adansonia

2025 • 47 • 11

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art. 47 (11) — Published on 21 July 2025
www.adansonia.com

PUBLICATIONS SCIENTIFIQUES

MUSÉUM NAL HIST NATURELLE

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Adansonia est une revue en flux continu publiée par les Publications scientifiques du Muséum, Paris
Adansonia *is a fast track journal published by the Museum Science Press, Paris*

Les Publications scientifiques du Muséum publient aussi / *The Museum Science Press also publish:* ***Geodiversitas***, ***Zoosystema***, ***Anthropozoologica***, ***European Journal of Taxonomy***, ***Naturae***, ***Cryptogamie*** **sous-sections** ***Algologie***, ***Bryologie***, ***Mycologie, Comptes Rendus Palevol***

Diffusion – Publications scientifiques Muséum national d'Histoire naturelle
CP 41 – 57 rue Cuvier F-75231 Paris cedex 05 (France)
Tél.: 33 (0)1 40 79 48 05 / Fax: 33 (0)1 40 79 38 40
diff.pub@mnhn.fr / http://sciencepress.mnhn.fr

ISSN (imprimé / *print*): 1280-8571/ ISSN (électronique / *electronic*): 1639-4798

Revision of the genus *Benthamia* A.Rich. (Orchidaceae, Orchidioideae, Habenariinae)

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Submitted on 3 September 2024 | accepted on 29 December 2024 | published on 21 July 2025

Hervouet J.-M., Descourvières P., Hermans J. & Longou L. 2025. — Revision of the genus *Benthamia* A.Rich. (Orchidaceae, Orchidioideae, Habenariinae). *Adansonia*, sér. 3, 47 (11): 171-249. https://doi.org/10.5252/adansonia2025v47a11. http://adansonia.com/47/11

ABSTRACT
A revision of the genus *Benthamia* A.Rich is presented, based on herbarium material, literature and field observations. A taxonomic history of the genus is given. Thirty-one species are recognized and described. Seven new species are described: *Benthamia litoralis* Hervouet & Descourv., sp. nov., *Benthamia decaryana* Descourv. & Hervouet, sp. nov., *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov., *Benthamia mascula* Hervouet & Descourv., sp. nov., *Benthamia trifida* Hermans & Hervouet, sp. nov., *Benthamia corona* Hermans & Hervouet, sp. nov., *Benthamia vulcanorum* Hervouet & Descourv., sp. nov. A new form is established: *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb f. *reticulata* Hervouet & Descourv., f. nov. One subspecies is raised to species level: *Benthamia herminioides* subsp. *arcuata* H.Perrier becomes *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov., seven taxa are reduced to synonymy: *Benthamia herminioides* subsp. *angustifolia* H.Perrier is a synonym of *Benthamia perfecunda* H.Perrier, *Benthamia verecunda* Schltr. and *Benthamia nigrovaginata* H.Perrier are synonyms of *Benthamia elata* Schltr., *Benthamia exilis* var. *tenuissima* Schltr. is a synonym of *Benthamia exilis* Schltr., *Benthamia herminioides* subsp. *intermedia* is a synonym of *Benthamia herminioides* Schltr., *Benthamia nivea* subsp. *parviflora* H.Perrier is a synonym of *Benthamia nivea* Schltr., *Benthamia perularioides* Schltr. is a synonym of *Benthamia rostrata* Schltr. Two species remain undescribed because they are known only from photographs, four specimens are discussed for their specific interest and are potentially new species but this remains to be confirmed when more data becomes available. Twelve taxa are lectotypified: *B. calceolata* H.Perrier, *B. elata* Schltr., *B. exilis* var. *tenuissima* Schltr., *B. nigrovaginata*

KEY WORDS
Orchidaceae,
Madagascar,
Mascarenes,
La Réunion,
Mauritius,
Comoros,
Seychelles,
conservation,
new synonyms,
new status,
lectotypifications,
epitypifications,
new forma,
new species.

H.Perrier, *B. verecunda* Schltr., *B. nigrescens* subsp. *borbonica* H.Perrier, *B. nigrescens* subsp. *humblotiana*, *B. catatiana*, *B. humbertii* H.Perrier, *B. melanopoda* Schltr., *B. perularioides* Schltr., *B. praecox* Schltr. Three species, *Benthamia dauphinensis* (Rolfe) Schltr., *Benthamia macra* Schltr. and *Benthamia misera* (Ridl.) Schltr., are considered ambiguous or insufficiently known. *Benthamia longecalceata* H.Perrier, is excluded, being a synonym of *Cynorkis falcata* (Frapp.) Schltr. *Benthamia micrantha* (Frapp. ex Cordem.) Hermans & Hervouet (*nom. illeg.*) is excluded, being *Cynorkis micrantha* (Frapp. ex Cordem.) Schltr. The relationship with other genera is investigated and several groups of similar species within the genus *Benthamia* are proposed as a starting point for a subgeneric classification.

RÉSUMÉ

Révision du genre Benthamia *A.Rich. (Orchidaceae, Orchidioideae, Habenariinae).*

Cet article présente une révision du genre *Benthamia* A.Rich, fondée sur des observations de terrain et des spécimens d'herbier. L'histoire du genre est présentée. 31 espèces sont reconnues. Sept nouvelles espèces sont décrites : *Benthamia litoralis* Hervouet & Descourv., sp. nov., *Benthamia decaryana* Descourv. & Hervouet, sp. nov., *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov., *Benthamia mascula* Hervouet & Descourv., sp. nov., *Benthamia trifida* Hermans & Hervouet, sp. nov., *Benthamia corona* Hermans & Hervouet, sp. nov., *Benthamia vulcanorum* Hervouet & Descourv., sp. nov. Une nouvelle forme est décrite : *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb f. *reticulata* Hervouet & Descourv., f. nov. Une sous-espèce est élevée au rang d'espèce : *Benthamia herminioides* subsp. *arcuata* H.Perrier devient *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov., sept taxons sont placés en synonymes d'autres espèces : *Benthamia herminioides* subsp. *angustifolia* H.Perrier est synonyme de *Benthamia perfecunda* H.Perrier, *Benthamia verecunda* Schltr. et *Benthamia nigrovaginata* H.Perrier comme synonymes de *Benthamia elata* Schltr., *Benthamia exilis* var. *tenuissima* Schltr. comme synonyme de *Benthamia exilis* Schltr., *Benthamia herminioides* subsp. *intermedia* comme synonyme de *Benthamia herminioides* Schltr., *Benthamia nivea* subsp. *parviflora* H.Perrier comme synonyme de *Benthamia nivea* Schltr., *Benthamia perularioides* Schltr. comme synonyme de *Benthamia rostrata* Schltr. Deux espèces dont on ne possède que des photos sont mentionnées mais non décrites. L'attention est attirée sur quatre spécimens intéressants et qui pourraient se révéler être des nouvelles espèces, insuffisamment documentées pour l'instant. Douze taxons sont lectotypifiés: *B. calceolata* H.Perrier, *B. elata* Schltr., *B. exilis* var. tenuissima, *B. nigrovaginata* H.Perrier, *B. verecunda* Schltr., *B. nigrescens* subsp. *borbonica* H.Perrier, *B. nigrescens* subsp. *humblotiana*, *B. catatiana*, *B. humbertii* H.Perrier, *B. melanopoda* Schltr., *B. perularioides* Schltr., *B. praecox* Schltr. Trois espèces sont considérées comme ambiguës ou insuffisamment connues : *Benthamia dauphinensis* (Rolfe) Schltr., *Benthamia macra* Schltr. et *Benthamia misera* (Ridl.) Schltr. *Benthamia longecalceata* H.Perrier, est exclue car synonyme de *Cynorkis falcata* (Frapp.) Schltr. *Benthamia micrantha* (Frapp. ex Cordem.) Hermans & Hervouet (*nom. illeg.*) est exclue, étant *Cynorkis micrantha* (Frapp. ex Cordem.) Schltr. Enfin les relations avec d'autres genres sont envisagées et différents groupes d'espèces semblables au sein du genre *Benthamia* sont donnés comme base d'une future subdivision du genre.

MOTS CLÉS
Orchidaceae,
Madagascar,
Mascareignes,
Île de La Réunion,
Île Maurice,
Comores,
Seychelles,
conservation,
synonymes nouveaux,
statut nouveau,
lectotypifications,
épitypifications,
formes nouvelles,
espèces nouvelles.

INTRODUCTION

The need for a revision of the genus *Benthamia*

In 2024 the genus *Benthamia* comprised 32 species, five subspecies and one variety (Plants Of the World Online (POWO): https://powo.science.kew.org, on November the 4th) from the West Indian Ocean.

We give in the next section, for reference, a detailed history of the genus, from 1828 on, leading to the current state of the art at the beginning of this study. It will be seen that species currently recognised as *Benthamia* have been previously classified in *Cynorkis*, *Habenaria*, *Hemiperis*, *Herminium*, *Holothrix*, *Peristylus, Platanthera* and *Rolfeella.*

This complicated history and a morphological examination showing a large diversity suggest that *Benthamia* as currently circumscribed is not monophyletic.

A majority of species have a scrotiform or very small spur and show an affinity with the type of the genus *Benthamia latisatis* (Thouars) Bytebier, they are mostly terrestrial but not exclusively. Others, mostly epiphytes, have tubular flowers. One species, *Benthamia calceolata*, stands apart with a calceolate lip. Finally, a number of species have cylindrical spurs and are reminiscent of *Cynorkis* or *Habenaria*.

Ngugi *et al.* (2020) published the first phylogenetic study showing that *Benthamia* is polyphyletic. The study included five species of *Benthamia*. Two species with long spurs, namely *Benthamia monophylla* (under the name *B. bathieana*) and *B. rostrata* (under the name *B. perularioides)*, appeared to be embedded in *Cynorkis*. Three species with short spurs, namely *Benthamia africana* (under the names *B. spiralis* and *B. sp.)*, *B. erinacea* (under the name *B. nigrescens*) and *B. flavida*, appeared to be close to the genus *Tylostigma,* and closer to *Habenaria* than to *Cynorkis*. We will come back to this study and the possible

groups of species within the genus *Benthamia* in the discussion, once nomenclatural issues have been solved.

Other molecular studies, with more species, will help characterise the genus *Benthamia*, but a key issue appears to be the correct identification of specimens. As is the case with many difficult genera, a large number of *Benthamia* specimens remain unidentified in herbaria, many are incorrectly identified, others are misfiled under other genera, and a number are labelled *Benthamia* but are not. A complete revision is therefore necessary. Molecular work can help, but ultimately taxa will need to be circumscribed on the basis of morphology, it thus appeared necessary to identify morphologically the existing specimens, thereby avoiding compromising further DNA analysis by misidentifications and this is the goal of the present study. The remaining taxonomical problems can then be addressed by later studies.

History of the genus *Benthamia*

The genus was created in 1828 by Achille Richard (Richard 1828: 37) for two species, *Benthamia latifolia* A.Rich., a new combination for *Satyrium latifolium* Thouars, and *Benthamia spiralis* A.Rich. Richard placed his new genus in the tribe Ophrydeae. Lindley (1835: 297) considered the genus *Benthamia* to be a synonym of the genus *Peristylus*. In Ridley's work on orchids of Madagascar (Ridley 1885), *Benthamia* was merged into *Habenaria*, with, in a section *Peristylus*, *Habenaria spiralis*, *Habenaria minutiflora* Ridl., which was later reduced into the synonymy of the former, and *Habenaria misera* Ridl. The year after (Ridley 1886) he described *Holothrix glaberrima*, which Perrier moved to *Benthamia* (Perrier 1934). In Kraenzlin's major work (Kraenzlin 1899) *Benthamia* was not included, members of the genus were scattered e.g. in *Herminium* and *Platanthera*. Schlechter (1915) published a critical evaluation of orchids in Madagascar, Mascarenes, the Comoros and Seychelles, in which all *Benthamia* species appeared as *Habenaria* or *Cynorkis*. Schlechter (1916) after studying the specimens collected in Madagascar by Perrier de la Bâthie, described *Benthamia nigrescens*, *B. procera*, *B. flavida*, *B. perrieri* (which, in 1925, he considered a synonym of *B. flavida*), and *B. praecox*. He also mentioned *Benthamia latifolia* A.Rich. from Mt. Ibity in Madagascar, which he later described as the new species *Benthamia bathieana* Schltr. In 1918 he added *Benthamia elata* (Schlechter 1918). In the year before his death, Schlechter (1924), created *Benthamia bathieana*, *B. dauphinensis* (based on *Habenaria dauphinensis* Rolfe), *B. exilis* and its variety *tenuissima*, *B. herminioides*, *B. macra*, *B. melanopoda*, *B. misera* (based on *Habenaria misera* Ridl.), *B. monophylla*, *B. nivea*, *B. perularioides*, *B. rostrata* (a new name for his *Platanthera madagascariensis* published in 1916, which was a *nom. illeg.*) and *B. verecunda*. He moved three species, *Holothrix madagascariensis* Rolfe, *Habenaria minutiflora* Ridl. and *Habenaria misera* Ridl, to the genus *Benthamia*. After Schlechter's death, Henri Perrier de la Bâthie (Perrier 1934) revised and published a monography of the genus, with a key. He included twenty-five species and created *Benthamia calceolata*, *B. catatiana*, *B. cuspidata*, *B. nigrovaginata* and *B. humbertii*. He also added four sub-species to *Benthamia nigrescens*: subsp. *borbonica*, subsp. *decaryana*, subsp. *humblotiana*, subsp. *secundiflora*, three sub-species to *Benthamia herminioides*: subsp. *angustifolia*, subsp. *arcuata* and subsp. *intermedia*, and a sub-species to *Benthamia nivea*: subsp. *parviflora*. Subsequently, he placed *Holothrix glaberrima* Ridl. and also *Habenaria cinnabarina* Rolfe in the genus *Benthamia*, with *Benthamia flavida* Schltr. as a new synonym, but this was contradicted in 2014 by J. Hermans & P.J. Cribb (Hermans & Cribb 2014) who placed *Habenaria cinnabarina* in *Cynorkis*. Perrier recognised *Benthamia minutiflora* (Ridl.) Schltr. as a synonym of the former *Satyrium spirale* published by Thouars in 1822. Based on plants collected by Henri Humbert and others in Madagascar, Perrier (Perrier 1951) created four more species: *Benthamia leandriana* (later renamed *Cynorkis tryphioides* var. *leandriana* by Jean Bosser in 1969, later becoming *Cynorkis leandriana* (Perrier) Hervouet in 2022), *Benthamia longecalceata* (here considered to be *Cynorkis falcata* (Frapp.) Schltr. from La Réunion), *Benthamia majoriflora* and *B. perfecunda*. Dressler (1990: 191) placed the genus *Benthamia* in the subtribe Habenariinae, together with *Peristylus* and *Tylostigma*. In 1998, Garay & Romero (1998) considered *Satyrium latifolium* Thouars to be illegitimate, being a name already used by Linnaeus, and thus created *Benthamia chlorantha* (Spreng.) Garay & Romero, based on *Habenaria chlorantha* Spreng. (1826). In the year 2000, Szlachetko & Rutkowski (2000) transferred *Oligophyton drummondii* Linder & Williamson to *Benthamia* and created *Benthamia drummondii* (Linder & Williamson) Szlach. & Rutk., although this is generally not accepted. Cribb, in *Genera Orchidacearum* vol. 2 (Pridgeon *et al.* 2001: 261), recognises about 25 species of *Benthamia*, endemic to Madagascar and the Mascarenes. In 2014, J. Hermans (in Hermans & Cribb 2014) argued that Thouars's name *Satyrium spirale* is illegitimate as it had been used already by Swartz in 1788, for a plant from Jamaica. Lindley (1824: t. 823) consequently described *Spiranthes africana* based upon Thouars's *Satyrium spirale* and his epithet now prevails. In 2014, Hervouet *et al.* (2014) published two new species, *B. boiteaui* and *B. bosseri*, found on the Ambondrombe mountain in Madagascar, the type material for both having been collected by Pierre Boiteau in April 1941.

Chase *et al.* (2015), in their updated classification of Orchidaceae, lumped Orchidinae and Habenariinae in one subtribe. However, Ngugi *et al.* (2020), including 368 samples representing 278 species of Orchideae, showed that a subdivision in three subtribes, Bartholininae, Orchidinae and Habenariinae, is perfectly justified, and that all *Benthamia* (and all *Cynorkis* but two) belong to Habenariinae.

In 2021, J. Hermans and P.J. Cribb (Hermans & Cribb 2021), in preparation for the publication of the « Flore des Mascareignes » volume on Orchidaceae, created *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb, based on *Habenaria erinacea* Cordemoy, preceding *Benthamia nigrescens* Schltr. by 21 years, the latter hence a new synonym. In addition, all the former subspecies of *Benthamia nigrescens* were merged into this taxon. *Habenaria spiraloides* Cordem., described in 1895, was also recognised as a *Benthamia* under the name *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb.

Finally, in 2025 Bytebier coined the new name *Benthamia latisatis* (Thouars) Bytebier for the type of the genus, based on the Thoursian name *Satorkis latisatis*, replacing *Benthamia chlorantha* (Spreng.) Garay & Romero.

KEY TO THE GENUS *BENTHAMIA* A.RICH.

1. Spur elongated, cylindrical 2
— Spur short, scrotiform 7

2. Leaves reduced to sheaths or not developed at flowering 3
— Leaves developed at flowering 4

3. Lip clearly trilobed ..... *Benthamia praecox* Schltr.
— Lip obscurely trilobed ..... *Benthamia exilis* Schltr.

4. Leaf single 5
— More than one leaf 6

5. Lip trilobed ..... *Benthamia glaberrima* (Ridl.) H.Perrier
— Lip entire ..... *Benthamia monophylla* Schltr.

6. Leaves 2, rarely 3 ..... *Benthamia rostrata* Schltr.
— Leaves 3 to 6 ..... *Benthamia bathieana* Schltr.

7. Spur scrotiform or dorso-ventrally flattened 8
— Spur a simple hollow at the base of the lip ..... *Benthamia boiteaui* Hervouet

8. Plants epiphytic 9
— Plants terrestrial 14

9. Plants more than 45 cm tall ..... *Benthamia majoriflora* H.Perrier
— Plant less than 45 cm tall 10

10. Lip entire or obscurely trilobed ..... *Benthamia erinacea* (Cordem.) Hermans & P.J.Cribb
— Lip distinctly trilobed 11

11. Lobes of lip truncate ..... *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov.
— Lobes of lip not truncate 12

12. Sepals green, petals white ..... *Benthamia trifida* Hermans & Hervouet, sp. nov.
— Sepals white or off-white 13

13. Flowers pure white ..... *Benthamia nivea* Schltr.
— Flowers off-white ..... *Benthamia corona* Hermans & Hervouet, sp. nov.

14. Petals white 15
— Petals green or yellow 16

15. Basal leaf solitary ..... *Benthamia herminioides* Schltr.
— Basal leaves several ..... *Benthamia madagascariensis* (Rolfe) Schltr.

16. Leaf solitary 17
— Leaves several 19

17. Lip calceolate ..... *Benthamia calceolata* H.Perrier
— Lip not calceolate 18

18. Leaf linear ..... *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb
— Leaf elliptic or elliptic-lanceolate ..... *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov.

19. Leaves near middle of stem 20
— Leaves basal 24

20. Leaves 5 or more ..... *Benthamia spiralis* (A.Rich.) A.Rich.
— Leaves fewer than 5 21

21. Flowers arranged in 3 rows ..... *Benthamia perfecunda* H.Perrier
— Flowers not arranged in 3 rows 22

22. Lip with prominent callus ..... *Benthamia melanopoda* Schltr.
— Lip lacking a prominent callus 23

KEY TO THE GENUS *BENTHAMIA* A.RICH. (continuation)

23. Spur ventrally flattened ..... *Benthamia vulcanorum* sp. nov.
— Spur scrotiform ..... *Benthamia mascula* Hervouet & Descourv., sp. nov.

24. Inflorescence arcuate ..... *Benthamia bosseri* Hervouet
— Inflorescence erect 25

25. Lip lateral lobes very short 30
— Lip clearly trilobed 26

26. Leaves more than 4 times longer than wide 27
— Leaves less than 4 times longer than wide 29

27. Leaves erect and regularly alternate ..... *Benthamia flavida* Schltr.
— Leaves not alternate 28

28. Leaves basal, rachis often less than a third of plant height ..... *Benthamia litoralis* Hervouet & Descourv., sp. nov.
— Leaves up to rachis, rachis often half of plant height ..... *Benthamia elata* Schltr.

29. Leaves 5 or more ..... *Benthamia humbertii* H.Perrier
— Leaves fewer than 5 ..... *Benthamia latisatis* (Thouars) Bytebier. (La Réunion and Mauritius)

30. Leaves more than 5 cm long, basal or cauline ..... *Benthamia africana* (Lindl.) Hermans
— Leaves less than 5 cm long, basal ..... *Benthamia decaryana* sp. nov.

MATERIAL AND METHODS

Acronyms of herbaria follow Index Herbariorum (http://sweetgum.nybg.org/science/ih/).

This study is mainly based on approximately 580 herbarium specimens stored at the Muséum national d'histoire naturelle (MNHN, herbarium P), but also using more than 450 specimens at AMES, BM, BR, CBNM, G, GOET, HEID, K, L, M, MO, R, REU, TAN, WU, herbaria visited by Johan Hermans and by Jean-Michel Hervouet for REU and TAN. This was combined with extensive field observations by two of the authors (Johan Hermans and Jean-Michel Hervouet), either in type localities of previously described species, or elsewhere. The descriptions are therefore based on both *in situ* observations and on herbarium material. Flowers were rehydrated for analysis under a binocular microscope and were drawn by either Johan Hermans (244 drawings) or Pascal Descourvières (87 drawings). The 87 original drawings by the latter author will be deposited at P.

Maps used as a background for the distribution maps have been downloaded from the following websites:

http://www.fao.org/geonetwork/srv/en (land cover of Madagascar, dated 2009)

https://www.data.gouv.fr/fr/datasets/carte-des-departements-2 (La Réunion island)

https://gadm.org (Mauritius). Similar data can be found at http://www.diva-gis.org.

The locality coordinates are either from original collectors, from field observations by the authors, using a Garmin etrex 10 GPS with a WGS 84 datum, from Google Earth or from the Tropicos website gazetteer to Malagasy botanical collecting localities: http://legacy.tropicos.org/projectwebportal.aspx?pagename=mad_gazetteer&projectid=17

All specimen localities were double-checked with Google Earth (https://earth.google.com).

A relational database was built using the database management system 4D version 17.1 (https://www.4d.com), storing a total of about 500 observations or localities. The Opensource Geographical Information System QGIS version 2.18.10 (www.qgis.org) was used to compose the final images.

For the plant identification terminology, we used Harris & Harris (2000). The plant size given in the descriptions includes the inflorescence, it will not be repeated. To simplify and avoid confusion with the roots we call tubers what is, strictly speaking with orchids, tuberous roots. Following all previous descriptions of *Benthamia* species, the peduncle is included in the description of the stem, as there is no clear transition between the two in the genus, see e.g. *Benthamia elata* Schltr, with leaves up to the rachis. As it is a common character to all species it will not be repeated that the ovary is pedicellate.

For classifying the vegetation of Madagascar, we use the terminology introduced by Gautier *et al.* (2018: table 23).

Conservation status assessments are given following the IUCN Red List categories and criteria, version 3.1 (IUCN 2012). They are mainly based on the number of localities known, the area of occupancy (AOO) and the extent of occupancy (EOO). When available, the official IUCN assessment is also given with a reference, it is taken from https://www.iucnredlist.org/. The differences between these two assessments are most likely due to the fact that many *Benthamia* specimens were not or not correctly identified in herbaria, some species appearing now more widespread than initially thought.

TAXONOMIC TREATMENT

Family Orchidaceae Juss.
Subfamily Orchidoideae A.A. Eaton
Tribe *Orchideae* (Dressler & Dodson) Verm.
Subtribe *Habenariinae sensu* Ngugi *et al.* (2020)

Genus *Benthamia* A.Rich.
(Figs 1; 2)

Monographie des Orchidées des Îles de France et Bourbon (Richard 1828: 37), *non* Lindl. (w).

Rolfeella Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33: 18 (Schlechter 1924). — Type species: *Benthamia glaberrima* (Ridl.) Schltr.

Type species. — *Benthamia latisatis* (Thouars) Bytebier (as *Benthamia latifolia* A.Rich.).

Distribution and ecology. — The genus *Benthamia* is widespread in Madagascar, La Réunion and Mauritius, with possibly one species (probably *B. africana* (Lindl.) Hermans) on the Comoros (Fig. 3). It ranges from sea level to high altitudes (2600 m). It is generally found in open places, both dry and marshy.

Etymology. — Named for the English botanist George Bentham (1800-1884), who together with Sir Joseph Hooker produced *Genera* Plantarum (1865-1883).

Description
Terrestrial or less commonly epiphytic (5 species) sympodial glabrous herbs with 2-7 swollen generally glabrous tubers, which are in fact tuberous roots. Stem erect or arcuate, sometimes with sheaths only (one species), or with 1-2 radical sheathing leaves, or with 2-10 cauline leaves. Leaves lanceolate, ovate or elliptic, sometimes not developed at anthesis (3 species). Rachis terminal, erect or rarely curved, few- to densely many-flowered. Floral bracts small, usually as long or longer than the ovary. Ovary pedicellate, fusiform or oblong, generally twisted (except *Benthamia bosseri*). Flowers small, resupinate (except one species with non-resupinate and pendent flowers), arranged in a narrow rachis, white, green or yellow; sepals and petals free or almost free, entire; labellum entire or trilobed; spur cylindrical (nine species) or short and scrotiform, entire or bilobed at apex, or a small hollow only in one species (*B. boiteaui*). Column short and massive, subterete, erect; anther erect to slightly deflexed, placed above the rostellum, apiculate or not, bilocular, locules parallel, without anther canals; pollinia two, ellipsoid, granular, 2 caudiculae rudimentary, with two viscidia, detachable, flat, ovate or subelliptic; rostellum small, tridentate or trilobed at the anterior edge; stigma always very short, cushion-shaped, with short convex lobes; auricles two, generally conspicuous, subspathulate or falciform, sometimes lacerated, on lateral sides of column. Fruit a dehiscent capsule, with floral parts persistent on the fruit.

Benthamia africana (Lindl.) Hermans
(Figs 4; 5; 6)

Kew Bulletin 69 (2)-9517: 10 (Hermans & Cribb 2014). — *Spiranthes africana* Lindl., *Botanical Register* 10: t. 823 (Lindley 1824). — *Satyrium spirale* Thouars, *Histoire particulière des plantes orchidées recueillies sur les trois îles australes d'Afrique* (Thouars 1822: t.9), *nom. illeg.* — *Habenaria spiralis* A.Rich., *Mémoires de la Société d'Histoire Naturelle de Paris*, tome IV (Richard 1828: 21), *nom. illeg.* — *Herminium spirale* (Thouars) Rchb.f., *Bonplandia* 3: 213 (1855). — *Peristylus spiralis* (Thouars) S.Moore, *in* Baker, *Flora of Mauritius and the Seychelles* (Moore 1877: 335), *nom. illeg.*

Habenaria minutiflora Ridl., *Journal of the Linnean Society, Botany* 21: 503 (Ridley 1885). — *Benthamia minutiflora* (Ridl.) Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33: 29 (Schlechter 1924). — Type: **Madagascar** • Est Imerina, Andrangoloaka; 19°02'S, 47°55'E; XI.1880; *J.M. Hildebrandt 3729*; holotype: BM!; isotypes: P[P00094580, P00094581]!, K[K000415552]!, AMES[AMES00099954]!, M[M0103630]!, G[G00190645, G00300208]!, HBG[HBG500730]!, WU!, Z[Z000064380]!, BM[BM000034593]!, GOET[GOET008457]!, W!, FR[FR0036981]!.

Benthamia procera Schltr., *Beihefte zum Botanischen Centralblatt* 34 (2): 301 (Schlechter 1916). — Type: **Madagascar** • Alaotra-Mangoro; alt. 800 m; 11.X.1912; *H. Perrier 11380*; holotype: P[P00738317]!; isotype: P[P00094573]!, **syn. nov.**

Type material. — *Sine loc.*; *L.M.A. du Petit-Thouars 5* (or *9* in BM); holotype: P[P00738391]!; isotype: BM!

Etymology. — Of Africa.

Phenology. — Mostly from April to November.

Distribution and ecology. — Madagascar, Mauritius, La Réunion, possibly Comoros. From sea level to 1500 m, in lowland and medium altitude moist evergreen forest. Widespread in Madagascar in the eastern part of the country. It grows on dry banks as well as in damp places (Fig. 7).

Conservation. — It is a very widespread and locally common species, of Least Concern so far (LC) in Madagascar and La Réunion. It was considered Endangered on Mauritius in 1994 (Strahm: app. 14) and should be looked for in the Comoros.

Additional specimens examined. — **Comoros** • Grande Comore; 14.VI.1899; *Pobeguin s.n.*; P[P00209897]!. With doubts, as already noticed by Perrier de la Bâthie, the specimen does not allow identification at species level. The flowers are in bud and are indeed reminiscent of *Benthamia africana*.
Madagascar • Nord Betsileo; I.1881; *Hildebrandt 3975a*; W[R14939]! • Analamanga, rochers de la Mandraka; 2.X.1912; *H. Poisson 602*; P[P00094607]! • Atsinanana, Andovoranto, district d'Anivorano; 18°53'S, 48°34'E; alt. 380 m; 14.X.1912; *R. Viguier et al. 687* and *687a*; P[P00334796, P00094608]! • Atsinanana, Andovoranto, district d'Anivorano; 18°53'S, 48°34'E; 15.X.1912; alt. 800 m; *R. Viguier et al. 727*; P[P00334727]! • Atsinanana, Ranolalina; 18°00'54"S, 49°00'09"E; 20.IX.1920; *R. Decary 82*; P[P00094586]! • Alaotra-Mangoro, district d'Ambatondrazaka; 17.VII.1921; *R. Decary 295*; P[P00094590]! • Analamanga, Betatao; 18°12'41"S, 47°52'41"E; alt. 1300 m; XI.1922; *H. Perrier 14962*; P[P00094605]! • Atsimo-atsinana, Vondrozo; 22°49'S, 47°20'E; 4.IX.1926; *R. Decary 5089*; P[P00738390]! • Atsimo-atsinanana, Vondrozo; 5.IX.1926; *R. Decary 5191*; P[P00094593]! • Analamanga, Mandraka, est de Tananarive; 18°55'31"S, 47°56'20"E; XI.1927; *H. Perrier 18006*; P[P00094538]! • Alaotra-Mangoro, entre Moramanga et Nosibe; alt. 400-700 m, X.1927; *H. Perrier 18027*; P[P00094572]! •

FIG. 1. — *Benthamia latisatis* (Thouars) Bytebier, specimen P00334779, showing the different parts of the plant: **A**, rachis; **B**, sterile bract; **C**, stem (including the peduncle); **D**, leaf; **E**, sheath. Photograph by Jean-Michel Hervouet.

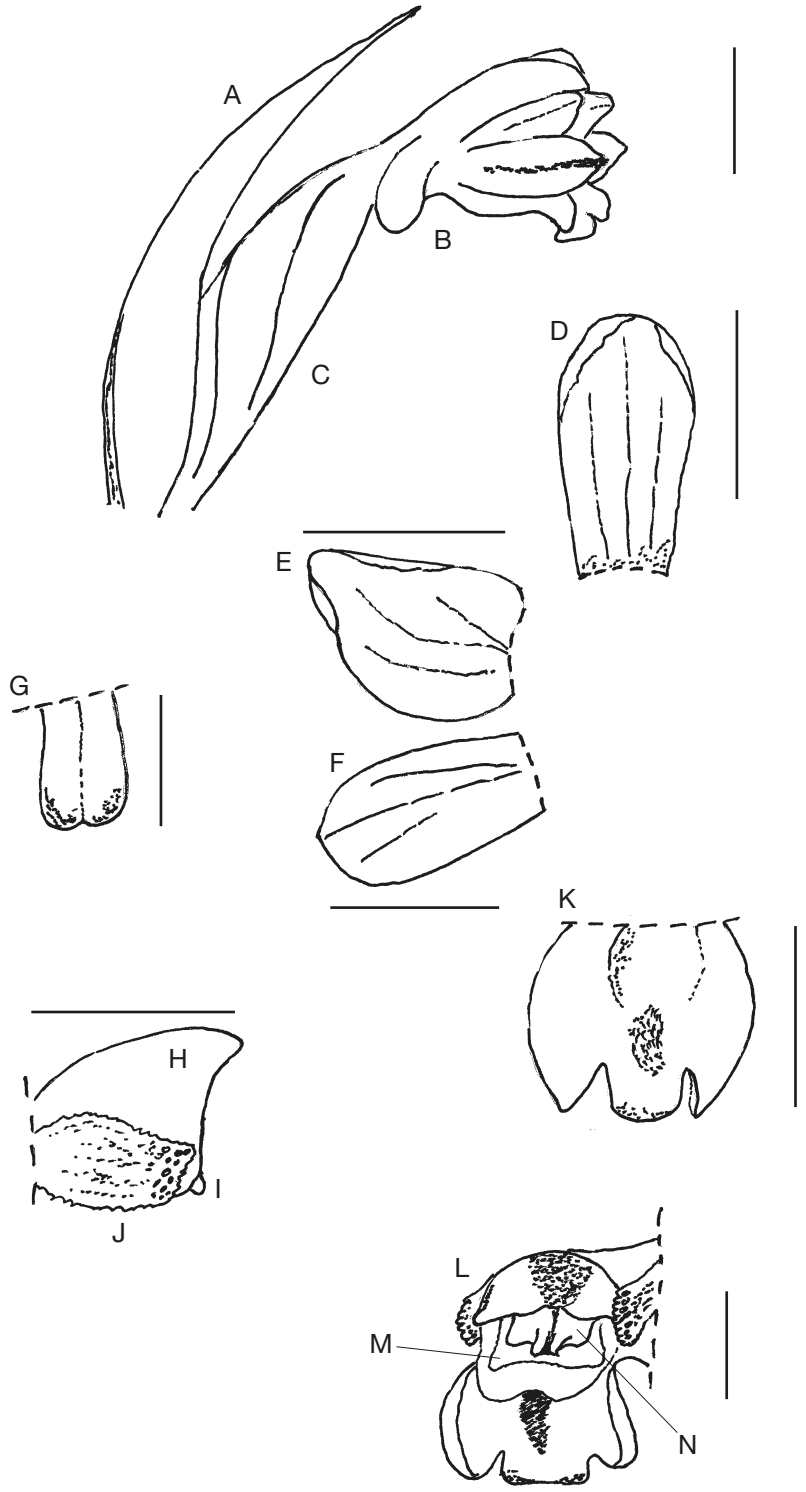

Fig. 2. — Sketch by Pascal Descourvières showing the different parts of a *Benthamia* A.Rich. flower: **A**, floral bract; **B**, profile of flower with spur; **C**, ovary; **D**, dorsal sepal; **E**, petal; **F**, lateral sepal; **G**, front view of spur; **H**, profile of column; **I**, rostellum; **J**, auricle; **K**, lip; **L**, front view of flower; **M**, stigmatic cavity; **N**, rostellum. Scale bars: A-F, H-L, 2 mm; G, 1 mm.

Centre, rocailles humides du Tampoketsa du haut Bemarivo; alt. 1000 m; 1928; *H. Perrier 1878*; P[P00094602], P[P00094603], P[P00094604]! • Alaotra-Mangoro, Analamazaotra; 18°56'05"S, 48°24'43"E; X.1936; *P. Boiteau 2175*; P[P00692295]!, TAN! • Alaotra-Mangoro, district d'Ambatondrazaka, Sasamanga Onibe; 800 m; XI.1938; *G. Cours 1039*; P[P00094589]! • Alaotra-Mangoro, sud de Moramanga; 1.IX.1942; *R. Decary 18163*; P[P00094594]! • Alaotra-Mangoro, sud de Moramanga; 2.IX.1942; *R. Decary 18172*; P[P00094595]!, TAN!, K[K000718260]! • Alaotra-Mangoro, district de Moramanga, Lakato; 19°11'30"S, 48°26'00"E; 2.IX.1942; *R. Decary 18240*; P[P00094596]!, K[K000718261]!, TAN! • Alaotra-Mangoro, Anosibe, sud de Moramanga; 19°25'29"S, 48°12'37"E;

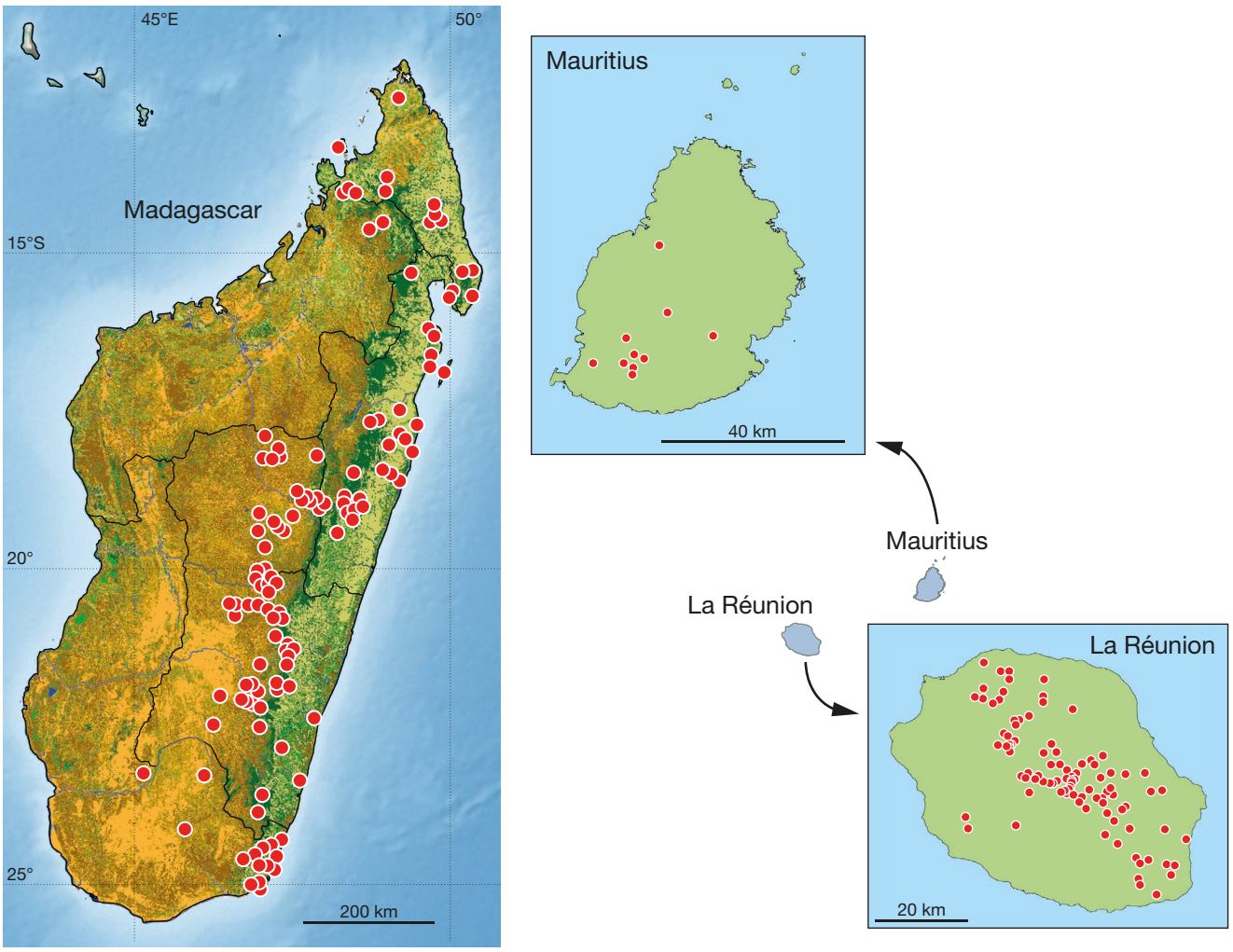

Fig. 3. — Distribution maps of the genus *Benthamia* A.Rich.

6.IX.1942; *R. Decary 18385*; P[P00094597, P02115324]!, TAN, G, K[K000718263]! • Alaotra-Mangoro, Périnet; 18°56'S, 48°25'E; 4.IX.1951; *R. Benoist 1114*; P[P00692221, P00692222]! • Haute Matsiatra, Anjamana Ambalarondra; 18°28'08"S, 49°00'02"E; 1954; *Vigreux 15341*; P[P00692311]! • Atsinanana, Ambodiriana Canton, Mariandrano; 18°27'06"S, 48°58'37"E; X.1955; *J. de la Croix Rakoto 7694RN*; G!, TAN!, K[K000718258]!, P[P01805121, P01805145]!, WAG[WAG.1924443]!) • Alaotra-Mangoro, Nombe, Moramanga; 2.VIII.1956; *P. Soga 8012*; P[P00692317]! • Analanjirofo, Sahatavy, district de Vavatenina; 17°28'22"S, 49°12'02"E; 17.IX.1960; *Laibosaka 11346*; P[P00692319]! • Alaotra-Mangoro, route de Moramanga, Anosibe; VIII.1962; *J. Bosser 16179*; P[P00692232, P00692233]! • Mountain forest; alt. 600 m; VII.1963; *W. Rauh R10032*; HEID[HEID789485, HEID789486, spirit 250342]! • Alaotra-Mangoro, route Moramanga-Anosibe; VIII.1963; *J. Bosser 18534*; P[P00692245]! • Atsinanana, Tamatave, near road; IX.1969; *J. Stewart 1122*; TAN! • Alaotra-Mangoro, forêt d'Analamazaotra; 18°56'05"S, 48°24'43"E; 4.XI.1970; *Keraudren-Aymonin 25358*; P[P00326136]! • Toamasina, in a marsh 4 km south of Mahavelona; 17°43'S, 49°30'E; alt. 0 m; 16.X.1986; *B. Pettersson et al. 11*; UPS!, K! • Alaotra-Mangoro, Andasibe, près d'Antanambe; 1.XII.1989; *P. Morat 8523*; P[P00094530]! • Vatovavy-Fitovinany, Vohipeno; 22°21'13"S, 47°50'25"E; X.1990; *Beaujard 368*; P[P00323116, P00323117]! • Atsinanana, east coast, Betampona Réserve Naturelle Intégrale, 40 km NW of Toamasina; 17°51'S, 49°12'E-17°55'S, 49°15'E; alt. 275-650 m; IX.1993; *B. Lewis et al. 612*; P[P00755163]!, K!, MO • Antsiranana, district d'Andapa, RNI de Marojejy, à 10 km au nord-ouest du village de Manantenina; 14°26'S, 49°46'E; alt. 750 m; 19.X.1996; *M. Rakotondrainibe 3416*; P[P01778631]! • Alaotra-Mangoro, Andasibe, forest around Vakona Lodge; 18°53'57"S, 48°26'38"E; alt. 1101 m; I.2000; *J. Hermans 6565*; K! • Haute Matsiatra, Ranomafana by the Namorona falls; V.2001; 21°14.70'S, 47°23.80'E; alt. 1135 m; *J. Hermans 5590*; K! • Alaotra-Mangoro, Moramanga, Lakato; 19°04'29"S, 48°21'59"E; alt. 1002 m; XI.2002; *G. Fischer et al. FS282*; WU[WU084252]! • Alaotra-Mangoro, Ambatovy; 18°53'S, 48°34'E; 3.VIII.2005; *C. Rakotovao 1930*; P[P02091797]!, K!, MO, TAN! • Alaotra-Mangoro, Ambatovy; 18°50'51"S, 48°18'31"E; 22.VIII.2005; *H. Razanantsoa et al. 359*; P[P02091796]!, K[K000718736]!, MO, TAN! • Alaotra-Mangoro, Andasibe, forest around Vakona Lodge; 18°53'38"S, 48°26'36"E; alt. 1060 m; I.2007; *J. Hermans 6760*; K! • Alaotra-Mangoro, Andasibe, forest around Vakona Lodge; 30.IX.2016; *J. Hermans 8025*; K!.

Mauritius • *sine loc.*; *L.H. Boivin s.n.*; P[P00738537]! (plant on the right only) • Au-dessous du plateau du piton du Pouce; 20°11'44"S, 57°31'20"E; X.1849; *L.H. Boivin s.n.*; P[P00738420]! • Forêt de Curepipe; 20°19'40"S, 57°32'14"E; 20.IX.1851; *L.H. Boivin s.n.*; P[P00738392]!; [very linear leaves, possibly hybrid with *Benthamia spiralis* A.Rich.] • VIII.1862; *P.B. Ayres s.n.*; P[P00738413]! (specimens on the left and on the right only), K! • In high and damp places; 1864; *L. Bouton s.n.*; K! • Grand Bassin, above Black Gorge; 20°25'05"S, 57°29'30"E; IV.1953; *Cooper s.n.*; K![spirit

FIG. 4. — *Benthamia africana* (Lindl.) Hermans, Sainte-Marie Island, Madagascar, 7 October 2012. Photograph by Jean-Michel Hervouet.

FIG. 5. — *Benthamia africana* (Lindl.) Hermans, Iaroka forest, Andasibe, Madagascar, 9 October 2022. Photograph by Jean-Michel Hervouet.

FIG. 6. — *Benthamia africana* (Lindl.) Hermans, Iaroka forest, Andasibe, Madagascar, 9 October 2022. Photograph by Jean-Michel Hervouet.

collection 29789] • Mare Longue; 20°22'36"S, 57°27'22"E; alt. 300 m; VII.1961; *H. St John 26479*; G! • Cascade; 20°22'22"S, 57°37'37"E; 9.IV.1974; *J. Bosser 21830*; P[P00738521]! • Pétrin; 20°24'31"S, 57°28'19"E; 9.IV.1974; *J. Bosser 21827*; P[P00738519, spirit]! • Plaine Champagne; 20°25'35"S, 57°23'30"E; 3.VI.1976; *J. Bosser 22262*; P[P00738375]! • Les Mares, track from Plaine Paule to Mt. Cocotte; 20°26'09"S, 57°28'11"E; alt. 650 m; 13.V.1979; *D. Lorence 2627*; P[P00738374]!, K!.

France, La Réunion • *J.B. Potier s.n.*; P[P00738526]! • *L.H. Boivin s.n.*; P[P00738394]! • *L.H. Boivin s.n.*; P[P00738414]! • *L.H. Boivin s.n.*; P[P02115323]! • *L.H. Boivin s.n.*; P[P00738530]! • Les Hauts du Breton; *L.H. Boivin 1064*; P[P00738531]! • *L.H. Boivin s.n.*; P[P00738393]! • *sine loc.*; 1846-1852; *L.H. Boivin s.n.*; G! Herb. Delessert • 1848; *L.H. Boivin 1064*; P[P00738423, P00738525]! • 1862; *Vieillard et al. s.n.*; P[P00738495]! • Montagne du Brûlé; 1862; *Anonymous s.n.*; P[P00738388]! • 8 km SSW Saint-Denis; alt. 1090 m; VII.1967; *Gill 728*; K! • Saint-Philippe, Mare Longue; 21°21'16"S, 55°44'22"E; 25.IX.1968; *T. Cadet 1625*; REU[REU017476]! • Salazie plain; 21°06'S, 55°32'E; alt. 1500 m; 7.III.1971; *T. Cadet 3135*; REU[REU017472]! • Takamaka, Saint-Benoit; 21°05'S, 55°38'E; alt. 600 m; 21.IV.1971; *T. Cadet 3236*; P[P00738416, spirit]!, REU[REU017473]! • Grand Brûlé; 21°14'50"S, 55°47'50"E; alt. 120 m; VIII.1972; *T. Cadet 3753*; REU[REU017475]! • Takamaka; 21°05'S, 55°38'E; alt. 600 m; VII.1972; *F. Friedmann 1695*; P[P00738419]! • La Montagne; 20°54'S, 55°24'E; alt. 650 m; 12.VII.1972; *T. Cadet 3657*; REU[REU006431, REU017474]! • Grand Brûlé; 21°14'50"S, 55°47'50"E; 30.VIII.1972; *T. Cadet 3756*;

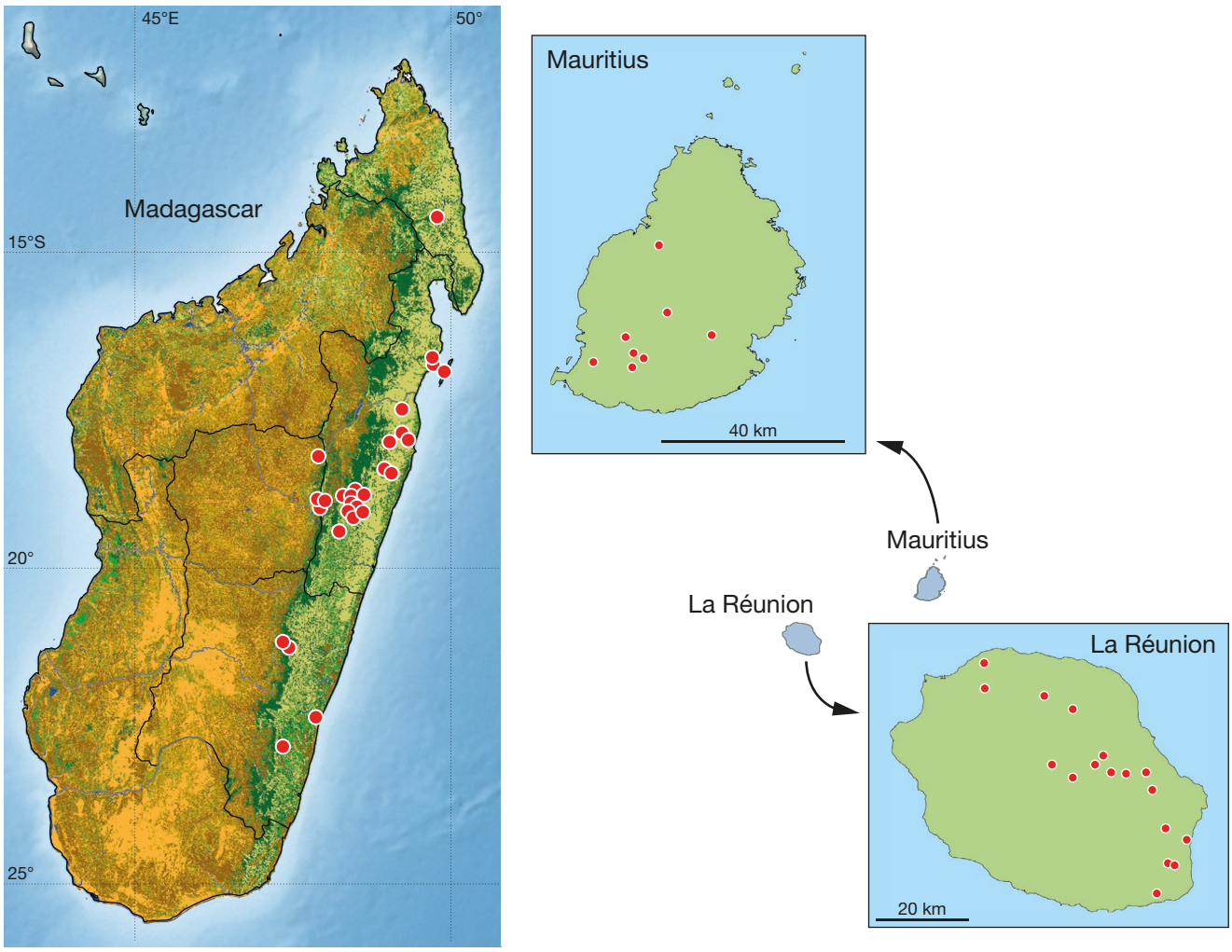

Fig. 7. — Distribution maps of *Benthamia africana* (Lindl.) Hermans.

P[P00738415], REU[REU006432]! • Plate Découverte, Hauts de Saint-André; 20°59'33"S, 55°34'24"E; alt. 750 m; 12.VI.1973; *T. Cadet 4268*; REU[REU006433], P[P00738412]! • Basse Vallée; 27.V.1974; *J. Bosser 22068*; P[P00738534]! • Les Trois Bras, Hauts de Sainte Anne; 21°09'08"S, 55°43'43"E; 30.V.1974; *J. Bosser 22082*; P, not found, anther drawn by Szlachetko in (Szlachetko & Rutkowski 2000: 141) under the name *Benthamia spiralis*, tentatively put here but not seen • Les Trois Bras, Hauts de Sainte Anne; 21°09'08"S, 55°43'43"E; 30.V.1974; *J. Bosser 22083*; P[P00738309, P00738310]! • Les Trois Bras, Hauts de Sainte Anne; 21°09'08"S, 55°43'43"E; 30.V.1974; *J. Bosser 22084*; P[P00738325, P00738326]! • Hauts de Sainte Anne, left bank of the Rivière de l'est; 21°07'S, 55°43'E; alt. 300-1100 m; 30.V.1974; *T. Cadet 4710*; REU[REU006434, REU006435]! • Bord de la RN3, au dessous de la Plaine des Palmistes; 21°06'58"S, 55°38'56"E; alt. 800 m; 4.VI.1974; *T. Cadet 4716*; P[P00738395]!, REU[REU006436, REU006437]! • Sentier de l'îlet à Guillaume; 20°57'S, 55°24'E; 11.V.1976; *J. Bosser 22292*; P[P00738318, P00738319]! • Basse Vallée; 21°21'16"S, 55°44'22"E; 24.V.1976; *J. Bosser 22202*; P[P00738320, P00738321]! • Basse Vallée; 21°21'16"S, 55°44'22"E; 24.V.1976; *J. Bosser 22268*; P[P00738497]! • Plaine des Palmistes; 21°06'58"S, 55°38'56"E; 8.VI.1976; *J. Bosser 22223*; P[P00738323, P00738324! • Plaine des Palmistes; 8.VI.1976; *J. Bosser 22223bis*; P[P00738368, spirit]! • Hauts de Sainte-Marie; 20°58'S, 55°31'E; alt. 1250 m; 18.VI.1976; *T. Cadet 5519*; REU[REU006438]! • Hauts du Tremblet; 21°17'43"S, 55°45'34"E; 20.IV.1978; *J. Bosser 22531*; P[P00738314, P00738315]! • Basse-Vallée; 21°21'16"S, 55°44'22"E; alt. 500 m; 13.VII.1979; *J. Stewart 2127*; K! • Sentier de l'îlet Patience; 21°06'S, 55°37'E; alt. 1100 m; 22.IX.2002; *T. Pailler TP48* & *TP48bis*; REU[REU007939, REU006427]! • Forêt de Bélouve; alt. 1560 m; 13.V.2003; *M. Pignal & C. Lartigau-Roussin 2086*; P[P00340567]! • La Plaine des Palmistes, La Tanguière; alt. 800 m; IV.2004; *V. Grondin et al. 1179*; CBNM! • La Plaine des Palmistes; alt. 850 m; VI.2004; *V. Grondin et al. 1187*; CBNM! • Sainte-Rose, Piton Crac; 21°13'38"S, 55°45'20"E; alt. 1000 m; V.2008; *Fontaine et al. 3374*; CBNM!.

Mascareignes • *Sine loc.*; *McGregor s.n.*; BM[BM000034596]! • *Moore s.n.*; BM[BM000034598]! • *L.M.A. du Petit-Thouars 1011*; BM[BM000034597]!.

Notes

There has been much confusion over the identity of the species. In La Réunion, several other species have long been included in the species concept, in Madagascar it also encompassed at least three other species, and in Mauritius it is thought to be sympatric with *Benthamia spiralis* A.Rich. (see the notes under that entry). Even with these clarifications *Benthamia africana* certainly remains a species complex, and further field observations and DNA analysis may show differences that remained unnoticed in dried specimens. We have kept the holotype as commonly accepted, the only Thouars specimen known of

Fig. 8. — *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov., Mount Marojejy, Madagascar, 29 October 2005. Flowers. Photograph by Jean-Michel Hervouet.

Fig. 9. — *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov., Mount Marojejy, Madagascar, 29 October 2005. Leaves. Photograph by Jean-Michel Hervouet.

Benthamia africana. However, the illustration given by Thouars (1822, plate 9) shows leaves adpressed on the ground, which is the case for some plants but not all.

Benthamia procera is included here as a synonym, only the lip midlobe length seems to be the distinctive feature, but the variations of the lip midlobe length on the type itself, from 1 mm to 1.6 mm, which is in the variation range of *Benthamia africana*, show that it is preferable to consider the type of *Benthamia procera* as *Benthamia africana* with an unusually long lip.

See also: Schlechter (1930: t.12 n°47), Perrier (1939: 31, as *Benthamia spiralis* A.Rich.), Perrier (1939: 32), Cribb & Hermans (2009: 47, as *Benthamia spiralis* (Thouars) A.Rich), Bernet (2010: 136, as *Benthamia spiralis* (Thouars) A.Rich.), Szelengowicz & Tamon (2013: 253, as *Benthamia nigrescens* Schltr.), Szelengowicz & Tamon (2013: 255, as *Benthamia verecunda* Schltr.), Hervouet (2018: 157), Pailler & Henze (2020 : 72), Hermans & Cribb (2023: 101, except figure 58 p. 105 which is *Benthamia mascula* Hervouet & Descourv., sp. nov.).

Description

Slender terrestrial herb, 20-62 (108) cm tall. Tubers 1-2, ovoid, 20-35 × 4-5 mm, roots fleshy and woolly, up to 65 mm long. Stem cylindrical, 1-5 mm in diameter, with 2 to 3 sheaths. Leaves 3-5, basal or cauline in the lower part of inflorescence, narrowly ligulate or linear-lanceolate, acute, 6-20 × 0.5-2 cm, shortly petiolate, higher on the stem grading into small sheaths. Rachis many-flowered, 6-38 cm long, cylindrical. Floral bracts linear, acuminate 4-12 mm × 0.8-3 mm. Ovary suberect, 4.5-9 × 1-1.9 mm. Flowers very small, 2-5 mm in diameter, secund, spreading, with greenish sepals, green or yellow petals and lip; dorsal sepal cucullate, elliptic, obtuse, 1.8-4.2 × 0.6-1.1 mm; lateral sepals obliquely oblong-ovate, obtuse, 1.8-3.8 × 0.5-1.1 mm, concave at the apex; petals porrect, recurved in apical half, lanceolate, subacute, 1.8-3.8 × 0.5-1.2 mm; lip trilobed, 1.8-3.1 × 1-2 mm, recurved, lateral lobes 0.2-0.4 mm, obtuse, midlobe fleshy, much longer than the lateral lobes, 0.8-1.3(1.6) mm; spur scrotiform to subrectangular, 0.5-1 to 0.4-0.9 mm across. Column 0.6-1.1 × 0.5-1 mm, auricles short, anther retuse or obtusely apiculate; rostellum trilobed, the three lobes subequal, 0.1-0.2 mm long, obtuse, hardly visible.

Benthamia arcuata (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov.
(Figs 8; 9)

Benthamia herminioides subsp. *arcuata* H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 36).

Type material. — **Madagascar** • Diana, Mt. Tsaratanana; 14°01'17"S, 48°57'60"E; alt. 2600-2880 m; IV.1924; *H. Perrier 16477*; holotype: P[P00094514]!.

Etymology. — From Latin "*arcuatus*", curved like a bow, in reference to the shape of the ovary.

Phenology. — April and October-November.

Distribution and ecology. — Madagascar. In montane ericoid thicket, in the north between 1850 and 2150 m (Fig. 10). *Benthamia herminioides* subsp. *arcuata* is listed by Szelengowicz & Tamon (2013: 245) for La Réunion. The text refers to the Madagascan species but the two photographs show *Benthamia perfecunda* on the left and *Benthamia mascula* sp. nov. on the right.

Conservation. — So far known only from Mt. Marojejy in Sava region and Mt. Tsaratanana in Diana region, the two northernmost regions in Madagascar. On Marojejy it grows in a very confined area but within a National Park. In view of our observations in Mt. Marojejy, it is considered Vulnerable (VU) according to criterion D1, number of mature individuals fewer than 1000. The population of Mt. Tsaratanana has not been documented since its discovery in 1924.

Additional specimens examined. — **Madagascar** • Sava, sommet oriental du massif de Marojejy; 14°26'48"S, 49°44'06"E; alt. 1850-2137 m; 26.III-2.IV.1949; *H. Humbert et al. 23755*;

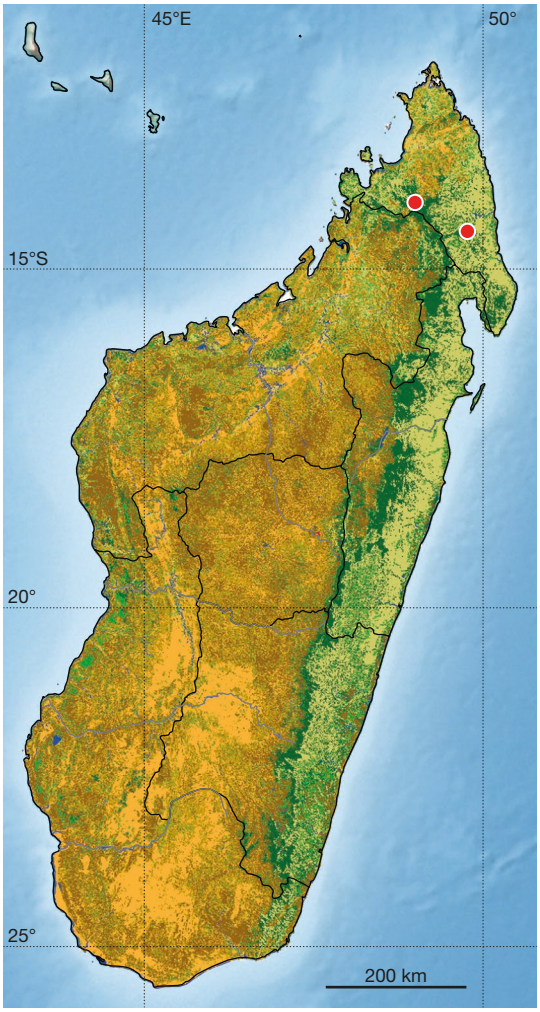

Fig. 10. — Distribution map of *Benthamia arcuata* (H.Perrier) Descourv. & Hervouet, comb. nov., stat. nov.

P[P00692986, P00692987]!, G • Sava, district d'Andapa, Massif du Marojejy; 14°26'48"S, 49°44'06"E; alt. 2000-2137 m; XI.1972; *P. Morat 4025*; P[P00692452]! • Sava, district d'Andapa, Massif du Marojejy; 14°26'48"S, 49°44'06"E; alt. 2000-2137 m; XI.1972; *P. Morat 4039*; P[P00692453]! • Sava, district d'Andapa, camp n°5, on the summit of Marojejy; 14°26'48"S, 49°44'06"E; alt. 2100 m; XI.1996; *N. Messmer et al. 372*; P[P02103086]!, K[G00163180]!, MO, S • Sava, district d'Andapa, RNI de Marojejy; 14°26'48"S, 49°44'06"E; alt. 2000-2137 m; 16.XI.1996; *M. Rakotondrainibe 3694*; P[P01778632]! • Sava, district d'Andapa, RNI de Marojejy; 14°26'48"S, 49°44'06"E; alt. 2050 m; 22.XI.2003; *H.H. Schmidt et al. 4263*; MO[MO3022641]!.

Notes

Perrier noted that the lateral lobes of lip are narrow and acute, which could not be verified on the type. The species was first described as a sub-species of *Benthamia herminioides* Schltr. but is readily distinguished by the larger flowers, the fleshy and thick floral parts and the very prominent callus on the lip. Specimens from Mt. Marojejy and Mt. Tsaratanana should be compared when fresh material becomes available from the latter locality. There is no obvious difference in dry material but the flowering seasons are different.

See also: Perrier (1939: 37), Cribb & Hermans (2009: 48).

Description

Erect terrestrial herb, 19-35 cm tall. Tubers 15-20 × 5 mm, 4- 7 roots up to 7 cm long, 3 mm in diameter. Stem erect, 1-2.5 mm in diameter, green, with 2-5 sheaths regularly spaced. Leaves 1-2, basal, 30-50 mm × 10-20 mm, narrowly ovate to ovate, acute, coriaceous, glossy. Rachis 4-12 cm, mostly secund, shorter than half of the inflorescence, bearing 10-30 flowers 2-5 mm apart. Floral bracts lanceolate, acuminate, 5-6 mm long, smaller or only slightly longer than the ovary. Ovary fusiform, curved at apex, 4-6 mm long. Flowers at right angle to ovary, hardly opened, campanulate, 2.5-4 mm long, all floral parts fleshy and thick, yellowish green; dorsal sepal, slightly apiculate at apex, concave, oblong, 2-2.3 × 0.8-1.2 mm; lateral sepals spreading, oblong or slightly obovate, navicular, green, 2 × 0.8-1 mm; petals oblong, adnate to the dorsal sepal, 1.9-2 × 1-1.1 mm, apex sub-acute to obtuse, slightly asymmetric, forming a hood with the dorsal sepal; lip 2-3 × 1-1.8 mm, with a very prominent longitudinal callus, trilobed, lateral lobes 0.3-1 × 0.5-0.7 mm, midlobe 0.5-1 mm × 0.5-0.7 mm; spur curved, adpressed to the ovary, 0.6-0.8 mm long, slightly bilobed. Column subterete, 0.6-1 mm high, 0.5 mm in

Fig. 11. — *Benthamia bathieana* Schltr., Mount Ibity, Madagascar, 1 April 2018. Photograph by Jean-Michel Hervouet.

diameter, with a short apiculus at apex; rostellum trilobed, short, with midlobe rounded; auricles strap-shaped, half the column length.

Benthamia bathieana Schltr.
(Figs 11; 12)

Repertorium Specierum Novarum Regni Vegetabilis 33 (Schlechter 1924: 25).

Benthamia latifolia Schltr., *Beihefte zum Botanischen Centralblatt* 34(2) (Schlechter 1916: 303), *nom. illeg. non* A.Rich. — Type: Madagascar • Vakinankaratra, Mt. Ibity; II.1914; *H. Perrier s.n.*; holotype: B, could not be traced, possibly destroyed during WWII.

Type material. — **Madagascar** • Vakinankaratra, Mt. Ibity; 20°06'25"S, 46°59'51"E; alt. 2000 m; IV.1921; *H. Perrier 13582*; holotype: P[P00094469]!; isotype: P[P00094470]!.

Etymology. — Named for the French botanist Henri Perrier de la Bâthie, who collected the type specimen on Mt. Ibity.

Phenology. — February to April.

Distribution and ecology. — Madagascar. Only recorded from the centre: from Mt. Ibity near Antsirabe and in the Itremo massif near Ambatofinandrahana, amongst rocks, in montane grasslands. The altitude range is 1700-2100 m (Fig. 13).

Fig. 12. — *Benthamia bathieana* Schltr., Mount Ibity, Madagascar, 1 April 2018. Photograph by Jean-Michel Hervouet.

Conservation. — This species is only known with certainty from Mt. Ibity and the Ambatofinandrahana area (including Itremo National Park). This is fewer than five localities, with an AOO less than 500 km² and a quality of habitat in continuing decline due to bush fires, it should be considered Endangered (EN) according to criterion B2.

Additional specimens examined. — **Madagascar** • Amoron'i Mania, environs d'Ambatofinandrahana; 20°40'11"S, 47°07'19"E; alt. 1600-1800 m; 23.II.1938; *R. Decary 13230*; P[P00094473]! • Amoron'i Mania, Itremo, 20°34'12"S, 46°34'55"E; IV.1964; *J. Bosser 19588*; P[P00094471, P00094472]!, TAN! • Vakinankaratra, Mt. Kiboy, Ibity massif; 20°3.66'S, 47°0.01'E; V.2001; *J. Hermans 121*; K!.

Notes

The identity of this species has only recently been correctly understood. It can easily be confused with *Benthamia rostrata* in photographs, though it is a much larger plant. Several *Benthamia rostrata* specimens have been labelled *Benthamia bathieana* in the literature and herbaria. Apart from the plant size it differs from *Benthamia rostrata* by the leaves which are closer together and wider, and its denser inflorescence. The

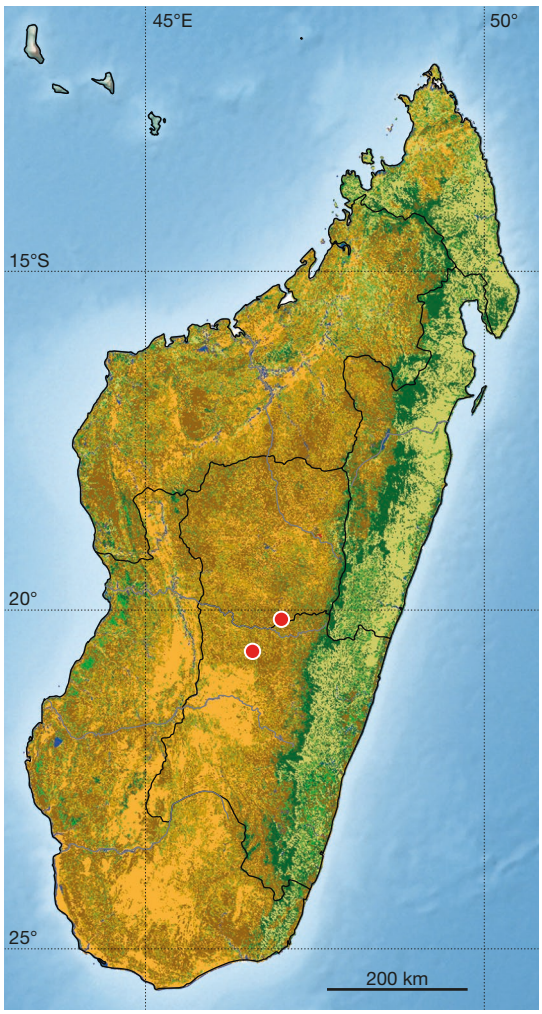

Fig. 13. — Distribution map of *Benthamia bathieana* Schltr.

Fig. 14. — *Benthamia boiteaui* Hervouet, Mount Ambondrombe, Madagascar, 9 March 2009. Photograph by Jean-Michel Hervouet.

flowers differ from *B. rostrata* by the petals and sepals twice as long, the side-lobes of the lip which are not equilateral vs equilateral in *B. rostrata*, the shorter spur, and the pale-yellow colour of the flowers (vs. greenish in *B. rostrata*).

The gathering *H. Perrier 13582* has two sheets in P, but one of them (P00094469) is clearly annotated in Perrier's handwriting that it is the material that was sent to Schlechter for the description, and can therefore be considered the holotype, with P00094470 being an isotype.

See also: Schlechter (1930: t.9 n°36), Perrier (1939: 23), Cribb & Hermans (2009: 42, photograph is *Benthamia rostrata* Schltr).

Description

Robust terrestrial herb up to 70 cm tall. Tubers 20-30, narrowly fusiform, extended by a root up to 12 cm long. Stem 10-15 mm in diameter, with base enclosed by sheaths, with leaves higher up. Leaves 5-6, big, oval or elliptic, the middle ones up to 16 × 7.5 cm, the upper ones becoming gradually smaller. Rachis rigid, elongate, 22-30 × 1.8 cm, densely 40-80-flowered. Floral bracts lanceolate, very acuminate, the lower ones longer than the ovary, 5-10 × 2 mm. Ovary 6-10 × 1.8 mm long. Flower butter yellow; sepals oblong, obtuse, 1-veined, dorsal sepal 3.5-3.9 × 1-2 mm long, concave and erect; lateral sepals 4-4.5 × 1.2-2 mm; petals oval-obtuse, 2-veined, 4 × 2-2.8 mm, a little expanded at the front edge towards the base. Lip 4-6 × 2.2-3 mm, without callus, broadly angular or wedge-shaped at the base, clearly trilobed from the middle; lateral lobes flat, triangular-falciform, midlobe linear-ligulate, somewhat obtuse and fleshy, upcurved at the apex; spur pendent, cylindrical, 3.6-4.5 × 0.5-0.7 mm long. Column 1.2-2 × 1 mm, anther oval-obtuse; auricles 2-3 times shorter than the anther.

Benthamia boiteaui Hervouet
(Figs 14; 15)

Adansonia, sér. 3, 36 (2): 213 (Hervouet *et al.* 2014).

Type material. — **Madagascar** • Haute Matsiatra, Ambondrombe; 21°52'47"S, 47°15'33"E; alt. 1900 m; 11.IV.1941; *P. Boiteau 4621*; holotype: P[P00692438]!.

Fig. 15. — *Benthamia boiteaui* Hervouet, Mount Ambondrombe, Madagascar, 9 March 2009. Photograph by Jean-Michel Hervouet.

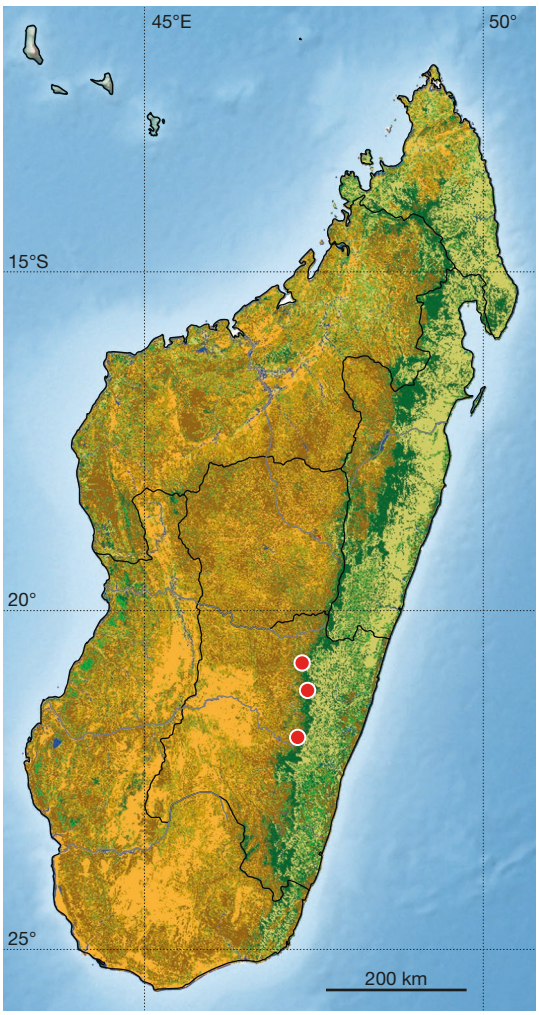

Fig. 16. — Distribution map of *Benthamia boiteaui* Hervouet.

Etymology. — Dedicated to Pierre Boiteau (1911-1980), collector of the type and former director of the Tsimbazaza botanical and zoological garden in Antananarivo.

Phenology. — March to April.

Distribution and ecology. — Madagascar. In Haute Matsiatra and Amoron'i Mania regions. Always found in damp places in montane grasslands or marshes, from 1000 to 1900 m. During the present study a specimen has been identified from Antoetra, near Ambositra, it remains however rather rare (Fig. 16).

Conservation. — Now known from three different locations, each in very limited areas giving an AOO of less than 500 km², in habitats of montane grasslands threatened by bush fires, indicating a conservation status as Endangered (EN) according to criterion B2.

Additional specimens examined. — **Madagascar** • Haute Matsiatra, Ambondrombe; 21°52'47"S, 47°15'33"E; alt. 1900 m; 11.IV.1941; *P. Boiteau 4621*; P[P00692439, P00692440]! • Haute Matsiatra, Ambondrombe; alt. 1700 m; 11.IV.1941; *P. Boiteau 4637*; P[P00692439, P00692440]! • Haute Matsiatra, Ambondrombe; alt. 1800 m; 12.IV.1941; *P. Boiteau 4687*; P[P00692303]! • Amoron'i Mania, Antoetra, piste du Vohibe, sud d'Ambositra; 20°46'27"S, 47°19'16"E; V.1969; *P. Morat 3148*; P[P00692448, P00692449]! • Haute Matsiatra, parc de Ranomafana; 21°11'S, 47°25'E; alt. 1150 m; 10.III.1995; *Turk et al. 722*; K!, K[spirit 72273.000], MO!, TAN! • Haute Matsiatra, Ambondrombe; alt. 1900 m; 1999; *J. Hermans 4403* ex Malala orchidées; K!.

Notes

This species shares some similarities with the genus *Tylostigma*, e.g. the spur is similar to that of *Tylostigma nigrescens* Schltr., but the lip lacks a transverse lamellate callus and is typical for *Benthamia*.

See also: Hervouet (2018: 158).

Description

Erect terrestrial herb 27-38 cm tall. Tubers and roots not seen. Stem cylindrical, 2 mm in diameter, dull pale green, with one or two sheaths above the ground followed, in the first ⅔rd, by 2-3 leaves, and then in the upper part 1-2 sterile bracts, linear, acute, 15-30 × 2-3 mm. Leaves amplexicaul, flexible, linear and acute, 50-130 × 5-8 mm. Rachis 5-8 cm long, terminal, erect, with 15-33 flowers. Floral bracts acicular,

Fig. 17. — *Benthamia bosseri* Hervouet: Andringitra massif, Madagascar, 7 April 2018. Photograph by Jean-Michel Hervouet.

Fig. 18. — *Benthamia bosseri* Hervouet: Mount Ambondrombe, Madagascar, 9 March 2009. Photograph by Jean-Michel Hervouet.

longer than ovary, 4-11 × 1.5-2 mm. Ovary 4.8-7 mm × 1.9-3 mm. Flowers 6 mm deep, 4.5 mm high, 5 mm wide, bright white; dorsal sepal elliptic, obtuse with a slightly rounded and concave apex, 3-6 mm × 1.2-3 mm; lateral sepals elliptic, 3.1-5.5 × 1.2-3 mm, with a visible vein, dorsally slightly keeled, ventrally slightly concave, apex rounded, sub-acute, margin smooth; petals partly overlapping and together with the dorsal sepal forming a hood over the column and lip, elliptic, 3-4.1 × 1.8-2 mm, with a visible vein, apex rounded, sub-acute, margin smooth or slightly irregular; lip trilobed, 2.5-5 × 1.6-3 mm, lateral lobes acute, 0.5 mm long, central lobe fleshy, 1.0-1.3 mm long; spur a shallow hollow only, very

Fig. 19. — Distribution map of *Benthamia bosseri* Hervouet.

short and obtuse, 0.1-0.3 × 1 mm, adpressed to the ovary. Column apiculate, 1-1.5 × 1-1.2 mm, lateral auricles large, suborbicular; rostellum trilobed, with midlobe apiculate; masullae very small, less than 0.12 mm in diameter.

Benthamia bosseri Hervouet
(Figs 17; 18)

Adansonia, sér. 3 36 (2): 217 (Hervouet *et al.* 2014).

Type material. — **Madagascar** • Haute Matsiatra, Ambondrombe; 21°52'47"S, 47°15'33"E; alt. 1700 m; 11.IV.1941; *P. Boiteau 4634*; holotype: P[P00692301]!.

Etymology. — Dedicated to Jean Bosser (1922-2013), who collected a specimen of the species and was instrumental in the advancement of our current knowledge of the orchids of Madagascar and the Mascarenes.

Phenology. — March and April.

Distribution and ecology. — Madagascar. First described from the Haute Matsiatra region in Madagascar, on Ambondrombe and Andringitra, in montane grasslands among rocks. Since 2014 it has

Fig. 20. — *Benthamia calceolata* H.Perrier: Ambodiriana forest, Manompana, Madagascar, 18 October 2022. Photograph by Véronique Lavergne.

Fig. 21. — *Benthamia calceolata* H.Perrier: Ambodiriana forest, Manompana, Madagascar, 18 October 2022. Photograph by Véronique Lavergne.

also been found around Antoetra in Amoron'i Mania region (first author's observation and photographs, without specimen). The altitudinal range is 1600-2100 m (Fig. 19).

Conservation. — Although found in two national parks, it is only known from three locations with an AOO less than 500 km², in habitats threatened by fires coming up from prairies around the mountains. This species can therefore be considered Endangered (EN) according to criterion B2.

Additional specimens examined. — **Madagascar** • Haute Matsiatra, Ambondrombe; 21°52'47"S, 47°15'33"E; alt. 1700 m; 11.IV.1941; *P. Boiteau 4634*; P[P00692265, P00692299, P00692300, P00692302]! • Haute Matsiatra, Parc National de l'Andringitra; 22°07'40"S, 46°51'48"E; IV.1964; *J. Bosser 19648*; P[P00692265]!.

Notes

The flowers remain fresh long after pollination, they are probably autogamous.

See also: Hervouet (2018: 159).

Description

Terrestrial herb 21-71 cm long. Tubers and roots not seen. Stem erect, cylindrical, 2-5 mm in diameter, green or purple (on the same plant), with leaves in the lower part, followed by 1-2 sheaths and 2-3 sterile bracts in the upper part. Leaves 2-3, amplexicaul, thin, flexible, linear, acute, 50-140 × 5-10 mm; sterile bracts linear, acute, 13-25 × 2-3 mm. Rachis 7-19 cm long, arcuate, bearing 20-50 flowers. Floral bracts decurrent, acicular, reddish, as long as ovary + flower, 7-12 × 2 mm. Ovary not twisted, 3-10 mm long, 1-2 mm in diameter, up to 3 mm when ripe, greenish or reddish. Flowers secund, not resupinate, drooping, yellow and reddish; sepals subsimilar, linear, concave, 3-3.5 × 1 mm, with a central vein, slightly keeled dorsally, reddish; petals linear, similar to sepals but slightly narrower, slightly fleshy at apex, 3-3.5 × 0.8-1.1 mm, a little narrower at the base, yellow; lip trilobed, 3-4 × 0.8-2 mm, with a longitudinal rounded callus prolonged into a thickened midlobe, 1 mm long, lateral lobes a little shorter than midlobe, thickened; spur very short, 1-1.5 mm, round and flattened, bilobed when dry. Column terete, very short, 0.9-1 mm, anther apiculate; auricles relict.

Benthamia calceolata H.Perrier
(Figs 20; 21; 22)

Bulletin de la Société botanique de France 81 (Perrier 1934: 32).

Type material. — **Madagascar** • Sava, Andratamarina, near Mananara; 16°17'49"S, 49°43'37"E; 20.VIII.1920; *R. Decary 24*; lectotype: P[P00094475]!, here designated; isolectotype: P[P00094476]!, only a flower dissection of the former.

Etymology. — From Latin "*calceolatus*": slipper-shaped, referring to the shape of the lip.

Phenology. — From June to November.

Distribution and ecology. — Madagascar. Only known from four locations, all near the east coast, almost from north to south. In humid places, in riparian *Pandanus* forest or lowland moist evergreen forest. Altitude from 100 to 500 m (Fig. 23).

Conservation. — Known so far from only four localities but the very large EOO suggests that it has been largely overlooked due to its diminutive habit. IUCN quoted it EN in 2015, under criteria B2ab(ii,iii,iv,v) (https://doi.org/10.2305/IUCN.UK.2017-2.RLTS.T70102664A70132920.en). The only recent observation has been in the Ambodiriana forest, which has an area of 240 ha. As fewer than 50 individuals have been counted, considering only the recently observed living specimens would indicate a Critically endangered species (CR) status under criterion D.

Additional specimens examined. — **Madagascar** • Sava, Manantenina; 24°16'49"S, 47°19'10"E; 10.VI.1925; *R. Decary 3877*; P[P00094477]! • Sava, Masoala Peninsula, west of village of Andrembona; 15°17'25"S, 50°13'10"E; alt. 470 m; 19.XI.1993, *K. Lance 39*; K!.

Fig. 22. — *Benthamia calceolata* H.Perrier: Ambodiriana forest, Manompana, Madagascar, 18 October 2022. Photograph by Véronique Lavergne.

Fig. 23. — Distribution map of *Benthamia calceolata* H.Perrier.

Notes

This species differs from all the others in the genus by the pouched lip. It has recently been seen in October 2022 in the Ambodiriana forest on the east coast of Madagascar, by Véronique Lavergne, who provided us with the first photographs of the species. The fasciculate habit observed on the type was not confirmed in recent observations.

There are two sheets of the *R. Decary 24* gathering, we chose P00094475 as the lectotype, the isolectotype P00094476 being a dissected flower.

See also: Perrier (1939: 28), Cribb & Hermans (2009: 43).

Description

Erect terrestrial herb, 30-60 cm tall. Tubers 5-8, elongated, up to 3 cm, cylindrical or fusiform, ending in a root. Stem erect, 2-3 mm in diameter, with a basal leaf and then 6-8 scale-like leaves, slowly turning into very acute floral bracts with linear blade. Leaf 1, oblong-lanceolate, *c.* 14 × 3.2 cm, acutely narrowed at both ends. Rachis slender, lax, narrow, 17 × 1 cm, bearing 30-45 flowers. Floral bracts lanceolate, very acute, in the middle of the rachis slightly longer than half the length of the ovary. Ovary 4.5-6 × 1.3 mm. Flowers 3 mm without the ovary, greenish yellow; all sepals 1-veined and with an obscure dorsal keel; dorsal sepal oval, obtuse or with apex subacute, 1.5-2.2 × 0.8-1 mm; lateral sepals oval-obtuse, 1.5-2.2 × 0.8-1 mm; petals much thicker, very concave, obovate, 1.4-2 × 0.7-0.8 mm, a little cucullate and very rounded at the tip; lip entire or very obscurely trilobed at apex, 1.8 × 1-1.1 mm, slipper shaped and very short, a little verrucose on the outside, with apex truncated; spur scrotiform, bilobed, as wide at the tip as long, 1-1.1 × 0.8-1 mm, contracted at the base, with a clear deep furrow at the tip. Column sub-terete, very different from others in the genus, 0.7-1 × 0.5-1 mm, with apex digitate, 0.3 mm long, slightly canaliculate in its internal part, overhanging the rostellum; rostellum trilobed with an erect midlobe around 0.3 mm long and two short lateral lobes; auricles basal, strap-like, nearly reaching the anther margins.

Benthamia corona Hermans & Hervouet, sp. nov. (Figs 24; 25; 26)

Diagnosis. — *Benthamia corona* Hermans & Hervouet, sp. nov. is distinct by its epiphytic habit, narrowly elliptic leaves, long sheaths

Fig. 24. — *Benthamia corona* Hermans & Hervouet, sp. nov., Hort. Malala Orchidées, 2001. Photograph by Johan Hermans.

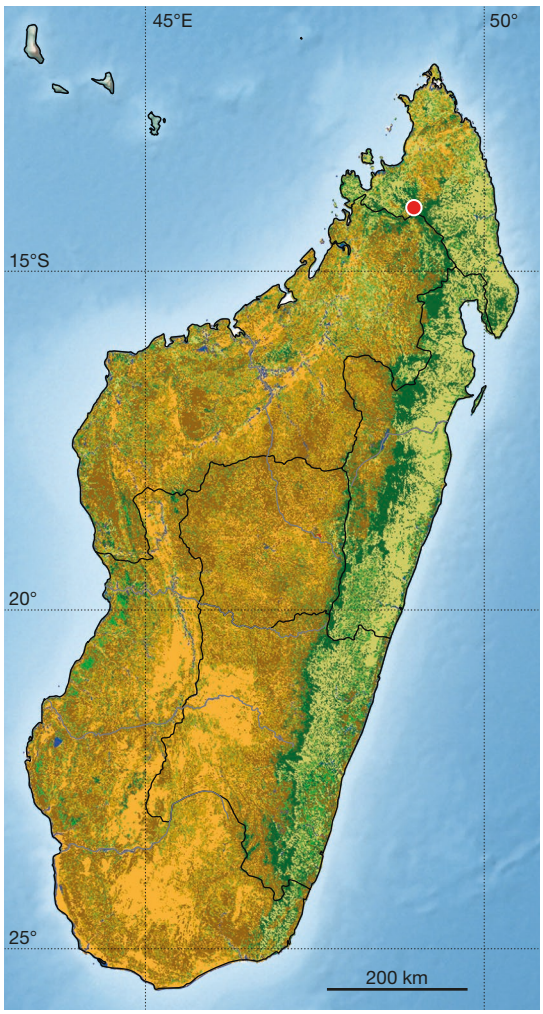

Fig. 25. — Distribution map of *Benthamia corona* Hermans & Hervouet, sp. nov.

decreasing in length as they become floral bracts, its loosely spiral rachis, the yellowish-white flowers (large for the genus), with a long corolla tube, its distinctly trilobed lip with triangular lobes and an incurved midlobe, and its anther that lacks a distinct midlobe. It shares a similar habit and spur with *Benthamia erinacea* but has narrower leaves, a less dense rachis and a trilobed lip (vs entire). It is most similar to *Benthamia nivea* and *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov. with which it shares the epiphytic habit, the sheath-floral bract arrangement, relatively large pale flowers and long corolla tube but differs by its narrowly elliptic (vs elliptic to ovate) leaves, flowers that are yellowish-white (vs pure white) and about 1/3rd smaller, the lobes of the lip that are triangular attenuate (vs obtuse to acute), its bi-globose flattened (vs globose-saccate) spur and its anther lacking a distinct midlobe.

Type material. — **Madagascar** • Analamanga, Anjozorobe area, Hort. Malala Orchidées; 2001; *J. Hermans 5183*; holotype: K!.

Etymology. — The species epithet refers to the crown-like appearance of the flowers and its morphological resemblance to, and commemorating the coronavirus (COVID-19), an infectious disease caused by the SARS-CoV-2 virus, which resulted in a world pandemic from 2019 to 2022.

Phenology. — Flowering time is not known.

Distribution and ecology. — Madagascar. Only known from Tsaratanana in Diana region and from Anjozorobe area in Analamanga region. Altitude and habitat are not known, it is thought to be from medium altitude moist evergreen forest (Fig. 25).

Conservation. — The extent of occurrence (EOO) of *Benthamia corona* Hermans & Hervouet, sp. nov. cannot be estimated since it is only known from one locality and from cultivated material but given the limited collection it is estimated to be in Category CR (Critically Endangered) under criterion D if we estimate that there are fewer than 50 individuals in the wild.

Additional specimens examined. — **Madagascar** • Diana, Tsaratanana; 14°01'17"S, 48°58'00"E; 1950; *R. Paulian Jard. Bot. 786*; P[P00692271]!.

Description

Slender epiphytic herb, 5.5-12 cm tall. Tubers 1-2, ovoid to fusiform, woolly, 22-32 × 5-10 mm, roots wiry, glabrous, 0.6– 0.8 mm in diameter. Stem 3-5 mm in diameter, with 1-2 thin basal enveloping sheaths, then leaves, then 3-5 sheaths, 7-15 × 2-5 mm, decreasing in size until they merge with the floral bracts. Leaves 2-3, cauline with the base enveloping the stem for 5-11 mm, erect to arching, narrowly elliptic, attenuate, 3.5-11.5 × 0.4-0.8 cm, petiolate, almost flat, pale to dark

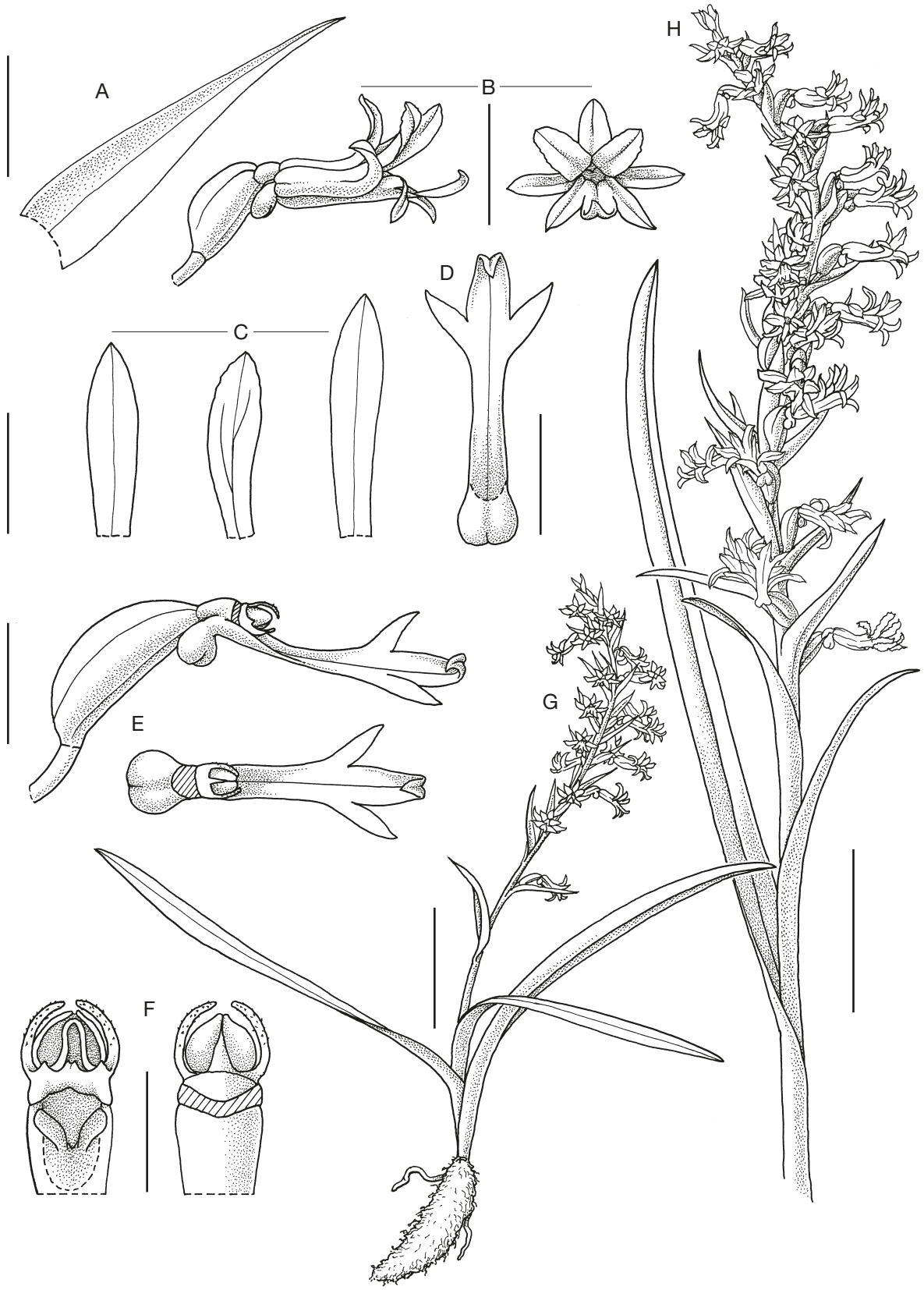

FIG. 26. — *Benthamia corona* Hermans & Hervouet, sp. nov.: **A**, floral bract; **B**, flower side view and front view; **C**, dorsal sepal, petal and lateral sepal; **D**, lip and spur from above; **E**, ovary and flower with sepals and petals removed side view and view from above; **F**, column from above and below; **G**, plant and inflorescence; **H**, inflorescence. Drawn by Deborah Lambkin. From *Hermans 5183* and photographs. Scale bars: A, B, 3 mm; C-E, 2.5 cm; F, 1 mm; G, 1.5 cm; H, 1 cm.

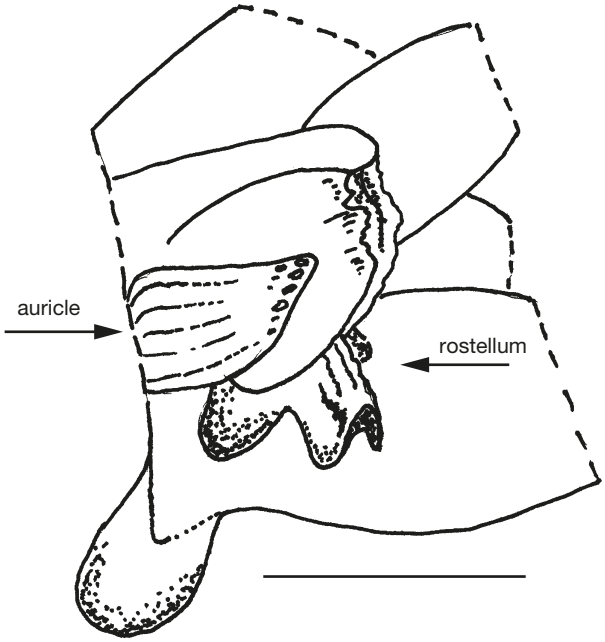

Fig. 27. — *Benthamia decaryana* Descourv. & Hervouet, sp. nov.: drawing of the column by Pascal Descourvières, showing the auricle and the rostellum.

green. Rachis up to 10 cm long, erect, pale green, loose in the upper half, with up to 30 spirally arranged flowers, developing acropetally with the lower flowers fertilized before the apical ones open. Floral bracts narrowly lanceolate, acuminate, somewhat incurved, decreasing considerably in size towards the apex with the basal ones more than twice the length of the ovary, the apical ones a little shorter, 6-13.5 × 1.1-1.8 mm, green. Ovary fusiform, at first erect then divergent, with three longitudinal ridges, 4.5-6.3 × 1.6-1.9 mm, pale green. Flowers large for the genus, fleshy, *c.* 3 × 3.5 × 5 mm long, corolla fused-tubular in the basal half; dorsal sepal recurved, narrowly elliptic, acute, 3.5-4.2 × 0.9-1.2 mm, greenish-white, green at the base; lateral sepals spreading to recurved, narrowly elliptic, margins involute, acute, 4.9-5.3 × 1.6-1.9 mm, greenish-white, green at the base; petals spreading, recurved, elliptic, the apex and anterior margin, thickened, erose, 2.8-3.6 × 1-1.5 mm, creamy-white; lip distinctly trilobed, 4.3-4.6 × 3.9-4.4 mm, creamy-white, with lateral lobes decurved, triangular and attenuate and midlobe with the apex distinctly incurved; spur bi-globose, laterally flattened, 0.9-1.2 × 0.9-1.3 mm, pale green. Column 0.8-0.9 × 0.9-1 mm, anther equally bilobed; auricles falcate, scabrid.

Benthamia decaryana Descourv. & Hervouet, sp. nov. (Figs 27; 28; 29)

Diagnosis. — This species has broadly similar flowers to those of *Benthamia africana* but the habit is smaller (largest plant known 35 cm high vs 62 cm). The most distinctive difference lies in the fact that leaves are all basal, less than 5 cm long, conduplicate, coriaceous, generally with undulate margins and arcuate, at least when dried (vs leaves linear or ligulate, 6-18 cm long, remaining flat when dried). The rostellum has a very wide and large midlobe, 0.4-0.5 mm long, protruding and pointing downwards (vs midlobe 0.1-0.2 mm).

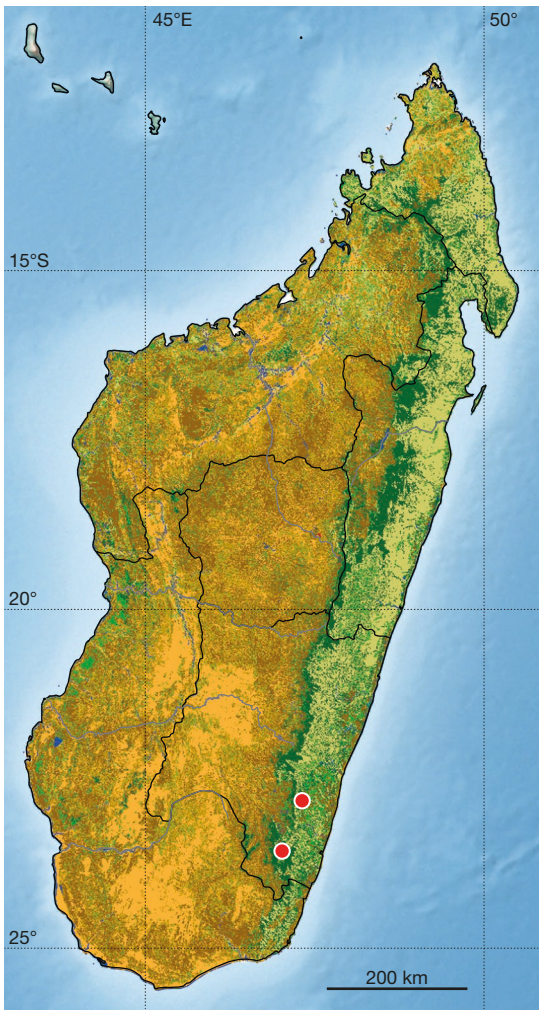

Fig. 28. — Distribution map of *Benthamia decaryana* Descourv. & Hervouet, sp. nov.

Type material. — **Madagascar** • Atsimo-Atsinanana, Midongy du sud; 23°35'S, 47°01'E; 23.VIII.1926; *R. Decary 5138*; holotype: P[P00094591]!; isotypes: P[P00094592]!, K!, TAN!.

Etymology. — Named for Raymond Decary (1891-1973), colonial administrator in Madagascar. He undertook seven scientific missions from 1922 to 1944, collecting, among many other things, 40000 specimens of plants.

Phenology. — September.

Distribution and ecology. — Madagascar. Known only from the Atsimo-Atsinanana region, therefore the south-east, in forest on laterite soil. A humid roadside is mentioned on the type specimen (Fig. 28).

Conservation. — This species has been collected only twice and has not been recorded since 1926. However, the *locus classicus*, South Midongy, is not very accessible. With only two known locations and the continuing decline of the forests in the region it must be considered Endangered (EN) under criterion B1.

Additional specimens examined. — Madagascar • Atsimo-Atsinanana, Vondrozo; 22°49'14"S, 47°19'10"E; 5.IX.1926; *R. Decary 5195*; P[P00094587]!.

Fig. 29. — *Benthamia decaryana* Descourv. & Hervouet, sp. nov.: drawing by Ludivine Longou, after dried specimens: **A**, habit; **B**, side view of part of the rachis. Scale bars: A, 10 mm; B, 5 mm.

Notes

This small species has a strikingly distinctive rostellum compared with other *Benthamia* species. The most distinctive difference is however the short basal conduplicate leaves, which are unique among other *Benthamia*.

Fig. 30. — *Benthamia elata* Schltr., Ranomafana, Madagascar, 25 October 2022. Photograph by Jean-Michel Hervouet.

Fig. 31. — *Benthamia elata* Schltr.: Ranomafana, Madagascar, 31 July 2016. Photograph by Jean-Michel Hervouet.

Description

Erect terrestrial herb, 12-23(35) cm tall. Tubers 1-2, ovoid-fusiform, 2-3 cm long. Stem 0.8-1.8 mm in diameter, with basal leaves and then 2-4 linear acute sheaths 5-30 mm long. Leaves 3-5, basal, 2-5 × 0.3-0.8 cm, conduplicate, slightly thick and coriaceous, often with undulate margins when dried. Rachis 6-21 cm long, with 10-37 flowers, at an average distance of *c.* 5 mm from each other. Floral bracts lanceolate-acuminate, 1.5-7 × 0.8-2 mm, shorter than the ovary except the lower ones, which can be a little longer. Ovary fusiform, 4-6 mm long to 8 mm when mature. Flowers small, greenish, about 2-2.5 mm long; dorsal sepal elliptic-oblong, obtuse, 2.2-2.5 × 0.8 mm; lateral sepals elliptic-oblong, subacute, 2.2-2.5 × 0.7 mm; petals 2.2 × 1.2-1.3 mm, as long as the sepals but wider, oblong, obtuse, thickened at the apex, lip concave at the base, 2.2-2.8 × 1.5 mm, trilobed at the apex, with midlobe broadly triangular, 0.7-0.8 × 0.5 mm, lateral lobes shorter, 0.3-0.5 mm wide; spur scrotiform, 0.5 × 0.6 mm. Column 0.8 × 0.5 mm, anther subterete, obtuse; auricles slightly falcate, subcrenulate, 0.5 mm long, as long as the anther, rounded at apex; rostellum trilobed, very unusual for the genus, with a large, fleshy and protruding downward pointing midlobe, 0.3-0.4 mm long, lateral lobes obtuse, shorter than the midlobe.

Benthamia elata Schltr.
(Figs 30; 31)

Repertorium Specierum Novarum Regni Vegetabilis 15 (Schlechter 1918: 324).

Benthamia nigrovaginata H.Perrier, *Bulletin de la Société botanique de France* 81: 32 (Perrier 1934). — Type: Madagascar • Haute Matsiatra, massif de l'Ikongo; 21°51'30"S, 47°26'30"E; 17.X.1926; *R. Decary 5789*; lectotype: P[P00094554]!, here designated; isolectotypes: P[P00094555, P00094556]!, **syn. nov.**

Benthamia verecunda Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33 (Schlechter 1924: 34). — Type: Madagascar • Diana, Manongarivo; 14°00'00"S, 48°23'30"E; alt. 1200 m; IV.1909; *H. Perrier 1944* (*H.L. Jumelle 19*); lectotype: P[P00094583]!, here designated; syntypes: P[P00094584, P00094585]!, **syn. nov.**

TYPE MATERIAL. — **Madagascar** • *sine loc.*; *Laggiara s.n.*; holotype: B, destroyed; lectotype: here designated: drawing by Schlechter, *Repertorium Specierum Novarum Regni Vegetabilis Beihefte* 68 (Schlechter 1930: t.10); Madagascar • Haute Matsiatra, 7-10 km W of Ranomafana; 21°16'S, 47°25'E; alt. 1130 m; 18.VIII.1987; *G.E. Schatz et al. 1452*; epitype: P[P00094495]!, here designated.

ETYMOLOGY. — From Latin "*elatus*": tall.

PHENOLOGY. — April to October. Earlier in the west than on the east coast.

DISTRIBUTION AND ECOLOGY. — Madagascar. Widespread in the north and in south-east regions, in medium altitude moist evergreen forest. From altitude of 750 m up to 1200 m (Fig. 32). The species was reported from La Réunion by Szelengowicz & Tamon (2013: 252) but the photographs show *Benthamia africana*.

CONSERVATION. — It has been considered Endangered under criteria B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv) by the IUCN SSC Madagascar Plant Specialist Group in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T70102671A70133186.en). With the inclusion of the two synonymised names this species has a very large EOO, is known from more than 10 locations over a large area. Although locally common it cannot be considered widespread and abundant, with a very fragmented EOO and a small number of locations we consider it Near Threatened (NT).

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Vatovavy-Fitovinany, Ifanadiana; 21.VI.1925; *R. Decary 3830*; P[P00094496, P00094497]!, WAG[WAG.0270037]!, BR[BR0000021830068]!, K!, MO!, TAN! • Atsimo-Atsinanana, Vondrozo; 22°49'14"S, 47°19'10"E; 9.IX.1926; *R. Decary 5465*; P[P00094588]! • Haute Matsiatra, bord de la RN45, Ranomafana; 16.VII.1969; *Y. Veyret 1108*; P[P00692308, P00692309, P00692310]! • Haute Matsiatra, forest E of Ranomafana, between Fianarantsoa and Ifanadiana; 21°15'S, 47°22'E; alt. 1200 m; 31.VII.1987; *P. Phillipson 2210*; K!, WAG[WAG.0251999]!, MO[MO3022628]!, TAN! • Sava, réserve Naturelle Marojejy, camp n°2; 7.X.1988; alt. 700 m; *J.S. Miller et al. 3423*; P[P00754989]!, TAN, photographs by Jean-Michel Hervouet in same location • Sava, Réserve Naturelle de Marojejy; 14°27'S, 49°47'E; alt. 660-830 m; X.1989; *J.S. Miller et al. 4376*; P[P00692447]!, K!, MO[MO3022634]!, TAN! • Haute Matsiatra, Parc National de Ranomafana; 21°16'S, 47°24'E; 5.VIII.1992; *R. Rakoto 168*; P[P00692458]! • Haute Matsiatra, Fianarantsoa à Ranomafana, 43 km de Fianarantsoa; 30.IX.1992; *L. Allorge et al. 519*; P[P01778633]!, G, K[K000718202]!, MO[MO3248447]!, WAG[WAG.0388228]! • Haute Matsiatra, Parc National de Ranomafana, parcelle n°3, Talatakely; 21°15'S, 47°27'E; alt. 800-1000 m; VI.1993; *A. Kotozafy 39*; P[P00755055]!, BR[BR0000005242085]!, K!, MO[MO322630]!, TAN! • Sava, Parc National de Marojejy; 14°26'S, 49°46'E; alt. 750 m; X.1996; *N. Messmer et al. 266*; G[G00163181], as *Cynorkis* sp. • Ranomafana; 2000; *J. Hermans 4395*; K! • Haute Matsiatra, environ 12 km à l'ouest de Ranomafana, Vohipara; 21°14'S, 47°24'E; V.2001; *J. Hermans 3561*; K! • Haute Matsiatra, along Namorona River just above Ranomafana; 4.X.2016; *J. Hermans 8045* & *8046*; K!.

NOTES

There are no significant differences between the types of *Benthamia verecunda*, *B. nigrovaginata* and *B. elata*. Black sheaths at the base of the plant are common among *Benthamia* (e.g. *B. melanopoda*). The lengths of the lateral lobes of the lip compared with the midlobe may vary from ⅓ to about the same length but these variations are visible within the type and syntype of *B. verecunda* itself. Schlechter did not mention *B. elata* when describing *B. verecunda*, though his drawings of both species are very similar. Nor did Perrier mention *B. elata* when describing *B. nigrovaginata*. Both compare their species with more obviously different species.

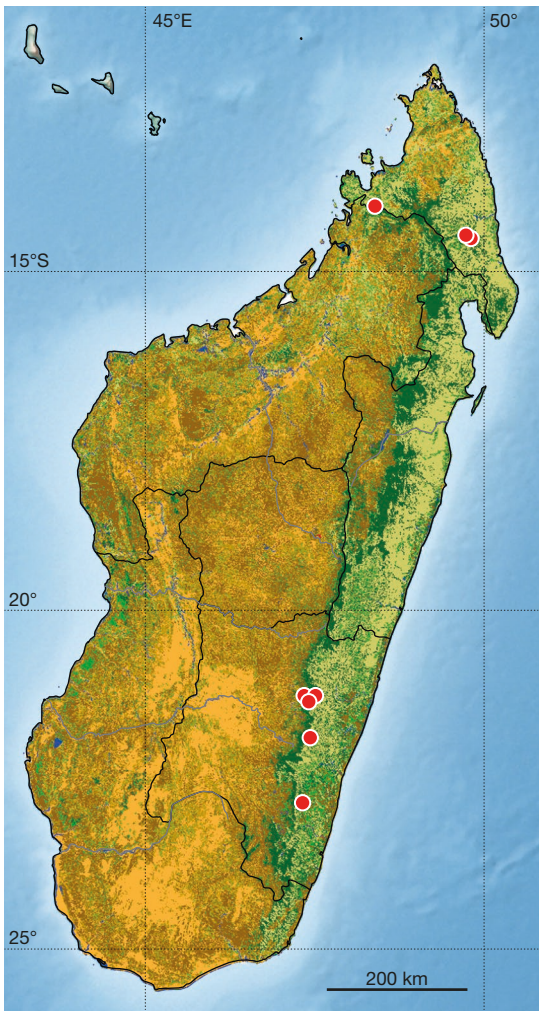

FIG. 32. — Distribution map of *Benthamia elata* Schltr.

See also: Schlechter (1930: t.12 n°48), Perrier (1939: 30), Perrier (1939: 33), Perrier (1939: 34), Cribb & Hermans (2009: 46), Cribb & Hermans (2009: 50), Hervouet (2018: 161).

DESCRIPTION

Erect terrestrial herb, 25 cm to more than 1 m tall. Tubers 2, oblong or fusiform. Stem 3-7 mm in diameter, with its base enveloped by 2-3 often black sheaths, then carrying leaves in the lower half and higher with 4-6 lanceolate-acuminate sheaths. Leaves 4-6, narrowly ligulate-lanceolate, 10-20 × 1.5-3.5 cm, acuminate, attenuate towards the base. Rachis many-flowered, cylindrical and very long, 20-40 × 1.3 cm, often half of the plant height, rather lax, flowers unilateral or almost so. Floral bracts lanceolate, 1-veined, 4-12 × 1.3-1.5 mm, narrowly acuminate, the lower ones longer than the flower. Ovary slender, cylindrical, twisted, 4.5-11 × 0.8-3 mm. Flowers 3.5-4.5 mm long without the ovary, 3-5.5 mm high, yellow or greenish-yellow; sepals oblong-ligulate, obtuse, 1-veined, 3-4 × 0.6-1.1 mm, the lateral sepals spreading, joined towards the base of the petals and the lip; petals lanceolate-oblong,

FIG. 33. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb, Andringitra Massif, Madagascar, 13 March 2009. Photograph by Jean-Michel Hervouet.

FIG. 34. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb: Col de Bébour, La Réunion, 24 March 2013. Photograph by Jean-Michel Hervouet.

obtuse, 3.7-5.5 × 0.8-1.4 mm, as long as the sepals, a little attenuate towards the apex; lip oblong, 3.1-6 × 1.2-2.3 mm, concave at the base, trilobed in the upper third, the lateral lobes triangular, 0.5-1.3 mm long, narrowly lanceolate-ligulate, the middle one ligulate-obtuse and 1-3 times larger than the laterals, 1.5-2.3 mm, sub-obtuse, thickened at the apex; spur in a semi-oblong sac shape, very rounded at the apex and a little flattened, 0.6-1.1 × 0.4-0.9 mm. Column subterete, 0.8-1.2 × 0.7-1 mm, anther digitate, slightly deflexed; auricles sub-spathulate, about as long as the anther; rostellum short and trilobed, the lateral lobes small, the midlobe very thick.

Benthamia erinacea (Cordem.) Hermans & P.J.Cribb (Figs 33; 34; 35; 36)

Lankesteriana 21 (2) (Hermans & Cribb 2021: 74). — *Habenaria erinacea* Cordem., *Flore de l'île de la Réunion*: 261 (Cordemoy 1895). —*Peristylus erinaceus* Frapp., *Catalogue provisoire des orchidées de la Réunion*: 9 (Frappier 1880), *nomen nudum.*

Peristylus secundiflorus Boivin ex S. Moore, *non* Kraenzl., *Journal of Botany* 5: 293 (Moore 1876), *nomen nudum.*

Habenaria secundiflora Cordem., *Flore de l'île de la Réunion*: 260, 551 (Cordemoy 1895).

Benthamia nigrescens Schltr., *Beihefte zum Botanischen Centralblatt* 34 (2): 301 (Schlechter 1916). — Type: **Madagascar** • Vakinankaratra, flanc est du mont Tsiafajavona; 19°22'S, 47°19'E; alt. 2000 m; III.1921; *H. Perrier 13506*; holotype: P[P00094545]!.

Benthamia nigrescens subsp. *borbonica* H.Perrier, *Bulletin de la Société botanique de France* 81: 30 (Perrier 1934). — Type: **France, La Réunion** • *L.H. Boivin s.n.*; lectotype: P[P00334740]!, here designated; isolectotype: P[P00334741]!.

Benthamia nigrescens subsp. *decaryana* H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 30). — Type: **Madagascar** • Diana, Ankaizina; 14°30'S, 48°55'E; alt. 1700 m; 19.IV.1923; *R. Decary 1982*; holotype: P[P00094548]!.

Benthamia nigrescens subsp. *humblotiana* H.Perrier, *Bulletin de la Société botanique de France* 81 (1934). — Type: **Madagascar** • Diana, Mt. Tsaratanana; 14°01'17"S, 48°58'00"E; alt. 2000 m; IV.1924; *H. Perrier 16110*; lectotype: P[P00094552]!, here designated; isolectotype: P[P00094553]!.

Fig. 35. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb: Bourg-Murat, La Réunion, 19 April 2018. Photograph by Jean-Michel Hervouet.

Benthamia nigrescens subsp. *secundiflora* H.Perrier, *Bulletin de la Société botanique de France* 81: 30 (Perrier 1934). — Based on *Peristylus secundiflorus* Boivin ex S. Moore., which is a *nomen nudum* (see notes below).

Benthamia nigrescens subsp. *typica* H.Perrier, *Bulletin de la Société botanique de France* 81: 30 (Perrier 1934). — Type: unknown. A wrong specimen has been cited by Perrier: *H. Perrier 8078*, i.e. P00094439, which is *Habenaria truncata*. By subsp. *typica* Perrier meant *Benthamia nigrescens*.

Benthamia catatiana H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 29). — Type: **Madagascar** • Anosy, Vallée d'Ambolo, au nord de Fort-Dauphin; 1 Jul., *L.D.M. Catat 4338*; lectotype: P[P00094478]!, here designated; isolectotype: P[P00094479]!, **syn. nov.**

Benthamia cuspidata H.Perrier, *Bulletin de la Société botanique de France* 81: 29 (Perrier 1934). — Type: **Madagascar** • Atsinanana, Mananara, sur la côte est; 02.IX.1920; *R. Decary 79*; holotype 2-part specimen: P[P00094493, P00094494]!, **syn. nov.**

Fig. 36. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb: Montagne d'Ambre, 5 April 2024. Side view of flower showing the spur. Photograph by Jean-Michel Hervouet.

Peristylus micranthus A.Rich. & *Benthamia micrantha* A.Rich., *nomen nudum in sched.*, based upon specimens from La Réunion, ex Herb. Richard (K-LINDL!, W!).

Type material. — **France, La Réunion** • Plaine des Palmistes; II.1883; *Cordemoy s.n. Herb. Cordemoy*; lectotype: MARS[MARS087704]!, designated by Hermans & Cribb (2021: 74).

Etymology. — From Latin "*erinaceus*", hedgehog, due to the bristled rachis.

Phenology. — Mostly February to May, but occasionally up to October.

Distribution and ecology. — Madagascar, La Réunion. Widespread but in Madagascar only in the eastern half, from 700 to 2400 m. Epiphytic, mostly in medium altitude moist evergreen forest (Fig. 37).

Conservation. — The status of this species is of Least Concern (LC) since it is widespread in Madagascar and La Réunion. It was been deemed Endangered by IUCN in 2015, under the name *Benthamia nigrescens*, under criteria B2ab(i,ii,iii,iv,v) (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T69222181A69245307.en) but at that time all subspecies were considered separately.

Additional specimens examined. — **Madagascar** • *Sine loc.*; *L. Humblot s.n.*; P[P00094551]! • Diana, île de Nosy Be, dans les plaines; 11.IV.1841; *A. Pervillé 801*; P[P00094549, P00094550]! • *Balfour s.n.*; 1875; K! • Alaotra-Mangoro, massif de l'Andrangovalo au sud-est du lac Alaotra (réserve de Zahamena); 17°40'S, 48°45'E; alt. 1200 m; X.1937; *H. Humbert et al. 17783*; P[P00094546]! • Haute Matsiatra, Ambalavao; 21.III.1953; *H. Randriamiera RN5581*; P[P00692313, P00692498]! • Vakinankaratra, Manjakatompo; alt. 1700-1800 m; V.1960; *J. Bosser 14443*; TAN! • Analamanga, lake Mantasoa; 19°00'45"S, 47°50'17"E; VIII.1962; *J. Bosser 16153*; P[P00692431]! photograph n°721 by Jean Bosser • Alaotra-Mangoro, route de Lakato; 19°11'30"S, 48°26'00"E; VII.1963; *J. Bosser 17176*; P[P00692238]! • Diana, Montagne d'Ambre; VI.1970; *J. Bosser 20377*; P[P00692267]! • Diana, Tsaratanana massif; alt. 1800-2000; 8.V.1974; *A. Gentry 11589*; MO[MO3248452]! • Diana, Ambahatra; 14°00'31"S, 48°25'49"E; III.1999; *L. Gautier et al. LG3647*; G! • Alaotra-Mangoro, road to Lakato; 19°03'S, 48°21'E; alt. 1041 m; II.2000; *J. Hermans 5561*; K! • Analamanga, Tampoketsa d'Ankazobe; 18°12'56"S, 47°17'17"E; 2000; *J. Hermans 5187;* K! • Alaotra-Mangoro, Maromizaha; 19.VIII.2022; *L.R. Rajaovelona et al. RJL1421*; K[K001522014]!, TAN!.

France, La Réunion • *Sine loc.*; *Cordemoy s.n.*; MARS[MARS087702, MARS087703, MARS087704!, MARS087706! and two specimens without number] • *sine loc.*; *A. Delteil s.n.*; P[P00334755]!, BR[BR0000021833151]! • *sine loc.*; *A.N. Desvaux 259*; P[P00334756]! • *sine loc.*; *L.H. Boivin 1068*; W! • *sine loc.*; *L.H. Boivin s.n.*; P[P00334747, P00334748, P00334750]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738485]! among *Cynorkis citrata* • *sine loc.*; *L.H. Boivin s.n.*; P[P00738486]! • *sine loc.*; *C. Richard 501* and *501bis*; P[P00334743, P00334742]! • *sine loc.*; *C. Richard s.n.*; P[P00334744]! • *sine loc.*; *C. Richard 387*; P[P00334745!, P00334746]! • *sine loc.*; VII.1837; *Gaudichaud s.n.*; P[P00334753]! • *sine loc.*; 1837; *Gaudichaud s.n.*; G! • II.1847; *L.H. Boivin 1063*; P[P00738489!, P00334751!, P00334752]! • *sine loc.*; 1849; *Giraudy s.n.*; P[P00738478]! • Plaine des Cafres; 21°09'S, 55°34'E; 6.VI.1851; *L.H. Boivin s.n.*; P[P00334749]! • *sine loc.*; 1867; *Herb. A. Richard. R19909*; W!, drawing of flower by Rchb.f., as *Herminium spirale* • *sine loc.*; 26.II.1875; *G. de l'Isle 69*; P[P00334754]! • *sine loc.*; 1932; *s.c.*; *s.n.*; P[P00334757]! • Bébour forest, Bélouve; 21°07'58"S, 55°34'23"E; alt. 1400 m; IV.1956; *J. Bosser 9464*; P[P00738461]! • Bébour forest, Bélouve; 21°07'58"S, 55°34'23"E; alt. 1500 m; IV.1956; *J. Bosser 9465*; P[P00738463, P00738465]!, MAU[MAU0001989]) • Hauts de Maka; alt. 1600 m; V.1957; *J. Bosser 11762*; P[P00738468]! • Brûlé de Saint-Denis; 20°55'S, 55°26'E; alt. 1200 m; V.1957; *J. Bosser 11842*; P[P00738462]! • Grande Montée; 20°56'S, 55°31'E; alt. 1600 m; V.1964; *Staub 11123*; MAU[MAU0001991]! • Saint-Denis, Hauts de Brûlé, Roche écrite path, Mamode forest camp; 20°55'S, 55°26'E; alt. 1200 m; III.1966; *T. Cadet 417, Herb.Maur. n°12073*; REU[REU006408]!, MAU[MAU0001990]! • Bébour forest; 21°06'40"S, 55°33'47"E; alt. 1300 m; 26.III.1969; *T. Cadet 2018*; REU[REU006409, REU006411]! • Mafate, Petite Mavis, Sentier Augustave; 21°02'34"S, 55°26'43"E; alt. 1100 m; 1.II.1970; *R. Lavergne RL1792*; REU[REU007779]! • Col de la Plaine des Palmistes, Plaine des Cafres; 21°09'S, 55°34'E; III.1970; *J. Bosser 20057*; P[P00738474]! • Plateau de Bébour; 21°06'S, 55°33'E; IV.1970; *J. Bosser 20066*; P[P00738494]! • Petite Plaine des Palmistes, berge de la Ravine Sèche; alt. 1100 m; 12.IV.1970; *T. Cadet 2298*; REU[REU006410, REU006412]! • Plateau de Bébour; 21°06'S, 55°33'E; II.1971; *J. Bosser 20694*; P[P00738470]! • Plateau de Bébour; 21°06'S, 55°33'E; II.1971; *J. Bosser 20708*; P[P00738473]! • Plaine des Affouches; 20°58'50"S, 55°25'00"E; 13.II.1971; *J. Bosser 20513*; P[P00738475! and spirit] • Saint-Philippe, Hauts de Basse Vallée; alt. 1200 m; 15.II.1971; *T. Cadet 3043*; REU[REU006413]! • Notre-Dame de la Paix, Plaine des Cafres; 21°09'S, 55°34'E; alt. 1600 m; 18.II.1971; *T. Cadet 3073*; REU[REU006414]! • Sentier du Bras Cabot, îlet de Patience; 21°06'S, 55°37'E; 19.II.1971; *J. Bosser 20573*; P[P00738479]! • Forêt de Bébour; 21°05'37"S, 55°36'43"E; alt. 1300 m; III.1973; *D. Lorence 36*; K!, MO! • Forêt de Bébour; 21°05'37"S, 55°36'43"E; alt. 1300 m; III.1973; *D. Lorence R15*; P[P00738454]!, K!, MO! • Forêt de Bébour; 21°07'33"S, 55°34'21"E; alt. 1300 m; 26.III.1973; *D. Lorence R17*; K!, MO! • Hauts de Saint-Benoit, forêt dans l'encaissement de la Rivière des Marsouins; 21°05'37"S, 55°36'43"E; alt. 350 m; 18.IX.1973; *T. Cadet 4429*; REU[REU006415]! • Basse Vallée; 3.III.1974; *J. Bosser 21810*; P[P00738469]! • Grand Matarum, cirque de Cilaos; 21°07'19"S, 55°28'40"E; 23.III.1974; *J. Bosser 21698*; P[P00738471, spirit]!, K! • Grand Matarum, cirque de Cilaos; 23.III.1974; *J. Bosser 21698 bis*; P[P00738477]! • Sentier du morne de Fourche, cirque de Salazie; 21°03'49"S, 55°26'38"E; 28.III.1974; *J. Bosser 21748*; P[P00738472]! • Brûlé de Saint-Denis; 20°55'S, 55°26'E; 19.III.1974; *J. Bosser 21657*; P[P00738467]! • Bébour, Bélouve; 21°06'40"S, 55°33'47"E; alt. 1350-1450 m; I.1975; *L. Bernardi 15119*; G! • Bébour, Cassé de Takamaka; 21°05'S, 55°38'E; 1350-1450m; I.1975; *L. Bernardi 15144*; G! • Salazie, on path Terre Plate-Cap des Anglais; alt. 1450 m; 7.IV.1976; *T. Cadet 5322*; REU[REU006416]! • Cirque de Mafate, sentier du bélier à Aurère; 21°02'24"S, 55°26'29"E; 14.V.1976; *J. Bosser 22154*; P[P00738457]! • Forêt de Bébour, 21°06'40"S, 55°33'47"E; 3.III.1978; *J. Bosser 22355*; P[P00738460]! • Hauts de Sainte-Rose; 21°09'S, 55°45'E; 18.IV.1978; *J. Bosser 22515*; P[P00738466]! • Rivière des Marsouins; 21°05'37"S, 55°36'43"E; 29.IV.1980; *F. Billiet 886*; BR[BR0000021551000]! • Bébour, Coteau des Calumets; 21°03'40"S, 55°25'40"E; alt. 1500 m; 6.IV.1984; *T. Cadet 6576bis*; REU[REU006417]! • *sine loc.*; X.1986; *J. Dupont s.n.*; P! spirit only • Sentier du Piton par la Plaine des Cafres; 21°09'S, 55°34'E; alt. 1700 m; 24.IV.1988; *J. Dupont s.n.*, P[P00738356]! • Plaine des Palmistes; alt. 800 m; II.2002; *T. Pailler TP40*; REU! • Takamaka; 21°05'S, 55°38'E; alt. 1375 m; 14.II.2003; *Hoarau et al. 12*; REU[REU006407]! • Tévelave; 21°12'11"S, 55°21'51"E; 1.III.2003; *T. Pailler et al. TP161*; REU[REU006418, REU006419]! • L'Étang-Salé, Source Nouvelle Bras Sec, Chemin Canal; 21°13'32"S, 55°22'09"E; alt. 1250 m; X.2003; *V. Grondin et al. 838*; CBNM! • La Plaine des Palmistes, Piton Bébour path; 21°07'41"S, 55°33'43"E; alt. 1310 m; II.2004; *J. Férard et al. 994*; CBNM! • La Plaine des Palmistes, La Tanguière; alt. 750 m; III.2004; *V. Grondin et al. 1222*; CBNM! • Saint-Philippe, Piton Mare d'Arzule; 21°19'00"S, 55°46'00"E; alt. 700 m; III.2004; *C. Fontaine et al. 1127*; CBNM! • Plaine des Palmistes, Sentier vers Piton des Cabris; 21°09'24"S, 55°39'03"E; alt. 1200 m; 21.V.2008; *F. Martos FM328* and *FM329*; REU[REU007870, REU007872]! • Plaine des Palmistes, Gros Piton Rond; 21°07'41"S, 55°33'43"E; alt. 1420 m; 2008; *F. Martos FM407*; REU[REU007869]! • Cilaos, Mare à Joseph vers Kerveguen; 21°07'27"S, 55°30'16"E; alt. 1200 m; 24.V.2009; *F. Martos FM697*, *FM698* and FM699; REU[REU007696, REU007695, REU007692]!.

Notes

In the protologue of *Benthamia catatiana*, Perrier states that this species is close to *B. nigrescens* (synonym of *B. erinacea*), with the following differences: lip calceolate and attenuate but with apex obtuse, petals 5.5-6 mm longer than sepals 4.5 mm, anther shortly apiculate, and ovary short, less than 3 mm. However, examination of a rehydrated flower from the type specimen (*Catat 4338*) shows no significant difference with flowers from specimens of *B. erinacea,* it is well within the variation range of *B. erinacea*.

The cuspidate leaves of *Benthamia cuspidata* can be found also in *Benthamia nigrescens* subsp. *humblotiana*.

Perrier gave specimen "*Boivin (sans n°)*" as type of *Benthamia nigrescens* subsp. *borbonica*. However there are in P two such specimens *L.H. Boivin s.n.* bearing his handwriting "*Benthamia nigrescens* subsp. *borbonica* H.Perr.", without mention of which one is the type. We have chosen P00334740 as the lectotype, with more individuals and more variations between them, P00334741 being an isolectotype.

Peristylus secundiflorus is a *nomen nudum* which was probably meant for specimens *L.H. Boivin 1063*, according to handwritings on sheets P00738489, P00334751 and P00334752, but it was never validly published.

For *Benthamia nigrescens* subsp. *humblotiana*, Perrier gave no specific type but mentioned Humblot's specimens (*sine loc.* and *s.n.*), from the north-east of Madagascar, and his own gathering *H. Perrier 16110* from Mt. Tsaratanana, which has two sheets. We have chosen sheet P00094552 of *H. Perrier 16110* as lectotype because it includes a dissected flower.

For *Benthamia catatiana* H.Perrier, there are two sheets of the specimen cited in the protologue, *L.D.M. Catat 4338* in P. We choose P00094478 as the lectotype, P00094479, a dissected flower, being an isolectotype.

The watercolour 55 by Eudoxie de Cordemoy in MAU has been designated as a paratype by Hermans & Cribb (2021: 74).

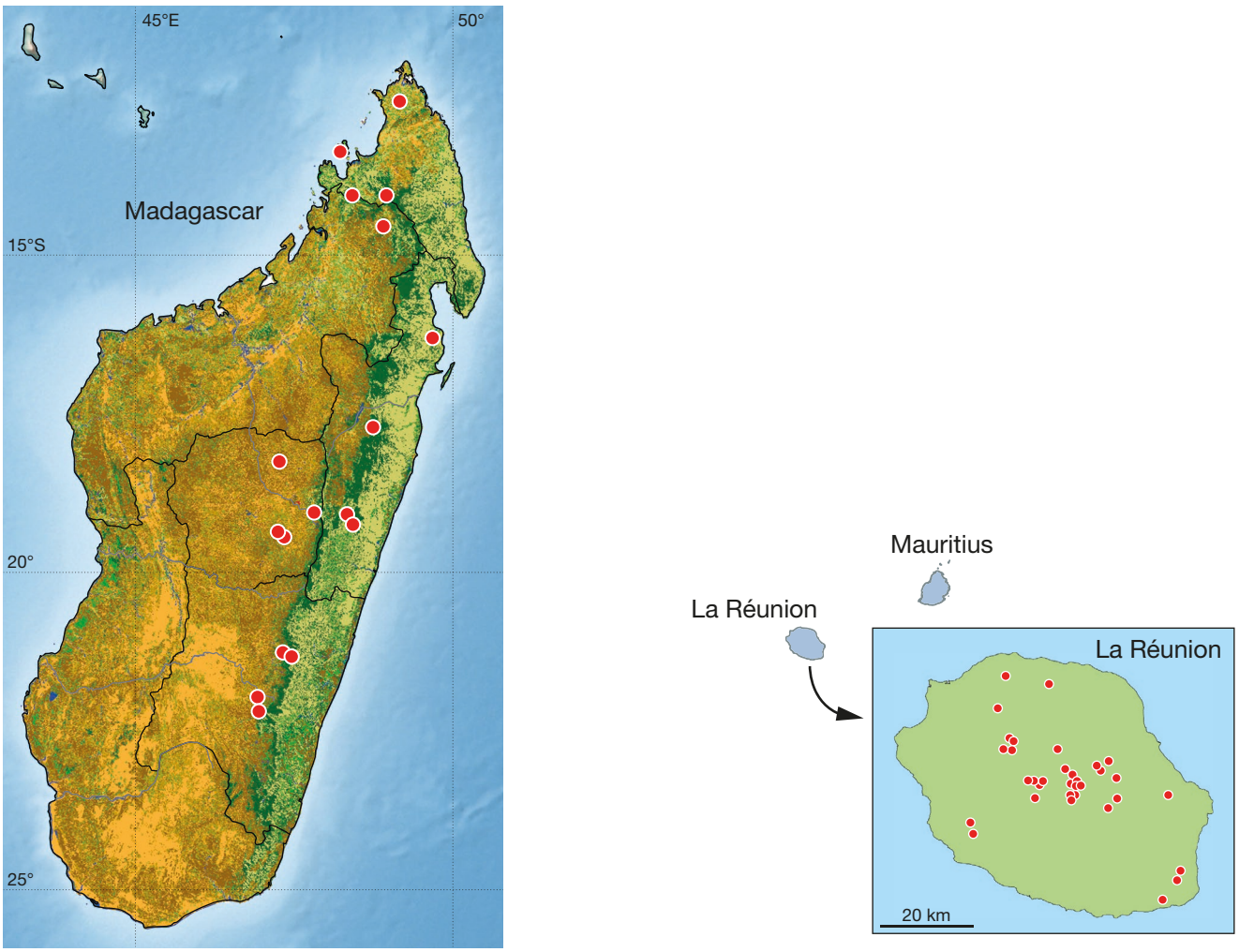

Fig. 37. — Distribution maps of *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb.

See also: Schlechter (1930: t.11 n°43), Perrier (1939: 25, as *Benthamia catatiana*), Perrier (1939: 26, as *Benthamia cuspidata*), Perrier (1939: 27), Cadet (1989: plate 23), Cribb & Hermans (2009: 43, *as Benthamia catatiana*), Cribb & Hermans (2009: 44), Cribb & Hermans (2009: 48, as *Benthamia cuspidata*), Bernet (2010: 134), Bosser & Lecoufle (2011: 178), Pailler *et al.* (2013: 29), Szelengowicz & Tamon (2013: 242, as *Benthamia cuspidata*), Szelengowicz & Tamon (2013: 249), Hervouet (2018: 170), Pailler & Henze (2020: 75), Hermans & Cribb (2023: 112).

Description

An erect epiphyte or lithophytic herb 8-45 cm tall. Tubers several, clustered, fleshy and elongate, roots wiry. Stem 1.4-4 mm in diameter, bearing two lanceolate, acuminate sterile bracts. Leaves cauline, 2-5, narrowly elliptic, oblong-elliptic or elliptic-lanceolate, acute or cuspidate, 4-15 × 1-4.5 cm, sheathing at the base, the upper two bract-like. Rachis erect, dense, often somewhat secund, narrowly cylindrical, 5 to 25 cm long. Floral bracts single-veined, lanceolate, very acute or acuminate, 4-20 mm × 1-4.5 mm, variable in size but generally longer than the ovary, especially the lower ones. Ovary 3-9.5 × 1-3 mm. Flowers *c.* 5 mm across, off-white or yellow to yellowish green, the petals and lip often more yellow; dorsal sepal single-veined, ligulate-lanceolate, acute, 2.8-6.3 × 0.7-1.3 mm; lateral sepals single-veined, narrowly lanceolate, keeled, 2.9-6.5 × 1-2.1 mm; petals triangular-ligulate, obtuse, 3-5.9 × 0.6-2 mm; lip concave at the base, ligulate, entire or slightly trilobed, without callus, obtuse, 3-6.5 × 1-3.3 mm; spur scrotiform, a little broader than long, 0.9-1.6 × 0.5-1 mm. Column *c.* 1-1.2 × 0.4-1 mm, anther subglobose, obtuse to shortly apiculate, auricles linear, subfalcate, longer than the anther; rostellum short, the midlobe obtuse, lateral lobes very small. Capsule less than 10 mm long.

Benthamia erinacea (Cordemoy) Hermans & P.J.Cribb f. ***reticulata*** Hervouet & Descourv., forma nov. (Figs 38; 39)

Diagnosis. — This form is in all aspects similar to the typical form, except for the leaves which are finely reticulated in white. It appears in mixed populations with the typical form.

Type material. — **Madagascar** • Analamanga, lake Mantasoa; 19°00'45"S, 47°50'17"E; VIII.1962, *J. Bosser 16153*; holotype: P[P00692431]!.

Fig. 38. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb: Iaroka forest near Andasibe, 11 July 2023. Typical form and f. *reticulata* f. nov. mixed. Photograph by Jean-Michel Hervouet.

Fig. 39. — *Benthamia erinacea* (Cordemoy) Hermans & P.J.Cribb f. *reticulata* f. nov.: forêt de Iaroka, 11 July 2023. Reticulated leaf. Photograph by Jean-Michel Hervouet.

Etymology. — From Latin "*reticulatus*", veined by a network.

Phenology. — Same as typical form.

Distribution and ecology. — Madagascar. Potentially within the distribution range of *Benthamia erinacea* in Madagascar, in the same habitat.

Conservation. — Very little is known so far on this form. Its conservation is certainly linked to that of the typical form, as it probably appears in its populations. It is provisionally quoted Data Deficient (DD).

Fig. 40. — *Benthamia exilis* Schltr., Andringitra Massif, Madagascar, 12 March 2009. Photograph by Jean-Michel Hervouet.

Notes

Specimens with reticulated or white-marbled leaves have been recorded by Jean Bosser (P[P00692431]) and Johan Hermans, they are frequent among populations in Andasibe region.

Description

As *Benthamia erinacea*, except that the leaves are finely reticulated in white.

Benthamia exilis Schltr.
(Fig. 40)

Repertorium Specierum Novarum Regni Vegetabilis 33: 26 (Schlechter 1924).

Benthamia exilis var. *tenuissima* Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33 (Schlechter 1924: 26). — Type: Madagascar • Vakinankaratra, Mt. Tsiafajavona; 19°21'25"S, 47°18'28"E; alt. 2400 m; III.1921; *H. Perrier 13522*; lectotype: P[P00094501]!, designated here; isolectotype: P[P00094502]!, **syn. nov.**

Type material. — **Madagascar** • Haute Matsiatra, massif d'Andringitra; 22°07'28"S, 46°52'07"E; alt. 2200 m; IV.1921; *H. Perrier 13652*; lectotype: P[P00094498]!; isolectotype: P[P00094499]!, designated by Hermans *et al.* (2007: 70).

Etymology. — From the Latin "*exilis*": slender, meagre, thin.

Phenology. — January to April.

Distribution and ecology. — Madagascar. So far only known from Mt. Tsiafajavona in the Vakinankaratra region and the Andringitra massif in Haute Matsiatra region, in montane grasslands, at elevations ranging from 1700 to 2400 m (Fig. 41).

Conservation. — Known only from two localities, Mt. Tsiafajavona and the Andringitra massif, this species has been seldom collected

and is considered Endangered (EN), according to criterion B2, with fewer than five known localities and threatened habitat.

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Haute Matsiatra, massif d'Andringitra; alt. 2200 m; II.1922; *H. Perrier 14390*; P[P00094500]! • Haute Matsiatra, massif d'Andringitra; alt. 2200 m; II.1922; *H. Perrier 14579*; P[P00094503]! for *Benthamia exilis* var. *tenuissima* • Haute Matsiatra, Andringitra; 2001; *J. Hermans 2063;* K!.

NOTES

The specimens available show a variation of habit from 12 cm to about 50 cm high and a great variation of rachis length. Considering this variability we include *Benthamia exilis* var. *tenuissima* Schltr. in the synonymy of *B. exilis*. For this variety Schlechter cited *Perrier 13522* for the type, but there are in P two specimens with this collection number. We have chosen P00094501 as lectotype because Perrier indicated on it that it was sent to Schlechter in April 1921.

Plants referred to var. *tenuissima* in Hervouet (2018: 162) are *Cynorkis micrantha* (Frapp. ex Cordem.) Schltr. In the same page 162 the specimen cited *Perrier* 74579 should read *Perrier* 14579.

An undescribed species close to *B. exilis* has been observed on the summit of Ambondrombe, but with a much longer midlobe of the lip. No herbarium specimen has been located. See also the notes under *Benthamia micrantha* in excluded species.

See also: Schlechter (1930: t.10 n°38), Perrier (1939: 20); Cribb & Hermans (2009: 43), Hervouet (2018: 162, the bottom photograph is *Cynorkis micrantha*).

DESCRIPTION

Very slender terrestrial herb, 13-50 cm tall. Tubers oblong and smooth. Stem filiform, 0.8-1.5 mm in diameter, covered by 4-7 distant sheaths with blade acute. Leaves absent. Rachis 8 × 1-1.2 cm, rather dense, many-flowered. Floral bracts lanceolate, almost as long as the flowers, 2.8-5 × 1-1.2 mm. Ovary fusiform-cylindrical, smooth, 4-5 × 0.8 mm. Flowers yellowish or greenish, sometimes with brown sepals; sepals oblong, somewhat obtuse, 2-3.5 × 0.8-1.5 mm, 3-veined, the dorsal sepal concave, the laterals oblique; petals oblong, obtuse, 1.9-3.1 × 0.9-2 mm, 3-veined and slightly expanded at the anterior edge in the lower half; lip narrowly oval in outline, 3-4.1 × 1.6-2.5 mm, almost orbicular and concave in its basal half, narrowly lanceolate and obscurely trilobed in the apical half, midlobe about 1.8 mm; spur with a wide base, narrowly cylindrical towards the apex, 1.8-3 × 0.3-0.4 mm long and bifid at the tip. Anther obtuse and short, 0.6-1.2 × 0.5-0.8 mm; auricles erect, linear, curved in a scythe shape and taller than the anther.

Benthamia flavida Schltr.
(Figs 42; 43)

Beihefte zum Botanischen Centralblatt 34(2) (Schlechter 1916: 302).

Benthamia perrieri Schltr., *Beihefte zum Botanischen Centralblatt* 34(2) (Schlechter 1916: 302). Type: Madagascar • Vakinankaratra, Antsirabe, marais tourbeux; alt. 2000 m; II.1914; *H. Perrier 8081*; holotype: P[P00094490]!.

FIG. 41. — Distribution map of *Benthamia exilis* Schltr.

Benthamia cinnabarina sensu H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 38). Perrier cited a wrong type: Trabonjy; V.1880; *J.M. Hildebrandt 3450*; P[P00094480]!, K!, which is indeed *Benthamia flavida*, but the basionym *Habenaria cinnabarina* Rolfe is referable to *Cynorkis cinnabarina* (Rolfe) Hermans & P.J.Cribb; the type is in K, it is a specimen cultivated by Lewis & Co in England in 1893.

TYPE MATERIAL. — **Madagascar** • Vakinankaratra, Cime du Famoizankova, au nord d'Antsirabe; 19°39'32"S, 47°03'48"E; alt. 2200 m; V.1912; *H. Perrier 11386*; holotype: P[P00094481]!.

ETYMOLOGY. — Derived from Latin « *flavus* », yellow, referring to the yellowish colour of the flower.

PHENOLOGY. — January to May.

DISTRIBUTION AND ECOLOGY. — Madagascar. Except for one locality in the north, mainly in montane grasslands in the central plateaux, in dry and open places, but sometimes also in wet areas, from 1200 m to 2200 m (Fig. 44).

CONSERVATION. — This plant is very common in Madagascar and can therefore be considered of Least Concern (LC). It was considered NT by IUCN in 2008, under the name *Benthamia cinnabarina.* See https://doi.org/10.2305/IUCN.UK.2013-1.RLTS.T44392752A44475517.en.

Fig. 42. — *Benthamia flavida* Schltr., Andringitra Massif, Madagascar, 13 March 2009. Photograph by Jean-Michel Hervouet.

Additional specimens examined. — **Madagascar** • *Sine loc.*; *R. Baron 5193*; P[P00094484]!, K! • *sine loc.; R. Baron 5245*; P[P00094485]! • *sine loc.*; *Bojer et al. s.n.*; P[P00094486]! • Nord Betsileo; I.1881; *J.M. Hildebrandt 3975*; W[R14942, R8645]!, WU, G, M, BM[BM000034589]! • Central, North Betsileo; I.1881; *comm. C. Rensch, J.M. Hildebrandt s.n.*; K! • Vakinankaratra, mont Ibity au sud d'Antsirabe; 20°05'44"S, 47°00'12"E; alt. 2000 m; II.1914; *H. Perrier 8097*; P[P00094487, P00094488]! • Haute Matsiatra, massif d'Andringitra; alt. 2000 m; IV.1921; *H. Perrier 13614*; P[P00094492]!, K! • Haute Matsiatra, massif d'Andringitra; alt. 2200 m; II.1922; *H. Perrier 14578*; P[P00094482, P00094491]! • Amoron'i Mania, environs d'Ambatofinandrahana; alt. 1600-1800 m; 19.II.1938; *R. Decary 13074*; P[P00094489]! • Sofia, de la haute Maevarano au bas Sambirano par Bealanana et la haute Sandrakoto; alt. 1400-1700 m; II.1951; *H. Humbert et al. 25402*; P[P00692280]!, TAN!, K! • Diana, Betainkankana, Ankaizina; 14°37'S, 48°43'E; V.1952; *J. Bosser 2560*; P[P00094483, P00692223]! • Amoron'i Mania, montagnes à l'ouest d'Itremo; 20°34'12"S, 46°34'55"E; 1955; *H. Humbert 30046*; P[P00692281]!, another specimen *Humbert 30046* is *Tylostigma nigrescens* Schltr. or *Tylostigma perrieri* Schltr. • Amoron'i Mania, montagnes à l'ouest d'Itremo; 20°34'12"S, 46°34'55"E; 1955; *H. Humbert 30050*; P[P00692283]!, TAN! • Amoron'i Mania, montagnes à l'ouest d'Itremo; 20°34'12"S, 46°34'55"E; alt. 1500-1700 m; 1955; *H. Humbert 30055*; P[P00692284 second from left only, P00692285 left only, P00692287]!, MO[3248465]! • Haute Matsiatra, Sendrisoa, Ambalavao, Antanifotsy; 22°13'S, 46°55'E; 5.II.1955; *C. Rakotovao 7303*; P[P00692316]! • Amoron'i Mania, route d'Ambositra à Ambatofinandrahana; 20°40'03"S, 47°08'03"E; III.1960; *M. Keraudren 148*; P[P00692288 plant in the middle is *Benthamia glaberrima*]! • Amoron'i Mania, Soanieranana, col d'Antoetra, district d'Ambositra; 20°46'27"S, 47°19'16"E; 21.III.1960; *M. Peltier 2229*; P[P00692293, P00692294]! • Amoron'i Mania, Ambositra, Anjoma; III.1960; *J. & M. Peltier 2173*; P[P01805103]!, TAN! plant on the left • Amoron'i Mania, route d'Ambatofinandrahana, à 10 km d'Ivato; 20°40'03"S, 47°08'03"E; II.1963; *F. Chabonis s.n.*; P[P00692269]! • Atsimo-Andrefana, environs de Betroka, région de Tuléar; 23°16'20"S, 46°05'58"E; II.1963; *J. Bosser 17387*; P[P00692239]! • PK300, RN7; IV.1963; *J. Bosser 16815*; P[P00692237]! • PK300, RN7; VIII.1963; *J. Bosser 17553*; P[P00692240]! • Haute Matsiatra, Andringitra; IV.1964; *J. Bosser 19508*; P[P00692254]! • Amoron'i Mania, massif de l'Itremo; 20°34'12"S, 46°34'55"E; IV.1964; *J. Bosser 19596*; P[P00692256, P00692257]! • Amoron'i Mania, 10 km route Ivato, route d'Ambatofinandrahana; 20°40'03"S, 47°08'03"E; IV.1964; *J. Bosser 19599*; P[P00692260]! plant on the left, the two others are *Tylostigma* • Haute Matsiatra, 25 km SW of Fianarantsoa; 5.III.1969; *W. Rauh 22258*; HEID[HEID740739, HEID740740, HEID740741, HEID740742, HEID740743, specimens in alcohol]! • Vakinankaratra, Mt. Ibity; 6.V.1970; *J. Bosser 20258*; P[P00692266]! • Amoron'i Mania, Morondava Ambatofinandrahana road, Col d'Itremo; 20°40'S, 46°35'E; alt. 1600 m; III.1971; *D.J. Mabberley 763*; K!, TAN! • Amoron'i Mania, near Morondava-Ambatofinandrahana road RN35, Col d'Itremo; 20°40'S, 46°35'E; III.1971; *D.J. Mabberley 770*; K! • Analamanga, Angavokely; 5.III.1988; *B. Pettersson et al. 222*; P[P02115318]!, K[spirit K55125.000]! • Analamanga, Angavokely; 22.III.1988; *B. Pettersson et al. 282*;

Fig. 43. — *Benthamia flavida* Schltr.: Mount Ibity, Madagascar, 13 March 2015. Photograph by Jean-Michel Hervouet.

P[P02115317]! • Amoron'i Mania, Antoetra village; 20°46'27"S, 47°19'16"E; alt. 1710 m; V.1993; *C.H. Jongkind et al. 870*; K[K000624472]!, BR[BR0000005242719]!, MO!, TAN! • Fianarantsoa province, SW of Ivato, off RN7, about 9 km on Ambatofinandrahana road; 20°40'03"S, 47°08'03"E; 1994; *J. Hermans 3519*; K! • Amoron'i Mania, Itremo, près du col; 20°34'28"S, 46°34'57"E; alt. 1710 m; 19.IV.1995; *D.J. Du Puy M912*; P[P00059608]!, K!, K[spirit SPC-72244.000], TAN! • Highlands, cultivated plant, found in bog; 1995; *J. Hermans 2740*; K! • Amoron'i Mania, Ambatofinandrahana; 1998; *J. Hermans 5047*; K! • Haute Matsiatra, Andringitra foothills, near the village of Soavihiny; 22°06'08"S, 46°47'04"E; V.2001; *J. Hermans 5240*; K! • Haute Matsiatra, Andringitra foothills, near village of Soavihiny; 22°04'54"S, 46°46'28"E; alt. 1506 m; V.2001; *J. Hermans 5245*; K! • Amoron'i Mania, road towards Ambatofinandrahana, Inselberg a few km before Anjomam Ankona; 20°40'11"S, 47°07'19"E; IV.2001; alt. 1548 m; *J. Hermans 5256*; K! • Amoron'i Mania, near Ambatofinandrahana; 20°40'03"S, 47°08'03"E; alt. 1500 m; 2001; *J. Hermans 3381*; K! • Vakinankaratra, Antsirabe, Mt. Ibity; 20°05'07"S, 47°01'06"E; alt. 2010 m; II.2003; *T. Andriamihajarivo 95*; P[P00692192]!, MO[MO3022646]!, TAN! • Haute Matsiatra, Ambalavao, réserve d'Anja; 21°50'10"S, 46°50'58"E; alt. 1171 m; 22.III.2006; *J.N. Labat 3656*; P[P00533700]! • Vakinankaratra, Mt. Ibity, Ankobohy; 20°04'19"S, 47°00'33"E; II.2007; *T. Ranarivelo et al. 463*; K! • Ihorombe, commune Iarintsena, Anja, mont Amboalandy; 21°51'08"S, 46°50'18"E; 1173 m; 16.III.2010; *Rajaonary et al. 70*; P[P06773265]! • Haute Matsiatra, Ambalavao, Iarintsana, Anja; 21°50'44"S, 46°49'55"E; alt. 1275 m; 16.III.2010; *Razafindraibe et al. 290*; P[P06796928]!, TAN! • Ihorombe, inselberg Bonnet du pape, fokontany Ifanadana, commune Zazafotsy, district Ihosy, RN7; 22°00'23"S, 46°21'42"E; III.2010, *L. Ramandimbisoa et al. 119*; P[P06773267]! and samples in alcohol • Amoron'i Mania, Ivato, Inselberg à 11.7 km d'Ivato vers la route d'Ambatofinandrahana; 20°39'55"S, 47°07'49"E; alt. 1542 m; 24.III.2010; *Rakotoarivelo et al. 292*; P[P06797815]! • Amoron'i Mania, Ambatofinandrahana, Itremo; 20°34'36"S, 46°35'06"E; alt. 1556 m; 3.V.2010; *Ralimanana RLI1450*; K[K000751569]!, P[P00939974]!, TAN! • Amoron'i Mania, Ambatofinandrahana, Itremo, Ambatoantrano; 20°33'55"S, 46°34'54"E; 4.V.2010; *S.E. Rakotoarisoa et al. 695*; K[K000664251]!, P[P00939969]!, MO!, TAN!, TEF!, SNGF! • Analamanga, Carion, inselberg Maharidaza; 47°43'39"S, 18°53'30"E; alt. 1501 m; 6.III.2011; *N. Ravololomanana 222*; P[P06796775]!, MO[MO3022632]!, TAN! • Amoron'i Mania, Antoetra, on inselberg; 20°46'27"S, 47°19'16"E; 14.II.2015; alt. 1676 m; *A. & C. Sieder et al. L6803*; WU! spirit material • Amoron'i Mania, Antoetra, inselberg; 20°46'27"S, 47°19'16"E; V.2018; *J. Hermans 8255*; K!.

Notes

The leaves are generally basal and alternate, but this is not the case for all specimens, e.g. *Bosser 2560* (P) from the north, which is in a disjunct area. This needs to be clarified from fresh material since plants with unusual patterns of leaves often occur in marshy soils (e.g. in Ambondrombe and Itremo).

Specimen *H. Perrier 113* cited by Schlechter in the protologue is an alternative numbering of *H. Perrier 11386*, which was sent to Schlechter in Berlin and returned, so there is no doubt that this is the holotype.

See also: Schlechter (1930: t.10 n°39), Perrier (1939: 39, as *Benthamia cinnabarina*), Cribb & Hermans (2009: 46, as *Benthamia cinnabarina*, photograph is *Benthamia africana*), Bosser & Lecoufle (2011: 175, as *Benthamia cinnabarina*), Hervouet (2018: 163).

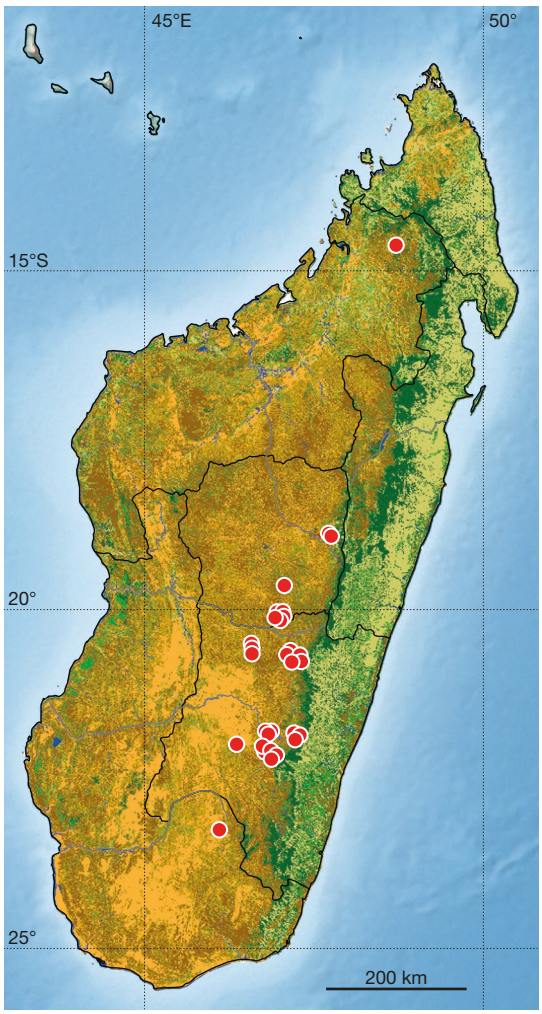

Fig. 44. — Distribution map of *Benthamia flavida* Schltr.

Description

Erect terrestrial herb, 15-35 cm tall. Tubers many, oblong. Stem 1.5-3 mm in diameter, with 4-5 leaves, basal or up to the middle, a little higher carrying a few sheaths gradually decreasing in size. Leaves, erect, alternate, linear or lanceolate-linear, 6-12 cm × 5-12 mm, acute. Rachis 5-16 cm long, several-flowered, but not very densely flowered, interrupted and spiral. Floral bracts narrow, lanceolate-linear, normally longer than the ovary, 6.5-12 × 1.1-2.5 mm. Ovary 2.5-7.5 × 0.8-2 mm. Flowers small, 4 mm without the ovary; sepals narrowly oblong, obtuse, 3-veined, dorsal sepal 3.5-4.9 × 0.6-1.5 mm, lateral sepals 2.7-4.8 × 0.3-1.2 mm; petals of the same length as sepals, wider, 3-5 × 0.9-1.5 mm, thickened and opaque in the upper half, a little expanded towards the middle of the front edge; lip oblong, 3.6-5.1 × 1.9-3.6 mm, trilobed, in the upper half, the lateral lobes very obtuse and about ⅔rd the size of the midlobe which is wider and around 1.5 mm long; spur scrotiform and a little flattened, as broad as high, 0.8-1.2 × 0.4-1.2 mm. Column 0.7-1.2 × 0.7-1 mm, anther shortly apiculate; auricles broadly spathulate, slightly shorter than the anther; rostellum with two very small lateral lobes and a larger obtuse midlobe, 0.1-0.2 mm long, upwards.

FIG. 45. — *Benthamia glaberrima* (Ridl.) H.Perrier: Mount Ibity, Madagascar, 5 March 2009. Photograph by Jean-Michel Hervouet.

Benthamia glaberrima (Ridl.) H.Perrier (Fig. 45)

Bulletin de la Société botanique de France 81 (Perrier 1934: 28). — *Holothrix glaberrima* Ridl., *Journal of the Linnean Society, Botany*, vol. 22: 125 (Ridley 1886); Perrier (1939: 22). — *Peristylus glaberrima* (Ridl.) Rolfe, *Orchid Review* 7 (73): 4 (Rolfe 1899). — *Platanthera glaberrima* (Ridl.) Kraenzl., *Orchidacearum Genera et Species*, vol. 1: 609 (Kraenzlin 1899). — *Habenaria glaberrima* (Ridl.) Schltr., *Beihefte zum Botanischen Centralblatt* 33: 405 (Schlechter 1915). — *Rolfeella glaberrima* (Ridl.) Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33: 18 (Schlechter 1924).

Habenaria deceptrix Baron ex Ridley, *nomen nudum* in Baron's "*Compendium des plantes Malgaches*". *Revue de Madagascar*, vol. 3, no. 10: 722 (Baron 1901).

TYPE MATERIAL. — **Madagascar** • Analamanga, Ambatovory; 18°54'S, 47°42'E; III.1882; *J. T. Fox 23*; holotype: K[K000415546]!.

ETYMOLOGY. — From Latin "*glaber*", glabrous, with superlative ending "*rima*" thus completely smooth, without hairs.

PHENOLOGY. — January to May.

DISTRIBUTION AND ECOLOGY. — Restricted to the central mountains and plateaux of Madagascar, from 1500 to 2250 m, in dry montane grasslands, also rocky outcrops and sometimes humid places (Fig. 46).

CONSERVATION. — Widespread in Madagascar, this species is considered of Least Concern (LC). However, it was considered Near Threatened (NT) by IUCN in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T68002690A68015027.en).

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Imerina; *R. Baron 849*; BM! • sine loc.; *Deans Cowan 23*; BM!, B!, M0000032247! • *sine loc.*; *B. Pettersson et al. 221*; K! flowers in spirit [K55124.000] • Montagnes d'Amoron Kay, est de l'Imerina; alt. 1600-1900 m; *H. Rusillon 166*; G! • Ambatovory; III.1886; *J. T. Fox 23*; K! ex LDS • north west, IX.1887; *R. Baron 5240*; K! mounted with *G.F. Scott Elliot 1944* and *Baron 849* • Near Mahabo; 19°07'S, 46°58'E; received IV.1890; *G.F. Scott Elliot 1944*; K! • Vakinankaratra, cime du Famoizankova près d'Antsirabe; 19°39'32"S, 47°03'48"E; alt. 2200 m; V.1912; *H. Perrier 11385*; P[P00094511]! • Vakinankaratra, pente du mont Ibity au sud d'Antsirabe; alt. 1800-2200 m; 20°05'44"S, 47°00'12"E; II.1914; *H. Perrier 8087*; P[P00094510 the plant on the right is *Benthamia rostrata*]! • Haute Matsiatra, massif d'Andringitra; alt. 2000 m; I.1922; *H. Perrier 14326*; P[P00094512]! • Vakinankaratra, flanc Est du Tsiafajavona; 19°19'58"S, 47°16'08"E; alt. 2000 m; 1928; *H. Perrier 13518*; P[P00094508, P00094509]! • Analamanga, massif de l'Angavo près d'Ankazobe; 18°14'S, 47°02'E; 10.III.1930; *R. Decary 7325*; P[P00094505]! • Analamanga, Tampoketsa au nord d'Ankazobe; 18°12'56"S, 47°17'17"E; 12.III.1930; *R. Decary 7453*; P[P00094504]!, TAN • Analamanga, massif de l'Angavo près d'Ankazobe; 18°14'S, 47°02'E; 16.III.1930; *R. Decary 7600*; P[P00094506]! • Amoron'i Mania, montagnes à l'ouest d'Itremo; 20°34'12"S, 46°34'55"E; alt. 1500-1700 m; 1955; *H. Humbert 30055*; P[P00692284 all but second specimen]!, P[P00692285 specimen on the right only]!, P[P00692286]!, TAN! • Vakinankaratra, environs de Faratsiho (face ouest de l'Ankaratra); 19°24'S, 46°57'E; alt. 1800 m; II.1957; *J. Bosser 10864*; P[P00094507]!, TAN! • Analamanga, Iarinandriana, 40 km from Antananarivo; 19°10'S, 47°30'E; IV.1957; *J. Bosser 11061*; TAN! • Vakinankaratra, massif de l'Ibity; 20°10'S, 47°01'E; 19.III.1960; *M. Peltier 2112*; P[P00692291]! • Amoron'i Mania, Ambositra, Anjoma; III.1960; *J. & M. Peltier 2173*; TAN! plant on the right • Amoron'i Mania, route Ambositra à Ambatofinandrahana; 20°40'03"S, 47°08'03"E; III.1960; *M. Keraudren 148*; P[P00692288, plant in the middle only]! • Haute Matsiatra, route Ambositra à Ambatofiterahana à 99 km de l'embranchement d'Ivato; 20°40'03"S, 47°08'03"E; III.1960; *M. Keraudren 157*; P[P00692289]! • Vakinankaratra, col des Tapias, 45 km avant Ambositra; 20°14'34"S, 47°06'04"E; IV.1964; *J. Bosser 19597*; P[P00692258]! • Haute Matsiatra, Andringitra Forest Reserve, along path to Pic Boby; 22°11'S, 46°55'E; alt. 1900-2050 m; 23.III.1989; *P. Goldblatt et al. 8965*; K!, MO[MO3011473]! • Vakinankaratra, Ankaratra Massif W of Ambatolampy; 19°20'S, 47°16'E; III.1989; *P. Goldblatt et al. 9011*; K!, MO[MO4314444]! • Analamanga, *c.* 85 km in direction Ankazobe; 18°15'59"S, 47°10'53"E;.XII.1998; *W. Rauh R21598*; HEID[HEID744389]! • Vakinankaratra, Ibity, Mt. Kiboy; 20°05'44"S, 47°00'12"E; alt. 1600 m; 1999; *J. Hermans 2410*; K! • Haute Matsiatra, Ambondrombe; alt. 2000 m; 1999; *J. Hermans 4406*; K! • Amoron'i Mania, Ambatofinandrahana, W of Itremo; 20°34'12"S, 46°34'55"E; 2002; *J. Hermans 3382*; K! • Vakinanakaratra, Ibity Massif; 20°04'10"S, 47°00'16"E; alt. 1700 m; II.2003; *G.E. Schatz et al. 4097*; TAN!, MO! • Vakinanakaratra, Ibity Massif; alt. 1700 m; 17.II.2003; *G.E. Schatz et al. 4139*; MO[MO3022642]! • Haute Matsiatra, Andringitra; alt. 1987 m; I.2005; *G. Fischer et al. FS2031-2005*; WU0848511! • Vakinankaratra, Mt. Ibity, Ankobohy; 20°04'30"S, 47°00'47"E; II.2007; *T. Ranarivelo et al. 465*; TAN!, K! •

Amoron'i Mania, Ambatofinandrahana, Itremo massif, about 25 km from Itremo village; 20°33'42"S, 46°33'49"E; alt. 1647 m; II.2010; *L.R. Rajaovelona et al. RJL145*; K!, TAN! • Haute Matsiatra, RN7 PK420.7, bifurcation à droite vers la commune d'Andoharanomaitso; 21°30'07"S, 46°58'43"E; alt. 1293 m; 14.III.2010; *L. Ramandimbisoa et al. 58*; P[P06773266]!.

NOTES

The species can be easily recognised in herbaria by its basal leaves followed by a series of prominent long acuminate sheaths, then by its dense rachis and also by its long and filiform spur.

See also: Cribb & Hermans (2009: 40), Bosser & Lecoufle (2011: 176), Hervouet (2018: 164).

DESCRIPTION

Erect terrestrial herb, 30-60 cm tall. Tubers 4-5, bunched, oblong-fusiform; Stem 2-3 mm in diameter, with a single radical sheathing leaf, higher covered by 6-11 acuminate sheaths 20-35 mm long. Leaf narrowly lanceolate-acute, 8.5-16 × 0.9-1.4 cm, very gradually narrowed towards the base, 5-veined. Rachis very dense, with 20-55 flowers, unilateral, 5-19 cm long. Floral bracts lanceolate, longly acuminate, 10-20 × 2.5-5 mm, normally longer than the flower. Ovary twisted, 5.5-10 × 1-2.5 mm. Flowers small, sulphur yellow; all sepals narrowly ligulate, a little fused to the petals at the base, dorsal sepal 5.1-7.5 × 0.6-1.3 mm, lateral sepals 4.5-8 × 0.5-1.8 mm; petals lanceolate, 5.2-8 × 0.6-2.1 mm, slightly longer than the sepals; lip oval in outline, 5.2-7.5 × 3-4.5 mm, obviously trilobed, a little fused with the sepals at the extreme base; midlobe oval-acute, the lateral lobes much smaller; spur filiform, pendent, 7.2-10 × 0.5-1.2 mm, a little longer than the ovary. Column straight, 1.1-2 × 0.9-1.5 mm; anther obtuse or subapiculate; auricles small, rounded, pollinia claviform with a very short caudicula; rostellum small, tridentate.

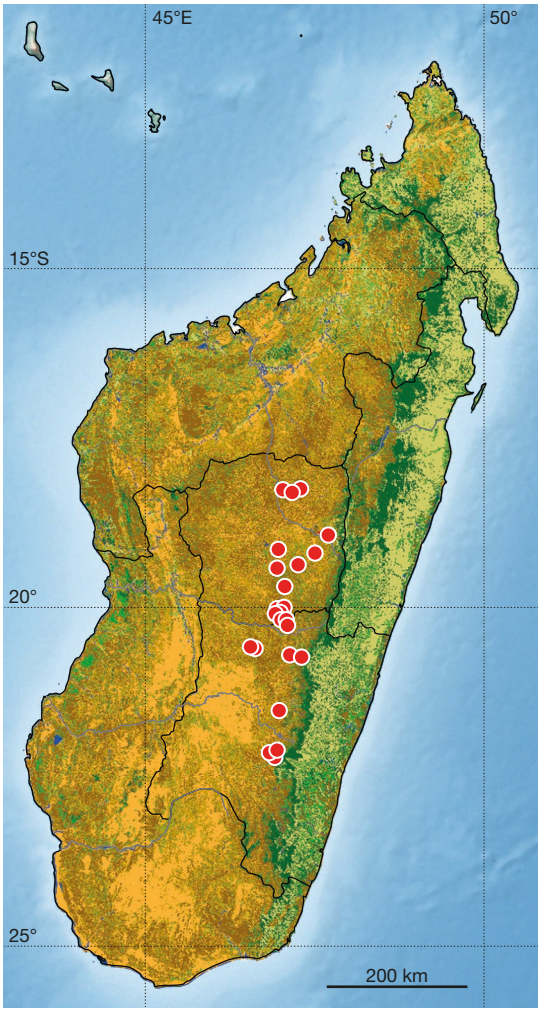

FIG. 46. — Distribution map of *Benthamia glaberrima* (Ridl.) H.Perrier.

Benthamia herminioides Schltr.
(Figs 47; 48; 49)

Repertorium Specierum Novarum Regni Vegetabilis 33 (Schlechter 1924: 27).

Benthamia herminioides subsp. *intermedia* H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 37). — Type: Madagascar • Diana, Mt. Tsaratanana; 14°01'17"S, 48°58'00"E; alt. 2000 m; IV.1924; *H. Perrier 16479*; holotype P[P00094515]!, **syn. nov.**

TYPE MATERIAL. — **Madagascar** • Vakinankaratra, mont Ibity au sud d'Antsirabe; 20°06'25"S, 46°59'51"E; alt. 2000 m,.II.1914; *H. Perrier 8103* (XIX); holotype: P[P00094513]!.

ETYMOLOGY. — Named for its similarity with species in the genus *Herminium*, according to Schlechter.

PHENOLOGY. — February to April.

DISTRIBUTION AND ECOLOGY. — Madagascar. Mainly in Analamanga, Alaotra-Mangoro, Haute Matsiatra and Amoron'i Mania regions, but with one locality in Sava region, Mt. Marojejy. In montane grasslands or marshes from 1000 to 2100 m (Fig. 50). *Benthamia herminioides* (subsp. *herminioides*) and *Benthamia herminioides* subsp. *intermedia* were listed as occurring in La Réunion by Szelengowicz & Tamon (2013: 244-245). However, there is no voucher for either and the photographs of *Benthamia herminioides* subsp. *intermedia* show a young *Benthamia latisatis*.

CONSERVATION. — This species seems widespread in Madagascar but is only known from fewer than 10 localities which do not cover more than 2 000 km², with a decline of the habitat quality, it is therefore considered Vulnerable (VU) according to criterion B2.

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Sava, sommet oriental du massif de Marojejy; III-IV.1939; *H. Humbert et al. 23880*; P[P00334789]! • Haute Matsiatra, Ambondrombe; 21°52'30"S, 47°15'37"E; alt. 1500 m; 11.IV.1941; *P. Boiteau 4840*; P[P00692304]! • Sava, pentes orientales du massif de Marojejy; 24.III.1949; alt. 1000 m; *H. Humbert 23638*; P[P00334791]! • Sava, sommet oriental du massif de Marojejy; 14°26'57"S, 49°43'57"E; 26.III-2.IV.1949; *H. Humbert et al.* 23879; P[P00334790]!, G! • Sava, sommet oriental du massif du Marojejy; 14°25'S, 49°43'E; alt. 1850-2137 m; 17-20.XII.1949; *H. Humbert 22717*; P[P00692985, P00692988, P01778630]!, G!, K! • Atsinanana, Brickaville; VI.1959; *W. Rauh 158*; HEID[HEID713727]! • Haute Matsiatra, Andringitra; IV.1964, *J. Bosser 19643*; P[P00692263]! • Analamanga, SE Carion, near the granite dome of Angavokely; alt. 1750-1780 m; 27.II.1988; *B. Pettersson et al. 203*; P[P02115315 flowers in bud]!, K[spirit K55118.000]! • Sava, Réserve naturelle de Marojejy, the trail to the summit of Marojejy Est; 14°26'S, 49°13'E; alt. 1900-2133 m; 15.II.1989; *J.S. Miller et al. 4150*; P[P00754986]!,

Fig. 47. — *Benthamia herminioides* Schltr.: Mount Ibity, Madagascar, 1 April 2018. Photograph by Jean-Michel Hervouet.

Fig. 48. — *Benthamia herminioides* Schltr.: Mount Ibity, Madagascar, 1 April 2018. Photograph by Jean-Michel Hervouet.

Fig. 49. — *Benthamia herminioides* Schltr.: Mount Ambondrombe, Madagascar, 11 April 2018. Yellow flowers. Photograph by Jean-Michel Hervouet.

MO[MO3022650]!, TAN! • Sava, Réserve naturelle de Marojejy; alt. 1900-2133 m; 15.II.1989; *J.S. Miller et al. 4179*; MO[MO3022625]! • Haute Matsiatra, Ranomafana National Park, parcelle n°3; alt. 1374 m; 21°20'03"S, 47°24'49"E; III.1992; *S.T. Malcomber et al. 1364*; P[P00754904]!, K, MO[MO3022611]!, TAN! • Haute Matsiatra, Ranomafana National Park, vicinity of Ampasina; 21°11'S, 47°25'E; 10.III.1995; *D. Turk et al. 727*; P[P00094582]!, K!, K[spirit K72250.000]!, WAG[WAG.1924442]! • Haute Matsiatra, Ambondrombe; alt. 1875 m; 9.III.2009; photos Jean-Michel Hervouet • Alaotra-Mangoro, Ambatovy; alt. 1120 m; 25.III.2011; *T. Stévart et al. 4115*; BRLU!, MO[MO3060441]!, K!, TAN!, spirit • Amoron'i Mania, Antoetra, on Inselberg; 20°46'27"S, 47°19'16"E; alt. 1676 m; II.2015; *A. & C. Sieder et al. L*6811 & *J. Hermans 8076*; K!, WU!, and spirit material • Alaotra-Mangoro, Andasibe, Iaroka forest; 29.IX.2019; *J. Hermans 835*;5 K!.

Notes

The flowers are amongst the smallest in the genus. They generally have a green calyx and white corolla, but the petals can be also greenish (original subsp. *intermedia*) or sulphur yellow (Marojejy and Ambondrombe, with plants with white corolla also present). The differences given by Perrier to establish the subspecies *intermedia* fall within the variability of the species

itself, but he noted on the herbarium sheet that the flowers are greenish.

Perrier also refers to *Benthamia herminioides* subsp. *typica* H.Perrier (Perrier 1934: 36). This name is not validly published (article 24.3 of the International Code of Nomenclature). With subsp. *typica* Perrier was referring to the autonym name, i.e. subsp. *herminioides*.

See also: Schlechter (1930: t.10 n°40), Perrier (1939: 36), Cribb & Hermans (2009: 48), Hervouet (2018: 165).

DESCRIPTION

Small or slender terrestrial herb, 20-70 cm tall. Tubers 2-3, 15-25 × 3-4 mm. Stem green, 1.5-3 mm in diameter, with 1-2 tubular sheaths at the base, 15-32 cm × 3 mm, and leaves in the lower half. Leaves 2-3, elliptic-lanceolate or lanceolate, 3-10 × 1.5-2.5 cm, shortly acuminate, very gradually and slightly narrowed towards the base. Rachis 5-25 cm, laxly 15-45 flowered, flowers fairly close together on stem, 3-6 mm apart, unilateral. Floral bracts lanceolate-acuminate, 2.2-6.5 × 0.7-1.5 mm, variable, generally about the same length as the ovary but sometimes shorter or longer, folded around the base of the ovary and apiculate. Ovary 2.5-5 × 0.9-1.5 mm, barrel-shaped with 3 distinct ridges. Flowers with green calyx, and petals generally white, sometimes yellow or greenish, small. Overall flower size 3 mm wide, 2 mm high, 2.5 mm deep; sepals oblong, obtuse, 1-veined, 1.8-2.75 × 0.4-1 mm, dorsal sepal forming a hood over the column together with the petals, lateral sepals concave or navicular, spreading and joined slightly at the base with the dorsal sepal and petals; petals 1-veined very obtuse, gradually thickened towards the apex, 1.7-2 × 0.6-1 mm, a little shorter than the sepals; lip rhomboid in outline, 1.1-2.7 × 0.9-1.2 mm, base a little concave, trilobed in the upper third, the midlobe triangular-acute, thick, twice as long as the lateral lobes which are obtuse and thickened at the apex, erect to inwards folding, embedded into the petals; spur very short, subglobose, saccate or a little claviform, 0.6-0.8 × 0.3-0.8. Column 0.5-0.7 × 0.5-0.7 mm, anther apiculate; auricles reaching half the anther length or more, slightly spathulate; rostellum with the midlobe triangular-acute; stigmata in a cushion, free only at the apex; pollen grains minute, around 0.2 mm.

Benthamia humbertii H.Perrier
(Figs 51; 52)

Bulletin de la Société botanique de France 81: 35 (Perrier 1934).

TYPE MATERIAL. — **Madagascar** • Ihorombe, pic d'Ivohibe; 22°30'25"S, 46°58'15"E; alt. 1500-2000 m; 5-11.XI.1924; *H. Humbert 3287*; lectotype: P[P00094517]!, here designated; isolectotype: P[P00094518]!, B[B100365917]!, one of the few specimens saved from the destruction of the Berlin herbarium at the end of second World War, G!, K[K000415555]!, TAN[TAN000409]!.

ETYMOLOGY. — Named for Henri Humbert (1887-1967) who collected the type material.

PHENOLOGY. — October and November.

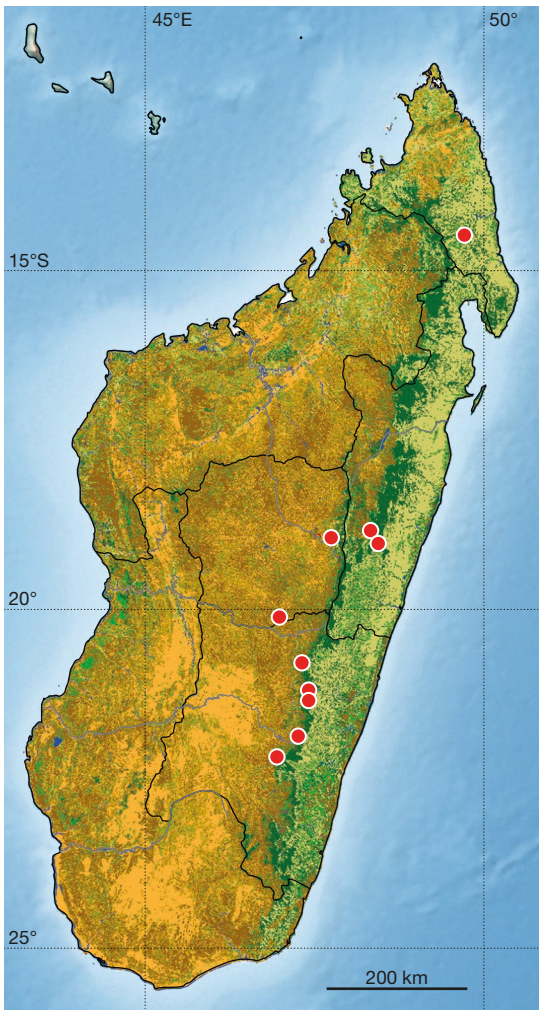

FIG. 50. — Distribution map of *Benthamia herminioides* Schltr.

DISTRIBUTION AND ECOLOGY. — Madagascar. In the southern half of the country, in montane grasslands from 1100 to 2000 m (Fig. 53).

CONSERVATION. — So far only known from fewer than 10 localities only, with an AOO less than 2000 km², and habitat threatened by frequent bushfires, it is considered Vulnerable (VU), despite a very large EOO according to criterion B2. It was considered EN by IUCN in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T70102654A70155404.en).

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Haute Matsiatra, Andringitra, Andrianony, cirque de Manjarivolo; alt. 1800 m; 1.XI.1970; *J.L. Guillaumet 3451*; TAN! • Anosy, massif du Beampingaratra, col de Vohipaha; 24°32'S, 46°53'E; alt. 1100-1400; 16.XI.1928; *H. Humbert 6658*; syntypes: P[P00094519, P00094520]! • Atsimo-Atsinanana, bassin de l'Itomampy, mont Papanga près de Befotaka; 23°51'S, 46°57'E; alt. 1300-1700 m; 2-3.XII.1928; *H. Humbert 6906 bis*; syntype: P[P00094521]! • Haute Matsiatra, Andrambovato, près de Fianarantsoa; 21°31'S, 47°25'E; XI.1963; *J. Bosser 18306*; P[P00692242, P00692243]! • Amoron'i Mania, Antoetra; 20°46'27"S, 47°19'16"E; photographs by Anton Sieder • Haute Matsiatra, Ankazomivady; 20°46'22"S, 47°10'48"E; 1721 m; 12.VIII.2017; photographs by Hasimbola Rakotobe • Haute Matsiatra, Ambondrombe; 21°52'30"S, 47°15'37"E; alt. 1875 m; 29.X.2022; photographs by Jean-Michel Hervouet.

Fig. 51. — *Benthamia humbertii* H.Perrier: Mount Ambondrombe, Madagascar, 11 April 2018. Photograph by Jean-Michel Hervouet.

Fig. 52. — *Benthamia humbertii* H.Perrier: Mount Ambondrombe, Madagascar, 29 October 2022. Photograph by Jean-Michel Hervouet.

Notes

One of the largest *Benthamia* species in Madagascar. It closely resembles *B. latisatis* from the Mascarenes but is easily distinguished by the leaves (alternate amplexicaul, 6-8 cm long vs 12-30 cm long, higher on the stem), by the sepals and petals which are 1-veined (3-veined in *B. latisatis*), the bigger lip with a crest, the non-apiculate anther and the indented rostellum in the middle.

See also: Perrier (1939: 36), Cribb & Hermans (2009: 49), Bosser & Lecoufle (2011: 177, the photograph shows *Benthamia elata*).

Description

Robust terrestrial herb, 50-70 cm tall. Tubers many, fusiform. Stem thick, 5-10 mm in diameter, carrying only 2-3 very lax sheaths in its lower part, of which the 2 outer ones are black, then 4-8 developed alternate amplexicaul leaves above the middle and higher again a few short sheaths becoming gradually similar to the floral bracts. Leaves rather thick, broadly oval-lanceolate, 6-8 × 2-4 cm, acuminate-acute. Rachis elongate, 15-18 cm, cylindrical, 2-2.4 cm in diameter, dense, with 35-100 flowers. Floral bracts narrowly lanceolate, concave at base, acuminate-acute, 1-veined, 10-14 × 3 mm, the lower ones a little longer than the ovary and flower, the upper ones about as long. Ovary twisted, 7-20 × 1.5-3 mm, reddish. Flowers greenish yellow, thick and short, 4-5 mm without the ovary; sepals 1-veined, dorsal sepal broadly elliptic, 4-5 × 1.7-2 mm, lateral sepals concave, elliptic to subtriangular or even navicular, very obtuse to subacute, 4.2-4.5 × 1.7-1.8 mm; petals elliptic, asymmetrical, 3.5-4 × 1.5-2 mm; lip broadly obovate, 4.5-5 × 3-4.5 mm, thick, trilobed in the apex, the lateral lobes short, triangular with obtuse apex, 0.4-0.5 mm long, the midlobe truncate, obtuse, 1-1.5 × 1 mm, thickened; spur scrotiform, compressed, wider than long, 1-2 × 1.8-2 mm. Column 1-1.2 × 1-1.2 mm, anther obtuse, not or hardly apiculate; auricles slightly spathulate, equalling half the length of the anther or less; rostellum trilobed, with

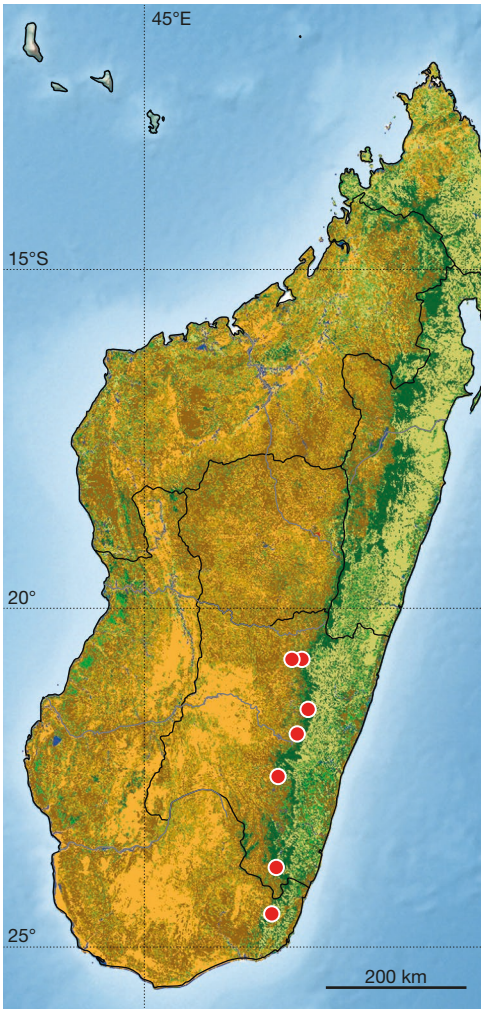

Fig. 53. — Distribution map of *Benthamia humbertii* H.Perrier.

Fig. 54. — *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov., Lakato road, Andasibe region, Madagascar, September 1963. Photograph by Jean Bosser.

two small horizontal lateral lobes, midlobe toothed, short and thick, slightly emarginate in the middle; stigma short, forming two distinct small, rounded masses.

Benthamia lakatoensis Descourv. & Hervouet, sp. nov. (Figs 54; 55; 56; 57)

Diagnosis. — Similar to *Benthamia nivea* but differing by the shape of the leaves, elliptic with apex rounded (vs elliptic with apex acute in *Benthamia nivea*), and in the smaller flowers, 4-6 mm (vs 5-10 mm for *Benthamia nivea*), forming a straight tube in their lower third (vs forming a curved tube), with petals not or hardly asymmetrical (vs completely asymmetrical), lateral lobes of lip divergent (vs parallel when flattened), base of lip narrow, hardly wider than the midlobe (vs base of lip twice wider than the midlobe), the dorsal sepal and petals ending in a single vertical plane in fresh specimens (vs flowers not opening widely). The auricles are nearly twice as long and the column is much less apiculate, the spur is half the length. The flowering season is August-November (vs February-April).

Type material. — **Madagascar** • Alaotra-Mangoro, route de Lakato; 19°11’30”S, 48°26’00”E; XI.1963; *J. Bosser 18340*; holotype: P[P00094562]!.

Etymology. — Referring to « Lakato », a village near Andasibe in the Alaotra-Mangoro region, where the type of the plant was first found.

Phenology. — August to November.

Distribution and ecology. — Madagascar. Only few plants have been recorded so far, from *c.* 725 to 1200 m, in medium altitude moist evergreen forest, from north to south. The type was collected along the road between the Route Nationale 2 and Lakato, a region that has suffered from severe deforestation in the recent years, it is very unlikely that it still exists there. A specimen has been located in Zahamena forest reserve, another one in Ranomafana national park, and more recently another from Tsaratanana area (Fig. 56).

Conservation. — Apart from the specimens found recently, this species has been collected in two localities only, one of them (road to Lakato) being heavily deforested. It can be considered Critically endangered (CR) according to criterion B2, with AOO less than 10 km^2, severely fragmented and in continuing decline.

Additional specimens examined. — **Madagascar** • Alaotra-Mangoro, massif de l’Andrangovalo au sud-est du lac Alaotra, réserve de Zahamena; 17°40’S, 48°45’E; alt. 1200 m; X.1937;

Fig. 55. — *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov., Lakato road, Andasibe region, Madagascar, September 1963. Photograph by Jean Bosser.

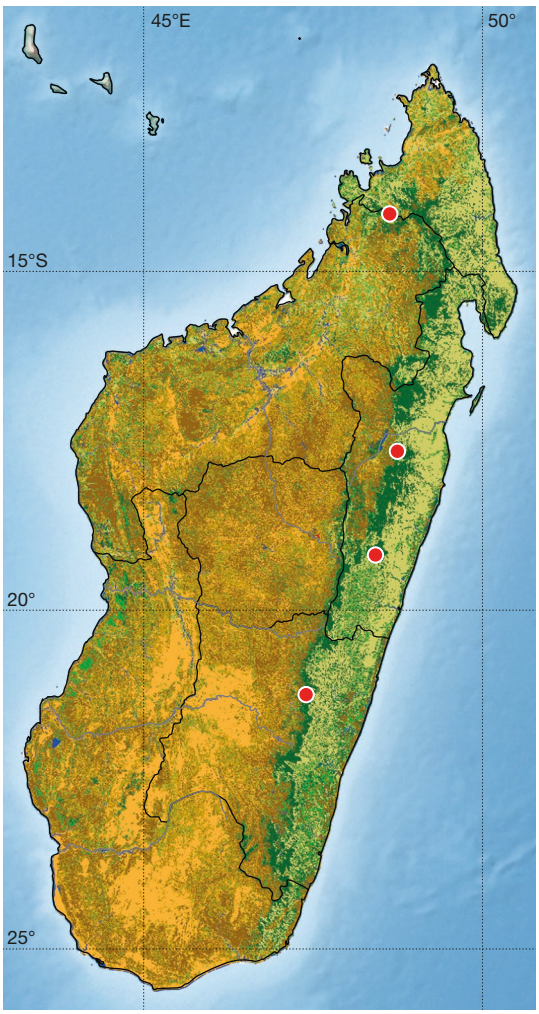

Fig. 56. — Distribution map of *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov.

H. Humbert et al. 17922; P[P00094547]! • Haute Matsiatra, parc national de Ranomafana, parcelle n°1, 26.VIII.1992; *R. Rakoto* 208; P[P00692459]!, K!, MO[MO3022622]! • Alaotra-Mangoro, Lakato, *Bosser 17229*; Jean Bosser and Jean-Pierre Peyrot slides. It is very likely that the specimen *Bosser 17229* referred to in the Bosser slide collection is in fact *Bosser 18340*, there is no specimen *Bosser 17229* in P • Diana, Ambanja district; alt. 725 m; 20.XI.2022, *L.R. Rajaovelona RJL1662*; K[K001304657]!.

Notes

A photograph of this species was published by Bosser & Lecoufle (2011: 179), as *Benthamia nivea*. However, it differs from the type material of *Benthamia nivea* and appears to be the new species. The auricles are twice as long as the anther and are similar to those of *Benthamia erinacea*. They are thinner than those of *Benthamia nivea*.

See also: Bosser & Lecoufle (2011: 179, as *Benthamia nivea*).

Description

Erect epiphytic herb, 15-25 cm tall. Tubers many, fusiform and villous, 3-6 cm long. Stem 1.5-2 mm in diameter, with the base covered by 1 sheath, with 2-3 basal leaves and sometimes another one higher up, followed by one or two sterile bracts. Leaves elliptic, 3-7 × 1-2 cm, with apex rounded, sometimes slightly mucronate. Rachis cylindrical, with 10-35 flowers, 6-10 cm long. Floral bracts narrowly lanceolate, very acuminate, longer than the ovary at the base of the rachis, then as long as the ovary. Ovary 7-10 × 1.5 mm. Flowers 4-6 mm long without the ovary, opening widely, snow white; all floral parts forming a straight tube in the lower third of the flower; dorsal sepal linear-obtuse, 4-6 × 1 mm, with a narrowed base, single-veined; lateral sepals a little wider, spreading, 4-6.5 × 1-1.1 mm; petals elliptic, with the apex rounded or subacute, 3-veined, obscurely dissymmetric, 4.5-6.5 × 1.2-2 mm, 3-4-veined in the lower 2/3rd; dorsal sepal and petals spreading, to the point of ending in a single vertical plane; lip narrowly oblong, 4-6.5 × 2.5-3.3 mm, with narrow base, without callus, trilobed at the apex in about the third of its length, 3-5-veined, lateral lobes wide, nearly as wide as the midlobe, divergent when flattened, subacute, 1.5-2 × 1 mm, midlobe slightly longer, 2-2.5 × 1.2 mm, apex subacute but folded upward, so that it appears truncate in fresh flowers, base of lip about as wide as the midlobe; spur subglobose, saccate, very short, 0.5-1 × 0.9 mm. Column 0.6-1 × 0.5-1 mm, anther almost orbicular, subterete, with an obtuse apiculus; auricles falciform, narrow, glandular, twice as long as the anther; rostellum tridentate.

FIG. 57. — *Benthamia lakatoensis* Descourv. & Hervouet, sp. nov.: drawing by Ludivine Longou, after photographs and dried specimens: **A**, habit; **B**, front view of flower; **C**, side view of flower. Scale bars: A, 10 mm; B, C, 1 mm.

FIG. 58. — *Benthamia latisatis* (Thouars) Bytebier, Caverne Dufour, La Réunion, 14 October 2021. Photograph by Jean-Michel Hervouet.

Benthamia latisatis (Thouars) Bytebier
(Figs 58; 59)

Candollea 80: 1-5 (Bytebier 2025). — *Satorkis latisatis* Thouars, *Histoire particulière des plantes orchidées recueillies sur les trois îles australes d'Afrique*: 10 (Thouars 1822), alternative Thouarsian name for *Satyrium latifolium* Thouars. — *Satyrium latifolium* Thouars, *Histoire Particulière des plantes orchidées recueillies sur les trois îles australes d'Afrique*: 10 (Thouars 1822), *nom. illeg.*, *non* L. (Linnaeus 1759). — *Habenaria chlorantha* Spreng., *Systema Vegetabilium* 3: 691 (Sprengel 1826), *nomen illeg. superfl.* — *Benthamia latifolia* (Thouars) A.Rich., *Mémoires de la Société d'Histoire naturelle de Paris,* tome IV: 38 (Richard 1828). — *Herminium latifolium* (Thouars) Lindl., *Edward's Botanical Register* 18: t.1499 (Lindley 1832). — *Peristylus latifolius* (Thouars) Lindl., *Genera and Species of Orchidaceous Plants*: 297 (Lindley 1835). — *Habenaria latifolia* (Thouars) T.Durand & Schinz, *Conspectus Florae Africae,* vol. 5: 80 (Durand & Schinz 1892), *nom. illeg.* — *Habenaria latifolia* (Thouars) Cordem., *Flore de l'île de la Réunion*: 260 (Cordemoy 1895). — *Benthamia chlorantha* (Spreng.) Garay & Romero, *Harvard Papers of Botany* 3: 53 (Garay & Romero 1998), *nomen illeg. superfl.*

FIG. 59. — *Benthamia latisatis* (Thouars) Bytebier, Caverne Dufour, La Réunion, 14 October 2021. Photograph by Jean-Michel Hervouet.

TYPE MATERIAL. — **France, La Réunion** • À la grande montée de la plaine; 20°56'S, 55°31'E; *L.M.A. du Petit-Thouars s.n.*; lectotype: 2-part specimen: P[P00094522, P00094523]!, designated by Garay & Romero (Garay & Romero 1998: 53).

ETYMOLOGY. — *Satorkis latisatis* is the alternative Thouarsian name of *Satyrium latifolium*. *Satorkis* replaces *Satyrium* because in Thouars nomenclature all genera in the family Orchidaceae must end with "orkis". "*Latisatis*" combines *lati* which is the beginning of *latifolium* and *satis* which refers to the genus *Satorkis*.

PHENOLOGY. — July to March.

DISTRIBUTION AND ECOLOGY. — La Réunion, Mauritius. Widespread in the north-east part of La Réunion, from 400 to 2100 m, and also present in the south of Mauritius (Fig. 60). On roadsides or banks in full sun as well as in understorey in forest.

CONSERVATION. — Widespread in La Réunion where it is of Least Concern (LC) but it is certainly Vulnerable (VU) in Mauritius, under criterion D2 (AOO less than 20 km²).

ADDITIONAL SPECIMENS EXAMINED. — **Mauritius** • *Sine loc.*; *Commerson s.n.*; P[P00334788]! • *sine loc.*; *Boivin s.n.*; W, another *Boivin s.n.* plate in W is *Benthamia erinacea* • *sine loc.*; *Hill 117*; BM[BM000032256]! • *sine loc.*; *Herb. Pamplemousses* 1556; MAU[MAU0002100]! • Pétrin, Les Mares; 20°24'31"S, 57°28'19"E; VII.1947; *G. Morin H/29*; MAU[MAU0002099]! • Marshy locali-

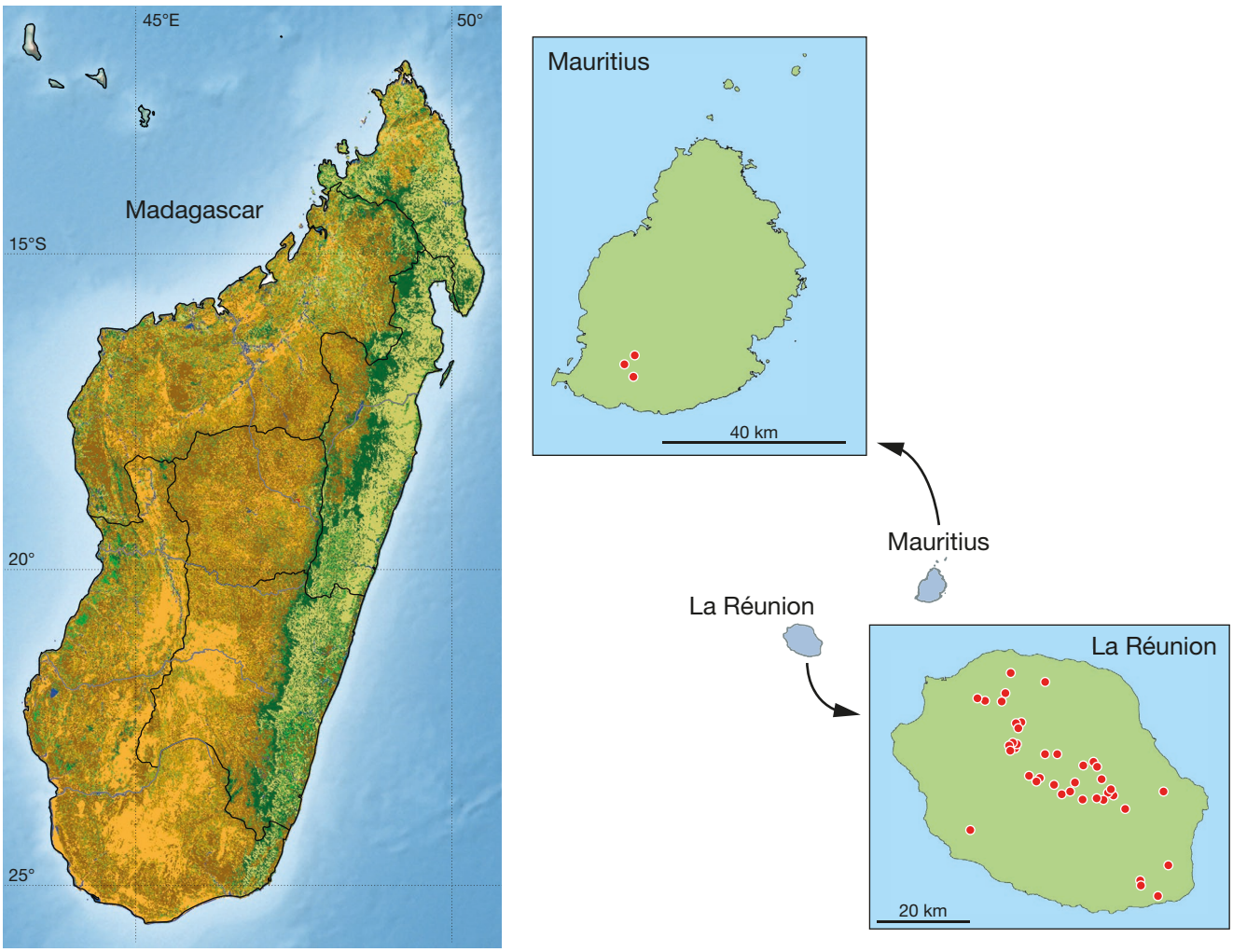

Fig. 60. — Distribution map of *Benthamia latisatis* (Thouars) Bytebier.

ties near Pétrin and Chemin Mingot; XI.1948; *R.E. Vaughan 20*; MAU[MAU000210, MAU0002102]! • Black river gorges; 20°25'35"S, 57°27'05"E; alt. 244 m; VII.1952; *Hill M5*; BM[BM000034596]! • Pétrin; IX.1969; *J. Gueho 13779*; P! • Pigeon Wood *c.* 100 m before Bassin Blanc; 20°27'01"S, 57°28'09"E; alt. 100 m; VIII.2006; *K. Pynee et al. 24849*; MAU[MAU0001992]! • Pigeon Wood *c.* 100 m before Bassin Blanc; IX.2009; *K. Pynee et al. 24850* & *24851*; MAU[MAU0001993]!.

France, La Réunion • *Sine loc.*; *Cordemoy s.n.*; MARS[MARS087705]! • *sine loc.*; *Cordemoy s.n.*; MARS! 2 specimens • *sine loc.*; *Renz 13018*; RENZ! • *sine loc.*; *Cordemoy s.n.*; MARS[MARS087690-MARS087700, 11 specimens]! • *sine loc.*; *Herb. Richard R19907*; W! • *sine loc.*; *A. Richard s.n.*; K-Lind!, with drawing by Lindley, same sheet as Bouton • À terre dans les forêts humides; *A. Richard 817*; P[P00334792, P00334793, P00334794, P00334795]! • Boucan-Launay; 20°55'S, 55°27'E; *Bernier s.n.*; P[P00334785]! • *sine loc.*; *A.N. Desvaux s.n.*; P[P00334786]! • *A.N. Desvaux 266*; P[P00334787]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738487]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00334780, P00334781, P00334783]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738488]! • *sine loc.*; 1825; *J.B.G.M. Bory s.n.*; P[P00094524]! • *sine loc.*; 1841; *C. Richard 667*; P[P00738464]! • *sine loc.*; 1847; *Armange 168*; P[P00334782]! • *sine loc.*; 1849; *Giraudy R11697*; W! • Saint-Benoit; 27.VI.1867; *J. Cordemoy s.n.*; REU! • *sine loc.*; 22.III.1872; *J.B. Potier s.n.*; P[P00334779]! • Plaine des Cafres, Saint-Pierre; 21°09'S, 55°34'E; 28.III.1872; *J.B. Potier s.n.*; P[P00334784]! • *sine loc.*; 1863; *J. Blackburn s.n. Herb. Hookerianum*; K! • *sine loc.*; 1875; *B. Balfour s.n.*; K! • Bélouve; 21°04'34"S, 55°32'31"E; alt. 1500 m; IV.1956; *J. Bosser 9470*; P[P00738338, P00738339]! • Plaine des Cafres, Petite Plaine; alt. 1600 m; 28.VII.1963; *W. Rauh 215*; HEID[HEID7899475]! • Plaine des Palmistes, cascade Biberon; 21°07'31"S, 55°37'43"E; alt. 1000 m; 11.X.1970; *T. Cadet 2813*; P[P00738481]!, REU[REU006396, REU006397]! • Basse-Vallée; 26.XI.1970; *F. Friedmann 750*; P[P00738337]! • Coteau Kervéguen; 21°07'27"S, 55°30'16"E; II.1971; *J. Bosser 20741*; P[P00738490]! • Plaine des Palmistes, rampes de la Grande Montée; 20°56'S, 55°31'E; alt. 1400 m; 14.II.1971; *T. Cadet 3037*; P[P00738482]! • Saint-Philippe, Hauts de Basse Vallée; alt. 1100 m; 15.II.1971; *T. Cadet 3040*; REU[REU006398]! • Sentier du Bras Cabot, îlet de patience; 21°06'S, 55°37'E; 19.II.1971; *J. Bosser 20572*; P[P00150073, spirit]! • Sentier de Mafate, Cirque de Hellbourg; 5.I.1972; *J. Bosser 21064*; P[P00738491]! • Dos d'âne; 20°58'S, 55°23'E; alt. 1250 m; VII.1972; *F. Friedman 1726*; P[P00738327, P00738328]! • Dos d'âne; 20°58'S, 55°23'E; 17.X.1972; *J. Bosser 21253* & *21253* bis; P[P00738357, P00738358], P[P00738493]! • Saint-Philippe, Basse Vallée; station 262; alt. 600 m; 20.X.1972; *J. Bosser 21295*, *21295 bis* and *21295 ter*; P[P00738329, P00738330, P00738331, P00738332 and spirit, P00738455, P00738456]!, P[P00738492]! • Basse Vallée, Saint-Philippe; 21°21'16"S, 55°44'22"E; alt. 900 m; 20.X.1972; *T. Cadet 3863*; P[P00738484]!, REU[REU006399, REU006400]! • Vallée de la rivière des Marsouins; 21°05'37"S, 55°36'43"E; alt. 600 m; 14.XI.1973; *T. Cadet 4403*; P[P00738480]!, REU[REU006401, REU006402, REU006403, REU006404]! •

Sentier du morne de Fourche, cirque de Salazie; 28.III.1974; *J. Bosser 21749*; P[P00738476]! • Sentier de Grand Îlet à la Roche Ecrite, Cirque de Salazie; 21°00'45"S, 55°28'08"E; alt. 1650 m; 15.X.1974; *T. Cadet 4830*; P[P00738483]!, REU[REU006405, REU006406]! • Tévelave; alt. 1050 m; 27.XI.1977; *F. Billiet et al. 472*; BR[BR0000021550997]! • Forêt de Bébour; 21°07'33"S, 55°34'21"E; 3.III.1978; *J. Bosser 22560*; P[P00738459]! • Bord de ravine, hauts de Sainte-Rose; 21°09'S, 55°45'E; 18.IV.1978; *J. Bosser 22523*; P[P00738355]! • Saint-Philippe, Hauts du Tremblet; 21°17'43"S, 55°45'34"E; alt. 1700 m; 20.IV.1978; *J. Bosser 22526*; P[P00738458]! • Saint-Philippe, Hauts du Tremblet; 21°17'43"S, 55°45'34"E; alt. 1700 m; 20.IV.1978; *T. Cadet 5829*; REU[REU017468]! • Roche écrite; 21°00'55"S, 55°27'39"E; alt. 1450 m; 19.III.1988; *R. Lavergne RL1368*; REU[REU007831]! • Near Piton Ravine à Marguet; 20°58'16"S, 55°23'53"E; alt. 1300 m; 16 .I.1990; *R. Lavergne RL1694*; REU[REU007774]! • L'Étang-Salé, Source Nouvelle Bras Sec, Chemin Canal; 21°13'32"S, 55°22'09"E; alt. 1100 m; X.2003; *V. Grondin et al. 827*; CBNM! • L'Étang-Salé, Source Nouvelle Bras Sec, Chemin Canal; 21°13'32"S, 55°22'09"E; alt. 1250 m; X.2003; *V. Grondin et al. 834*; CBNM! • Plaine des Palmistes, La Tanguière; alt. 850 m; XII.2003; *J. Férard et al. 978*; CBNM! • GR de la roche écrite, le Brûlé, Saint-Denis; 20°57'26"S, 55°26'17"E; 28 .I.2002; *M. Pignal et al. 1949*; P[P00239561]!, K[K000718199]!) • Plaine des Palmistes, Îlet Patience path; 21°06'S, 55°37'E; 22.XI.2002; *T. Pailler TP49*; REU[REU006395, REU006396, REU007943]! • Bébour, sentier îlet à Bananes; 21°05'54"S, 55°35'35"E; alt. 1300 m; 11.II.2004; *J. Fournel JF76*; REU[REU006394]! • Route du Volcan towards Piton de l'Eau; 21°11'02"S, 55°40'28"E; alt. 2100-2200 m; 15.III.2007; *F. Martos FM82* and *FM83*; REU[REU007625, REU007626]! • Saint-Denis, Plaine des Chicots; 20°58'26"S, 55°25'47"E; alt. 1900 m; 5.V.2008; *F. Martos FM316*; REU[REU007866]! • Plaine des Palmistes, Piton des Cabris; 21°09'24"S, 55°39'03"E; alt. 1700 m; 2008; *F. Martos FM322*; REU[REU007868]! • Plaine des Cafres; XI.2011; *G. Folio et al. FG58*; REU[REU009516]!.

Notes

The largest plant in the genus. It is very variable and very small flowering specimens may appear uncharacteristic. It is perhaps surprising that the species has never been found in Madagascar, where it is replaced by the closely related *Benthamia humbertii* H.Perrier, with similar flowers but different leaves.

The Thouars specimen P00094522 in P is generally considered the holotype of *Satyrium latifolium* Thouars, however Thouars did not assign types. Therefore, we designate here this specimen as the lectotype, the flower dissection on sheet P00094523 being an isolectotype.

See also: Cadet (1989: plate 22, as *Benthamia latifoli*a (Thouars) A.Rich.), Benke (2004: 64, as *Benthamia latifoli*a (Thouars) A.Rich.), Bernet (2010: 132, as *Benthamia latifoli*a (Thouars) A.Rich.), Szelengowicz & Tamon (2013: 244, as *Benthamia herminioides* ssp. *intermedia* H.Perrier), Szelengowicz & Tamon (2013: 246, as *Benthamia latifolia*), Pailler & Henze (2020: 73), Hermans & Cribb (2023: 107).

Description

Robust terrestrial herb, 30-180 cm tall. Tubers 2, oblong. Stem cylindrical, 3-10 mm in diameter, bearing two basal sheathing sterile bracts and several lanceolate, acuminate sterile bracts along length. Leaves 2-7, fleshy, cauline, ovate to oblong-lanceolate, acute, 12-30 × 3-10 cm, sheathing the stem at base. Rachis 12-25 cm long, densely cylindrical, with 20-120 flowers. Floral bracts lanceolate, acuminate, as long as the flowers, 5-15 × 1.8-5 mm. Ovary suberect, 4-7 × 1.5-1.9 mm. Flowers spreading, *c.* 10 mm across, not opening widely, greenish or yellow-green; dorsal sepal oblong-elliptic, obtuse, 2.7-5.5 × 1.1-3.2 mm; lateral sepals obliquely oblong-ovate, obtuse, 2.9-4.8 × 1-1.8 mm; petals ovate-elliptic, subacute, 2-5.1 × 1.3-3.3 mm, forming a hood with the dorsal sepal. Lip trilobed, 2.2-5 × 2.5-5.1 mm; lateral lobes semi-circular, slightly shorter than the midlobe; midlobe fleshy, oblong, blunt, keeled, around 1.2 mm wide; spur shortly cylindrical-conical, slightly incurved, very slightly bilobed at apex, 1-1.6 × 0.7-1.3 mm long. Column 1-2 × 0.7-1.8 mm, anther obtuse to sub-apiculate; auricles spathulate, about half the size or as long as the anther, rostellum short and thick. Capsule *c.* 10 mm long.

Benthamia litoralis Hervouet & Descourv., sp. nov.
(Figs 61; 62; 63)

Diagnosis. — Similar to *Benthamia africana* but differing by the strap-like basal leaves and the much longer lateral lobes of the lip (triangular acute half as long as the midlobe, vs obtuse and much shorter than midlobe in *Benthamia africana*). The flowers are very similar to those of *Benthamia flavida* but have a smaller lip (lip 2-3.2 mm in *Benthamia litoralis* sp. nov. vs lip 3.6-5.1 mm in *Benthamia flavida*), the latter species having very different alternate and erect leaves (vs strap-like and basal in *Benthamia litoralis* sp. nov.). It is also similar to *Benthamia elata*, which is a much larger plant (20-41 cm for *Benthamia litoralis* sp. nov. vs 25-100 cm for *Benthamia elata*) with different leaves (linear strap-like for *Benthamia litoralis* sp. nov. vs ligulate-lanceolate for *Benthamia elata*), larger flowers and longer rachis (4.5-17 cm for *Benthamia litoralis* sp. nov. vs 20-40 cm for *Benthamia elata*).

Type material. — **Madagascar** • Sava, parc National de Masoala, 1 km au Nord de la rivière Fampotakely; 15°35'S, 50°25'E; 18.IX.1994; *G.M. Rahajasoa 434*; holotype: P[P00692457]!.

Etymology. — From Latin "*litoralis*", referring to the sea-shore, due to the vicinity of its habitat to the coast.

Phenology. — September-October.

Distribution and ecology. — Madagascar. It is restricted to low altitude sandy areas of littoral forest of the east coast (Fig. 62).

Conservation. — This species is known from eight locations near the east coast of Madagascar but is locally abundant. It is assessed as Near Threatened (NT) because all the coastal biotopes are under threat in the east coast of Madagascar.

Additional specimens examined. — **Madagascar** • Atsinanana, environs de Tamatave; VII.1914; *H. Perrier 1843*; P[P00094600, P00094601]! • Sava, canton Ampanavoana, district d'Antalaha. RN2; 15°41'00"S, 50°21'30"E; 23.IX.1953; *H. Tsilizy 5485*; P[P00692312]! • Sava, Masoala Peninsula, crest of Ambato Mountain, north of village of Antanadavahely; 15°16'18"S, 50°20'32"E; alt. 390 m; IX.1993; *K. Lance 04*; K! spirit • Sava, Masoala Peninsula, Ambatoavy escarpment, E. of Andranobe; 15°40'15"S, 49°58'42"E; 11.VII.1994; *K. Lance 139*; K! • Sava, Maroantsetra, commune d'Abinanitelo, fokontany Ambalamahogo, Maimboro summit; 15°18'39"S, 49°22'43"E; alt. 1100 m; 6.IX.2004; *P. Antilahimena 2840*; P[P00755154]! • Sava, Tampolo in Masoala Peninsula; alt. 1 m; 4.XI.2005; photographs by Jean-Michel Hervouet • Atsinanana, Pangalanes, Lake Ampitabe; 18°36'18"S, 49°12'47"E; 4.X.2019, *J. Hermans 8358*; K! • Analanjirofo, Manompana, Ambodiriana forest; alt. 50 m; VII.IX.2023; photographs by Véronique Lavergne.

Fig. 61. — *Benthamia litoralis* Hervouet & Descourv., sp. nov., Palmarium, Canal des Pangalanes, Madagascar, 31 October 2012. Photograph by Jean-Michel Hervouet.

Fig. 62. — Distribution map of *Benthamia litoralis* Hervouet & Descourv., sp. nov.

Notes

Herbarium specimens of *Benthamia litoralis* sp. nov. look similar to *Benthamia africana* and *B. elata* and have been confused. Table 1 below outlines the main differences.

See also: Cribb & Hermans (2009: 45 as *Benthamia cinnabarina* (Rolfe) H.Perrier).

Description

Erect terrestrial herb 20-41 cm tall. Tubers 2, elongated, pyriform, 2 cm × 4-7 mm, with 4-5 filiform roots up to 3 cm long. Stem cylindrical, 1-2 mm in diameter. Leaves 2-4, basal, amplexicaul, with around 13 veins, linear strap-like, acute, 30-200 × 4-20 mm. Rachis terminal, sub-dense, 4.5-17 cm, mostly unilateral, shorter than half of the stem, bearing 7-44 flowers, 2-5 mm apart. Floral bracts lanceolate, apiculate, single-veined, 3-7 × 0.75-1.3 mm, sheathing the ovary, as long as the ovary. Ovary fusiform, 3-7 mm long, 1-2 mm in diameter. Flowers yellowish green, resupinate, opening fully, overall 4 mm deep, 3 mm wide, 2 mm high; sepals subsimilar, slightly concave, linear, obtuse, dorsal sepal 2.75-3 × 0.6-0.8 mm, lateral sepals spreading, 2-3 × 0.5-1 mm; petals triangular linear, 2-3 × 0.5-0.8 mm; lip trilobed, 2-3.2 × 0.8-1.75 mm, all lobes triangular and acute; lateral lobes at 45° from the longitudinal axis of the lip, 0.3-0.5 mm long, central lobe 1-1.1 mm long; spur scrotiform or globular, very small, curved, 0.5-1 × 0.6-1 mm long, slightly wider than long. Column subterete, 0.6-1.1 × 0.7-1 mm, with rounded apex; auricles linear, nearly as long as the column; rostellum trilobed, short, with lateral lobes acute and midlobe rounded.

Benthamia madagascariensis (Rolfe) Schltr.
(Fig. 64)

Beihefte zum Botanischen Centralblatt 34 (2): 300 (Schlechter 1916). — *Holothrix madagascariensis* Rolfe, *Journal of the Linnean Society, Botany* 29: 55 (Rolfe 1893); Perrier 1939: 35. — *Habenaria madagascariensis* (Rolfe) Schltr., *Oesterreichische Botanische Zeittschrift*

Fig. 63. — *Benthamia litoralis* Hervouet & Descourv., sp. nov.: drawing by Marie-Aimée Allard: **A**, habit; **B**, side view of flower and ovary; **C**, front view of flower; **D**, part of rachis with swollen fruits. Scale bars: A, 1 cm; B, C, 1 mm; D, 0.5 cm.

49: 23 (1899). — *Peristylus madagascariensis* (Rolfe) Rolfe, *Orchid Review* 7 (73): 4 (Rolfe 1899). — *Platanthera madagascariensis* (Rolfe) Kraenzl., *Orchidacearum Genera et Species* 1: 609 (Kraenzlin 1899).

Peristylus macropetalus Finet, *Notulae Systematicae* 2: 24 (Finet 1911). — Type: *sine loc.*; culture in P; XII.1910, *M.F. Geay s.n.*; holotype: P[P00334758]!.

TABLE 1. — Differences between *Benthamia africana*, *B. elata* and *B. litoralis* sp. nov.

Benthamia africana	***Benthamia elata***	***Benthamia litoralis* sp. nov.**
Leaves linear-lanceolate, basal or cauline in lower part of inflorescence	Leaves lanceolate, nearly up to the rachis	Leaves linear strap-like, mostly basal, leaving a long gap between leaves and rachis
Rachis very long, 6-38 cm	Rachis very long, 20-40 cm	Rachis short, 4.5-17 cm
Plant medium or large (20-62 cm)	Plant large (25-100 cm)	Plant small (20-41 cm)
Flowers small (2-5 mm)	Flowers large (5 mm)	Flowers small (3 mm)
Lip lateral lobes very small and obtuse	Lip lateral lobes from 1/3 to size of central lobe	Lip lateral lobes acute, less than 1/3 of central lobe
Sheaths 2-3 below the leaves	Sheaths 2 below the leaves	Sheaths absent below the leaves

TYPE MATERIAL. — **Madagascar** • Anosy, near Fort-Dauphin; 25°02'S, 46°59'E; *G.F. Scott Elliot 2643*; lectotype: K!, selected by Hermans *et al.* (2007: 73); isolectotype: P[P00094529]!.

ETYMOLOGY. — "Madagascariensis", from Madagascar.

PHENOLOGY. — February to August.

DISTRIBUTION AND ECOLOGY. — Madagascar. Only in the Anosy region in the north of Fort-Dauphin, except for one possibly dubious record from the south of Antananarivo. In coastal marshes (Fig. 65).

CONSERVATION. — This species is widespread in marshland in the Fort-Dauphin region but is threatened by the mining activities in the coastal sands of this region, so it should be considered now as Near Threatened (NT).

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Atsimo-Atsinanana, plains near Vaingandrano; 23°20'50"S, 47°36'50"E; 6.III; *G.F. Scott Elliot 2257*; K[K000415554], BM[BM000076235]! • *sine loc.*; 1897; *L.D.M. Catat 4326*; P[P00334762, P00334763, P00334764]! • Anosy, région de Fort-Dauphin; 1897; *G. Paroisse 28*; P[P00334765, P00334766]! • Analamanga, damp area near Manjakandriana; 18°54'37"S, 47°48'29"E; VI.1905; *C. d'Alleizette 7066b*; L[L1487718]! • Anosy, Manantenina; 10.VI.1926; *R. Decary 3876*; P[P00334770]! • Anosy, Fort-Dauphin; 24.VI.1926; *R. Decary 4087*; P[P00334773]! • Anosy, Fort-Dauphin; 26.VI.1926; *R. Decary 3982*; P[P00334771, P00334772]! • Anosy, Fort-Dauphin; 1.V.1932; *R. Decary 9793*; P[P00334774]! • Anosy, Fort-Dauphin, Pic Saint-Louis; alt. 300 m; 3.VII.1932; *R. Decary 9973*; P[P00334776]!, BM[BM000034591!, BM000034592]!, K!, TAN! • Anosy, Fort-Dauphin; 30.VIII.1932; *R. Decary 9841*; P[P00334775]! • Anosy, Soanierana, district de Fort-Dauphin; 25°00'S, 46°53'E; 16.X.1932; *R. Decary 10776*; P[P00334777]! • Anosy, Fort-Dauphin; 21.VIII.1937; *Poisson 2635*; TAN! • Anosy, Fort-Dauphin; 6.VI.1939; *R. Decary 14129*; P[P00334778]! • Anosy, vallée du Mandrare, affluent de la Manampanihy, montagne au sud de Tanandava; 24°26'00"S, 47°00'00"E; alt. 850 m; 11-16.III.1947; *H. Humbert 20555*; P[P00334759]! • Anosy, bassin de la Manampanihy, mont Vohimavo au nord d'Ampasimena; 24°22'S, 47°10'E; alt. 830 m; 27-28.III.1947; *H. Humbert 20720*; P[P00334760, P00334761]!, K[K000718265]!, TAN!, G! • Anosy, RN 11, Canton Enomihila, district de Manantenina; 24°17'S, 47°19'E; 28.V.1953; *D. Ramarokoto 5432RN*; P[P00334767, P00326093]! • Anosy, Fort-Dauphin; 10.IV.1956; *Raonarivelo 85111*; P[P00692460]! • Anosy, Fort-Dauphin, Pic Saint-Louis trail; 25°00'29"S, 46°57'42"E; 12.V.1968; *D. Seligson 594*; P[P00334768 noted "purple flowers" so questionable]! • Anosy, route de Manantenina, environs de Fort-Dauphin; 4.IV.1969; *Y. Veyret 1041*; P[P00334769]! • Anosy, Fort Dauphin, Pic Saint-Louis; VII.1969; *F. Friedmann 181*; TAN! • Anosy, Sainte-Luce; 23.IV.1969; *W. Rauh R22146*; HEID[HEID740744, HEID740745, HEID740746]! • Atsimo-Andrefana, Tuléar, route entre Mahatalaky et Manafiafy, 2 km à l'ouest du village d'Ambandrika; 24°46'S, 47°12'E; alt. 0-10 m; 13.VI.1994; *A. Randrianasolo 367*; P[P02103231]!, K!, MO[MO3022641]!, TAN! • Anosy, Fort-Dauphin area; 24°47'30"S, 47°05'00"E; 1999; *J. Hermans 4242*; K! • Anosy, near Mahatalaky, Tolagnaro province; 2001; *J. Hermans 5351*; K! • Anosy, Iabakoho, Antsotso Avaratra, Ivohibe; 24°34'10"S, 47°12'26"E; alt. 105 m; V.2006; *C. Birkinshaw et al. 1639*; K[K000395392]!, P[P00593236]!, MO!, TAN! • Anosy, Mahatalaky; alt. 10 m; 5.VIII.2012; *N. Rakotonirina 783*; MO[MO3022627]!.

NOTES

According to Rolfe, *Holothrix madagascariensis* (Rolfe 1893: 55) has the habit of *Habenaria glaberrima* Ridley but is readily distinguished by the laxer rachis with larger flowers, the much larger lateral lobes of the lip, and the very short saccate spur. In Rolfe's publication the species is illustrated on plate XII, which is mislabelled *Habenaria elliotii*.

The specimen *C. d'Alleizette 7066b* in L (L1487718) was collected close to Antananarivo, very far from the distribution range given by other records. We consider the locality dubious. Note that there is also a second specimen *C. d'Alleizette 7066b* in L (L1487725), of *Benthamia monophylla*.

A specimen in P (*D. Seligson 594*) has a note saying that the flowers are purple. This is questionable since all specimens seen in the wild so far have white flowers.

See also: Cribb & Hermans (2009: 47), Bosser & Lecoufle (2011: 178), Hervouet (2018: 166).

DESCRIPTION

Erect terrestrial herb, 25-50 cm tall. Tubers 1-2, ovoid, roots wiry, *c.* 1 mm in diameter, up to 20 cm long. Stem 2-5 mm in diameter, with leaves on the lower half, higher up with 3-4 narrow bladed sheaths. Leaves 3-6, linear, 8-15 cm × 3-5 mm. Rachis 5-10 cm, with 15-40 flowers rather densely distributed. Floral bracts narrow, very acute, 7-10 × 1-2 mm. Ovary fusiform, straight, 7-12 × 1-2 mm. Flowers forming a green tube at the base, secund, white; sepals 1-veined, clearly linear, dorsal sepal 5-10.5 × 0.6-2.2 mm, the lateral sepals a little shorter, 5-10 × 0.9-2 mm, adnate to the petals and to the lip; petals longer and wider than sepals, 5.2-10 × 0.3-2 mm, oblanceolate-linear, rounded at the tip, 1-veined; lip 8-10 × 3-7 mm, narrow, divided into three lobes in the upper quarter; lobes equal, *c.* 3 mm long, 1-1.5 mm wide; spur very shortly saccate, 0.8-1.1 × 0.6-1 mm, as wide at the base as high. Column 1.2-2.8 × 1-2 mm, anther apiculate; auricles broadly oblong, as long as the anther; rostellum with the median tooth twice as long as the lateral, obtuse and gutter-shaped at the apex.

Fig. 64. — *Benthamia madagascariensis* (Rolfe) Schltr., Sainte-Luce Forest, near Fort-Dauphin, Madagascar, 25 February 2001. Photograph by Jean-Michel Hervouet.

Fig. 65. — Distribution map of *Benthamia madagascariensis* (Rolfe) Schltr.

Benthamia majoriflora H.Perrier
(Fig. 66; 67)

Notulae Systematicae 14 (2): 140 (Perrier 1951).

Type material. — **Madagascar** • Sava, pentes occidentales du massif de Marojejy, district d'Andapa; 14°26'05"S, 49°45'38"E; 28.XI-06.XII.1948; *H. Humbert et al. 22224*; holotype: P[P00094531]!.

Etymology. — From Latin "*major*", greater, and "*florus*", flowered.

Phenology. — From October to December.

Distribution and ecology. — Madagascar. So far only known in the slopes of Mt. Marojejy in the north-east, in Sava region. Epiphytic, often on *Ravenea* palms, from 500 m to 1500 m (Fig. 68). Specimen *Iharivolana et al. IH021* in Geneva (G[G00409570]) is possibly a withered *Benthamia majoriflora* from Sorata forest, Amboriala in the district of Vohemar, which would be the first record outside the Mt. Marojejy area.

Conservation. — If we exclude the specimen recently collected in the district of Vohémar, this species has been collected from a single locality along the path to the summit of Mt. Marojejy, it can be considered Critically endangered (CR) according to criterion B2, AOO less than 10 km², a single location and quality of habitat on decline.

Additional specimens examined. — **Madagascar** • Sava, massif du Marojejy; alt. 1300 m; XI.1972; *P. Morat 4009*; P[P00692450, P00692451]! • Sava, massif du Marojejy; alt. 700-1150 m; 8.X.1988; *J.S. Miller 3494*; MO[MO3022624]! • Sava, massif du Marojejy; alt. 1000-1200 m; 25.XI.1989; *J.S. Miller 4593*; MO[MO3022635]! • Sava, NW of Manantenina; 1995; *J. Hermans 2751*; K! • Sava, Réserve Naturelle Intégrale de Marojejy; 14°26'12"S, 49°44'30"E; alt. 1300 m; 26.X.1996; *M. Rakotondrainibe 3518*; P[P06796735]! • Sava, Marojejy massif; alt. 1400 m; 1999; *J. Hermans 4408*; K! • Sava, Marojejy massif; alt. 1400 m; 1999; *J. Hermans 5089*; K! • Sava, Marojejy National Park, camp n°3 and camp n°2; 14°25'09"S, 49°44'46"E-14°25'24"S, 49°45'29"E; alt. 1280-1350 m; XI.2003; *H.H. Schmidt et al. 4313*; K! spirit material, MO • Sava, Marojejy, between encampment Marojejya & Propithecus; 14°26'15"S, 49°45'16"E; alt. 1106 m; XI.2010; *L.R. Rajaovelona et al. RJL281*; K[K000664873]!, TAN!.

Notes

A very distinctive, large epiphytic plant with white flowers. Flowers and habit are similar to those of *Benthamia humbertii* or *B. latisatis*, both terrestrial.

Fig. 66. — *Benthamia majoriflora* H.Perrier, Mount Marojejy, Madagascar, 28 October 2005. Photograph by Jean-Michel Hervouet.

Fig. 67. — *Benthamia majoriflora* H.Perrier: Mount Marojejy, Madagascar, 28 October 2005. Photograph by Jean-Michel Hervouet.

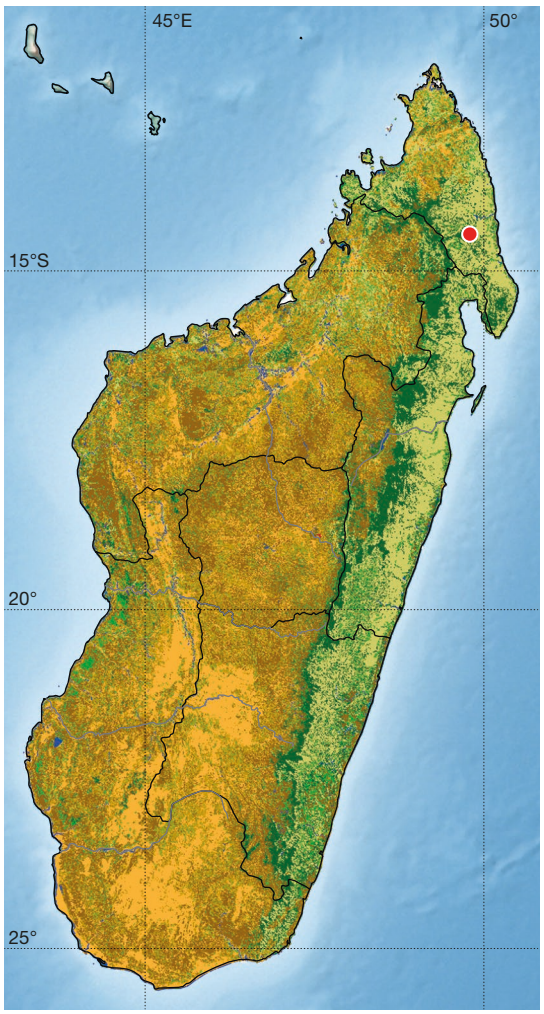

Fig. 68. — Distribution map of *Benthamia majoriflora* H.Perrier.

See also: Cribb & Hermans (2009: 49), Hervouet (2018: 167).

Description

Erect robust epiphytic herb, 60-100 cm tall, turning black when dry, yellowish-green when alive. Tubers in bundles, very fleshy, up to 5, roots not seen. Stem 5-11 mm in diameter, the lower part covered with dark red sheaths. Leaves 1-5, acutely lanceolate, 22 × 4 cm, in lower half or up to the rachis. Rachis 10-18 cm long, 2.5-3 cm wide, very dense, bearing 40-100 flowers. Floral bracts narrow, 7 × 2 mm, much shorter than the ovary. Ovary 12-13 × 2-3 mm long. Flowers 5 mm long, white or very light green; sepals narrowly elliptic, obtusely narrowed, dorsal sepal 5-5.2 × 1.2-2 mm, lateral sepals 4-5 × 1.3-2.1 mm; petals asymmetric, 4.5-4.9 × 1.8-2.7 mm, lower margins widely expanded, base 2.5 mm high; lip widely ventricose, concave, 5-6 × 3.1-4.5 mm, obscurely 4-veined, apex trilobed, lobes narrow, acute, midlobe thicker, with a thick callus; spur purse-shaped, 1-1.5 × 0.7-1 mm. Column 1-2.5 × 1-1.5 mm; anther acute at the top; auricles prominent, nearly as wide as the anther is high.

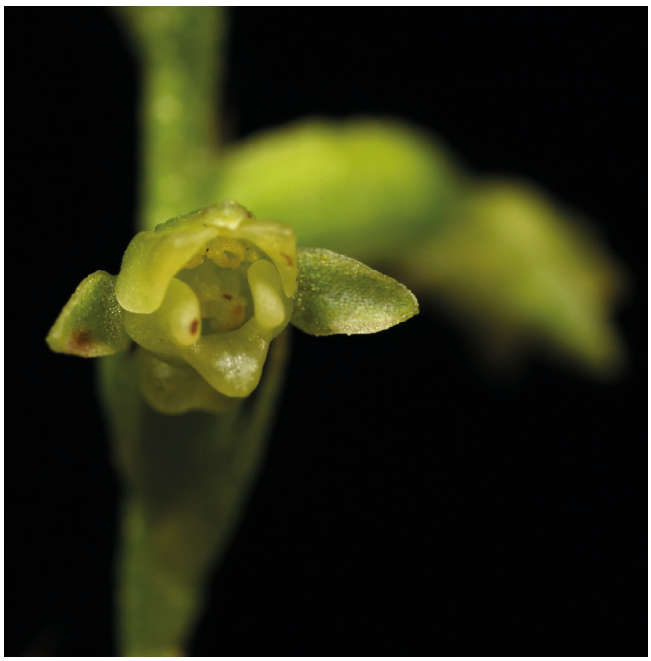

Fig. 69. — *Benthamia mascula* Hervouet & Descourv., sp. nov., Mount Ambondrombe, Madagascar, 10 April 2018. Photograph by Jean-Michel Hervouet.

Benthamia mascula Hervouet & Descourv., sp. nov. (Figs 69; 70; 71; 72)

Diagnosis. — Similar to *Benthamia africana* but differing by the clearly trilobed lip (vs obscurely trilobed), the absence of a callus on the lip, the larger scrotiform spur and the 2-3 leaves in the middle of the stem (vs basal or in the lowest part of the stem), it differs from *Benthamia perfecunda* by the secund rachis (vs in three ranks), flowers that are not autogamous (vs autogamous), smaller leaves and a lax rachis (vs dense).

Type material. — **France, La Réunion** • Sentier du Bras Cabot, îlet de Patience; 21°06'S, 55°37'E; 7.IV.1978; *J. Bosser 22460*; holotype: P[P00738370]!.

Etymology. — Referring to the proportionally large scrotum-shaped spur.

Phenology. — March to May.

Distribution and ecology. — La Réunion and Madagascar. Widespread in La Réunion and so far only known from photographs from Ambondrombe in Madagascar, in montane grassland. From 1600 to 2300 m (Fig. 73).

Conservation. — This species is not very rare in La Réunion, and has largely been overlooked, it is found in protected areas in La Réunion. It is thus considered of Least Concern (LC). In Madagascar it is provisionally considered Data Deficient (DD).

Additional specimens examined. — **Madagascar** • Haute Matsiatra, summit of Ambondrombe; 21°52'30"S, 47°15'37"E; alt. 1875 m; 10.IV.2018; photograph by Jean-Michel Hervouet (Fig. 69). **France, La Réunion** • Massif de la Fournaise, Ramon crater area; 21°17'41"S, 55°42'22"E; alt. 2000 m; 15.II.1971; *T. Cadet 3045* and *3046*; REU[REU006428, REU006429]! • Plaine des Salazes; 21°06'S, 55°32'E; alt. 2500 m; 3.III.1971; *T. Cadet 3134*; REU[REU017471]! • Salazie plain; 21°06'S, 55°32'E; alt. 1500 m; 7.III.1971; *T. Cadet 3136*; REU[REU006430]! • Brûlé de Saint-Denis; 20°55'S, 55°26'E;

Fig. 70. — *Benthamia mascula* Hervouet & Descourv., sp. nov., Le Brûlé, La Réunion, 18 April 2018. Photograph by Jean-Michel Hervouet.

2.V.1974; *J. Bosser 21924*; P[P00738536]! • Takamaka; 21°05'S, 55°38'E; 24.V.1974; *J. Bosser 22050*; P[P00738381]! • Sentier du Bras Cabot, îlet de Patience; 21°06'S, 55°37'E; 7.IV.1978; *J. Bosser 22472*; P[P00738367]! • Hauts de Sainte-Rose; 21°09'S, 55°45'E; 18.IV.1978; *J. Bosser 22521*; P[P00738517]! • Morne des patates à Durand; alt. 1000-1100 m; 20°56'S, 55°27'E; 5.V.1978; *J. Bosser 22448*; P[P00738376]! • Plaine des Fougères; 21°00'15"S, 55°29'21"E; alt. 1200 m; 28.V.2003; *T. Pailler TP79* and *TP79.2*; REU[REU006442, REU007937 except plant on the right]! • L'Étang-Salé, source of La Nouvelle Bras Sec; alt. 1300 m; II.2004; *V. Grondin et al. 1014*; CBNM! • Plaine des Palmistes, sentier Piton Bébour; 21°07'41"S, 55°33'43"E; 26.II.2004; *J. Férard et al. 1009*; CBNM! • Piton Rouge, Plaine des Cafres; 21°09'S, 55°34'E; alt. 1900 m; 9.III.2004; *T. Pailler TP162* and *TP163*; REU[REU006440, REU006424]! • Route du Volcan, vers Le Piton de l'Eau; 21°11'02"S, 55°40'28"E; alt. 2100-2200 m; 15.III.2007; *F. Martos FM88* and *FM89*; REU[REU007631, REU007632]! • Plaine des Palmistes, Piton des Cabris; 21°09'24"S, 55°39'03"E; alt. 1200 m; 21.V.2008; *F. Martos FM318* and *FM319*; REU[REU007893, REU007902]! • Route du Volcan, vers Le Piton de l'Eau; 21°11'02"S, 55°40'28"E; 21.V.2008; *F. Martos FM348* and *FM349*; REU[REU007892, REU007901]!.

Fig. 71. — *Benthamia mascula* Hervouet & Descourv., sp. nov., Le Brûlé, La Réunion, 18 April 2018. Photograph by Jean-Michel Hervouet.

Notes

The species also seems to be in Madagascar, according to photographs from Ambondrombe, however no herbarium specimen from this island has been located so far. The position of the leaves on the stem is similar to *Benthamia macra* Schltr. from Madagascar but the latter has a smaller spur, different bracts (acicular and shorter than ovary in *Benthamia mascula* sp. nov., lanceolate acuminate and longer than ovary in *Benthamia macra*), the flowers are smaller (lip at most 2.5 mm long vs 4 mm for *Benthamia macra*) and the rachis is denser. It is apparent on some specimens that not all the flowers are pollinated and some remain fresh late in the season, while others are fruiting on the same rachis, it is thus probably allogamous.

See also: Bernet (2010: 139, as *Benthamia* sp. 2), Szelengowicz & Tamon (2013: 245, as *Benthamia herminioides* subsp. *arcuata* H.Perrier, photograph on the right only).

Description

Erect terrestrial herb, 25-60 cm tall. Tubers 2, digitate, up to 25 mm long, roots thick, starting from the junction between stem and tubers. Stem 2-5 mm in diameter, with 2 basal sheaths, then leaves in the middle, then 3-4(7) acicular sterile bracts, 1-2 cm long. Leaves 2-3, cauline, narrowly ovate or elliptic-lanceolate, acuminate, erect, 4-8 cm × 4-12 mm for the larger. Rachis unilateral, lax, 5-13 cm long, with 5-10 mm between successive flowers, bearing 7-30(50) flowers. Floral bract nearly as long or ¾ of the length of the ovary. Ovary 4-8 mm long, at right angle to the rachis when mature. Flowers greenish, partly closed except the spreading lateral sepals, around 2-3 mm long; dorsal sepal elliptic, concave, 1-veined, apex rounded, 1.8-2 × 0.8-1.1 mm; lateral sepals obliquely elliptic, concave, 1-veined, apex subacute or

Fig. 72. — *Benthamia mascula* Hervouet & Descourv., sp. nov., drawing by Ludivine Longou, after photographs and dried specimens: **A**, habit; **B**, front view of flower; **C**, side view of flower and ovary; **D**, part of rachis with fresh flowers and fruits. Scale bars: A, 10 mm; B, 0.6 mm; C, 0.5 mm; D, 2 mm.

obtuse, 1.6-2.3 × 1-1.2 mm; petals more or less obliquely elliptic, 1-veined, apex subacute, 1.8-2 × 1 mm, forming a hood with the dorsal sepal. Lip 1.5-2.5 × 2-3 mm, trilobed in upper third, with thick lobes, without callus, smooth and glossy, canaliculate, with the lateral lobes slightly shorter then midlobe, forming with the perianth a narrow entrance into the spur; spur markedly bilobed, scrotiform, 1 mm long, nearly as wide as long, narrowed at base. Column subterete, 0.6 mm long, with two basal auricles shorter than the column, rectangular, with distal margin irregular.

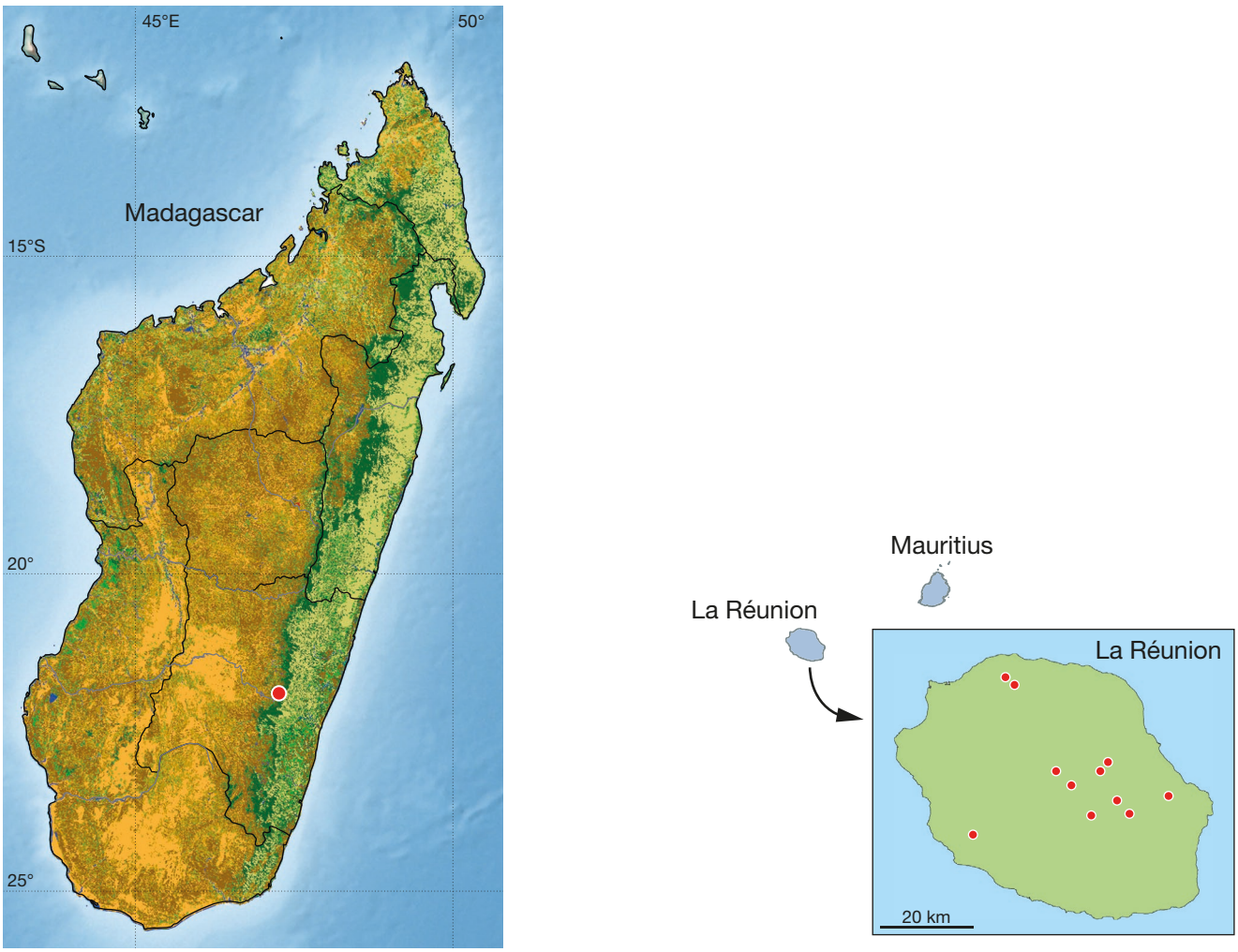

Fig. 73. — Distribution maps of *Benthamia mascula* Hervouet & Descourv., sp. nov.

Benthamia melanopoda Schltr.
(Fig. 74)

Repertorium Specierum Novarum Regni Vegetabilis 33: 29 (Schlechter 1924).

Type material. — **Madagascar** • Vakinankaratra, flanc est du mont Tsiafajavona; 19°22'S, 47°19'E; alt. 2000 m; III.1921; *H. Perrier 13543*; lectotype: P[P00094534]!, here designated; isolectotype: P[P00094535 and flowers in spirit]!.

Etymology. — From the Greek "melano", black, and "poda", foot, due to the black sheaths at the base of the plant.

Phenology. — March to April.

Distribution and ecology. — Madagascar. From Analamanga south to Anosy region. Found in montane grassland, but also in marshes at Ambohitantely in Analamanga region, from 1500 m to 2000 m (Fig. 75).

Conservation. — This species is currently known from fewer than five locations, with an AOO less than 500 km² and a habitat threatened by bushfires, it is therefore considered as Endangered (EN) according to criterion B2.

Additional specimens examined. — **Madagascar** • Haute Matsiatra, au pied de l'Ambondrombe; 21°52'30"S, 47°15'37"E; alt. 1200 m; 10.IV.1941; *P. Boiteau 4559*; P[P00692298]! • Anosy, sommet de la Menakompy à l'est d'Ampandrandava; 24°07'S, 45°48'E; alt. 1100 m; IV.1943; *A. Seyrig 658*; P[P00094533]!; det. *Benthamia macra* by Perrier) • Vakinankaratra, Manjakatompo; 1.V.1951; *R. Benoist 909*; P[P00692220]! • Haute Matsiatra, Andringitra, versant du Vohidray; alt. 1500 m; 13 .I.1971; *J.L. Guillaumet 3760*; TAN!.

Notes

The only *Benthamia* with basal lobes of the lip that can be longer than the midlobe. The very prominent callus at the apex of the lip is also very distinctive. The species was recorded from La Réunion by Szelengowicz & Tamon (2013: 247). The text refers to the Madagascan species but the photograph probably shows a withered *Benthamia perfecunda*.

See also: Schlechter (1930: t.11 n°41), Perrier (1939: 38), Cribb & Hermans (2009: 47), Hervouet (2018: 168).

Description

Erect slender terrestrial herb, 60-78 cm tall. Tubers 2, fusiform, elongated, ending in a root, roots 7-8, 1-2 mm in diameter. Stem 3-6 mm in diameter, with the base en-

Fig. 74. — *Benthamia melanopoda* Schltr.: Ambohitantely, Madagascar, 10 March 2015. Photograph by Jean-Michel Hervouet.

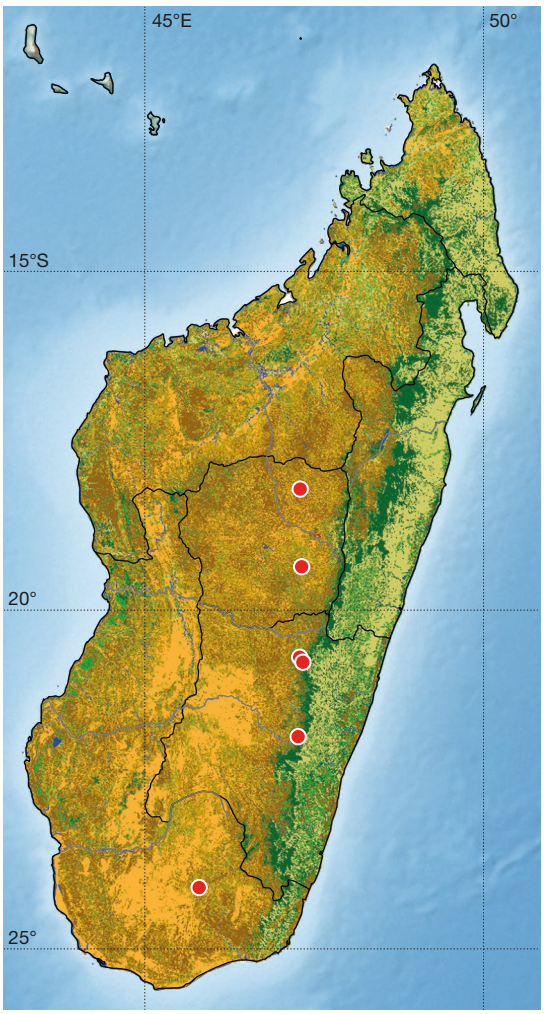

Fig. 75. — Distribution map of *Benthamia melanopoda* Schltr.

veloped by 2-3 black sheaths, in the middle with leaves, higher up with several sheaths with their blade decreasing in size with height. Leaves 3-4, 10-12 × 0.8-1 cm, grass-like, clasping the stem. Rachis cylindrical, dense, bearing 36-90 flowers, 10-15 × 1.5 cm. Floral bracts narrowly lanceolate-acuminate, 7-18 × 1-2 mm, the lower ones up to three times longer than the flower. Ovary fusiform-cylindrical, twisted, 3.5-7 × 2-4 mm. Flowers butter yellow, 2-3 × 2.5-3 mm without the ovary; sepals oblong, obtuse, slightly mucronate, 3-veined, dorsal sepal 2-2.6 × 1-1.4 mm, lateral sepals 2-2.6 × 1-1.4 mm, slightly asymmetrical; petals oval, obtuse, with one main vein and two smaller, 2-2.5 × 1.2-1.5 mm, almost as long as the sepals, but a little wider; lip broadly oval, 2-3 × 2-2.5 mm, concave, trilobed in the upper third; lobes oval-triangular obtuse, almost equal, the lateral lobes a little thickened and narrowed towards the tip, 0.3-0.7 mm long, sometimes larger than the midlobe, the midlobe very fleshy, with a very prominent central callus at the tip; spur very short, 0.8-1 × 0.5-0.7 mm, oblongly saccate, obtuse, thickened at the base. Column subterete, short, 0.6-0.7 × 0.5-0.8 mm, anther not apiculate, obtuse to hardly apiculate; auricles rounded, crenulate, almost half the length of the anther or smaller; rostellum trilobed, lateral lobes short, horizontal, midlobe toothed, erect, 0.1-0.2 mm long. Capsules 6 × 3 mm, developing before the apical flowers have opened.

Benthamia monophylla Schltr.
(Figs 76; 77)

Repertorium Specierum Novarum Regni Vegetabilis 33: 30 (Schlechter 1924).

Type material. — **Madagascar** • Haute Matsiatra, massif d'Andringitra; alt. 2200-2600 m; III.1922; *H. Perrier 14387*; holotype: P[P00094540]!; isotype: P[P00094541]!.

Etymology. — "*Monophylla*", in Greek with a single leaf.

Phenology. — January to April.

Fig. 76. — *Benthamia monophylla* Schltr.: Andringitra massif, Madagascar, 7 April 2018. Photograph by Jean-Michel Hervouet.

Fig. 77. — *Benthamia monophylla* Schltr., Andringitra massif, Madagascar, 7 April 2018. Photograph by Jean-Michel Hervouet.

Distribution and ecology. — Madagascar. A high elevation plant, from 1600 to 2600 m, found in the southern half of the country, mostly from Andringitra massif (Haute Matsiatra region) to Andohahela in the south (Anosy region), in humid mountain grasslands or small patches of vegetation on rocks (Fig. 78).

Conservation. — This species has a large EOO and is locally abundant, but the AOO is probably less than 2000 km². It was quoted NT by IUCN in 2016 (https://doi.org/10.2305/IUCN.UK.2018-1.RLTS.T44393380A69785668.en).

Additional specimens examined. — **Madagascar** • Analamanga, near Mandraka; 18°55'30"S, 47°56'20"E; XII.1905; *C. d'Alleizette 7066b*; L[L1487725]! • Haute Matsiatra, pic Boby, Andringitra; 22°11'S, 46°53'E; 1946; *A.M. Homolle 1192*; P[P02115319, P02115320]! • *sine loc.*; 1946; *A.M. Homolle 1263*; P[P00692277]! • *sine loc.*; 1946; *A.M. Homolle 1277*; P[P00692278]! • Anosy, massif de l'Andohahela; 24°36'S, 46°42'E; alt. 1800-1975 m; I.1934; *H. Humbert 13608*; P[P0009454, P00094543, P00094544]!, G!, TAN! • Haute Matsiatra, canton Sendrisoa, district Ambalavao; 22°13'S, 46°55'E; 17 .I.1958; *C. Rakotovao 9938RN*; P[P00692318, P00692461]! • Haute Matsiatra, 30 km NW of Fianarantsoa; VIII.1963; *W. Rauh 10613*; HEID[HEID2500341]! • Haute Matsiatra, pente du Vohidray, Andringitra; 13.I.1971; *J.L. Guillaumet 3761*; TAN! • Anosy, massif de l'Andohahela, RN11; I.1974; *P. Morat 4389*; P[P00692454, P00692455]! • Haute Matsiatra, Andringitra reserve; 22°10'S, 46°56'E; alt. 1975 m; 13 .I.1987; *M. Nicoll 262*; K[K000453691, K000453692]!, MO[MO3022623]!, TAN! • Haute Matsiatra, Andringitra, near to Pic Boby; II.2007; *T. Ranarivelo et al. 484*; K!, TAN! • Haute Matsiatra, Andringitra; *D. Roberts DLR119* & *DLR120*; K! • Haute Matsiatra, Andringitra; *D. Roberts DLR125*; K[spirit 76706]!.

Notes

Plants sometimes have two basal leaves (e.g. on Ambondrombe). The flowers have a lip that is very similar to the petals and are reminiscent of some *Holothrix* in South Africa. It can form huge colonies, e.g. on Andringitra. With its elongate spur, this species is not a typical *Benthamia* with a short spur like the type of the genus, *Benthamia latisatis*. Perhaps it belongs to a different genus.

The specimen *H. Perrier 14387* has two sheets in P, but Perrier's handwriting on specimen P00094540 clearly shows that it is the sheet sent to Berlin for the description by Schlechter, it is therefore the holotype.

See also: Schlechter (1930: t.11 n°42), Perrier (1939: 24), Perrier (1939: 30), Cribb & Hermans (2009: 42), Cribb & Hermans (2009: 46), Hervouet (2018: 169).

Fig. 78. — Distribution map of *Benthamia monophylla* Schltr.

Description

Erect terrestrial herb, 15-50 cm tall. Tubers 2, oblong-fusiform. Stem 1-4 mm in diameter, with 2-3 sheaths at the base and one radical leaf. Leaf 1 (rarely 2), linear to oblong, 6-15 cm × 6-35 mm, a little narrowed towards the base, somewhat acute or shortly acuminate. Rachis 8-15 cm long, subdense, unilateral, bearing 35-60 flowers. Floral bracts lanceolate-acuminate, 1.5-7 × 0.8-2 mm, normally equalling the flower or sometimes a little longer. Ovary 4.5-6.8 × 0.9-1 mm. Flowers about 3 mm wide, yellow; sepals elliptic-oblong, obtuse, 1-veined, 1.5-3 × 0.8-1.3 mm, lateral sepals navicular, dorsal sepal concave; petals 1.3-3 × 0.9-1.5 mm, as long as the sepals but a little wider and fleshy, oblong, obtuse, 2-veined and a little thickened towards the apex; lip concave, oval-elliptic, 1.8-3.4 × 0.9-1.75 mm, obtuse, entire or obscurely trilobed, the base 3-veined, the anterior part thickened and fleshy; spur narrowly conical, gradually narrowing towards the apex, 1.4-3.5 × 0.4-0.8 mm, somewhat curved. Column 0.5-1.1 × 0.4-0.9 mm, anther subglobose, very obtuse; auricles oblong, subcrenulate, half the length of the anther.

Benthamia nivea Schltr.
(Fig. 79)

Repertorium Specierum Novarum Regni Vegetabilis 33 (Schlechter 1924: 31).

Benthamia nivea subsp. *parviflora* H.Perrier, *Bulletin de la Société botanique de France* 81 (Perrier 1934: 34). — Type: Madagascar • Diana, mont Tsaratanana; 14°01’17”S, 48°57’60”E; IV.1924; *H. Perrier 16478*; holotype: P[P00094560]!, **syn. nov.**

Type material. — **Madagascar** • Vakinankaratra, flanc est du mont Tsiafajavona; 19°22’S, 47°19’E; alt. 2000 m; III.1921, *H. Perrier 13507*; holotype: P[P00094557]!; isotypes: P[P00094558, P00094559]!, K[K000415553]!).

Etymology. — From the Latin “*niveus*”, snow-white.

Phenology. — February to May.

Distribution and ecology. — Madagascar. On Andringitra massif (Haute Matsiatra region), Mt. Tsiafajavona (Vakinankaratra region) and Mt. Tsaratanana (Diana region), in medium altitude moist evergreen forest, from 2000 to 2200 m. Fig. 80.

Conservation. — This species is known from fewer than five localities, has an AOO less than 500 km² and is certainly declining since it has not been seen in the wild since 2001, it is therefore considered Endangered (EN), in accordance to criterion B2 and the quotation by IUCN in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T69221994A69252097.en).

Additional specimens examined. — **Madagascar** • *sine loc.*; *R. Baron 5187*; K! • Vakinankaratra, Manjakatompo; 19°21’25”S, 47°18’28”E; alt. 2000 m; III.1961; *J. Bosser 15025*; TAN! • Vakinankaratra, au-dessus de Manjakatompo; 19°21’25”S, 47°18’28”E; alt. 2200 m; III.1961; *J. Bosser 15265*; P[P00094561]! • Vakinankaratra, forestry station at Manjakatompo; 19°21’25”S, 47°18’28”E; alt. 1800-2000 m; 27.III.1987; *G.E. Schatz 1298*; P[P00094563]!, MO • Vakinankaratra, Ambatolampy area, Hort. Malala Orchidées, cultivar Madagascan Dream BC/RHS; 11.IV.2000; *J. Hermans 4903*; K! • Haute Matsiatra, Andringitra; IV.2000; ex Jean Bosser, *J. Hermans 5341*; K! • Diana, source of Andranomalaza; alt. 1700 m; V.2000; *L. Gautier et al. LG3656*; G00096571! • Haute Matsiatra, Andringitra foothills, near the village of Soavihiny; 22°05’40”S, 46°47’04”E; 5.V.2001; alt. 1506 m; *J. Hermans 123*; K!.

Notes

This species is similar to *Benthamia erinacea*, but it differs by its thinner leaves and by the colour of the flowers. The flowers are pure white, with a wider trilobed lip. Also similar to *Benthamia lakatoensis* sp. nov., from which it differs by the shape and position of the floral parts and the flowering time, see the diagnosis of the latter species.

Perrier distinguished *Benthamia nivea* subsp. *parviflora* as follows: flowers smaller (5-6 mm), lateral lobes of lip acute, lip with 3 veins, staminodes (in our study named auricles) half the thickness, rostellum with 3 lobes of equal size. The type is indeed a small plant, but it remains in the variation range observed outside Tsaratanana. Lips with acute lateral lobes are also evident on the type of *Benthamia nivea*. The number of veins, the auricles and the rostellum are also variable. For all these reasons we prefer to consider *Benthamia nivea* subsp. *parviflora* as a synonym of *Benthamia nivea*.

Fig. 79. — *Benthamia nivea* Schltr., Antananarivo prov., Ambatolampy area, Hort. Malala Orchidées, 2000. Cultivar Madagascan Dream BC/RHS 11/4/2000. Photograph by Johan Hermans.

Fig. 80. — Distribution map of *Benthamia nivea* Schltr.

The gathering *H. Perrier 13507* has three sheets in P and one in K, but H. Perrier's handwriting on specimen P00094557 clearly shows that it is the sheet sent to Berlin for the description by Schlechter, it can therefore be considered the holotype.

One specimen, *Gautier LG3656* in G (G00096571), has been added here for reference but with doubts. It has been identified as *Benthamia nivea* subsp. *parviflora* by P.J. Cribb but the collector's notes say "yellow tepals". A dissection shows no other difference to a small *Benthamia nivea*.

See also: Schlechter (1930: t.11 n°44), Perrier (1939: 33), Cribb & Hermans (2009: 50).

Description

Erect epiphytic herb, 11-40 cm tall. Tubers many, fusiform, villous, 3-7 cm long. Stem 1-3 mm in diameter, with the base covered by 1-2 sheaths, with 2-3 basal leaves and sometimes another one higher up. Leaves 2-4, elliptic-lanceolate, 5-14 × 2-3.5 cm, with apex acute. Rachis cylindrical or unilateral, with 10-65 flowers, 3-13 cm long. Floral bracts narrowly lanceolate, very acuminate, the lower ones longer than the flower, the upper ones as long as the ovary, 5.5-9 × 1.3-2.5 mm. Ovary 5-8 × 1.1-1.8 mm. Flowers 5-10 mm long without the ovary, not opening widely, snow white, nicely scented according to collectors, all floral pieces forming a slightly curved tube (going down, then up) in the lower third of the flower; dorsal sepal linear-obtuse, slightly porrect, 4.3-8 × 0.6-1.3 mm, with narrowed base, 1-veined; lateral sepals a little wider, 5-8 × 0.7-1.2 mm; petals dissymmetric, slightly porrect, wider than sepals, 4-8.5 × 0.8-1.8 mm, 3-4-veined in the lower 2/3rd, thickened higher up, obtuse; dorsal sepal and petals a little spreading but not ending in a single plane; lip narrowly oblong, 4.5-9 × 1.6-4 mm, the base a little concave, trilobed in about the upper third, with a very light longitudinal callus, 5-veined visible only at the base; lateral lobes thin, subacute, parallel to the midlobe when flattened, divergent in the fresh because folded, 1.4-2.5 mm long; midlobe wider and slightly longer, 1.7-3.5 × 0.8-1.1 mm, obtuse and thickened, rounded or obscurely truncate; base of lip twice wider than midlobe; spur subglobose, saccate, 0.7-1.2 × 0.7-1.5 mm. Column 0.6-1 × 0.4-1.1 mm; anther almost orbicular, with an obtuse nose-shaped apiculus; auricles falciform, narrow, as long as the anther or slightly longer; rostellum tridentate, sometimes with the midlobe longer.

FIG. 81. — *Benthamia perfecunda* H.Perrier, Antoetra, Madagascar, 18 March 2015. Photograph by Jean-Michel Hervouet.

FIG. 82. — *Benthamia perfecunda* H.Perrier: Ankazomivady, Madagascar, 27 February 2011. Photograph by Jean-Michel Hervouet.

Benthamia perfecunda H.Perrier
(Figs 81; 82; 83)

Notulae Systematicae 14 (2) (Perrier 1951: 140).

Benthamia herminioides subsp. *angustifolia* H.Perrier, *Bulletin de la Société botanique de France 81* (Perrier 1934: 37). — Type: **Madagascar** • Haute Matsiatra, mont Tsaratanana; 14°01'17"S, 48°57'60"E; alt. 2600 m; IV.1924; *H. Perrier 16503*; holotype: P[P00094516]!, **syn. nov.**

TYPE MATERIAL. — **Madagascar** • Sava, sommet oriental du massif de Marojejy; 14°26'57"S, 49°43'57"E; alt. 1830-2135 m; 26.III.1949; *H. Humbert 23754:* lectotype: P[P00094564]!, selected by Hermans & Cribb (2021: 76); isolectotypes: MO[MO2176327]!, P[P00094565, P00094566]!.

ETYMOLOGY. — "*Perfecunda*": Latin for very fertile, alluding to the fact that all flowers produce fruits.

PHENOLOGY. — From January to April.

DISTRIBUTION AND ECOLOGY. — Madagascar and La Réunion. Widespread, from 600 to 2000 m, in medium altitude moist evergreen forest, montane grasslands and ericoid thickets (Fig. 84).

CONSERVATION. — This species is widespread in La Réunion and therefore has a global conservation status LC (Least Concern). It is Data Deficient in Madagascar (DD) and is currently known in about ten localities in this country, probably because it has been overlooked so far.

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • *sine loc.*; *A.M. Homolle 1174*; P[P01805136]! • Alaotra-Mangoro, forêt d'Andasibe sur l'Onive; 18°28'S, 48°28'E; 1200 m; II.1925; *H. Perrier 17089*; P[P00692456]! • Sava, Vallée inférieure de l'Androranga, massif du Betsomanga; 14°15'30"S, 49°44'00"E; alt. 1300-1350 m; XI.1950; *H. Humbert et al. 24331*; P[P00692279]! • Diana, massif de Marivorahona; 13°46'40"S, 48°59'30"E; alt. 2000-2244 m; 18-26.III.1951; *H. Humbert et al. 25753*; P[P02115322 plant on the left]! • Haute Matsiatra, Andringitra; 22°07'40"S, 46°51'48"E; IV.1964; *J. Bosser*

19647; P[P00692264]! • Analamanga, Angavokely; 18°55’36”S, 47°45’07”E; 26.II.1988; *B. Pettersson et al. 189*; P[P02115316]! • Sava, Réserve naturelle de Marojejy; alt. 1900-2133 m; 15.II.1989; *J.S. Miller 4164*; MO[MO3022619]! • Sava, Réserve Naturelle de Marojejy; 14°26’S, 49°13’E; alt. 1900-2133 m; 15.II.1989; *J.S. Miller 4168*; TAN! • Sava, Marojejy, au dessus du village Manantenina; 14°26’S, 49°44’E; alt. 1300-1450 m, III.1990; *A. Randrianasolo 111*; K!, MO!, TAN!.

France, La Réunion • Bois de la rivière de l’Est; 2.VI.1851; *L.H. Boivin s.n.*; P[P00334799 specimen on the right could be *Benthamia spiraloides*]! • Sentier du Bras Cabot, Plaine des Palmistes; 21°06’S, 55°37’E; alt. 1400-1500 m; VI.1957; *J. Bosser 11490* and *11491*; P[P00738403, P00738378]! • Bébour forest; 21°06’40”S, 55°33’47”E; alt. 1300 m; 26.III.1969; *T. Cadet 2106*; REU[REU006443]! • Plateau de Bébour; 21°06’S, 55°33’E; III.1970; *J. Bosser 20068*; P[P00738405]! • Gîte du volcan; 21°06’36”S, 55°29’46”E; IV.1970; *J. Bosser 20058*; P[P00738404]! • Sentier du Bras Cabot, îlet de Patience; 21°06’S, 55°37’E; 19.II.1971; *J. Bosser 20574*; P[P00738377]! • Montée de la Plaine des Chicots; 20°58’26”S, 55°25’47”E; II.1971; *J. Bosser 20684*; P[P00738397]! • Plateau de Bébour; 21°06’S, 55°33’E; II.1971; *J. Bosser 20703*; P[P00738311]! • Coteau Kerveguen; 21°07’27”S, 55°30’16”E; II.1971; *J. Bosser 20743*; P[P00738385]! • Piton Taïpoul, Foc-Foc, piton de la Fournaise; 21°17’07”S, 55°42’04”E; alt. 2100 m; 16.IV.1971; *T. Cadet 3225*; REU[REU00644, REU017470]! • Brûlé de Saint-Denis; 20°55’S, 55°26’E; 19.III.1974; *J. Bosser 21658*; P[P00738379 and spirit]! • Pied de Piton Mare à Boue, Plaine des Cafres; 21°09’35”S, 55°34’35”E; alt. 1550 m; 30.III.1974; *T. Cadet 4615*; REU[REU006439]! • Plaine des Cafres, base du Piton Mare à Boue; 21°09’35”S, 55°34’35”E; 30.III.1974; *J. Bosser 21781*; P[P00738383]! • Plaine des Cafres, Piton Mare à Boue; 21°09’35”S, 55°34’35”E; 30.III.1974; *J. Bosser 21771* and *21771bis*; P[P00738384, P00738533]! • Brûlé de Saint-Denis; 20°55’S, 55°26’E; 2.V.1974; *J. Bosser 21925*; P[P00738380 and spirit]! ; Brûlé de Saint-Denis; 20°55’S, 55°26’E; 9.V.1974; *J. Bosser 21927*; P[P00738382]! • Descente Plaine des sables à la ravine Langevin; 21°15’17”S, 55°39’45”E; 10.V.1976; *J. Bosser 22126*; P[P00738400]! • Coteau Kervéguen; 21°07’27”S, 55°30’16”E; 16.VI.1976; *J. Bosser 22319*; P[P00738396]! • Sentier du Bras Cabot, îlet de Patience; 21°06’S, 55°37’E; 7.IV.1978; *J. Bosser 22465*; P[P00738406]! • Sentier du Piton des Neiges, Cilaos; 21°07’06”S, 55°29’12”E; 15.IV.1978; *J. Bosser 22508*; P[P00738399]! • Descente Plaine des Sables, Le Tremblet; 21°17’14”S, 55°43’20”E; 20.IV.1978; *J. Bosser 22538*; P[P00738398]! • SF Roche-Écrite; 21°00’55”S, 55°27’39”E; alt. 1320 m; 19.III.1988; *R. Lavergne RL1367*; REU[REU007766]! • Saint-Joseph, Caverne de Cotte; 21°14’16”S, 55°38’18”E; alt. 2240 m; III.2004; *J. Férard et al. 1043*; CBNM!.

Fig. 83. — *Benthamia perfecunda* H.Perrier, Bourg-Murat, La Réunion, 26 March 2013. Photograph by Jean-Michel Hervouet.

Notes

After examining the types, we see no significant difference between *Benthamia herminioides* subsp. *angustifolia* and *Benthamia perfecunda*. In his publication of *Benthamia perfecunda* Perrier only cited *Benthamia macra* and *Benthamia verecunda* as similar species. Perrier stated that the leaves of *Benthamia herminioides* subsp. *angustifolia* are 5 cm long, this is a mistake since one leaf of the type is 11 cm long, which falls within the *Benthamia perfecunda* leaf dimensions. The fact that all flowers are pollinated is observed on all specimens and is a strong indication that the plant is autogamous.

This species is very different from *Benthamia herminioides,* even though it was initially described as the subspecies *angustifolia*. Perrier himself says that the stigmas are very different from those of other subspecies of *Benthamia herminioides*. It is generally a larger plant, with differently shaped leaves (linear to grasslike vs elliptic-lanceolate to lanceolate for *Benthamia herminioides*). The flowers are fleshy, campanulate, and uniformly green (vs with calyx green and corolla white for *Benthamia herminioides*). A very distinctive and unique feature in the genus is the 3-ranked rachis (vs secund).

Changing the rank from subspecies to species was therefore necessary. Then the earliest name at the rank of species has priority (article 11.2 of the International Code of Nomenclature), which is *Benthamia perfecunda*, *B. herminioides* subsp. *angustifolia* becoming a heterotypic synonym.

Surprisingly this species has long been overlooked in La Réunion, only Bernet illustrated it as *Benthamia* sp. 4 (Bernet 2010). Jean Bosser consistently noted on his specimens that there were three helicoidal rows of flowers.

See also: Perrier (1939: 38), Cribb & Hermans (2009: 43), Cribb & Hermans (2009: 48), Bernet (2010: 141, as *Benthamia* sp. 4), Szelengowicz & Tamon (2013: 245, as *Benthamia herminioides* subsp. *arcuata,* photograph on the left only), Hervouet (2018: 171), Szelengowicz & Tamon (2013: 252).

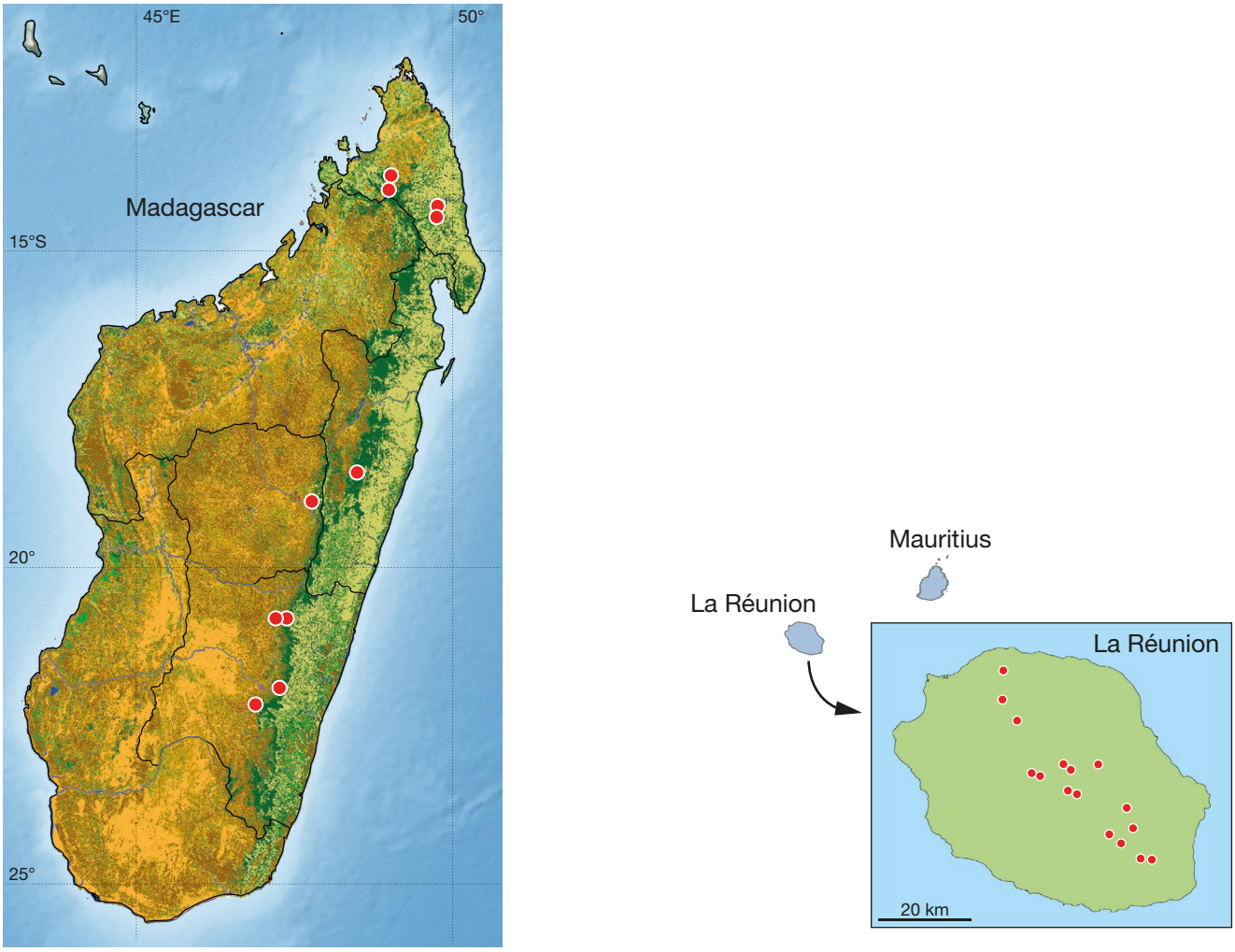

Fig. 84. — Distribution map of *Benthamia perfecunda* H.Perrier.

Description

Erect terrestrial herb 30-80 cm tall. Tubers 2, roots around 4-6, up to 6 cm long, 1-2 mm in diameter. Stem cylindrical, 2-4 mm in diameter, covered below by blackish sheaths. Leaves 2-4, cauline in the basal half of the stem or slightly higher, 5-15 cm × 5-12 mm, erect, linear or grass-like, acute, amplexicaul at base, with 7-8 veins. 4-5 sterile bracts in the upper half of the stem. Rachis terminal and dense, 6-15 cm long, bearing 20-60 flowers, broadly cylindrical but in fact arranged in 3 slightly spiralling rows, 2-5 mm apart. Floral bracts acicular, 3-10 × 1.1-1.8 mm, slightly smaller than the ovary, rarely a little longer. Ovary elongated, a little arcuate-reflexed, green, fusiform, at right angle to the rachis at the end of anthesis, 3-8 × 1-2 mm. Flowers not opening fully, campanulate, 2-3 mm long, nearly aligned with the ovary, green or greenish-yellow; dorsal sepal oblong, 1.5-2.8 × 0.5-1.1 mm, 1-veined; lateral sepals asymmetrically oblong, concave, spreading, 1.5-3.1 × 0.4-1.2 mm; petals broadly oval, 1.2-2.9 × 0.3-2.1 mm, shorter than the lateral sepals, adnate to the dorsal sepal, forming a hood over the lip; lip ovate, trilobed at apex, obtuse, calceolate, fleshy, 1.5-3.2 × 1-3.2 mm, without callus, the lobes reduced to 3 rounded teeth, lateral lobes 0.5 mm long, central lobe equal or longer, blunt, concave in proximal part, lateral lobes folded upwards, up to the petals, so that a rectangular entrance into the flower is formed; spur 0.4-1.5 × 0.2-0.8 mm, horizontal and parallel to the ovary or touching it, obtuse, cylindrical or slightly flattened, not narrowed at the base, straight or curved along the ovary. Column 0.5-1.1 mm high, 0.4-1.2 mm wide, obtuse, anther with an obtuse apiculus; auricles very short, less than a quarter of the length of the anther; rostellum thin, more tri-crenate than trilobed; stigmata distinct, well developed, thick, porrect-claviform, 0.5 mm long.

Benthamia praecox Schltr.
(Fig. 85)

Beihefte zum Botanischen Centralblatt 34 (2): 303 (Schlechter 1916).

Type material. — **Madagascar** • Haute Matsiatra, nord du massif d'Andringitra; alt. 1000 m; *H. Perrier 11481* (161); holotype: P[P00094571]!.

Fig. 85. — *Benthamia praecox* Schltr., Fianarantsoa prov., SW of Ivato, off RN. 7, about 9 km on Ambatofinandrahana road, 29 March 1994. Photograph by Johan Hermans.

Fig. 86. — Distribution map of *Benthamia praecox* Schltr.

Etymology. — From the Latin "*praecox*", precocious, blooming early or bearing flowers before the leaves.

Phenology. — September to November.

Distribution and ecology. — Madagascar. Only in Betsileo land (high plateaux of Amoron'i Mania and Haute Matsiatra) from 1000 to 1400 m. On bare granite rocks and montane grasslands, and, according to Lewis *et al.* (1996), high altitude moss and lichen in rainforest and montane ericoid thicket (Fig. 86).

Conservation. — Known from only three localities, but there are a relatively large number of specimens in P. It could not be found in October 2022 in Ambatofinandrahana region. With an AOO of less than 500 km², less than five localities and a threatened habitat it should be according to criterion B2 considered Endangered (EN), which is its current status in IUCN Red List since 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T70102634A70112747.en).

Additional specimens examined. — **Madagascar** • *sine loc.*; *M. Nicoll s.n.* & *Kew Spirit Collection n°58663*, drawing by Judi Stone in *Genera Orchidacearum*, vol. 2 (Pridgeon *et al.* 2001: 262) • Haute Matsiatra, ouest de Fianarantsoa; IX.1919; *H. Perrier 12886*; P[P00334729, P00334730]! • Haute Matsiatra, Ambalavao; 20.X.1940; *R. Decary 15908*; P[P00692273]!, TAN! • Amoron'i Mania, P.K. 10 route Ivato-Ambatofinandrahana; 20°40'03"S, 47°08'03"E; IX.1956; *J. Bosser 9868*; P[P00334728]!, TAN! • Amoron'i Mania, Anjoma, route d'Ivato à Ambatofinandrahana; 11.XI.1959; *J. Peltier 1199*; P[P01805104]! • Amoron'i Mania, Ivato, granite rock; 20°40'03"S, 47°08'03"E; 24.IX.1961; *W. Rauh 7284*; HEID[HEID713724, labelled *Liparis*]! • Haute Matsiatra, 10 km au sud d'Ambalavao; 14.X.1970; *M. Keraudren-Aymonin 24625*; P[P00692446]! • Haute Matsiatra, Andringitra reserve; 22°10'S, 46°56'E; alt. 1975 m; I.1987; *M. Nicoll 288*; K!, MO! • Amoron'i Mania, SW. of Ivato, about 9 km on Ambatofinandrahana road; 29.III.1994; *J. Hermans 3149*; K[spirit K58663.000]! • Amoron'i Mania, road towards Ambatofinandrahana, Inselberg a few km before Anjomana Ankona; 20°40'11"S, 47°07'91"E; alt. 1548 m; IV.2001; *J. Hermans 5219,* K!.

Notes

The species can be recognised by its long cylindrical spur and the short auricles. In his original description Schlechter stated that the leaves are not developed at anthesis ("*foliis sub anthesi*

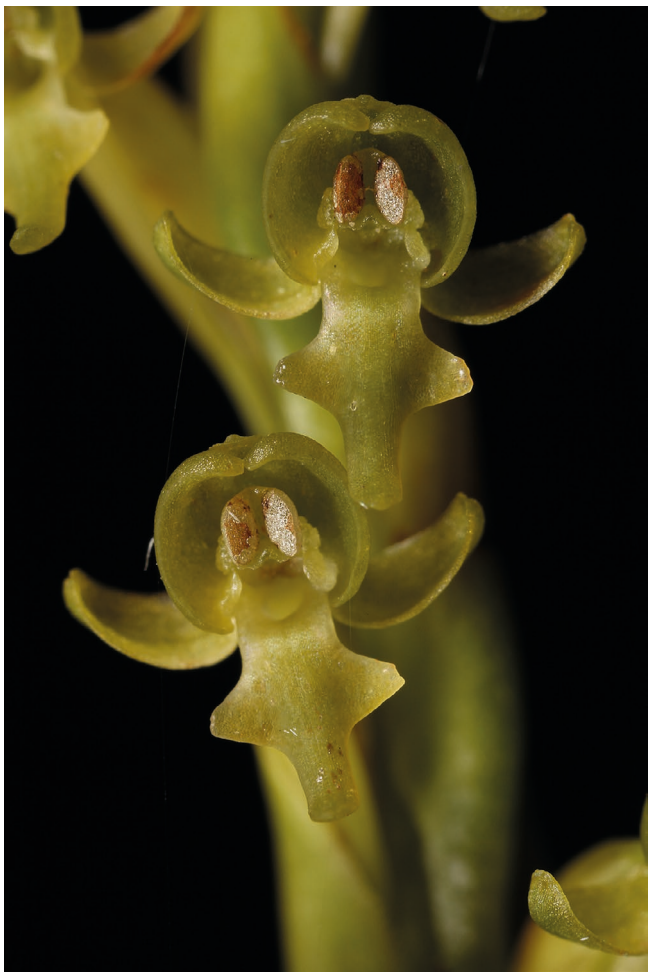

Fig. 87. — *Benthamia rostrata* Schltr.: Mount Ibity, Madagascar, 1 April 2018. Photograph by Jean-Michel Hervouet.

nondum evolutis"). This is questionable since all specimens in P have leaves, only one specimen at K has no leaves.

Schlechter doubted that this species would belong to the genus *Benthamia*, because of the long spur and the short staminodes (here auricles).

See also: Schlechter (1930: t.12 n°46), Perrier (1939: 20), Cribb & Hermans (2009: 43).

Description

Erect slender terrestrial herb, 10-40 cm tall. Tubers 5-7, stalked, oblong-claviform, downy, roots numerous. Stem 1.5-3 mm in diameter, with 2-3 basal amplexicaul sheaths, 20-35 × 6-10 mm, a tuft of leaves and a few bract-like sheaths higher up. Leaves 5-9, erect, acuminate-aristate, 40-70 × 2-5 mm. Rachis rather dense, bearing 25-45 flowers, elongated, 8-23 cm long, unilateral. Floral bracts lanceolate-linear, 4-7 × 1-1.6 mm, very acute, a little longer than the ovary. Ovary 4-8 × 1-2 mm, a little curved. Flowers small, greenish-brown; sepals elliptic-oblong, obtuse, dorsal sepal 2-2.9 × 0.9-1.3 mm, lateral sepals 2.2-3.1 × 0.9-1.3 mm; petals as long, 2-3 × 0.9-1.4 mm, lanceolate-ligulate obtuse, a little expanded towards the base of the front edge; lip broadly cuneate, 3-4 × 1.6-2.5 mm, trilobed above the middle, lobes not equal, ligulate-obtuse, the middle one thick, around 1.8 mm long, the laterals divergent, around 1 mm long; spur narrowly cylindrical or conical, somewhat obtuse, 2-3 × 0.3-0.8 mm. Anther subglobose; auricles hardly visible at the base of column, suborbicular, twice as short as the anther.

Benthamia rostrata Schltr.
(Fig. 87)

Repertorium Specierum Novarum Regni Vegetabilis 33: 33 (Schlechter 1924). — *Platanthera madagascariensis* sensu Schltr., *Beihefte zum Botanischen Centralblatt* 33: 299 (Schlechter 1916), *non* Kraenzl. (Kraenzlin 1899: 609).

Benthamia perularioides Schltr., *Repertorium Specierum Novarum Regni Vegetabilis* 33: 32 (Schlechter 1924). — Type: **Madagascar** • Vakinankaratra, mont Tsiafajavona; 19°19'58"S, 47°16'08"E; alt. 2500 m; III.1921; *H. Perrier 13523*; lectotype: P[P00094567]!, here designated; isolectotype: P[P00094568]!, **syn. nov.**

Type material. — **Madagascar** • Vakinankaratra, mont Ibity au sud d'Antsirabe; alt. 2000 m; II.1914; *H. Perrier 8101*; holotype: P[P00094574]!; isotype: P[P00094575]!.

Etymology. — From the Latin "*rostratus*", beaked, referring to the midlobe of the lip.

Phenology. — January to April.

Distribution and ecology. — Madagascar. Widespread in montane grasslands from 1400 to 2370 m. Can also grow on bare laterite soils (Fig. 88).

Conservation. — The conservation status of this species is of Least Concern (LC). It has the largest number of specimens of the genus in herbaria and is still widespread in Madagascar. It has however been assessed EN by IUCN in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T70102386A70124752.en).

Additional specimens examined. — **Madagascar** • *sine loc.*; *Baron 849*; P[P00094569, as *Rolfeella glaberrima*, on the same sheet as *Dr. Fox 23* but different]!, K[K000415545]! • *sine loc.*; *R. Baron 5252*; P[P00094570]! • Ankaratra; *R. Capuron 759*; P[P00692268]! • *sine loc.*; *A.M. Homolle 1112*; P[P00692276]! • Ihorombe, plaine de la Menarahaka, entre Ihosy et Ivohibe; 22°27'S, 46°15'E; *B. Descoings 983*; P[P00692270]! • Ankaratra; *G.F. Scott-Elliot 2096*; BM[BM000034590]! • Ankaratra; *G.F. Scott-Elliot 1982*; P[P00334731]! • Central Madagascar; *R. Baron 2271*; K! • *sine loc.*; *R. Bonet s.n.*; P[P00326135]! • Analamanga, Tampoketsa d'Ankazobe; *E. Ursch 1019*; TAN!, P[P00692272]! • Analamanga, Ambatovory; 18°54'S, 47°42'E; III.1883; *Dr. Fox 24*; K! ex LDS • Centre; 1887; *C.M. Le Myre de Vilers s.n.*; P[P00094474]! • Analamanga, Ambohimanga; 18°45'42"S, 47°33'49"E; 12.VI.1905; *C. d'Alleizette s.n.*; L[L1487720]! • Analamanga, environs de Nanisana près de Tananarive; 18°54'S, 47°42'E; 20.I.1906; *L. Rotereau s.n.*; P[P06796776]! • Analamanga, Nanisana; 18°54'S, 47°42'E; I.1906; *C. d'Alleizette 977M*; P[P00334732]! • Vakinankaratra, Manandona; alt. 1400 m; IV.1912; *H. Perrier 8024*; P[P00094576]! • Vakinankaratra, mont Ibity; 20°04'03"S, 47°00'04"E; alt. 2000 m; II.1921; *H. Perrier 13581*; P[P00094578]! • Analamanga, Ambohimanga; 18°45'42"S, 47°33'49"E; 27.III.1921; *R. Decary 302*; P[P00334738]! • Analamanga, Ambohimanga; 18°45'42"S, 47°33'49"E; IV.1921; *R. Decary 52*; P[P00334739]! • Haute Matsiatra, massif d'Andringitra; alt. 2000 m; II.1923; *H. Perrier 14431*; P[P00094579]! • Diana, Ankaizina; alt. 1500 m; 19.IV.1923; *R. Decary 1918*; P[P00334737]! • Diana, An-

kaizina; alt. 1500 m; 19.IV.1923; *R. Decary 1936*; P[P00334736]! • Diana, Ankaizina; 18°54'S, 47°42'E; alt. 1700 m; 19.IV.1923; *R. Decary 1997*; P[P00334735]! • Vakinankaratra, entre Ambatolampy et Antsirabe; alt. 1600 m; II.1927; *H. Perrier 17906*; P[P00334733, P00334734]! • Haute Matsiatra, Andringitra; 26.II.1938; *P. Boiteau 3135*; P[P00692296, P00692297]! • Haute Matsiatra, au sommet de l'Ambondrombe; 21°52'30"S, 47°15'37"E; alt. 2000 m; 11.IV.1941; *P. Boiteau 4611*; P[P00692437]! • Analamanga, Ambohitantely; 18°05'S, 47°16'E; 24.II.1945; *A.M. Homolle s.n.*; P[P00692274]! the four plants on the left are *Tylostigma nigrescens* Schltr. or *Tylostigma perrieri* Schltr. • Analamanga, Tampoketsa d'Ankazobe; 18°13'S, 47°17'E; 7.II.1948; *P. Boiteau 6725*; TAN! • Diana, massif de Marivorahona; alt. 2000-2244 m; 18-26.III.1951; *H. Humbert et al. 25753*; P[P02115322 plant on the right only, P02115321, plant on the right only]! • Alaotra-Mangoro, Ambatosoratra, Atozaka, RN3; 17°38'30"S, 48°50'00"E; 20.III.1953; *ResNat 6055*; P[P00692314]! • Haute Matsiatra, RN 5, Canton Sendrisoa, District Ambalavao; 27.II.1954; *R. Rakoto 6484*; P[P00692315]! • Vakinankaratra, route d'Ambatolampy, Faratsiho; 19°23'S, 47°16'E; alt. 1800; VIII.1955; *J. Bosser 10880*; P[P00692227]! • Vakinankaratra, Ambohimandroro, Ampatolampy; XI.1955; *J. Bosser 9206*; TAN! • Vakinankaratra, Nanokely, Ankaratra; 19°32'S, 47°03'E; alt. 2000 m; II.1957; *J. Bosser 10878*; P[P00692226]! • Vakinankaratra, Nanokely (district de Faratsiho); 19°32'S, 47°03'E; 26.II.1960; *M. Peltier 1915*; P[P00692290]! • Analamanga, Soavina PK 22 route de Tamatave; 18°52'S, 47°40'E; III.1960; *J. Bosser 13532*; P[P00692228]! • Amoron'i Mania, Fiadanana, Ilaka, Ambositra; 20°34'30"S, 46°57'30"E; 20.III.1960; *M. Peltier 2149*; P[P00692292]! • Analamanga, vallée de Soavina, PK 23 route de Tamatave; II.1961; *J. Bosser 14863*; TAN! • Vakinankaratra, Manjakatompo; 19°21'25"S, 47°18'28"E; III.1961; *J. Bosser 15024*; P[P00692229]! • Analamanga, lake Mantasoa; 19°00'45"S, 47°50'17"E; IX.1962; *J. Bosser 16144*; P[P00692230]! • Vakinankaratra, Nanokely, Ankaratra; 19°32'S, 47°03'E; II.1963; *J. Bosser 17573*; P[P00692241]! • Route de Majunga; III.1963; *J. Bosser 16783*; P[P00692235]! • Vakinankaratra, route d'Ambatolampy; 19°23'S, 47°16'E; III.1963; *J. Bosser 16797*; P[P00692236]! • Vakinankaratra, route Ambatolampy-Faratsiho; II.1964; *J. Bosser 19264*; P[P00692246, P00692247]! • Haute Matsiatra, sentier du pic Boby, Andringitra; 22°11'S, 46°53'E; IV.1964; *J. Bosser 19478*; P[P00692248, P00692249]! • Haute Matsiatra, Andringitra; 22°13'S, 46°55'E; IV.1964; *J. Bosser 19492*; P[P00692251]! • Haute Matsiatra, Andringitra; IV.1964; *J. Bosser 19506*; P[P00692252, P00692253]! • Vakinankaratra, Col des Tapias, 45 km avant Ambositra; 20°14'34"S, 47°06'04"E; IV.1964; *J. Bosser 19598*; P[P00692259]! • *sine loc.*; 28.III.1969; anonym; HEID[HEID250340]! • Vakinankaratra, Mt. Ibity western slope; 20°05'44"S, 47°00'12"E; alt. 1900 m; III.1972; *G. Cremers 2037*; TAN! • Vakinankaratra, south of Antsirabe, Mt. Ibity; 20°10'S, 47°03'E; alt. 1300-1800 m; III.1985; *L.C. Barnett et al. 491*; TAN!, MO[MO3022638]! • Haute Matsiatra, Andringitra Forest Reserve, along path to Pic Boby; 22°11'S, 46°55'E; alt. 1900-2050 m; III.1989; *P. Goldblatt et al. 8964*; P[P00692435]!, MO[MO4314431]!, TAN!, WAG[WAG.1130546]! • Vakinankaratra, Ankaratra Massif, W of Ambatolampy; 19°20'S, 47°16'E; alt. 2350 m; III.1989; *P. Goldblatt et al. 9012*; MO[MO4314448]!, TAN! • Amoron'i Mania, on hillside near Talavina, PK 204 from Antananarivo to Ambositra; 20°10'42"S, 47°05'24"E; alt. 1230-1330 m; V.1993; *C.H. Jongkind et al. 829*; K!, MO[MO3022616]!, P[P00692179]!, TAN! • Vakinankaratra, Col Tapia, 36 km S of Antsirabe; 20°10'41"S, 47°05'16"E; alt. 1400 m; IV.1995; *D. DuPuy et al. M906*; K!, P[P00059605]!, MO!, WAG!, TAN! • Analamanga, Tampoketsa d'Ankazobe; 17°52'07"S, 47°03'39"E; 18.III.1999; *J.N. Labat 2951*; P[P00160016, P00160017]!, G!, K!, MO!, TAN! • Between Antananarivo and Ambositra, Tapia forest; 2000; *J. Hermans 4393*; K! • Vakinankaratra, between Antsirabe and Ambositra, on RN7, about 3 km before Col Tapia; alt. 1440 m; IV.2001; *J. Hermans 5251*; K! • Vakinankaratra, between Antsirabe and Ambositra, on RN7, about at Col Tapia; 20°14'25"S, 47°06'12"E; alt. 1740 m; V.2001; *J. Hermans 5205*; K! with spirit • Amoron'i Mania, Ambositra, Ivato, road to Antoetra; 20°45'43"S, 47°19'31"E; alt. 1701 m; 25 .I.2007; *A. Sieder FS4188* and *J. Hermans 8086*; WU[WU0063773, spirit material]! • Amoron'i Mania, Ambatofinandrahana, 25 km W of Itremo village; 20°34'12"S, 46°34'55"E; alt. 1647 m; 21.II.2010; *L. Rajavelona et al. RJL148*; K[K664548]!, TAN! • Amoron'i Mania, Antoetra, on inselberg; 20°46'27"S, 47°19'16"E; II.2015; alt. 1676 m; *A. & C. Sieder et al. 6801*; WU! spirit material • N4, 126 km north of Tana, inselberg; II.2017, *A. & C. Sieder et al. 7309*; WU! flower in alcohol • Vakinankaratra, between Antsirabe and Ambositra, on RN7, Col Tapia; IV.2018; *J. Hermans 8241*; K! • Analamanga, Andakana RN4; 18°15'58"S, 47°10'51"E; 19.III.2019; alt. 1461 m; *A. & C. Sieder et al. 7792*; WU! • Analamanga, RN4, *c.* 12 km after Ankazobe; alt. 1461 m; III.2019; *Sieder A. & C. et al., L*7787; WU!.

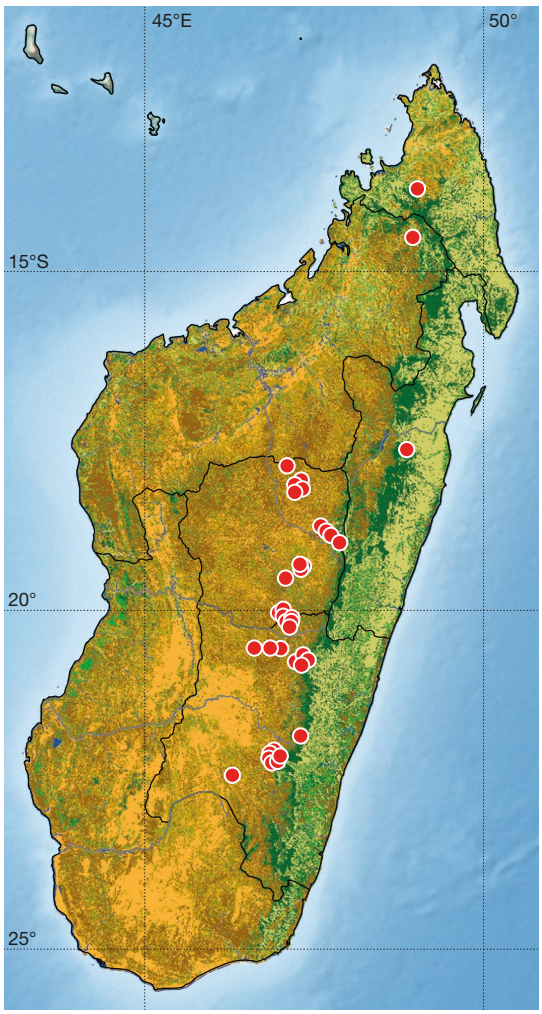

Fig. 88. — Distribution map of *Benthamia rostrata* Schltr.

Notes

A very widespread species, with a variable spur length. Any differences between *Benthamia rostrata* and *B. perularioides* do not hold when a large number of specimens are examined. Moreover, there are no distinct distribution zones as suggested by Perrier (Perrier 1939: 24, 25), with *Benthamia perularioides* north of Ankaratra and *Benthamia rostrata* south of Ankaratra. This species was also often misidentified as *Benthamia bathieana*, which added to the confusion.

Benthamia perularioides and *B. rostrata* were described in the same publication by Schlechter. The rules of nomenclature allow a choice of which name to prioritise. We have chosen *B. rostrata* because this name is more widely used. The type indicated by Schlechter for his *Platanthera madagascariensis* is "Perrier de la Bathie XXI, β". He copied this on specimen P00094574 which has handwritten XXI and B together with the number *8101*. Schlechter (1924: 33) gave "*H. Perrier 8101* (XXI B)" when he coined the name *Benthamia rostrata*. The specimen P00094574 was thus sent to Berlin and returned to Paris, so there is no ambiguity that it is the holotype. For *Benthamia perularioides* Schlechter cited Perrier 13523 for the type, but there are in P two specimens with this collection number. We have chosen P00094567 as lectotype because Perrier indicated on it that it was sent to Schlechter in April 1921.

This species, which has an elongated spur, is different from the type of the genus *Benthamia* and other species with a scrotiform or short spur. It is perhaps misplaced in *Benthamia*. As a matter of fact, specimens identified as *Benthamia perularioides* in (Ngugi *et al.* 2020) were found to be embedded in *Cynorkis*.

At the beginning of the flowering time the spur is enveloped by the bracts, as is also observed in some African *Habenaria*.

See also: Schlechter (1930: t.12 n°45, as *Benthamia perularioides*), Perrier (1939: 24, as *Benthamia perularioides*), Perrier (1939: 25), Cribb & Hermans (2009: 42, as *Benthamia perularioides*), Cribb & Hermans (2009: 43), Bosser & Lecoufle (2011: 180), Hervouet (2018: 172).

Description

Erect slender terrestrial herb, 22-70 cm tall. Tubers 4-11, clustered, fusiform, slender and white, 5-8 mm in diameter, 20-60 mm long, roots up to 8, wiry, white, 1-2 mm in diameter. Stem 2-4 mm in diameter, with the base covered by sheaths 25-30 mm long, with above slightly fleshy leaves and higher up 7-10 lanceolate sheaths, gradually turning into floral bracts. Leaves 2-3, more or less narrowly oblong, 7-20 × 1.5-4 cm, shortly acuminate or mucronate. Rachis rigid, erect, 16-25 × 1.2 cm, densely many-flowered, somewhat unilateral with 30-50 flowers. Floral bracts lanceolate, very acuminate, erectly spreading, 5-15 × 1.5-3 mm, embedding the ovary, the lower ones longer than the ovary. Ovary twisted, 5-10 mm long, diameter 0.6-1.6 mm, the basal part fused to the base of the floral bract. Flowers resupinate, *c.* 7.5 mm and 4 mm deep, olive green turning yellowish; sepals narrowly oblong, obtuse, slightly navicular, the dorsal obscurely 3-veined, erect, 1.8-3.2 × 0.7-1.6 mm, the laterals single-veined, spreading, 2.3-4 × 0.7-1.9 mm; petals narrowly oval-obtuse, obscurely 2-veined, a little expanded at the anterior margin towards the base, 1.7-3.2 × 0.9-1.6 mm, forming a hood with the dorsal sepal; lip a little longer than the sepals, 2.8-4 × 1-2.3 mm, rhomboid in outline, tri-lobed, sometimes geniculate between the spur and the lobes, the central lobe tongue-shaped with apex curving up, obtuse, 1.5 × 0.5 mm, the lateral lobes triangular, obtuse, 0.5 × 0.7 mm; spur subcylindrical, trumpet-shaped at first then becoming thinner, pendent or trapped into the bract, narrowed from the base to the obtuse apex, whitish green, as long as the sepals, 2.3-6 × 0.3-0.6 mm. Anther not apiculate, suborbicular, 1-2.2 × 0.8-1.3 mm, with two distinct chambers; auricles very rounded, thick, almost a quarter the length of the anther; lateral lobes of the rostellum obsolete, the middle one obtuse, pointing backwards. Sweetly scented in the evening.

Benthamia spiralis A.Rich.

Monographie des Orchidées des Îles de France et Bourbon: 39 (Richard 1828). — *Habenaria dissimulata* Schltr., *Beihefte zum Botanischen Centralblatt* 33: 404 (Schlechter 1915). — *Benthamia spiralis* var. *dissimulata* (Schltr.) H.Perrier, *Bulletin de la Société botanique de France* 81: 34 (Perrier 1934).

Type material. — **Mauritius** • *sine loc.*; *J. Néraud 8*; holotype: P[P00738316]!.

Etymology. — From the Latin "*spiralis*", spiral, referring to the arrangement of the rachis.

Phenology. — Mainly May to October, but flowering time rarely noted on specimens.

Distribution and ecology. — Mauritius. Habitat unknown, except the vicinity of a marsh mentioned for one specimen (Fig. 89).

Conservation. — This species is at least Critically Endangered (CR), with an area of occupancy severely fragmented and less than 10 km² and an inferred continuing decline (criterion B2ab). The most recent collection, by Francis Friedmann, dates back to 1971, there is thus no recent proof that it is not extinct.

Additional specimens examined. — **Mauritius** • *sine loc.*; *J.B.G.M. Bory R43052*; W! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738422]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738537! plant in the middle only] • *sine loc.* • *L.H. Boivin s.n.*; P[P00738421]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738538]! • *sine loc.*; 1831; *L. Bouton s.n.*; P[P00738527]! • *sine loc.*; 1846-1848; *L.H. Boivin s.n.*; W! • Marais contigu au chemin de Chirac près du point le plus élevé; X.1849; *L.H. Boivin s.n.*; P[P00738389]! • *sine loc.*; VIII.1862; *P.B. Ayres s.n.*; P[P00738413 plant in the middle only]! • Pétrin; 20°24'31"S, 57°28'19"E; V.1971; *F. Friedman 1162*; P[P00738417, P02088511]!.

Notes

When Achille Richard described this species in 1828, it was for him clearly distinct from *Satyrium spirale* Thouars. The latter species appears on page 21 of the same publication under the name *Habenaria spiralis* (Thouars) A.Rich. Moreover, he wrote on the *Néraud* 8 type specimen: « *non in* P. Th. », meaning that it was not a Du Petit-Thouars species. The name was validly published since no one had used the name *Benthamia spiralis* before. When Schlechter wanted to transfer *Benthamia spiralis* A.Rich. to *Habenaria* in 1915, he was hindered by the already existing *Habenaria spiralis* (Thouars) A.Rich. which has *Satyrium spirale* Thouars as basionym. He therefore created a new name: *Habenaria dissimulata* Schltr. Many subsequent authors have mistakenly considered *Benthamia spiralis* A.Rich as a new name for *Satyrium spirale* Thouars. To add to the confusion the original Thouars name *Satyrium spirale* was illegitimate because it was already used by Swartz in 1788, for what is now *Spiranthes torta* (Thunb.) Garay & H.R.Sweet from Central America. For this reason,

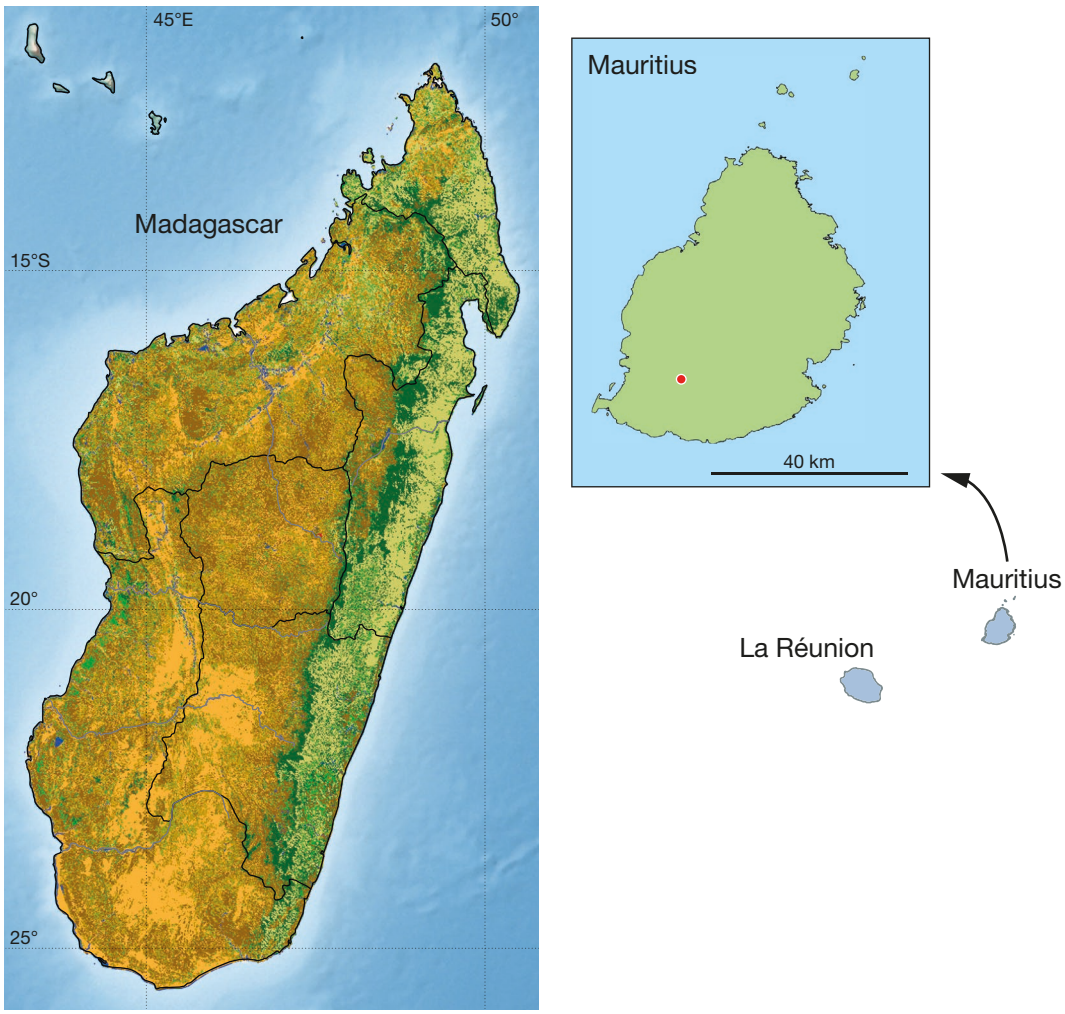

Fig. 89. — Distribution map of *Benthamia spiralis* A.Rich.

Lindley applied the new name *Spiranthes africana* in 1824, later changed to *Benthamia africana* (Lindl.) Hermans in 2014. Examination of the types proves them to be different, we have thus *Benthamia spiralis* A. Rich, endemic to Mauritius, as a different species from *Benthamia africana*, from Madagascar and the Mascarenes. That *Benthamia spiralis* A.Rich. was a different species or variety was also the interpretation of Perrier de la Bâthie who wrote (Perrier 1934: 33): « on doit le distinguer comme variété et certains botanistes pourraient même le considérer comme une espèce distincte » (« it must be considered as a distinct variety and some botanists could even consider it as a distinct species »), « avec un port plus robuste et des feuilles plus grandes, plus larges et plus nombreuses » (« with a more robust habit, larger, wider and more numerous leaves »), but he mistakenly named it *Benthamia spiralis* (Thouars) A.Rich. var. *dissimulata* (Schltr.) H.Perrier and among other specimens he cited one from La Réunion island (Boivin 1064, P[P00738525]!, which is for us merely *Benthamia africana.*

This species differs from *Benthamia africana* mainly by the more numerous cauline regularly alternate linear leaves, borne up to the base of the rachis, and also by the longer lateral lobes of the lip, the petals with fleshy tips and revolute margins, and the much longer floral bracts, up to twice the length of the ovary. Both plants are growing together and field observations are necessary to know to which extent they hybridize.

Description

Erect terrestrial herb 42-66 cm tall. Tubers 2, fusiform, 4 × 0.8 cm, roots 2-6, up to 6 cm long, 1-2 mm in diameter. Stem with the base covered by 1-2 sheaths, 3-5 mm in diameter. Leaves 5-10, erect, linear or strap-like, alternate subdistichous, acute and glabrous, 8-19 cm × 4-11 mm, regularly spaced (internode 2-3 cm), up to the rachis. Rachis terminal (4)7-17(23) cm, bearing 27-45 flowers roughly arranged in a spiral, 4-6 mm apart. Floral bracts linear-lanceolate, acute, enveloping the ovary at the basis, 8-15 mm long, up to twice the length of the ovary. Ovary fusiform, twisted, glabrous, slightly curved at the apex, almost vertical, 5-8 mm long. Flowers resupinate, 2.5-4.5 mm long, green; sepals 1-veined; dorsal sepal elliptic-oblong, 2-3 × 0.8-1 mm; lateral sepals similar or slightly longer, 2.1-3 × 0.9-1 mm; petals oblong-triangular, thickened at the apex, with slightly revolute margins, 2.2-2.6 × 0.8-1.2 mm; lip 2-3 × 1.2 mm, concave in the proximal part,

FIG. 90. — *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb, Ialatsara forest, Madagascar, 1 August 2016. Photograph by Jean-Michel Hervouet.

subcanaliculate, clearly trilobed at apex, like a trident, with a thickened midlobe 0.5-1 mm long, obtuse, lateral lobes acute, 0.3-0.5 mm long; spur 0.8-1 mm, slightly bilobed, slightly contracted at the base. Column subterete, 0.5-1 × 0.8-1 mm, with an obtuse to subacute nose-shaped apiculus 0.2-0.3 mm long, with lateral broadly rectangular auricles, with irregular margins; rostellum trilobed, hardly visible in dried material.

Benthamia spiraloides (Cordem.) Hermans & P.J.Cribb (Figs 90; 91; 92)

Lankesteriana 21 (2): 76 (Hermans & Cribb 2021). — *Habenaria spiraloides* Cordem., *Flore de l'île de la Réunion* (Cordemoy 1895: 551). — Type: **France, La Réunion** • Plaine des Palmistes, *Cordemoy s.n.*; holotype: [not found] • Plaine des Palmistes, chemin vers l'îlet Patience; 21°06'S, 55°37'E; 1100 m; IV.2002; *T. Pailler 48*; neotype: REU[REU007939]!, designated by Hermans & Cribb (2021: 76).

ETYMOLOGY. — Named for its similarity to what was once called *Satyrium spirale* Thouars, now *Benthamia africana*.

PHENOLOGY. — July to March.

DISTRIBUTION AND ECOLOGY. — La Réunion and Madagascar. Terrestrial or epiphytic, in moss, in semi-shade. In Madagascar observed thriving on rotten *Eucalyptus* stumps, or on the ground in pine plantations. Between 1000 and 1900 m (Fig. 93).

CONSERVATION. — This species has been provisionally quoted Vulnerable (VU) in La Réunion (Hermans *et al.*, 2023), where less than ten locations are known and its semi-shaded habitat among mossy rocks is threatened (criteria B1ab and B2ab). In Madagascar it is present in a number of reserves like Angavokely and Manongarivo and has probably been overlooked in a number of places. It can thrive in pine or *Eucalyptus* plantations and is therefore of Least Concern (LC).

ADDITIONAL SPECIMENS EXAMINED. — **Madagascar** • Diana, massif de Manongarivo; 14°00'00"S, 48°23'30"E; alt. 1200 m; IV.1909; *H. Perrier 1944 bis*; P[P00094536, P00094537]! • Analamanga, Manjakandriana; 18°54'S, 47°48'E; VIII.1955; alt. 1200 m; *J. Bosser 8292*; P[P00692224]! • Analamanga, Lake Mantasoa; 19°00'45"S, 47°50'17"E; IX.1962; *J. Bosser 16416*; P[P00692234]! • Analamanga, Ankeramadinika, Ambatoloana; VI.1963; *J. Bosser 16161*; P[P00692231]! • Alaotra-Mangoro, route de Lakato; 19°11'30"S, 48°26'00"E; VIII.1963; *J. Bosser 18523*; P[P00692244]! • N25, peu après le PK15 en venant de la N7; 17.VII.1969; *Y. Veyret 1114*; P[P00692305, P00692306, P00692307]! • Analamanga, Angavokely; 18°55'36"S, 47°45'07"E; 2.VI.1970; *Y. Veyret 1303*; P[P05096694]! • Analamanga, Angavokely; 18°55'36"S, 47°45'07"E; 27.VII.1970; *Y. Veyret 1330*; P[P05096692, P05096693, P05096695]! • Diana, Réserve spéciale de Manongarivo, chemin d'Ambalafary au vallon supérieur de la Bekolosy; 14°02'S, 48°18'E; alt. 840 m; 16.V.1995; *L. Gautier et al. LG2668*; P[P00098891]!, K!, G!, WAG[WAG.0388478]! • Alaotra-Mangoro, Ambatovy; 18°50'51"S, 48°18'31"E; 21.X.2005; *H. Razanantsoa et al. 579*; P[P02091795]! • Alaotra-Mangoro, Andasibe, near Mantadia forest; 1.X.2016; *J. Hermans 8038*; K! • Alaotra-Mangoro, Moramanga, Maromizaha; alt. 1080 m; 18.VIII.2022; *L.R. Rajaovelona 1402*; K[K001522047]!, TAN!.
France, La Réunion • Sur les montagnes; *C. Richard 697*; P[P00738528]! • *sine loc.*; *L.H. Boivin s.n.*; P[P00738369]! • *sine loc.*; *J. Renz 13027*; RENZ! • *sine loc.*; 1837; *C. Richard 397*; P[P00738529]! • *sine loc.*; 1867; *Herb. A. Richard R19908*; W! • Takamaka; 21°05'S, 55°38'E; 24.V.1974; *J. Bosser 22049*; P[P00738522]! • Bélouve forest; alt. 1500 m; V.2003; *M. Pignal et al. 2079*; P[P00340568]!, K!, MO! • Plaine des fougères; 21°00'15"S, 55°29'21"E; alt. 1200 m; 28.V.2003; *T. Pailler TP78*; REU[REU006450, REU007938]! • Piton rouge, Plaine des Cafres; 21°09'S, 55°34'E; 1900 m; 9.III.2004; *T. Pailler TP164*; REU! • Bébour, route forestière de Takamaka, sentier îlet à bananes; 21°05'54"S, 55°35'35"E; alt. 1200 m; 16.VI.2004; *J. Fournel JF110*; REU[REU010244, REU010245, REU010246]! • L'étang salé; 21°13'32"S, 55°22'09"E; alt. 1000 m; 5 .VI.2005; *V. Grondin 1796*; CBNM! • Plaine des Fougères, sentier vers Be Massoune; 21°00'15"S, 55°29'21"E; alt. 1380 m; 29.IX.2005; *J. Fournel JF306*; REU[REU010337]! • Piton Marmite, Salazie; alt. 1850 m; 31.VII.2006; *J. Fournel JF405*; REU[REU010388]! • Bébour, sentier la rivière; 21°06'40"S, 55°33'47"E; alt. 1300-1350 m; 7.VI.2007; *F. Martos FM128* and *FM129*; REU[REU007895, REU007897]! • Dimitile, sentier Bayonne; 21°13'10"S, 55°27'45"E; 15 .VI.2008; *F. Martos FM362* and *FM363*; REU[REU007896, REU007898]! • Dimitile, sentier Bayonne; 21°13'10"S, 55°27'45"E; 25.IV.2009; *F. Martos FM623*; REU[REU007754]! • *sine loc.*; XI.2017; *ML04*; CBNM! • *sine loc.*; IX.2019; *ML02*; CBNM! • Bébour forest; 21°06'40"S, 55°33'47"E; 15.XI.2019; *J. Hermans 8365*; K!.

Fig. 91. — *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb: Bras-Cabot, Bébour forest, La Réunion, 3 November 2021. Photograph by Jean-Michel Hervouet.

Fig. 92. — *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb, Ialatsara forest, Madagascar, 1 August 2016. Photograph by Jean-Michel Hervouet.

Notes

This species has long been overlooked in Madagascar, where it has been confused with *Benthamia africana* and *Benthamia misera.* Before the present study many specimens in herbaria were unidentified.

See also: Bernet (2010: 138, as *Benthamia* sp. 1), Szelengowicz & Tamon (2013: 243, as "*Benthamia dauphinensis* H.Perrier"), Hervouet (2018: 160, as *Benthamia dauphinensis* (Rolfe) Schltr.), Hermans & Cribb (2023: 122).

Description

A slender epiphytic or terrestrial glabrous herb, 20-45 cm tall. Tubers 2-3, ovoid, roots fleshy and woolly. Stem *c.* 1 mm in diameter with 2 to 3 short basal sheaths. Leaves 1-3, cauline, narrowly ligulate or linear-lanceolate, acute, 7-14 × 0.5-1.5 cm, shortly petiolate, the second leaf *c.* 2-3 cm above the basal and shorter. Rachis spiral, 5-12 cm long, lax to dense, with 15-27 flowers, with 2 to 4 more or less leaf-like sheaths, often purple-red. Floral bracts linear, acuminate-filiform 4-11 mm × 1-3 mm, brownish-red. Ovary disproportionately large, at first erect then divergent, with three longitudinal ridges, 5-11 × 1-2.7 mm, generally brownish purple. Flowers 2-4 mm in diameter, corolla almost tubular, generally with reddish-brown sepals, yellow petals, lip and spur; dorsal sepal cucullate, 3-veined, elliptic, obtuse, 1.5-3.2 × 0.6-1.4 mm; lateral sepals hardly spreading, forming a tube with the dorsal, 3-veined, obliquely oblong-ovate, obtuse, 1.3-3.1 × 0.8-3.1 mm, concave at the apex; petals lanceolate, subacute, 1.7-3.1 × 0.6-1.2 mm; lip barely trilobed, 1.8-3.1 × 0.9-1.8 mm, lateral lobes basal, small, rounded, midlobe thick, fleshy, about as long as the lateral lobes, the apex often incurved; spur scrotiform to subrectangular, often sub-bilobed-sacculate, the base funnel-shaped, 0.5-1 × 0.5-0.7 mm, twice as long as wide. Column with short auricles, less than ⅓ the size of the anther, anther retuse or obtusely apiculate.

Benthamia trifida Hermans & Hervouet, sp. nov.
(Figs 94; 95; 96)

Diagnosis. — *Benthamia trifida* Hermans & Hervouet, sp. nov. shares the fleshy pale petals and lip with contrasting green sepals with *Benthamia herminioides* but that species is terrestrial or lithophytic, has a much shorter leaf at anthesis and a more densely flowered rachis. It shares the habit of *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb but in that species the leaves are narrower and borne higher on the stem, the lateral sepals are not spreading-reflexed and the spur is scrotiform (vs flattened). It is also similar to the widespread terrestrial or lithophyte *Benthamia africana* (Lindl.) Hermans but that species has more leaves (3 to 5 vs 1 to 3) which are narrower and more attenuate, a denser rachis and a more distinctly trilobed lip.

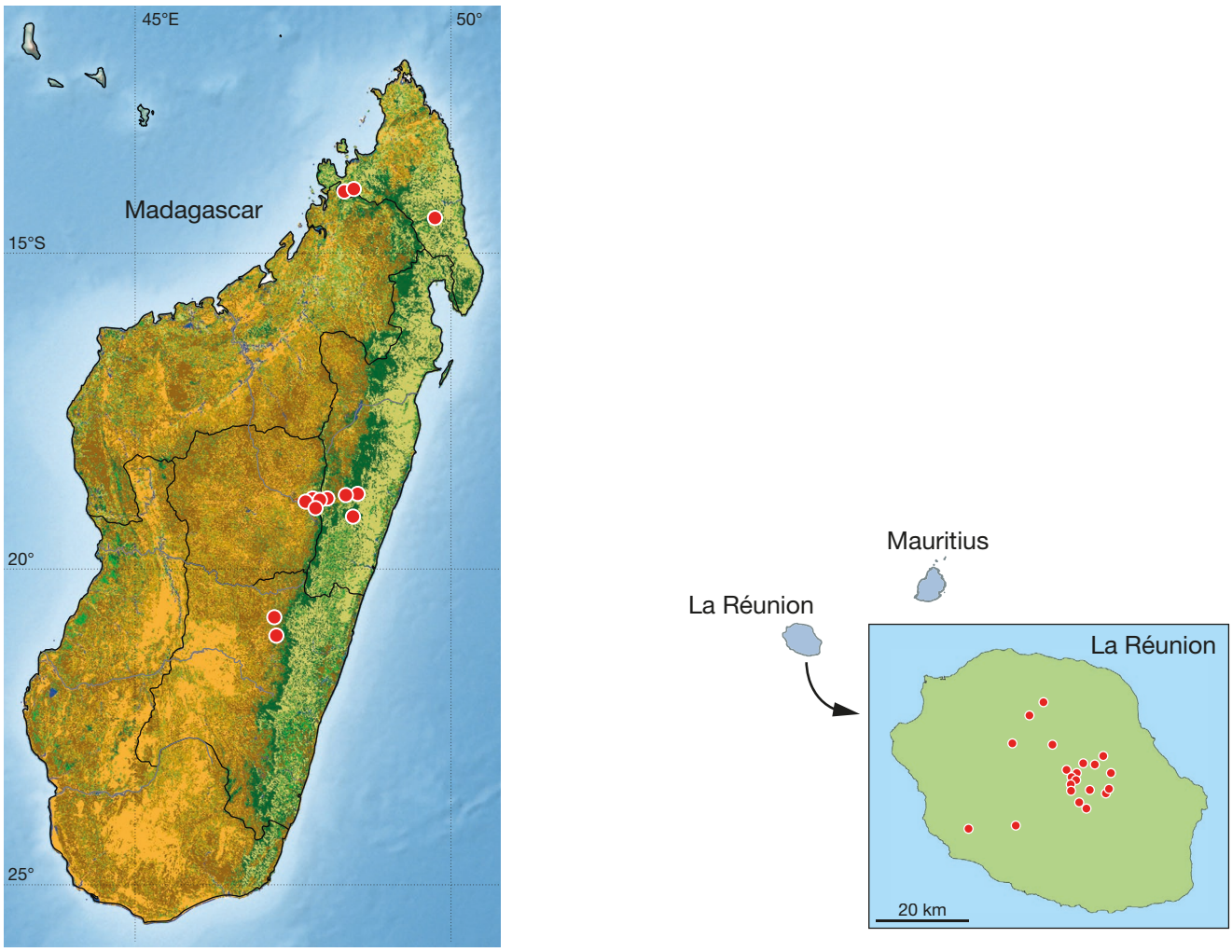

Fig. 93. — Distribution map of *Benthamia spiraloides* (Cordem.) Hermans & P.J.Cribb.

Type material. — **Madagascar** • Alaotra-Mangoro, Andasibe area; 19°00'40"S, 48°27'24"E; alt. 1150 m; V.2001; *J. Hermans 8224*; holotype: K!.

Etymology. — The species epithet *trifida*, refers to the distinctive three-pointed calyx and corolla.

Phenology. — Flowering from March to May.

Distribution and ecology. — Madagascar. From Andasibe region (Alaotra-Mangoro region) down to Ranomafana in the south (Haute Matsiatra region), so far known from only two localities. Altitudinal range 950 to 1200 m, medium altitude moist evergreen forest (Fig. 97).

Conservation. — The AOO of this species is less than 500 km², the two locations known are a national park that suffered poaching of orchids during the Covid years, Ranomafana N.P., and a forest which is not yet an official reserve and is threatened by logging, the Iaroka forest near Andasibe. This species is thus considered Endangered (EN) according to criterion B2.

Additional specimens examined. — **Madagascar** • Alaotra-Manoro, Andasibe area; 19°00'40"S, 48°27'24"E; alt. 1100 m; V.2001; *J. Hermans 8231*; K! • Haute Matsiatra, Ranomafana N.P.; 21°14'22"S, 47°23'41"E; alt. 1025 m; 20.III.2015; photographic records by Jean-Michel Hervouet (Figs 94; 95) • Alaotra-Mangoro, Andasibe area; alt. 1200 m; 5.V.2023.; photographic records by J. Hermans.

Notes

This species is very variable in size and even very small plants can produce flowers.

Description

Slender epiphytic herb, 4-25 cm tall. Tubers 2-3, ovoid, woolly, 10-25 × 3-8 mm, roots wiry, woolly, 0.6-1.4 mm in diameter. Stem 3-5 mm in diameter, with 2 to 3 short basal enveloping sheaths. Leaves cauline, generally 1 but up to 3 in older plants, erect to arcuate, narrowly ligulate or linear-lanceolate, acute, 3-12.5 × 0.5-1.5 cm, shortly petiolate, the midvein slightly raised beneath, pale to dark green. Rachis more or less spiral, erect, secund, green, with 1 to 2 sheaths towards the base, loosely flowered in the upper half, with up to 45 flowers but generally fewer. Floral bracts narrowly lanceolate, acuminate, about as long as the ovary, 3-5.6 × 1.2-1.8 mm, green. Ovary disproportionately large, at first erect then divergent, with three longitudinal ridges, 3.5-6.5 × 1-1.4 mm, pale green. Flowers fleshy, *c.* 3 × 4 mm, corolla almost tubular at the base, sepals pale green, petals and lip often pale pink but sometimes pale yellowish-green; dorsal sepal cucullate, narrowly elliptic, obtuse, arcuate over the column, 1.5-2.2 × 0.4-0.9 mm; lateral

Fig. 94. — *Benthamia trifida* Hermans & Hervouet, sp. nov., Ranomafana, Madagascar, 20 March 2015. Photograph by Jean-Michel Hervouet.

sepals spreading to recurved, narrowly elliptic, concave, obtuse, 1.9-2.1 × 0.8-0.9 mm; petals, ovate, subacute, the apex and anterior margin thickened and more or less lobed, 1.8-2 × 1-1.2 mm. Lip obtusely trilobed, 1.5-1.9 × 1.1-1.7 mm; lateral lobes thickened towards the apex, rounded; midlobe thick, fleshy, the apex curved; spur subrectangular, flattened, sometimes sub-bilobed, 0.8-1.3 × 0.8-0.9 mm, green. Column 0.6-0.9 × 0.6-0.8 mm, with prominent suborbicular auricles, anther curved, obtusely apiculate.

Benthamia vulcanorum Hervouet & Descourv., sp. nov. (Figs 98; 99; 100)

Diagnosis. — Similar to *Benthamia africana* but differing in the number and position of leaves (2-3 leaves in the middle of the stem vs 3-5 basal and cauline leaves in lower part of the stem), in the non-resupinate flowers, that are half closed and facing upwards (vs resupinate, opened and horizontal), the differently coloured flower parts (yellow tips of petals and lip, yellow spur, vs uniform green for *Benthamia africana*) and the flattened spur (vs scrotiform). Similar to *Benthamia perfecunda* but flowers not in three rows, the ovary is vertical (vs perpendicular to the rachis in *Benthamia perfecunda*), and the number and the position of the leaves are different (2-4 cauline leaves in lower part of the stem for *Benthamia perfecunda*).

Type material. — **France, La Réunion** • *sine loc.*; 14.II.1969; *T. Cadet 1963*; holotype: P[P00738518]!.

Etymology. — The species range lies in high altitude zones between the Fournaise volcano and the Piton des Neiges, hence the name *vulcanorum*, "of the volcanoes".

Phenology. — From March to April, at the end of the rainy season.

Distribution and ecology. — La Réunion. Collected between 1700 and 2300 m, growing on bare soil made of volcanic ash (Fig. 101).

Conservation. — This species is known from more than ten localities but its AOO is very restricted, less than 20 km², it could be threatened by the consequences of a volcanic eruption throwing ashes, it must therefore be considered Vulnerable (VU) according to criterion D2.

Fig. 95. — *Benthamia trifida* Hermans & Hervouet, sp. nov., Ranomafana, Madagascar, 20 March 2015. Photograph by Jean-Michel Hervouet.

Additional specimens examined. — **France, La Réunion** • Coteau Kervéguen; 21°07'27"S, 55°30'16"E; II.1971; *J. Bosser 20737*, *20740*, *20744* and *20745*; P[P00738532, and spirit, P00738371, P00738372, P00738524]! • Sentier du Côteau Maigre, Plaine des Cafres; 21°08'08"S, 55°31'40"E; II.1971; *J. Bosser 20479*; P[P00738373]! • Sentier du Côteau Maigre, Plaine des Cafres; 21°08'08"S, 55°31'40"E; II.1971; *J. Bosser 20481*; P[P00738523 and spirit]! • Piton Mare à boue, Plaine des Cafres; 21°07'56"S, 55°30'45"E; 30.III.1974; *J. Bosser 21774*; P[P00738520]! • Base du Piton Mare à Boue, Plaine des Cafres; 21°09'35"S, 55°34'35"E; 30.III.1974; *J. Bosser 21783*; P[P00738535]! • Sentier du Piton des Neiges, Cilaos; 21°07'06"S, 55°29'12"E; alt. 1700-1800 m; 14.IV.1978; *J. Bosser 22506*; P[P00738312, P00738313]! • Descente Plaine des sables le Tremblet; 21°17'14"S, 55°43'20"E; alt. 2000 m; 20.IV.1978; *J. Bosser 22540*; P[P00738401]! • *sine loc.*; alt. 2300 m; 1987; *J. Renz 14774*; RENZ! • Sentier du Piton

FIG. 96. — *Benthamia trifida* Hermans & Hervouet, sp. nov.: **A**, dorsal sepal, lateral sepal and petal; **B**, flower, side view with floral bract and front view; **C**, lip, spur and column, side and front view; **D**, column; **E**, flower with lip removed, front view; **F**, plant and inflorescence; **G**, tuber, plant and inflorescence; **H**, anther. Drawn by Deborah Lambkin. From *Hermans 8224*, *Hermans 8231*, and photographs. Scale bars: A, B, E, 2 mm; C, 1.5 mm; D, 1 mm; F, 3 cm; G, 2 cm; H, 0.5 mm.

des Neiges par la Plaine des Cafres; 21°07'57"S, 55°32'36"E; alt. 1700 m; 24.IV.1988; *J. Dupont 1*; P[P00738359 and spirit]! • Sommet Kervéguen; 21°07'27"S, 55°30'16"E; alt. 2300 m; 24.V.2000; *F. Martos FM706*; REU[REU007702]! • Route forestière du volcan; 21°11'40"S, 55°38'36"E; alt. 2200 m; 1.III.2003; *T. Pailler et al. TP70*; REU[REU006420]! • Bébour, Piton des Neiges to Bélouve path; alt. 1900 m; 5.III.2003; *V. Hoarau et al. 13* and *14*; REU[REU007941, REU006426] ! • Saint-Joseph, Caverne de

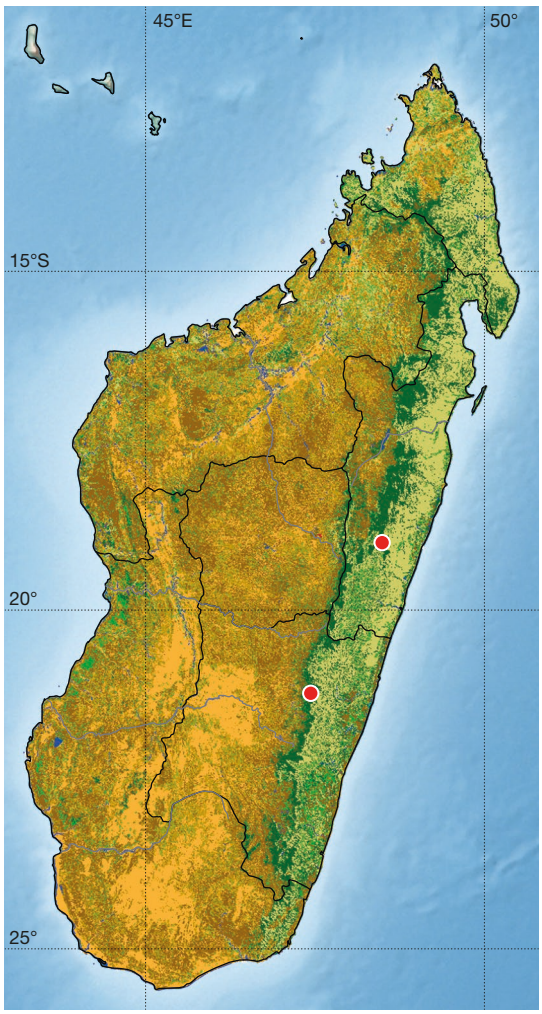

Fig. 97. — Distribution map of *Benthamia trifida* Hermans & Hervouet, sp. nov.

Cotte; alt. 2240 m; 21°14'16"S, 55°38'18"E; III.2004; *J. Férard et al. 1041* and *1042*; CBNM! • Saint-Joseph, Oratoire Sainte-Thérèse; 21°12'37"S, 55°39'15"E; 2300 m; II.2005; *V. Grondin et al. 1564*; CBNM! • Maïdo, sentier du Grand Bénard; 21°04'09"S, 55°23'16"E; 21.III.2007; *V. Lecomte s.n.*; REU[REU005135]! • Route du Volcan, vers Le Piton de l'Eau; 21°11'02"S, 55°40'28"E; 21.V.2008; *F. Martos FM340* and *FM341*; REU[REU007894, REU007903]! • Puy Ramond; 21°17'41"S, 55°42'22"E; 22.II.2020; *V. Lavergne*; photographs.

Notes

Although long overlooked, this species has distinctive features, such as the flat spur, the erect flowers and the leaves similar to those of the local *Tylostigma*, which shares the same altitude and habitat close to the top of the volcanoes Fournaise and Piton des Neiges. It was noted and briefly described by Bernet (Bernet 2010) who provisionally labelled it *Benthamia* sp. 3. It is likely that Jean Bosser also noticed this plant as he systematically noted on his specimens that the lip and petals were green with yellow tips. Another distinctive feature to look for is the erect ovary often prolonged by erect half-closed flowers. It is surprising that among 20 specimens found none were collected before 1969. However, it is unlikely that this is due

Fig. 98. — *Benthamia vulcanorum* Hervouet & Descourv., sp. nov., Le Tremblet, La Réunion, 20 April 2018. Photograph by Jean-Michel Hervouet.

to a recent arrival, since the plant is endemic to La Réunion. Given the number of very similar specimens and the absence of would-be parents in the same habitat, it is unlikely that this species is a hybrid. In the *Benthamia africana* complex in Madagascar, some plants (e.g. observation of first author on Sainte-Marie Island) may have two-colour erect flowers with a flattened spur, but in this case all the leaves are basal, as leaves in the drawing by Thouars (Thouars 1822: t.9).

There is also in the spirit collection in P a sample corresponding to the type P00738518.

See also: Bernet (2010: 140, as *Benthamia* sp. 3), Szelengowicz & Tamon (2013: 248, as *Benthamia misera*).

Description

Erect terrestrial herb 25-80 cm tall. Tubers 2-4, fusiform, 2 × 0.8 cm, roots 2-6, up to 7 cm long, 1-3 mm in diameter. Stem cylindrical, 1.2-3 mm in diameter, with leaves in the

Fig. 99. — *Benthamia vulcanorum* Hervouet & Descourv., sp. nov., Le Tremblet, La Réunion, 20 April 2018. Photograph by Jean-Michel Hervouet.

middle of or slightly lower. Leaves 2-3, 10-15 cm × 5-10 mm, erect, linear, longitudinally folded, rigid. Rachis terminal, 5-15 cm long, bearing 12-24 flowers roughly arranged in a spiral, 4-6 mm apart. Floral bracts lanceolate, acuminate, 8-10 mm long, slightly shorter to longer than the ovary. Ovary fusiform, not twisted, vertical, 5-5.5 mm long, with 3 longitudinal ridges sometimes coloured purple. Flowers not resupinate, hardly opening, 2-3 mm long, all floral parts except lateral sepals forming a loosely closed upward facing tube along the ovary, green with tips of petals, lip and spur yellow; dorsal sepal concave, oval, 2-2.5 × 1.2-1.3 mm; lateral sepals navicular, oblong, spreading, green, 2.8 × 1 mm; petals oblong, shorter than the lateral sepals, 2-2.2 × 0.9-1 mm, forming with the dorsal sepal a hood over the lip, green with a fleshy and yellow apex; lip 2.2-3 × 1.5 mm, without callus, concave in proximal part, trilobed at apex, calceolate, green with yellow apex, with central lobe 0.5-0.6 mm long, thickened, lateral lobes folded upwards, thickened, 0.3 mm long; spur 1 mm, flattened into a disc, not bilobed, slightly narrowed at the base. Column 0.9-1 mm high, 0.6 mm long, short, obtuse, without apiculus; auricles about as long as the column, sub-spathulate.

AMBIGUOUS OR INSUFFICIENTLY KNOWN SPECIES

Below we deal with species known only from a single specimen, that share similarities with other well-known species or could potentially be hybrids, and on which we are unable to make a taxonomic decision. We also mention undescribed species observed in the field, for which there are no specimens known. Finally, we list specimens which again share similarities but also differences with well-known species and for which additional data, especially observations in the field, are needed.

Benthamia dauphinensis (Rolfe) Schltr.

Repertorium Specierum Novarum Regni Vegetabilis 33: 25 (Schlechter 1924). — *Habenaria dauphinensis* Rolfe, *Journal of the Linnean Society, Botany* 29: 56 (Rolfe 1891).

Type material. — **Madagascar** • Anosy, Fort-Dauphin; *G.F. Scott Elliot 2867*; holotype: K[K000415551]!.

Etymology. — From the city of Fort-Dauphin in the south-east of Madagascar, the "dauphin" being the young Louis XIV.

Phenology. — Unknown.

Distribution and ecology. — Madagascar. Collected near Fort-Dauphin in the south-east of the country.

Conservation. — This species has been quoted CR by IUCN in 2015 (https://doi.org/10.2305/IUCN.UK.2015-2.RLTS.T68501445A68713181.en).

Notes

This species is only known from the holotype. The combination of a single leaf, the slightly lobed lip and the spur are strongly reminiscent of *Benthamia monophylla.* Moreover, it has been found in a region where the latter is present. However, the flowers are smaller, the spur is much shorter and has a different shape, and its rachis is not secund. Neither confirming it a proper species or synonymising it with *Benthamia monophylla* is satisfactory and more material is needed.

See also: Hervouet (2018: 160, photographs are *Benthamia spiraloides*).

Description

Erect terrestrial herb, around 50 cm high. Tubers and roots not known. A single basal leaf, linear 7-9 × 0.6-0.7 mm. Rachis lax, bearing 15-20 flowers. Floral bracts lanceolate, acuminate, 3 × 0.8 mm long. Ovary 5 × 1 mm. Flowers greenish; sepals elliptic-oblong, obtuse, dorsal sepal 1.8 × 0.9 mm, concave; lateral sepals 1.8 × 1 mm; petals nearly similar to sepals, 1.3 × 0.9 mm long; lip very concave, 1.8 × 1.1 mm long, obscurely trilobed, lateral lobes rounded, midlobe very obtuse, spur about 1.4 × 0.4 mm, flattened, almost bidentate at the tip, truncate. Column 1.1 × 0.9 mm, apiculate.

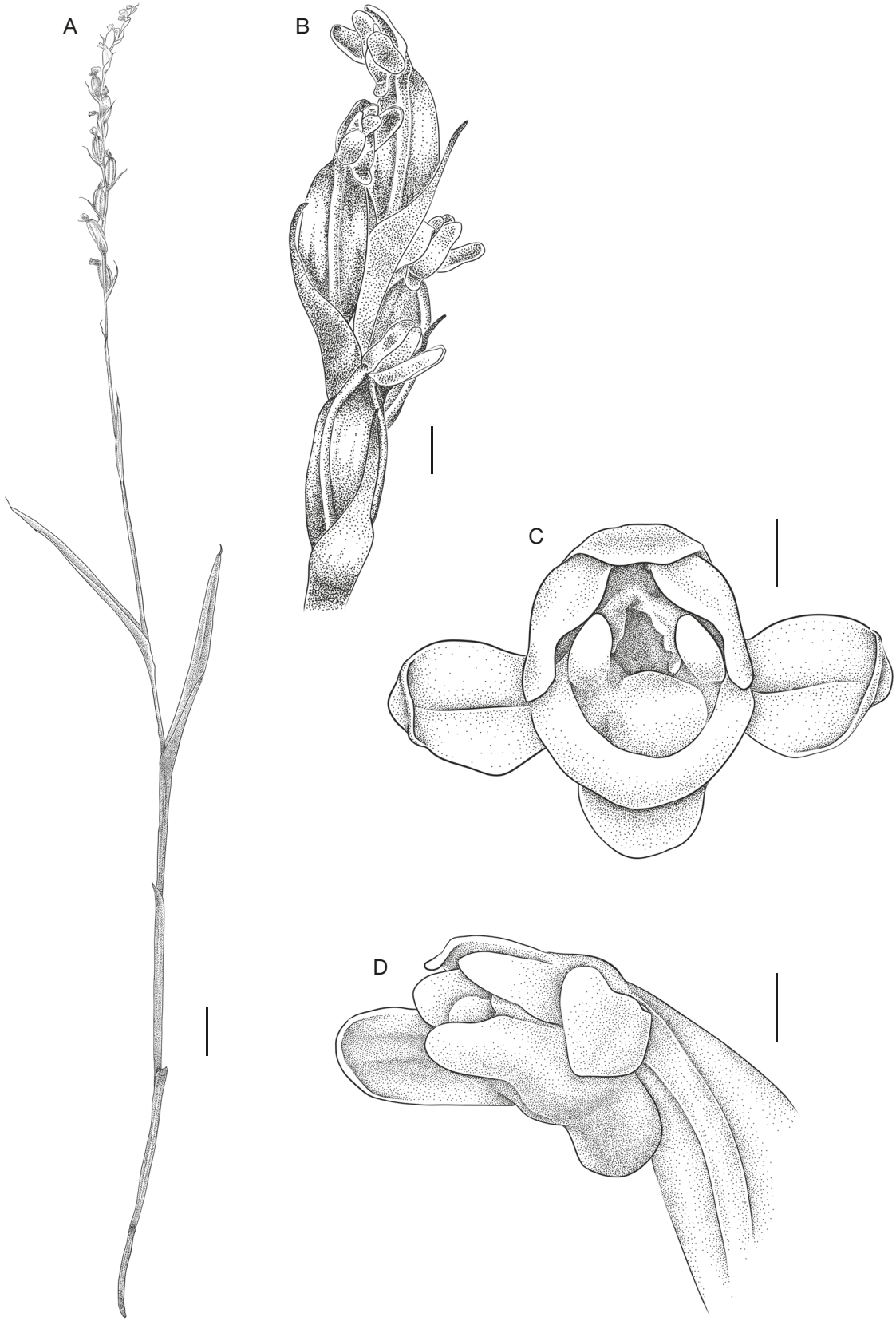

FIG. 100. — *Benthamia vulcanorum* Hervouet & Descourv., sp. nov., drawing by Ludivine Longou after photographs and dried specimens: **A**, habit; **B**, part of rachis; **C**, front view of flower; **D**, side view of flower.. Scale bars: A, 12 mm; B, 2 mm; C, D, 1 mm.

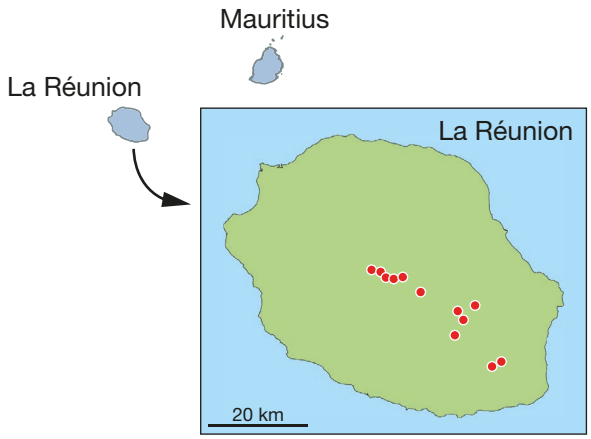

Fig. 101. — Distribution map of *Benthamia vulcanorum* Hervouet & Descourv., sp. nov.

Benthamia macra Schltr.

Repertorium Specierum Novarum Regni Vegetabilis 33: 28 (Schlechter 1924).

Type material. — **Madagascar** • Haute Matsiatra, Massif d'Andringitra; 22°07'40"S, 46°51'48"E; alt. 2500 m; II.1922; *H. Perrier 14577*; holotype: P[P00094532]!.

Etymology. — From Latin "*macer*", thin, meagre.

Phenology. — February.

Distribution and ecology. — Madagascar. Collected only once in the Andringitra massif, at the altitude of 2500 m.

Conservation. — Data Deficient (DD).

Notes

This species is known only from the type specimen, which is damaged. The leaves are reminiscent of *Benthamia mascula* sp. nov., but the spur, the bracts, and the size of the flower are different; the flowers are reminiscent of *Benthamia melanopoda*, and at least one specimen of *Benthamia melanopoda* (*A. Seyrig 658*, P[P00094533]!) was identified on the herbarium sheet as *Benthamia macra* by Perrier. However, there is no prominent callus on the lip and the side-lobes of the lip are not as long as the midlobe, which prevented us from putting this species in synonymy with *Benthamia melanopoda*. It also shares similarities with *Benthamia perfecunda*. It is surprising that this plant has not been found again on Andringitra since 1924, despite the fact that this area has been visited by many botanists. It could be a hybrid, with the most likely parents in Andringitra being *Benthamia perfecunda*, *Benthamia bosseri* or *Benthamia flavida,* the latter the only similar species mentioned by Schlechter.

A note by Jean Bosser attached to the type P00094532 mentions a flower in alcohol, but it could not be located.

See also: Perrier (1939: 29), Cribb & Hermans (2009: 46).

Description

Slender terrestrial herb, *c.* 45 cm high; stem terete, glabrous, enveloped at the base by a few sheaths, higher up with 3 distant leaves, upright, narrowly linear-acute, up to 13 cm × 8 mm. Rachis elongate, *c.* 12 cm, rather lax, bearing *c.* 20 flowers, secund. Floral bracts lanceolate-acuminate, as long as or a little longer than the ovary. Ovary fusiform cylindrical, glabrous, slightly twisted, 7 mm long. Flowers small, glabrous, greenish-brown; sepals dark, the rest greenish; sepals oblong, obtuse, 4 mm, the dorsal sepal 3-veined, the laterals 1-veined; petals 3-veined, oblong obtuse, thickened towards the tip, a little attenuate towards the base, as long as the sepals; lip oblong in contour, 4 × 2.25 mm, a little contracted in the middle, trilobed in the upper third; lateral lobes curved in a scythe-shape and obtusely-triangular, the middle one semi-oblong, very obtuse, almost twice as long as the laterals; spur very short, oblong and obtusely sac shaped. Anther subglobose and apiculate; auricles obtuse, short, hardly surpassing half the anther.

Benthamia misera (Ridl.) Schltr.

Repertorium Specierum Novarum Regni Vegetabilis 33: 24 (Schlechter 1924). — *Habenaria misera* Ridl., *Journal of the Linnean Society, Botany* 21: 503 (Ridley 1885).

Type material. — **Madagascar** • Imerina; *W. Deans Cowan s.n.*; holotype BM[BM000034594]!, with tracing and drawing of flower in Reichenbach herbarium in W, *R11448*.

Etymology. — From the Latin "*misera*", miserable, due to the poor aspect of the plant.

Phenology. — Unknown.

Distribution and ecology. — Madagascar. From the central region of Imerina, according to Deans-Cowan.

Conservation. — Data Deficient.

Notes

This species is reminiscent of *Benthamia erinacea* but with an unusual shape of leaves. Moreover, the type specimen is damaged, so we decided to keep it as an insufficiently known species. Specimens identified as *Benthamia misera* by Perrier belong to two different species: *Benthamia spiraloides* (P[P00094536, P00094537]) and *Benthamia africana* (P[P00094538]), the species is thus known only from the holotype. It was reported from La Réunion by Szelengowicz & Tamon (2013: 248). The text refers to the Madagascan species and the photographs show *Benthamia vulcanorum* sp. nov.

See also: Perrier (1939: 28), Cribb & Hermans (2009: 44).

Description

Erect terrestrial herb. Roots unknown. Leaves two, oval or oval-lanceolate, radical, cuspidate; inflorescence a lax and slender rachis with flowers on all its length. Bracts lanceolate, twice the length of flowers. Flowers small; lateral sepals oval-lanceolate, obtuse; dorsal sepal wider; petals smaller,

lanceolate, fleshy; lip entire, ovate, short, fleshy at the top, hollow at the base, with erect margins; spur very small and saccate. Anther very short, apiculate.

Benthamia sp. 1
(Fig. 102)

SPECIMENS EXAMINED. — **Madagascar** • Haute Matsiatra, Ambondrombe; 21°52'30"S, 47°15'37"E.

REMARK
This species is so far only known from the top of Ambondrombe, it is close to *Cynorkis falcata* and *Benthamia exilis*. The flowers are yellow and the most distinctive feature is the long midlobe of the lip. Like *Benthamia exilis* it has no leaves when flowering. The sepals are folded back as in *Cynorkis falcata*. This species would probably be best placed into the genus *Cynorkis*.

Benthamia sp. 2
(Fig. 103)

SPECIMENS EXAMINED. — **Madagascar** • Amoron'i Mania, Zafimaniry country, Antoetra.

REMARK
Photographed by Véronique Lavergne in May near Antoetra in Madagascar. It is a very large plant. Though the midlobe of the lip is shorter and the leaves rather linear, it could be a variety of *Benthamia elata*.

Benthamia indet. 1

SPECIMENS EXAMINED. — **Madagascar** • Analanjirofo, Maroantsetra, commune d'Ambinanitelo, Fokontany Marovovonana; 15°19'10"S, 49°23'45"E; alt. 943 m; 3.IX.2004; *P. Antilahimena 2722*; P[P00755146]!, MO[MO3022648].

REMARK
This species is close to *Benthamia arcuata* comb. nov., stat. nov., but it is epiphytic, the leaves are not coriaceous and the rachis is longer. Field observations and more material are needed.

Benthamia indet. 2

SPECIMENS EXAMINED. — **Madagascar** • Ihorombe, Isalo N.P.; alt. 1000 m; X.1924; *H. Perrier 16543*; P[P00094606]!.

REMARK
The plants are close to *Benthamia africana*, but with significant differences, such as the very elongated floral parts and an unusual longitudinal thin crest on the lip, a spur which is flattened and not scrotiform. The location is very far from the nearest known locality of *Benthamia africana*. Field observations and additional specimens are necessary to make a decision.

FIG. 102. — *Benthamia* sp. 1, on top of Ambondrombe, 9 March 2009. Photograph by Jean-Michel Hervouet.

Benthamia indet. 3

SPECIMENS EXAMINED. — **Madagascar** • Ihorombe, plateaux et vallées de l'Isalo, gorges de la Sakamarekely et de la Sambalinieto; 23°14'00"S, 45°08'00"E; alt. 460 m; 19-25.X.1924; *H. Humbert 2835*; P[P00094598, P[P00094599]!.

REMARK
The two plants were referred to *Benthamia africana* (Perrier's handwriting on specimens in 1932, later changed into *Benthamia* sp. in 1939) but again are outside of the distribution range of this species. The size is even smaller than that of *Benthamia decaryana* sp. nov. and the leaves are different. Further study and field observations are necessary.

Fig. 103. — *Benthamia* sp. 2, near Antoetra, Zafamaniry country, 17 May 2014. Photograph by Véronique Lavergne.

EXCLUDED SPECIES

Cynorkis leandriana (H.Perrier) Hervouet

Adansonia, sér. 3, 44 (9): 68 (Hervouet & Hermans 2022). — *Benthamia leandriana* H.Perrier, *Notulae Systematicae* 14: 139 (Perrier 1951). — *Cynorkis tryphioides* var. *leandriana* (H.Perrier) Bosser, *Adansonia n.s.* 9: 358 (1969).

Type material. — **Madagascar** • Melaky, Tsingy du Bemaraha; *J. Leandri 951*; holotype: P[P00102088]!.

Notes

This taxon was first described as a *Benthamia* but belongs in *Cynorkis*, it is close to *Cynorkis tryphioides* Schltr., *Cynorkis windsorensis* Hervouet and *Cynorkis ankaranensis* Hervouet (Hervouet & Hermans 2022: 68).

Cynorkis falcata (Frapp.) Schltr.

Beihefte zum Botanischen Centralblatt 33 (2) (Schlechter 1915: 400). — *Hemiperis falcata* Frapp., in Cordemoy, *Flore de la Réunion*: 241 (Cordemoy 1895).

Benthamia longecalceata H.Perrier, *Notulae Systematicae* 14: 139 (Perrier 1951). — Type: **Madagascar** • Sava, Sommet ouest du Marojejy; alt. 2000 m; III-IV.1949; *H. Humbert et al. 23868*; lectotype: P[P00094528]!, designated by Hermans *et al.* (2007: 72); Cribb & Hermans (2009: 42), **syn. nov.**

Type material. — **France, La Réunion** • *sine loc.*; *Cordemoy s.n.*; lectotype: MARS[MARS087655]!, designated by Hermans & Cribb (2021: 101).

Additional specimens examined. — **Madagascar** • Sava, nord-est du Maimborondro au nord du Maroambihy-Lokoho; alt. 400-500 m; III.1949; *H. Humbert 23388*; P[P00094527]! • Sava, mont Beondroka, au Nord de Maroambihy; 17-22.III.1949; *H. Humbert 23602*; P[P00094525, P00094526]!, G!.

Notes

This species was previously known only from La Réunion, but *Benthamia longecalceata* from Madagascar appears to be a new synonym. Here is a translation of the original Latin description of *Benthamia longecalceata* by Perrier: "Geophyte, slender, 25-40 cm high, one-leaved. Leaf oval (1.3 × 1-1.5 cm), shortly (5-10 mm) petiolate, acute-acuminate. Inflorescence slender, peduncle a few sheaths. Rachis dense, 2-4 cm long, 7-10 mm wide, 10- to 20-flowered. Floral bracts acute, narrowly lanceolate, shorter than the pedicellate ovary. Sepals one-veined; dorsal sepal obtusely ovate (2 × 1.5 mm), lateral sepals subfalciform (3 × 1.8 mm). Petals obtusely subfalciform, small (2 × 1 mm), one-veined. Lip elongated (2.5 mm), slipper-shaped, spur pendent, cylindric, the same length as the lip (2.5 mm)."

It is highly likely that Jean Bosser also discovered this synonymy but did not publish it. As a matter of fact, he left several notes on the specimens stating that this species was very close to *Hemiperis falcata* Cordem. of La Réunion and that further dissections should be done. He even filed the two specimens which were not the holotype in the *Cynorkis falcata* folder in P, where we found them.

Cynorkis micrantha (Frapp. ex Cordem.) Schltr.

Beihefte zum Botanischen Centralblatt 33 (2): 401 (Schlechter 1915). — *Hemiperis micrantha* Frapp. ex Cordem., *Flore de l'île de la Réunion*: 239 (Cordemoy 1895).

Hemiperis aphylla Cordem. *nomen nudum* based on *Cordemoy 9*, also quoted *Habenaria* or *Bescherellia*. — *Benthamia micrantha* (Frapp. ex Cordem.) Hermans & Hervouet, *Flore des Mascareignes* 170: 118 (Hermans & Cribb 2023), *nom. illeg., non Benthamia micrantha* (Suksd.) Druce (itself *nom. illeg.* in Boraginaceae).

Type material. — **France, La Réunion** • *sine loc.*; *Cordemoy 9*; lectotype: MARS!, designated by Hermans & Cribb (2021: 103); isolectotype K!.

Additional specimens examined. — **France, La Réunion** • Piton Mare à Boue Plaine des Cafres; 21°09'S, 55°34'E; 30.III.1974; *J. Bosser 21773*; P[P00150069!] • *J. Bosser 21661*; P! spirit • Îlet de Patience, Bras Cabot path; 21°06'S, 55°37'E; 7.IV.1978; *J. Bosser 22462*; P[P02088075, P02088076]! • Sainte-Rose; 10.II.2010; 21°09'S, 55°45'E; alt. 2070 m; *Hivert 3586*; CBNM! • Saint-Joseph; 26.I.2010; alt. 1920 m; *Hivert 3587*; CBNM!.
Madagascar • Analamanga, Angavokely; 18°55'36"S, 47°45'07"E; 25.III.2015; photograph in Hervouet (2018: 162) as *Benthamia exilis* var. *tenuissima*.

Notes

Evidence has been published by Pailler *et al.* (2024), based on DNA analysis and morphological comparison, that this species better fits into the genus *Cynorkis*, its correct name is therefore *Cynorkis micrantha* (Frapp. ex Cordem.) Schltr. Note

that Schlechter published another *Cynorkis micrantha* the same year (*Botanische Jahrbücher fur Systematik, Pflanzengeschichte und Pflanzengeographie* v.53: 388, 1915), it is a *nom. illeg*., synonym of *Cynorkis anacamptoides* Kraenzl.

See also: Pailler & Henze (2020: 74, as *Benthamia exilis* Schltr.), Hermans & Cribb (2023: 118).

Tylostigma spp.

Beihefte zum Botanischen Centralblatt 34 (2): 297 (Schlechter 1916).

Remark

During this study we found many *Tylostigma* specimens filed under *Benthamia*. For example, *Tylostigma nigrescens* Schltr. and *T. perrieri* Schltr., both with white flowers and growing in marshes, have often been identified as *Benthamia* sp. Yet *Tylostigma* flowers have no spur, whereas *Benthamia* flowers always have a distinctive spur, except *Benthamia boiteaui* for which it is a simple hollow. Another difference is that *Tylostigma* flowers have a transverse lamellate callus at the base of the lip, which does not occur in *Benthamia*.

DISCUSSION

Our revision identified 31 species, seven of which are new to science. Three species are insufficiently known and two others are known only by photographs.

Of these 31 species, 19 have a scrotiform or very small spur, showing an affinity with the type of the genus *Benthamia latisatis*. The core of the genus would thus consist of: *Benthamia africana*, *B. arcuata* comb. nov., stat. nov., *B. boiteaui*, *B. bosseri*, *B. decaryana* sp. nov., *B. elata*, *B. flavida*, *B. herminioides*, *B. humbertii*, *B. latisatis*, *B. litoralis* sp. nov., *B. majoriflora*, *B. mascula* sp. nov., *B. melanopoda*, *B. perfecunda*, *B. spiralis*, *B. spiraloides*, *B. trifida* sp. nov., *B. vulcanorum* sp. nov. Among these species, *Benthamia boiteaui* does not have a real spur, but just a hollow at the base of the lip, it could be a morphological transition towards *Tylostigma*. Two other species in this list (*Benthamia africana* and *B. flavida*) are related to *Tylostigma* according to Ngugi *et al.* (2020). One species, *B. chlorantha* (=*B. latisatis*), was found to be in a clade with *Tylostigma perrieri* Schltr. in Jin *et al.* (2017). All these species are terrestrial, except the notable exception of *Benthamia majoriflora*.

Five species have tubular flowers: *Benthamia corona* sp. nov., *B. erinacea*, *B. lakatoensis* sp. nov., *B. madagascariensis*, *B. nivea*. All these species are epiphytic except *Benthamia madagascariensis*. In this group *Benthamia erinacea* is also related to *Tylostigma*, according to Ngugi *et al.* (2020).

Benthamia calceolata stands apart from the other species, with its very distinct lip.

Several species have cylindrical spurs and are terrestrial:

Benthamia bathieana, B. exilis, *B. monophylla, B. praecox, B. rostrata,* as well as *Benthamia* sp. 1 in view of its similarity to *B. exilis*. Three of them, *Benthamia bathieana, B. monophylla, B. rostrata,* appear to be embedded in *Cynorkis* according to Ngugi *et al.* (2020). This was acknowledged by Pailler *et al.* (2024) who reinstated the name *Cynorkis micrantha,* this species being close to *Benthamia exilis.*

Benthamia glaberrima seems related to the genus *Peristylus* Blume, e.g. to *Peristylus constrictus* (Lindl.) Lindl. from Asia, but this may be only a convergence. Nevertheless, *Peristylus affinis* (Don) Seidenf. from Asia can morphologically hardly be distinguished from the core group of *Benthamia*. *Peristylus goodyeroides* (Don) Lindl. would also be considered a *Benthamia*, if it would occur in Madagascar, since the column has prominent basal auricles. *Peristylus* is a genus closely related to *Habenaria.* It would be good to include it in further molecular analysis studies and given its variability it also needs a revision.

Lastly, *Oligophyton* H.P.Linder, from the Chimanimani Mountains in Zimbabwe, should also be investigated. Its single species *Oligophyton drummondii* H.P.Linder & G.Will. was transferred to *Benthamia* as *B. drummondii* (H.P.Linder & G.Will.) Rutkowski & Szlach. and could belong here although, in the protologue, Linder & Williamson (1986) argued that it is different from *Benthamia* and *Peristylus*.

We hope this revision will provide a safe ground to further studies, including molecular analysis, aiming at circumscribing genera *Benthamia*, *Cynorkis*, *Habenaria*, *Peristylus* and *Tylostigma*.

Molecular analysis would be also useful to give a closer look at very variable species such as *Benthamia africana* and *B. erinacea*, each one with disconnected distribution ranges.

Note

Benthamia mamilyae L.Rapp & Hermans was published (Candollea 80: 110, 2025) just before the final publication of the present paper and could not be taken into account.

Acknowledgements

Many and sincere thanks to the Muséum national d'histoire naturelle in Paris for their long and generous hospitality and their very fruitful collaboration (in particular and by alphabetical order: Marie-Aimée Allard for the nice plate of *Benthamia litoralis* sp. nov., Emmanuel Côtez and Thierry Deroin for their ongoing support and advice, Didier Geffard-Kuriyama for enabling us to use the microscope platform BAOBAB of the "Atelier d'Iconographie scientifique" and his kind explanations, Florent Martos for his very generous help and collaboration, and many interesting conversations, Marc Pignal and Germinal Rouhan for their accurate and ongoing help on nomenclature. Many thanks to the two reviewers who greatly contributed to polish the English and suggested many scientific improvements. Sincere thanks to Benny Bytebier (University of Kwazulu-Natal) for spending a lot of time on the manuscript, pointing out nomenclatural issues and communicating data on his *Benthamia* specimens. We thank Royal Botanic Gardens Kew and Deborah Lambkin for her drawings of *Benthamia trifida* sp. nov. and *Benthamia corona* sp. nov. Thanks to Laurent Gautier for communicating data on Geneva specimens.

We thank Pr. Thierry Pailler (Université de La Réunion) for showing the first author *Benthamia* specimens of the La Réunion Herbarium and fruitful exchanges, especially on the former *Benthamia micrantha*, and for sending spirit material then donated to MNHN. Thanks to Jacques Fournel for providing information on his specimens in La Réunion Herbarium. We acknowledge the important findings of Véronique Lavergne in Ambodiriana forest in Madagascar, of *Benthamia calceolata*, *Benthamia elata* and *Benthamia litoralis* sp. nov. She was also generous in providing photographs and duly documented notes. *In situ* observations are of utmost importance in a revision and we waermly thank Laurent Catan, Charles Robert and Jean-Maurice Tamon for fruitful fieldtrips in Mascarene Islands.

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Submitted on 3 September 2024;
accepted on 29 December 2024;
published on 21 July 2025.