figs 23, 24; Du Petit-Thouars (Thouars 1822: t. 92); Bernet (2010a: 90); Cadet (1989: 55); Szelengowicz & Tamon (2013: 357); Robert (2019: 350). Photographs captioned as *Liparis flavescens* in Bosser & Lecoufle (2011: 407) and in Cribb & Hermans (2009: 157) are all *L. ochracea*.

***Liparis foliosa* Lindl.** (Lindley 1825: t. 882); Loddiges (1825: t. 1097); Hooker (1827: t. 2709); Moore in Baker (1877: 343). Types: Île de France? [Mauritius], Hort. *Barclay*, 1824 (holotype K-Lindl.); Hort. Bot. Gard. Glasgow (paratype K-Lindl.); *Bot. Reg.* t. 882 (1825) para-iconotype.

Cestichis foliosa (Lindl.) Hoffmanns. (Hoffmannsegg 1842a: 38).

Alipsa foliosa Schltdl. (Schlechtendal 1842: 228).

Liparis flammula Frapp. (Frappier 1880: 15) **nom. nud.** *Liparis flammula* Frapp. in Cordem. (Frappier in Cordemoy 1895: 183). Type missing. **synon. nov.**

Small to medium epiphytic plant up to 17 cm, on a very short rhizome, roots fleshy, very long, up to 20 cm × 2 – 3 mm in diam., growths in small clusters of 3 – 5 pseudobulbs. *Pseudobulbs* at first elongate then becoming distinctly globular to ovoid, fleshy, somewhat glossy, a few acute whitish-yellow sheaths with prominent veins at the base when mature, generally carrying 3 (rarely 2) leaves at the apex, 12 – 25 mm diam. *Leaves*, erect to erectly spreading when mature ligulate-lanceolate, more or less longitudinally corrugate (strongly veined in the herbarium), with a distinct central recess, narrowed into a conduplicate petiole, 4.5 – 16 × 1.5 – 2.6 cm, dark green to yellowish-green. *Inflorescence* elongate, laxly racemose emerging from the new growth, 8 – 16 cm long, 3 – 4 mm in diam., with up to 16 flowers but generally fewer. *Peduncle* with 1 – 3 peduncle sheaths up to 14 × 3.5 mm. *Rachis* in

Fig. 23. *Liparis flavescens*. A habit $\times 1$; B flower $\times 9$; C dorsal sepal $\times 12$; D petal $\times 12$; E lateral sepal $\times 12$; F lip $\times 12$; G lip callus $\times 36$; H column, front view $\times 12$; J column, side view $\times 12$; K anther cap, top $\times 30$; L anther cap, bottom $\times 30$. From *Pervillé* 143 (K-Lindl.). DRAWN BY OLIVER WHALLEY.

Fig. 24. *Liparis flavesces*. A habit; B flower. PHOTOS: PATRICE BERNET.

the upper $\frac{1}{3}$ of the inflorescence, becoming more lax as the flowers open. *Floral bracts* lanceolate, attenuate, more or less auriculate at the base, becoming smaller towards the apex of the rachis, $4.1 - 9.8 \times 0.8 - 1.6$ mm. *Flowers* small, erectly spreading $8 - 10 \times 6 - 8$ mm, characteristically the dorsal sepal strongly reflexed, the lip blade and lateral sepals in an almost vertical plane, petals and sepals pale yellowish green, lip darker green with a yellow-green disk becoming orange with age, column white, anther green. *Pedice*l and *ovary* erect, somewhat ridged, $9.5 - 14 \times 0.8 - 1.8$ mm. *Dorsal sepal* erect to strongly recurved, margins incurved ligulate, apex obtuse, $7.8 - 10 \times 1.5 - 2.1$ mm. *Lateral sepals* lanceolate with the apex narrowed and more strongly incurved, strongly down-curved and parallel with the blade of the lip, $6.1 - 8.1 \times 2.3 - 3.9$ mm. *Petals* recurved, margins incurved, linear, $6.3 - 8.7 \times 0.3 - 0.6$ mm. *Lip* ovate, strongly down-curved just below the base, base barely winged with two rounded, thickened ridges especially obvious in living plants, blade margins rounded more or less irregularly dentate, apex with a distinct protruding lobule, disk thickened, $5.8 - 6.7 \times 4.8 - 5.5$ mm. *Column* linear clavate, curved, the front margins with small angular wings towards the apex, $3.9 - 6.4 \times 0.8 - 1.9$ mm. *Anther* obovoid with a distinct rounded lobe at the anterior margin and sometimes with a miniscule sharp beak, c. 1×1 mm. *Pollinia* 2 fused pairs, narrowly ovoid, bipartite, c. 0.6×0.4 mm.

RECOGNITION. A small to medium-sized plant, with distinctly rounded pseudobulbs, persistent, ligulate-lanceolate leaves, a laxly flowered inflorescence and small flowers with reflexed segments, lateral sepals in a

vertical plane with the lip, lip strongly decurved from the base, ovate with rounded ridges at the base, anterior margin lobed, disk thickened, darker green becoming orange, column with indistinct wings, anther roundly lobed or minutely beaked at the front margin.

Liparis foliosa is similar to the Australian *L. reflexa* but the lip is larger in *L. reflexa*, oblong (vs ovate), the anterior margin which is emarginate with a small central lobe in *L. reflexa* (vs a larger single lobe in *L. foliosa*). In *Liparis reflexa* the lip is thickened at the base into a single callus, whereas *L. foliosa* has thickened callus-like ridges, the orange colouring is linear on the former and covers the entire disc of the lip in the latter. It is similar to the Madagascan *L. longipetala* but the pseudobulbs in *L. foliosa* are larger, the leaves thicker, not longly acuminate, the lip callus smaller and the anther rounded and not beaked as in *L. longipetala*.

DISTRIBUTION. This species may well be endemic to Réunion: S and Central, Cirque de Cilaos and Mafate, Saint-Pierre, Bébour forest, Plain des Palmistes (Map 22). The collection from Madagascar (*Pervillé* 710 in P) is poor and may be another species. Records from Mauritius, including the type, *Barclay* 1824 (K-Lindl.), may be an error in the recording and could have originated from Réunion. There are no other records from the island but its habitat may have disappeared since the 19th century.

SPECIMENS EXAMINED. MADAGASCAR. NW, March 1841, *Pervillé* 710 (P). MAURITIUS. Île de France? [Mauritius], Hort. *Barclay*, 1824 (holotype K-Lindl.); Hort. Bot. Gard. Glasgow (paratype K-Lindl.). RÉUNION. Plaine des Palmistes, *Cordemoy* (MARS); photo. *Cordemoy* watercolour of *Liparis reflexa* (K); Bébour Plateau,

Map 22. Distribution of *Liparis foliosa*.

April 1970, *Bosser* 20072 (P); Hauts de Basse Vallée, 1400 m, Feb. 1971, *T. Cadet* 3059 (P); Bébou forest, April 1971, *Guého* 14743 (MAU, P); Bébou, 1300 m, March 1973, *Lorence* R23 (P); Piton Mare à Boue, Plaine des Cafres, March 1974, *Bosser* 21779 (P); Petite Plaine des Palmistes, March 1974, *Bosser* 21784 (P); Bébou forest, March 1982, *Bosser* 22711 (P); Hort. 1987, *Bosser* F58 (P); Plaine des Palmistes, 1400 m, Feb. 2002, *Paillier* TP28 (P); Piton Textor, 1600 m, Bélouve, Feb. 2004 ex *Bernet*, *Hermans* 8155 (K); Belouve forest, Salazie, 1620 m, Dec. 2003, *Ferard et al* 923 (CBNM); Piton Textor, 1600 m, Feb. 2004, ex *Bernet*, *Hermans* 8156 (K); Dimitile, Cilaos Bébou Bélouve, 1200 m, Jan. 2003, ex *Bernet* & Rivière, *Hermans* 8157 (K); Piton Textor, 1500 m, Feb. 2004, ex *Bernet* & Rivière, *Hermans* 8164 (K); Bélouve, 1600 m, March 2004, ex *Bernet*, *Hermans* 8163 (K). **WITHOUT LOCALITY.** Hort. mixed sheet including Hort Glasgow, type of *Curtis. Bot.* t.2709 (K); Hort 183 P02118440 (P); Herb. *Richard* 409 (P).

HABITAT. Epiphyte in high altitude evergreen forest, in semi-xerophytic forest. On high branches. Altitude: 500 – 1600 m.

CONSERVATION STATUS. Category **EN**: The extent of occurrence (EOO) of *Liparis foliosa* is estimated to be 139,396 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 36 km² (which falls within the limits for Endangered status under the criterion B2). With only five known subpopulations representing four locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction. Previously assessed and published (as *Liparis flammula*) in the IUCN Red data listing for Réunion as DD (Picot 2013: 25).

FLOWERING TIME. January to April.

ETYMOLOGY. Lindley's name refers to the leafy nature of the plant (he called it the 'Many leaved *Liparis*' (1825: t.882)). *Liparis flammula* refers to the flame-like appearance of the newly emerging leaves

NOTES. Lindley first described and illustrated *Liparis foliosa* in 1825 in *Edwards' Botanical Register* (t.882), based on a cultivated plant from Robert Barclay Esq. said to have come from Île de France [Mauritius]. On

Fig. 25. *Liparis foliosa*. Engraving from Hooker [1827](#): t.2709.

the same sheet there is a preparatory pencil drawing for the illustration in the Lindley Herbarium at K and together with the plant material there is no doubt that this is the original material used by Lindley. The same year another illustration appeared in *The Botanical Cabinet* (Loddiges 1825: t.1097), here it is mentioned that the plant ‘...was lately introduced from Mauritius, by our worthy friend, Mr. Barclay, of Bury Hill, who kindly imparted it to us. It flowered in November, and is a curious and interesting plant, although not very showy...’. The text is presumably by George Loddiges, no author is mentioned of *L. foliosa* but one must assume it refers to Lindley’s newly published name. Robert Barclay Esq. of Bury Hill (near Dorking in Surrey) (1751 – 1830), a wealthy collector, grower and student of plants, was well connected in the botanical world and had a number of overseas contacts who supplied him with plant novelties. One of these contacts was Dr Charles Telfair (1778 – 1833) a naval surgeon resident in Mauritius but also known to have collected plants in Madagascar, Réunion and the Seychelles (Dorr 1997: 468). W. J. Hooker refers to this in Barclay’s obituary and also reproduced his last letter to Barclay (Hooker 1830: 122). Telfair also had a great interest in botany, working with Wenceslas Bojer, corresponding with several botanists in Europe and introducing a number of plants from the region. Loddiges cultivated several of them, presumably obtained via Barclay. *The Horticultural Register* of 1831 (Paxton & Harrison 1831: 190) recorded the species flowering at the Loddiges & Sons Nursery in Hackney. Another plant from the Barclay collection is illustrated and described in *Curtis’ Botanical Magazine* in 1827 (t.2709) (Fig. 25) by W. J. Hooker who noted that it is ‘...drawn from a plant presented by Mr. Barclay, to the Glasgow Botanic Garden, which flowered in the month of Oct. 1826. It is a native of the Mauritius, and there, in all probability, grows upon trees. The figure given in *Botanical Register* being drawn from a young specimen, the bulbs were not formed, and hence, probably, Mr Lindley was induced to suppose the plant was terrestrial...’. There is a specimen that flowered at Kew, annotated by Robert Rolfe that may be the type of the illustration in *Curtis’ Botanical Magazine* t.2709, there is another specimen at K of the plant that originally flowered at Glasgow Botanic Garden. Another plant of unknown origin, flowered in the Botanical Garden in Paris in the 1830s (P02118440) and was identified by Achille Richard as this species.

Considering the origin of the *Liparis* described by Lindley, there is no evidence that it actually came from Mauritius. Barclay may have noted the origin as having been sent by Telfair from Mauritius but it is possible that it could have been collected on Réunion. In 1828, Achille Richard included Lindley’s species in his *Monograph of the orchids of Mauritius and Réunion*; he

likened it to *L. flavescens* differing in its longer, narrower leaf and more flowers.

Five years after his original description, Lindley, in his *Genera and Species of Orchidaceous Plants* (1830a: 29) listed ‘*Liparis foliosa* Lindley’ but also has ‘*Liparis? reflexa* Lindl. l.c.’ and ‘*Cymbidium reflexum* R.Br. Prodr.331’ and had the species coming from Mauritius, New Holland and Port Jackson, the last two referring to an Australian origin. In his observations Lindley wrote that the plants from Mauritius were found to have an entire clinandrium and the Australasian one to have a dentate one but otherwise not different. This re-classification is explained further by Lindley in *The Transactions of the Horticultural Society of London* (1830b: 68), where he gave the same nomenclature arrangement and referred to a plant collected in New Holland by Captain McArthur in 1825 and described by Brown as *Cymbidium reflexum*. He goes on to say that ‘Upon comparing it with the Ile de France *Liparis foliosa*, described by me in the *Botanical Register*, fol. 882, I see no reason to doubt its being the same species; that plant which flowered in Mr Barclay’s stove, and which I there described, was destitute of bulbs, but the plant of the Garden was furnished with large ovate oblong bulbs, each of which was terminated by three ligulate acuminate channelled leaves indistinctly five-nerved. The scape was about the same length as the leaves of that shoot which produced it, but much shorter than the full grown leaves of the old bulb. The differences that seem to exist I am disposed to believe depend upon the age of the plant, which, when old, would have bulbous stems, of which it would be destitute when young ...’ De Candolle in his *Géographie Botanique Raisonnée* (De Candolle 1855: 1036) used the variability and distribution given by Lindley for *L. reflexa*, to illustrate the geographical variance in species. Lindley’s decision of putting the Mauritius plant into synonymy with Brown’s Australian *L. (Cymbidium) reflexa* was followed by subsequent authors, including Ridley’s monograph of the genus (1887: 287).

Moore in Baker (1877: 343) in the *Flora of Mauritius and the Seychelles* noted that ‘*Liparis foliosa* Lindl. given as Mauritius on the authority of Barclay, is in all probability, not a native of this region. Du Petit-Thouars makes no mention of it, and it was not seen by either Richard or Bojer. On the other hand, carefully dissecting it will, I believe, show that it is identical with the Australian *L. reflexa* Lindl.’

Frappier in Cordemoy in the *Flora of Réunion* of 1895 accepted Lindley’s *Liparis reflexa* with a question mark after the name. He gave a description and cited plants from ‘Plaine des Cafres et des Palmistes. An uncommon epiphyte in semi-shade between 1500 – 1500 m, Flowering in Oct. (according to Cordemoy), seen dried and alive.’ He also noted that this plant partly belongs in the herbarium of J. M. C. Richard where it is labelled

Table 9. Comparison of the type material of *Liparis foliosa* from Mauritius / Mascarenes and *L. reflexa* from Australia.

	<i>L. foliosa</i>	<i>L. reflexa</i>
Specimen	Hort. Barclay, 1824 (K-Lindl.)	Brown 5506 (K)
Pseudobulbs shape	globular to ovoid	longly ovoid
Pseudobulb size (mm)	c. 25 × 25	25 – 40 × 2 – 30
Leaves number	3	1 – 3
Leaves size (cm)	up to 16 × 2.6	up to 30 × 3.5
Inflorescence height (cm)	c. 15	10 – 30
Inflorescence type	loosely racemose	fairly densely racemose
No. flowers per inflorescence	8 – 15	5 – 30
Flower size (mm)	8 – 10 × 6 – 8	10 – 15 × 8 – 10
Dorsal sepal (mm)	7.8 – 10 × 1.5 – 2	7 – 10 × c. 2
Lateral sepals (mm)	6.1 – 8.1 × 2.3 – 3.9	6.5 – 9.5 × c. 2
Petal (mm)	6.3 – 8.7 × 0.3 – 0.6	6.5 – 9.5 × c. 1
Lip size (mm)	5.8 – 6.7 × 4.8 – 5.5	7 – 10 × 3 – 4
Lip shape/colour	ovate, yellow green with an orange spot on the disc, thickened	oblong, base deeply channelled with 2 orange ridges about 4 mm long
Anther	roundly lobed	slightly beaked
Habitat	epiphyte	generally on rock

L. foliosa Lindl.; the other in the Cordemoy herbarium. The Cordemoy herbarium (MARS), has a sheet labelled *L. reflexa* from Plaine des Palmistes and is clearly *L. foliosa* as described by Lindley; there also is a black & white photograph at K of one of Cordemoy's watercolours showing the same plant.

Examining the literature and all the material available it is clear that *Liparis foliosa*, as described by Lindley in 1825 is a valid species and is different from *L. reflexa* (R.Br.) Lindl. from Australia, SE Queensland to E New South Wales.

The possible confusion of the origin of Barclay's plants is questionable as the provenance from Telfair is solid and there are no records of Barclay importing plants from Australia (as explained above and also see (Hooker 1830: 122)); the only question is over its origin from Mauritius or Réunion. The cultivated plants from Kew and Glasgow have the same origin, as have the illustrations in the *Botanical Register*, *Botanical Cabinet* and *Curtis' Botanical Magazine*.

There are undoubted similarities between *Liparis foliosa* and *L. reflexa* from Australia; they both have bulbous pseudobulbs, linear-lanceolate leaves, greenish-yellow flowers with orange marking on the lip and reflexed sepals and petals but so do several other *Liparis* from around the world. It is not surprising that Lindley thought them to be the same species, at a time when only limited material was available. There are a number of differences between the two species (Table 9): the plant habit is somewhat different with the pseudobulbs more elongate in *L. reflexa*, the leaves and inflorescence longer. The principal differences are in the oblong lip (vs ovate) which is larger in *L. reflexa*, the anterior margin which is emarginate with a small central lobe in *L. reflexa* (vs a larger single lobe in *L. foliosa*), a single thickened callus in *L. reflexa* (vs thickened callus-like ridges), its

orange coloured stripe (vs entirely orange disc). The column of *L. foliosa* is more acutely winged.

The name *Liparis flammula* first appeared in Frappier's 1880 listing of the plants of Réunion on p. 15 as '*Liparis flammula* Fr.'. It was subsequently described in detail by Cordemoy (Frappier in Cordemoy (1895: 183)). Cordemoy's description is clear and describes a plant around 15 – 20 cm high with distinct pseudobulbs, lanceolate leaves resembling flames and a mucronate lip. Frappier did not indicate a type nor is there any reliable contemporary herbarium material available. There are a number of more recent collections (Bossier 22711, T. Cadet 3059, Lorence R23, Hermans ex Bernet 8155-7, 8163-4) and combined with the description, these indicate that this is the same species as Lindley's *L. foliosa*. They all match the Barclay's plants, especially the more complete cultivated ones. The photographs in Bernet (2010a: 102) of his *Liparis* sp. 1 & 2 match this species.

A similar specimen has been recorded from Madagascar (*Lavango Surveillant* 6031 in P) but as the specimen has seed capsules only it is not possible to ascertain its identity.

ILLUSTRATIONS. Figs 25, 26; Lindley (1825: t.882); Loddiges (1825: t.1097); Hooker (1827: t.2709) (Fig. 25); Bernet (2010a: 102, as sp. 1 & 2); Szelengowicz & Tamon (2013: 356).

***Liparis gracilipes* Schltr.** (Schlechter 1924: 138); Perrier (1939: 266); Hermans *et al.* (2007: 218); Cribb & Hermans (2009: 150). Type: Madagascar, Mt Tsaratanana, Perrier 15747 (P00094979) (lectotype P, designated here; isolectotype Perrier 15747 (P00094980) P)).

Medium to large slender plant, erect terrestrial,

Fig. 26. *Liparis foliosa*. **A** habit; **B** inflorescence; **C** flower. PHOTOS: PATRICE BERNET.

lithophyte or epiphyte, up to 22 cm tall growing in dense clumps, the older pseudobulbs retaining their leaves, rhizome woody, short c. 8 mm diam., roots slender, filiform, more or less pilose. *Pseudobulbs* very slender av. 3 mm diam., up to 15 cm long, woody, in 3 – 5 sections each carrying a 10 – 12 mm acute sheaths. *Leaves* 2 – 3 (rarely 4), erectly spreading, thin, elliptic to lanceolate elliptic, acuminate, base rounded with a petiole 6 – 15 mm long, margins slightly undulate, with 5 strong veins, 7 – 10 cm long, 1.7 – 5 cm wide. *Inflorescence* slender, erect, up to 15 cm long, laxly 5 – 12-flowered. *Peduncle* up to 8 cm, slender with 2 – 3 lanceolate, acuminate erectly spreading sheaths up to 8 mm long, sometimes with a larger leaf-like bract. *Rachis* up to 7.5 cm long but normally shorter. *Floral bracts* lanceolate acuminate but wider than the peduncle sheaths, 4 – 9 × 2 – 3.5 mm. *Flowers* erectly spreading, greenish to greenish-white, becoming yellow on ageing, medium size, up to 11 × 7 mm. *Pedicel* and *ovary* slightly winged, up to 11 × 1.2 mm. *Dorsal sepal* somewhat reflexed, narrowly lanceolate to ligulate-lanceolate, obtuse, 8 – 15 × 2 – 3.1 mm. *Lateral sepals* oval-obtuse 7.5 – 11 × 4.1 – 5 mm. *Petals* deflexed, narrowly linear, 8 – 12 × 0.7 – 1.3 mm. *Lip* curved, suborbicular, tip slightly indented, margins sub-crenulate, two strong curved veins running parallel with the margins, at the base with a distinct wedge-shaped, erect, tridentate callus, 6.5 – 10.1 × 6.8 – 10 mm. *Column* hardly curved at the tip, with very small thin triangular wings near the apex, 4.2 – 4.8 × 1 mm. *Anther* rounded without a beak c. 0.8 × 0.9 mm. *Pollinia* oval 0.3 – 0.5 mm diam.

RECOGNITION. It is likely that this species has been confused with other vegetatively similar species with a

long stem but the medium-sized flowers with a distinct rounded lip with wavy edges, strong side veins and the dentate callus are characteristic.

In plant habit the species is similar to *Liparis chantaliae* (described above) but the leaves are much thicker in texture and elliptic vs broadly oval, the lip suborbicular vs broadly oval-lanceolate and the callus tridentate vs bi-lamellar, the flowers are also much smaller. It equally has similarities with *L. longicaulis* with its elongate stem but differs in that the stem is very thin and has two to rarely three leaves with short wavy margins. The flowers are distinct by the wide rounded lip with at the base an erect three pointed wedge-shaped callus. The species is also similar to *L. caulescens* from Réunion, but the leaves are more cordate, there are fewer flowers a quarter smaller and the lip is suborbicular vs broadly obovate with a tridentate vs bidentate callus.

DISTRIBUTION. Endemic to Madagascar in Antsiranana and Fianarantsoa provinces (Map 23).

SPECIMENS EXAMINED. **MADAGASCAR.** Mt Tsaratanana, *Perrier* 15747 (P00094979) (lectotype P); *Perrier* 15747 (P00094980) (isolectotype P); Anosibe an'ala ?, 850 m, *Hermans* 5267 (K); Fianarantsoa, W of Ranomafana, May 2001, 746 m, *Hermans* 1010 (K); Andapa, Doany, Anjilavahely, March 2006, *Ravelonarivo et al.* 1809 (K, MO). **HABITAT.** Moss forest, river margins and shaded and humid rocks. Altitude: 800 – 1800 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis gracilipes* is estimated to be 45,562 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 16 km² (which falls within the limits for Endangered

0 100 200 km

Map 23. Distribution of *Liparis gracilipes*.

status under the criterion B2). With only four known subpopulations representing four locations (sensu IUCN), *L. gracilipes* has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. The habitat near Anosibe an'ala has been destroyed due to slash-and-burn.

FLOWERING TIME. January to May.

ETYMOLOGY. Referring to the long slender pseudobulbs.

NOTES. The species was described by Schlechter in Germany from herbarium material sent to him by Perrier and this was then returned to the Paris herbarium, as indicated on the herbarium label. In his description, Schlechter cited *Perrier* 15747 as the type, there are two sheets of this number and P00094979 is designated here as the lectotype and P00094980 is an islectotype; the first specimen is more representative of the species and has more open flowers. Until recently known from the type only.

ILLUSTRATIONS. Perrier (1939: 255).

***Liparis imerinensis* Schltr.** (Schlechter 1924: 141); Perrier (1936: 255; 1939: 294); Hermans *et al.* (2007: 218); Cribb & Hermans (2009: 154); Hervouet (2018: 409). Type: Madagascar, near Manjakandriana, E Imerina, 1920, *Perrier* 12973 (P00094997) (lectotype P, designated here; *Perrier* 12973 (P00094998) islectotype P).

Large erect terrestrial *plant*, up to 25 cm tall, rhizome very short, roots wiry, flexuose more or less pilose. *Pseudobulbs* normally two; one erect, carrying 2 – 3 leaves, the other leafless and almost divaricate at a right angle or almost horizontal, cylindrical, stem-like, enveloped by sheaths, 4.5 – 11 cm long, 2.2 – 5.1 mm diam. *Leaves* erectly spreading, oval-elliptic, shortly acuminate, slightly apiculate, semi-petiolate (1 – 2 cm) towards the base, soft, plicate and distinctly veined, 6 – 12 × 3 – 4 cm. *Inflorescence* erect, somewhat exceeding the length of the leaves, subulxly 5 – 16-flowered. *Peduncle* slender, ridged, up to 7 cm, with 1 – 4 slender sheaths. *Rachis* up to 5 cm. *Floral bracts* erectly spreading, linear-lanceolate, acuminate, the lower ones slightly longer than the pedicellate ovary, the higher ones slightly shorter, up to 10 × 2 mm. *Flowers* erectly spreading, medium in size, greenish-yellow becoming ochre-coloured on ageing, overall up to 15 × 12 mm. *Pedicel* and *ovary*, glabrous, slightly ridged becoming almost triangular in cross-section, 6 – 11 × 1 – 2 mm. *Dorsal sepal* erect, narrowly lanceolate, somewhat obtuse, the base subauriculate-expanded, 7.2 – 10 × 1.0 – 1.9 mm. *Lateral sepals* porrect, semi-oval, obtuse, 4- or 5-veined, 5.6 – 9.1 × 2.2 – 3.5 mm. *Petals* deflexed, narrowly linear, oblique, 5.7 – 8.5 × 0.3 – 0.5 mm. *Lip* contracted, subrectangular, broadly oval or oval-rhomboid, narrowed-acute or apiculate at the apex, base obtusely triangular-auriculate, with a small two-horned thickening (c. 0.3 mm) at the base, 5.3 – 7.9 × 4.1 – 5.5 mm. *Column* semi-terete, angular-obtuse along the stigmatic surface, 3.2 – 4.5 × 1.2 – 1.4 mm. *Anther* triangular acute at the front, up to 1.3 × 1.1 mm. *Pollinia* oval c. 0.5 × 0.6 mm.

RECOGNITION. Its single erect flowering growth reaches up to 25 cm, with the leafy pseudobulb up to 11 cm long, the other leafless and leaning to almost horizontal. Lip oval-rhomboid, with a bidentate callus, acute at the apex, with five veins and anther with a short beak at the front.

Similar to *Liparis andringitrana* in some respects but it is a somewhat larger plant with longer pseudobulbs, the older pseudobulb being almost divaricate. Its lip has an acute tip whilst that of *L. andringitrana* is rounder and indented, the callus consists of two horns (vs a rounded lobe).

DISTRIBUTION. Endemic to Madagascar: Antananarivo and Toliara provinces. The majority of collections are from the Highlands around the capital, a few are from much further South in Toliara province (Map 24).

0 100 200 km

Map 24. Distribution of *Liparis imerinensis*.

SPECIMENS EXAMINED. MADAGASCAR. Imerina, *Lyall* s.n. K0002421140 (K); Ambatovory, Dec. 1886, *Fox* 21 (K ex LDS); Ambohimanga, June 1905, *d'Alleizette* 346 (P); near Manjakandriana (E Imerina), 1920, *Perrier* 12973 (P00094997) (lectotype P); *Perrier* 12973 (P00094998) (isolectotype P); Centre, Manerinerina, Tampoketsa between Ikopa and Betsibola, forest of the Eastern slopes, c. 1500 m, Dec. 1924, *Perrier* 16869 (P); Centre, Analabe N of Antananarivo, forest remnant, Feb. 1928, *Perrier* 18431 (P); Ambohimanga, April 1928, *Decary* 6210 (P); Centre, Ambohimanga near Antananarivo, terrestrial in forest, Feb. 1932, *Perrier* 19010 (P); Toliara, lower basin of the Mananara, 700 – 900 m, Feb. 1934, *Humbert* 13929 (P); Toliara, lower basin of the Mananara, tributary of the Mandrare, 700 – 900 m, Feb. 1934, *Humbert* 13929bis (P); Forest S of Ambositra, rocks by a stream, Feb. 1942, *Decary* 17516 (P); Manerinerina (Ankazobe Tampoketsa) forest, Jan. 1942, *Decary* 17140 (P); Ambohitantely forest, Feb. 1945, *Homolle* s.n. (P); Mandrare valley, tributary of the Manampanihy (SE), Mts S of Tanandava, c. 850 m, March 1947, *Humbert* 20559 (P); Ambohimanga, Feb. 1938, *Jard. Bot. Tana.* 3254 (P); W Betsileo, 1500 – 1700 m, Jan. – April 1955, *Humbert* 28171 (P); Ambohimanga, Jan. 1964, *Bosser* 18830 (P); Antananari-

vo, SE of Nandihizano (Carion), Angavokely forest, Mt Ambatolava, 1700, Feb. 1988, *Pettersen & Nilsson* 198 (K); Angavokely, Jan. – Feb. 1996, *Ceplitis & Brostrom* 891 (P, TAN, UPS); Tampoketsa of Ankazobe, near Ambohitantely forest, May 2001, 1448 m, *Hermans* 2121 (K); Ambohimanga area, 2001, 1395 m, *Hermans* 5413 & 5395 (K).

HABITAT. Epiphyte, terrestrial or lithophyte amongst moss, moss forest, evergreen forest. Altitude: 1200 – 1800 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis imerinensis* is estimated to be 53,247 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 40 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis imerinensis* is known from nine subpopulations representing nine locations (sensu IUCN), thus been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. The habitat in the Manjakandriana region has been destroyed and is now a Eucalyptus plantation.

FLOWERING TIME. December to May.

ETYMOLOGY. Referring to Imerina; an old kingdom and geographical area of the highlands of Madagascar.

VERNACULAR NAMES. 'Famany' (*d'Alleizette* 346 in P).

NOTES. Schlechter (1924) described *Liparis imerinensis* from a collection made by Perrier in 1920 in Manjakandriana to the E of Antananarivo. He mentioned that he had only little material available for his description. Perrier (1939: 294) added further information from other collections for his description in the *Flore de Madagascar*. Schlechter cited Perrier 12973 as the type; there are two sheets of this number in Paris and P00094997 is designated here as the lectotype and P00094998 is an isolectotype, the first specimen being more complete.

Liparis imerinensis seems to be a variable species both in plant and floral characteristics: the callus on the lip is obvious in some collections but hardly noticeable in others. Perrier 16869, 18431 and 19010 (all P) are all annotated by Perrier as 'var', perhaps confirming the variability of the species.

ILLUSTRATIONS. Fig. 27; Schlechter (1932: t.53), the drawing does not show a callus on the lip; Cribb & Hermans (2009: 157); the photograph in Bosser & Lecoufle (2011: 408) shown as *Liparis imerinensis* has the characteristics of *L. ochracea*.

***Liparis jumelleana* Schltr.** (Schlechter 1916: 320; 1924: 142; Perrier (1939: 289); Hermans *et al.* (2007: 219); Cribb & Hermans (2009: 156). Type: Madagascar, Sambirano valley, Perrier 11366 (133) (P00095450) (lectotype P, designated here; Perrier 11366 (133) (P00095451) isolectotype P).

Fig. 27. *Liparis imerinensis*. A habit; B rachis; C flowers. PHOTOS: JOHAN HERMANS.

Small to large erect terrestrial *plant*, 8 – 24 cm high, rhizome very short or absent, roots wiry, somewhat woolly. *Pseudobulbs* 2, stem-like, elongate, fleshy, the old one leafless and at a wide angle to the flowering one or lying flat, enveloped by 2 – 3 brown sheaths, sometimes with a large leaf-like sheath, up to 12 cm long, c. 5 mm diam. *Leaves* 2 – 3, erectly spreading, thin, oval to obliquely elliptic, shortly acuminate, narrowed at the base into a short pleated-veined, petiole, 4 – 13 × 1.5 – 6.5 cm. *Inflorescence* slender, erect, laxly 4 – 9-flowered. *Peduncle* up to 9 cm, with a few sterile oval lanceolate bracts, av. 7 × 3 mm. *Rachis* c. 5 cm long. *Floral bracts* erectly spreading, lanceolate, around half the length of the ovary, 4.5 – 7 × 2 – 3 mm. *Flowers* medium size, pale greenish-yellow becoming brown with age, 12 – 15 × 9.0 – 12 mm. *Pedicel* and *ovary* rounded at the base becoming angular towards the pedicel, up to 15 × 1.3 mm. *Dorsal sepal* recurved, lanceolate, subacute, 7.1 – 11 × 1.5 – 2.1 mm. *Lateral sepals* porrect, semi-oblong, somewhat obtuse, 7.1 – 9 × 3.5 – 5.1 mm. *Petals* decurved, narrowly linear, subacute, 7.1 – 9.0 × 0.3 – 0.6 mm. *Lip* transversely elliptic, with proportionally small wings at the narrow base, the blade very rounded at the sides, the front margins almost straight ending in a small triangular cusp, with two small but distinct thickened calli at the base thinning out into three strong central veins, 5.1 – 6.3 × 6.9 – 10.1 mm. *Column* almost straight, somewhat broadened towards the base, with two small wings at the apex, 3.0 – 3.3 × 1.1 – 1.3 mm. *Anther* rounded with a distinct acute beak, c. 1.0 × 1.2 mm. *Pollinia* pear-shaped, c. 0.5 × 0.4 mm.

0 100 200 km

Map 25. Distribution of *Liparis jumelleana*.

RECOGNITION. Usually a squat plant with 2 – 3 thin leaves on the flowering growth, the previous growth being leafless and lying at an angle or flat on the ground. It has short, stem-like pseudobulbs, medium-sized flowers with a typically broad lip with a short triangular apex, small wings at the base and two small but distinct nipple-like calli at the base thinning out into the three central veins, and an anther with a sharp beak.

The only other species with a very broad lip is *Liparis laurentii* described below but *L. laurentii* has a single perennial leaf on a slender pseudobulb (vs 2 to 3 deciduous leaves of a different shape and size), the lip calli are shorter and blunter in *L. jumelleana*. In habit it somewhat resembles *L. imerinensis* but the lip shape and callus are very different with the lip transversally elliptic vs oval and the callus small and rounded vs two-horned.

DISTRIBUTION. Endemic to Madagascar: Antsiranana. The distribution is scattered from the Sambirano region in the North to Andapa in the NE (Map 25).

SPECIMENS EXAMINED. MADAGASCAR. Sambirano valley, Perrier 11366 (133) (lectotype P (P00095450); isolectotype P (P00095451); Marivorahona massif, SW Manambato, high Mahavavy to North, Ambilobe distr., 2200 m, March 1951, Humbert 25774 (P); Ankarana massif, Diego-Suarez, 30 – 350 m, Jan. – Feb. 1960, Humbert 32481 (P); Antsiranana, Anjialavabe, near Tsaralanto village, Feb. 2006, 1030 m, Antilahimena *et al.* 4604 (P, MO); Antsiranana, Andapa, Doany, SE of Andranomolo, 1489 m, April 2006, Rakotovo *et al.* 3139 (K, MO).

HABITAT. Epiphyte, terrestrial or lithophyte in humid evergreen forest at mid-altitude. On gneiss rock. Altitude: 300 – 2200 m.

CONSERVATION STATUS. Category EN: the extent of occurrence (EOO) of *Liparis jumelleana* is estimated to be 4,675 km² (within the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 20 km² (which also falls within the limits for Endangered status under the criterion B2). With five known subpopulations representing five locations (sensu IUCN), *L. jumelleana* has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. October to May.

ETYMOLOGY. Named for Henri Jumelle (1866 – 1935), professor of botany and director of the Botanic Garden in Marseille (France). He did not work in Madagascar but collaborated extensively with Perrier.

NOTES. Some of Perrier's earlier collections followed an alternative numbering system: here the type has the old number 133 bracketed by Perrier, with the new number 11366. As often, Schlechter assigned more

than one herbarium sheet to the name; from these the specimen P00095450, corresponding most closely to the description, has been designated as lectotype, the other (P00095451) as the isolectotype.

Plant size is quite variable as is obvious from the type specimens but lip size and shape seem to be consistent throughout its range.

ILLUSTRATIONS. Fig. 28; Schlechter (1932: t.54); Perrier (1939: 283).

***Liparis laurentii* Hermans & Nusb. sp. nov.** Type: Madagascar, Antsiranana, Sava Region, Vohemar distr., Commune rurale de Nosibe, forêt de Bobankora, partie nord, 410 m, 3 March 2003, Gautier, Wohlhauser & Nusbaumer 4204 (holotype G (G00007152), isotypes K (K000395947), P (P00635637), TAN, MO, herbarium of Daraina).

<http://www.ipni.org/urn:lsid:ipni.org:names:60479367-2>

Small scrambling to ascending terrestrial *plant* of 2 – 3 growths, up to 9 cm high, on a short rhizome, roots flexuose, somewhat woolly, c. 1 mm diam. *Pseudobulbs* slender, ascending, tubular, more or less thickened towards the base, 20 – 45 × 5 – 10 mm, dark green, entirely enveloped by 2 – 3 long brownish papery attenuate sheaths, strongly ridged and with a few dark brown specks, the upper one caudate, up to 23 × 7 mm, with a single leaf at the apex. *Leaf* somewhat fleshy, persistent on the older pseudobulbs, broadly ovate, acute, rounded to subcordate at the base, with a 1 – 2 cm sheathing petiole, blade leathery and rigid, pale green, with several darker veins, 3.1 – 7.5 × 2.5 – 4.5 cm. *Inflorescence* erect from the apex of the pseudobulb, up to 9 cm long, carrying up to 5 flowers but generally fewer. *Peduncle* partly enveloped by the leaf petiole and with 1 – 2 bract-like sheaths, 5.1 – 9 × 3.2 – 4.6 mm. *Rachis* loosely racemose, the older flowers fading before the new ones open. *Floral bracts* lanceolate, somewhat cordate at the base, 3.5 – 6 × 0.9 – 3.1 mm. *Flowers* medium sized, c. 1.8 × 1.5 cm, facing upwards, the ovary and floral bracts pale whitish-green, the petals and sepal brownish green, the lip pale green with the disk darker viridian, anther darker green. *Pedice*l and *ovary* slender, slightly winged, sometimes somewhat dentate, 10 – 16 × 1.1 – 2.1 mm. *Dorsal sepal* erect, arching, the margins recurved, ligulate, acute, 7.2 – 10.3 × 1.1 – 1.8 mm. *Lateral sepals* falcate-oblong, obtuse, parallel with the lip, margins a little recurved, 5.1 – 9.8 × 3.2 – 4.8 mm. *Petals* spreading, curled upwards towards the apex, margins recurved, linear, 7.2 – 9 × 0.3 – 0.5 mm. *Lip* transversely elliptic to reniform, with small basal wings, the margin entire but the anterior tip emarginated with a small central lobule, base with two distinct horn-like calli, 4.1 – 6.5 × 6.1 × 7.8 mm. *Column* slightly

Fig. 28. *Liparis jumelleana*. A habit; B flower. PHOTOS: MARC MOREL (SFO).

arched towards the apex, wings long, membranous, rounded, $2.5 - 3.9 \times 1 - 1.3$ mm. *Anther* ovate with a

distinct sharp beak upturned at the apex, sometimes a little verrucose on the exterior, remaining attached by

a thin filament at the base after pollination, c. 2.2×0.8 mm. *Pollinia* ovate c. 0.4×0.3 mm. *Fruit*: young capsule ovoid, 7×4 mm, with six longitudinal bands including three more protruding, mature capsule and seeds unknown.

RECOGNITION. *Liparis laurentii* is a small single-leaved plant with a slender pseudobulb, broadly ovate leaf, few-flowered inflorescence, and medium-sized flowers, with a transversely elliptic to reniform lip, the anterior tip emarginate with a small central lobule and a base with two distinct horn-like calli.

It is related to *Liparis clareae* but smaller, the leaf has a more distinct central vein and the base is rounded (vs cordate), has fewer flowers (1 – 5 vs 6 – 12), a much wider, transversely elliptic to reniform lip (vs ovate), with entire margins (vs serrate), an emarginate apex (vs entire), horn-like basal calli (vs slight swellings) and elongate column wings (vs short and obtuse). It has similarities with *L. warpurii* but the leaf of *L. laurentii* is broadly ovate (vs lanceolate), the flowers smaller and the lip not serrate at the margins and with horn-like calli (vs a single rounded callus). It is similar in size to *L. magnifica* described below but the lip is transversally elliptic (vs obovate), the anther beak is much longer and the lip callus is separate (vs joined). It differs from *L. superclareae* described below, by its diminutive size, and shape of the lip, callus and anther (Table 8). The only other species with a very broad lip is *L. jumelleana* but *L. laurentii* has a single perennial leaf on a slender pseudobulb (vs two to three deciduous leaves of a different shape and size on a ridged pseudobulb), and the lip calli are shorter and blunter in *L. jumelleana*.

DISTRIBUTION. Endemic to Madagascar: Antsiranana province only. The species has been found in the Loky-Manambato National Park (Daraina) area in the NW and another collection was made a little further South near Doany (Map 26).

SPECIMENS EXAMINED. **MADAGASCAR.** Diego Suarez, Vohemar, Daraina, Bobankora forest, 410 m, March 2003, *Gautier et al.* 4204 (holotype G, isotypes K, P, TAN); Anjialavahely, Sava, Andapa, Doany, Anjialavahely, Feb. 2006, 1293 m, *Ravelonarivo et al.* 1606 (MO, P).

HABITAT. Terrestrial amongst leaves and humus in forest from 410 – 1293 m altitude. In the Loky-Manambato National Park (Daraina), a total of about 40 individuals were observed in one locality during the flora and vegetation survey of the region. The species was there growing on the ground, along a crest, close to the top of a granitic mountain reaching 607 m elevation with a non-climatic raw mineral soil (*Riquier 1968*; *Jourde et al. 1974*). It grows in a mesophilous forest surrounded by a matrix of dry deciduous forest. The vegetation of the Daraina locality reaches up to 10 – 15 m high with emergent trees up to 18 (– 21) m,

with a quite dense shrub stratum at 0.5 – 1 m high, with shrub strata increasing in density between 4 – 8 m high and with a very sparse stratum at 8 – 10 m high (*Gautier et al. 2006*; *Nusbaumer 2011*). Altitude: 410 – 1293 m.

CONSERVATION STATUS. Category **EN**: The extent of occurrence (EOO) of *Liparis laurentii* cannot be estimated since it is only known from two subpopulations, one included in the Loky-Manambato Category V Protected Area (Daraina) and the second one at 100 m exterior of the limit of the provisionally protected area of the Corridor Marojejy–Anjanaharibe-Sud–Tsaratanana (COMATSA), whereas its minimal area of occupancy (AOO) is estimated to be 8 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only two known subpopulations representing two locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. In the Daraina region, this species was collected rather early during the floristic survey and we expected several subpopulations to be observed

0 100 200 km

Map 26. Distribution of *Liparis laurentii*.

Fig. 29. *Liparis laurentii*. A habit; B flower; C dorsal sepal; D lateral sepal; E petal; F lip; G column, side view; H column and ovary; J anther cap from above; K anther cap from below; L anther cap, side view. From Nusbaumer LG4204 (G). DRAWN BY JULIET BEENTJE.

later, because its habitat, the mesophilous forest, is quite frequent in Loky-Manambato. Nevertheless, it turned out that no additional fertile or sterile material of this species was encountered among the more than

54,000 plant species occurrences recorded including about 5,000 herbarium specimen collections (Nusbaumer 2011).

FLOWERING TIME. February to March.

ETYMOLOGY. Named for Dr Laurent Gautier of the Conservatoire et Jardin botaniques de Genève, one of the co-finders of the new species, the upturned petals also have a striking resemblance to his beautifully groomed moustache.

NOTES. The new species is known from two localities in North-Eastern Madagascar. Specimens in herbaria had either been unidentified or named as *Liparis clareae* with which it shares a number of features but is very different, as discussed above. The plant from the Doany area (Ravelonarivo *et al.* 1606) comes from a much higher elevation than those collected in the Bobankora forest near Daraina (Gautier *et al.* 4204), they also seem to consist of more mature and therefore larger plants and flowers; all other characteristics and proportions are otherwise identical.

ILLUSTRATIONS. Figs 29, 30.

***Liparis listeroides* Schltr.** (Schlechter 1924: 143); Perrier (1936: 247; 1939: 273); Hermans *et al.* (2007: 219); Cribb & Hermans (2009: 148); Hervouet (2018: 410). Type: Madagascar, Andringitra massif, March 1922, c. 1400 m, Perrier 14440 (P00095453) (lectotype P, designated here); Perrier 14440 (P00095454) (isolectotype P).

Medium sized, slender, erect terrestrial or epiphytic plant, up to 18 cm high, rhizome very short, roots wiry, more or less hairy. *Pseudobulbs* stem-like, thin, erect, fleshy, enveloped by thin grey striate sheaths overlapping each other, with two leaves at the apex (rarely 3), older growths retaining their leaves, up to 13 cm, c. 5 mm diam. *Leaves* sub-opposite, erectly spreading to sub-erect, oval or elliptic-lanceolate, acute, base rounded or wedge-shaped, sessile or on a short petiole, fairly leathery and glossy, pale green becoming darker with age, 3.5 – 7.3 × 1.5 – 3.0 cm. *Inflorescence* erect, up to 15 cm long and almost as long as the pseudobulbs, sub-laxly 5 – 15-flowered. *Peduncle* almost as long as the raceme, slightly ridged, with two to three sheaths c. 5 × 3 mm. *Rachis* successive flowering, up to 9 cm long. *Floral bracts* erectly spreading, acuminate, about $\frac{1}{3}$ – $\frac{1}{2}$ the length of the pedicellate ovary, c. 4 × 2 mm. *Flowers* small to medium in size 8 – 11 × 6.5 – 7 mm, greenish-yellow becoming more yellow with age, the disk of the lip darker viridian green, lip generally appears darker in herbarium material. *Pedicel* and *ovary* glabrous, slender, a little ridged, 8 – 12 × 0.7 – 3 mm. *Dorsal sepal* reflexed (often remaining in herbarium material), narrowly lanceolate almost tubular, somewhat obtuse, base subcordate to auriculate, 5.5 – 8.0 × 1.1 – 1.5 mm. *Lateral sepals* folded beneath the lip, semi-

Fig. 30. *Liparis laurentii*. Habit of the type collection with fresh flower and wilted flower on a young fruit. PHOTO: LOUIS NUSBAUMER.

oval, obtuse, $5.0 - 6.0 \times 2.5 - 3.9$ mm. *Petals* reflexed, linear almost tubular, subacute, slightly narrowing towards the base, $5.5 - 8.3 \times 0.5 - 0.8$ mm. *Lip* slightly curved, shortly auriculate at base, expanded into an obcordate blade sometimes covered by small viscous droplets in living plants, with two simple central veins and two branched lateral ones, the margins curved, the front margin a little denticulate-undulate, subtruncate or emarginated with a bicornate or 2-horned callus at the base which can be up to 1.4 mm long, $4.5 - 7.1 \times 5.0 - 6.9$ mm. *Column* slightly curved, up to 5×1.5 mm, somewhat angular wings. *Anther* with a short, obtuse beak, c. 1.0×1.1 mm. *Pollinia* 2 pairs, oval c. 0.5×0.6 mm.

RECOGNITION. Distinguished by its long stem with two somewhat leathery oval-lanceolate leaves at the top. Its lip is entire, slightly indented on the anterior margin and rounded with a distinct two-horned callus at the base. Its anther is slightly beaked. It is a very variable species both in shape of the lip and that of the two calli on the lip which can be more or less united or separate and up to 1.4 mm long, parallel or slanting. In herbarium specimens, the lip of the flowers often appear considerably darker and denser than the rest of the floral segments.

Both *Liparis bernieri* and *L. danguyana* are similar species but there are substantial differences (Table 5). The leaf of *L. danguyana* is thinner than those of *L. bernieri* and *L. listeroides* which are more leathery with indistinct veins. The flowers of *L. listeroides* are generally smaller than the other two. The lip of *L. danguyana* has two small but distinct calli at the base, those of *L. bernieri* are less distinct and rounded, those of *L. listeroides* are long and tooth-like. The front margin of the lip of *L. danguyana* is apiculate, the others have a slightly denticulate margin. The anther cap of *L. danguyana* is rounded at the front and suborbicular, that of *L. listeroides* is slightly beaked. Considering these differences and specific geographical distribution it is reasonable to recognise all three species. Vegetatively, there is some resemblance with *L. stenophylla* but the leaves are more lanceolate than elliptic. It shares the basal teeth of the lip with *L. polycardia* and *L. imerinensis* but the plant and flower are smaller, the leaves shorter and broader and the inflorescence shorter.

DISTRIBUTION. Endemic to Madagascar: Antananarivo, Antsiranana and Fianarantsoa provinces (Map 27).

SPECIMENS EXAMINED. MADAGASCAR. Andringitra massif, March 1922, c. 1400 m, *Perrier* 14440 (P00095453) (lectotype P); *Perrier* 14440 (P00095454) (isolectotype P); Centre, Mandraka, Ankeramadinika forest, *François* in Herb. *Perrier* 16966bis (P); Centre, Mt Tsaratanana, forest, c. 1500 m, April 1924, *Perrier* 16089 (P); Centre, Tsinjoarivo, forest, c. 1400 m, Feb. 1925, *Perrier*

16970bis (P); Mandraka, undergrowth, evergreen forest, Feb. 1959, *Bosser* 12625 (P); Mandraka, Feb. 1959, *Bosser* 12723 (TAN); Antananarivo, Mandraka, PK69, March 1984, *Dorr et al.* 2918 (K, MO, P, TAN); E of Ankaramy, Manongarivo, Antsatroto, 1470 – 1570 m, April 1992, *Malcomber et al.* 1498 (K, MO, TAN); Moramanga area, Fiheranana, 1999, *Hermans* 2867 (K); Antananarivo, near Mandraka, 1215 m alt., Jan. 2000, *Hermans* 4869 & 5203 (K); Antananarivo, towards Anjozorobe along RN3, 1550 – 1600 m, Jan. 2000, *Hermans* 456 (K); Toamasina, near Andasibe, Jan. 2000, *Hermans* 4945 (K); Toamasina, road to Lakato 1041 m, Feb. 2000, *Hermans* 1003 (K); Toamasina, Mantadia area, May 1997, 1089 m, *Hermans* 5598 (K); Toamasina, Anosibe an'ala, April 2010, *Rajavelona et al.* 235 (K, TAN); Sofia, Bandabe, Apr. 2007, *Revelonarivo* 2264 (P); Antsiranana, Ampasindava, Bongomihiravavy forest, Dec. 2008, *Madiomanana et al.* MAD 201 (G); Toamasina, Ambatovy, 1070 m, April 2014, *Ambatovy Spirit Collection* 1575 (TAN); Antsiranana, Mt d'Ambre, 890 m, *Ramandimbimanana et al.*, SDR050 (G, K, P); Antsiranana, Mt d'Ambre, April 2008, *Trigui et al.* SMT263 (G, K, P).

Map 27. Distribution of *Liparis listeroides*.

Fig. 31. *Liparis listeroides*. A habit; B inflorescence; C flowers. PHOTOS: A JEAN-MICHEL HERVOUET; B, C JOHAN HERMANS.

HABITAT. Moss forest, evergreen forest in undergrowth, in shade, moss and lichen-covered trees. Altitude: 1040 – 1600 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis listeroides* is estimated to be 87,271 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 56 km² (which falls within the limits for Endangered status under the criterion B2). Because *L. listeroides* is known from 12 subpopulations representing 14 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. More specifically the species has been affected by habitat loss due to land clearance by burning in the Manongarivo and Mandraka areas. Also affected by charcoal production in the Lakato area.

FLOWERING TIME. January to April.

ETYMOLOGY. The plant resembles a medium-sized *Listera* R.Br. in its habit (Schlechter 1924: 143). *Listera*, in turn, was named for Dr Martin Lister (c. 1638 – 1712), English physician and naturalist.

NOTES. Schlechter assigned more than one herbarium sheet to the type; the specimen (P00095453) corresponding most to the description and most complete was designated as the lectotype, the other (P00095454) being an isoelectotype.

ILLUSTRATIONS. Fig. 31; Schlechter (1932: t.54); Cribb & Hermans (2009: 151); Hervouet (2018: 410).

***Liparis longicaulis* Ridl.** (Ridley 1885: 461; 1886b: 270); Perrier (1936: 246; 1939: 272); Hermans *et al.* (2007: 220); Cribb & Hermans (2009: 148); Hervouet (2018: 411). Type: Madagascar, Ankafana, *Hildebrandt* 3979 (lectotype BM00090069, designated here; *Hildebrandt* 3979 isoelectotypes G, K, M, P, WU, Z); Madagascar, Ankafana, *Deans Cowan* s.n. BM00090068 (lectoparatype BM), *Hildebrandt* 3979 P00095461 (lectoparatype P).

Leptorkis longicaulis (Ridl.) Kuntze (1891: 671). Type as above.

Liparis longicaulis var. *crassilabia* in Herb. Perrier (16072) **nom. nud.** Type: Central, Mt Tsaratanana, April 1924, Perrier 16072 (P001778654-7).

Large terrestrial or rarely epiphytic plant up to 35 cm tall, rhizome short, repent or slightly ascending, roots more or less finely villous. *Pseudobulbs* often clustered, stem-like, up to 25 cm long, 5 – 11 mm diam., distinctly tetragonal or angular-winged when alive, enveloped by several overlapping greyish-white sheaths along its length, carrying two leaves (very

rarely three) at the apex. *Leaves* broadly ovate, rounded to sub-cordate at the base, subsessile or shortly petiolate, attenuate to acuminate at the tip, undulate, crenulate along the margins, glaucous green to pale green, 5 – 9 × 3.2 – 5.5 cm. *Inflorescence* erect carrying up to 10 flowers but generally fewer, often exceeding the length of the stem, 10 – 24 cm. *Peduncle* about twice the length of the rachis, c. 2 mm in diam., with one or two cordate to lanceolate peduncle sheaths up to 10 × 5 mm. *Rachis* about ½ to ⅓ of the inflorescence, laxly-flowered. *Floral bracts* lanceolate, the base more or less cordate, 7 – 10 × 2 – 4.5 mm. *Flowers* large, up to 24 × 18 mm, olive green to dark green becoming more yellow with age, the lip with a darker disk, column and ovary white, pollen yellow, flowers opening in succession, the upper ones sometimes cleistogamous or deformed. *Pedice*l and *ovary* somewhat ridged to winged, 11 – 17 × 0.6 – 1.8 mm. *Dorsal sepal* erect or curved forward a little at the apex, linear to ligulate, attenuate, margins recurved, 16 – 22 × 1.5 – 3.5 mm. *Lateral sepals* forming a platform below the lip, sometimes partly fused into one blade, broadly falcate, the outer margins curved upwards, 10 – 18 × 5 – 7.9 mm. *Petals* narrow linear, recurved, the margin incurved, 10 – 15 × 0.6 – 1.3 mm. *Lip* oval to broadly ovate, the base with short rounded wings then broadening into an obtuse anterior lobe with an irregular dentate margin, callus at the base fairly indistinctly bilobed-rounded, 10 – 13.2 × 5.5 – 9.9 mm. *Column* slender, slightly arching, wings long, obtuse, 4.5 – 6.9 × 1 – 1.9 mm. *Anther* generally with a short angular-obtuse beak, 1.1 – 1.6 × 0.6 – 1.3 mm. *Pollinia* two pairs united at the tip by an obsolete viscidium, c. 0.7 × 1 mm.

RECOGNITION. This is a large plant with long angular (sometimes not obvious in herbarium material) pseudobulbs, almost entirely covered by white sheaths, broadly ovate leaves, and large flowers with an obtuse lip, crenulate at the front, and a small rounded callus at the base.

It bears some similarity to *Liparis gracilipes* but its leaves are much thinner and broadly oval vs elliptic, the lip ovate vs suborbicular, the callus indistinct vs tridentate. There is also some similarity to *L. zaratananae* but again the pseudobulbs are angular vs rounded, the leaves broadly ovate vs ovate-elliptic and the lip ovate vs oval. Historically it has been confused in the field and in herbaria with the newly described *L. chantaliae* but it is distinct because of its angular (vs rounded) pseudobulbs covered by papery sheaths, short rhizome, slightly smaller flowers, lip with an obtuse tip (vs attenuate), indistinct callus and the less acute beak of the anther (Table 7).

DISTRIBUTION. Widespread and endemic to Madagascar: Antananarivo, Antsiranana, Fianarantsoa, Mahajanga and Toamasina provinces (Map 28).

0 100 200 km

Map 28. Distribution of *Liparis longicaulis*.

SPECIMENS EXAMINED. MADAGASCAR. Ankafana, *Hildebrandt* 3979 (lectotype BM, islectotypes G, K, M, P, WU, Z); Ankafana, *Deans Cowan* s.n. BM090068, P00095461 lectoparatypes BM, P); Imerina, Ankeramadinika, *Fox* 20 (BM, K); Central, Dec. 1883, *Baron* s.n (K); Betsileo-land, *Baron* 228 (K); s. loc. *Warpur* 20 (K); Ambohimanga, 1906, *Alleizette* 351bis (P); Ambatovy, June 1909, *Alleizette* 346bis (P); Central, Mt Tsaratanana, c. 1800 m, April 1924, *Perrier* 16072 (P); Andasibe forest, Onive valley, c. 1000 m, Feb. 1925, *Perrier* 16969 (P); Central, Tsinjoarivo, c. 1400 m, Feb. 1925, *Perrier* 16966 (P); Analabe, forest remnant N of Antananarivo, Feb. 1928, *Perrier* 18430 (P); NE, Marojejy massif, 800 – 1200 m, Jan. – Feb. 1949, *Humbert* 23158 (G, P); Anjozorobe, March 1959, *Bosser* 12858 (P); Eastern side of Lake Tsiazompaniry, 1600 m, March 1970, *Bosser & Morat* 1432 (P); lake Tsiazompaniry, March 1970, *Bosser* 20010 (P); Angavokely, 1992, *Petterson & Nilsson* 562 (P, K); Mangindrano area, Ambohimirahavy Mts, 1800 m, 1997, *Hermans* 2390, 2391, 2607 (K); Toamasina, near base of Col de Mantadia, 958 m alt., Feb. 2000, *Hermans* 4972 (K); Fianarantsoa, Andringitra, 1765 m, 2005 *Fischer* 2110 (WU); Toamasina, Ambatovy forest, 1086 m, March 2005,

Antilahimena et al. 3659 (TAN); Toamasina, Moramanga, Ambohibary, Ampitambe, Ambatovy, 1135 m, March 2005, *Andriantiana* 95 (MO, P, TAN); Toamasina, Andasibe, 1157 m, March 2007, *Antilahimena* 5644 (TAN); Toamasina, Ambatovy, 1122 m, June 2008, *Rakotondrajaona* 441 (MO, P, TAN); Toamasina, Ambatovy, 959 m, July 2008, *Radrianasolo et al.* 756 (MO, P, TAN); Toamasina, Ambatovy, 1135 m, July 2008, *Radrianasolo et al.* 789 (TAN); Toamasina, Menalamba, Analamay, 1069 m, July 2008, *Antilahimena et al.* 6374 (MO, P, TAN); Toamasina, Ambavahadiala, 1091 m, June 2008, *Rakotonandrasana* 1344 (MO, TAN); Toamasina, Ambatovy, 1098 m, June 2008, *Rakotovoao et al.* 4131 (MO, TAN); Toamasina, Ambatovy, Analamay, 1106 m, July 2008, *Radrianasolo et al.* 802 (TAN); Toamasina, Andasibe, Menalamba, Ambatovy, Forêt de Berano, 1032 m, Sept. 2008, *Andriantiana* 443 (K, MO, P, TAN); Toamasina, Ambatovy, Analamay côté Nord, 1069 m, Sept. 2008, *Randrianasolo et al.* 858 (TAN); Toamasina, Ambatovy, 1183 m, April 2010, *Bernard et al.* 1538 (MO, P); Toamasina, Andasibe, Menalamba, Ambatovy, Berano, 1030 m, Oct. 2011, *Rakotovoao et al.* 5625 (MO, TAN); Andasibe, Andasifahatelo, Marinho, 1017 m, April 2012, *Rasoazanany et al.* 160 (MO, P, TAN); Moramanga, Andasibe, Tsaravelona, 988 m, April 2012, *Razafindrahaja & Antilahimena* 198 (MO, P, TAN); Toamasina, Ambatovy April 2012, 1134 – 1151 m, *Ambatovy Shade House* 962 (MO, TAN); Toamasina, Mantadia, Sahanody, 944 m, March 2013, *Razafindrahaja et al.* 303 (MO, TAN); Toamasina, Ambatovy, March 2013, 1091 m, *Ambatovy Spirit Collection* 819Z1/1 (TAN); Toamasina, Mantadia, Sahandambo, March 2013, 982 m, *Bernard et al.* 2108 (P, TAN); Toamasina, Mantadia, Falierana, Ambodigoviala, March 2013, 948 m, *Rasoazanany et al.* 481 (MO, P, TAN); Toamasina, Ambatovy, 1103 – 1119 m, March 2013, *Ambatovy Shade House* 1098 (BRLU, MO, TAN); Toamasina, Mantadia, Falierana, Sahandambo, 1041 m, March 2013, *Bernard et al.* 2076 (MO, P, TAN); Toamasina, Mantadia, Falierana, Andranomanamponga, 995 m, March 2013, *Ramahlenina et al.* 206 (TAN); Andasibe, Analamazaotra, 1034 m, Dec. 2013, *Ramandimbisoa et al.* 359 (MO, TAN); Toamasina, Mantadia, Ambodigavoala-Barrière, 986 m, Dec. 2013, *Razafindrahaja et al.* 376 (TAN); Toamasina, Ambatovy, 1041 m, Oct. 2014, *Ambatovy Shade House* 4598 (BRLU, MO, TAN); Toamasina, Ambatovy, 1179 – 1227 m, Oct. 2014, *Ambatovy Shade House* 4649 (BRLU, MO, P, TAN); Toamasina, Ambatovy s.n., Feb. 2015, 1041 m, *Ambatovy Spirit Collection* 4598 (TAN); Toamasina, Ambatovy, 925 – 1054 m, Feb. 2015, *Ambatovy Shade House* 2359 (TAN); Toamasina, Ambatovy, 985 – 1054 m, March 2015, *Ambatovy Shade House* 2392 (MO); Toamasina, Ambatovy, April 2015, 1016 m, *Ambatovy Spirit Collection* 2435/4883 (TAN).

HABITAT. Evergreen forest, moss forest, riverine forest, degraded forest. Often amongst dense undergrowth in deep shade in humus-rich and moist soil. Altitude: 800 – 1800 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis longicaulis* is estimated to be 95,273 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 104 km² (which falls within the limits for Endangered status under the criterion B2). With 11 subpopulations representing 17 known locations (sensu IUCN), this species has been preliminarily assessed as VU using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. December to April.

ETYMOLOGY. Referring to the long distinct pseudobulb-stem.

NOTES. Henry Ridley (1885: 461) described the species from material he had received from the Rev. Deans Cowan and Johannes Hildebrandt in 1880 and 1881 respectively. The plant and flower are represented in Deans Cowan's sketchbook, kept at the Natural History Museum (BM) in London (Cowan 1880: 18). Ridley based the name on both collections. The Deans Cowan material is duplicated in P but both sheets are less typical than that of Hildebrandt which has five collections in different European herbaria. The latter was therefore chosen as the lectotype for the species. Perrier in 1924 annotated a specimen from Mt Tsaratanana in N Madagascar (16072) as *Liparis longicaulis* var. *crassilabia*, mentioning differences from the Imerina (Highland) forms in the lip lacking visible veins and the anther having a very short rostrum. This varietal name was never published. The plant shows the typical characteristics of the species but the lip is a little broader and more acute at the apex.

It has been noted that the flowers are scented (Hermans 3997).

ILLUSTRATIONS. Figs 32, 33; Cowan (1880: 18); Perrier (1939: 271); Cribb & Hermans (2009: 151, the illustration labelled as *Liparis zaratananae* is this species); Hermans *et al.* (2007: pl.45); Hervouet (2018: 411).

***Liparis longipetala* Ridl.** (Ridley 1885: 459; 1886b: 275); Perrier (1936: 243); Hermans *et al.* (2007: 220); Cribb & Hermans (2009: 152). Type: Madagascar, Ankafana (S Betsileo), Hildebrandt 3980 (holotype BM; isotypes G (partly mislabelled as Hildebrandt 3981), K, W).

Leptorkis longipetala (Ridl.) Kuntze (1891: 671). Types as above.

Liparis anthericoides H.Perrier (1936: 243) **synon. nov.**; Perrier (1939: 263); Hermans *et al.* (2007: 215); Cribb & Hermans (2009: 145); Bosser & Lecoufle (2011: 405); Hervouet (2018: 405). Types: Madagascar, Central, Andasibe forest (Onive basin), c. 1300 m, Feb. 1925, Perrier 17103 (lectotype P, designated here); Madagascar, Central, Andasibe forest, 1000 m, Feb. 1925, Perrier 17104; Madagascar, E, Analamazoatra forest, 800 m, July 191, Perrier 10981 (lectoparatype P).

Medium-sized epiphytic or terrestrial *plant*, 5 – 25 cm tall, rhizome short, roots wiry, thin, glabrous av. 1 mm diam. *Pseudobulbs* fleshy, whitish-green, spherical or oval, 10 – 18 × 9 – 16 mm, enveloped by thin bract-like sheaths, with 2 – 3 leaves generally persisting on the previous growths. *Leaves* pale green, erect to erectly spreading, ligulate to oblanceolate, the lower $\frac{1}{3}$ somewhat narrowing, becoming longly attenuate, the basal sheaths papery and enveloping the petiole, 6 – 16 cm × 8 – 20 mm. *Inflorescence* erect, from the side of the pseudobulbs, somewhat curved at the tip, up to 22 cm long, 1 – 2 mm in diam., 8 – 25 flowers. *Peduncle* with 2 – 4 scales or narrowly acute sterile bracts, 6 – 8 × 1.5 – 2 mm, in the lower half. *Rachis* loosely racemose, flowers 8 – 12 mm apart, 4 – 6.5 cm. *Floral bracts* thin, narrowly acute, 3 – 9 × 1.3 – 2 mm, becoming shorter towards the apex of the inflorescence. *Flowers* small, overall av. 7 × 10 mm, pale green to yellow with the lip often darker, olive-green, the column almost white, anther pale green, overall becoming more yellow-brown with age. *Pedicellate ovary* subfiliform to slightly ridged, becoming a distinct thicker and twisted ovary towards the base, 6 – 16 mm long. *Dorsal sepal* broadly linear to lanceolate, subacute, curved backwards, 3-veined, 5.6 – 8 × 1.1 – 1.9 mm. *Lateral sepals* oblong to almost oval, falcate, 4.1 – 6.1 × 1.4 – 3.2 mm. *Petals* linear, sometimes a little wider towards the tip, 5.2 – 8.5 × 0.4 – 1.1 mm. *Lip* with a narrow auriculate base then expanding into an obovate to broadly oval blade, emarginated with a small apicule at the tip, with a long rounded ridge-like basal callus with a more or less bilobed or thickened tip, 3.5 – 5.5 × 2.3 – 4.1 mm. *Column* slender, curved towards the apex, expanded below the rostellum into distinct, long, angular pointed wings, 3 – 4.9 × 0.8 – 1.2 mm. *Anther* suborbicular with a long curved acute beak, 0.8 – 1.3 × 0.7 × 1. *Pollinia* 2, generally bipartite, without viscidium. The anther chambers sometimes contain one or sometimes two pollen masses; this variation occurs even in individual flowers on the same inflorescence, c. 0.4 × 0.3 mm. *Seed capsule* sub-spherical 5 – 6 mm diam.

RECOGNITION. A medium-sized plant with rounded pseudobulbs enveloped by thin white papery sheaths, two long lanceolate leaves, a laxly-flowered inflores-

Fig. 32. *Liparis longicaulis*. A habit $\times 1$ (the stem is likely to be that of *Liparis chantaliae*); B column and ovary $\times 9$; C column $\times 9$; D lip $\times 6$; E dorsal sepal (flattened) $\times 6$; F petal $\times 6$; G lateral sepal $\times 6$; H flower $\times 6$; J T/S through stem $\times 9$; K pollinium $\times 30$. From Hildebrandt 3979 (K). DRAWN BY OLIVER WHALLEY.

Fig. 33. *Liparis longicaulis*. A habit; B flower. PHOTOS: A JEAN-MICHEL HERVOUET; B JOHAN HERMANS.

cence and flowers with a long rounded callus at the base of the lip, long and angular column wings, and an anther with a very acute beak. The lip often appears darker than the rest of the flower in herbarium material.

It is similar to *Liparis foliosa* from Réunion but the pseudobulbs of *L. longipetala* are smaller, the leaves longly acuminate, the lip callus more pronounced and the anther beaked and not rounded as in *L. foliosa*. The flower is somewhat similar to those of *L. bulbophylloides* but the plant is caespitose vs longly rhizomatous, the leaves ligulate vs ovate, and the flowers almost half the size.

DISTRIBUTION. Endemic to Madagascar: mainly in the Eastern forests of Antananarivo, Toamasina and Fianarantsoa province but also in the North in Antsiranana province. The Ankafana area referred to in the type is the old mission post near Fianarantsoa (Map 29). Szelengowicz & Tamon (2013: 361), cited and illustrated this species from Réunion but its habit, leaf and shape of the lip are different; the plant illustrated belongs to a different species and is probably *Liparis foliosa*.

SPECIMENS EXAMINED. MADAGASCAR. Ankafana (S Betsileo), *Hildebrandt* 3980 (holotype BM, isotypes G, K, W); Central, Andasibe forest (Onive basin), c. 1300 m, Feb. 1925, *Perrier* 17103 (lectotype P); Central, Andasibe forest, 1000 m, Feb. 1925, *Perrier* 17104; East, Analamazoa forest, 800 m, July 191, *Perrier* 10981 (lectoparatypes P); Analamazoa, July 1935, *Herb. Jard. Bot. Tan.* 3387 (TAN); Angavokely, May 1937, *Herb. Jard. Bot.* 2474 (TAN); Analamazoa, June 1941, *Jard. Bot.* 4853 (TAN); SE, Mandrare valley, tributary of the Manampanihy (SE), Mts S of Tanandava, March 1947, *Humbert* 20546 (G, P); Ampandrandava area, 1943, *Seyrig* 791b (P); s. loc., *Mason* 144 (K-spirit); s. loc., 1959, *Rauh & Buchloh* M658(251961) (HEID); Périnet, Aug. 1962, *Bosser* 16447 (P); Mt d'Ambre, *Bosser* 13539 (TAN); Mt d'Ambre, *Jard. Bot.* 624 (P, TAN); SW of Périnet, between Antananarivo and Tamatave, Oct. 1969, *Stewart* 1158 (K); Ranomafana, S of Namorona R., 1100 – 1250 m, March 1992 *Malcomber & Rakoto* 1346 (G, MO, K, P, TAN); Fianarantsoa, Ranomafana, 1100 – 1250 m, March 1993 *Turk et al.* 332 (K, MO, TAN); Antsiranana, near Mt d'Ambre, 1999, *Hermans* 2865 (K);

0 100 200 km

Map 29. Distribution of *Liparis longipetala*.

Andasibe area, Andriamaharo, Hort 2000, *Hermans* 5202 (K); Toamasina, road to Lakato, 1041 m alt., Feb. 2000, *Hermans* 1005 (K); Anjozorobe, Malala Hort, 2000, *Hermans* 6716 (K); Fianarantsoa, W of Ranomafana, May 2001, 1135 m, *Hermans* 118 (K); s. loc., Hort., Aug. 2005, *Hermans* 6672 (K); Fianarantsoa, near Andringitra, 2005, *Fischer et al.* FS2043 (SZU); Toamasina, Andasibe, Menalamba, Analamay forest, 1056 m, Jan. 2007, *Bernard* 542 (G); Mt d'Ambre, May 2008, 1055 m, *Trigui et al.* 384 (G); Toamasina, Ambatovy, Sahavaharina forest, 1047 m, Sept. 2008, *Antilahimena et al.* 6542 & 6542bis (MO, P, TAN); Toamasina, Ambatovy, Aug. 2010, 1029 m, *Antilahimena et al.* 7526 (MO, P); Toamasina, Andasifahatelo, Marinho, Mantadia, 968 m, April 2012, *Rasoazanany & Ratolojanahary* 157 (MO, P); Toamasina, Andasibe, Faliriana, Bekalakody, 1038 m, May 2012, *Antilahimena & Razafindrahaja* 8401 (MO, P, TAN); s. loc., Feb. 2016, *Sieder* 6930, *Hermans* 8062 (WU); Toamasina, Mantadia area, May 2018, *Hermans* 8219 (K).

HABITAT. Wet evergreen forest, in forest on mossy ground or epiphytic in evergreen forest. Altitude: 800 – 1500 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis longipetala* is estimated to be 117,936 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 52 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis longipetala* is known from seven subpopulations representing 12 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. February to August.

ETYMOLOGY. Referring to the petals which are said to be longer than in other species. *Liparis anthericoides* refers to the vegetative similarities with *Anthericum* (Liliaceae).

NOTES. *Liparis longipetala* was described by Henry Ridley in 1885 based on specimens collected by *Johannes Hildebrandt* (3980) in Central Madagascar; there are several sheets of this collection (BM, G, K and W). Some sheets in G are labelled and identified in error as *Hildebrandt* 3981 which is the type number of *Cynorkis hispidula* Ridl. (Ridley 1885: 517). More than 50 years after the description of *L. longipetala* Perrier described *L. anthericoides* based on several of his own collections from the Andasibe area in Eastern Madagascar. He cited *Perrier* 17103 and 17104 (both in P). *Perrier* 17103 was collected at 1300 m and has a good range of plants and also has small drawings by Perrier of floral detail, it is therefore designated as the lectotype. *Perrier* 17104 comes from the same locality but was collected at c. 1000 m and is a lectoparatype. He also cited *Perrier* 10981 in his description and this is also to be treated as a lectoparatype. There is no doubt that *L. longipetala* and *L. anthericoides* are the same which unfortunately means that Perrier's appropriate epithet, lacking precedence, becomes synonymous with Ridley's less appropriate epithet (Table 10). Plant size of this locally common species is variable but the shape of pseudobulb, leaves and inflorescence are consistent. The lip-shape with its characteristic narrowed base, oblong blade and long rounded ridge-like basal callus with a more or less bilobed end are identical, the sharply beaked anther and small triangular pointed column wings are also the same. It is unlikely that Perrier saw any of the type material of *L. longipetala* and he repeated some of Ridley's limited description in his own texts (Perrier 1936: 243 & 1939: 263). He mistakenly placed *L. longipetala* in sect. *Coriifoliae* and *L. anthericoides* in sect. *Moliifoliae*.

Table 10. Comparison of type specimens of *Liparis anthericoides* and *L. longipetala*.

	<i>L. anthericoides</i>	<i>L. longipetala</i>
Specimen	Hildebrandt 3980 (BM, K, W)	Perrier 17103-4 & 10981 (P)
Plant height (cm)	6 – 17.5	7 – 15
Pseudobulb (mm)	12 – 16 × 10 – 11	11 – 15 × 10 – 12
Leaf shape	ligulate to oblanceolate	ligulate
Leaf size	7 – 17 cm × 6 – 18 mm	7 – 14 cm × 9 – 14 mm
Inflorescence size (cm)	6 – 18	8 – 15
No. flowers per inflorescence	8 – 15 flowers	10 – 12 flowers
Floral bract (mm)	4 – 5 × 1 – 2	3 – 4 × 1 – 1.3
Dorsal sepal (mm)	5.5 – 6 × 1.2 – 1.6	7 – 8 × 1 – 1.1
Lateral sepals	4.1 – 4.8 × 1.9 – 2.5	5.2 – 6.0 × 2.4 – 3
Petal (mm)	5.1 – 6.8 × 0.4 – 0.6	7.0 – 8.5 × 0.5 – 0.7
Lip shape	oblong	oblong
Lip size (mm)	3.9 – 5.1 × 2.9 – 3.9	5.2 – 5.5 × 3.9 – 4.0
Lip callus	truncate to rounded	long, obtuse-bi-lobed at end
Column wing shape	wings rectangular	wings short triangular,
Column wing size (mm)	2.5 – 3.4	2.8 – 4 × 1.0 – 1.2
Anther shape	sharply beaked	sharply beaked
Anther size (mm)	0.8 – 1.1 × 0.7 – 0.8	0.9 – 1.3 × 0.7 × 1
Distribution	Madagascar: Andasibe, Toamasina prov	Madagascar: Ankafina, Fianarantsoa prov.
Flowering	Feb.	March

Liparis longipetala is a widespread species in the humid evergreen forest of Madagascar above 800 m and its flowering time from February to August is quite long. Ridley cited long petals as one of the characteristics of his *L. longipetala* but these are variable and not unusually long for the genus.

ILLUSTRATIONS. Figs. 34, 35 and 36; Perrier (1939: 255); Cribb & Hermans (2009: 147); Bosser & Lecoufle (2011: 405); Guérin & Hervouet (2013: 320); (Hervouet 2018: 405).

***Liparis lutea* Ridl.** (Ridley 1885: 458; 1886b: 274); Perrier (1939: 279); Hermans *et al.* (2007: 220); Cribb & Hermans (2009: 152). Type: Madagascar, Ankafana, Deans Cowan s.n. BM000090073 (holotype BM). *Leptorkis lutea* (Ridl.) Kuntze (1891: 671). Type as above.

Very small, up to 8 cm, erect terrestrial *plant*, on a short rhizome with the previous growth deciduous, roots wiry, c. 1 mm diam. *Pseudobulbs* almost stem-like, with three leaves, the petiolate base enveloping the elongate pseudobulb, two to three membranous sheaths at the base, 16 × 6 mm. *Leaves* ovate to lanceolate, 5 – 6.5 × 1.6 – 2.3 cm with a c. 25 mm petiole. *Inflorescence* c. 11 cm long, 1 mm diam., with three sheaths along its length, with c. 10 flowers. *Peduncle* 2 – 3, sheaths lanceolate acuminate, 7 – 8 × 2.5 – 3 mm. *Rachis* dense, flowers appressed to the rachis, c. 3.5 cm. *Floral bracts* ovate, lanceolate acuminate, 3.8 – 4.3 × 1.2 – 1.7 mm, about half the length of the ovary. *Flowers* small c. 9 × 7 mm, yellow to pale green. *Pedicel* and *ovary* somewhat ridged, 6 – 9 × 0.8 –

1.2 mm. *Dorsal sepal* narrowly linear, wider at the base, acuminate obtuse at the apex, 4.8 – 6.1 × c. 0.9 mm. *Lateral sepals* ovate, a little falcate, 4.1 – 4.6 × 2.1 – 2.2 mm. *Petals* narrowly linear almost subulate, 4.5 – 5.4 × c. 0.3 mm. *Lip* ovate cordate, obtuse, with three strong veins in the middle, slight swelling towards the base but without obvious callus, auriculate at the base, 2.9 – 4.1 × 2.0 – 3.1 mm. *Column* short and thick, curved towards the apex, shortly winged 2.2 – 2.9 × 0.5 – 1.1 mm. *Anther* cordiform 0.7 – 0.9 mm diam. *Pollinia* ovate c. 0.3 × 0.2 mm.

RECOGNITION. A very small plant with a dense raceme, the flowers not spreading much and almost appressed to the rachis, relatively large floral bracts, and small, yellow flowers with lip with three central veins, lacking a callus, a slightly winged column and heart-shaped anther.

The type material and the drawing by Deans Cowan (Cowan 1880: 22) provide limited evidence of the morphology of the species; it is similar to *Liparis densa* but the pseudobulbs are shorter, the leaves smaller, the inflorescence and rachis more elongate, carrying at least two lanceolate sheaths low on the peduncle (not present or smaller in *L. densa*) and the flower segments smaller. Due to the limited nature of the type material of *L. lutea*, it is difficult to compare the two species. It is also similar to *L. bathiei* but the floral bracts are smaller and narrower, the anther is beaked (vs cordiform) and the column has more pronounced wings.

DISTRIBUTION. Endemic to Madagascar: the Fianarantsoa area only (Map 30). The type locality of Ankafana refers the highland area in-between Antsirabe and Ambalavao.

Fig. 34. *Liparis longipetala*. A habit $\times 1$; B flower, ovary, bract from side $\times 9$; C flower, ovary, bract from front $\times 9$; D lip $\times 12$; E lip basal callus showing lateral basal thickening $\times 12$; F lip from side $\times 9$; G lip from behind $\times 12$; H lateral sepals $\times 9$; J petal $\times 9$; K dorsal sepal $\times 9$; L column from side $\times 12$; M column front $\times 12$; N top of column, anther cap lifted $\times 21$; P anther cap underneath $\times 21$; Q anther cap above $\times 21$; R pollinia $\times 36$. From *Hermans 5202 & Stewart 1158 (K)*. DRAWN BY OLIVER WHALLEY.

Fig. 35. *Liparis longipetala*. A habit $\times 1$ (inflorescence 1.5); B flower $\times 12$; C dorsal sepal $\times 12$; D petal $\times 12$; E lateral sepal $\times 12$; F lip $\times 9$; G column side $\times 21$; H column front $\times 21$; J anther cap top $\times 30$; K anther cap underside $\times 30$; L pollinia $\times 30$. From Hildebrandt 3980 (K). DRAWN BY OLIVER WHALLEY.

Fig. 36. *Liparis longipetala*. A habit; B flowers. PHOTOS: JOHAN HERMANS.

SPECIMENS EXAMINED. MADAGASCAR. Ankafana, in marsh, 1880, *Deans Cowan* s.n. (holotype BM); Ankiseve, Sendrisoa, Ambalavao, Feb. 1953, *Rakoto* 5570 (P, TAN); s. loc., *Lawrance* s.n. Spirit 34514 (K).

HABITAT. In marshland. Altitude: c. 1500 m.

CONSERVATION STATUS. Category EN: the extent of occurrence (EOO) of *Liparis lutea* cannot be estimated since it is only known from two subpopulations whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only two known subpopulations representing two locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. *Liparis lutea* is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. February.

ETYMOLOGY. Presumably referring to the yellow colour of the flowers.

NOTES. Henry Ridley (1885) described *Liparis lutea* from a plant collected by the Rev. William Deans

Cowan. The type consists of a single growth only but Deans Cowan, in his sketchbook of Madagascar orchids (Cowan 1880: 22 no 48) (Fig. 37) shows a fairly detailed watercolour sketch of a plant plus some detail of a flower. The species is only known from the holotype and two other collections at present and it is likely that this species will remain somewhat ambiguous because of the limitations of the description and type material. If further material comes to hand it should be compared with *Liparis densa*, of which it may well prove to be an unusual or smaller form.

ILLUSTRATIONS. Cowan (1880: 22 no 48) (Fig. 37).

***Liparis magnifica* Hermans sp. nov.** Type: Madagascar, Toamasina, Andasibe area, 1997, *Hermans* 2575 (holotype K).

<http://www.ipni.org/urn:lsid:ipni.org:names:77201800-1>

Very small epiphytic or terrestrial *plant*, up to 8 cm, ascending, clustered on a short to sometimes extended rhizome, roots villous. *Pseudobulbs* stem-like, terete,

0 100 200 km

Map 30. Distribution of *Liparis lutea*.

greenish brown to dark red, $12 - 51 \times 2 - 7$ mm, almost completely covered by 2 – 3 papery, partly overlapping sheaths which are strongly acuminate at the apex, $11 - 23 \times 3 - 5$ mm, carrying a single semi-erect to divergent leaf at the apex. *Leaf* persistent, lanceolate, rounded to subcordate at the base, attenuate at the tip, pale to dark green, distinctly marked with silvery-white longitudinal interrupted streaks or continuous bands, $3 - 5 \times 1.3 - 2$ cm. *Inflorescence* erect, apically racemose, with 1 – 5 flowers, 4 – 6.5 cm long. *Peduncle* somewhat angular to corrugate, about $\frac{2}{3}$ of the inflorescence, pale green, with 1 – 2 lanceolate peduncle sheaths up to 7×2 mm. *Rachis* apical, extending as the flowers open. *Floral bracts* narrowly lanceolate, $3.6 - 5.1 \times 1.1 - 1.7$ mm. *Flowers* medium in size, erectly spreading, up to 14×9 mm, petals and sepals whitish-green to pale green becoming yellowish-green when maturing, lip green with the disk, column white. *Pedicel* and *ovary* ridged, $7.5 - 10.3 \times 0.6 - 0.9$ mm. *Dorsal sepal* erect, recurved towards the apex, ensiform, margins recurved, $6.9 - 8.2 \times 1.2 - 1.9$ mm. *Lateral sepals* strongly recurved beneath the lip, elliptic, acute at the tip, $5.9 - 6.5 \times 2.5 - 2.9$ mm. *Petals* parallel or slightly divergent to the pedicellate ovary, linear, margins recurved, $7.1 - 7.9 \times 0.3 - 0.4$ mm. *Lip*

strongly recurved around the middle, obovate, auriculate at the base, anterior margin retuse, undulate, disk a little thickened, callus shortly bidentate to 'M'-shaped, $5.2 - 5.8 \times 4.3 - 4.5$ mm. *Column* curved towards the middle, wings longly, roundly-lobed, $3.3 - 4.4 \times 1.1 - 1.4$ mm. *Anther* roundly ovoid with a short triangular beak, base indented, $1 - 1.2 \times 0.9 - 1$ mm. *Pollinia* in two pairs, pyriform, c. 0.5×0.4 mm. *Seed capsule* fusiform, c. 15×5 mm.

RECOGNITION. This small new species is distinct by the single lanceolate leaf, marked with silvery white longitudinal bands, the short pseudobulbous stem, lanceolate floral bracts, the obovate lip with an undulate anterior margin and a distinct bidentate callus at the base. The species is distinct from all the other single-leaved *Liparis* of the region by the longitudinal silvery markings on the lanceolate leaf. It is closest to *L. warpurii* but differs by the lanceolate peduncle sheaths and floral bracts narrowly lanceolate vs cordate in *L. warpurii*, the leaf with an overall silvery upper surface vs banded, the flowers about half the size, the lip is more curved and obovate vs angular, the lip margin undulate vs dentate-serrate and the more sharply beaked anther. There are also similarities with *L. clareae* but the new species is much smaller in both plant and flower and the callus is bidentate vs indistinct. It is similar in size to *L. laurentii* described above but the lip is obovate vs transversally elliptic, the anther beak is much shorter and the lip callus is joined vs separate, it differs from *L. superclareae* described below by the much smaller plant and flower, the shorter anther and the lip callus bidentate vs obscure (Table 8).

DISTRIBUTION. Endemic to the Eastern forests of Madagascar in Fianarantsoa and Toamasina provinces (Map 31).

SPECIMENS EXAMINED: MADAGASCAR. Toamasina, Andasibe area, c. 1000 m, 1997, *Hermans* 2575 (holotype K); Toamasina, Ambatovy, Ambohibary, 1055 m, Oct. 2005, *Razanatsoa et al.* 502 (TAN); Toamasina, Ambatovy: Région Alaotra-Mangoro, April 2013, *Ambatovy Spirit Collection* 860Z17 (MO, TAN); Toamasina, near Anosibe an 'Ala, Feb. 2018, *Gamisch et al.* 7655 WU); Fianarantsoa, Ranomafana area, 970 m, April 2018, *Hermans* 8220 (K).

HABITAT. Epiphyte or terrestrial in wet medium-altitude forest, often amongst leaf-litter and mosses. Altitude: 950 – 1350 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis magnifica* is estimated to be 1,999 km² (which falls within the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 12 km² (which also falls within the limits for Endangered status under the criterion B2). *Liparis magnifica* is known from three subpopulations representing three locations (sensu IUCN), this

Fig. 37. *Liparis lutea*. Watercolour by Deans Cowan 1880: 19. © The Trustees of the Natural History Museum, London.

0 100 200 km

Map 31. Distribution of *Liparis magnifica*.

species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. April and May.

ETYMOLOGY. The epithet refers, firstly, to Madame Mag Izouard of Vakôna Lodge in Madagascar, who brought this species to our attention and, secondly, to the magnificence of the markings on the foliage.

NOTES. For some time the new species was only known from photographs of its leaves which had been found in forest around Vakôna Lodge near Andasibe in Eastern Madagascar by its owner Mme Izouard. On recent flowering it was possible to match the species to several herbarium collections from the same area. Since then the new species has also been found in the Ranomafana area in the SE of the island.

Liparis cardiophylla var. *angustifolia*, mentioned by Perrier (1936: 244) and only known from the type specimen, also has whitish leaves with darker veins. It was initially thought that it could be the same as *L. magnifica* but its flowers are very different and correspond well with the characteristics of *L. warpurii*. It is discussed under that species.

ILLUSTRATIONS. Figs 38, 39.

Liparis nectarina Frapp. ex Cordem. (Frappier in Cordemoy 1895: 184); Bernet (2010a: 92). Type: Réunion, Entre Deux, 800 m, 22 April 2012, Bernet in Hermans 8153 (neotype K, designated here)

Liparis nectarina Frappier (1880: 15) **nom. nud.**

Very small to small epiphytic or terrestrial plant 4.5 – 10 cm high, on a very short rhizome, roots wiry, slightly villous, c. 1 mm diam. *Pseudobulbs* ovoid to elliptic 15 – 20 × 7 – 10 mm, covered by 3 – 4 whitish brownish amplexant, scarious sheaths, with 2 – 3 leaves, the third smaller and sheath-like number of leaves, the older pseudobulbs without leaves. *Leaves* erectly spreading, elliptic-lanceolate, in living plants corrugate into three distinct veins, in herbarium material several-veined, overall 3.2 – 7.5 × 1 – 1.9 cm, acuminate, with a short 5 – 12 mm petiole, somewhat leathery, pale green. *Inflorescence* erect, relatively thick for the genus, corrugate up to 12 cm long but generally shorter, c. 2 mm in diam., with 5 – 7 flowers. *Peduncle* about $\frac{2}{3}$ of the inflorescence, with 1 – 2 elongate peduncle sheaths 8 – 15 × 3 – 5 mm. *Rachis* densely racemose becoming more spreading as the flowers open. *Floral bracts* lanceolate, acuminate, 6 – 8.5 × 1.2 – 1.8. *Flowers* parallel with the rachis, small to medium in size, overall c. 11 × 7 mm, segments pale green becoming yellow and then orange with age, anther paler, the lip darker green with the central ridge and callus almost olive-green. *Pedicel* and *ovary* elongate, twisted, sharply ridged, 7.1 – 8 × 1.3 – 1.8 mm. *Dorsal sepal* erect, narrowly lanceolate, acuminate, the margins infolded, 7.8 – 8.1 × 1.2 – 1.8 mm. *Lateral sepals* ovate, obtuse, folded beneath the lip, spreading and only overlapping near the base 5.6 – 5.8 × 2.6 – 3.8 mm. *Petals* descending, more or less curved, linear, margins infolded, 8.2 – 9 × 0.6 – 0.9 mm. *Lip* distinctly auriculate at base, then very strongly curved and expanded into an obcordate blade, the margins curved, the anterior margin undulate, broadly emarginated, a bilobed rounded callus at the base becoming a longitudinal swollen ridge on the disc, covered by small sticky droplets in living plants, overall 5.5 – 6.1 × 5.3 – 6.4 mm. *Column* curved and roundly bilobed at the apex, 3.8 – 4 × 1.4 – 1.5 mm. *Anther* oval with a distinct acute beak at the anterior margin, 0.9 – 1 × 0.9 – 1 mm. *Pollinia* (2) ovoid c. 0.5 × 0.4 mm. *Seed capsule* obovate, erect, c. 6 × 5 mm.

RECOGNITION. *Liparis nectarina* is a small plant with an ovoid pseudobulb covered by sheaths, two elliptic-lanceolate corrugate leathery leaves with three distinct recessed veins, an inflorescence with one or two elongate sheaths, few-flowered towards the tip, and

Fig. 38. *Liparis magnifica*. 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 top of column, anther removed; K column, side view; L anther cap, dorsal view; M anther cap, ventral view. From Hermans 2575 (K). DRAWN BY JUDI STONE.

Fig. 39. *Liparis magnifica*. A & B habit; C flower. PHOTOS: **A** JOHAN HERMANS; **B, C** JEAN-MICHEL HERVOUET.

small to medium-sized flowers, with a lip strongly auriculate at the base, with an emarginate apex, undulate, with a rounded bilobed callus and swollen longitudinal disk, nectar-like droplets (in living plants) on the surface, and a sharply beaked anther.

Liparis nectarina is closest to *L. flavescens* in habit and lip shape but the leaves of *L. nectarina* are leathery (vs membranous), strongly three-veined (vs many-veined), the lip margin is clearly emarginate (vs entire) and more deeply undulate. It is also similar to *L. scaposa* but the flowers of *L. nectarina* are at least a third larger, it has two leaves (vs one) and the anther is sharply beaked (vs roundly lobular). The lateral sepals overlap in both of the above species whilst they are divergent in *L. nectarina*, the distinct viscous droplets on the lip also seem to be particular to this species.

DISTRIBUTION. Endemic to Réunion. Frappier refers to ‘Hab. Saint-Pierre (Tampon)’. It has now also been found in nearby localities at the Entre Deux and Takamaka in the S Central mountains of the Island. Szelengowicz & Tamon (2013: 363) also report it from the more Westerly Cirque de Mafate (Map 32).

SPECIMENS EXAMINED: RÉUNION. Entre Deux, 800 m, April 2012, *Bernet* in *Hermans* 8153 (neotype K); Cilaos, April 1974, *Bosser* 22479 (P); Takamaka 900 m, Sept. 2007, *Bernet* in *Hermans* 8160 (K); Feb. 2002, Plaine des Palmistes, *Bernet* in *Hermans* 8167 (K).

HABITAT. Epiphyte or terrestrial in shaded forest; 800 – 2000 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis nectarina* is estimated to

be 164 km² (which falls within the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 16 km² (which also falls within the limits for Endangered status under the criterion B2). *Liparis nectarina* is known from three subpopulations representing two locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction. Previously assessed and published in the IUCN Red data listing for Réunion as category DD (Picot 2013: 25).

FLOWERING TIME. March to April.

ETYMOLOGY. Frappier, in his description, refers to the nectar-like droplets on the disk of the lip. A viscous substance on the lip is not unique to this species and can be found in others, such as *Liparis listeroides*, but the distinct droplets are unusual.

NOTES. *Liparis nectarina* first appeared in Frappier’s list in 1880, without a description. It was then formally described by Cordemoy (1895) which incorporated Frappier’s text on the Orchidaceae. Frappier did not indicate a type but gave the locality of ‘Tampon Saint-Pierre’. It is assumed that Frappier’s herbarium was lost (Bosser 2011) and there are no plants in Cordemoy’s herbarium that are labelled as such or fit the description. It was therefore decided to assign a new type from a more recent and well-documented collection (neotype *Bernet* in *Hermans* 8153). It originated from a similar area in the South-central mountains of Réunion. There are

Map 32. Distribution of *Liparis nectarina*.

several fruiting specimens in herbaria, currently filed under *L. flavescens*, that could be this species (e.g. *Bosser* 20989, 21211, 21310, 22180 (P), *Balfour* 1875 (K) etc.)

ILLUSTRATIONS. Figs 40, 41 and 42; Bernet (2010a: 92); Szelengowicz & Tamon (2013: 363).

***Liparis nephrocardia* Schltr.** (Schlechter 1924: 145); Perrier (1936: 253; 1939: 288); Hermans *et al.* (2007: 220); Cribb & Hermans (2009: 154); Bosser & Lecoufle (2011: 409); Hervouet (2018: 414). Types: Madagascar, Mt Tsaratanana, Jan. 1923, *Perrier* 15746 (P00095479) (lectotype P, designated here); Mt Tsaratanana, Dec. 1922, *Perrier* 15246 (P00095476) paratype P).

Small to medium, erect epiphyte, lithophyte or humicole *plant*, 9 – 17 cm high, rhizome very short, roots flexuose c. 1.5 mm diam. *Pseudobulbs* short, broadly ovoid to conical, 10 – 24 mm high, 7 – 13 mm wide, entirely covered by 2 – 3 sheaths and the leaf petioles, with two larger leaves and a third smaller one. *Leaves* elliptic-lanceolate, acute or acuminate, narrowed into a petiole (up to 2.5 cm), plicate, erectly

spreading, margins slightly undulate, 6.2 – 15 × 2 – 3.5 cm. *Inflorescence* up to 17 cm; variable in size, shorter or the same length as the leaves in the high altitude form, exceeding the length of the leaves in the lowland form, slightly ridged, with up to 14 flowers. *Peduncle* with a single sheath towards the base and 2 – 5 broadly-lanceolate sterile leaf-like bracts below the rachis, 7 – 9 × 2 – 3.5 mm. *Rachis* laxly flowered, 3 – 6 cm long. *Floral bracts* erectly spreading, initially similar to the sterile bracts below but then decreasing in size, lanceolate-acuminate, 5.4 – 8 × 1 – 3 mm. *Flowers* small, up to 10 × 8 mm, erectly spreading, greenish-yellow at first becoming brownish-yellow with age. *Pedicel* and *ovary* somewhat ridged, c. 5 × 1.5 mm. *Dorsal sepal* narrowly lanceolate, obtuse, base subcordate-auriculate, 6.5 – 8 × 1.1 – 1.7 mm. *Lateral sepals* porrect, elliptic-oblong, obtuse, 5.1 – 6.5 × 2.3 – 2.7 mm. *Petals* deflexed, obliquely linear, 5.1 – 7.9 × 0.3 – 0.5 mm. *Lip* strongly curved in the middle, the base subrectangular, basal wings short and rounded, with a rounded callus at the base forming a crescent or 'V' or 'M' shape, abruptly expanded in the middle into a kidney-shaped obcordate blade, rounded to

Fig. 40. *Liparis nectarina*. A habit; B flower; C dorsal sepal; D lateral sepal; E petal; F lip; G lip and column; H column; J anther cap, front view; K anther cap, rear view; L pollinia. From Hermans 8153 & 8160 (K). DRAWN BY JULIET BEENTJE.

undulate at the anterior margin, $4.1 - 5.6 \times 3.8 - 5.4$ mm. *Column* curved at the apex with subrectangular wings, $2.3 - 4.1 \times 0.8 - 1.2$ mm. *Anther* obtusely beaked at the front, c. 1×0.9 mm. *Pollinia* oval c. 0.4×0.3 mm.

RECOGNITION. A squat, broad-leaved plant normally with one flowering growth and a short conical pseudobulb, several broadly lanceolate sterile bracts below the rachis with similar floral bracts but becom-

Fig. 41. *Liparis nectarina*. A habit; B flowers. PHOTOS: PATRICE BERNET.

Fig. 42. *Liparis nectarina*. Flower. PHOTO: PATRICE BERNET.

ing smaller, a lip with a large rectangular base and then expanded into a broad rounded subcordate blade with an entire, semi-circular to 'M'-shaped callus and an obtusely beaked anther cap.

Schlechter compared *Liparis nephrocardia* with *L. jumelleana* but it is very different in habit and in having a somewhat longer and kidney-shaped blade of the lip. *Liparis bosseri* described above is similar in plant and flower size but the inflorescence of *L. bosseri* far surpasses the leaves (vs about the same length) and lacks the distinct rounded callus. It is similar to *L. andringitrana* in both habit and flower but *L. nephrocardia* is a little smaller and squatter, its lip is sub-rectangular near the base and the callus is lobed and much more obvious vs obscure, it also has more prominent column wings (Table 2).

DISTRIBUTION. Endemic to Madagascar: Antsiranana, Fianarantsoa and Toamasina provinces only (Map 33).

SPECIMENS EXAMINED. MADAGASCAR. Mt Tsaratanana, Jan. 1923, *Perrier* 15746 (P00095479) lectotype (P); Mt Tsaratanana, Dec. 1922, *Perrier* 15246 (P00095476), paratype (P); Sambirano, Northern slopes of the Sambirano valley, 600 m, Dec. 1922, *Perrier* 15745 (P); East, near the confluence of the Onive and the Mangoro, c. 700 m, Feb. 1925, *Perrier* 17135 (P); Mts N of Mangindrano, Ambohimirahavy, 1800 m,

0 100 200 km

Map 33. Distribution of *Liparis nephrocardia*.

Jan. 1951, *Humbert* 24887 (P); Fianarantsoa, Ranomafana area, Jan. 1992, *Hermans* 8286 (K).

HABITAT. Humid evergreen forest and moss-forest. Altitude: 600 – 1800 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis nephrocardia* is estimated to be 20,007 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 16 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis nephrocardia* is known from four subpopulations representing four locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. December to March.

ETYMOLOGY. Refers to the kidney / heart shape of the blade of the lip.

NOTES. This is one of the few species where Schlechter indicated a holotype specimen (*Perrier* 15746) '...to avoid future confusion' but, even then, there are two sheets with the same number, collected at the same

locality but at a different time, the better specimen is designated here as the lectotype. Perrier (1936: 253) mentioned that *Perrier* 17135 differs a little from the holotype in that it has 3-veined sepals (not 5-veined), petals shorter than the dorsal sepal and with two veins only, a smaller lip and the callus which is narrowly 'V' shaped. But there is some variability in all the specimens recorded by Schlechter.

There seem to be two distinct forms of this species, a smaller one from Mt Tsaratanana and the Sambirano region and a lush lower altitude form from the Eastern forests where the plant is almost double the size and the inflorescence much longer.

ILLUSTRATIONS. Figs 43, 44; Bosser & Lecoufle (2011: 409) but the flowers do not look like this species; Hervouet (2018: 414).

***Liparis ochracea* Ridl.** (Ridley 1885: 461; 1886b: 270); Hermans *et al.* (2007: 221); Cribb & Hermans (2009: 158); Bernet (2010a: 94; 2010b: 69); Bosser & Lecoufle (2011: 410); Hervouet (2018: 415). Type: Madagascar, Ankafana, Deans Cowan watercolour no. 581.9 (691), p.17 no 36, 1880 (holotype BM).

Leptorkis ochracea (Ridl.) Kuntze (1891: 671).

***Liparis connata* Ridl.** (Ridley 1885: 462; 1886b: 270).

Type: Madagascar, Imerina, Deans Cowan s.n. BM000090067 (holotype BM).

Leptorkis connata (Ridl.) Kuntze (1891: 671).

***Liparis hildebrandtiana* Schltr.** (Schlechter 1924: 140);

Perrier (1936: 251; 1939: 286). Type: Madagascar, Mt Tsiafajavona, Perrier 13511 (holotype P).

Large, erect, terrestrial, epiphytic or rarely lithophytic plant, up to 28 cm tall but generally between 15–20 cm, rhizome very short, repent, roots filiform, flexuose more or less pilose. *Pseudobulbs* stem-like, narrowly cylindrical-ovoid to subcylindrical but bulbous at the base, up to 6 cm long, 2 cm wide, covered by 2–3 long and overlapping stem-sheaths, sometimes the older leafless pseudobulb obliquely divergent, with up to 5 leaves starting half-way up the stem and ending with 2–3 larger ones towards the apex. *Leaves* erectly spreading, obliquely elliptic to ovate-elliptic, apiculate to obtuse, base rounded-cuneate and then narrowed into a 1.5–4 cm petiole, overall 7–15 × 3–5 cm, plicate, margins a little undulate to crenulate. *Inflorescence* erect, up to 15 cm, 2–3 mm in diam., laxly with up to 11 flowers but generally fewer. *Peduncle* costate, with 2–4 peduncle sheaths, the basal ones amplexant, the higher spreading, up to 35 × 4 mm. *Rachis* up to 8 cm long. *Floral bracts* erectly-spreading, variable but generally the lower ones lanceolate-acuminate, the higher ones shorter, ovate-acuminate to cordate and almost leaf-like, 6–14 × 2.5–5 mm. *Flowers* large, erectly spreading, up to 20 × 15 mm, sepals and petals greenish-white to more or less greenish yellow becoming more yellow-orange with age, the lip a little darker and sometimes with a darker patch

on the disk, column white, anther white to greenish-white, pollinia yellow. *Pedice*l and *ovary* slightly ridged to costate, 9–14 × 2–5 mm. *Dorsal sepal* arching over the column, narrowly-triangular, base cordate, tip obtuse to acuminate, 12–17 × 2–3.5 mm. *Lateral sepals* porrect below the lip, frequently fused or part fused with one another, subfalcate, oblong-lanceolate, somewhat obtuse, 11.5–16 × 3.5–5 mm. *Petals* pendent and recurved towards the tip, narrowly linear narrowing towards the apex, margins incurved, 10–15 × 0.5–1.2 mm. *Lip* elliptic, apex truncate-obtuse and shortly indented, anterior margins undulate to dentate, strongly curved just above the middle, base shortly cordate-auriculate, with two distinct parallel calli at the base, more or less longitudinally semi-obovate to lobular, overall 9.6–14.2 × 5–7.4 mm, generally about half as wide as long. *Column* slightly curved, semi-terete, the margins extended into rounded wings along the apical half, 4–7 × 1.5–2.5 mm. *Anther* shallow, broadly obovate with a tiny apicule at the anterior margin, 1.0–1.2 × 1.1–1.3 mm. *Pollinia* ovate, c. 0.5 × 0.6 mm. *Seed capsule* costate.

RECOGNITION. This is a variable species both in habit and flower but there are a number of distinguishing characteristics. It is a large plant with three to five broad ovate-elliptic leaves along a bulbous stem, a costate peduncle, broad, almost leaf-like floral bracts, large flowers with a long narrowly triangular dorsal sepal, a strongly curved lip almost twice as long as wide with a denticulate anterior margin, with parallel calli at the base and a rounded anther.

There are some strong similarities with *Liparis sambiranoensis* but that has a longer pseudobulb and a more distinct rounded epichile and angular hypochile of the lip (vs almost pandurate), a curved column with small angular wings make the latter species also distinct. Similar to *L. ornithorrhynchos* but the latter is generally shorter in growth, has a more rounded leaf, somewhat smaller flowers with narrower bracts, a narrower dorsal sepal, much rounder lip without distinct calli and an anther without a distinct beak. A number of Hildebrandt specimens from the same locality were confused with *L. ornithorrhynchos*.

DISTRIBUTION. Widespread in Madagascar in the highlands and Eastern forests. Antananarivo, Antsiranana, Fianarantsoa and Toamasina provinces (Map 34). There is a record from Toliara (*Rakotoson* 9421) and they seem to be more compact elongate plants growing in a drier environment. Herbarium material collected by Boivin in 1850–51 (P00095480-2) on Nosy-Be in Northern Madagascar could be a misidentification, the plants mainly consist of damaged or fruiting specimens; the floral bracts are not typical for this species. The species is rare on Réunion and records are relatively modern (Bernet 2010b: 69).

SPECIMENS EXAMINED. MADAGASCAR. Ankafana, Deans Cowan watercolour 1880: London, Natural History Museum, no. 581.9 (691), p.17 no 36, 1880 (holotype

Fig. 43. *Liparis nephrocardia*. A habit $\times 1$; B flower, front $\times 8$; C flower, side view $\times 10$; D dorsal sepal $\times 10$; E petal $\times 10$; F lateral sepal $\times 10$; G lip $\times 10$; H lip basal callus $\times 15$; J lip, side view $\times 10$; K column, side view $\times 15$. UNFINISHED DRAWING BY OLIVER WHALLEY.

Fig. 44. *Liparis nephrocardia*. A habit; B rachis. PHOTOS: JOHAN HERMANS.

BM); Nossi-Bé, Lokobe (Loucoube), Jan. 1850 – March 1851, *Boivin* s.n. P00095480-2 (P); Fianarantsoa, *Scott Elliot* 2065 (P); Ankafana forest, S Betsileo, March 1881, *Hildebrandt* 4048 (W); S Betsileo, Ankafana forest, *Hildebrandt* 3985b (W); Centre, Tsinjoarivo, Feb. 1925, *Perrier* 16971-3 (P); Centre, Andasibe forest, Feb. 1925, *Perrier* 17133 (P); Centre, Andasibe forest, Feb. 1925, *Perrier* 17134 (P); Mandraka, March 1925, *François* 17206 (P); Mandraka, Ankeramadinika forest, *Perrier* 15953 (P); Mandraka, Ankeramadinika forest, *Perrier* 17134bis (P); Carion, Feb. 1938, *Jard. Bot. Tana.*, 3370 (P); E, near the confluence of the Onive and the Mangoro, *Perrier* 17195 (P); S of Ambositra, Feb. 1942, *Decary* 17574 (P); W of Itremo, *Humbert* s.n (P-spirit); Ambatofitorahana, Betsileo, 1350 – 1600, Jan. 1955, *Humbert* 28417 (P); Road Antananarivo-Fianarantsoa, Jan. 1957, *Descoings* 2159 (P, TAN); Behara, Isilitsily, Amboasary, March 1957, *Rakotoson* 9421 (P, TAN); between Ambositra and Fianarantsoa, Aug. 1963, *Rauh* 10681 (HEID); Mt Tsaratanana, Jan. 1964, *Rakotozafy* 1289 (P); S of Ambositra, Jan. 1964, *Bosser*

18841 (P); S of Ambositra, PK300, Jan. 1965, *Bosser* 18937 (P); PK 290 main road S of Tana towards Fianarantsoa, Sept. 1969, *Stewart* 1060 (K); Fianarantsoa, Ambatofitorahana, Jan. 1996, *Hermans* 5372 (K); Fianarantsoa, Ambatofitorahana, 1996, *Hermans* 3738 & 3739 (K); Angavokely, 1500 m, Jan. 1996, *Hermans* 5377 (K); Antananarivo, Manjakatempo, 1800 m, 1997, *Hermans* 3939 (K, K-spirit); Manjakatempo, Dec. 1997, *Hermans* 2585, 4269 (K); Tsiazompaniry area, 1997 *Hermans* 2556 (K); Ambatovory, 1997, *Hermans* 2598 (K); Manjakatempo, 1999, *Hermans* 2476 (K); Ambatofitorahana, towards Fianarantsoa, 1999, *Hermans* 2881 (K); Antananarivo, Anjozorobe forest, 2000, *Hermans* 4257.1 (K); Ankaratra Massif, 2001, *Hermans* 5405 (K); road towards Ambatofinandrahana, before Anjomam Ankona, April 2001, *Hermans* 2111 (K); Toamasina, Ampitambe, Ambatovy, 1123 m, March 2005, *Rakotoavao et al.* 1411 (TAN); Toamasina, Antsakabary, Andapanomby, Mikara, 1021 m, April 2007, *Birkinshaw et al.* 1677 (K); Toamasina, Antaniditra, côté Ouest de Analamay, 1078 m, Oct. 2008,

Map 34. Distribution of *Liparis ochracea*.

Radrianasolo 943 (MO, P, TAN); Toamasina, Morarano, Marovoay, 1030 m, April 2009, *Ravelonarivo* 3277 (MO, P, TAN); Antananarivo, Ambatolampy, Ambatotsipihina, Dec. 2009, *Rajaovelona* 100 (K, TAN); Toamasina, Antaniditra, Ambatovy forest, 1035 m, Oct. 2008, *Antilahimena et al.* 6627 (MO, P, TAN); s. loc. (K Spirit 21018.000); s. loc., *Plazon* s.n. R7523 (W). **RÉUNION.** s. loc. *Boivin* 1035 P409214 (P); *Boivin*, s.n. P409246 (P); Marquat ravine, Clos d'Âne, 700 m, March 1973, *Friedmann* 2145 (P); Ilet Solitude, Hauts de la Possession, 600 m, March 1973, *T. Cadet* 4183 (P, REU); Dimitile, 2000 m, March 2003, *Bernet & Rivière* in *Hermans* 8165 (K).

HABITAT. Humid Eastern forest, highland forest, lichen forest, in damp shade in moss, on rocks and on moss-covered trees. Altitude: 600 – 2000 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis ochracea* is estimated to be 783,412 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 132 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis ochracea* is known from 24 subpopulations representing 29 locations

(sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

Previously assessed and published (as *Liparis hildebrandtiana*) in the IUCN Red data listing for Réunion as CR (Picot 2013: 11).

FLOWERING TIME. January to April.

ETYMOLOGY. The name presumably refers to the ochre colour of the flower, especially the ochre area in the lamina of the lip mentioned by Ridley in his description. This is not often seen in this species; Ridley's description relied on Deans Cowan's fairly rudimentary watercolour which shows this feature.

NOTES. The species was described in 1885 by Henry Ridley based upon a watercolour drawing in William Deans Cowan's sketchbook of Madagascan orchids (Cowan 1880: 17), now kept at the Natural History Museum, London. Ridley confirmed in his description that there was no herbarium specimen of it. Deans Cowan was not one of the most accomplished botanical artists but the watercolour shows the plant and also some

detail of the flower and its parts; together with Ridley's description, the species is fairly well defined. In the same publication Ridley also described *Liparis connata* which he admitted is likely to be a monstrous form of another species where the lateral sepals are fused together; otherwise it shows all the characteristics of *L. ochracea*. In 1924 Rudolf Schlechter described *L. hildebrandtiana*; 'named in memory of the Madagascar researcher Johann Maria Hildebrandt', it has all the characteristics of *L. ochracea*. Perrier (1936: 242, 251; 1939: 286) reduced both *L. ochracea* and *L. connata* to the synonymy of *L. hildebrandtiana*: in his reasoning he mentioned that he thought *L. hildebrandtiana* is nothing else but the *Liparis* named by Ridley as *L. ochracea* and *L. connata* but that it was impossible to verify this synonymy as *L. ochracea* was only described from a watercolour by Deans Cowan and *L. connata* is an abnormal cleistogamous form. He proposed therefore to conserve, notwithstanding its later publication, the name of Schlechter which, he said, is at least applied to a clearly defined species and is represented by several herbarium specimens, showing clearly the variability of the species and the cleistogamous forms that exist. This statement may well be true but is not valid under the rules of nomenclature and therefore the name *L. ochracea* has priority under ICN article 11.4.

Both Ridley and Perrier mentioned the great variability of the species plus the tendency to produce cleistogamous or deformed flowers, this is also confirmed by observations in the field. Perrier (1936: 251) gave a detailed analysis of the different variants and abnormalities found in plants from different localities, he also annotated a number of herbarium specimens; fusion of the lateral sepals seems to be quite common and the absence or deformity of anther and stigma are also frequent, especially the flowers at the apex of the inflorescence. He mentioned that the shape of the lip can also vary but the number of veins (seven) and their disposition (three median undivided and four branched laterals) are always present.

A specimen in the Paris herbarium (Boivin 1035 P00409214) from Réunion, misidentified as *Liparis caulescens*, is annotated as *L. polycardia* Rchb.f. but is in fact *L. ochracea*.

ILLUSTRATIONS. Fig. 45; Cowan (1880: 17); Schlechter (1932: T.211); Cribb & Hermans (2009: 157); Bernet (2010a: 94; 2010b: 69), (Bossier & Lecoufle 2011: 410); Hervouet (2018: 415). Photographs shown in Bossier & Lecoufle (2011) as *Liparis flavescens* (p. 407) and as *L. imerinensis* (p. 408) both have the characteristics of *L. ochracea*.

***Liparis ornithorrhynchos* Ridl.** (Ridley 1885: 460; 1886b: 270); Perrier (1939: 293); Hermans *et al.* (2007: 221); Cribb & Hermans (2009: 158). Types: Madagascar, Ankafana, Deans Cowan 35 (BM00090064) (lectotype BM,

designated here); Madagascar, Ankafana, Deans Cowan watercolour 1880: London, Natural History Museum, no. 581.9 (691), p.17 no 35, 1880 (BM); lectoparatype Madagascar, Ankafana, S Betsileo Hildebrandt 4049 BM, G, K (pro parte), LE, M).

Leptorchis ornithorrhynchos (Ridl.) Kuntze (1891: 671).

Small erect to arching terrestrial plant on a short to repent rhizome, rhizome up to 5 cm long covered with thin sheaths, roots filiform more or less villous 3 – 5 mm diam., overall up to 15 cm but often smaller. Pseudobulbs stem-like, up to 5 cm long, 7 – 10 mm diam., completely covered by 2 – 3 papery sheaths up to 45 mm long, with 2 or rarely 3 leaves at the top, disintegrating when the new growth emerges. Leaves shortly petiolate, ovate, acute, somewhat plicate, 3.5 – 7.5 × 1.5 – 3.5 cm, green. Inflorescence erect, laxly 8 – 12-flowered, overall between 6 and 12 mm long, 3 – 4 mm diam. Peduncle angular, with 2 – 3 acutely lanceolate peduncle sheaths, 8 – 9 × 3 – 4 mm. Rachis between 4 and 6 cm. Floral bracts ovate-lanceolate, the upper ones more acutely-lanceolate, 4.2 – 11.5 × 1.8 – 2.9 mm, decreasing in size towards the apex. Flowers large, spreading, up to 16 × 10 mm, overall pale green becoming more yellowish-green with age, the column white, with a darker green longitudinal band on the disk of the lip. Pedicel and ovary long and thin, up to 15 × 1.5 mm. Dorsal sepal linear, erect to arching, margins incurved, 8.5 – 11.1 mm. Lateral sepals ovate-lanceolate, obtuse, folded underneath the lip, 9.3 – 9.5 × 3.8 – 5.2 mm. Petals narrowly linear, spreading, 10.8 – 10.6 × 0.6 – 1 mm. Lip rounded to cordate with a short, narrow auriculate base, margins slightly undulate, a short apicule at the tip, with a broad disk and without calli, 7.9 – 9.2 × 8.0 – 8.3 mm. Column arching, almost straight, with long elongate wings, up to 5 mm long, 1.5 mm wide. Anther ovate with an elongate-rostrate obtuse beak, 0.9 – 1.0 × 1.0 – 1.2 mm. Pollinia ovate, c. 0.5 mm. Seed capsule obovate, slightly ridged, up to 15 × 8 mm.

RECOGNITION. The plant has a creeping rhizome, a short thin stem covered with two to three long papery sheaths, two ovate, plicate leaves, ovate-lanceolate floral bracts becoming narrower and shorter towards the apex of the inflorescence, a long and thin pedicellate ovary, and relatively large flowers, with the lateral sepals folded beneath the lip and about twice as long as wide, a roundly to broadly cordate lip with a narrow base, no calli and a distinctly beaked anther cap.

In his description Ridley compared it with *Liparis bowkeri* from mainland Africa but that has a different habit, rounded vs stem-like pseudobulbs and also has two distinct calli at the base of the lip. In habit and lip-shape *L. ornithorrhynchos* is similar to both *L. imerinensis* and *L. andringitrana* but it does not have the flattened

Fig. 45. *Liparis ochracea*. **A** habit; **B** inflorescence; **C** flower. PHOTOS: **A** JEAN-MICHEL HERVOUET; **B, C** JOHAN HERMANS.

pseudobulbs of *L. andringitrana*, the flowers almost $\frac{1}{3}$ larger and lack a callus at the base of the lip. It is often confused in herbaria with *L. ochracea* but its habit, smaller and rounder lip lacking a callus and its beaked anther cap make it distinct. The syntype or lectoparatype (Hildebrandt 4049) at K differs in its lip shape from that at W and elsewhere; the collection is a mixed group containing *L. ochracea*.

DISTRIBUTION. Endemic to Madagascar: Antananarivo and Fianarantsoa provinces (Map 35).

SPECIMENS EXAMINED. MADAGASCAR. Madagascar, Ankafana, Deans Cowan 35 (BM00090064) (lectotype BM); Ankafana, Deans Cowan watercolour 1880: London, Natural History Museum, no. 581.9 (691), p.17 no 35, 1880 (drawing of lectotype BM); Ankafana, S Betsileo, Hildebrandt 4049 (lectoparatypes BM, G, K (pro parte), LE, M); Central, 1880's Baron 1221 (K); Betsileo-land, 1880's Baron 196 (K); s. loc., Baron s.n., rec. July 1880 (K); Fianarantsoa, Jan. – Feb. 1890, Scott Elliot 2065 (BM, K); Road to Lakato, April 1964, Bosser 17753 (P); Fianarantsoa, Ranomafana, vicinity of Ampasina, March 1995, Turk *et al.* 741 (K, P); Angavokely area, 1997, Hermans 2700 (K).

HABITAT. Highland evergreen forest, in shade, damp places. Altitude: 1000 – 1500 m.

FLOWERING TIME. January to April.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis ornithorrhynchos* is estimated to be 11,163 km² (which exceeds the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 16 km² (which also falls within the limits for Endangered status under the criterion B2). *Liparis*

ornithorrhynchos is known from four subpopulations representing four locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

ETYMOLOGY. Presumably referring to the resemblance of the anther to the beak of a bird.

NOTES. Ridley (1885) described *Liparis ornithorrhynchos* and cited two distinct collections: material collected by the Rev. William Deans Cowan in 1880 and specimens collected in 1881 by Johann Hildebrandt from a similar area. The Deans Cowan material consists of a single herbarium sheet of several plants kept at BM, it is annotated '35' in Ridley's hand which refers to one of Dean's Cowans watercolours (Cowan 1880: 17, no 35). Hildebrandt's collection is represented in several European herbaria. The Deans Cowan specimen was selected as the holotype because it corresponds well to Ridley's description and also matches Dean's Cowan's illustration. The Hildebrandt material is a mixed group containing some atypical plants that do not correspond well with the description, the majority of plants being in seed. They are considered to be syntypes or lectoparatypes.

ILLUSTRATIONS. Fig. 46; Cowan (1880: 17 no 35); Cribb & Hermans (2009: 157) is *Liparis ochracea*.

***Liparis parva* (Kuntze) Ridl.** (Ridley 1885: 462); Ridley (1886b: 275); Perrier (1936: 249); Perrier (1939: 277); Hermans *et al.* (2007: 221); Cribb & Hermans (2009:

0 100 200 km

Map 35. Distribution of *Liparis ornithorrhynchos*.

153). Types: Madagascar, Ankafana, trees, *Deans Cowan* 38 (BM000090074) (holotype BM); Madagascar, Ankafana, *Deans Cowan* watercolour 1880: London, NHM, no. 581.9 (691), p.19 no 38, 1880 (illustration of holotype BM).

Leptorkis parva Kuntze (1891: 671).

Very small epiphytic plant on a very short rhizome, roots villous, overall 2.5 – 3.9 cm high without the inflorescence. *Pseudobulbs* adjoining, at first elongate then globular when mature, very pale green, with a few membranous sheaths around the base, a pair of leaves at the apex. *Leaves* opposite, lanceolate to lanceolate-ovate, c. 3 × 1 cm acuminate, on a short 5 – 8 mm petiole. *Inflorescence* erect, up to 8 cm long, laxly 6 – 12-flowered. *Peduncle* with one or two c. 6 × 1.5 mm spreading peduncle sheaths. *Rachis* slightly angular, c. 3 cm long. *Floral bracts* cordate, lanceolate to ovate apiculate, 3.3 – 6.0 × 1.4 – 2 mm. *Flowers* medium size, erectly spreading, c. 12 × 7 mm, petals and sepals greenish yellow, the lip olive green, column green becoming white towards the apex, anther yellowish green, all parts becoming orange yellow on ageing with the lip orange. *Pedicel* and *ovary* at first straight then acutely curved upwards towards the column, a little

angular, 5.5 – 9.1 × 0.5 – 0.8 mm. *Dorsal sepal* narrowly lanceolate, margins incurved, 5.2 – 6.8 × 0.8 – 1.2 mm. *Lateral sepals* lanceolate, falcate, obtuse, deflexed, 3.6 – 5.5 × 2 – 3.1 mm. *Petals* spreading, linear, 5.9 – 7.1 × 0.3 – 0.5 mm. *Lip* narrowly auriculate at the base, then ovate to suborbicular, obtuse a little indented at the anterior margin, with a longitudinal raised disk (not obvious in dried specimens) ending in an obtuse sub-rectangular callus at the base, 4.1 – 5.1 × 3 – 3.6 mm. *Column* thick, semiterete, wings broad, angular and strongly incurved, c. 4 × 1 mm. *Anther* with a short sharp apicule at the front, c. 1 × 0.8 mm. *Pollinia* ovate, c. 0.3 mm diam.

RECOGNITION. *Liparis parva* is a very small two-leaved plant with relatively large flowers, orbicular pseudobulbs, long and narrow leaves, a loosely flowered and zig-zag inflorescence, and flowers with a lip with a large sub-rectangular callus at the base, wide and angular, incurved column wings, a pedicellate ovary and column at an acute angle.

The species has some similarities with *Liparis cladophyllax* and *L. dryadum* but neither have the distinct globular pseudobulbs and have a column that is indistinctly winged vs distinctly angular, and a lip almost half the size. *Liparis parva* bears some similarity to *L. cespitosa* but that species has a single leaf and flowers half the size (Table 1).

DISTRIBUTION. Endemic to Madagascar: Fianarantsoa and Toamasina provinces (Map 36). Szelengowicz *et al.* (2011: 11) and Szelengowicz & Tamon (2013: 367), cited and illustrated this species from Réunion: it is not possible to verify the identity of the plant from the photographs but it is unlikely to be this species.

SPECIMENS EXAMINED. MADAGASCAR. Ankafana, trees, *Deans Cowan* 38 (BM000090074) (holotype BM); Ankafana, *Deans Cowan* watercolour 1880 (illustration of holotype BM); Mandraka, Ankeramadinika, 1930's *Perrier* 16966 *bis* & *ter* (P); Toamasina, Maromizaha area, 1100 – 1200 m, 1997, *Hermans* 3987 (K); s. loc., May 2018, *Hermans* 8218 (K).

HABITAT. In wet Eastern and highland evergreen forests, in deep shade, on moss and lichen-covered trees. Altitude: 1100 – 1500 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis parva* is estimated to be 7,631 km² (which exceeds the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 12 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only three known subpopulations representing three locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

Fig. 46. *Liparis ornithorrhynchos*. A habit; B flower. PHOTOS: JEAN-MICHEL HERVOUET.

FLOWERING TIME. February.

ETYMOLOGY. Refers to the small size of the plant.

NOTES. *Liparis parva* was described by Henry Ridley, based on a plant found by the Rev. William Deans

0 100 200 km

Map 36. Distribution of *Liparis parva*.

Cowan in the Highland forest of Madagascar. The same specimen was also drawn by Deans Cowan in his sketchbook, the drawing number (38) is given in Ridley's hand on the herbarium specimen. The plant seems to shrink greatly when dried and herbarium specimens lose the globular shape of the pseudobulbs.

Perrier (1939: 283) mentioned that the plant produces short white stolons but this is not reflected in the herbarium material.

ILLUSTRATIONS. Figs 47, 48; Cowan (1880: 19); Perrier (1939: 283); Cribb & Hermans (2009: 155).

***Liparis perrieri* Schltr.** (Schlechter 1913: 164, 21 of extract; 1924: 146); Perrier (1936: 250; 1939: 285); Hermans *et al.* (2007: 222); Cribb & Hermans (2009: 154). Types: Madagascar, Firingalava (Boina), Perrier 499 (P00095497) lectotype P, designated here; Perrier 499 (P00095498) islectotype P; West, Bemarivo valley, Dec. 1906, Perrier 1886 (Schlechter 45) syntypes P).

Liparis perrieri Schltr. var. *trinervia* H.Perrier ex Hermans (in Hermans *et al.* 2007: 289); Perrier (1939: 285); Hermans *et al.* (2007: 222); Cribb & Hermans (2009: 154) **synon. nov.** Type: Madagascar, Toamasina, E, Savoka, near the confluence of the

Onive & Mangoro, terrestrial, 700 m, Feb. 1925, Perrier 17136 (holotype P (P00095499); isotype (P90005500) P).

Liparis perrieri Schltr. var. *trinervia* H.Perrier (1936: 251) **nom. nud.** Based upon Perrier 17136.

Large erect lithophytic or rarely epiphytic plant, up to 28 cm, on a very short rhizome, roots filiform, flexuose, woolly, 3 – 4 mm diam. *Pseudobulbs* solitary or with a smaller growth or with 1 – 2 leafless oblique remnants, 1 – 3 cm, generally carrying 3 leaves, rarely 4, base with a smaller stem sheath. *Leaves* erectly-spreading, somewhat leathery, plicate, broadly elliptic, acute, base contracted into a 6 – 11 cm long sheath-like petiole, blade 8 – 25 × 3 – 8 cm, pale green and somewhat glossy, strongly veined, especially in dried specimens. *Inflorescence* erect, up to 30 cm tall, ridged, purplish-green, 10 – 40-subdensely-flowered in the upper half. *Peduncle* with 1 – 2 membranous sheaths and 2 – 5 sterile decurved bracts up to 5 mm long. *Rachis* sub-dense, up to 15 cm. *Floral bracts* decurved, lanceolate-acute, about half the length of the pedicellate ovary, 2.8 – 7 × 1.2 – 1.8 mm, pale green, brown at the base. *Flowers* small, erectly-spreading, opening in succession with the lower ones fading well before the upper ones open, overall up to 10 × 9 mm, ovary, sepals and petals green tinted more or less with purple, lip pink-violet to purple (rarely entirely green), green in the upper margins, column white becoming green towards the tip, anther cap pale green. *Pedicel* and *ovary* twisted and strongly roundly ridged, up to 12 × 0.6 – 1.1 mm. *Dorsal sepal* strongly incurved and recurved, oblong-ligulate, obtuse, broadening towards the base, 4 – 6.3 × 0.8 – 2 mm. *Lateral sepals* obliquely ovate-obtuse, strongly recurved to revolute below the lip, 3.0 – 5.4 × 1.8 – 2.8 mm. *Petals* linear to spatulate, incurved, spreading, 3.8 – 5.8 × 0.4 – 0.9 mm. *Lip* ovate to flabellate-dilate, the base rectangular strongly auriculate, anterior margin recurved, retuse, more or less denticulate, carrying 2 more or less prominent horn-like calli at the very base, 3.1 – 4.5 × 3 – 4.6 mm. *Column* curved forward in the upper half, strongly roundly winged towards the apex, 2 – 3.2 × 0.8 – 1.2 mm. *Anther* obovoid, often with a long apicule at the tip, 0.8 – 1.1 × 0.7 – 0.9 mm. *Pollinia* ovoid 0.3 – 0.5 × 0.5 – 0.7 mm. *Seed capsule* narrowly obovate, up to 12 × 5 mm.

RECOGNITION. This is a large, somewhat variable species with one flowering growth with many small flowers and the remnants of the previous year's growth. It has a ridged peduncle, strongly decurved floral bracts, green flowers tinted with purple, a much darker violet to purple lip with two separate horn-like calli at the very base, calli that are easily missed in dissection of herbarium material, a column winged near the apex and an obovoid anther without a distinct apicule.

The species is similar to *Liparis nervosa* and its numerous variants which has a widespread distribu-

Fig. 47. *Liparis parva*. Inflorescence. PHOTO: JOHAN HERMANS.

tion in tropical Africa and also India and Japan extending to the Philippines and in Central and South America. The two species are very similar and both are very variable. Plants of *L. nervosa* are generally more compact, the inflorescence denser and the callus on the lip more pronounced. The main consistent difference is in the floral bract: in *L. nervosa* it is parallel with the ovary or erect and about $\frac{3}{4}$ the length of the pedicellate ovary whereas, in *L. perrieri*, it is always deflexed or recurved and about half the length of the ovary. This is seen in both dried specimens and in living plants. Schlechter (1913: pl. VII) drew *L. perrieri* to show erect bracts that do not correspond with the herbarium material and is, therefore, likely to be an error. Amongst the Madagascan species, *L. perrieri* is not easily confused. *Liparis rivalis* is also a large plant with a dense raceme of small flowers but the plant has a distinct stem and the lip is ovate-flabellate vs broadly obovate obtuse, the callus is very prominent vs obscure. Some forms of it have a very compact stem, others more elongate; the latter tend to come from drier habitats in the W of the Island. It is vegetatively close to *L. bemarahensis* described above but the flowers of *L. bemarahensis* are larger by a third, the rachis lax (vs sub-dense) and the anther distinctly beaked.

DISTRIBUTION. Found mainly in Western Madagascar in the provinces of Antsiranana, Mahajanga and Toliara

(Map 37). The variant *trinervia* is found in Toamasina Province. Records from Fianarantsoa province (Perrier 11475 in P) are of fruiting specimens with a dubious identity. For Réunion there are photographs of this species, labelled as *Liparis nervosa* in Szelengowicz *et al.* (2011: 11) and Szelengowicz & Tamon (2013: 364) but there are no vouchers available, it is said to have been found in one location on Réunion.

SPECIMENS EXAMINED. MADAGASCAR. Firingalava (Boina), Perrier 499 (P00095497) (lectotype P), Perrier 499 (P00095498) (isolectotype P); Nossi Be, Jan. 1850, Boivin s.n. (P); West, Bemarivo valley (Boina), Dec. 1906, Perrier 1886 (Schlechter 45) (syntypes P); Sambirano, slopes of the Sambirano valley, Jan. 1923, Perrier 15336 (P) Sambirano, slopes of the Sambirano valley, Manongarivo Massif, Jan. 1923, Perrier 8032 (P); East, Savoka, near the confluent of the Onive & Mangoro, 700 m, Feb. 1925, Perrier 17136 (P); Ambodiriana, E of Antsalova, 100 – 150, Dec. 1952, Léandri & Capuron 2078 (P); Diego Suarez, Anivorano N, Antenampandranana forest, Ankarana Tsingy, Feb. 1960, Cours & Humbert 5561 (P); Diego Suarez, Ankarana Tsingy, Feb. 1960, 30 – 350 m, Humbert & Cours 32690 (P); vicinity of Tsiandro, 5 – 600 m, Jan. 1953, Léandri 2366 (P); Mahajanga, Ankarafantsika, Service Forestière 31 (P); NW of Ambohitsaretelo, 1100 – 1200 m, Jan. 1985, Dorr 3505

Fig. 48. *Liparis parva*. Flower. PHOTO: JOHAN HERMANS.

(G, K); Anjanaharibe, near Andranotsarabe, 1050 m, 1994, *Hermans* 117 (K); Mahajanga, Tsiandro area, 1999, *Hermans* 2460 (K); Antsiranana, Ankarana area, 1999, *Hermans* 2443 (K); E of Ankaramibe, Manongarivo reserve, Bekolosy, 800 – 100 m, Dec. 1992, *Malcomber et al.* 2000 (K, P); Tsingy of Antsalova, 1999, *Hermans* 2464 (K); Sakaraha, Zombitse, Feb. 2007, *Ranarivelo et al.* 598 (K, P, TAN); Ampasaindava, Bongomihiravavy forest, 415 m, Dec. 2008, *Madiomanana et al.* 191 (G, K, P); Antsiranana, Ampasindava, Bongomihiravavy forest, Dec. 2008, *Madiomanana et al.* MAD191 (G); Ampasindava, Andranomatavy forest, 405 m, Jan. 2010, *Ammann et al.* 503 (G, K, P); Beana, Ambahaky, 217 m, Jan. 2012, *Bolliger et al.* 102 (G, K); Antsiranana, Mt d'Ambre, 879 m, Jan. 2012, *Randimbirison & Ramandimbimanana* RCH089 (G); Antsiranana, Sava, 713 m, *Bone* 219 (K); road to Bealanana, Jan. 2016, *Sieder & Andriantiana* SKA6961 (WU); Ambanja, *Beentje et al.* 4584 (K); s. loc. *Chabonis* P01778646 (P).

HABITAT. The species is mainly restricted to the Western forest where it is found in the more humid areas growing on granite, calcareous rock or the base of trees on humus in moderate shade. Also in evergreen humid forest. Altitude: 500 – 1200 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis perrieri* is estimated to be 252,553 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 76 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis perrieri* is known from 18 subpopulations representing 18 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. December to February.

ETYMOLOGY. Named for Henri Perrier de la Bâthie (1873 – 1958).

NOTES. It was described and illustrated by Schlechter (1913) based on several specimens collected by Perrier. In the description, he referred to *Perrier* 479 as the type, this is a typographical error and it should be *Perrier* 499 which is from the correct locality and on the type sheet in P confirmed by Perrier and Schlechter. The type consists of two sheets and sheet P00095497 is designated as the lectotype because it is

0 100 200 km

Map 37. Distribution of *Liparis perrieri*.

more complete, P00095498 is an isoelectotype. Schlechter also mentioned *Perrier* 45 (1886 of *Perrier*) and this is labelled as a 'co-type' or syntype. *Liparis perrieri* is a variable and widespread species and exhibits a considerable range in plant and flower size and shape. *Perrier* (1936: 251) described var. *trinervia* without a Latin diagnosis but the name was later validated by Hermans (in Hermans *et al.* 2007: 289). It is said to differ from the typical form by the "lateral sepals with five veins; the lip being shortly apiculate in the middle of the front indentation, with three veins, the middle one simple, and with a well separated callus, in a conical swelling and very pronounced; the anther with the front lip subrectangular". It comes from the Eastern side of the island and is a local variant within the morphological range of the species. Although it is said to differ in having lateral sepals with five veins this is not consistent and can also be found in the syntype of the typical variety (*Perrier* 1886), the different lip, callus and anther shape can also be observed in other specimens of the typical Western form.

Perrier 1885 (P00095491) mentioned an abnormal form where the inflorescence emerges from the old leafless growth. This seems to be an oddity not observed in other specimens.

ILLUSTRATIONS. Figs 49, 50; Schlechter (1913: pl.7); Schlechter (1932: T.55).

***Liparis polycardia* Rchb.f.** (Reichenbach f. 1885: 543). Type: Madagascar, Fôret d'Anhaya?, Humblot s.n. (R16689) (holotype W).

Leptorchis polycardia (Rchb.f.) Kuntze (1891: 671), as *Leptorkis*.

Large epiphyte or terrestrial plant up to 23 cm tall but usually smaller, on a short ascending rhizome up to 15 mm long, 3 – 4 mm diam., partly covered by disintegrating sheaths, roots fleshy 1 – 2 mm diam. *Pseudobulbs* stem-like, thin, swollen towards the base, becoming thinner towards the apex, fleshy 3.1 – 7 × 0.5 – 1 cm, enveloped by 3 – 5 papery lanceolate-longly attenuate sheaths, partly overlapping each other, up to 4 cm long and 15 mm wide, with one to two opposite or sub-opposite leaves on top, older growths retaining their leaves. *Leaves* sometimes single but generally 2, erectly spreading, ligulate, longly attenuate, strongly veined, 5.5 – 16 × 1.2 – 3.2 cm, with a short 1 – 2 cm petiole. *Inflorescence* generally as long as the plant or longer, 7 – 24 cm × 1.1 – 1.5 mm in diam., with up to 15 flowers. *Peduncle* carrying 2 – 4 somewhat cordate bract-like sheaths 12 – 18 × 3 – 5 mm. *Rachis* laxly racemose, up to 15 cm long. *Floral bracts* lanceolate, becoming smaller towards the apex, 2.8 – 9 × 1 – 3 mm. *Flowers* small to medium in size 6.5 – 9 × 5.5 – 8 mm, pale green becoming yellow to

brownish yellow, the lip a little darker with the disk dark green, column white. *Pedice*l and *ovary* terete to somewhat grooved, 7 – 12 × 0.4 – 0.9 mm. *Dorsal sepal* ligulate-ensiform, strongly recurved, 5.8 – 9.2 × 0.9 – 1.2 mm. *Lateral sepals* obovate, recurved below the lip, 4.8 – 7.8 × 2.2 – 3.2 mm. *Petals* filiform, curved, 6.3 – 8.8 × 0.2 – 0.6 mm. *Lip* obcordate to cuneate to expanded flabellate, anterior margin slightly undulate to almost dentate, base hardly winged with two distinct, more or less flattened horn-like calli at the base, 5.1 – 6.9 × 4.2 – 6.6 mm. *Column* slightly curved at the apex a little thickened at the apex and then with two small but distinct triangular wings, 3.5 – 4 × 0.7 – 1.1 mm. *Anther* more or less sharply beaked, the pollen chambers only slightly divided, 1 – 1.3 × 0.7 – 0.9 mm. *Pollinia* obovoid, bipartite, on a common viscidium, 0.5 × 0.4 mm.

RECOGNITION. A large plant with a very long inflorescence and small to medium-sized flowers, the stem-like pseudobulbs covered with long attenuate, papery sheaths, longly ligulate and attenuate leaves, an obcordate lip lacking wings at the base and with two sharply-horned calli at the base, and a strongly beaked anther.

In his description Reichenbach mentioned that the flowers are like those of *Liparis foliosa*, referring, as explained above, to *L. reflexa* (R.Br.) Lindl. (Lindley 1825: t.882) from Australia, but plant habit, length of the inflorescence and the shape of the lip are different with the leaves about half the size, the flowers a little smaller with the lip obcordate vs oblong and the callus horn-like vs indistinct. It shares the basal teeth of the lip with *L. listeroides* and *L. imerinensis* but the plant and flower are bigger, the leaves longer and narrower (ligulate vs oval-elliptic) and the inflorescence longer by a third.

The most closely allied species is *Liparis stenophylla* which is similar in habit, flower size and shape but its leaves are more horizontal rather than erectly spreading, the leaves are narrowly lanceolate (vs lanceolate in *L. polycardia*), the petiole shorter, the inflorescence generally shorter, the petals shorter and the lip obovate to suborbiculate rather than obcordate.

Some forms have larger than average flowers and a less distinctly heart-shaped lip with a more denticulate anterior margin (*Hermans* 6737 and *Antilahimena* 4753), the drawing by Reichenbach accompanying the type also shows a denticulate lip.

DISTRIBUTION. Endemic to Madagascar: Antsiranana, Fianarantsoa and Toamasina provinces (Map 38). The label on the type specimen in W indicates Comores as a locality but this has been corrected to Madagascar which corresponds with Humblot's travels as shown in his notebooks (Humblot 1882 – 1885). The label indicated 'Forêt d'Anhaya' as the collecting locality but no reference has been found to this name. A specimen in the Paris herbarium (*Boivin* 1035

Fig. 49. *Liparis perrieri*. A habit; B flower; C dorsal sepal; D lateral sepal; E petal; F lip; G column; H anther cap exterior; J anther cap interior. Based on H. Perrier 17136. DRAWN BY LINDA GURR, BASED ON SKETCHES BY J. HERMANS.

P409214) from Réunion labelled as *Liparis caulescens* is annotated to be '*Liparis polycardia* Reichenb. f.' by

Fig. 50. *Liparis perrieri*. A habit; B flower. PHOTOS: JOHAN HERMANS.

Achille Finet but the plant habit and flowers are very different; it is in fact *L. ochracea*.

SPECIMENS EXAMINED: MADAGASCAR. Forêt d'Anhaya, Humblot s.n., (Rchb.f. 16689) (holotype W); North & Central, Tanambe, Warpur s.n. (K); s. loc., 1959, Rauh & Buchloh M658 (HEID); Antsiranana province, Anjanaharibe, 1050 m, 1994, Hermans 2293 (K); Masoala PN., Anjahana, Maroatsetra, 383 – 400 m, May 1996, Aridy *et al.* 273 (K); Toamasina, 1041 m, Feb. 2000, Hermans 1008 (K); Fianarantsoa, Ranomafana area, Ambatolahy, May 2001, 1046 m, Hermans 5396, 5399, 5582 & 6690 (K); Mantadia, Belakato, 1080 m, Nov. 2003, Roberts *et al.* TPPO21 (K); Antsiranana, Andapa, Doany, Anjialavahely, Ankarongameloka forest, 1546 m, March 2006, Antilahimena & Tianina 4753 (K, MO, P); Toamasina, Andasibe area, c. 968 m, Sept. 2007, Hermans 6737 (K); Toamasina, Alaotra-Mangoro region, 1107 m, May 2008, Rakotovo 4054 (K, MO, P, TAN); Toamasina, Ambatovy, 1088 m, Aug. 2008, Bernard 1057

(TAN); Toamasina, Moramanga, Analamay, 1063 m, Sept. 2008, Rakotondrajaona *et al.* 566 (TAN); Toamasina, Moramanga, Andasibe, Andasifahatelo, Marinjo, April 2012, Rasoazanany & Ratolojanahary 154 (MO, P); Toamasina, Andasibe, Faliriana, Bekalakody, 962 m, May 2012, Antilahimena & Razafindrahaja 8405 (MO, P, TAN); Toamasina, Ambohibary, Ampitambe, Ambatovy, Antampimbato forest, 1299 m, June 2012, Antilahimena & Ravelonarivo 8410 (MO, P, TAN); Toamasina, Ambatovy, 1146 m, April 2015, Ambatovy Shade House 5060 (MO, TAN); Moramanga, Andasibe, Maromizaha, 1001 m, March 2018, Gamisch *et al.* 7738 (WU).

HABITAT. Epiphyte or terrestrial in wet forest at medium elevation, in deep leaf litter. Altitude: 400 – 1500 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis polycardia* is estimated to be 44,008 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its

0 100 200 km

Map 38. Distribution of *Liparis polycardia*.

minimal area of occupancy (AOO) is estimated to be 48 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis polycardia* is known from nine subpopulations representing 10 locations (sensu IUCN), this species has been preliminarily assessed as VU using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. February to June.

ETYMOLOGY. Probably referring to the many heart-shaped lips on the flowers.

NOTES. *Liparis polycardia* has remained somewhat enigmatic for some time. Reichenbach f. (1885) validly described it, together with a number of other new species discovered by Leon Humboldt. It was included in Ridley's 1887 monograph of the genus where Reichenbach's description was repeated and marked as 'unseen' and possibly related to *L. puncticulata*, and said to have come from SE Africa. Kuntze (1891: 671) transferred it to his new genus *Leptorchis* together with other *Liparis*. It is not included in subsequent litera-

ture except for a listing in Durand & Schinz (1895: 9) and repeated by Voeltzkow (1917: 444) as coming from Africa. It is recorded in Govaerts (2017) as an unplaced name.

ILLUSTRATIONS. Figs 51, 52 and 53.

***Liparis puncticulata* Ridl.** (Ridley 1886a: 119; 1886b: 270); Perrier (1936: 245; 1939: 266); Hermans *et al.* (2007: 222); Cribb & Hermans (2009: 150); Hervouet (2018: 461). Types: Madagascar, Baron 4334 (K000242144) lectotype K, designated here; isoelectotypes Baron 4334 BM (BM00090071), P (P0095501)).

Leptorchis puncticulata (Ridl.) Kuntze (1891: 671).

Large slender, erect *plant*, terrestrial or rarely epiphytic up to 40 cm tall, often forming clumps of 5 or more growths, on a short 0.3 – 2 cm rhizome, roots flexuose, woolly. *Pseudobulbs* slender, stem-like, hardly thickened at the base, 16 – 38 cm long, 5 – 9 mm diam. Covered by 6 – 9 membranous sheaths slightly overlapping in the lower half and becoming more distant towards the apex, keeled and acuminate at the tip, characteristically spotted with more or less visible dark dots, with 3 – 4 somewhat distant leaves at the apex. *Leaves* narrowly lanceolate to ligulate, on a short 3 – 8 mm petiole, acute, margins generally a little undulate, sometimes irregularly serrate, 5.5 – 8 × 1.2 – 2.5 cm, pale green. *Inflorescence* erect, thin c. 2 – 3 mm diam., up to 30 cm tall but generally shorter, carrying up to 11 flowers but most often far fewer. *Peduncle* somewhat ridged, with a few 8 – 14 × 3 – 4 mm sterile bract-like sheaths. *Rachis* up to 18 cm, laxly racemose, the lower flowers fading or disappearing well before the apical ones open. *Floral bracts* erectly spreading, lanceolate acute 7.2 – 11 × 2 – 3 mm. *Flowers* medium size, up to 19 × 12 mm, erectly spreading, pedicellate ovary pale greenish white becoming darker towards the base of the flower, sepals and petals pale to olive green, lip olive green, the basal lobes paler, with a characteristic very dark green disk, column white, anther greenish-yellow, all parts becoming yellow to pale orange with age. *Pedicel* and *ovary* slender erect, 10 – 21 × 1.1 – 1.8 mm. *Dorsal sepal* lanceolate to ligulate-angustate, the base strongly lobed and for the most part strongly incurved, 7.7 – 14.5 × 1 – 1.8 mm. *Lateral sepals* broadly lanceolate, obtuse, curved alongside or under the lip, 6 – 12.5 × 3 – 4 mm. *Petals* oblanceolate to linear, strongly incurved along their length, 9 – 15 × 0.5 – 1 mm. *Lip* cuneate, the base thickened, longly auriculate, at first hollowed into a narrow gutter then widened into an obtriangular blade, bilobed to obscurely obcordate at the anterior margin which is distinctly dentate. Without a distinct callus at the base but with a thickened bilobed ridge with a rhomboid depression in-between, overall 8 – 13 × 4 – 6.7 mm. *Column* suberect, the tip curved, wings short and obscure, 3.5 – 6 × 0.6 – 1.5 mm. *Anther* rounded, with a

Fig. 51. *Liparis polycardia*. A main habit; B small flowering habit; C flower; D lateral sepal; E lip; F column. From Rakotovao 4054 & Warpur s.n. (K). DRAWN BY JULIET BEENTJIE.

Fig. 52. *Liparis polycardia*. **A** habit; **B** flower $\frac{3}{4}$ view; **C** lateral sepals; **D** lip; **E** column; **F** anther cap, top view; **G** anther cap, underside. From *Antilahimena* 4753 (K). DRAWN BY JULIET BEENTJE.

short beak-like apicule at the front, c. 1×0.9 mm. *Pollinia* ovoid c. 0.5×0.4 mm. *Seed capsule* fusiform, c. 12×6 mm.

RECOGNITION. This is a large plant characterised by its long, thin pseudobulbs covered by pale sheaths slightly overlapping towards the base but more

distant towards the apex, the sheaths often carrying dense, dark spots. It has three to four somewhat distant leaves, an elongate inflorescence with bracts along its length and a few medium-sized flowers towards the apex. The flowers have a wedge-shaped lip with a thickened ridge-like callus at the base

Fig. 53. *Liparis polycardia*. **A** inflorescence; **B** flower. PHOTOS: JOHAN HERMANS.

and dentate anterior margin and a much darker coloured base.

The long thin stem of *Liparis puncticulata* is also found in *L. gracilipes* but its leaves are much narrower (narrowly lanceolate vs elliptic) and the lip wedge-shaped vs suborbicular. The closest species is *L. sambiranoensis* but its stem is more slender, not angular, the stem sheaths do not overlap all along the stem, the leaves are fewer, more distant, much narrower: narrowly lanceolate vs elliptic and not as thin, the peduncle longer, and the flowers a little smaller with the lip wedge-shaped vs broadly oval.

DISTRIBUTION. Endemic and fairly widespread in Madagascar, provinces of Antananarivo, Antsiranana, Toamasina, Fianarantsoa (Map 39). There is a dubious record from Toliara (*Humbert* 20689 in P). Its main distribution is in the humid Eastern forest around Mandraka on the border of Antananarivo and Toamasina province.

SPECIMENS EXAMINED. MADAGASCAR. Central, *Baron* 4334 (lectotype K, isolectotypes BM, P); Nidy forest, *Catat* 1793 (P); s. loc. *Baron* 2306 (K); Central, July 1894, *Baron* 6752 (K); Mt Tsaratanana, April 1923, *Perrier* 16485 (P); Ankaizinana, April 1923, *Decary* 2020 (P); Central, Mandraka, 1925? *François* in herb. *Perrier* 16965bis (P); Central, Analabe (N Imerina), N of Antananarivo, c. 1300 m, Feb. 1928, *Perrier* 18432

(P); Central, Ankeramadinika forest, c. 1400 m, April 1928, *Perrier* 18549 (P); Mandraka, June 1938, *Herb. Jard. Bot. Tan.* 3670 (P); Toliara, Manampanihy basin, Mt Vohimavo, N of Ampasimena, c. 600 m, March 1947, *Humbert* 20689 (P); Lokoho Valley, Jan. 1949, *Humbert* 22946 (P); Ambatoharanana, March 1951, *Cours* 4022 (P); Marivorahaona Massif, SW of Manambato, c. 1200 m, March 1951, *Humbert & Capuron* 25722 (K, P, REU, TAN); Andrambovato, Jan. 1959, *Humbert & Capuron* 28468 (P); Mandraka, April 1960, *Bosser* 14254 (P); Mandraka, Feb. 1960, *Bosser* 13540 (TAN); Central, Tsinjoarivo, Feb. 1964, *Bosser* 18978 (P); Mandraka forest, April 1964, *Bosser* 19690 (P); Andringitra, April 1964, *Bosser* 19495 (P); Lake Mantasoa, March 1970, *Bosser* 20002 (P); Andrianany, 1560 m, Oct. 1970, *Guillaumet* 3357 (TAN); Antananarivo, Mandraka, 1984, *Dorr et al.* 2922 (MO, TAN); Marivorahona Mts, Ambilobe, 1999, *Hermans* 2446 (K); near Mandraka Jan. 2000, *Hermans* 4919 (P); Alaotra-Mangoro, Ampitabe, Ambatovy, 1140 m, May 2008, *Antilahimena et al.* 6192 (K, MO, P); Alaotra-Mangoro region, 1107 m, May 2008, *Rakotova* 4054 (MO, TAN); Fivondronana Moramanga, Ambatovy, June 2008, 1121 m, *Antilahimena et al.* 6248 (MO, TAN); Ambatolampy, Sahatrendrika, 1535 m alt,

0 100 200 km

Map 39. Distribution of *Liparis puncticulata*.

Jan. 2010, *Rajaovelona* RJL62 (K, TAN); Ambatovy, *Andriantiana* 618 (MO).

HABITAT. Terrestrial in humus and in moss-rich forest or on the base of moss-covered trees. Altitude: 800 – 2500 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis puncticulata* is estimated to be 101,847 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 64 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis puncticulata* is known from 14 subpopulations representing 14 locations (sensu IUCN), this species has been preliminarily assessed as VU using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. The main concentration of colonies is in the Mandraka area which has now been greatly eroded and only few forest remnants remain.

FLOWERING TIME. January to July but mainly January and February.

ETYMOLOGY. Refers to the black spots, more or less visible, on the stem sheaths.

VERNACULAR NAMES. Avonala (*Herb. Jard. Bot. Tan.* 3670 in P).

NOTES. Three herbarium sheets of Baron's type material exist, one in BM which has no flowers, one at P with flower fragments only and one at K which has several good flowers; for this reason the K specimen has been designated as the lectotype, the others are isoelectotypes. There also is a tracing by Reichenbach of the Kew type at W.

ILLUSTRATIONS. Figs 54, 55; Perrier (1939: 271); Hermans *et al.* (2007: pl.46); Cribb & Hermans (2009: 151); Guérin & Hervouet (2011: 96); Hermans (2013: 293); Hervouet (2018: 416).

Liparis punctilabris Frapp. ex Cordem. (Frappier in Cordemoy 1895: 184); Bernet (2010a: 96). Type: Réunion, Dimitile, Palmistes, 1800 m, March 2002, Bernet in Hermans 8161. (neotype, designated here, K). *Liparis punctilabris* Frappier (1880: 15) **nom. nud.**

Very small epiphytic or terrestrial plant 5 – 7 cm high, on a short rhizome, roots wiry, woolly, c. 3 mm diam. *Pseudobulbs* ovoid to conical 12 – 15 × 9 – 10 mm, the base covered by membranous sheaths without strong veins, carrying 2 – 3 erectly-spreading leaves. *Leaves* ovate to lanceolate, acute, narrowed into a short petiole at the base, blade corrugate, 3.8 – 6 × 1.5 – 2.1 cm, pale green. *Inflorescence* erect, up to 95 mm, corrugate, with up to 13 flowers. *Peduncle* with 2 – 3 small narrowly lanceolate bracts. *Rachis* loosely racemose, in the upper third of the inflorescence. *Floral bracts* narrowly lanceolate 3.5 – 5.5 mm, about $\frac{1}{3}$ the length of the ovary, minutely erose at the base. *Flowers* small, erectly spreading, av. 9 × 7 mm, floral segments overall pale and translucent, with minute dark spots within the structure, especially the lip (not always obvious in dried specimens). *Pedicellate ovary* green, perianth yellowish green, becoming yellow-orange with age, lip and column green, anther white-brown. *Pedicel* and *ovary* cylindrical corrugate, 8 – 13 × 0.7 – 0.8 mm. *Dorsal sepal* erect, linear-ligulate, more or less widened at the base, margins recurved, 6.8 – 7 × 1.1 – 2 mm. *Lateral sepals* broadly oblong-falcate, obtuse, curved below the lip and overlapping, 4.7 – 5.2 × 2.3 – 2.8 mm. *Petals* linear, spreading, margins incurved, 6.3 – 6.5 × 0.4 – 0.6 mm. *Lip* transversally elliptic to reniform, with distinct short wings at the base then abruptly broadened into the blade which is slightly undulate at the anterior margin and minutely mucronate at the apex, two distinct calli (appearing as an angular cushion in living material) at the base ending in longitudinal rounded ridges along the central vein, 3.2 – 3.5 × 5 – 5.1 mm. *Column* slightly curved, hunchbacked, broadened in the upper half with

O. A. Whalley Kew Oct 2002.

Fig. 54. *Liparis puncticulata*. A habit $\times 1$; B flower $\times 6$; C dorsal sepal $\times 12$; D petal $\times 12$; E lateral sepal $\times 12$; F lip of type $\times 12$; G lip of *Baron* 6752 $\times 10$; H column, side view $\times 8$; J column, front view $\times 8$. From *Baron* 4334 & *Baron* 6752 (K). DRAWN BY OLIVER WHALLEY.

Fig. 55. *Liparis puncticulata*. A habit; B rachis. PHOTOS: JOHAN HERMANS.

elongate rounded wings, $2.1 - 2.3 \times 0.8 - 0.9$ mm. Anther ovoid, with a short rounded lobe at the anterior margin. Pollen 2, ovate c. $0.5 - 0.3$ mm. Seed capsule obovate, erect c. 10×5 mm.

RECOGNITION. This is a very small plant, with ovoid-conical pseudobulbs, ovate, corrugate leaves, and small flowers with translucent and punctate segments, a transversally elliptic to reniform lip wider than long (Frappier, in his key, referred to the lip being orbicular but this may have been a misinterpretation especially as he also described it as very obtuse, all other characteristics correspond with his description), shortly auriculate at the base, mucronate at the tip, and with an angular bilobed callus at the base, a short column and thickened at the apex, wings long and indistinct, and an anther with a small lobule in front.

The plant has some similarities with *Liparis bathiei*, *L. flavescens* and *L. lutea* but their inflorescences are denser, their lip ovate (vs transversally elliptic), their column wings more angular and their anther with a more acute beak.

DISTRIBUTION. Endemic to Réunion: Saint Pierre (Tampon: Piton Hyacinthe); Saint-Benoit (Bébour); Plaine des Palmistes (Map 40).

SPECIMENS EXAMINED. RÉUNION. Dimitile, Palmistes 1800 m, March 2002, *Bernet* in *Hermans* 8161, neotype (K); Piton Hyacinthe, Plaine des Cafres, herb. *Cordemoy* s.n. (MARS); Basse Vallée, Oct. 1972, *Bosser* 21310 (P); Descente Plaine des Sables, Ravine Langevin, May 1975, *Bosser* 22128 (P); Bébour Bélouve, 1400 m, Jan. 2003, *Bernet & Rivière* in *Hermans* 8152 (K).

HABITAT. Very moist shaded forest of the interior of the island. Altitude: 1000 – 1800 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis punctilabris* is estimated to be 169 km^2 (which falls within the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 20 km^2 (which also falls within the limits for Endangered status under the criterion B2). With only three known subpopulations representing two locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing as EN (Picot 2013: 12).

FLOWERING TIME. January to April.

ETYMOLOGY. Referring to the punctate lip (mainly visible in living flowers).

Map 40. Distribution of *Liparis punctilabris*.

NOTES. *Liparis punctilabris* first appears in Frappier's listing of Réunion plants in 1880 but without a description. It was then described by Cordemoy (1895) who incorporated Frappier's manuscript.

Frappier indicated several localities in Réunion but there is no clear type material. A fruiting specimen is in the Cordemoy herbarium (MARS) corresponds with the description and comes from Piton Hyacinthe which is one of the localities mentioned by Frappier in Cordemoy. There is no direct proof that this specimen is part of the type material and the fruiting plant is a poor representation of the species. As there is no other historical representative material available it was decided to assign a new type from a more recent and well-documented collection (Bernet in Hermans 8161). The new type originates from a similar area in the South-central mountains of the island.

ILLUSTRATIONS. Figs 56, 57; Bernet (2010a: 96); Szelengowicz & Tamon (2013: 368).

***Liparis rivalis* Schltr.** (Schlechter 1924: 146); Perrier (1939: 267); Hermans *et al.* (2007: 223); Cribb & Hermans (2009: 150); Hervouet (2018: 417). Types:

Madagascar, Mt Tsaratanana, *Perrier* 15244 (P00095517) (lectotype P, designated here; isolectotype *Perrier* 15244 (P00095518).

Large erect terrestrial *plant*, up to 35 cm tall; rhizome very short; roots more or less pilose, c. 1 mm diam. *Pseudobulbs* slender, stem-like, up to 22 cm × 3–6 mm, partly covered by 4–8 amplexant sheaths, sometimes with a leaf-like bract just below the leaves, with 3–5 apical sub-petiolate leaves. *Leaves* asymmetric, somewhat falciform, thin, lanceolate to elliptical-lanceolate, acuminate, up to 5–15–2–5 cm but usually in the smaller range, pale green. *Inflorescence* erect, longer than the leaves, carrying up to 30 flowers, up to 15 cm. *Peduncle* with a few short costate peduncle sheaths sizes and several sterile bracts. *Rachis* densely-flowered, racemose, up to 14 × 2 cm diam. *Floral bracts* spreading, linear-lanceolate, acuminate, the lower ones a little longer than the pedicellate ovary, the apical ones shorter, 5.2–7 × 0.9–1.6 mm, green. *Flowers* small, up to 9 × 6 mm, erectly-spreading, lower ones fading before the upper ones open, ovary and column green, sepals and petals brownish-green, lip pale orange and becoming darker towards the middle

Fig. 56. *Liparis punctilabris*. A habit; B flower, side view; C flower from above; D dorsal sepal; E lateral sepal; F petal; G lip; H column, side view; J anther cap; K anther cap; L pollinium. From *Hermans* 8152 & 8161 (K). DRAWN BY JULIET BEENTJE.

Fig. 57. *Liparis punctilabris*. A habit; B inflorescence; C flower. PHOTOS: PATRICE BERNET.

to a dark orange-red on the disk; the whole becoming more yellow with age. *Pedice* and *ovary* glabrous, costate, $4.5 - 7 \times 0.5 - 1.1$ mm. *Dorsal sepal* erect, ligulate-lanceolate, $5.5 - 7.2 \times 0.3 - 1$ mm. *Lateral sepals* perfect, forming a platform beneath the lip, narrowly oblong, $4.5 - 6.3 \times 1.9 - 2.2$ mm. *Petals* margins incurved, curved upwards, obliquely linear $5.4 - 7.0 \times 0.3 - 1$ mm. *Lip* slightly curved, broadly obovate, with very small auricles at the base, very obtuse to almost truncate at the front, the margins undulate to crenulate, with a small callus-like thickening at the base, $4.1 - 5.4 \times 3.8 - 4.6$ mm. *Column* very small $1.2 - 2.8 \times 0.4 - 0.5$ mm, curved at the apex, with small wings. *Anther* oblate with a small obtuse beak at the front, c. 0.5×0.5 mm. *Pollinia* ovoid, c. 0.3×0.2 mm.

RECOGNITION. This is a very distinct species with a long, slender stem-like pseudobulb with asymmetric falciform leaves at the apex, and a dense racis of small flowers. Its flowers are yellow orange with the centre of the lip dark orange to red, a broadly ovate lip, obtuse at the front and with very small auricles at the base, a scarcely visible basal callus and a very small column.

It is somewhat similar in habit to *Liparis gracilipes*, *L. listeroides*, *L. puncticulata* and *L. danguayana* but the asymmetric leaves, long inflorescence with many small flowers and very small column sets it apart. It shares with *L. caulescens* from Réunion a similar habit, including the somewhat asymmetric leaves, the brownish-yellow flower colour and lip shape but plants of *L. caulescens* are generally shorter, the spike laxly racemose (vs densely racemose), fewer flowered, the flower segments almost double the size, the lip with a distinct callus and the column larger and with angular vs rounded wings (Table 6). Some forms have slightly larger flowers than average and a lip without distinct wings but are still the same species (e.g. *Humbert* 25132).

DISTRIBUTION. Endemic mainly to the North of Madagascar in Antsiranana and Toamasina provinces (Map 41).

SPECIMENS EXAMINED. MADAGASCAR. Mt Tsaratanana, *Perrier* 15244 lectotype (P); *Perrier* 15244 isolectotype (P); NE, foothills of the Marojejy massif, near col Doanyanala, 1949, *Humbert* 23143 (G, K, P); Anjanaribe, rd to Andapa, c. 1200 m, Dec. 1950, *Cours* 3699 (P, TAN); Mt Rahobevava, 960 m, March 1951, *Cours* 4278 (P, TAN); Mts N of Mangindrano, 1800 – 2100 m, Jan. 1951, *Humbert* 25132 (P); Mt d'Ambre, Dec. 1967, *L. B.* 12034 (G); Antsiranana, near Anjanaharibe, Jan. 1994, *Hermans* 2119, 2885 (K); near Andranotsarabe, 1050 m, Nov. 1994, *Hermans* 1001 (K); Rahobevava area, 1999, *Hermans* 2425 (K); Antsiranana area, 1999, *Hermans* 2439 (K); Anjanaribe, 1999, *Hermans* 2444 (K); Andapa area, 1999, *Hermans* 2468 (K); Masoala, E slope of Ambohitsitondroinan, 1125 m, Feb. 2003, *Lowry et al.* 6170 (P, TAN);

Antsiranana, near Mt d'Ambre, Jan. 2017, *Hermans* 8106 (K).

HABITAT. Terrestrial at the edge of streams or damp places, in undergrowth in evergreen forest of gneiss and laterite. Often in deep leaf litter and moss. Altitude: 800 – 1600 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis rivalis* is estimated to be 40,636 km² (exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 32 km² (which falls within the limits for Endangered status under the criterion B2). With only eight known subpopulations representing eight locations (sensu IUCN), *L. rivalis* has been preliminarily assessed as VU using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. December to March.

ETYMOLOGY. Refers to the habitat, near the margin of streams, where the type specimen was found.

NOTES. Rudolf Schlechter (1924: 146) described *Liparis rivalis* from material collected by Perrier on Mt Tsaratanana. There are two sheets of type material:

0 100 200 km

Map 41. Distribution of *Liparis rivalis*.

the specimen with barcode P00095517 corresponds best to the description and is more complete than P00095518 and is designated as the lectotype.

ILLUSTRATIONS. Fig. 58; Perrier (1939: 271); Hervouet (2018: 417).

Liparis salassia (Pers.) Summerh. (Summerhayes 1953: 133; Hermans *et al.* (2007: 223); Cribb & Hermans (2009: 156); Bernet (2010a: 98); Bosser & Lecoufle (2011: 409); Hervouet (2018: 418). Type: Île de Bourbon [Réunion], Montes Salassii, Commerson in Herb. Jussieu 3770. (P00672904) (holotype P in Herb Jussieu).

Epipactis salassia Pers. (Persoon 1807: 513).

Ophrys salassia ms. in Herb. Commerson sec. A.Rich. (Richard 1828: 53).

Serapias salassia (Pers.) Steud. (Steudel 1821: 767).

Neottia salassia (Pers.) Steud. (Steudel 1841: 189).

Malaxis purpurascens Thouars (1822: tt. 26 & 27). Type: s. loc. Thouars s.n. (P00112470) (holotype P).

Liparis purpurascens (Thouars) Lindl. (Lindley 1825: t.882); Moore in Baker (1877: 343); Ridley (1886b: 279); Frappier in Cordemoy (1895: 183); Perrier (1939: 267).

Leptorkis purpurascens (Thouars) Kuntze (1891: 670).

Liparis salassia (Pers.) Summerh. var. *miroslawskiana* Marg. & Szeleng. (Margonska & Szelengowicz 2011: 15), **synon. nov.** Types: Réunion, E Coast, at Takamaka, March 2011, Szelengowicz 0311 (holotype UGDA-HBM, isotype UGDA-HBM spirit coll.).

Small erect or divergent terrestrial or rarely epiphytic or lithophytic *plant* on a short ascending up to 16 cm tall but generally around 10 cm, completely reddish to violet-red when alive, rhizome c. 3 mm diam., roots thin, villous. The most recent 2 or 3 growths retaining their leaves, older pseudobulbs becoming reptant. *Pseudobulbs* stem-like, fusiform to somewhat angular, purple-red, 5 – 10 cm × 3 – 6 mm, partly covered by 2 – 4 sheaths (10 – 15 mm long), generally carrying 2 apical leaves and sometimes a 3rd smaller leaf a little lower. *Leaves* somewhat coriaceous, cordate to ovate, abruptly contracted into a short petiole (5 – 12 mm), margins more or less undulate, 2 – 6 × 1.5 – 3.5 cm, dark green, glossy, the veins and petiole dark red-purple, purple-brown underneath. *Inflorescence* up to 10 cm long, generally shorter, somewhat grooved, dark red-brown. *Peduncle* with 1 – 2 cordate to

Fig. 58. *Liparis rivalis*. A habit; B inflorescence. PHOTOS: JOHAN HERMANS.

lanceolate peduncle sheaths c. 5×2 mm. *Rachis* subcorymbose, elongating with age, with up to 16 flowers, generally fewer. *Floral bracts* lanceolate, $5 - 5.8 \times 1.2 - 1.5$ mm, much shorter than the pedicellate ovary, reddish-brown. *Flowers* medium in size, up to 1.4×1.5 mm, ovary, dorsal sepal and petals burgundy, lateral sepals yellow-brown more or less marked with burgundy, lip pale-yellow with the veins dark burgundy, column white marked with purple, anther pale yellow, pollinia orange to brown. *Pedicel* and *ovary* tubular to fusiform, twisted, sulcate, up to 12×1.5 mm, elongating with age. *Dorsal sepal* recurved, subulate to linear, margins incurved, subapiculate, $5.5 - 8 \times 0.7 - 1.4$ mm. *Lateral sepals* oblong ovate, obtuse, connate at the base, folded underneath the lip, $4.7 - 6.7 \times 2 \times 2.9$ mm. *Petals* descending to divergent, subulate to linear, the margins more or less incurved, subapiculate, obtuse, $4.5 - 5.6 \times 0.2 - 0.3$ mm. *Lip* suborbicular to obcordate-triangular, curved downwards toward the middle, base with long upturned lobes entire at the margins, forming small auricles at the base, emarginated to apiculate at the front, anterior margins serrate to lacinate, with a more or less pro-

nounced basal callus which can be divided, $3.5 - 5.9 \times 4.2 - 4.9$ mm. *Column* elongate, arcuate toward the apex, wings at the tip obtusely triangular, $2 - 3.4 \times 0.7 - 1.5$ mm. *Anther* ovoid, strongly beaked, c. 1.1×0.9 mm. *Pollinia* ovoid c. 0.4×0.3 mm. *Seed capsule* oblong, a little narrowed from the apex to the base, pedicel slender, c. 12×3.5 mm.

RECOGNITION. A distinctive small plant with a short thin pseudobulb and two to three, cordate to ovate, purple-red leaves, with undulate margins, at the top. Its inflorescence is subcorymbose and bears medium-sized, more or less burgundy coloured flowers, with a paler lip with a serrate anterior margin and indistinct rounded callus. The anther is distinctly beaked. It is quite distinct from all the other Madagascan and Mascarene species in its typical habit, lip shape and colour.

DISTRIBUTION. Widespread in Madagascar, Antsirana, Fianarantsoa, Mahajanga and Toamasina provinces. Réunion and Mauritius (Map 42). Possibly also on Grande Comore in the Comoro Islands but there is some doubt over these records: this probably stems from a Humblot specimen in the Reichenbach

Map 42. Distribution of *Liparis salassia*.

herbarium in W (R39766), marked as coming from the Comoros. There are no other indications of the origin and Humboldt collected not only in the Comoros but also in Madagascar, it is therefore difficult to ascertain its origin. It is this specimen that probably was the reason Voeltzkow (1917: 444) included the Comoros in its distribution. This was subsequently copied by others. With its wide distribution it would be no surprise if the species was found there but there are currently no reliable records.

SPECIMENS EXAMINED. COMOROS. Grande Comore?, Humboldt R39766 (W). **MADAGASCAR.** North & Central, 1899, *Warpurs* s.n. (K); Central-North, Mt d'Ambre, 1200 m, Sept. 1926, *Perrier* 17724 (P); Matitanana basin, Tsianovoka forest, Sept. 1934, *Heim* s.n. (P); Moramanga forest, Sept. 1942, *Decary* 18189 (P); NE, Marojejy massif, E of Ambalamanasy, 1000 – 1500 m, Dec. 1958, *Humbert & Capuron* 22248 (P); Mt d'Ambre, Dec. 1964, *Morat* 1227 (P); Andasibe, May 1984, *Dorr* 3120 (TAN); NW of Ambohitsarato-Bebao, c. 1100 m, Jan. 1985, *Dorr* 3461 (K, MO, P, TAN); Anjanaharibe, 1050 m, 1994, *Hermans* 3555 (K); Mantadia, Belakato, 1090 m, Nov. 2003, *Roberts et al.* TPPO26 (K); Antsiranana, Mt d'Ambre, Nov. 2007, 1200 m, *Nusbaumer et al.* 2362 (G, P); Mt d'Ambre, 1040 m, April 2008, *Ramandimbimanana et al.* SDR056 (G, K); Alaotra Mangoro, Ambohibary, Ambatovy, Marohonkona, June 2012, *Ramahenina et al.* 81 (P); Moramanga, Analamazaotra, site Andranomadio, Dec. 2013, 927 m, *Razafindralaibe et al.* 606 (TAN); s. loc. *Academ. Mal.* 984 (TAN). **MAURITIUS.** s. loc., *Commerson* s.n. P00738600 (P), (G); s. loc., *Bouton* (K-Lindl); s. loc., *Bouton* in herb. *Lemann* (CGE); Piton Grand Bassin, May 1966, *Vaughan* 12204 (MAU, P); Mt Louis, March 1971 *Bosser* 21158 (P); s. loc., *Léman* P00738598 (P); s. loc. *Wiehe* 1704 (MAU, P). **RÉUNION.** Île de Bourbon, Montes Salassii, *Commerson* in Herb. *Jussieu* 3770. (P00672904) (holotype P in Herb. *Jussieu*); sur les hauts de St Louis de la rivière de St Etienne, *Commerson* s.n. MPU017853 (MPU) 1771 (G); St. Etienne river, Aug. 1771, *Commerson* s.n. P00112471-4 (P); s. loc. *Thouars* s.n. P00112470 (P); on the Bonita, July 1837, *Gaudichaud* s.n. (P); s. loc., ex herb. *Richard*, R15286 (W); *Richard*, R39765 (W); s. loc. Herb. *Desvaux* (P); Mare Longue, St Phillippe, Oct. 1972, *Bosser* 21278 (P); Takamaka, 650 m, April 2002, *Bernet* 1 (P); Takamaka, 700 m, April 2002, *Bernet* 2 (P); Piton Mare d'Azule, April 2004, *Pause & Fontaine* 1145 (CBNM); Sain-Benoit, Grand Etang, April 2008, *Fontaine* 2455 (CBNM); Sainte-Rose, Mourouvin, 256 m, Sept. 2014, *Ferard & Lacoste* 4127 (CBNM); s. loc. *Léman* 824, Herb. *Maire*, P00409226 (P).

HABITAT. In humid evergreen forest on gneiss and laterite. In shady and damp places, in humus or moss, on moss-covered trees. Altitude: 1000 – 1500 m in Madagascar, generally lower (300 – 900 m) on the Mascarenes.

CONSERVATION STATUS. Category **LC:** The extent of occurrence (EOO) of *Liparis salassia* is estimated to be 967,522 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 64 km² (which falls within the limits for Endangered status under the criterion B2). *Liparis salassia* is known from 24 subpopulations representing 29 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. Previously assessed and published in the IUCN Red data listing for Réunion as LC (Picot 2013: 17).

FLOWERING TIME. December to April in Madagascar, generally March to May in the Mascarenes.

ETYMOLOGY. The type description refers to Mt Salass in the middle of Réunion, referring to les Salazes, N of the Cirque de Cilaos (Jean-Michel Hervouet, pers. comm. 2017).

NOTES. For a long time, this species appeared in literature as *Liparis purpurascens*, mainly because an earlier description by Persoon was overlooked by Du Petit-Thouars and subsequent authors. The typification of the species has also been confused with various Commerson specimens located in Paris, Montpellier and private herbaria. It is interesting to note that all the type material consists of fruiting plants. Persoon, in his description refers to a Commerson collection in the Jussieu herbarium (now in P); it was therefore decided to confirm sheet P00672904 from 'Mont Salassii' in the Jussieu herbarium as the holotype because it is the original material used by the author. Another Commerson specimen in the Jussieu herbarium (*Jussieu* 3770 P00672922) labelled '*Ophrys salassiae*' may not be this species. The other Commerson sheets in the Paris herbarium (P00112471-4, P00738600) come from another locality on Réunion and were not mentioned by Persoon in his description.

Liparis salassia (Pers.) Summerh. var. *mieroslawskiana* Marg. & Szeleng., from Réunion, is said to differ by the sepals which are initially connate from their base for most of their length, as the flower develops only at the basal part, and the lip with upturned margins, giving it a piriform shape. These characteristics can be observed more or less in other colonies in Réunion and Madagascar and are well within the range of variability of the species. It is, therefore, considered a synonym.

The species was first described in 1807 by Christiaan Hendrik Persoon (1761 – 1836) in his *Synopsis plantarum*, as *Epipactis salassia*, based on specimens collected by Phillibert Commerson (1727 – 1773) in 1771 on Réunion who, in manuscript on the

herbarium sheet, had named them *Ophrys salassia*. Commerson had sent various large collections to France where they were distributed to herbaria, including that of Abbé Pourret (1754 – 1818), whose collection was later acquired by Baron Joseph-Athanase Barbier (1767 – 1846). His herbarium ended up in P but also in Montpellier (Dorr 1997: 93). In 1821 Ernst Gottlieb Steudel (1821: 767) transferred the species to the genus *Serapias*.

In 1822 du Petit-Thouars (tt. 26 & 27) described *Malaxis purpurascens*, based on his own collection, it is unclear if it originated from Mauritius or Réunion. His illustration in t.26 shows a typical plant in flower, but t.27 shows a very different plant with a much longer stem, long rhizome, and may well be a different *Liparis*. The type material of *M. purpurascens* in P correspond to t.26, there is no material that matches t.27.

Unaware of Persoon's original description, Achille Richard noted in his *Monograph of the Orchids of Réunion and Mauritius* (1828: 53) the existence of the name *Ophrys salassia* written on the Commerson herbarium sheet in P and put it as a synonym of Du Petit-Thouars' *Liparis purpurascens*. This was repeated by John Lindley who transferred Du Petit Thouars' *Malaxis* to the genus *Liparis* in 1825 (sub. t. 882). Steudel transferred it to the genus *Neottia* (1841: 189), before Kuntze (1891: 670) put it into *Leptorkis*, together with other species. It is puzzling why the species was not mentioned in Perrier (1936). Finally, Summerhayes (1953: 133) summarised the confusion and established *Liparis salassia* (Pers.) Summerh.

ILLUSTRATIONS. Fig. 59; Du Petit-Thouars (Thouars 1822: t.26); Du Puy *et al.* (1999 pl. 31); Hermans *et al.* (2007: pl. 46); Cribb & Hermans (2009: 157); Bernet (2010a: 98); Bosser & Lecoufle (2011: 411); Margonska & Szelengowicz (2011: 15); Szelengowicz & Tamon (2013: 369); Hervouet (2018: 418).

***Liparis sambiranoensis* Schltr.** (Schlechter 1924: 147); Perrier (1939: 290); Hermans *et al.* (2007: 224); Cribb & Hermans (2009: 158); Hervouet (2018: 419). Type: Madagascar, Sambirano Valley, Perrier 15194 (holotype P). *Liparis panduriformis* H.Perrier (1936: 253); Perrier (1939: 289); Hermans *et al.* (2007: 221); Cribb & Hermans (2009: 158), **synon. nov.** Type: Madagascar, Manongarivo massif, Perrier 1946 (holotype P).

Large erect terrestrial, lithophyte or rarely epiphytic plant 15 – 40 cm high, emerging directly from the base of the previous growth, roots filiform, more or less villous. *Pseudobulbs* cylindrical, narrowly elongate, sometimes somewhat flattened-angular, almost entirely covered by membranous sheaths and by the sheath-like petiole of the lower leaves, with 3 or 4 to rarely 5 leaves towards the top, growth emerging from the previous leafless growth which is divaricate, older

pseudobulbs disintegrating and merging in the substrate, without obvious rhizome, 7 – 18 × 2 – 3 cm. *Leaves* erectly spreading, variable in size, often in two pairs 15 – 30 mm apart, blade elliptic-acuminate, corrugate, narrowed into a long petiole amplexant to the pseudobulb, overall 10 – 18.5 × 5 – 7.5 cm, pale green, more or less glossy. *Inflorescence* erect, up to 30 cm long, from the centre of the growth, much longer than the leaves, carrying up to 25 flowers, the lower ones fading before the upper ones open. *Peduncle* costate, with a few ovate-lanceolate sterile bracts. *Rachis* laxly racemose, up to 15 cm. *Floral bracts* shorter than the pedicellate ovary, porrect, ovate-lanceolate, strongly attenuate at the tip, almost cordate at the base, 8 – 12 × 3.8 – 4.1 mm, green. *Flowers* large, erectly spreading, up to 29 × 14 mm, ovary pale green, sepals and petals pale greenish-yellow, lip darker olive green to orange, column and anther white, all parts becoming paler and more yellow with age, tepals and lip a little glossy. *Pedice*l and *ovary* porrect, slightly upturned toward the base of the flower, cylindrical, somewhat grooved, 10 – 17 × 1.5 – 2 mm. *Dorsal sepal* erect to incurved, linear-lanceolate, base cordate-auriculate, margins more or less recurved, 12.5 – 18 × 1.2 – 3.8 mm. *Lateral sepals* parallel, descending below the lip, obliquely oblong, obtuse, 11 – 16 × 3.4 – 5.9 mm. *Petals* divaricate, obliquely linear, margins recurved, obtuse, 11.4 – 17 × 0.5 – 1.5 mm. *Lip* strongly curved in the middle forming a gutter-like hypochile, shortly auriculate at the base and a broadly oval hypochile serrate to crenate at the anterior margin, with a bi-gibbose callus at the base, 9.1 – 14 × 5.4 – 8.8 mm. *Column* strongly curved towards the apex, with distinct sharply triangular wings, 4.1 – 6 × 1.1 – 1.5 mm. *Anther* ovoid, with a short acute beak at the tip, 1.1 – 1.5 × 0.9 – 1.0 mm. *Pollinia* ovoid c. 0.5 × 0.7 mm.

RECOGNITION. This is a large plant, up to 40 cm tall, with a distinct thin stem and about four glossy leaves borne a few centimetres apart, old pseudobulb divaricate, large flowers in a many-flowered lax raceme. Its lip is longer than wide, narrowed around the middle, serrate or crenate on the front margin and with a bigibbose callus at the base, and its column has sharply triangular wings and a shortly beaked anther.

It is closest to *Liparis ochracea* but *L. sambiranoensis* has longer pseudobulbs, generally a longer inflorescence, a longer lip with a rounded epichile and angular hypochile (vs almost pandurate) and short angular vs elongate column wings. There are similarities with *L. ornithorrhynchos* but this species has a different habit with shorter pseudobulbs, fewer flowers, the lip is almost pandurate vs rounded and the anther sharply triangular vs elongate-obtuse. It is also similar to *L. bemarahensis* described above but it

Fig. 59. *Liparis salassia*. A habit; B inflorescence. PHOTOS: JOHAN HERMANS.

differs by the plant habit, shape of the lip, callus and anther, as shown in Table 4.

DISTRIBUTION. Comoros: Moheli, Grande Comore, Mayotte, Anjouan. Madagascar: Antsiranana province and Mahajanga province where it partly overlaps with *Liparis bemarkensis* (Map 43). Possibly also Réunion (Szelengowicz *et al.* (2011: 11); Szelengowicz & Tamon (2013: 371)), where the plant is illustrated and resembles the species but there are no vouchers for this.

SPECIMENS EXAMINED. COMORO ISLANDS. Anjouan, March 1886, *Humboldt* 1509 (BM, P); Moheli, Miringeni, Chalet St Antoine, Feb. 1975, *Floret* 1246 (P); Grande Comore, Karthala, below Madjou Madjou, 1300 m, March 1975, *Floret* 1302 (P); Mayotte, Benara Massif, 580 m, Dec. 1996, *Labat & Pascal* 2903 (MAYOTTE, P); Mayotte, Tchaourembo, 450 m, Feb. 1996, *Pascal* 387 (K, P); Hort, 2001-2, *Pignat* 1871 (Pspirit); Mayotte, Grande Terre, Chirongui, Feb. 2004, *Barthelot et al.* 1303 (MAO, P).

MADAGASCAR. Sambirano Valley, *Perrier* 15194 (holotype P); Manongarivo massif, *Perrier* 1946 (holotype P); Sambirano Valley, c. 200 m, Oct. 1922, *Perrier* 15122 (P); near Tsiandro, 300–600 m, Nov. 1932, *Capuron & Léandri*

1910 (P); NE, mid valley of the Andraronga, Feb. 1949, *Humbert* 23218 (P); NE, Western foothills of the Marojejy massif, near col Doanyanala, Feb. 1949, *Humbert* 23232 (P); Mangandran, Belanana, April 1953, *Rabatoto* 5078(P); Mangandran, Belanana, April 1953, *Rabatoto* 5245 (P); Diego Suarez, Anivorano, Antenampandran Feb. 1960, *Cours* 5557(P); Siandro, Behandrao, Dec. 1952, *Capuron et al.* 1997 (P); Mt d'Ambre, 1000 m, Dec. 1959 – Jan.1960, *Humbert* 32118 (P); Diego Suarez, Ankarana, 300 – 350 m, Jan. – Feb. 1960, *Humbert* 37690 (P); Diego Suarez, Akarana, Jan. 1969, *Morat* 3059 (P); Mt d'Ambre, March 1971, *Bosser* 21170 (P); Nossi Be, Jan. 1971, *Cremers* 1324 (TAN); Andapa, Bealampona, 75 m, April 1995, *Ravelonarivo* 740 (MO, P, TAN); Marojejy, March 1995, *Rasoavimbahoaka* 556 (K, MO, P, TAN); s. loc., 1997, *Hermans* 3602 (K); N of Mangindran, 800 m, 1999, *Hermans* 2475 (K); North, Antsiranana area, 1999, *Hermans* 2429 (K); Ankarana area, 1999, *Hermans* 2442 (K); Manongarivo, Ambahatra, March 1999, *Gautier et al.* LG3443 (G, K, P); Ambanja area, 1999, *Hermans* 2715 (K); Ambanja area, 2000, *Hermans* 1011 (K); Andapa, Anjialavabe, N of Ambodivohitra Antsahabalika, Feb. 2006, *Antilahimena et al.* 4579 (P); Sava, Andapa,

Map 43. Distribution of *Liparis sambiranoensis*.

Ambodivohitra, Anjialavabe, Feb. 2006, *Rakotovao* 2687 (G, P, TAN); Sava, Sambava, Feb. 2007, *Rakotovao et al.* 3524 (K, MO); Mt d'Ambre, May 2008, *Ramandimbimanana et al.* 106 (G); Mt d'Ambre, May 2008, *Trigui et al.* 304 (G); Mt d'Ambre, March 2012, *Ramandimbimanana* 472 (G); Ambanja, *Beentje et al.* 4584

(K); Mahajanga, Beanka, S of Kimanambolo, 390 m, Nov. 2012, *Gautier et al.* LG5843 (G).

HABITAT. Wet, dense evergreen forest in N & NW Madagascar and Mayotte in humid soil and humus or rarely epiphytic in thick moss on fallen trees or the base of trees. Chalky outcrops in deciduous forest. Altitude: 200–1000 m.

Table 11. Comparison of the type specimens of *Liparis panduriformis* and *L. sambiranoensis*, based on average measurements.

	<i>L. panduriformis</i>	<i>L. sambiranoensis</i>
Specimen	<i>Perrier</i> 1946 (P)	<i>Perrier</i> 15194 (P)
Plant height (cm)	18	18.5
Pseudobulb stem length (cm)	7	6.5
Leaves (cm)	14 × 8	11 × 5
Inflorescence (cm)	22	14.5
Floral bract (mm)	c. 9 × 2 – 3	c. 11 × 4
No of Flowers	16, large	12, large
Dorsal sepal (mm)	14 × 2.1	12 × 1
Lateral sepals (mm)	10 × 3.1	12 × 3.5
Petal (mm)	11 × 0.4	13 × 0.4
Lip (mm)	9.8 × 5.2	9.5 × 4.7
Column (mm)	3.9 × 0.5	5 × 1
Anther (mm)	0.9 × 0.8	1.3 × 1
Distribution	Madagascar: Antsiranana prov., Manongarivo	Madagascar: Antsiranana prov., Sambirano

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Liparis sambiranoensis* is estimated to be 332,359 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 72 km² (which falls within the limits for Endangered status under the criterion B2). With 16 known subpopulations representing 17 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing for Mayotte as VU D2 (Mercks 2013).

FLOWERING TIME. October to May.

ETYMOLOGY. Refers to the Sambirano river and area in Madagascar where the species was first found. *Liparis panduriformis* refers to the three-lobed, lute-shaped lip.

VERNACULAR NAMES. A local name for the species is said to be 'Ahijajavy' (Rabatoto 5078 (P)).

NOTES. *Liparis sambiranoensis* was described by Schlechter in 1924 from material collected by Perrier in the Sambirano area of Northern Madagascar; it has since been found to have a wide distribution in the North of the island and on the Comoros. *Liparis panduriformis* was described by Perrier in 1936 from plants collected in 1909 in the Manongarivo also from the Sambirano region; a specimen without flowers had been sent to Schlechter at the time and Perrier subsequently found more herbarium material on which he based his description. On close examination it is clear that these two species are identical, with *L. sambiranoensis* having precedence (ICN article 11.4). Table 11 shows the similarities of the characteristics. The pandurate lip of *L. panduriformis* is given as distinct from other species but the lip of *L. sambiranoensis* shows the same characteristics with a contracted winged base, a narrowed part below then an expanded part where the lip is naturally curved in living specimens, then a slightly narrowed part and ending in an oblong epichile. In flattened, dried specimens these parts become less distinct and are variable. The plant and flower size are also identical, the floral bracts are relatively large and cordate at the base, the lip has two rounded calli at the base, a more or less crenate anterior margin, small rounded column wings and a beaked anther cap.

It is interesting to note that the species was collected as early as 1886 by Léon Humboldt on the Comoros (Humboldt 1509 at BM & P). The specimens at BM were misidentified by Ridley as *Liparis flavescens*.

ILLUSTRATIONS. Fig. 60; Hermans *et al.* (2018: 20); Hervouet (2018: 419).

***Liparis scaposa* Frapp. ex Cordem.** (Frappier in Cordemoy 1895: 183); Bernet (2010a: 100); Hervouet

(2018: 403) as *Liparis ambohimangana*. Types: Réunion, Plaine des Cafres, 6 June 1851, Boivin s.n. (P00112475 upper seven specimens only) (holotype P); Réunion, 1847 – 1852, Boivin s.n. (P00112476) (isotype P).

Liparis verrucosa Frapp. ex Cordem. (Frappier in Cordemoy 1895: 185). Type: Réunion, Plaine des Palmistes, Aug. 1895, Cordemoy s.n. (lectotype MARS).

Liparis verrucosa var. *plana* Cordem. (Frappier in Cordemoy 1895: 185). Without Type.

Liparis verrucosa var. *undulata* Cordem. (Frappier in Cordemoy 1895: 185). Without Type.

Liparis microcharis Schltr. (Schlechter 1924: 144) **synon. nov.**; Perrier (1939: 279); Hermans *et al.* (2007: 220); Cribb & Hermans (2009: 152); Hervouet (2018: 413). Type: Madagascar, Mt Vohitrakidahy S of Ambositra (W Betsileo), Feb. 1919, Perrier 12423 (holotype P).

Very small to small terrestrial or epiphytic *plant*, very variable in size, 3 – 8 cm tall at most, few wiry roots, generally in small tufts on a short rhizome. *Pseudobulbs* completely or partly submerged in the soil or humus, broadly oval to subcylindrical-conical, single- or 2-leaved, very small, 3.1 – 10 × 2.3 – 8 mm, covered with 2 – 3 thin white sheaths, one larger than the others, up to 10 – 18 × 4 – 5 mm. *Leaves* emerging from the apex of the pseudobulb, mainly carried on the flowering bulb, lanceolate, acute, margins sometime slightly undulate or minutely dentate, with a prominent central vein, narrowed into a short petiole at the base, somewhat fleshy, pale to dark green, with a prominent central vein, overall 15 – 60 × 4 – 15 mm. *Inflorescence* erect, wiry, much longer than the leaf, up to 12 cm long, with 3 – 7 flowers towards the apex. *Peduncle* disproportionally long, generally well over half the length of the inflorescence, carrying an occasional peduncle scale 4 – 6 mm long, sometimes with one or two sterile bracts. *Rachis* densely racemose, up to 2 – 5 cm long. *Floral bracts* half the length of the ovary at most, lanceolate, acute, 2.1 – 3.9 × 0.5 – 1.3 mm. *Flowers* variable in size, very small to small, thin, green, yellowish-green to orange-pale yellow, the petals often a little paler, the lip with a darker green glossy central groove, the callus also darker green, apex of the column white, anther white, 5 – 10 × 4 – 8 mm. *Pedicel* and *ovary* conical, slender, 4.5 – 7.5 × 0.3 – 1.1 mm. *Dorsal sepal* erect, lanceolate, margins incurved, more or less cordate at the base, 4.8 – 7 × 1.2 – 2.1 mm. *Lateral sepals* curved beneath the lip, oblong-falcate, 3.5 – 5.1 × 1.8 – 2.5 mm. *Petals* deflexed to spreading, linear, subulate, 4.4 – 6.7 × 0.3 – 0.4 mm, slightly spatulate at the apex. *Lip* broadly oval to suborbicular, rounded or slightly emarginated-auriculate at the base, anterior margin more or less crenulate, a hollow triangular groove runs from the base towards the anterior margin which is glossy and shiny in living plants, with a comparatively large bilobed, slightly depressed callus at the base, overall 2.8 – 5.5 × 3.1 – 5.5 mm. *Column* broadened at the base, acutely curved at the apex with

Fig. 60. *Liparis sambiranoensis*. A habit; B rachis. PHOTOS: JOHAN HERMANS.

pronounced auriculate wings at the apex, $2.2 - 4 \times 0.5 - 1$ mm. *Anther* comparatively small and sitting at the very apex of the column, broadly obovate with a small rounded lobule at the anterior margin, $0.3 - 0.5 \times 0.4 - 0.6$ mm. *Pollinia* in two pairs, ovate – flattened on one side c. 0.3×0.2 mm. *Seed capsule* oblong or oblanceolate, ridged, $8 - 9 \times 3.5 - 4$ mm.

RECOGNITION. This small, variable plant has a rounded-conical pseudobulb, lanceolate leaves, small flowers, a disproportionately long, few-flowered inflorescence, and flowers with a wide to fan-shaped lip, a prominent rounded bilobed notched callus on lip and a longitudinal groove. Its column is distinctly lobed at the apex, and its small anther has a small lobule at the anterior margin.

It is close to *Liparis ambohimangana* which has stolons, always a single leaf and generally a shorter inflorescence. Also similar is *L. cespitosa* in habit but *L. scaposa* is larger in plant size and has a larger flower, different lip-shape and a more prominent callus. *Liparis parva* has a somewhat similar lip but with a more elongate callus. The four species are compared in Table 1. It is also similar to *L. nectarina* but the plant and flowers of

L. scaposa are much smaller, overlapping lateral sepals (divergent in *L. nectarina*), and a roundly lobular anther (vs sharply beaked). In its small size it is similar to the ambiguous *L. xanthina* which is a little larger in all aspects, the lip is wider and a different shape (broadly oval vs oblong). It is also similar to *L. lutea* but the prominent callus on the lip is distinct.

DISTRIBUTION. Madagascar: Antananarivo, Fianarantsoa and Toamasina provinces. More widespread on Réunion (Map 44).

SPECIMENS EXAMINED. MADAGASCAR. Mt Vohitrakidahy S of Ambositra (W Betsileo), Feb. 1919, *Perrier* 12423 (holotype of *L. microcharis*, P); Ankeramadinika forest, May 1928, *Perrier* 18548 (P); Ankeramadinika forest, François 4 in Herb. *Perrier* 17548bis, larger plant without stolon only (part, as syntype of *L. monophylla* P); Imerina, Ambohimanga, April 1928, *Decary* 6222 (P00095463 – 4) (as syntype of *L. monophylla*, P); Ilafy, Oct. 1905, *d'Alleizette* 611 M (P); Mandraka forest, March 1907, herb. *Rotureau* (P02222824) (P); SE of Nandihizana (Carion), Angavokely, 1600 m, Feb. 1988, *Pettersson & Nilsson* 197 (K, P, UPS); SE of Nandihizana (Carion), Angavokely, 1600 m, March 1992, 1600 m, *Pettersson & Nilsson* 587 (K, P); Angavokely area,

Map 44. Distribution of *Liparis scaposa*.

Dec. 1997, *Hermans* 2108 (K); Angavokely area, 1999, *Hermans* 2858 (K); near Mandraka, 1139 m, 2000, *Hermans* 4973 (K); Toamasina, Andasibe, near Vakôna, 1101 m alt., Jan. 2000, *Hermans* 455 (K); Andasibe, Menalamba, Ambatovy, Behontsa, June 2009, 1000 m, *Antilahimena et al.* 7133 (MO, P, TAN); Ambatovy, Région, Alaotra-Mangoro, 1080 – 1098 m, April 2012, *Ramandimbisoa* 207 (BRLU, MO, TAN); Ambatovy, May 2012, *Ambatovy Shade House* 1174; Antananarivo, Anjozorobe, May 2018, *Hermans* 8214 (K); s. loc. (TAN). **RÉUNION.** Plaine des Cafres, June 1851, *Boivin* s.n. holotype P (P00112475 upper 7 specimens only); Réunion, 1847 – 1852, *Boivin* s.n. isotype P (P00112476); Plaine des Palmistes, Aug. 1895, *Cordemoy* s.n. (MARS); Plaine des Palmistes, forest, Aug. 1895, *Cordemoy* s.n. (MARS); s. loc., *Cordemoy* s.n. (P); Petite Plaine, 1500 m, 17 July 1963, *Rauh* 10147 (HEID 251968); Montée de la Plaine de Chicots, Feb. 1971, *Bosser* 20685 (P); East river, April 1971, *T. Cadet* 3177 (P, REU); Plaine des Cafres, March 1974, *Bosser* 21775 (P); Petite Plaine des Palmistes, March 1974, *Bosser* 21785 (P); Morne des Patates à Durand, April 1975, 1000 – 1100 m, *Bosser* 22452 (P); Bébour forest, March 1978, *Bosser* 22356 (P); Haut des Tampons,

Notre Dames de la Paix, 1982, *Bosser* 22577 (P); Brûlé de St Denis, March 1994, *Bosser* 21659 (P); Ilet de Patience, Bras Cabot path, April 1978, *Bosser* 22461 (P); *Delleil ex Drake* s.n. P00409209 (P); Dimitile, 1900 m, March 2012, *Bernet in Hermans* 8158 (P); Sainte Marie, Sentier Piton Fougères, 1570 m, Feb. 2017, *Ferard & Lacoste* 5002 (CBNM); Plaine des Palmistes, 800 m, May 2004, *Grondin & Ferard* 1176 (CBNM).

HABITAT. Terrestrial on embankments, forest remnants, on humus and moss-covered rock and forest floor. On granite and gneiss rocky outcrops to quartz-rich sandy banks in shade or semi-shade limestone, laterite. Epiphyte on branches and at the base of trees, in moss. In shade of *Philippia*, ericaceous vegetation. Altitude: 1000 – 2000 m.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis scaposa* is estimated to be 132,719 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 76 km² (which falls within the limits for Endangered status under the criterion B2). With 10 known subpopulations representing eight locations (*sensu* IUCN), this species has been preliminarily assessed as VU using

the green listing method. In Madagascar, this species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming) while in Réunion island, it is threatened by grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing for Réunion as LC (Picot 2013: 17).

FLOWERING TIME. January to May.

ETYMOLOGY. *Liparis scaposa* is thought to refer to the long rachis, *L. verrucosa* is said by Frappier to refer to the uneven groove in the centre of the lip. *Liparis microcharis* refers to the small dainty appearance of the plant.

NOTES. *Liparis scaposa* was first collected by Boivin during his 1847 – 1852 expedition, on Réunion. Frappier found it in the Paris Herbarium and his notes were posthumously published by Cordemoy (1895: 183) who mentioned that there was some doubt about the identity of *L. scaposa* and its similarity to *L. verrucosa* which was described just two pages later; the main difference given in the key being the absence or presence of calli on the lip. There is no doubt that the two species are the same and have been recognised as such by recent authors (Bernet 2010a: 100). Frappier also mentioned two varieties: ‘*plana*’ and ‘*undulata*’ which are only different in the shape of the leaf margins and are well within the variability of the species. It was thought to be endemic to Réunion but close examination of living and herbarium material shows that there are a number of reliable records of this species from Madagascar which were previously identified as *L. microcharis*, now considered a synonym. Finet (1909: pl.1) described and illustrated it based on the Boivin type. *Liparis microcharis* was described by Schlechter (1924: 144) and based on a Perrier collection from S of Ambositra in central Madagascar; it shares all the characteristics of *L. scaposa* apart from its sometimes smaller flower size. Generally, the plants and flowers from Réunion are a little larger than the ones found in Madagascar but are well within the variability of the species. Szelengowicz *et al.* (2011: 11) reported *L. microcharis* from Réunion; the description and photographs confirm that this is *L. scaposa*.

The type sheet, Boivin s.n. P00112475 has seven small fruiting plants on the top of the sheet and two different plants below. The upper plants correspond well with Frappier’s description; the lower plants resemble *Liparis punctilabris* and should therefore not be considered part of the type. Another specimen Boivin s.n. (P00112476), without precise provenance shows the typical species and can be considered an isotype.

ILLUSTRATIONS. Figs 61, 62; Finet (1909: pl.1: 20 – 27); Cribb & Hermans (2009: 157); Bernet (2010a: 100); Szelengowicz & Tamon (2013: 372); Hervouet (2018: 403).

***Liparis stenophylla* Schltr.** (Schlechter 1924: 148); Perrier (1939: 266); Hermans *et al.* (2007: 224); Cribb & Hermans (2009: 148); Hervouet (2018: 420). Types: Madagascar, Manongarivo massif, Perrier 8048 (lectotype P (P000955524), designated here); Perrier 8045 (P000955525) lectoparatype P).

Erect, medium to large (15 – 32 cm) terrestrial or rarely lithophytic or epiphytic plant on a short 1 – 2 cm tufted rhizome, the leading 2 or 3 growths retaining their leaves, roots flexuose, more or less villous. *Pseudobulbs* slender, terete, up to 16 × 10 mm, olive green, the flowering one partly enveloped by 3 – 5 brownish-white carinate, acute sheaths, disintegrating on the older growths, with two sub-opposite leaves at the apex. *Leaves* erectly spreading to almost horizontal, narrowly lanceolate to ligulate attenuate, margins almost parallel, with a short petiole, somewhat fleshy, 9 – 16 × 0.9 – 2 cm, pale green with the veins darker, more or less glossy. *Inflorescence* erect, flexuose, up to 20 cm × 2 mm, with up to 25 flowers. *Peduncle* about $\frac{1}{3}$ of the inflorescence with a few bract-like lanceolate-acuminate sheaths. *Rachis* laxly several-flowered becoming thinner towards the apex. *Floral bracts* lanceolate acuminate, somewhat amplexicaul, shorter than the pedicellate ovary, 3 – 6 × 0.75 – 1.5 mm. *Flowers* small, erectly spreading, c. 12 × 8 mm, ovary, petals and sepals pale yellowish-green, lip pale greenish-yellow with the disk darker green, becoming darker towards the middle, basal teeth green, column whitish with the apex becoming green, anther pale yellow. *Pedice*l and ovary slightly twisted, slender, more or less ridged, 4.7 – 11 × 0.4 – 0.8 mm. *Dorsal sepal* erect or slightly reflexed especially at the apex, narrowly lanceolate acute, margins recurved except at the apex, broadening towards the base and shortly subcordate, 6.5 – 7.5 × 0.6 – 1.3 mm. *Lateral sepals* curved parallel beneath the lip, obliquely oblong-ovate, obtuse, 4 – 5.8 × 2 – 3 mm. *Petals* divergent, semi-erect or descendant, margins strongly recurved, linear obtuse, 4.9 – 7 × 0.4 – 0.7 mm. *Lip* a little curved towards the base, obovate to suborbicular, the anterior margin crenate to serrate, indented in the middle, the base narrowed and auriculate, with two distinct horn-like calli (c. 0.7 mm long), 4.8 – 6.2 × 4 – 5.2 mm. *Column* a little incurved, shortly winged towards the apex, 2.7 – 4.9 × 0.6 – 1.3 mm. *Anther* ovoid, strongly beaked, c. 1 × 0.7 mm. *Pollinia* ovoid c. 0.6 × 1.2 mm.

RECOGNITION. *Liparis stenophylla* is a medium-sized to large plant with a long thin pseudobulb partly covered with long carinate sheaths, two long ligulate leaves with darker veins, a long thin, laxly-flowered inflorescence. It has small flowers, with an obovate to suborbicular lip, with two distinct horn-like teeth at the base, and an indented and crenate-serrate anterior margin.

The most closely allied species is *Liparis polycardia* which is similar in habit, flower size and shape but its

Fig. 61. *Liparis scaposa*. A plant habit $\times 1.3$; B flower, front view $\times 9$; C flower, side view $\times 12$; D flower, side front view $\times 12$; E dorsal sepal $\times 15$; F petal $\times 15$; G lateral sepal $\times 15$; H lip $\times 15$; J lip basal callus, side view $\times 15$; K column, front view $\times 15$; L column, side view $\times 15$; M column anther/stigma $\times 36$; N anther cap above $\times 39$; P anther cap behind $\times 39$; Q anther cap front underside $\times 39$; R pollinia $\times 39$. From Hermans 4973 (K). DRAWN BY OLIVER WHALLEY.

Fig. 62. *Liparis scaposa*. **A** plant habit in Réunion; **B** plants in Madagascar; **C** flower. PHOTOS: A PATRICE BERNET; B JEAN-MICHEL HERVOUET; C JOHAN HERMANS.

leaves are more erectly spreading rather than horizontal, the leaves are ligulate (vs narrowly lanceolate in *L. polycardia*), the petiole longer, the inflorescence generally longer, the petals longer and the lip obcordate rather than obovate to suborbiculate. The species is similar in many respects to *L. listeroides* but differs in its longer pseudobulbs and the much longer ligulate leaves (vs oval-elliptic to broadly ligulate in *L. listeroides*), the lip is also broader in *L. listeroides*. It is also similar to *L. danguyana* but the plant is almost double the size, the leaves are narrowly lanceolate vs broadly oval and the anther is beaked vs rounded. *Liparis stenophylla* was until recently only known from the lower elevations of Northern Madagascar but has recently also been found in Eastern Forest near Ranomafana (Hermans 8213). Its distribution overlaps with *L. listeroides* which is usually confined to higher elevations.

DISTRIBUTION. Endemic to Northern Madagascar: Antsiranana, Fianarantsoa and Toamasina provinces (Map 45).

SPECIMENS EXAMINED. MADAGASCAR. Manongarivo massif, *Perrier* 8048 (lectotype P) & *Perrier* 8045 (lectoparatype P); Andranompany, Brickaville distr., Ambalarondra, April 1951, 350 m, *Cours* 4514 (P); Toamasina, Ambanizana, Masoala Peninsula, 450 m, May 1988, *Lowry & Schatz* 4487 (MO); NE, Masoala Peninsula, c. 470 m, Sept. 1993, *Lance* 14 (K); NE, Masoala Peninsula, 280 m, *Lance* 110 (K); Antsiranana, Anjanaharibe, Nov. 1994, *Hermans* 6544 & 6547 (K); near Brickaville, Andranampony, 1999, *Hermans* 2426 (K); Toamasina, Ambohibary, Ambatovy, Analamay, 1074 m, Aug. 2011, *Miandrimanana* 514 (MO, P, TAN); Toamasina, Ambatovy: Alaotra-Mangoro Région, Moramanga Distr., 1080 – 1098 m, April 2012, *Ramandimbisoa* 207 (AMB843) (BRLU, MO, TAN); Fianarantsoa, Mahakajy, April 2018, *Hermans* 8213 (K).

HABITAT. Dense, wet, evergreen forest, either terrestrial in shady undergrowth, in humus and mosses, lithophytic on moss-covered rocks or epiphytic. Altitude: 280 – 1100 m.

FLOWERING TIME. November to August but mainly November to May.

CONSERVATION STATUS. Category **VU**: the extent of occurrence (EOO) of *Liparis stenophylla* is estimated to be 66,448 km² (exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 24 km² (which falls within the limits for Endangered status under the criterion B2). With six known subpopulations representing six locations (sensu IUCN), *L. stenophylla* has been preliminarily assessed as VU using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

ETYMOLOGY. The name refers to the slender leaves.

NOTES. Schlechter (1924: 148) cited both *Perrier* 8045 and 8048 as types. Both are from the same locality in the Manongarivo Massif but collected a month apart. As *Perrier* 8048 is more complete it was chosen as the lectotype.

ILLUSTRATIONS. Figs 63, 64; Hervouet (2018: 420).

***Liparis superclareae* Hermans sp. nov.** Type: Madagascar, Maroantsetra, Anjahana, Ambanizana, 120 m, June 2002, *Antilahimena* 1054 (holotype K; isotypes MO, P).

<http://www.ipni.org/urn:lsid:ipni.org:names:77201936-1>

Erect, ascending, medium-sized, terrestrial plant, 15 – 18 cm tall; rhizome woody c. 5 – 8 × 4 mm, covered in sheaths up to 2 cm long; roots somewhat villous, c. 2 mm diam. *Pseudobulbs* tubular, in a linear series, a single leaf at the apex, the previous year's growth leafless and carrying long fibrous remnants at the apex, apart from some short gaps, enveloped by brownish sheaths covered in brown specks, 5 – 9.5 cm long 2 – 5 mm diam. *Leaf* lanceolate, unequally cordate at the base, attenuate at the tip, strongly veined, 7.9 – 9.8 × 2.9 – 4.1 cm.

0 100 200 km

Map 45. Distribution of *Liparis stenophylla*.

O.W. Whalley R86Kew Nov. 2004.

Fig. 63. *Liparis stenophylla*. A habit $\times 1$; B dorsal sepal $\times 12$; C lip $\times 12$; D lip with basal callus $\times 21$; E anther and stigma (top of column) $\times 21$; F lateral sepal $\times 12$; G petal $\times 12$; H flower $\times 12$; J column and ovary $\times 12$. From Perrier 8045 (P) & Hermans 6547 (K). DRAWN BY OLIVER WHALLEY.

Fig. 64. *Liparis stenophylla*. **A** habit; **B** rachis; **C** flowers. PHOTOS: **A, B** JOHAN HERMANS; **C** JEAN-MICHEL HERVOUET.

Inflorescence erect, far exceeding the leaf, 9 – 16 cm long, 1 – 2 mm in diam., carrying up to 6 flowers. *Peduncle* up to 10 cm, about double the length of the raceme with 2 – 4 sterile bracts, 9 – 11 × 3 – 4 mm. *Rachis* loosely racemose, up to 7 cm long, the lower flowers fading before the apical ones open. *Floral bracts* narrowly lanceolate, a little cordate at the base, 6 – 10 × 1.2 – 2.8 mm. *Flowers* large, erectly spreading, up to 25 × 18 mm, sepals, petals and lip yellow, anther green, ovary white. *Pedicel* and *ovary* thin, curved, slightly winged, 12 – 16 × 1.1 – 1.5 mm. *Dorsal sepal* ligulate, narrowed towards the

base, incurved, obtuse at the tip 15.5 – 18.2 × 1.4 – 1.8 mm. *Lateral sepals* longly ovate, curved-falcate, 15.8 – 18.3 × 4 – 6.3 mm. *Petals* spreading, linear, expanded at the base, 17.6 – 19.1 × 0.5 – 0.9 mm. *Lip* longly-auriculate at the base, expanded into an elliptic blade angular at the base and dentate in the anterior margin, a short thickened central ridge at the base and slight swelling along the central vein, 15.2 – 16.1 × 11 – 11.4 mm. *Column* relatively short and thick for the genus, slightly curved, with very broad thin rounded wings, 4.9 – 6.1 × 2.5 – 3.1 mm. *Anther* strongly sharply beaked, around

twice as long as wide, $1.5 - 2 \times 0.8 - 0.9$ mm. *Pollinia* 2, ovoid, c. 5×3 mm.

RECOGNITION. *Liparis superclareae* has tubular pseudobulbs, covered by brown sheaths, a single, lanceolate leaf, disintegrated on previous growth, and very large flowers, with an elliptic lip, dentate at the margins with a thickened ridge at the base, and a relatively short and broad, widely winged column, with a very long sharp beaked anther.

Liparis superclareae is close to *L. clareae* with which it shares the general habit and lip shape but the new species has much longer pseudobulbs, the leaves of the previous growth disintegrate before the new ones develop (vs persistent), its leaves are lanceolate (vs ovate) and are at least 2.5 – 3 times longer than wide (vs 2 times), the floral bracts are less cordate at the base, the flowers and all its segments much larger, the column shorter with broad long wings (vs short-auriculate) and the anther much more sharply beaked. It is also similar to *L. warpurii* with which it shares the leaf and lip shape but the new species has a more linear plant habit (vs scrambling), the leaves of the previous growth disintegrate before the new ones develop (vs persistent), the floral bracts are less cordate at the base, the flowers and all its segments much larger, the lip has a thickened ridge (vs rounded callus), the column is short and broadly winged (vs shortly obtuse) and the anther much more beaked. It differs from *L. magnifica* and *L. laurentii*, described above, by its much larger size, shape of the lip, callus and anther, as shown in Table 8.

DISTRIBUTION. Endemic to Madagascar: known from the type only from Maroantsetra in Toamasina province (Map 46).

SPECIMENS EXAMINED. MADAGASCAR. Maroantsetra, Anjahana, Ambanizana, 120 m, June 2002, Antilahimena 1054 (holotype K, isotypes P, MO).

HABITAT. Humid forest. Altitude: c. 120 m.

CONSERVATION STATUS. Category **CR**: The extent of occurrence (EOO) of *Liparis superclareae* cannot be estimated since it is only known from one subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km^2 (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis superclareae* is only known from one subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. May to June.

ETYMOLOGY. Referring to the much larger size of plant and flower compared with *Liparis clareae*.

NOTES. *Liparis superclareae* is currently only known from the type specimen collected by Patrice Antilahimena

in Maroantsetra. The collection consists of several flowering plants with type material in K, P and MO. The species overlaps in distribution with *L. clareae* which is more common in central Eastern forests. It could be considered a lower altitude, larger-flowered local form of this species but the pronounced deciduous habit, pseudobulb, leaf-shape and the shape of the column and anther make it distinct enough to be considered a distinct species.

ILLUSTRATION. Fig. 65.

***Liparis trulliformis* Schltr.** (Schlechter 1924: 149); Perrier (1939: 293); Hermans *et al.* (2007: 224); Cribb & Hermans (2009: 156). Type: Madagascar, Mt Tsaratanana, Perrier 15744 (holotype P).

Small erect epiphytic plant up to 7 cm high, flowering growth emerging directly from the base of the leafless previous growth which is divergent to decumbent, roots flexuose, more or less villous. Pseudobulbs short, oblong, cylindrical, covered by sheaths and the base of the lower leaf, less than 2 cm tall and 10 mm diam., with 2 – 3 leaves in the upper half. Leaves erectly spreading, plicate, elliptic-acuminate, with a long

0 100 200 km

Map 46. Distribution of *Liparis superclareae*.

Fig. 65. *Liparis superclareae*. A habit; B flower; C dorsal sepal; D lateral sepal; E petal; F lip; G column and ovary; H column, side view; J anther cap from below; K anther cap from above; L anther cap from side; M pollinia. From *Antilahirmena* 1054 (K). DRAWN BY JULIET BEENTJE.

sheath-like narrow petiole, $3.4 - 4.9 \times 1.3 - 2.1$ cm. *Inflorescence* up to 8 cm long, surpassing the leaves. *Peduncle* about half the length of the inflorescence,

with 2 – 3 lanceolate bracts. *Rachis* sub-densely 5 – 6-flowered. *Floral bracts* erectly spreading, lanceolate acute to acuminate, lower one longer than those at

the apex, $4 - 6.1 \times 2.3 - 2.6$ mm. *Flowers* erectly spreading, small, c. 14×8 mm, greenish-yellow. *Pedicel* and *ovary* glabrous, a little ridged, c. 9×1 mm. *Dorsal sepal* erect, ligulate-lanceolate, obtuse with the base shortly auriculate, $7.1 - 8.1 \times 0.9 - 1$ mm. *Lateral sepals* porrect, obliquely-oblong, obtuse, $6.8 - 7.1 \times 2.3 - 2.5$ mm. *Petals* narrowly linear, margins recurved, a little spatulate at the apex, $6.3 - 6.5 \times 0.4 - 0.6$ mm. *Lip* slightly curved, ovate-trullate, a little expanded-angular towards the lower third, then slightly contracted towards the upper third and rounded at the top, a little dentate around the margins, base very slightly auriculate, on top with a small bipartite flattened callus, $6 - 6.3 \times 3.1 - 3.3$ mm. *Column* curved, wings indistinct, 3×0.8 mm. *Anther* ovoid, distinctly beaked, a little blunt at the tip, c. 1×0.6 mm.

RECOGNITION. *Liparis trulliformis* is a small squat plant with elliptic plicate leaves, the new growth emerges from the disintegrating divergent or decumbent previous growth, an inflorescence with a few small flowers. Its flowers have an ovate-trullate lip, almost twice as long as wide, with a flattened bifold callus at the base, and a strongly and bluntly beaked anther.

Liparis trulliformis is somewhat similar to *L. bathiei* but different by the longer pseudobulbs, prominent plicate leaves, trowel-shaped lip which is almost twice as long as wide. It is also close to *L. bosseri* described above but the lip of *L. bosseri* is obovate (vs ovate-trullate), lacks a distinct callus at the base of the lip and has an anther with a spatulate beak vs a sharp beak.

DISTRIBUTION. Endemic to Madagascar: Antsiranana province only (Map 47).

SPECIMEN EXAMINED. MADAGASCAR. Mt Tsaratanana, Perrier 15744 (holotype P).

HABITAT. Epiphyte in forest. Altitude: c. 1800 m.

CONSERVATION STATUS. Category **CR**: the extent of occurrence (EOO) of *Liparis trulliformis* cannot be estimated since it is only known from one subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km^2 (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis trulliformis* is only known from one subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January.

ETYMOLOGY. Referring to the trowel shape of the lip.

NOTES. Known from the type specimen only, collected by Perrier in 1923 on Mt Tsaratanana close to the type locality of *Liparis zaratananae* (the collecting numbers

are consecutive). Only four plants grew in the colony and two were collected and sent to Schlechter in 1923 who described it a year later together with several other *Liparis*. These might be juvenile plants of another species, but as it comes from a fairly under-explored area it has been decided to recognise the species until more information becomes available.

ILLUSTRATION: Fig. 66.

Liparis vulturiceps Hermans & P.J.Cribb (2014: 9517: 4); Hervouet (2018: 421). Type: Madagascar, Toamasina, Akanin'ny Nofy (Lake Ampitabe), Nov. 1997, Hermans 4187 (holotype K).

Medium-sized erect terrestrial or epiphytic plant, up to 20 cm, with a short rhizome; roots 2 – 3 mm diam., woolly. *Pseudobulbs* 8 – 18 cm long, 5 – 7 mm diam., caespitose, 2 – 3-leaved, largely covered by thin overlapping greenish-brown sheaths, 20 – 25 mm long. *Leaves* ovate, $2 - 8.2 \times 1.5 - 4$ cm, glossy, dark green with a short 5 – 10 mm petiole. *Inflorescence* terminal from the centre of the leaves of the new growth, 50 – 65 mm long, with 2 – 6 flowers. *Peduncle* ridged, 2 – 3 mm diam., pale green, with a scale $8 \times 2 - 3$

0 100 200 km

Map 47. Distribution of *Liparis trulliformis*.

Fig. 66. *Liparis trulliformis*. **A** habit; **B** flower; **C** floral bract; **D** dorsal sepal; **E** lateral sepal; **F** petal; **G** lip; **H** column and lip, side view anther cap removed; **J** column, side view, anther cap removed; **K** column, front view; **L** anther cap, side view; **M** anther cap, dorsal view. From Perrier 15744. DRAWN BY JUDI STONE.

mm. *Rachis* 3 – 5 cm long. *Floral bracts* lanceolate 5 – 6 × 2 – 2.5 mm. *Flowers* medium in size, 14 × 9 mm, pale green becoming ochre with age, petals and column paler, main callus on lip dark green, the anther white, pollinia yellow. *Pedicel* and *ovary* twisted, smooth, pale green, 13 – 16 × 1 – 1.5 mm. *Dorsal sepal* strongly recurved against the ovary, linear, acuminate, 12 – 15 × 2 – 2.5 mm. *Lateral sepals* auriculate, the outer margin distinctly recurved, 10 – 13 × 5.5 – 6 mm. *Petals* folded against the back of the flower, linear, acuminate, 12 – 14 × 1 – 1.2 mm, margins recurved. *Lip* pandurate, 11 – 13 × 7 – 8 mm; lateral lobes rounded, small; mid-lobe flabellate, large with the anterior margin distinctly undulate; callus basal, large, 3-lobed, 3 – 5 mm long, its basal lobes rounded, erect, the mid-lobe clavate. *Column* erect, incurved in the apical half, wings expanded over the upper third becoming distinctly falcate at the tip, 4.5 × 2.3 mm. *Anther* oblanceolate, strongly ridged, with a short beak, 2 × 0.7 mm. *Pollinia* 2, pyriform, elongate, 0.9 × 0.3 mm.

RECOGNITION. This is a medium-sized plant with a long thin pseudobulb and two (rarely three) fleshy leaves at the top, around five medium flowers with strongly recurved petals and dorsal sepals, petals auriculate and parallel with the lip, lip pandurate with a long rounded callus at the base, column with falcate wings.

The habit of the plant is somewhat similar to other bifoliate *Liparis*, including *L. bernieri*, *L. listeroides* and *L. longicaulis*, but its pseudobulbs are generally shorter and the leaves thicker. The lip shows some similarity to that of *L. ochracea*, *L. longicaulis* and *L. puncticulata* but the habit, flower, lip calli and falcate column wings are all very different, as explained in Hermans & Cribb (2014: 4).

DISTRIBUTION. Endemic to Madagascar: Toamasina and Fianarantsoa provinces (Map 48).

SPECIMENS EXAMINED. **MADAGASCAR.** Toamasina, Akanin'ny Nofy (Lake Ampitabe), 1 Nov. 1997, Hermans 4187 (holotype K); Toalanara, N of Ezoanbo, Beentje *et al.* 4602 (K).

HABITAT. Found in Eastern Madagascar, in degraded humid evergreen forest in leaf litter in dense shade. In leaf litter or on moss-covered tree-trunk. Altitude: around 1000 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis vulturiceps* is estimated to be 38,236 km² (exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 16 km² (which falls within the limits for Endangered status under the criterion B2). With only four known subpopulations representing four locations (sensu IUCN), this rare species has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale

subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. November to March.

ETYMOLOGY. Refers to the vulture-like appearance of the flower.

ILLUSTRATIONS. Figs 67, 68 and 69; Hermans & Cribb (2014: 69-9517), Hermans (2015: 247), Hermans (2016: 4); Hervouet (2018: 421).

Liparis warpurii Rolfe as *L. warpuri* (Rolfe 1908: 69); Perrier (1939: 262); Hermans *et al.* (2007: 224); Cribb & Hermans (2009: 146). Types: Madagascar, 10 June 1900, Warpur s.n. (lectotype K, designated here; lectoparatypes Warpur 473 (K000242145) K; drawing of Warpur 473, 1906 K.)

Liparis clareae Hermans var. *angustifolia* H.Perrier ex Hermans (in Hermans *et al.* 2007: 217, 289); Cribb & Hermans (2009: 146); (Hervouet 2018: 406), **synon. nov.** Type: Madagascar, confl. Mangoro & Onive, Perrier 17018 (holotype P).

Liparis cardiophylla var. *angustifolia* H.Perrier (1936: 244; 1939: 269) **nom. nud.**

0 100 200 km

Map 48. Distribution of *Liparis vulturiceps*.

Fig. 67. *Liparis vulturiceps*. A habit $\times 1.3$; B inflorescence $\times 4.5$; C & D lateral sepal $\times 6$; E dorsal sepal $\times 6$; F, G petal $\times 6$; H lip, side view $\times 6$; J lip from above $\times 6$; K lip basal callus $\times 9$; L lip and column from side $\times 6$; M anther cap, side view $\times 21$; N anther cap from above $\times 21$; P anther cap underneath $\times 21$; Q column, front view $\times 9$; R column and callus, side view $\times 9$; S pollinia $\times 21$. From Hermans 4187 (K). DRAWN BY OLIVER WHALLEY.

Fig. 68. *Liparis vulturiceps*. Habit. PHOTO: MORITZ GRUBENMANN.

Small scrambling terrestrial plant up to 10 cm high, on a long rhizome with new growths often from internodes of the previous pseudobulb, roots flexuose, hairy. *Pseudobulbs* slender, dark green, sometimes speckled dark brown, almost entirely enveloped by several long brownish papery imbricate sheaths, overall up to 50×7 mm, with a single leaf at the apex. *Leaf* almost sessile, narrowly ovate, acute, subconduplicate, a little cordate at the base, glaucous on the upper surface, green underneath, sometimes partly mottled or entirely silvery, $2.5 - 6.5 \times 1 - 2.5$ cm. *Inflorescence* slender, erect, up to 6 cm long, up to 4 flowers towards the apex but usually fewer. *Peduncle* about $\frac{1}{2}$ the length of the inflorescence, with one or two sterile bracts. *Rachis* loosely few-flowered. *Floral bracts* sessile, cordate, acuminate, $4.1 - 8 \times 1.6 - 3.5$ mm. *Flowers* large, up to 21×18 mm, all segments pale yellowish-green except for the lip which has a much darker emerald green disk, column cream, anther cap pale yellow. *Pedice*l and *ovary* slender, slightly winged, $8 - 12 \times 1.5 - 2$ mm. *Dorsal sepal* linear, erect, the margins recurved, $9.3 - 9.9 \times 0.8 - 1.6$ mm. *Lateral sepals* falcate-oblong, obtuse, parallel with the lip, margins a little recurved, $8.5 - 12 \times 3.1 - 4.1$ mm. *Petals* divergent, filiform, margins recurved, $7.7 - 10.4 \times 0.3 - 1$ mm. *Lip* slightly curved, shortly unguiculate, obovate, denticulate at the anterior margin, disk thickened, with a small

rounded, often bilobed or trilobed callus at the base, $6.9 - 10 \times 5.9 - 9.2$ mm. *Column* incurved, wings shortly obtuse, $4.1 - 6 \times 0.8 - 0.9$ mm. *Anther* obovoid, obtusely beaked at the front, c. 1.2×1 mm. *Pollinia* 2, bipartite, obovoid c. 0.7×0.6 mm

RECOGNITION. *Liparis warpurii* is a small scrambling plant with a thin pseudobulb and a single narrowly ovate leaf, few-flowered inflorescence and floral bracts that are cordate at the base. It has large flowers, with a shortly unguiculate, obovate lip, serrate at the front, small rounded callus at base, and a bluntly beaked anther.

Rolfe indicated that *Liparis warpurii* was close to *L. parva* but it is very different being a much larger plant (*L. parva* is c. 4 cm), single-leaved (vs two-leaved) and has a different inflorescence and flowers. The closest species is *L. magnifica*, described above, but it differs by the foliage which is not longitudinally streaked with silvery-white, the cordate peduncle sheaths and floral bracts (vs lanceolate in *L. magnifica*), the flowers about double the size, a less curved and angular lip (vs obovate), with a dentate margin (vs undulate), and a less sharply beaked anther. It is similar to *L. clareae* but differs in having narrower leaves, more numerous flowers (three to five), longer sepals, a larger lip, with a rectangular blade and a disk with a more distinct rounded callus at the base, a taller column and a smaller anther, the beak being wider

Fig. 69. *Liparis vulturiceps*. Flower. PHOTO: JOHAN HERMANS.

and more obtuse. It is similar to *L. laurentii*, described above, but the leaf of *L. laurentii* is broadly ovate (vs lanceolate), the flowers are smaller, the lip not serrate at the margins and with horn-like calli (vs a single rounded callus) (Table 8).

DISTRIBUTION. Endemic to Madagascar: Toamasina Province (Map 49).

SPECIMENS EXAMINED. MADAGASCAR. *Warpur* s.n., 10 June 1900 (lectotype K); *Warpur* 473 (K000242145) (lectoparatype K); drawing of *Warpur* 473, 1906 (K); s. loc., Oct. 1899, *Warpur* s.n. (K); Tamambe, Tsilohan'ala, June 1900, *Warpur* s.n. (K); Eastern forest, near the confluence of the Mangoro & Onive, c. 700 m, Feb. 1925, *Perrier* 17018 (P); s. loc., *Bogner* s.n. (K-spirit 31440); Toamasina, fokontany Ampitabe, Ambatovy, 1051 m, July 2008, *Randrianasolo et al.* 760 (MO, P, TAN); Toamasina, Ambohibary, Ampitambe, Forêt d'Ampangadiantrandraka, 1010 m, Oct. 2009, in fruit, *Ravelonarivo et al.* 3283 (MO, P, TAN); Toamasina, Ambatovy, 1050 m, March 2012, *Stévant et al.* 4119 (BRLU, K, MO, TAN); Ambatovy: Région Alaotra-Mangoro, Distr. Moramanga, 1054 – 1119 m, March 2013, *Ambatovy Spirit Collection* 765 (TAN).

HABITAT. Epiphyte or terrestrial in wet Eastern forest, moss and lichen-covered trees, in soil. Altitude: 700 – 1100 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Liparis warpurii* is estimated to be 1,812 km² (which falls within the limits for Endangered status under criterion B1) and its area of occupancy (AOO) is estimated to be 12 km² (which falls within the limits for Endangered status under the criterion B2). With only three subpopulations representing three locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. September to July.

ETYMOLOGY. Refers to Mr Warpur (fl. 1890 – 1901), a Belgian collector, who first imported the species into Europe. Rolfe, in his description, has the name ending in one 'i' but this is an error to be corrected to 'ii' according to the Botanical Code (Turland *et al.* 2018: 60.14).

NOTES. The type material of *Liparis warpurii* had not been fully understood and consists of a sheet of sterile

0 100 200 km

Map 49. Distribution of *Liparis warpurii*.

plants collected by Warpur, an inflorescence with one flower only, lacking its lip from a cultivated plant from the Warpur collection, plus an unsigned watercolour from a cultivated plant from the Warpur collection showing the plant and a close-up of a flower (Fig. 70). This combination of material clearly shows that *L. clareae* var. *angustifolia*, described by Perrier in 1936 and known only from the type specimen, is also the same taxon and quite distinct from *L. clareae*.

Plants were collected by Warpur in Madagascar in June 1900 and herbarium material of plants without flower arrived at Kew in December; the herbarium sheet has a label by Warpur stating that the specimen came from Tananbe (or Tamambe) and grew in soil on dry slopes in forest. One can assume that at the same time living plants from the same origin also came to Kew where they were cultivated for several years. During this time Warpur supplied great quantities of orchids from Madagascar to European orchid growers, either directly or through auctions at Protheroe & Morris. Some of these were also grown at Kew. It is not entirely certain where the plants were collected: Tananbe could be Tanambe near Lake Aloatra in Toamasina province but there are several other possibilities, the name meaning 'big village' in Malagasy. The plants flowered at Kew on several occasions, a plant and flower were painted in 1906 (in the style of Matilda Smith, Fig. 70) and a flower without a lip is also preserved on a herbarium sheet in 1907, both are annotated with the Kew accession number 437. Rolfe finally described the new species in 1908. The herbarium sheet and watercolour are both annotated by Rolfe as being 'close to *L. parva*'. Rolfe, in his description, just referred to 'Warpur' as the type specimen but mentioned that the plant was 'introduced about 7 years ago'. The K herbarium sheet Warpur from 'Tananabe' 10 June 1900 is chosen here as the lectotype with the single imperfect flower Warpur437 (K0002452145) being an lectoparatype plus the watercolour of Warpur437 of September 1906 being an additional lectoparatype. Additional material without a number, dated October 1899, is also at K. *Liparis cardiophylla* H.Perrier var. *angustifolia* H.Perrier was described by Perrier in 1936 but lacked a Latin diagnosis, the name was validated in 2007 Hermans *et al.* (2007: 289).

ILLUSTRATIONS. Figs 70, 71 and 72; Cribb & Hermans (2009: 147).

***Liparis zaratananae* Schltr.** (Schlechter 1924: 151); Perrier (1936: 253; 1939: 269); Hermans *et al.* (2007: 224); Cribb & Hermans (2009: 148). Types: Madagascar, Mt Tsaratanana, Oct. 1922, Perrier 15743 (P00095528) (holotype P); Madagascar, Mt Tsaratanana, Dec. 1922, Perrier 15743 (P00095529) (lectoparatype. P).

Medium-sized terrestrial plant up to 17 cm high, rhizome very short, pseudobulbs retain leaves for two seasons, roots flexuose, more or less pilose.

Pseudobulbs stem-like, up to 9 cm long, c. 5 mm in diam., enveloped by several sheaths and the lower leaf petiole, with 2 – 3 leaves at the apex. *Leaves* somewhat papery, erectly spreading, ovate-elliptic, blade 5.5 – 9.5 × 2.5 – 5 cm, acuminate, pleated-veined, rounded and abruptly contracted into a 1 – 2 cm petiole. *Inflorescence* erect longer than the leaves up to 12.5 cm. *Peduncle* costate, 5 – 7 cm with 2 – 3 bracts. *Rachis* subclaxly 6 – 8-flowered. *Floral bracts* lanceolate acuminate, 5 – 7.1 × 1.1 – 1.8 mm. *Flowers* large, erectly spreading up to 18 × 11 mm, green becoming brown-yellow with age. *Pedicel* and *ovary* slender, glabrous, slightly ridged, up to 17 × 2 mm. *Dorsal sepal* reflexed, ligulate-lanceolate, somewhat obtuse and bi-auriculate at the base, 12 – 15.5 × 1.5 – 1.8 mm. *Lateral sepals* porrect, falcate-oblong, obtuse, 11.3 – 12.8 × 3.8 – 4.1 mm. *Petals* deflexed, narrowly linear, obtuse, 12.5 – 13.2 × 0.5 – 0.6 mm. *Lip* curved, with the base contracted and shortly biauriculate, abruptly expanded into a very broadly oval blade, apiculate at the apex and the front margins almost sub-denticulate, base with a small rounded-subcordate, sometimes obsolete callus, 9.2 – 10.1 × 7.5 – 7.7 mm. *Column* slightly curved, short and thick, a little expanded above the middle, 4 – 5 mm long, somewhat winged. *Anther* with a spatulate beak, 1 mm long, rounded at the apex and narrowed towards the base, overall c. 1.9 × 1.1 mm. *Pollinia* ovoid, united by a thin membrane, c. 0.6 × 0.4 mm.

RECOGNITION. *Liparis zaratananae* is a medium-sized plant with fairly short, slender pseudobulb and two or rarely three, ovate-elliptic leaves, with a 1 – 2 cm petiole, the leaves being retained on at least two growths. It has large flowers with a broadly oval lip narrowed at the base and slightly serrulate at the anterior margin, a rounded and indistinct callus, an anther with a distinct spatulate, 1 mm long beak, rounded at the apex and narrowed towards the base, and a short and thick column.

Liparis zaratananae is somewhat similar in habit and inflorescence to *L. jumelleana* but it is well characterised by the more ovate leaves with a more sharply defined petiole, larger flowers, smaller petals and the lip oval vs transversally elliptic and the spatulate vs pointed beak of the anther. There are similarities with *L. sambiranoensis* but the plant is generally a little smaller, the leaf more petiolate, two years growth remain whilst *L. sambiranoensis* emerges from a repent pseudobulb, the bracts are smaller (not cordate), the lip a very different in shape (shortly auriculate vs distinctly auriculate) and much shorter dentate at the front and the anther has a spatulate beak vs triangular.

DISTRIBUTION. Endemic to Madagascar: Antsiranana province, Mt Tsaratanana only (Map 50).

Fig. 70. *Liparis warpuri*. Watercolour by Matilda Smith of the type specimen. Reproduced by kind permission of the Trustees of the Royal Botanic Gardens, Kew.

O. A. Whalley from drawing of J. Hermans (RbgKew.Oct 2002.)

Fig. 71. *Liparis wairupuri*. A habit $\times 1$; B dorsal sepal $\times 6$; C lateral sepals $\times 6$; D petal $\times 6$; E lip $\times 6$; F column and ovary, side view $\times 9$; G column, front view $\times 9$; H T/S through lip $\times 6$. Based on H. Perrier 17018 (P). Unfinished drawing by Oliver Whalley from sketches by J. Hermans. The lip callus shown in E, F and H is based on dried specimens and does not show the more swollen bi- or tri-lobed callus.

Fig. 72. *Liparis warpuri*. **A** habit; **B** flower; **C** flowers showing distinct callus. PHOTOS: **A, C** JEAN-MICHEL HERVOUET; **B** PHOTO: JOHAN HERMANS.

SPECIMENS EXAMINED. **MADAGASCAR.** Mt Tsaratanana, Oct. 1922, *Perrier* 15743 (P00095528) (holotype P); Mt Tsaratanana, Dec. 1922, *Perrier* 15743 (P00095529) (lectoparatype P); Centre, Mt Tsaratanana, c. 2000 m, April 1924, *Perrier* 16484.

HABITAT. Forest undergrowth, moss and lichen. Altitude: 1500 – 2000 m.

CONSERVATION STATUS. Category **CR**: the extent of occurrence (EOO) of *Liparis zaratananae* cannot be estimated since it is only known from one subpopula-

0 100 200 km

Map 50. Distribution of *Liparis zaratananae*.

tion whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis zaratananae* is only known from one subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction. At Mt Tsaratanana the habitat is particularly affected by clearance for cultivation of illegal drugs.

FLOWERING TIME. *Perrier* 15743 P00095528 has October, P00095529 has December and *Perrier* 16484 has April.

ETYMOLOGY. Refers to Mt Tsaratanana (Zaratanana), the type locality in Northern Madagascar. *Perrier* (1939: 269) changed the epithet to *tsaratananae* believing Schlechter to have made a typographic error, but there is no basis for this as Schlechter used the German version of spelling.

NOTES. *Liparis zaratananae* is often confused in herbaria with other species. It was first collected in October 1922 by *Perrier* from a small colony of six plants on Mt Tsaratanana and sent to Schlechter for

identification in May 1923. He returned it to the Paris herbarium in October of the same year and published the description a year later. There are two sheets from the same locality, one has a collecting date of October (X) and the other December, this could be an error but could equally be a collection from a later date. *Perrier* made another collection in 1924, from a different area of Mt Tsaratanana of a somewhat different form with a wider lip and more linear anther beak. No other reliable records exist of the species.

ILLUSTRATION. *Perrier* (1939: 271). The photographs in Cribb & Hermans (2009: 149) labelled *Liparis zaratananae* are of *L. chantaliae*.

Ambiguous species and unplaced names

***Liparis xanthina* Ridl.** (*Ridley* 1886b: 275); *Perrier* (1939: 278); *Hermans et al.* (2007: 224); Cribb & Hermans (2009: 153); *Hervouet* (2018: 422) **nomen dubium**. Type: Madagascar, Ankafana (S Betsileo), *Deans Cowan* s.n. (holotype BM (BM000090075); *Deans Cowan* watercolour 39 (illustration of holotype BM).

Leptorkis xanthina (*Ridl.*) *Kuntze* (1891: 671).

Plant erect, very small, epiphyte, 6 cm, rhizome very short, roots rounded, filiform, glabrous. *Pseudobulbs* oval-conical with 2 leaves, 4 – 7 mm, covered in degrading sheaths. *Leaves* ovate, 5.5 – 6 × 2.5 – 2.8 cm. *Inflorescence* erect c. 7 cm, laxly 13-flowered. *Peduncle* one or two sheaths 6 × 1 – 1.2 mm. *Rachis* 3 – 4 cm, with the lower flowers before the upper ones open. *Floral bracts* lanceolate, c. 3 × 1 mm. *Flowers* very small, yellow, overall c. 7 × 5 mm. *Pedicel* and *ovary* rounded, winged, c. 3 × 0.3 mm. *Dorsal sepal* narrowly linear, obtuse, c. 3.5 × 1 mm. *Lateral sepals* ovate-oblong and obtuse, c. 3.5 × 2 mm. *Petals* narrowly linear c. 3.5 × 0.3 mm. *Lip* curved, oblong and obtuse, c. 2.5 × 2 mm. *Column* rather thick, c. 2 × 1.3 mm. *Anther* not known.

RECOGNITION. *Liparis xanthina* has an inflorescence that is longer than its leaves; two fairly broad leaves, small flowers and fairly long floral bracts.

It is similar in its inflorescence and flowers to *Liparis dryadum* but it has broader and larger leaves. It also resembles in size and habit *L. densa*, *L. lutea*, *L. nephrocardia* and *L. bathiei* but, without flowers, it is not possible to be certain from the type herbarium material if it differs sufficiently. The type plant at BM has one growth and no flowers, its habit matches several species but it is not possible to determine which. *Deans Cowan*'s watercolour does not allow identification with any certainty and we, therefore, consider this name ambiguous (*nomen dubium* designated here) due to the lack of reliable type material. It shares many characteristics with *L. bathiei* which may be the same species but there is not enough reliable material to support this.

DISTRIBUTION. Endemic to Madagascar: Fianarantsoa area (Ankafana; the highland area in-between Antsirabe and Ambalavao) (Map 51).

SPECIMENS EXAMINED. MADAGASCAR. Ankafana (S Betsileo), *Deans Cowan* s.n. (holotype BM). BM000090075 and Deans Cowan watercolour 39 (BM) (syntype BM).

HABITAT. In trees. Altitude: unknown.

CONSERVATION STATUS. Category **CR**: the extent of occurrence (EOO) of *Liparis xanthina* cannot be estimated since it is only known from one subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). *Liparis xanthina* is only known from a single subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. Not known.

ETYMOLOGY. Refers to the yellow colour of the flowers.

NOTES. *Liparis xanthina* was described by Henry Ridley based on a specimen collected by William Deans Cowan of the London Missionary Society who was sent out to Madagascar in 1874, settled in Fianarantsoa and returned to England in 1881. Deans Cowan provided a number of herbarium specimens to Ridley and also left an album of watercolours of his finds, these often help to illustrate the type material (Fig. 73). In his description Ridley refers to Deans Cowan's drawing 89 which must be mistranscription of 39, since 89 does not exist in the Deans Cowan's sketchbook (Cowan 1880).

ILLUSTRATION. Cowan (1880: 39) (Fig. 73).

***Liparis pulchella* Cordemoy ms.**

Cordemoy s.n. from Réunion in the Marseille herbarium specimen was labelled by Cordemoy as *Liparis pulchella*. The name is unpublished and no other records have been found. It has similarities with *L. flammula* and *L. nectarina* but there are insufficient features left to identify with any certainty. The name *L. pulchella* was also used by Hooker f. in 1889 for an Asian species (now *L. petiolata*).

***Liparis obliqua* Frappier ms.**

This is an unpublished name on a Cordemoy herbarium sheet of *L. caulescens* May 1863 (MARS).

***Liparis arno(ma)toides* Cordemoy ms.**

This name appears on a Cordemoy herbarium specimen that lacks flowers and provenance (MARS).

***Liparis* sp. nov.**

Schlechter (1913: 22) mentioned a '*Liparis* sp. nov. ?' from Madagascar, Manongarivo. This corresponds to a specimen without flowers in P (Perrier 11847) but it is not possible to identify and is likely to be a species of *Malaxis*.

New species with insufficient material

The following collections are insufficiently complete to describe but appear to represent a new species.

MADAGASCAR: Mangandran, Bealanana, RN 4, June 1953, *Levango Surveillant* 6031 (P00409223), P001805101-2 (P); Antananarivo, c. 130 km towards Mahajunga, *Hermans* 2122 (K). A large bulbous plant related to *Liparis foliosa* but larger and more bulbous. The specimens are with fruit capsules only.

Malaxis

Malaxis Sol. ex Sw. (Swartz 1788: 119). Type species: *Malaxis spicata* Sw. (Swartz 1788: 119).

Achroanthes Raf. (Rafinesque 1819: 195).

Acroanthes Raf. (Rafinesque 1819: 261).

0 100 200 km

Map 51. Distribution of *Liparis xanthina*.

Fig. 73. *Liparis xanthina*. Watercolour by Deans Cowan 1880: 19. © The Trustees of the Natural History Museum, London.

Microstylis (Nutt.) Eaton (1822: 115), *nom. et orth. cons.*

Type species: *Microstylis ophioglossoides* (Muhl. ex Willd.) Nutt. ex Eaton (1822: 353).

Cheiropterocephalus Barb.Rodr. (Rodrigues 1877: 28).

Glossochilopsis Szlach. (Szlachetko 1995: 122).

Kornasia Szlach. (Szlachetko 1995: 120).

Lisowskia Szlach. (Szlachetko 1995: 121).

Pycnantha Ravenna (2011: 30).

Terrestrial or rarely epiphytic, lithophytic *herb*. *Roots* hairy. *Stem* cylindrical to pseudobulbous, fleshy, often creeping and rooting in basal part. *Leaves* thin textured to fleshy, usually pleated, petiole sheathing at base. *Inflorescence* erect, racemose, unbranched. *Floral bracts* setose to lanceolate, persistent. *Flowers* non-resupinate or resupinate, green, brown, yellow, pink or purple. *Dorsal sepal* spreading, free. *Lateral sepals* free or fused, spreading. *Petals* often narrower than the sepals, free, spreading. *Lip* erect, flat but sometimes concave at base, entire to lobed, auriculate at base or lacking auricles, apical margins entire to toothed, lacking a spur, callus absent, cushion-like or obscurely transversely ridged. *Column* lacking a foot; anther dorsal, attached by a slender filament, locules opening ventrally, pollinia four, waxy, lacking appendages or rarely with one or two tiny viscidia, stigma semi-circular or ovate; rostellum often obtuse or emarginate at apex (adapted from Cribb in Pridgeon *et al.* 2005: 471).

DISTRIBUTION. A genus of about 300 species found throughout the tropics and subtropics of the Old and New World, with a few species in temperate regions of Europe, Asia and the Americas. Four species in Madagascar of which three endemic (75%), one endemic to the Seychelles, one to the Comores, one with a wider distribution on main-

land Africa. None on the Mascarenes. Ridley mentioned the W African *Microstylis stelidostachya* Rchb.f. (Reichenbach f. 1881: 118) (now *Orestias stelidostachya* (Rchb.f.) Summerh. (Summerhayes 1937: 460) from the Comoros in error.

TAXONOMIC NOTES. Most authors until recently have followed the treatments of Schlechter (1911a) and Seidenfaden (1978) in accepting a broadly defined *Malaxis*. However, in this sense, *Malaxis* is undoubtedly polyphyletic. More species need to be included in ongoing DNA studies to resolve the problems.

The systematic history of *Malaxis* is complex. Ridley (1888) produced the first infrageneric treatment of *Microstylis* (subsequently subsumed in *Malaxis*), recognising eight sections, six of which were confined to the New World, one to Africa, and two to Asia. Smith (1909, 1913) and Schlechter (1911a) recognised non infrageneric groupings in *Microstylis*. Seidenfaden (1978) included *Microstylis* in *Malaxis* and discussed previous infrageneric treatments, transferring five section established in *Microstylis* to *Malaxis*.

More recently, Szlachetko (1995), Szlachetko & Margonska (2002) and Margonska *et al.* (2012) recognised a number of new genera in subtribe Malaxideae. Most of them were included in *Malaxis* by previous authors. Szlachetko & Olsewski (2001) accepted the segregate genera *Lisowskia* and *Kornasia* in their account of the orchids of Cameroon.

Data from DNA sequence analysis shows that *Malaxis* s.l. is polyphyletic (Cameron 2005) but not along the lines defined by Szlachetko and his co-workers.

ETYMOLOGY. From the Greek *malaxis* (*malasso*), to soften, in allusion to the soft-textured leaves.

Taxonomy of *Malaxis*

Artificial key to *Malaxis* in Madagascar, the Mascarenes, Comoros and Seychelles

1. Plant large, more than 10 cm tall; leaves large, more than 7 cm long, borne along the stem ***Malaxis seychellarum***
- 1'. Plant small, less than 10 cm tall; leaves 2, less than 7 cm long, borne at the apex of the pseudobulb or stem. 2
2. Flowers non-resupinate, with the lip uppermost in the flower 3
- 2'. Flowers resupinate with the lip lowermost in the flower 4
3. Lip distinctly 3-lobed, the basal auricles overtopping the column, the front margin entire . . . ***M. madagascariensis***
- 3'. Lip indistinctly 3-lobed, basal auricles not overtopping the column, anterior margin sinuate ***M. physuroides***
4. Leaves cordate; column wings triangular ***M. cardiophylla***
- 4'. Leaves oval to oblong; column wings rounded. 5
5. Leaf petiole short, less than 1 cm long; lip wider than long, the basal auricles lower than the column . . ***M. atrorubra***
- 5'. Leaf petiole more than 1 cm long; lip suborbicular, the basal auricles folded around the column . . ***M. weberbaueriana***

Malaxis atrorubra (*H.Perrier*) Summerh. (Summerhayes 1954: 578); Hermans *et al.* (2007: 225); Cribb & Hermans (2009: 160). Type: Madagascar, Manerinerina, Tampoketsa, *Perrier* 16828 (holotype P). *Microstylis atroruber* H.Perrier (1936: 233; 1939: 259).

Small terrestrial *plant*, c. 10 cm high, on a short creeping rhizome with the new growth emerging from the base or node of the previous withered decumbent pseudobulb, covered in brown scarious sheath remnants; roots filiform, hairy. *Pseudobulbs* caulescent, 45 –

75 × 3 – 7 mm, completely covered with 3 – 5 brownish amplexant sheaths, attenuate to caudate at the tip, 5 – 22 × 4 – 5 mm, with 3 leaves at the apex generally with one smaller than the others. *Leaves* ovate acute, narrowed into a 5 – 8 mm petiole at the base, blade oblique, 3.5 – 5.6 × 2.1 – 3.3 cm. *Inflorescence* erect, lengthening with age, up to 88 mm long but generally shorter, thin, corrugate, with up to 12 flowers. *Peduncle* up to 40 mm with up to 5 bract-like sheaths. *Rachis* laxly racemose, up to 50 mm, flowers opening in succession. *Floral bracts* narrowly lanceolate, acute, 1.9 – 2.3 × 0.5 – 0.8 mm. *Flowers* very small to small, erectly spreading, c. 5.5 × 6 mm, dark purple, almost black, lip sometimes greenish-yellow. *Pedicel* and *ovary* straight, corrugate to winged 2.2 – 2.5 × 0.3 – 0.4 mm. *Dorsal sepal* oval-lanceolate, obtuse, broad at the base 2.8 – 3.5 × 1.1 – 1.5 mm. *Lateral sepals* ovate 2.7 – 3.1 × 1.1 – 1.6 mm. *Petals* linear obtuse, 1.8 – 2.1 × 0.3 – 0.5 mm. *Lip* very shortly and narrowly winged at the base below the column then abruptly broadened into a subglobose to oval blade rounded at the anterior margin, with 2 longitudinal crescent-shaped swellings along a central vein, 1.9 – 2.2 × 2.1 – 2.7 mm. *Column* very short, with characteristic large rounded wings at the apex, 0.9 – 1.2 × 0.4 – 0.5 mm. *Anther* very small, broadly obovate, with two distinct chambers, c. 0.3 × 0.35 mm. *Pollinia* ovoid c. 2 mm

RECOGNITION. A small plant with three leaves, small flowers with an obtuse dorsal sepal, widened at the base, a lip slightly wider than long, with a very narrow base not surrounding the column, two crescent-shaped swellings on the blade along a central vein, and a very short column with large rounded wings at the apex.

The broad lip is similar to that of *Malaxis cardiophylla* but plant and leaf are different with the base of *M. cardiophylla* being more cordate than this species, the leaves of *M. cardiophylla* also have a distinct elongate petiole. The lip is broader in *M. cardiophylla* which also lacks the crescent-shaped swellings. The column has rounded apical wings (vs angular). The species is different from *M. weberbaueriana* (Kraenzl.) Summerh. (Summerhayes 1934: 208) in having leaves with a shorter petiole, flowers that are equally small, but have a lip with much smaller basal auricles that do not surround or surpass the column as in *M. weberbaueriana*. It differs from *M. wekvitschii* from Angola by the less cordate ovate leaves, the entire ovate lip (vs three-lobed) and the large rounded wings (vs angular) of the column.

DISTRIBUTION. Endemic to Madagascar: Antananarivo province (Map 52).

SPECIMENS EXAMINED. MADAGASCAR. Manerinerina, Tampoketsa, Perrier 16828 (holotype P); Kitsamby forest, Jan. 1964, Thérézien s.n. P1778684. (P); Soavinandriana area, 1997, Hermans 3551 (K).

HABITAT. Terrestrial in humid evergreen forest on plateau. Altitude: 1000 – 1500 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Malaxis atrorubra* cannot be estimated since it is only known from two subpopulations whereas its area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). With only two known subpopulations representing two locations (sensu IUCN), *M. atrorubra* has been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. October to January.

ETYMOLOGY. Refers to the dark-red to dark purple colour of the flowers.

NOTES. Perrier originally described it as *Microstylis atroruber* and it was transferred to the genus *Malaxis* by Summerhayes (1953). According to the ICN (Turland *et al.* 2018: 60.11) the use of a hyphen in this instance is to be treated as an error and corrected: therefore *atro-rubra* becomes *atrorubra*.

0 100 200 km

Map 52. Distribution of *Malaxis atrorubra*.

Perrier's holotype is a young plant with few flowers. In his description he noted that the lip calli were verrucose which is not obvious in specimens.

Margonska (2009: 91) considered this species to be conspecific with *Malaxis welwitschii* from Angola (as *Lisowskia welwitschii*) together with *M. francoisii* (H.Perrier) Summerh. (Summerhayes 1954: 578) also from Madagascar but the plant, lip and column of *M. atrorubra* are considerably different as explained above. The species was described at the same time as *M. francoisii* and based on a collection by Perrier and François, who would have seen the living plants. It is unlikely that Perrier would have described the same species twice in the same paper.

ILLUSTRATIONS. Perrier (1939: 255).

Malaxis cardiophylla (Rchb.f.) Kuntze (1891: 673); Hermans *et al.* (2007: 225). Types: Comoros, Mayotte, Combani forest, *Humblot* 1437 (437) (holotype W, isotypes BM, LD, LG, P (P00094908-10)).

Microstylis cardiophylla Rchb.f. (Reichenbach 1885: 543); Ridley (1888: 66); Perrier (1939: 257).

Orestias cardiophylla (Rchb.f.) Marg. (Margonska & Szlachetko 2006: 218), **synon. nov.**

Small, terrestrial, lithophytic or epiphytic tufted *plant* 5.5 – 10 cm high, on a very short, occasionally branching rhizome, roots fibrous. *Pseudobulbs* slender, caulescent, 20 – 60 × 3 – 5 mm, covered by 3 – 4 membranous sheaths, generally carrying two leaves, sometimes accompanied by a third smaller leaf, leaves persistent on previous growths. *Leaves* thin, broadly cordate, more or less unequally lobed at the base, shortly acute at the tip, with a short 6 – 12 mm petiole, 1.8 – 3 × 1.3 – 2 cm. *Inflorescence* erect, thin, 6 – 10.5 cm, with 7 – 23 flowers. *Peduncle* short, with 3 – 5 bract-like sheaths. *Rachis* loosely racemose, flowering in succession hardly 1 – 2 cm above the upper leaf. *Floral bracts* erectly spreading, narrowly lanceolate to cordate-triangular, 2.5 – 5 × 0.9 – 1.1 mm. *Flowers* small, 5 – 6 mm including the ovary, violet or purplish, the lip green with a yellow callus. *Pedicle* and *ovary* glabrous, 3 – 3.5 × 1.1 – 1.3 mm. *Dorsal sepal* oval-lanceolate, obtuse, 1.9 – 2.8 × 0.7 – 1.2 mm. *Lateral sepals* ovate, obtuse, 2 – 2.8 × 1 – 1.3 mm. *Petals* linear, obtuse, narrowed towards the apex, 2.1 – 2.7 × 0.5 – 0.6 mm. *Lip* oblong, obtuse and sinuate at the anterior margin, broadly winged at the base not surpassing the column, the disk with two rounded minutely pubescent longitudinal ridges, 1.5 – 2.1 × 1.6 – 2 mm. *Column* slender, up to c. 1.1 × 0.3 mm, the apical wings triangular-acute, ascending. *Anther* ovate with a rounded anterior lobe, c. 0.6 × 0.8 mm. *Pollinia* ovate 0.8 × 0.5 mm.

RECOGNITION. *Malaxis cardiophylla* is a small plant with two, broadly cordate, persistent leaves with a long

petiole, a loosely racemose rachis, with up to 20 small flowers, an oblong, broadly lobed, obtuse lip, with two longitudinal vein-like ridges.

Malaxis cardiophylla is similar to *M. weberbaueriana* but the plant and flowers are distinct, especially the leaves which are cordate (vs lanceolate) and a lip which is broader and does not surpass or envelop the column. A drawing by Ridley (at K) based on *Humblot* 437 (presumably based on the BM specimen), shows differently shaped (not cordate) leaves. Perhaps *M. cardiophylla* is an aberrant or local form of *M. weberbaueriana* but based on current evidence it is left as a separate entity. It is also similar in lip-shape to *M. atrorubra* but it is broadly vs narrowly winged, its habit and leaf shape are slightly different with a broadly cordate leaf vs ovate with the base oblique, and its column structure with rounded (vs angular) lobes.

DISTRIBUTION. Comoro Islands, Mayotte. Perrier (1939: 257) gave 'Grande Comore, Combani' as the locality of this species but *Humblot's* Field Notebooks in P (1882 – 1885) clearly list the "plant growing next to rocks, flowers violet, from Mayotte, Combani forest". It is a common mistake to confuse Combani forest of Grande Comore with Combani on the island of Mayotte (Hervouet & Barthelat 2014: 268) (Map 53).

SPECIMENS EXAMINED. COMOROS. Mayotte, Combani forest, *Humblot* 1437 (437) (holotype W, isotypes BM, LD, LG, P (P00094908-10)); Mayotte, Grande Terre, Tsararano, Benara, Dec. 2002, *Barthelat* 1116 (K, P); Mayotte, Summit of Petit Benara, Jan. 1990, *Tinguy* 1134 (P).

HABITAT. Near rock, in forest, terrestrial or epiphytic. Altitude: around 300 – 400 m.

CONSERVATION STATUS. Category **CR**: The extent of occurrence (EOO) of *Malaxis cardiophylla* cannot be estimated since it is only known from one subpopulation whereas its minimal area of occupancy (AOO) is estimated to be 4 km² (which falls within the limits for Critically Endangered status under the criterion B2). *Malaxis cardiophylla* is only known from a single subpopulation representing one location (sensu IUCN), this rare species has thus been preliminarily assessed as CR using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence, slash-and-burn farming and urban development, resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing for Mayotte as VU D2 (Mercks 2013).

FLOWERING TIME. December to January.

ETYMOLOGY. A reference to its heart-shaped leaves.

NOTES. Reichenbach originally described it as *Microstylis cardiophylla* but it was transferred to the genus *Malaxis* by Kuntze (1891). The species was placed in the genus *Orestias* by Margonska &

Map 53. Distribution of *Malaxis cardiophylla*.

Szlachetko (2006) in their revision of the mainland African genus *Orestias* Ridl. (Ridley 1887: 24). The main differences cited are the characteristics of the lip and gynostemium but these seem identical in several species of *Malaxis* from the same region. Ridley, in creating the genus based it mainly on the length and shape of the column especially the arched and expanded tip of the column: a similar length and shape can be found in many other species of *Malaxis* and the type material of *M. cardiophylla* shows no curvature of the column. Significantly, Ridley did not place *M. cardiophylla* in his new genus *Orestias*. The distinction between the genera seems to be exclusively based on morphological characteristics which overlap and are not exclusive, it is therefore prudent to leave them in the older genus *Malaxis*.

Margonska (in Margonska *et al.* 2012: 451) unnecessarily lectotypified *Malaxis cardiophylla* with Humblot 437 (R40906) and isolectotype (BM000088116). The holotype in W is clearly marked as such and there is, therefore, no need for lectotypification; she also overlooked the other isotypes.

ILLUSTRATIONS. Figs 74, 75; Margonska & Szlachetko 2006: 218.

***Malaxis madagascariensis* (Klinge) Summerh.** (Summerhayes 1954: 578); Hermans *et al.* (2007: 225); Cribb & Hermans (2009: 160). Type: Madagascar, Hamelin s.n. (holotype LE⁺); Iconotype: drawing in LE & Klinge (1898: t.2).

Microstylis madagascariensis Klinge (1898: 140, t.2); Perrier (1939: 257).=

Small *plant* 10 – 12 cm high, on a short rhizome, the previous pseudobulb leafless. Pseudobulbs conical-cylindrical, partly covered by leaf-like bracts, with 4 – 5 leaves at the apex. Leaves oval-lanceolate, acuminate, pleated-undulate, spotted, the blade as long as the petiole, including sheath, 6 – 9 × 2 – 4 cm. *Inflorescence* erect, slender, angular, pale purple c. 15 cm long, with c. 30 flowers. *Peduncle* about $\frac{1}{3}$ the length of the inflorescence with a few bract-like sheaths. *Rachis* densely racemose, pyramidal-cylindrical, elongate. *Floral bracts* linear-lanceolate, as long as the pedicellate ovary. *Flowers* not resupinate, small, c. 9 mm long, 7 mm wide, dull brownish-purple, flower buds green. *Dorsal sepal* broadly oblong, rounded, obtuse convex, c. 4 × 2.5 mm. *Lateral sepals* oblong, obtuse, convex c. 4 × 2 mm. *Petals* spreading, linear,

Fig. 74. *Malaxis cardiophylla*. Drawing by E.-A. Finet on Humblot 437 in P. Courtesy of the Muséum national d'Histoire naturelle, Paris.

shortly acute, c. 4×0.35 mm. *Lip* 3-lobed, the lobes obtuse, the lateral lobes auriculate the mid-lobe a little bigger, with the auricles at the base as long as the lobes and completely enveloping the column, mid-lobe with a rounded apex, c. 5×4.5 mm. *Column* short, wings small, obtuse.

RECOGNITION. *Malaxis madagascariensis* is a small plant with conical-cylindrical pseudobulbs, pleated undulate leaves, and a long inflorescence with up to 30 flowers. The flowers are small, non-resupinate, and have a distinctly three-lobed lip with the basal auricles surrounding the column.

It has some similarities with *Malaxis physuroides* but in *M. madagascariensis* the pseudobulbs are thicker and shorter, the lip is three-lobed (vs suborbicular). There are some vegetative similarities with *M. seychellarum* but again the three-lobed lip with entire margins vs oblong, distinctly dentate at the margin lip is very different. In many ways the species is more akin to some E Asian species, such as *Crepidium punctatum* (J.J.Wood) Szlach. (Szlachetko 1995: 131), a species that also has spotted leaves, a similar habit but a different flower structure with the dorsal sepal broader and the lip far less deeply three-lobed.

DISTRIBUTION. Madagascar: Hamelin seems to have collected mainly in the North and Eastern forests of

Madagascar in search of horticulturally desirable species like *Eulophiella elisabethae* Rolfe (1891: t.325). Map 54.

SPECIMEN EXAMINED. MADAGASCAR. s. loc., 1893, Hamelin s.n. (holotype LE†).

HABITAT. Not known.

CONSERVATION STATUS. Data deficient, known from the type only with an imprecise locality.

ETYMOLOGY. Referring to the assumed country of origin.

NOTES. Klinge originally described it as *Microstylis madagascariensis* but Summerhayes (1954) transferred it to the genus *Malaxis*. Margonska (in Margonska *et al.* 2012: 303) placed the species under *Crepidium koordersii* (J.J.Sm.) Szlach. (Szlachetko 1995: 127) from Indonesia. Margonska does not substantiate this decision apart from stating that “they are without any doubt conspecific and that no species from *Crepidium* has ever been recorded from Madagascar and that the origin of the *Microstylis madagascariensis* plant cultivated at Hort. Petrop. was Madagascar and the subsequent mechanical transferring of taxa without careful checking have led to citation errors in contemporary publications relating to Madagascar”. Although the plant habit and lip have some similarities there are significant differences between the two species: the leaves of *Malaxis madagascariensis* are considerably

Fig. 75. *Malaxis cardiophylla*. **A** habit; **B** flowers. PHOTOS: ETIENNE VENNETIER.

smaller and said to be spotted by Klinge (vs green), the inflorescence is much shorter, the proportions of the lip are different with the mid-lobe narrower and the lateral lobes longer. In addition *C. koordersii* has completely green flowers whilst Klinge clearly indicates a purple colouration for both rachis and flowers. Although Klinge is clear about the origin of the plant being from a Humblot Madagascar collection, it is entirely possible that this may have been a mix-up, as suggested by Margonska but there is no evidence for this. It is not clear if the species actually belongs in *Crepidium* and there is no doubt that several closely related *Malaxis* are found on Madagascar. On this evidence there is no reason to remove this species from the Madagascar Flora until a more credible case is put forward. Margonska cited the original Klinge drawing at LE as the iconotype. In 2014 Margonska proposed to conserve the name *Microstylis koordersii* (*Crepidium koordersii*) from Java and Sulawesi against *M. madagascariensis* because the name of the latter would have priority and the new nomenclatural combination would be a potential source of confusion and imply occurrence in Madagascar.

Malaxis madagascariensis is therefore somewhat enigmatic being based on a single specimen collected at an unknown locality in 'Madagascar' by Hamelin who was a commercial collector there in the late 19th century, supplying plants to the nurseries of Linden

and Messrs F. Sander & Co in Europe. He collected large quantities of *Eulophiella elisabethae* in Madagascar at the same time as the *Malaxis* specimen. Nothing is known about the exact localities where he collected or how the new plant reached Johannes Klinge in Leningrad. Klinge's description is based on a cultivated plant flowering in the hothouses of the Imperial Botanical Collections, Leningrad. His type specimen was kept at the Komarov Botanical Institute in Leningrad (LE) but according to Christenson (1995) much of the type material was lost or destroyed, including the type of Klinge's *Microstylis madagascariensis*. It has not been possible to verify this with LE. It was therefore necessary to select a new type with the illustration by Klinge the only option.

Klinge's description is not detailed and his more detailed drawing has no scale which makes most of the description speculative. It is entirely possible that there was a mix-up in the origin of the cultivated plant, especially as no further material has been recorded from Madagascar. The species may remain ambiguous.

ILLUSTRATION. Klinge (1898: t.2) (Fig. 76).

***Malaxis physuroides* (Schltr.) Summerh.** (Summerhayes 1954: 578); Hermans *et al.* (2007: 225); Cribb & Hermans (2009: 160). Type: Madagascar, Sambirano

0 250 500 km

Map 54. Distribution of *Malaxis madagascariensis*.

Manongarivo massif, 400 m, April 1909, *Perrier* 8010 (89 of Schlechter) (holotype P).

Microstylis physuroides Schltr. (Schlechter 1913: 164; 1924: 133); Perrier (1936: 233; 1939: 258).

Lisowskia physuroides (Schltr.) Szlach. (Szlachetko 1995: 121).

Small scrambling terrestrial, epiphytic or lithophytic plant 9 – 11 cm high, on a short creeping rhizome with the new growth emerging from the base or node of the previous withered decumbent pseudobulb, cov-

ered in brown scarious sheath remnants, roots filiform, flexuose, villous. *Pseudobulbs* caulescent, succulent, cylindrical, 5 – 7.5 cm long, 3 – 6 mm diam., covered with 3 – 4 yellowish, papery overlapping sheaths attenuate at the tip, with 2 – 3 (rarely 4) leaves at the apex. *Leaves* erectly spreading, broadly oval-acute, rounded to sub-cordate at the base and contracted into a 8 – 12 mm petiole, overall 3.3 – 7.2 × 2.4 – 4.1 mm. *Inflorescence* erect, thin, 7 – 14 cm long, with up to 40 flowers. *Peduncle* about as long as the raceme, somewhat angular, with several small bract-

Fig. 76. *Malaxis madagascariensis*. Habit and flower, from Klinge [1898](#): t2.

like sheaths, red. *Rachis* very densely racemose. *Floral bracts* erect, narrowly lanceolate, acute, up to 2.3×0.5 mm. *Flowers* not resupinate, c. 3×4 mm, dark red. *Pedicel* and *ovary* glabrous $2 - 2.3 \times 0.2 - 0.4$ mm. *Dorsal sepal* oval-lanceolate obtuse, $1.7 - 2 \times 0.8 - 0.9$ mm. *Lateral sepals* oval-obtuse, $1.2 - 1.7 \times 0.7 - 0.8$ mm. *Petals* linear, $1 - 1.2 \times 0.2 - 0.3$ mm. *Lip* suborbicular, obtuse with distinct obtuse basal wings folded around the column, margins of the blade sinuate, anterior margin rounded-truncate to a little indented, disk with a subreniform callus (perhaps pubescent) just below the middle, $1.6 - 1.9 \times 1.5 - 1.7$ mm. *Column* short, straight, with indistinct wings, c. 0.5×0.2 mm. *Anther* ovate, truncate at the back, angular-obtuse at the front c. 0.33×0.2 mm. *Pollinia* ovoid c. 2 mm.

RECOGNITION. A small plant with cylindrical succulent pseudobulbs, two to three broadly apical oval leaves. Inflorescence almost as long as the plant, very densely-flowered, flowers small, red, lip suborbicular with obtuse basal wings alongside the column, anterior margin rounded-truncate with a distinct rounded callus on the disc.

Schlechter, in his description, likened it to *Microstylis stelidostachya* Rchb.f. and *Malaxis katochilus* Schltr. from E Africa (now *Malaxis prorepens* (Kraenzl.) Summerh. (Summerhayes 1934: 208) but the rachis is much less dense and the flowers are different especially in the shape of the lip and the rounded callus. *Malaxis physuroides* differs significantly from all the other *Malaxis* from the Madagascar region by the very dense rachis of small flowers and the distinct rounded single callus on the lip.

DISTRIBUTION. Endemic to Madagascar: Antsiranana and Toamasina provinces (Map 55).

SPECIMENS EXAMINED. MADAGASCAR. Sambirano Manongarivo massif, 400 m, April 1909, *Perrier* 8010 (89 of Schlechter) (P); confluence of the Onive and the Mangoro area, c. 700 m, Feb. 1924, *Perrier* 17188 (P); Mt d'Ambre, Nov. 2007, 1400 m, *Nusbaumer et al.* LN2374 (G).

HABITAT. Humid evergreen forest, shaded wet rocks. Altitude: 400 – 1400 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Malaxis physuroides* is estimated to be 31,200 km² (which falls within the limits for Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 20 km² (which also falls within the limits for Endangered status under the criterion B2). *Malaxis physuroides* is only known from three subpopulations representing three locations (sensu IUCN), this species has thus been preliminarily assessed as EN using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming), resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. November to April.

ETYMOLOGY. A reference to the orchid genus *Physurus* Rich. ex Lindl. (now *Erythrodes* Blume (1825: 410)) with which it shares the habit of some of the species.

NOTES. In 1913 Schlechter described it as *Microstylis physuroides*, based on material collected by Perrier and also illustrated the plant and flower. Schlechter, in his early collaboration with Perrier, used a different numbering system for specimens than Perrier. It was placed into the genus *Malaxis* by Summerhayes (1954). Szlachetko (1995) transferred it to his new genus *Lisowskia* but none of the morphology or genetics support this. Margonska (in Margonska *et al.* 2012: 454) designated as lectotype P00094916, referring to Perrier's specimen in Paris 8010 (89 of Schlechter). She designated a hypothetical specimen in Berlin that was assumed lost as an isoelectotype, but there is no reason to believe that such a specimen existed or was lost. As there is only one Perrier sheet (annotated by Schlechter) that is obviously original material used by the author, there is no need to assign lectotypes.

ILLUSTRATIONS: Schlechter (1913: pl.7; 1932: T.51).

***Malaxis seychellarum* (Kraenzl.) Summerh.** (Summerhayes 1954: 578); Robertson (1989: 223).

Map 55. Distribution of *Malaxis physuroides*.

Type: Seychelles, Mahé, Mt Harrison, 1888, *Schimper* 104 † & 352†. Neotype designated here: Seychelles, above La Misère, c. 2000 ft, March 4, 1888, *Lister* s.n. (BM).

Liparis seychellarum Kraenzl. (Kraenzlin 1902: 60).

Microstylis seychellarum (Kraenzl.) Schltr. (Schlechter 1915a: 411); Diels (1922: 439).

Microstylis thomassetii Rolfe (1922: 24). Type: Seychelles, Mahé, Cascade Estate, Aug. 1902, *Thomasset* 99 (holotype K: K000242167, isotype K000242166)

Seidenfia seychellarum (Kraenzl.) Szlach. (Szlachetko 1995: 122); Margonska *et al.* (2012: 538).

Medium to large humicole *plant*, epiphyte or lithophyte 10 – 33 cm tall but generally between 15 and 25 cm, rhizome very short, repent, roots filiform, flexuose more or less pilose. *Pseudobulbs* stem-like, narrowly cylindrical-ovoid to subcylindrical, thickened-bulbous at the base, 5 – 8 cm long, 1 – 2 cm in diam., covered by 2 – 3 long and overlapping stem-sheaths, sometimes the older pseudobulb obliquely divergent and always leafless, with up to 2 – 5 leaves but generally 3 – 4, starting half-way up the stem and ending with 2 – 3 larger ones towards the apex. *Leaves* erectly spreading, obliquely elliptic to ovate-elliptic, apiculate to obtuse, base rounded-cuneate and then attenuate into a 1.5 – 3 cm petiole, overall 7 – 20 × 2.5 – 7 cm, plicate, margins a little undulate to crenulated, thin, purple becoming green or green. *Inflorescence* erect, up to 30 cm, 2 – 3 mm in diam., green to purple, densely racemose with up to 50 flowers. *Peduncle* costate, with 2 – 3 bract-like peduncle sheaths, up to 4 × 2 mm. *Rachis* around $\frac{3}{4}$ of the inflorescence. *Floral bracts* arched, descending, linear-lanceolate-acuminate, 3 – 8 × 1.5 – 2 mm, green to purple-brown. *Flowers* not resupinate, very small to small, opening in succession, overall c. 5 × 6 mm, variable in colour from pale greenish-yellow, lemon-yellow, purplish green to purple, fading to yellow-orange, there seem to be distinct colour forms in different locations. *Pedicel* and *ovary* linear, slightly arched, 3.2 – 5 × 0.3 – 0.8 mm, green, often tinted purple. *Dorsal sepal* lanceolate, obtuse, 2.3 – 3.9 × 0.4 × 1.1 mm. *Lateral sepals* linear-oblong, obtuse, subfalcate, 2.3 – 3.2 × 0.9 – 1.6 mm. *Petals* linear, obtuse, arched and crossing below the column, 2.9 – 3.8 × 0.3 – 0.6 mm. *Lip* transversally oblong to flabellate, shortly winged at the base, with a more or less distinct basal callus, distinctly irregularly dentate at the anterior margin, 1.8 – 2.1 × 2.5 – 3.3 mm. *Column* slightly incurved, wings small, distinctly rounded, apex triangular, 1.2 – 1.6 × 0.3 – 0.8 mm. *Anther* broadly ovoid, angular at the base, c. 0.3 × 0.4 mm. *Seed capsule* obovoid, shortly pedicellate, 8 – 10 mm long

RECOGNITION. This is a large plant, with non-resupinate flowers, arched descending floral bracts, subfalcate petals, an oblong to flabellate lip with a

callus at the base and dentate margin, and an anther with rounded lobes at the apex.

Kraenzlin mentioned that in shape it was similar to *Liparis flavesces* but the obviously wider petals and the short wedge-shaped, very wide at the front, toothed lip were distinctive. It is indeed similar to several *Liparis* from Madagascar and the Mascarenes and vegetatively comparable with species like *L. ochracea* but the dense rachis of small non-resupinate flowers with a dentate lip margin make it very distinct. Rolfe, in describing *Microstylis thomassetii*, stated that it was related to the Asian *Microstylis rheedii* Lindl. (Lindley 1830a: 21) but differed by the narrower leaves and the shorter dentate lip. The latter shows, together with a number of other species from Asia, a number of similarities both in plant and flower but the flowers of *Malaxis seychellarum* are smaller and the teeth at the margin of the lip are generally fewer (6 – 8 vs 8 – 18) and not as deeply and acutely dentate. There is undoubtedly a genetic relationship between the species but the Seychelles taxon warrants specific recognition.

DISTRIBUTION. Endemic to the Seychelles: on the islands of Mahé and Silhouette (Map 56).

SPECIMENS EXAMINED. SEYCHELLES. Mahé, Mt Harrison, 1888, *Schimper* 104 and 352 (†); above La Misère, 4 March 1888, *Lister* s.n. (BM); Mahé, Mt Siebert 6 April 1888, *Lister* s.n. (neotype BM); Mahé, Cascade Estate, 1901, *Thomasset* s.n. (K000242166 & K000242167 on mixed sheet K); s. loc., 24 June 1918, Hort. Kew (K); Silhouette, 1908, *Gardiner* 112 (K); Silhouette, 1908, *Gardiner* 105 (K); Silhouette, 1908, *Gardiner* s.n. (K); Mare aux Cochons, 2000ft, 1908, *Gardiner* s.n. (K); Silhouette, *Gardiner* s.n. (K); Mahé, Morne Pilot, 2400 ft, Sept. 1908, *Gardiner* s.n. (K); Mahé, Mare aux Cochons, 1908, *Gardiner* s.n. (K); Mahé, Mourné Seychellois, 18 July 1936, *Osborne Day* 76 (BM); Mahé, Trois Frères, Dec. 1961, *Jeffrey & Zelia* 552 (K); Mahé, Trois Frères, 500 m, Nov. 1961, *Jeffrey & Zelia* 456 (K, MAU); Mahé, Trois Frères, 500 m, Nov. 1961, *Jeffrey & Zelia* 452 (K); Mahé, above Sans Souci, 400 m, Nov. 1961, *Jeffrey & Zelia* 401 (K); Mahé, Mahe, summit of Morne Blanc, June 1970, 660 m, *Proctor* 4021 (K); Mahé, Morne Blanc, Oct. 1970, *Schlieben* 116774 (K); Mahé, Congo Rouge, April 1972, *Jacquemin* 1035 (P); Mahé, Congo Rouge, April 1972, *Jacquemin* 971 (P); Mahé, Congo rouge, Hort. Tana, Jan. 1973, *Jacquemin* 1033 (P); Mahé, Congo Rouge, Oct. 1973, *Proctor* 4512 (K); Mahé, Cascade Estate, Morne Blanc, 600 m, March. 1975, *Lesouef* 192 (G); Mahé, Mt Harrison, April 1978, *Robertson* 2634 (K); Mahé, Mt Simpson, Nov. 1980, *Friedmann* 3523 (P); Mahé, Congo Rouge, Nov. 1980, *Friedmann* 3487 (P); Mahé, Congo Rouge, Nov. 1980, *Friedmann* 3489(P); Mahé, 600 – 700 m, Oct. 1981, *Renz* 13031.1 & 13031.2 (RENZ); Mahé, Congo Rouge, May 1982, *Bosser* 226655 (P); Mahé, Morne Blanc, May 1982, *Bosser* 22686 (P); Mahé, Congo Rouge, May 1982,

Map 56. Distribution of *Malaxis seychellarum*.

Bosser 22664 (P); Silhouette, Jardin Marron, June 1985, *Friedmann* 3487 (P); Morne Blanc, May 1985, *Friedmann* 5050 (P); Silhouette, Jardin Marron, June 1985, *Friedmann* 5284 (P); Mahé, Morne Blanc, March 2003, *Rouhan & Vos* 153 (P); s. loc., *Horne* s.n. (K).

HABITAT. Montane forest, growing in moss on rocks, on trees and tree ferns, in damp humus in shady undergrowth. Altitude: 400 – 750 m.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Malaxis seychellarum* is estimated

to be 65 km² (which falls within the limits for Critically Endangered status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 24 km² (which falls within the limits for Endangered status under the criterion B2). With only two known subpopulations representing three locations (sensu IUCN), this species has been preliminarily assessed as EN using the green listing method. This species is threatened by the presence of invasive species in the Seychelles, resulting in habitat quality reduction.

FLOWERING TIME. The species seems to flower all year round with the main season from November to May. Flowering and seed-bearing plants co-exist.

ETYMOLOGY. In reference to the Seychelles archipelago where the species is endemic.

NOTES. Moore in Baker (1877: 343) commented on a flowerless specimen at K as follows: “gathered in the Seychelles by Mr Horne, which has the habit of *Liparis flavescens*, but with smaller bracts, shorter pedicels and smaller fruits. It is probably a new species belonging either to this genus or to its close ally *Microstylis*”. Kraenzlin (1902) described *L. seychellarum* based on a collection by Andreas Schimper (1856 – 1901), a German botanist and geographer who, in 1898, took part in the SS *Valdivia* expedition which visited the Seychelles as part of its itinerary. It was transferred to the genus *Microstylis* by Schlechter (1915a). The report of the expedition did not appear until the 1920s where *Microstylis seychellarum* was included and illustrated (Diels 1922: 439). It is known that most of Kraenzlin’s type material was lost and, as the Schimper type for *L. seychellarum* has not been found, it must be assumed lost. Most of Schimper’s herbarium was kept as spirit in the Bonn (BON) herbarium but this was subsequently destroyed. Other material went to Basel (BAS) but there is no record of the plant there. The illustration in Diels (1922) could be based on Schimper’s plant but there is no direct evidence for this, it also lacks detail to be able to assign it as an Iconotype. It was therefore necessary to create a new type for the species: a specimen collected by Joseph Lister (March 4 1888, Lister s.n. (BM)) was chosen. Lister (1857 – 1927) explored the Seychelles as naturalist on H.M.S. *Egeria* from February to May 1888. The specimen is in good condition, represents the species well and was collected on Mahé at La Misère not far from Schimper’s collection locality on Mt Harrison. The neotype (*Lesoeuf* 192 in G) (indicated in error by the author as *L. bernardi* s.n., leg. *Lesoeuf* 192), chosen by Margonska *et al.* (2012: 538) is not representative.

In 1922 *Microstylis thomassetii* of Rolfe was published posthumously, based on a 1901 collection by Thomasset from the Cascade Estate on Mahé, the same area as Schimper’s type locality. There is no doubt that it is the same species. It is in fact possible that this material was collected in the same place and had the same origin. Just before his death in 1901, Schimper sent some herbarium material from the Cascade Estate to Kew (Hemsley 1916: 3) but there is no evidence that the specimen used by Rolfe to describe his *Microstylis thomassetii* did not come directly from Thomasset. Summerhayes (1931) in his enumeration of the angiosperms of the Seychelles archipelago removed Rolfe’s species to synonymy in *Microstylis seychellarum* and in 1954 he transferred it to the genus *Malaxis*. Szlachetko (1995) included the species in his new genus *Seidenfia*,

together with several other *Malaxis*, but there is no evidence for this.

ILLUSTRATIONS. Fig. 77; Diels (1922: 440); Robertson (1989: 219); Margonska *et al.* (2012: 538).

Malaxis weberbaueriana (Kraenzl.) Summerh. (Summerhayes 1934: 208). Type: Cameroon, Cameroon Mts, 1906, Weberbauer 42 (holotype B†, iconolectotype K K000106616, selected by Cribb (1984: 289)).

Liparis weberbaueriana Kraenzl. (Kraenzlin 1908: 128). *Lisowskia weberbaueriana* (Kraenzl.) Szlach. (Szlachetko 1995: 121).

Malaxis francoisii (H.Perrier) Summerh. (Summerhayes 1954: 578); Hermans *et al.* (2007: 225); Cribb & Hermans (2009: 160). Type: Madagascar, Mandraka, E Imerina, François in Perrier 17585 (holotype P) **synon. nov.**

Microstylis francoisii H.Perrier (1936: 234; 1939: 259).

Very small to small terrestrial or epiphytic plant up to 12 cm, on a tufted to creeping rhizome roots wiry, villous. *Pseudobulbs* swollen at the base, then cauliform, thin, 4 – 8 cm × 2 – 5 mm, partly covered by 2 – 3 thin sheaths with 3 – 4 apical leaves, one often considerably smaller. *Leaves* ovate, attenuate at base and tip, narrowed into a short petiole, thin, with prominent veins, pale to dark green, 3 – 7.5 × 2 – 4.5 cm. *Inflorescence* erect, thin, c. 1 – 2 mm in diam., up to 13 cm long. *Peduncle* about ½ the length of the inflorescence, with several sterile bracts towards the base. *Rachis* laxly several- to many-flowered, with up to 18 flowers. *Floral bracts* lanceolate, spreading, 2.9 – 5.3 × 1.1 – 2 mm. *Flowers* very small, erectly spreading, 3.5 – 4 × 3 – 4.1 mm including the ovary, yellowish-green to brownish-red, petals and sepals pale translucent, lip a tinted maroon-purple. *Pedicel* and *ovary* cylindrical, ridged, 2.6 – 3.1 × 0.3 – 0.8 mm. *Dorsal sepal* ovate, obtuse to attenuate, 2.1 – 3.8 × 1.1 – 1.7 mm. *Lateral sepals* ovate, oblique, 1.8 – 2.1 × 1 – 1.3 mm. *Petals* linear-lanceolate, 2.8 – 3 × 0.3 – 0.6 mm. *Lip* entire, oval to suborbicular with two elongate, somewhat pubescent swellings on each side, the base recurved and folding around the column, often surpassing the column, 1.9 – 2.6 × 1.8 – 2.8 mm. *Column* straight, with minute rounded wings at the apex, 0.6 – 0.8 × 0.3 – 0.5 mm. *Anther* below the apex of the column, broadly ovate with a small lobule at the anterior margin, c. 0.4 × 0.5 mm. *Pollinia* orbicular, c. 0.2 × 0.2 mm.

RECOGNITION. This small plant has long thin pseudobulbs, two to three (rarely four) ovate leaves with short petioles at the tip, a long, laxly flowered inflorescence, and very small flowers, with a lip with

Fig. 77. *Malaxis seychellarum*. A habit; B flower. PHOTOS: JEAN-MICHEL HERVOUET.

pubescent swellings, a base folded around the column, and a column with rounded apical wings.

The oval lip is similar to that of *Malaxis cardiophylla* but plant and leaf are different with the base of *M. cardiophylla* being more cordate than in this species, the leaves of *M. cardiophylla* also have a distinct long petiole. The lip is broader in *M. cardiophylla* which also lacks the crescent-shaped swellings, *M. weberbaueriana* has much longer basal auricles that surround or surpass the column. The column has rounded apical wings (vs angular). It differs from *M. welwitschii* from Angola by the taller elongate plant with thin pseudobulbs, shorter pseudobulb sheaths, apical ovate leaves (vs caulescent, cordate), the entire ovate lip (vs three-lobed) with the basal wings folded around the column (vs below) and the rounded (vs angular wings) of the column.

DISTRIBUTION. Cameroon, Bioko, Fernando Po, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Zaire, Zambia, Zimbabwe. Fairly widespread in Madagascar: Antananarivo, Antsiranana and Toamasina provinces (Map 57).

SPECIMENS EXAMINED. CAMEROON. Cameroon Mts, 1906, *Weberbauer* 42 (holotype B†, icono-lectotype K (K000106616)); Bamenda, Bali-Ngamba, June 1951,

Ujor 30424 (P); NW Region Boyo Laikom, Dec. 1998, 1860 m, *Etuge et al.* 4606 (K). **MADAGASCAR.** Mandraka valley, E Imerina, Feb. 1926, *François* in Herb *Perrier* 17585 (holotype P); Mts N of Mangindrano, near summit Ambohimirahavy, 1200 m, Jan. – Feb. 1951, *Humbert* 25340 K, P, REU, TAN); NW of Tsiroanomandidy, 1997, *Hermans* 3567 (K); Ambohimirahavy Mts, 1500 m, 1999, *Hermans* 2463 (K).

HABITAT. Terrestrial, evergreen forest on gneiss laterite, woodland floor. Altitude: 1200 – 1500 m in Madagascar, 1000 – 1800 m on Mainland Africa.

CONSERVATION STATUS. Category **EN**: the extent of occurrence (EOO) of *Malaxis weberbaueriana* is estimated to be 53,111 km² (which exceeds the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 12 km² (which falls within the limits for Endangered status under the criterion B2). *Malaxis weberbaueriana* is known from three subpopulations representing three locations (sensu IUCN), this species has thus been preliminarily assessed as EN using the green listing method. In Madagascar, this species is threatened by selective logging, timber harvesting for small-scale subsistence and tavy (slash-and-burn farming),

0 100 200 km

Map 57. Distribution of *Malaxis weberbaueriana*.

resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. January and February in Madagascar. December to June in mainland Africa.

ETYMOLOGY. Named by Kraenzlin for August Weberbauer (1871 – 1941) who first found the species in Cameroon and *Microstylis francoisii* H.Perrier for Edmond François (1887 – 1950).

NOTES. It was described as *Liparis weberbaueriana* by Kraenzlin (1908) from Mt Cameroon. In 1936 Perrier described *Microstylis Françoisii*, under the ICN code (Turland *et al.* 2018) this is corrected to *Microstylis francoisii* under Recommendation 60F on the use of capitals in specific names and under Article 60.7 on the use of diacritical signs. It was based on a collection by François from central Madagascar. Both were transferred, together with other *Microstylis*, to the genus *Malaxis* by Summerhayes in 1934 and 1954 respectively. Szlachetko transferred the species to his new, divisive genus *Lisowskia* in 1995. Margonska put a number of species into synonymy in her *Lisowskia welwitschii* (Rchb.f.) Marg. (Margonska 2007: 50), it is also wrongly claimed that the lectotype was designated by Szlachetko (Szlachetko & Margonska 2001: 366). Margonska (2009: 90) considered *Malaxis weberbaueriana* the same as *M. welwitschii* from Angola

(as *Lisowskia welwitschii*), in which she also included *Malaxis atrorubra*. Apart from stating that a thorough comparison was made, no other evidence or explanation was given. Looking at the types of *Liparis welwitschii* and taking into account geographical separation and variability, there are considerable differences as outlined above and the species is distinct from *Malaxis weberbaueriana*. *Malaxis francoisii* shows all the characteristics of *M. weberbaueriana* in plant habit, lip shape and column of *M. weberbaueriana*, the latter is the older name.

The transfer to *Malaxis* of *Liparis welwitschii* Rchb.f. (Reichenbach 1865: 184) was never made and is hereby validated:

***Malaxis welwitschii* (Rchb.f.) Hermans comb. nov.**

<http://www.ipni.org/urn:lsid:ipni.org:names:60479376-2>

Liparis welwitschii Rchb.f., *Flora* 48: 184 (Reichenbach 1865). Type: Angola, Golungo, 1855, Welwitsch 660a (holotype W (R39776); isotypes G, K, P).

Leptorkis welwitschii (Rchb.f.) Kuntze (1891: 671).

Lisowskia welwitschii (Rchb.f.) Marg. (Margonska 2007: 50).

ILLUSTRATIONS. Fig. 78. Williamson (1977: 111); Geerinck (1984: 271); Szlachetko & Olszewski (2001: 369); Fischer *et al.* (2010: 278).

Oberonia

***Oberonia* Lindl.** (Lindley 1830a: pl. 15). nom. cons. Type species: *Oberonia ensiformis* (Sm.) Lindl. (Lindley 1859: 4).

Iridorkis Thouars (1809: 319).

Iridorchis Thouars (1822: t.92), orth. var. of *Iridorkis*.

Titania Endl. (Endlicher 1833: 31).

Epiphytic herbs. Growths usually clustered, rarely borne on an elongated rhizome. Leaves generally iridiform and unifacial, often fleshy, articulate or not at base, distichous, often imbricate at base. Inflorescence unbranched, pubescent or glabrous. Floral bracts persistent, often erose. Flowers often in whorls, spiral to scattered, always omnidirectional on rachis, cupped, flat, reflexed, recurved. Sepals and petals free, spreading, sometimes erose. Lip sessile, entire or lobed, usually spreading, usually concave at base, lacking a callus or spur but sometimes with a thickened lip pad. Column lacking a foot and generally without wings; anther terminal, firmly attached to column apex, bilocular, pollinia waxy, four, cohering in two unequally sized pairs, viscidium absent or abbreviated;

Fig. 78. *Malaxis weberbaueriana*. Habit. PHOTO: FRANÇOIS BRIGODE.

stigma transversely reniform to ovate; rostellum protruding. Ovary glabrous to papillate (adapted from Cribb in Pridgeon *et al.* 2005: 475)

DISTRIBUTION. A genus of some 150 – 200 species centred in tropical S and SE Asia and the Malay Archipelago but extending to tropical Africa, Madagascar, the Mascarene Islands, the Philippines, New Guinea, NE Australia and the SW Pacific Islands across to Tahiti. A single species in the Madagascar region; found on Madagascar, Réunion, Mauritius, Rodriguez and also E & S Africa.

ETYMOLOGY. Named after Oberon, the fairy king who lived in hiding, in allusion to the hidden flowers of some species.

NOTES. The genus was first recognised by du Petit-Thouars in 1809, who referred to Lamarck's '*Angraecum distichum*' (= *Epidendrum distichum* Lam.) as the only species. Thouars (1822: t.92) depicted this species under the names *Iridorkis* (as *Iridorchis*) *equitans* and *Cymbidium equitans*. *Oberonia* Lindl. (Lindley 1830a) is conserved over *Iridorkis* Thouars.

Taxonomy of *Oberonia*

Oberonia disticha (Lam.) Schltr. (Schlechter 1924:

132); Perrier (1939: 253); Hermans *et al.* (2007: 236); Cribb & Hermans (2009: 160); Bernet (2010a: 106); Bosser & Lecoufle (2011: 426); Lebrun & Stork (2017: 154); Hervouet (2018: 433). Types: Île de France [Mauritius] Commerson s.n. (P02088335) (lectotype P, designated here; lectoparatypes Commerson s.n. (P03756311) & Commerson s.n., Jussieu 3871+A (P006730096) P-JUS)).

Epidendrum distichum Lam. (Lamarck 1783: 189).

Pleurothallis disticha (Lam.) A.Rich. (Richard 1828: 49).

Cymbidium equitans Thouars (1822: t.92). Type?: s. loc. Thouars 15? (P005440569).

Iridorkis equitans (Thouars) Kuntze (Kuntze 1891: 669).

Oberonia equitans (Thouars) Frapp. ex Cordem. (Frappier in Cordemoy 1895: 178) non *Oberonia equitans* (G.Forst.) Mutel 1837.

Oberonia equitans (Thouars) Schltr. (Schlechter 1915a: 411) non *Oberonia equitans* (G.Forst.) Mutel 1837.

Oberonia brevifolia Lindl. (Lindley 1830a: 16); Moore in Baker (1877: 343). Type: Mauritius, Bouton s.n. (K00718159) (holotype K-LINDL).

Malaxis brevifolia (Lindl.) Rchb.f. (Reichenbach f. 1864: 215).

Small to medium size epiphytic plant 3 – 17 cm high, with a single growth or clustered-tufted on a short rhizome, roots whitish, wiry c. 1 mm diam. *Pseudobulbs* elongate, covered with 2 – 9 caulinary iridiform pairs of leaves. *Leaves* usually imbricate, bilaterally flattened, triangular-ensiform, acute or acuminate, decreasing towards the apex, more or less fleshy, yellowish green to pale green, 2 – 8.5 × 0.5 – 2.5 cm. *Inflorescence* sessile or shortly pedunculated, erect, reclining or pendant, 4 – 12 cm long. *Peduncle* short, about ¼ of the inflorescence. *Rachis* densely racemose, cylindrical, tapering, verrucose to hirsute, with 10 to more than 100 flowers. *Floral bracts* lanceolate-acuminate, verrucose to distinctly villose, 1.1 – 2 × 0.8 – 1.1 mm. *Flowers* very small, not resupinate, c. 2 mm in diam., yellowish green to pale orange, the anther and column paler. *Pedicel* and *ovary* cylindrical to fusiform, glabrous to verrucose, 1.3 – 2.3 × 0.4 – 1.5 mm. *Dorsal sepal* broadly oval to subtriangular, acute, 0.7 – 1.2 × 0.4 – 0.8 mm. *Lateral sepals* broadly oval 0.6 – 1.2 × 0.4 – 0.7 mm. *Petals* ovate to linear, apical margin more or less serrate, 0.6 – 0.8 × 0.2 – 0.3 mm. *Lip* auriculate at the base then flabellate-cordate with the anterior margin bilobed or sinuate to denticulate, deflexed, 0.9 – 1.5 × 0.9 – 1.3 mm. *Column* short, oblong, roundly bilobed at the apex, 0.4 – 0.5 × 0.2 – 0.3 mm. *Anther* oval with a small lobule at the anterior margin, c. 0.2 × 0.2 mm. *Pollinia* ovate c. 1 mm diam. *Seed capsule* ovoid to globular with distinct rounded ridges, c. 2.5 × 2.5 mm.

RECOGNITION. This is a distinctive small to medium-sized plant with distichous leaves, a long dense inflorescence with numerous very small flowers. Lip

auriculate at the base, then flabellate-cordate with the margin bilobed to denticulate.

Oberonia disticha is very variable in plant size and shape, inflorescence and flower shape. Lip morphology, and especially the anterior margin, can vary from deeply dentate to almost entire. If the flowers were much larger it is possible that the various forms would have been classified as distinct species. *Oberonia disticha* is similar to a number of other *Oberonia* from Australasia and especially *O. equitans* (G.Forst.) Mutel (1837: 84) which is very variable itself. The plants are very similar, although *O. disticha* generally has a narrower basal sheath of the leaf. The rachis of *O. equitans* is denser, the flowers are about the same size although those of *O. equitans* are generally smaller. One of the main differences is that the pedicellate ovary of *O. equitans* is pilose to villose, that of *O. disticha* glabrous to verrucose (this may not appear so as the villose floral bract often embraces the ovary). The lip of *O. equitans* is subentire to subquadrate (vs auriculate at the base then flabellate-cordate in *O. disticha*), the anterior margin of the lip of *O. disticha* is more deeply and irregularly dentate.

DISTRIBUTION. One of the few widespread species: the Comoros, throughout Madagascar but mainly in Antananarivo and Toamasina provinces, Mauritius (including Rodrigues) and Réunion (Map 58). Also in Eastern and Southern Africa.

SPECIMENS EXAMINED. S. loc. *Thouars* s.n. P005440569 (P); s. loc. *Herb. Richard* 509 (W). **COMOROS.** Anjouan, 1000 – 1400 m, June & Aug. 1875, *Hildebrandt* 1709 (W); Grande Comore, June 1899, *Pobeguïn* s.n. P00101337 (P); 1885, *Humblot* s.n. R37830 (W); Comoros, Moheli, 600 m, June 1945, *Legrand* s.n. P00101311 (P); Grande Comore, Mioumbadjou, on Karthala, Aug. 1958, *Duran* 1196 (TAN); Nioumbadou, Aug. 1958, *Benson* 86 (P); Grande Comore, la Grille forest, May 1963, *Bosser* 17967 (P); Anjouan, Dzindi, 1964, *Lavanchie* 34 (P); Anjouan, 1964, *Lavanchie* s.n. P101339 (P); Miringoni, St. Antoine, c. 700 m, Nov. 1968, *Schlieben* 11233 (K, M); Karthala, 1300 m, March 1975, *Floret* 1294 (P); Anjouan, between Koki and Chandra, Aug. 1987, *D'Arcy* 17578 (MO); Anjouan, Ntingui Mts, 1595 m, Dec. 1990, *Hunter* 104 (MO); Grande Comore, Mdjoiezi, 340 m, Nov. 1999, *Labat & Yahaya* 3120 (CNDRS, K, MO, P); Grande Comore, Bahani, 600 m, July 2000, *Brionnaud et al.* 20 (CNDRS, K, MO, P); Grande Comore, Singani, Mdjoiezi, 410 m, July 2000, *Brionnaud et al.* 34 (CNDRS, MO, P); Karthala, Oct. 2008, 575 m, *Rouhan et al.* 894 (P); Miringoni, Nov. 2008, 890 m, *Rouhan et al.* 813 (P); N'dzwani, 800 m, Nov. 2009, *Pignat & Loup* 3690 (P); Grande Comore, *Coulon* 9. **MADAGASCAR.** *Herbier de Lamarck* s.n. P00382691 (P); s. loc. *Commerson* s.n. P00094922 (P); s. loc. *Commerson* s.n.

Jussieu 3871+A P006730095 (P-JUS); s. loc. *Commerson* s.n. (G); Ambanivola 1855, *Goudot* s.n. (G); Ankafana, 1880, *Deans Cowan* s.n. P00101302 (P); coast to capital, May 1880, *Kitching* s.n. (K); S Betsileo, 1881, *Hildebrandt* 4209 (W); Imerina, 1881, *Deans Cowan* s.n. BM00088456 (BM); Central, Jan. 1882, *Baron* 1091 (K, P); Ankeramadinika, Nov. 1886, *Fox* 59 (K ex LDS); Central, *Baron* 2188 (K, P); s. loc. 1887, *Le Myre de Vilers* s.n. P00101303-4 (P); Ambohimombo forest, 1350 – 1440 m, Dec. 1894, *Forsyth Major* 287 (K); Ambohimombo forest, 1350 – 1440 m, Jan. 1895, *Forsyth Major* s.n. (G); Ambodilasa, Nov. 1899, *Warpur* s.n. (K); Maroa, Antongil Bar, *Mocquerys* s.n. (G); Ankaratra, *Perrier* 1860bis P101333 (P); *Humblot* 379 P00101313-5 (K, P, W); between Tamatave & Antananarivo, July – Aug. 1862, *Meller* s.n. (K); Analamazaotra, Aug. 1862, *Baron* (K); *Baron* 379 (K); Mandraka forest, Oct. 1905, *d'Alleizette* 481M (P); 1905, Mandraka forest, *Alleizette* s.n. P02222760 (P); Manongarivo massif, c. 1900 m, April 1909, *Perrier* 1923 (P); Analamazaotra forest, c. 800 m, Feb. 1912, *Perrier* 1860 (P); Analamazaotra forest, 800 m, *Perrier* 11877 (P); Ambre forest, July 1917, *Poisson* 135 (P); Antanambe, Feb. 1920, *Decary* 36 (P); Andringitra massif, 1800 m, Feb. 1922, *Perrier* 14584 (P); Befotaka, Farafangana, Aug. 1926, *Decary* 5183 (P); Farafangana, Vondrozo forest, Sept. 1926, *Decary* 5323 (P); Farafangana, high Rienana valley, Oct. 1926, *Decary* 5525 (P, TAN); Itomampy basin, Mt Papanga near Befotaka, Dec. 1928, *Humbert* 6928 (P); Kalambatitra massif, 1400 – 1750 m, Nov. 1933, *Humbert* 11885 (P); Analamazaotra, Oct. 1936, *Herb. Jard. Bot. Tan.* 2162 (TAN); Analamazaotra, Oct. 1937, *Herb. Jard. Bot. Tan.* 3062 (P); Antamalaza, Oct. 1938, *Herb. Jard. Bot. Tan.* 4058 (TAN); between Vohemar and Ambilobe, July 1939, *Decary* 14722 (P); Zahamena reserve, March 1941, *Decary* 16806 (P); Zahamena reserve, March 1941, *Decary* 16731 (P); Fanovana, Eastern forest, July 1942, *Decary* 18065 (P); Antsiranana, Joffreville to Mt d'Ambre, Oct. 1944, *Homolle* 9 (P); Ankaratra, 850 m, Dec. 1944, *Cours* 2047 (K, P); Rahohevava, 960 m, March 1951, *Cours* 4277 (K, P, TAN); Sendrisoa, Ambalavao, Feb. 1953, *Rakoto* 5551RN (P, TAN); Andranomadihloha, Vohimay, Mahazony, Ambalavao, Nov. 1954, *Rakotoavao* 639 (P); Farafangana, Lahoney, Oct. 1955, *Rakotoavao* 7663RN (P); Ambatoloana, Mangatiandriana distr., Sept. 1956, *Benson* 86 (TAN); 1959, *Rauh* 1959 (HEID); Ambalavao, Aug. 1960, *Rakotoniaina* 11203RN (P); Manaka East, Ambatondrazaka, Jan. 1961, *Rakotoavao* 11775RN (P); s. loc. *Mason* 1963, 29222 (K-spirit); Périnet, 1966, *Herb. Jard. Bot. Tan.* 1340 (P); Sahamataga, Oct. 1966, *Rakatozafy* 721 (TAN); Ivohibe towards Ihosy, May 1971, *Cremers* 1524 (TAN);

Map 58. Distribution of *Oberonia disticha*.

Ampasimpotsy, 800 m, Feb. 1972, *Bosser* 21140 (P); Mandritsara, Antsiasiaika, April 1974, *Morat* 4518 (P, TAN); S of Fénérive, Feb. 1975, *Croat* 32585 (K, MO, P, TAN); Marojejy, Nov. 1983, *Deroin* 108 (P); Andasibe – Périnet area, Nov. 1984, *Dorr & Barnett* 3233 (K, MO, P); Toamasina, Alaotra-Mangoro, 1000 m, May 1984, *Dorr* 3096 (MO); W of Foulpointe, 0 – 50 m, Dec. 1984, *Barnett & Dorr* 227 (M); Tampolo forest, Oct. 1986, *Pettersson & Nilsson* 25 (K); Antananarivo, Anjozorobe forest, 1400 m, Sept. 1991, *Rakotozafy et al.* 2694 (K, MO, P, TAN); Sambirano, Mt Antsatrotro, 1500 m,

Oct. 1991, *Andrianatoandro* 008 (P); Toliara, Andohahela, 500 – 1000 m, Feb. 1993, *Malcomber et al.* 2139 (BR, K, MO, P, TAN); Masoala Peninsula, Ambanizana river, Nov. 1993, *Lance* 86 (K); Anjozorobe, 1250 – 1400 m, Jan. 1993, *Schatz* 3478 (MO); Mt d'Ambre, 1994, *Daniel duPuy* 1 (P); Antsirana, near Andranotsarabe, 1050 m, Nov. 1994, *Hermans* 3217 (K); Toamasina, Ambatondrazaka, SE of Lake Alaotra, 1120 m, Jan. 1995, *David DuPuy et al.* M796 (K, P); Antananarivo, around Lake Mantasoa, Jan. 1996, *Hermans* 3568 (K); 1996, *Muller* 16295

- (RENZ); Angavokely, Feb. 1996, *Ceplitis & Brostrom* 1012 (R, TAN); Antsiranana, 1800 m, May 2000, *Gautier & Rakotomanonjy* 3719 (P); Fianarantsoa, Mahabo-Mananivo, 24 m, Aug. 2003, *Razakamala* 745 (MO, TEF); Fianarantsoa, Fivondronana: Nosy Varika, 13 m, June 2004, *Ranaivojaona et al.* 829 (MO, P, TEF); Fianarantsoa, Andringitra, 1770 m, Jan. 2005, *Fischer & Andriantiana* 1770 (WU); Toamasina, Moramanga, 1032 m, Feb. 2005, *Antilahimena et al.* 3389 (MO, P, TAN); Analamay, Ambatovy, Ampitabe, 1109 m, Feb. 2005, *Razafindraibe & Antilahimena* 56 (MO, P); Fianarantsoa, Iakora, Begogo, Bekora, 1392 m, Feb. 2005, *Andrianjafy et al.* 855 (MO, P, TAN); Toamasina, Andasibe, Menalamba. Ambatovy, 1020 m, March 2005, *Antilahimena et al.* 3673 (MO, P, TAN); Antananarivo, Fivondronana: Anjozorobe, 1436 m, March 2005, *Rabehevitra et al.* 1364 (MO, TAN); Toamasina, Ampitambe, Ambatovy, 1173 m, March 2005, *Andriantiana* 126 (MO, TAN); Toliara, Betroka, Ivahona, Befarafara, 1102 m, May 2005, *Andrianjafy et al.* 1102 (MO, P, TAN); Fianarantsoa, Befotaka, 1239 m, Sept. 2005, *Rakotovao et al.* 2075 (TAN); Fianarantsoa, Antakohandra, Manombo, 18 m, Sept. 2005, *Razakamalala et al.* 2244 (MO, P, TAN); Toamasina, Brickaville, Maroseranana, 341 m, Nov. 2005, *Andriamihajarivo et al.* 728 (MO, P, TAN); Toliara, Betroka, Ivahona, 1424 m, Nov. 2005, *Andrianjafy et al.* 492 (MO, P, TAN); Sava, Ambodivohitra. Anjialavabe, 1156 m, March 2006, *Rakotovao et al.* 2842 (P, TAN); Antsiranana, Sava, Doany, Andranomololo, 738 m, May 2006, *Rakotovao et al.* 3194 (MO, TAN); Toamasina, Didy, Amboarabe, Est d'Antsevabe, forêt de Ambolotsangana, 1200 m, June 2006, *Andriamihajarivo et al.* 1002 (MO, TAN); Antsiranana, Doany, Andranomilolo, forêt d'Andrakengy, 942 m, Nov. 2006, *Razakamalala et al.* 2855 (MO, P, TAN); Antsiranana, Diego, Sava, Vohemar, Andrafainkona, 1427, Nov. 2007, *Razakamalala* 3687 (MO, P, TAN); Vohemar, Nov. 2007, 1327 m, *Razakamalala et al.* 3687 (P); Antsiranana, Mt d'Ambre, Nov. 2007, *Nusbaumer et al.* 2447 (G, P); Mahajanga, Fokotany Tsaravilona, 950 m, Feb. 2008, *Ravelonarivo et al.* 3031 (MO, P, TAN); Mt d'Ambre, 1000 m, April 2008, *Trigui et al.* 207 (G, P, TEF); Fivondronana, Ambatovy, 1125 m, May 2008, *Antilahimena et al.* 6126 (MO, P, TAN); Moramanga, Ambohibary, Ambatovy, 1098 m, Sept. 2008, *Miandrimanana* 366 (TAN); Toamasina, Sahafasenina, 1190 m, Dec. 2008, *Fischer & Andriantiana* 1190 (WU); Toamasina, Didy, 1108 m, Jan. 2010, *Andrianavoravelona* 230 (K, MO, TAN); Fianarantsoa, Ambalavao, Andringitra, 1600 m, Nov. 2010, *Rakotonasolo* 1671 (K, TAN); Antananarivo, Manjakandriana, Nandihizana-Carion, 1686 m, March 2011, *Rabarimanarivo et al.* 308 (MO, P, TAN); Toamasina, Analamay, 1019 m, July 2011, *Andriamiarinoro* 221 (MO, TAN); Toamasina, Andasibe, Bekalakody, Mantadia, 943 m, April 2012, *Razafindrahaja & Antilahimena* 230 (MO, P, TAN); Mantadia, 970 m, Dec. 2013, *Antilahimena et al.* 8719 (MO, TAN); Andasibe, Fokontany Falierana, 990 m, Dec. 2013, *Antilahimena et al.* 8770 (MO, TAN); Andasibe, Analamazaotra, 976 m, Dec. 2013, *Razafindraibe et al.* 511 (TAN); Andasibe, Analamazaotra, 966 m, Dec. 2013, *Razafindraibe et al.* 558 (TAN); Analamazaotra, 927 m, Dec. 2013, *Razafindraibe et al.* 625 (TAN); E of Ambalavao, *Haine* 235 (K); Central plateau, *Hodgkin & Stansfield* (K); *Blackburn* s.n. (K); 1400 – 1750 m, *Homolle* 1167 (P); *Desvaux* s.n. P00101301 (P); *Leman* s.n. Herb. Maire P00101340 (P); Angavokely, *Bosser* 14874 (P); *Bosser* 15381, 19280 (TAN); Périnet, Sept., *Herb. Bot.* 2162 (TAN); *Dorr* 1196 (TAN); *Rakoto* 11 (TAN); s. loc. *Fischer & Andriantiana* WU084706 (WU). **MAURITIUS.** s. loc. *Commerson* s.n. P02088335 lectotype (P); s. loc. *Commerson* s.n. P03756311 and s. loc. *Commerson* s.n. Jussieu 3871+A P006730096 lectoparatypes (P-JUS); s. loc. *Commerson* s.n. (G); s. loc. 1816, *Thouars* s.n. BM0088459 (BM); s. loc. 1819, *Macgregor* s.n. BM00088458 (BM); s. loc. Sept. 1849, *Boivin* s.n. P002088325 (P); s. loc. *Bouton* s.n. K00718159 (K-Lindl.); s. loc. 1864, *Bouton* Herb Hooker (K); Bois Fandaman, 1928, *Vaughan* 509 (K); Bassin Anglais, Oct. 1941?, *Vaughan* 3025 (P); Pouce Mt, April 1963, *Guého* 10671 (BM); Bassin Blanc, April 1974, *Bosser* 21850 (P); Gaulettes Serrées, March 1980, *Bosser* 19604 (MAU, P); Grand Bassin, March 1980, *Bosser* 21164 (P); Grand Bassin, March 1980, *Bosser* 22578(P); Petrin, Jan. 2004, *Pynee* 23789 (P); s. loc. *Wallich* s.n. BM00088458 (BM); s. loc. forest interior, *Bojer* Herb Hooker (K); s. loc. Herb Hooker (K); s. loc. *Bouton* s.n. P02088334 (P); s. loc. *Bojer* I 132 (W); s. loc., 1833, *Bojer* s.n. (G); Rodriguez, *Balfour* 1223, Venus Expedition BM00088457 (BM, K). **RÉUNION.** s. loc. 1846, *Armange* 162 P02088321 (P); s. loc. 1847, *Boivin* 1033 (P); s. loc. 1867, *Cordemoy* s.n. (MARS); s. loc. 1837, *Richard* 396 (P); Helle Bausy St. Martin, 1875, *del'Isle* 228 (K, P); Haut de Meniol, May 1957, *Bosser* 12203 (P); St. Philippe, Nov. 1968, *Schlieben* 10965 (P); Plaine des Palmistes, 700 m, 1969, *T. Cadet* s.n. (P); Hauts de Bras Panon, Oct. 1972, *Bosser* 21202 (P); Basse Vallée, April 1974, *Bosser* 21806 (P); Montée de la Plaine des Affouches, March 1974, *Bosser* 21735 (P); Morne des Patates à Durand, March 1974, *Bosser* 21652 (P); Montée de la plaine des Affouches, March 1974, *Bosser* 21736 (P); Les Trois Bras. May 1974, *Bosser* 22082 (P); Route de Cilaos, 600 m, Feb. 1978, *Bosser* 20725 (P); Les Marais du Bassin blanc, 1978, *Bosser* 18892 (P);

Bassin Blanc, March 1978, *Bosser* 22409 (P); Sentier Bras Rouge, Cilaos, April 1978, *Bosser* 22491 (P); April 1987, *J. Renz* 15152 (RENZ); s. loc. *Potiers* s.n. (P); s. loc. *Deltail* s.n. P02088318 (P); without data, R0068788 (W); s. loc. *Bory* s.n. R15323 (W).

HABITAT. Evergreen forest, wet dense forest, cloud forest, littoral forest, coffee plantations. Altitude: 300 – 1600 m in the Comoros, 0 – 1900 m in Madagascar, c. 500 m in Mauritius, 300 – 1200 m in Réunion.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Oberonia disticha* is estimated to be 1,566,838 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 344 km² (which falls within the limits for Endangered status under the criterion B2). With 59 known subpopulations representing 69 locations (sensu IUCN), this widespread species has been preliminarily assessed as LC using the green listing method. This species is threatened by mining activities, selective logging, timber harvesting for small-scale subsistence, tavy (slash-and-burn farming), grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction.

Previously assessed and published in the IUCN Red data listing for Réunion as LC (Picot 2013: 17).

FLOWERING TIME. October to August, but mainly June to November in the Comoros; throughout the year but mainly November to March in Madagascar; January to September, but mainly March to April, in Mauritius; March to November, but mainly March to May, in Réunion.

ETYMOLOGY. Refers to the distichous leaves, Lindley's *Oberonia brevifolia* refers to the short leaves.

VERNACULAR NAMES. 'Fontsilahinjanahary' (Baron 1901: 714; Dandouau 1909), 'Ahipisabato' (*Réserves naturelles Madagascar, Rakotovo* 11775RN (P)).

NOTES. The nomenclature and typification of the species is confusing and complex. The main complication has been the mix-up with *Epidendrum equitans* described by Johann Georg Forster (1786: 60) for a plant from Polynesia (*Oberonia equitans* (G.Forst.) Mutel 1837), the two species were often confused which is not surprising as Forster's description was very rudimentary. Meanwhile Thouars illustrated his *Cymbidium equitans* Thouars (1822: t.92), the name having been used by Swartz (1799: 72); it is unknown if the original name refers to the Forster plant from the Pacific.

Richard (1828: 49) used the name '*Pleurothallis disticha* Nob.' and listed both *Cymbidium equitans* Swartz and Du Petit-Thouars and *Epidendrum equitans* Forst. below, he also illustrated the species. At first sight it appears that Richard was creating a new species with a new name but studying the context and Richard's

methodology it seems that he had his own particular concept of precedence in nomenclature. When Richard wrote 'Nob.' he seems to be indicating that he changed either the genus, species name or both, in some instances he also used it in the traditional sense of him creating an entirely new entity. For example, in *Platyplepis goodyeroides* Nob (Richard 1828: 34) he had Thouars' *Goodyera occulta* as a 'synonym', a similar pattern is repeated for several other species. With his *Pleurothallis disticha* he simply created a new name for Swartz's & Thouars *Cymbidium* and Forster's *Epidendrum*, he listed them as 'synonyms' and cited Thouars type material amongst others. In his introduction he mentioned the link between Asian and African species and he probably started the confusion with Forster's *Epidendrum*.

Lindley (1830a: 16) employed the name *Oberonia brevifolia*, giving *Epidendrum equitans* Forst. (Pacific entity), *Cymbidium equitans* (Forst.) Sw. (Pacific entity) and *Pleurothallis disticha* Rich. (African entity) as synonyms. Lindley's name was based on Bouton s.n. (K-Lindl. 00718159), a mixed sheet collected by Louis Sulpice Bouton on Mauritius; specimens of the same origin are also in Hooker's herbarium at K and at P. Frappier in Cordemoy (1895) included as synonyms in his *Oberonia equitans* (Thouars) Frapp. ex Cordem. (African entity) the following: *Oberonia brevifolia* Lindl. (African & Pacific entity), *Epidendrum equitans* Forst. (Pacific entity), *Cymbidium equitans* (Forst.) Sw. (Pacific entity), *Pleurothallis disticha* Rich. (African entity) and *Malaxis brevifolia* (Lindl.) Rchb.f. (African & Pacific entity). Other authors (e.g. Durand & Schinz 1895: 7) more or less mixed the nomenclature of the African and the Polynesian / Asian species. Finet annotated several specimens in P as *Oberonia equitans* Mutel var. *brevifolia* (Commerson s.n., Thouars s.n. etc).

The typification of *Epidendrum distichum* is equally complex: Lamarck's description (1783: 189) mentioned plants seen by Commerson on Île de France [Mauritius] as: "observée dans l'Île de France par M. Commerson v.s.", he also confirmed seeing herbarium material (*vidi siccam*). A specimen in Lamarck's herbarium (P00382691) has '*Madagascar Com.*' on the label and may belong to the type. In addition to various collections from Madagascar, three specimens in the Paris herbarium are labelled as coming from Île de France [Mauritius], collected by Commerson: *Commerson* s.n. (P006730096), as *Epidendrum ? pusillum* and annotated in error by Finet as '*Oberonia equitans* Mantel, var. *brevifolia*'. Another *Commerson* s.n. (P02088335) has a printed label and is identified in the same way by Finet. The third is a Commerson collection in the de Jussieu herbarium with two plants: Jussieu 3871 +B on the left (P00673095) has *Cymbidium equitans* and coming from Madagascar, the one on the right Jussieu 3871+A (P006730096) is labelled in error

'*Epidendrum pusillum* ? Île de France, Commerson'. Of the three, *Commerson* s.n. (P02088335) corresponds best with Lamarck's description and is designated here as lectotype. *Commerson* s.n. (P03756311) and *Commerson* s.n. in Herb. *Jussieu* 3871+A (P006730096) are lectoparatypes. There is a similar Commerson collection in G, also labelled *Cymbidium equitans*.

The Du Petit-Thouars collection P005440569 in P refers to his *Cymbidium distichum* but the status of this type is doubtful however: '*Cymbidium equitans*' is not given on the sheet and it is not known if it was based on the Forster (Swartz) plant from the Pacific.

ILLUSTRATIONS. Fig. 79; Du Petit-Thouars (Thouars 1822: t.25); Richard (1828: t.8); Cowan (1880: 16); Perrier (1939: 255); Cadet (1989: t.56); LaCroix & Cribb (1995: 287); Du Puy *et al.* (1999 pl.31); Hermans *et al.* (2007: pl.48); Cribb & Hermans (2009: 163); Bernet (2010a: 104); Bosser & Lecoufle (2011: 426); Paillet *et al.* (2013: 57); Szelengowicz & Tamon (2013: 377); Hervouet (2018: 433).

Stichorkis

Stichorkis Thouars (1809: 318), lectotype: *Stichorkis disticha* (Lam.) Pfitzer (1897: 103) designated by Rasmussen (1979: 132), Typ. Cons.

Stichorchis Thouars (1822: Tab. 1 & t.90).

Distichis Thouars ex Lindl. (Lindley 1847: 181).

Liparis Rich. Sect. *Distichae* Ridl. (Ridley 1886b: 244).

Disticholiparis Marg. & Szlach. (Margonska & Szlachetko 2004: 175).

Epiphytic or rarely terrestrial or lithophytic *plants*. Rhizome creeping, covered by tubular scales. *Stem* pseudobulbous, erect, one-noded, clustered or not, covered when young by 2 – 5 sterile sheaths, one-leaved at apex. *Leaf* erect, linear or oblanceolate, conduplicate. *Inflorescence* erect, racemose, rachis laterally flattened, shorter than peduncle; floral bracts distichous, imbricate. *Flowers* non-resupinate, opening in succession, usually yellow, green, or orange, often translucent. *Sepals* recurved, dorsal sepal free, lateral

Fig. 79. *Oberonia disticha*. A plants in habitat; B inflorescence. PHOTOS: JOHAN HERMANS.

sepals sometimes fused for part or all of length. *Petals* free, often linear and unlike sepals, erect. *Lip* often reflexed, entire or lobed, usually with a pad-like callus, concave at the base, lacking a spur. *Column* incurved-arcuate, laterally winged near apex; anther attached by a slender filament, biloculate, pollina waxy, ovoid bilaterally flattened, four in two parts, each with a small viscidium; stigma concave; rostellum thin-textured, blunt (adapted from Cribb in Pridgeon *et al.* 2005: 483).

DISTRIBUTION. A genus of some 38 species from the Mascarenes, Comoros, the Malay Archipelago, the Philippines, New Guinea, Australia and the SW Pacific Islands. Pridgeon *et al.* (2005: 485) reports the genus from Madagascar in error.

ETYMOLOGY. From the Greek *Stichos*, row or rank, and *Orchis*, orchid, in reference to the two distichous rows of bracts that characterise this genus.

NOTES. Du Petit-Thouars described *Stichorkis* and *Leptorkis* (Thouars 1809: 317 – 318). *Stichorkis* has most often been included in *Liparis* Rich. (Richard 1817: 21) (conserved over *Leptorkis* Thouars), but it is now recognised as distinct. Thouars (1822) considered *Stichorkis* to comprise two species, one of which was already described by Lamarck as *Angraecum cespitosum* (= *Epidendrum cespitosum* Lam.). He described the other species as *S. distichis* Thouars, with *Malaxis disticha* as alternative name, and depicted it with *S. cestichis* Thouars (alternatively *Malaxis cespitosa* (Lam.) Thouars).

The Thouarsian new-style epithets ‘*Distichus*’ and ‘*Cestichis*’ which appeared at the lower left corner of the illustrations of Thouars (1822) were mistaken for generic names by Lindley. Pfitzer (1888) accepted *Stichorkis* as a distinct genus but used Lindley’s erroneous name ‘*Cestichis*’. Pfitzer (1897: 103) corrected this mistake and made four combinations in *Stichorchis*. Ames (1905, 1908), apparently unaware of Pfitzer’s work, used *Cestichis* Lindl. ex Pfitz. for some Asiatic species. Schlechter (1911a) used ‘*Cestichis*’ as a name for a subgenus.

Rasmussen (1979) reviewed some of the nomenclatural problems caused by the confusion over the two sets of names used by Thouars and suggested conservation of *Liparis* against *Stichorkis*, but he recognised that this concept represents a well-defined group of species and lectotypified *Stichorkis* with *Malaxis disticha* Thouars. Based on the same species, Ridley (1886b) recognised *Liparis* sect. *Distichae* with an epiphytic habit, single-leaved pseudobulbs, a linear to oblanceolate leaf, a flattened rachis with distichous, imbricate bracts and flowers opening in succession.

Margonska & Szlachetko (2004: 175) superfluously established the genus *Disticholiparis*, based upon the morphological characters listed above, for this group of distinctive species. They were unaware of Rasmussen’s lectotypification of *Stichorkis*.

The DNA analysis of Cameron (2005) indicated that *Liparis* is polyphyletic, the species of *Liparis* sect. *Distichae* forming a clade sister to both *Oberonia* and another group of epiphytic *Liparis* with linear leaves. On the basis of his results, *Stichorkis* has now been accepted.

Thouars did not indicate a type in his rudimentary description of 1809, but erroneously included Lamarck’s *Angraecum caespitosum*. Rasmussen (1979) therefore selected *Stichorkis disticha* as the type for the genus based on Thouars 1822 work. Szlachetko *et al.* (2008) rejected this interpretation but have not been followed by other botanists.

Taxonomy of *Stichorkis*

Stichorkis disticha (Thouars) Pfitzer (1897: 103); Bernet (2010a: 88). Type: Réunion – Mauritius, s. loc., Thouars 17 (holotype P, P00112462).

Liparis disticha (Thouars) Lindl. (Lindley 1824: sub t.882); Frappier in Cordemoy (1895: 180).

Malaxis disticha Thouars (1822: t.89).

Cestichis disticha Pfitzer (1888: 131).

Liparis disticha (Thouars) A.Rich. (Richard 1828: 54); Hermans *et al.* (2007: 218).

Leptorkis disticha Kuntze (1891: 671).

Disticholiparis disticha (Thouars) Marg. & Szlach. (Margonska & Szlachetko 2004: 178).

Liparis gregaria Lindl. (Lindley 1830a: 33); Moore in Baker (1877: 343).

Disticholiparis gregaria Marg. & Szlach. (Margonska & Szlachetko 2004: 178).

Stelis micrantha Sieb. ms. in Herb. Maur. 168 (G, P).

Medium-sized, erect epiphytic or lithophytic *plant* up to 20 cm high, on a short, branching rhizome, roots thin, wiry. *Pseudobulbs* ovoid to pyriform, more or less angular, 8 – 15 × 5 – 12 mm, covered with 3 – 5 lanceolate-acute sheaths, the upper ones longer (up to 25 mm), disintegrating with age, a single leaf at the apex. *Leaf* linear, bilobulate-acute at the apex, longly attenuate at the base, 12 – 20 × 0.9 – 1.5 cm. *Inflorescence* terminal, more or less arching, 8 – 18 cm long with up to 20 flowers. *Peduncle* thin, about $\frac{2}{3}$ of the inflorescence, with 1 – 3 amplexant sheaths. *Rachis* flattened, covered with prominent floral bracts, 1 – 5 cm long. *Floral bracts* distichous, initially partly overlapping becoming distant with age, some without flower, greenish-yellow, persistent, oval acute, 3 – 6.5 × 1.5 – 1.8 mm. *Flowers* medium in size, overall av. 12 × 6 mm, 2 to 10, opening in succession, sepal and petals greenish yellow to orange, lip darker yellow to dark orange. *Pedicel* and *ovary* cylindrical, recurved at the base, 6 – 9 × 0.8 – 2 mm. *Dorsal sepal* reclined and almost parallel with the ovary, narrowly oval, acute, 4.5 – 7 × 2 – 2.5 mm. *Lateral sepals* descending, the margins recurved obliquely oval-acute, 5 – 7 × 2.1 – 3.2 mm. *Petals* erect, margins recurved, linear obtuse, 3.8 – 7 × 1.1 × 1.5 mm, sometimes a little

wider at the tip. *Lip* pandurate, recurved at the base, the margins forming two rounded lobes, at the angular basal part carrying 2 small calli, the middle inflexed, the terminal part triangular-acute, recurved, $3.6 - 5.5 \times 2 - 4.1$ mm. *Column* triangular with the base very broad, wings triangular-acute towards the apex, $2.1 - 3 \times 1.1 - 2$ mm. *Anther* oval, with a small lobule at the anterior margin, c. 0.4×0.5 mm. *Pollinia* ovate, in two parts, c. 0.3×0.2 mm. *Seed capsule* ovoid, triangular, $8 - 10 \times 4 - 5$ mm.

RECOGNITION. *Stichorkis disticha* is a medium-sized pseudobulbous epiphyte with a single linear leaf, flattened rachis, with large distichous floral bracts, medium-sized, and orange-yellow flowers, with a pandurate lip with two calli at the base, column that is broad at the base, and has triangular wings.

It is vegetatively similar to some of the Asian species in the genus, especially *Stichorkis gibbosa* (Finet) Cootes (syn. *Liparis gibbosa* (Finet) J.J.Wood (in Wood *et al.* 2011: 531)) from tropical Asia and the SW Pacific but the lip and calli are a different shape with the lip pandurate — two-lobed vs four-lobed, with two distinct

calli vs ecallose and the floral bracts are about a third shorter in *Stichorkis disticha*.

DISTRIBUTION. Comoros (Grande Comore, Anjouan), Mauritius and Réunion (Map 59).

SPECIMENS EXAMINED. S. loc., *Thouars* 17 (holotype P, P00112462); s. loc. Herb. *Blackburn* s.n. (K); s. loc., *Bélanger* 1828 – 1829 (G); s. loc., ex Herb. Paris 1821, Herb. *de Candolle* s.n. (G). **COMOROS.** Grande Comore, June 1899, *Pobéguin* s.n. (P); Grande Comore, March 1989, *Monnerat* 23 (P); Grande Comore, Maoueni, la Grille forest, 780 m, Nov. 1999, *Labat et al.* 3091 (P); Anjouan, 1999, *Hermans* 5100 (K); Grande Comore, Maoueni, La Grille forest, 830 m, July 2000, *Brionnaud et al.* 10 (CNDRS, K, MO, P); Karthala, 890 m, Oct. 2008, *Rouhan et al.* 810 (P); Anjouan, *Bosser* Jard. Bot. Tan. 492 (P). **MAURITIUS.** s. loc. 1828, *Sieber* s.n. in Herb de Candolle (G); s. loc. *Sieber* s.n. in Herb *Moricand* (G); s. loc. leg. *Sieber* s.n. (G); Grand Bassin, *Bouton* s.n. 1830 (K, P); s. loc. *Bouton* s.n. (G); s. loc., *Blackburn* in herb. *Henslow* (CGE); s. loc. 1835, Herb. *Shuttleworth* s.n. BM00090080 (BM); s. loc., 1838 herb. *Sieber* 108 & 168

Map 59. Distribution of *Stichorkis disticha*.

Fig. 80. *Stichorkis disticha*. A habit; B inflorescence. PHOTOS: JOHAN HERMANS.

(P); s. loc. Ayres s.n. rec. Feb. 1864 (K, P); s. loc. Commerson s.n. (P); Cascade des Galets, Sept. 1941, Vaughan 3020 (MAU, P); Plaine Paul, March 1963, Guého 10672 (MAU, P); Aug. 1975, Guého 17502 (MAU, P); Gaulettes Serrées, March 1980, Bosser 22581 (P); Gaulettes Serrées, May 1997, Page 24179-80 (MAU); Gaulettes Serrées, near Camp Thorel, June 1997, Florens et al. 22808 (MAU, P); Gaulettes Serrées, 420 m, Dec. 1998, Florens et al. 22977 (MAU, P); Pouce, c. 800 m, May 2000, Florens et al. 23335 (P). **RÉUNION.** s. loc., 1829, Goudot s.n. (G); s. loc., 1829, Herb Moricand (G); s. loc., 1847 – 1852, Boivin 1037 (P); s. loc. Richard 400 (P); Salazii, Cordemoy 8bis (P); s. loc., Richard s.n. (G, K-Lindl.); s. loc., Boivin s.n. (K); s. loc., 1876, DeLisle s.n. (P); Saint Philippe (Mare Longue), 300 m, May 1957, Bosser 11880 (P); Cilaos, Nov. 1967, Staub 13009 (P); Route de Cilaos, 500 – 600 m, Feb. 1971, Bosser 20721 (P); Îlet à Guillaume, Dec. 1971, Bosser 21032 (P); Hell-bourg-Bélome, Dec. 1972, Bosser 21593 (P); Îlet à Guillaume path, 700 m, Jan. 1972, Friedmann 1546 (P); Bassin Blanc, April 1974, Bosser 21852 (P); Grand Matarum, March 1974, Bosser 21699 (P); Grande Chaloupe, 400 m, Jan. 1975, Bernardi 14997 (G); forest of Brûlé de Baril, 300 m, 18 May 1977,

T. Cadet s.n. (P); Cilaos, 1400 m, 5 Feb. 1969, J. Cadet 1985 (P); Saint-Denis, Bois de Nefles, 1050 m, April 2006, Ferard & Pausé 1969 (CBNM); Le Tampon, Grand Bassin, sentier Piton, 1250 m, Jan. 2006, Grondin & Lavergne 1832 (CBNM); s. loc., Rauh 10243 (HEID); Van Heurck s.n. (P); Delteil s.n., Herb. Drake (P); Desvaux 270 (P); Cosson s.n. (P).

HABITAT. Dense humid forest, evergreen forest, locally forming small populations on tree trunks, main branches or rock in undergrowth. Altitude: 300 – 1400 m.

CONSERVATION STATUS. Category **LC**: the extent of occurrence (EOO) of *Stichorkis disticha* is estimated to be 3,899,035 km² (far exceeding the limits for Vulnerable status under criterion B1) whereas its minimal area of occupancy (AOO) is estimated to be 64 km² (which falls within the limits for Endangered status under the criterion B2). With 11 known subpopulations representing 13 locations (sensu IUCN), this species has been preliminarily assessed as LC using the green listing method. This species is threatened by selective logging, timber harvesting for small-scale subsistence, slash-and-burn farming, grazing and anthropogenic fires, resulting in habitat reduction and habitat quality reduction.

FLOWERING TIME. Throughout the year but mainly from December to March.

ETYMOLOGY. Refers to the distichous habit of the rachis and floral bracts.

NOTES. The species was first described and illustrated by Thouars in 1822 as *Malaxis disticha*. He was not specific on the origin of the type specimen but in the accompanying table he recorded it both from Mauritius and Réunion. Due to confusion over Thouars' complex nomenclature, Lindley both transferred it to *Liparis* in 1824 and created *L. gregaria* in 1830, now considered conspecific with it. Pfitzer finally transferred the species to *Stichorkis* in 1897. Several Sieber specimens of this species in P and G are labelled '*Stelis micrantha*' in error. *Stichorkis* is morphologically distinct and is also supported as separate from *Liparis* in genetic evidence.

ILLUSTRATIONS. Fig. 80; Du Petit-Thouars (Thouars 1822: t.89); Cadet (1989: 54); Bernet (2010a: 88); Pailler *et al.* (2013: 61); Szelengowicz & Tamon (2013: 374).

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