



## **Two New Species of Xyris L. (Xyridaceae) Endemic to Madagascar with a Key to the Malagasy Species**

Authors: Rakotonirina, Nivo, Callmander, Martin W., Phillipson, Peter B., and Lock, J. Michael

Source: Candollea, 69(2) : 171-178

Published By: The Conservatory and Botanical Garden of the City of Geneva (CJBG)

URL: <https://doi.org/10.15553/c2014v692a9>

---

BioOne Complete ([complete.BioOne.org](http://complete.BioOne.org)) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at [www.bioone.org/terms-of-use](http://www.bioone.org/terms-of-use).

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

---

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

# Two new species of *Xyris* L. (Xyridaceae) endemic to Madagascar with a key to the Malagasy species

Nivo Rakotonirina, Martin W. Callmander, Peter B. Phillipson & J. Michael Lock

## Abstract

RAKOTONIRINA, N., M. W. CALLMANDER, P. B. PHILLIPSON & J. M. LOCK (2014). Two new species of *Xyris* L. (Xyridaceae) endemic to Madagascar with a key to the Malagasy species. *Candollea* 69: 171-178. In English, English and French abstracts.

A review of the available herbarium material and of the currently recorded species of the genus *Xyris* L. (Xyridaceae) from Madagascar in the context of the “Catalogue of the Vascular Plants of Madagascar” project has led us to identify two new species which are described here as: *Xyris labatii* Rakoton., Callm. & Phillipson and *Xyris marojejyensis* Lock, Rakoton., Callm. & Phillipson. This brings the total number of species that we recognize on the island to seven. A key to the Malagasy species of *Xyris*, illustrations of the new species and a discussion of their morphological affinities are provided, together with preliminary conservation status assessments following IUCN Red List Categories and Criteria.

## Key-words

XYRIDACEAE – *Xyris* – Taxonomy – Madagascar – IUCN Red List

## Résumé

RAKOTONIRINA, N., M. W. CALLMANDER, P. B. PHILLIPSON & J. M. LOCK (2014). Deux nouvelles espèces de *Xyris* L. (Xyridaceae) endémiques de Madagascar avec une clé des espèces malgaches. *Candollea* 69: 171-178. En anglais, résumés anglais et français.

Une révision du matériel d’herbier disponible et des espèces connues actuellement dans le genre *Xyris* L. (Xyridaceae) à Madagascar dans le cadre du projet «Catalogue des plantes Vasculaires de Madagascar» nous a conduit à identifier deux nouvelles espèces qui sont décrites ici: *Xyris labatii* Rakoton., Callm. & Phillipson and *Xyris marojejyensis* Lock, Rakoton., Callm. & Phillipson. Cela porte à sept le nombre total d’espèces que nous reconnaissons dans l’île. Une clé des espèces malgaches de *Xyris*, des illustrations des nouvelles espèces et une discussion de leurs affinités morphologiques sont présentées, ainsi que des évaluations préliminaires du statut de conservation suivant les Catégories et les Critères de la Liste Rouge de l’UICN.

Addresses of the authors: NR: Missouri Botanical Garden, P.O. Box 3391, Antananarivo 101, Madagascar. E-mail: [nivo.rakotonirina@mobot-mg.org](mailto:nivo.rakotonirina@mobot-mg.org)

MWC: Missouri Botanical Garden, P.O. Box 299, St. Louis, MO, 63166-0299, U.S.A. and Conservatoire et Jardin botaniques de la Ville de Genève, case postale 60, 1292 Chambésy, Switzerland.

PBP: Missouri Botanical Garden, P.O. Box 299, St. Louis, MO, 63166-0299, U.S.A. and Département Systématique et Evolution (USM 602), Muséum National d’Histoire Naturelle, CP 39, rue Cuvier 57, 75231 Paris CEDEX 05, France.

JML: Herbarium, Library, Art & Archives, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, United Kingdom.

Submitted on July 10, 2014. Accepted on September 15, 2014.

Edited by P. Bungener

## Introduction

The family *Xyridaceae* is pantropical, and comprises c. 415 species (CAMPBELL, 2014) in five genera, of which the genus *Xyris* L. is by far the largest, and contains all of the species occurring naturally in Africa and Madagascar (LEBRUN & STORK, 2012). Species of *Xyris* consist of generally small herbs, usually less than 90 cm tall, with basal linear distichous leaves. The flowers are borne in dense cone-like inflorescences on elongated peduncles and have three delicate petals, usually yellow but sometimes white or blue (LOCK, 2001). In his treatment for the “Flore de Madagascar et des Comores”, PERRIER DE LA BÂTHIE (1946) recognized seven native species, all possessing yellow petals, and comprising the three endemic species: *X. hildebrandtii* L. A. Nilsson, *X. madagascariensis* Malme and *X. humilis* Kunth, and four others that were shared with continental Africa. Subsequent revisionary work for the continent by LOCK (1998, 1999a, 1999b, 2010) has contributed to refining the taxonomy of *Xyris*, at least for those species shared with Madagascar. However it is clear that some species complexes are in need of further investigation throughout their distribution range, notably for those plants provisionally referred to *X. anceps* Lam. and *X. capensis* Thunb., which also occur in South America, and *X. congensis* Büttner (LOCK, 1999b, 2001). LOCK (1998: 889) stated sagely that: “The Madagascar species of *Xyris* are badly in need of revision”.

Lock’s words cited above have been borne out by our taxonomic evaluation for the “Catalogue of Vascular Plants of Madagascar” (MADAGASCAR CATALOGUE, 2014). Nevertheless we believe our investigations are a step towards an improved understanding of the diversity of *Xyris* in Madagascar. They have served to clarify the status of the known species and have highlighted the existence of two new species endemic to Madagascar that we describe in this article: *X. marojejyensis* Lock, Rakoton., Callm. & Phillipson and *X. labatii* Rakoton., Callm. & Phillipson. Our work is a step towards the full revision that is needed, but additional effort is certainly required to fully understand the three species complexes mentioned above.

LOCK (1999a) also noted the possible occurrence of a fourth African species, *X. angularis* N. E. Br. in Madagascar, based on the Paris Herbarium sheet of *Du Puy & al. M639* [P016760]. This material is mixed with *X. congensis* and no other material of *X. angularis* has been found among the Madagascar collections at the relevant herbaria. It is possible that the fragments of *X. angularis* are not part of Du Puy’s gathering, and were mounted in error on the sheet, in which case it is possible that they may not even have originated from Madagascar. In the absence of further reports of this species in Madagascar we prefer to regard its presence in the country as doubtful.

We currently accept seven species of *Xyris* native to Madagascar, like PERRIER DE LA BÂTHIE (1946), but we only retain two of them from the latter treatment, namely *X. anceps* and *X. humilis*. Most of the remaining material cited by PERRIER DE LA BÂTHIE (1946) under his other five species: *X. batokana* N. E. Br., *X. hildebrandtii*, *X. madagascariensis*, *X. semifuscata* Baker and *X. umbilicis* L. A. Nilsson is best placed within either *X. capensis* or *X. congensis* as currently circumscribed. The notable exception is the type of *X. baronii* Malme (*Scott-Elliot 2915*) and (*Humbert 5757*), both from Taolagnaro (Fort Dauphin) which PERRIER DE LA BÂTHIE (1946) included in *X. hildebrandtii*. This species was subsequently subsumed under *X. congensis* (LOCK, 1999b) together with synonym *X. baronii*. While accepting the placement of *X. hildebrandtii* as a synonym of *X. congensis*, we believe that *X. baronii* should be resurrected, as a distinct species, for which a number of new collections are now available. This taxon occurs primarily in the South East of Madagascar at low elevations near Taolagnaro, but there are also scattered collections from other localities near the east coast as far north as Nosy Boraha (Ile Sainte Marie). *Xyris baronii* differs from *X. congensis* by its longer leaves (c. 40-75 cm vs. 20-40 cm in *X. congensis*) ovoid- cylindrical (vs. ellipsoid) inflorescence and in its ovate (vs. elliptic) bracts.

In the present article we describe the two new Malagasy endemic species and provide a new identification key to the Malagasy species of *Xyris*. The new species are given preliminary risk assessments based on the IUCN Red List Categories and Criteria (IUCN, 2012). Calculations of the “Area of Occupancy” (AOO), “Extent of Occurrence” (EOO) and number of subpopulations were based on the methods presented in CALLMANDER & al. (2007). A discussion of their morphological affinities is provided for each of the new species. Additional information for the other species from Madagascar and a complete synonymy for *Xyris* in Madagascar can be found in the MADAGASCAR CATALOGUE (2014).

### Key to the Malagasy species of *Xyris*

- 1 Keel of lateral sepals entire; bracts, leaf and stem bases pale or dark brown when dried ..... 2
- 1a. Keel of lateral sepals toothed, at least in the middle; bracts, leaf and stem bases always dark brown when dried ..... 5
- 2 Scape spirally twisted, base swollen, bulbous; leaves filiform, c.1 mm wide ..... ***X. labatii***
- 2a. Scape straight, not twisted, base not swollen; leaves linear, more than 2 mm wide ..... 3

3. Bracts with a distinct sub-terminal, triangular or rhomboid mark; inflorescence broadly ovoid at anthesis, or rarely subspherical; plants perennial ..... 4
- 3a. Bracts without a distinct sub-terminal, triangular or rhomboid mark; inflorescence sub-spherical at anthesis; plants usually annual ..... *X. capensis*
4. Keel of lateral sepals not winged; bract apices conspicuously thickened, dark brown, somewhat recurved; plant less than 15 cm tall ..... *X. humilis*
- 4a. Keel of lateral sepals winged; bract apices not conspicuously thickened, light brown, not recurved; plant more than 25 cm tall ..... *X. anceps*
5. Leaves large (0.6-0.8 cm); inflorescence c.10 mm in diam., broadly ovate-elliptic, not elongating with age ..... *X. marojejyensis*
- 5a. Leaves narrow (< 0.3 cm); inflorescence < 6 mm in diam., sub-orbicular or ovate, becoming distinctly elongated with age ..... 6
6. Leaves 40-75 × 0.3 cm; inflorescence ovoid-cylindrical, c. 2 cm long at anthesis ..... *X. baronii*
- 6a. Leaves 20-40 × 0.15-0.2 cm; inflorescence ellipsoid, c. 1 cm long at anthesis ..... *X. congestis*

### Taxonomy

*Xyris marojejyensis* Lock, Rakoton., Callm. & Phillipson, *spec. nova* (Fig. 1).

**Typus:** MADAGASCAR. **Prov. Antsiranana:** Sommet oriental du massif de Marojejy (NE) à l'W de la haute Manantenina, affluent de la Lokoho, [14°25'48"S 49°43'48"E], 1850-2137 m, fl., 17-20.XII.1948, *Humbert & Capuron 22770* (holo-: P [P00730642]!; iso-: BR!, G [G00406221]!, K!, MO!, P [P00730640]!, TAN!).

*Haec species a congeneris madagascariensibus caule robusto, foliis ca. 8 mm latis, inflorescentia nitida in vetustate non elongata atque bractis fertilibus grandibus (ca. 10 × 8 mm) distinguitur.*

Large perennial herb to 1 m. Leaves up to 35 × 0.6-0.8 cm; sheaths 5-6 cm long, weakly ridged; ligule c. 2 mm long, rounded, brown-hyaline; lamina up to 35 cm long and 0.8 cm wide, flat, thickened and coriaceous, smooth, slightly asymmetric and blunt at the apex, margins thickened. Scapes terete up to 70 cm tall and 3 mm in diam., with a single deflexed-pubescent longitudinal ridge. Inflorescences broadly ellipsoid, c. 10 mm in diam. Lowest pair of sterile bracts broadly ovate to orbicular, c. 4 × 4 mm, glossy brown, rounded at the apex; upper sterile bracts, 4-6, similar but larger; fertile bracts, 6-8, broadly ovate-elliptic, c. 10 × 8 mm, glossy brown, slightly darker towards the rounded or retuse-mucronate apex, lacking a dorsal mark, concave, smooth. Flower lateral sepals slightly

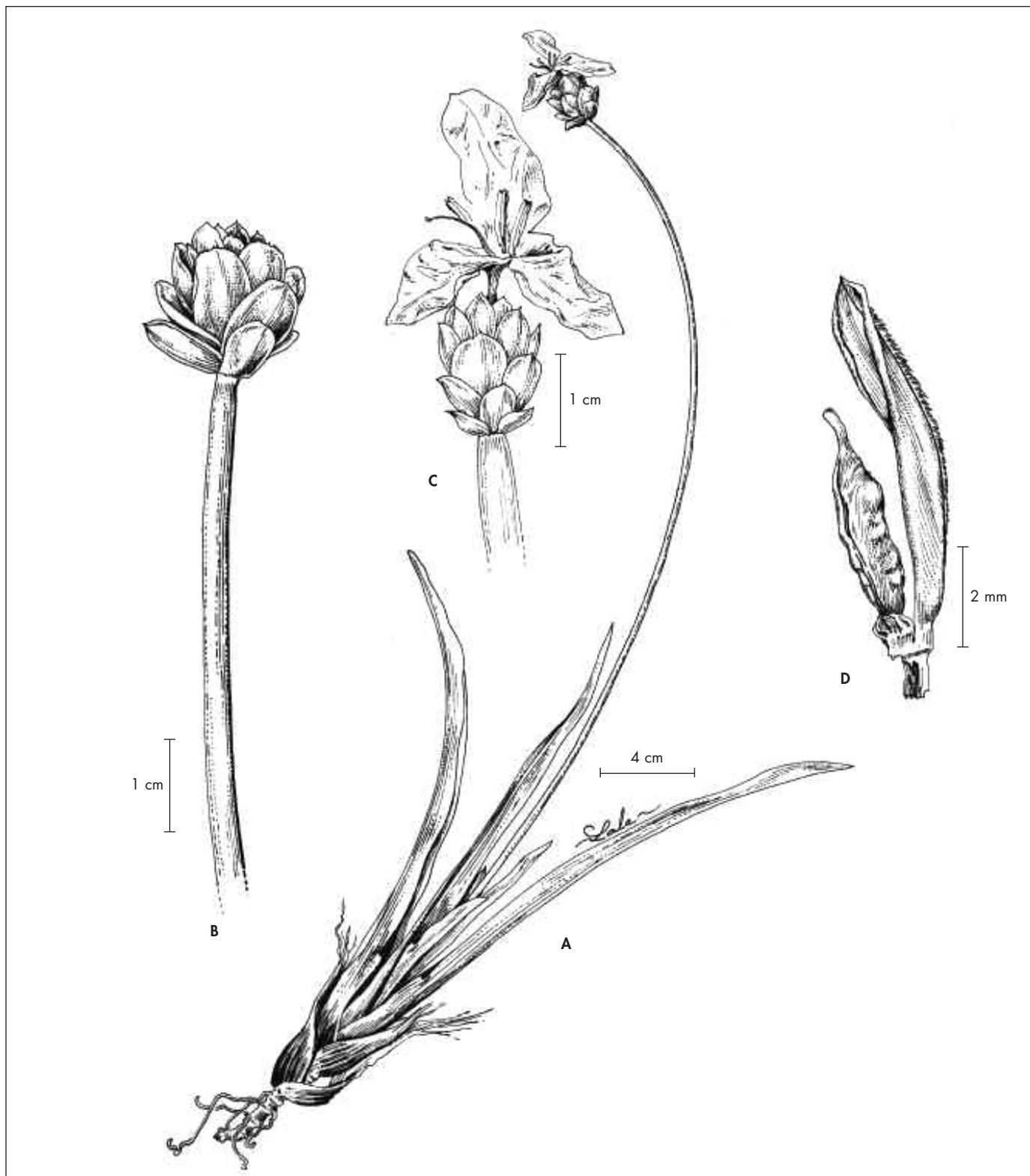
curved, strongly keeled c. 8 × 0.6 mm, very pale brown, much darker on the keel, the keel spinose-pubescent, particularly towards the middle. Petals suborbicular, c. 1 cm in diam., yellow. *Staminodia* not present. *Stamens* 3, alternating with the petals, epipetalous; anthers sessile, linear. 4 × 1 mm, with a longitudinal dehiscence. *Ovary* obovate, c. 5.5 × 1.9 mm, brown. *Style* 3-branched, the branches capitate at the apex. Young fruit ovoid, 0.5 × 0.2 mm, brown, glabrous. *Seeds* ovoid 0.1 × 0.03 mm, brown, glabrous.

*Distribution and ecology.* – *Xyris marojejyensis* is known only from between 1300 to 2100 m in the Marojejy massif in north-eastern Madagascar, growing in ericoid shrubland on substrates derived from gneiss and quartzite (Fig. 2).

*Notes.* – The large size of its leaves and bracts, and the shape of its scapes and flowers easily distinguished *X. marojejyensis* from its Malagasy congeners. The new species can be distinguished from the other larger species occurring in Madagascar, *X. baronii* and *X. congestis*, most easily in the case of the former by the shape of its scapes (terete vs. ovoid-fusiform in *X. baronii*) and dimensions of its bracts (c. 10 × 8 vs. 4-5 × 0.5 mm in *X. baronii*), and from the latter by the broader leaves (0.6-0.8 vs. 0.15-0.3 cm in *X. congestis*) and corolla (1 cm. in diam. vs. 0.35 cm in diam. in *X. congestis*).

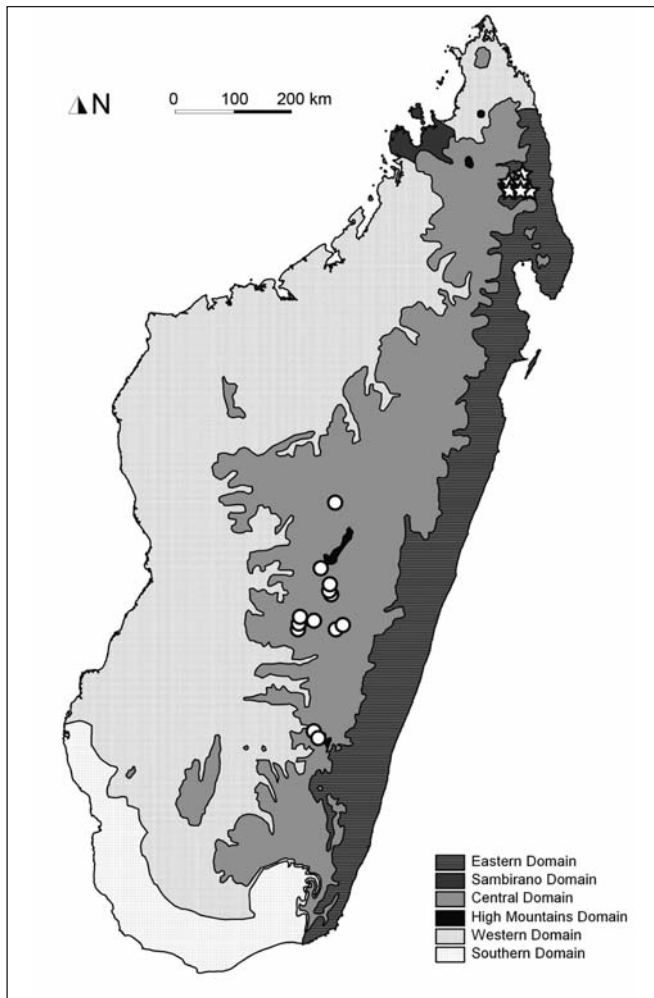
*Conservation status.* – With an EOO of 398 km<sup>2</sup>, and an AOO of 63 km<sup>2</sup> and three known subpopulations all occurring in a Protected Area (Marojejy), *X. marojejyensis* is assigned a preliminary status of Least Concern [LC] due to its distribution at high elevation in a non-threatened habitat.

*Paratypes.* – MADAGASCAR. **Prov. Antsiranana:** Sommet du Marojejy, [14°25'48"S 49°43'48"E], 29.III.1947, *Cours 3537* (P [P01640932], TAN); Vallée inférieure de l'Androranga, affluent de la Bemarivo (NE), aux env. d'Antongondriha, massif de Betsomanga, [14°15'30"S 49°44'00"E], 1300-1950 m, 17-20.XI.1950, *Humbert & Capuron 24333* (P [P01640952]); Vallée de la Lokoho (NE), Mt Beandroka au N de Maroambihy, [14°30'00"S 49°50'30"E], 1400-1450 m, 17-22.III.1949, *Humbert & Capuron 23618* (G, K, MO, P [P00853045]); *ibid. loc.*, *Humbert & Capuron 23621* (P [P00730621]); Along the trail to the summit of Marojejy E, NW of Mandena, 14°26'S 49°43'E, 1900-2133 m, 15.II.1989, *Miller & Lowry 4153* (MO, P [P00853038], TAN); Massif de Marojejy, [14°25'40"S 49°43'48"E], 2000-2137 m, XI.1972, *Morat 4081* (P [P00853037]); *ibid. loc.*, 10.5 km NW of Manantenina, along tributary at head of Andranomifototra river, 14°26'24"S 49°44'30"E, 1625 m, 4-13.XI.1996, *Rakotomalaza & al. 869* (MO); *ibid. loc.*, partie SW, 14°28'S-14°37'S 49°33'E-49°42'E, 1295-1620 m, 12.V.1989, *Randrianasolo 16* (MO); *ibid. loc.*, above Manentinina Village, 14°26'S 49°43'E, 1600-2137 m, 28.III.1990, *Randrianasolo 139* (MO, P [P00730622], TAN); *ibid. loc.*, 14°25'45"S 49°42'30"E, 1672 m, 9.III.1994, *Rasoavimbahoaka & al. 161* (MO, P [P00730624], TAN); *ibid. loc.*, au sommet de Marojejy, 14°26'50"S 49°43'57"E, 2132 m, 23-24.III.1995, *Rasoavimbahoaka & al. 520* (MO, P [P00730623], TAN).



**Fig. 1.** – *Xyris marojejensis* Lock, Rakoton., Callm. & Phillipson. **A.** Whole plant growth habit; **B.** Inflorescence; **C.** Inflorescence; **D.** Fruit with single lateral sepal showing toothed keel.

[Humbert 22770, TAN] [Drawing: R. L. Andriamiarisoa]



**Fig. 2.** – Map showing the distribution of *Xyris marojeiyensis* Lock, Rakoton., Callm. & Phillipson (stars) and *Xyris labatii* Rakoton., Callm. & Phillipson (circles) in Madagascar, plotted on the map of phyogeographical domains sensu HUMBERT (1955).

***Xyris labatii*** Rakoton., Callm. & Phillipson, **spec. nova** (Fig. 3, 4).

**Typus:** MADAGASCAR. **Prov. Antananarivo:** Ambatofinandrahana, massif de l'Itremo, Atsirakambiaty, 20°35'22"S 46°34'01"E, 1680 m, 27.III.1999, fl., *Labat 3050* (holo-: P [P00160157]!; iso-: G [G00341191]!, K, MO!, TAN!).

*Haec species a congeneris madagascariensis caule e base tumida orto, foliis filiformibus, caulibus scapisque spiraliter tortis atque seminibus obovoideis distinguitur.*

Clumped perennial herb, tufted (10-)20-50 cm. *Stem* spirally twisted, from the bulbous base to the shoot. *Leaves* up to 23 × 0.1 cm; sheaths (0.4-)1-5 cm long, ridged, ligule c. 1 mm, slightly acute, brown-hyaline; blades filiform and coriaceous, strigillose, symmetric and aristate at the apex, margins thickened. *Scapes* up to (1-)8-28 × 0.1 cm, terete. *Inflorescences* ellipsoid, c. 0.3-0.6 × (3-)0.5-0.6 cm, red-brown.

Sterile bracts, 2-6, obovate, glossy brown, rounded to acute at the apex; fertile bracts ovate-elliptic c. 0.6 × 0.3 cm, apex acute, concave, smooth glossy brown, hyaline towards the margins, sometimes erose. *Flower* with lateral sepals c. 1.3 × 0.4 cm, slightly curved, keeled, hyaline and darker on the keel, smooth. *Petals* obovate, c. 0.1 × 0.08 cm yellow. *Stamens* 3, anther sessile, linear-shaped, c. 1.2 × 0.2 mm, epipetalous. *Ovary* obovate c. 3 × 1.2 mm, brown. *Style* 3-branched, 1.2 mm long; stigma twisted, 2.4 mm long. *Fruits* obovate, 2 × 1.5 mm, glabrous, with a longitudinal dark-brown dehiscence groove. *Seeds* obovoid, 0.3 × 0.2 mm, dark brown

**Distribution and ecology.** – *Xyris labatii* is known from the central highlands of Madagascar, in the Amoron'i Mania, Vakinankaratra and Haute Matsiatra regions. It grows on rocky areas, often on quartzite from 1200 to 2500 m (Fig. 2).

**Etymology.** – The species epithet honours our friend and colleague, Jean-Noël Labat (1959-2011) who disappeared too soon. Jean-Noël collected the type specimen and as is often the case, he made a useful photograph to accompany his excellent collection.

**Notes.** – *Xyris labatii* can be recognized by its bulbous stem bases and its twisted leaves and scapes. It is similar to *X. humilis*, which also occurs in the central highlands of Madagascar, but the new species can be distinguished by its filiform leaves (vs. very narrowly linear in *X. humilis*) (8-23 × 0.1 cm vs. 3-5 × 0.1-0.2 cm).

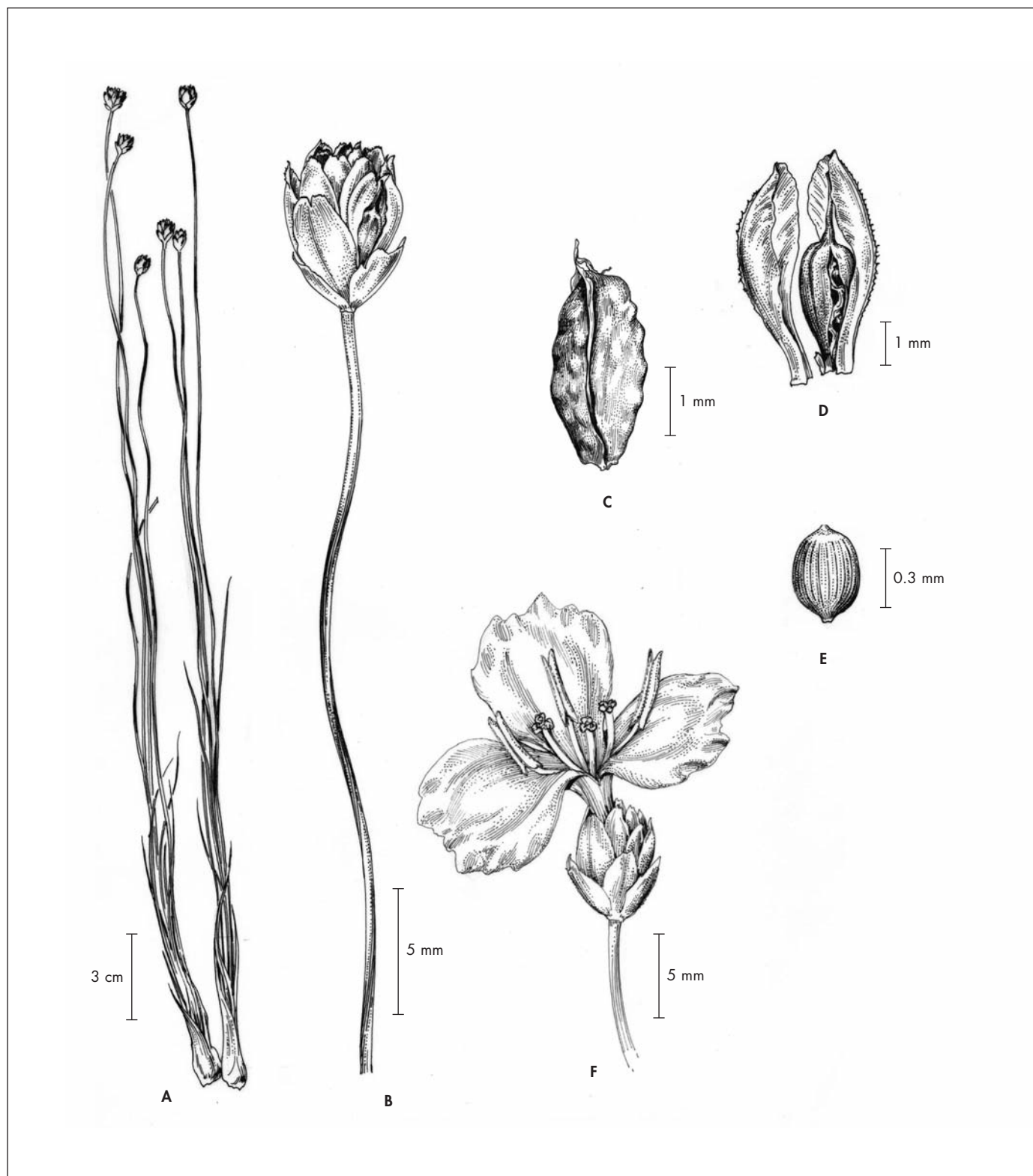
**Conservation status.** – With an EOO of 12,460 km<sup>2</sup>, and an AOO of 153 km<sup>2</sup> and eleven subpopulations, two of which are in the protected area network (Andringitra), *X. labatii* is assigned a preliminary status of "Least Concern" (LC) following IUCN Red List Categories and Criteria (IUCN, 2012)

**Paratypes.** – **MADAGASCAR. Prov. Antananarivo:** Mont Ibity, c. 27 km SW of Antsirabe, 20°05'24"S 47°00'23"E, 1840-1890 m, 15.III.2004, *Almeda 8706* (CAS, TAN); Antsirabe, Beapombo, à 400 m avant d'arriver au sommet d'Ibity, 20°04'58"S 47°00'37"E, 2170 m, 5.II.2003, *Andriamihajarivo 103* (MO, P [P00853040], TAN); *ibid. loc.*, 20°10'S 47°03'E, 1300-1800 m, 6.III.1985, *Dorr & al. 3853* (MO, P [P01641000]); *ibid. loc.*, 20°07'00"S 47°01'00"E, 24.XII.1965, *Peltier 2127* (P [P01640947]); Mahasoà à Ambohimasina, Betafo, [19°50'S 46°51'E], III.1976, *A. Rakotozafy 1736* (TAN); Hauts-plateaux, env. à 15 km à l'W de Arivonimamo (entre Arivonimamo et Soamahamanina, 60 km à l'W de Antananarivo), 18°54'43"S 47°05'21"E, 1260 m, 23.I.2000, *Raynal-Roques & Jérémie 24816* (G, K, MO, P [P00853043], TAN, WAG); *ibid. loc.*, 20°05'33"S 47°00'14"E, 2080 m, 16.II.2003, *Schatz & al. 4075* (MO); *ibid. loc.*, 20°04'10"S 47°00'16"E, 1700 m, 17.II.2003, *Schatz & al. 4130* (MO, P, TAN). **Prov. Fianarantsoa:** Sommet très rocheux (quartzitique) à l'E d'Atsirakambiaty, à l'W d'Ambatoandranon, 20°34'39"S 46°34'26"E, 1681 m, 18.IV.2003, *Andriamihajarivo 179* (MO, P, TAN); 10 km W of Ivato on route #35, [20°34'30"S 46°37'30"E], 1500-1685 m, 27.I.1975, *Croat 29532* (MO, P [P01640906], TAN); Vicinity of col de Itremo, [20°34'30"S 46°37'30"E], 1500-1685 m, 27.I.1975, *Croat 29830* (MO, TAN);



**Fig. 4.** – Type of *Xyris labatii* Rakoton., Callm. & Phillipson. Type collection (*Labat 3050*) in its natural habitat on Itremo.

[Photo: J.-N. Labat]



**Fig. 3.** – *Xyris labatii* Rakoton., Callm. & Phillipson. **A.** Whole plant showing swollen bulbous base; **B.** Inflorescence; **C.** Fruit; **D.** Fruit with sepal pair showing toothed keels; **E.** Seed; **F.** Inflorescence.

[A-B, D-F: *Labat 3050*, TAN; C: *Schatz & al. 4130*, TAN] [Drawing: R. L. Andriamiarisoa]



Env. d'Ambatofinandrahana, [20°33'S 46°48'E], 1600-1800 m, 19.II.1938, *Decary 12993* (P [P00853042]); *ibid. loc.*, *Decary 13090* (P [P00853041]); Mt Boby, [22°11'S 46°53'E], 20.III.1945, *Homolle 1209* (P [P01924015]); *ibid. loc.*, *Homolle 1201* (P [P01924014], TAN); Massif de l'Andringitra (Iratsy), vallées de la Rimbava et de l'Antsifotra et montagnes environnante, [22°12'S 46°55'E], 2000-2500 m, 27. XI.1924, *Humbert 3890* (P [P01640921, P01640957]); Massif de l'Itremo, W of Ambatofinandrahana: Montagnes à l'W (W Betsileo), [20°34'30"S 46°37'30"E], 1500-1700 m, 17-22.I. & 18-22.IV.1955, *Humbert 28325* (P [P019524021]); *ibid. loc.*, *Humbert 29893* (P [P01640936]); *ibid. loc.*, *Humbert 29936* (G, K, MO, P [P00730639, P00730641], TAN, WAG); Route Ambositra à Ambatofinandrahana sur rocher après l'embranchement d'Ivato, 20°33'S 46°48'E, III.1960, *Keraudren 158* (P [P01640896]); Itremo mountain, c. 1 km below the highest point of the road, 20°36'S 46°35'E, 1600 m, fl., 17.III.1995, *Lye, Arnstein & Ranaivojoana 20894* (TAN); Itremo massif, W of Ambatofinandrahana, along road to Col d'Itremo, ca. 2 km before (NE of) bridge over Ambalarangolana creek, 20°33'58"S 46°35'35"E, 1450 m, 10.XI.2002, *Lowry & al. 5914* (MO, TAN); *ibid. loc.*, 20°40'S 46°35'E, 1600 m, fl., 23.III.1971, *Mabberley 780* (K, TAN); *ibid. loc.*, [20°37'S 47°12'E], 24.XII.1965, *Peltier 5612* (P [P0164927]); *ibid. loc.*, 20°36'45"S 46°35'05"E, 1650 m, 14.III.1992, *Phillipson, Clement & Rafamantanantsoa 3889* (MO, TAN); *ibid. loc.*, inselberg à 11,7 km d'Ivato vers la route d'Ambatofinandrahana, et c. 4 km avant le village d'Anjoman' Ankona, 20°39'45"S 47°07'42"E, 1500 m, fl., 24.III.2010, *Rakotoarivelo & al. 330* (MO, P, TAN); *ibid. loc.*, about 6 km NW of Itremo, 20°33'35"S 46°34'55"E, 1333 m, 9.II.2009, *Rakotoarisoa 628* (K, MO, P, TAN).

## Acknowledgments

The authors thank the Parc Botanique et Zoologique de Tsimbazaza and the Missouri Botanical Garden staff in Antananarivo for help and support in this study. We thank Roger Lala Andriamiarisoa for his fine illustrations and Lisa Campbell and Fred Stauffer for their very helpful review of an early version of this manuscript. We are also grateful to the curators of the following herbaria for access to their collections: G, K, MO, P, TAN and TEF. Financial support was by grants from the Andrew W. Mellon Foundation.

## References

- CALLMANDER, M. W., G. E. SCHATZ, P. P. LOWRY II, M. O. LAIVAO, J. RAHARIMAMPIONONA, S. ANDRIAMBOLOLONERA, T. RAMINOSOA & T. CONSIGLIO (2007). Application of IUCN Red List criteria and assessment of Priority Areas for Plant Conservation in Madagascar: rare and threatened Pandanaceae indicate sites in need of protection. *Oryx* 41: 168-176.
- CAMPBELL, L. M. (2014). The Xyridaceae pages-an electronic monograph. [<http://sweetgum.nybg.org/xyridaceae>].
- HUMBERT, H. (1955). Les territoires phytogéographiques de Madagascar. *Année Biol.* 31: 439-448.
- IUCN (2012). *IUCN Red List Categories and Criteria: Version 3.1*. 2<sup>nd</sup> edition. IUCN Species Survival Commission, Gland & Cambridge.
- LEBRUN, J. P. & A. K. STORK (2012). *Tropical African flowering plants. Ecology and Distribution*. Vol. 7. Conservatoire et Jardin botaniques de la Ville de Genève.
- LOCK, J. M. (1998). Notes on the Genus *Xyris* (Xyridaceae) in East Africa. *Kew Bull.* 53: 883-895.
- LOCK, J. M. (1999a). A Synopsis of *Xyris* (Xyridaceae) in South-Central Africa. *Kew Bull.* 54: 310-326.
- LOCK, J. M. (1999b). Xyridaceae. In: BEENTJE, H. J. & C. M. WHITEHOUSE (ed.), *Fl. Trop. E. Africa*.
- LOCK, J. M. (2001). *Xyris* (Xyridaceae) in Africa - a progress report. In: ROBBRECHT, E., J. DEGREEF & I. FRIIS (ed.), *Plants systematics and phytogeography for the understanding of African biodiversity*, Proceedings of the XVI<sup>th</sup> AETFAT meeting, *Syst. Geogr. Pl.* 71: 443-448.
- LOCK, J. M. (2010). Xyridaceae. In: TIMBERLAKE, J. R. & E. S. MARTINS (ed.), *Fl. Zambesiaca* 13(4): 1-28.
- MADAGASCAR CATALOGUE (2014). *Catalogue of the Vascular plants of Madagascar*. Missouri Botanical Garden, Saint-Louis & Antananarivo [<http://www.efloras.org/madagascar>].
- PERRIER DE LA BÂTHIE, H. (1946). Xyridacées. In: HUMBERT, H. (ed.), *Fl. Madagascar Comores* 35.