

Sagina hookeri Timaná, sp. nov. (Caryophyllaceae),
a new endemic species for the flora of Île Amsterdam
(French Southern and Antarctic Lands)

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***Sagina hookeri* Timaná, sp. nov. (Caryophyllaceae), a new endemic species for the flora of Île Amsterdam (French Southern and Antarctic Lands)**

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KEY WORDS

Caryophyllaceae,
Île Saint-Paul,
Île Amsterdam,
Southern Indian Ocean,
French Southern and
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new species.

ABSTRACT

A new endemic species of *Sagina* L., *Sagina hookeri* Timaná, sp. nov. (Caryophyllaceae) is described for the flora of Île Amsterdam, in the southern Indian Ocean (French Southern and Antarctic Lands). Differences between this taxon and *S. diffusa* (Hook.f.) Timaná (endemic to the neighboring island of Saint-Paul) and *S. procumbens* L. (introduced in several circum-austral islands) are discussed, and an identification key to those three *Sagina* species occurring in Saint-Paul and Amsterdam islands is presented.

RÉSUMÉ

Sagina hookeri Timaná, sp. nov. (Caryophyllaceae), une nouvelle espèce endémique pour la flore de l'Île Amsterdam (Terres australes et antarctiques françaises).

Une nouvelle espèce endémique de *Sagina* L., *Sagina hookeri* Timaná, sp. nov. (Caryophyllaceae) est décrite pour la flore de l'Île Amsterdam dans le sud de l'Océan Indien (Terres australes et antarctiques françaises). Les différences entre ce taxon et *S. diffusa* (Hook.f.) Timaná (endémique de l'île voisine de Saint-Paul) et *S. procumbens* L. (introduite dans plusieurs îles circumaustrales) sont discutées, et une clé de détermination est présentée pour les trois espèces de *Sagina* se trouvant dans les îles Saint-Paul et Amsterdam.

MOTS CLÉS

Caryophyllaceae,
Île Saint-Paul,
Île Amsterdam,
Sud de l'Océan Indien,
Terres australes et
antarctiques françaises,
espèce nouvelle.

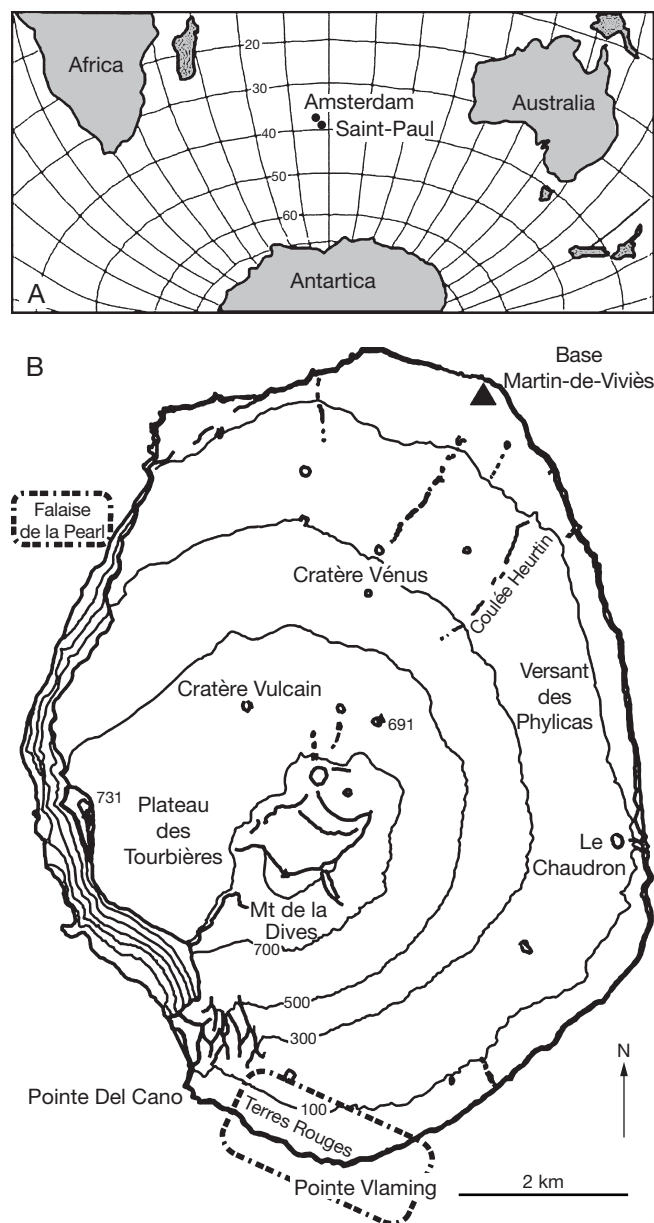


FIG. 1. — **A**, Location of Île Amsterdam in the Southern Indian Ocean; **B**, locality details showing the two sites known for *Sagina hookeri* Timaná, sp. nov. (dashed frames).

INTRODUCTION

The genus *Sagina* L. (Caryophyllaceae) consists of 15 (Crow 1978; Crow 2005), 25 (Bittrich 1993) to 30 species (Lu & Rabeler 2001; Hernández-Ledesma *et al.* 2015) of annual and perennial herbs, distributed mostly, but not exclusively, in the northern temperate regions of North America, Europe and Asia. No comprehensive monograph or infrageneric phylogeny of this genus has been completed, and southern species tend to be easily misidentified as *Colobanthus* Bartl., another genus of the Caryophyllaceae. In fact, molecular phylogenetic studies have demonstrated that *Sagina* and *Colobanthus* are sister genera (Harbaugh *et al.* 2010; Greenberg & Donoghue 2011); morphologically, they differ from each other by the presence

of petals in *Sagina* (absent in *Colobanthus*) and episepalous stamens in *Sagina* (alternisepalous in *Colobanthus*) among other characters (see Timaná 2018 for further discussion).

Colobanthus kerguelensis Hook.f. is a well-known and distinctive species found in Kerguelen, Crozet and Heard islands. Three *Sagina* species have been reported for the French Southern and Antarctic Lands (Terres australes et antarctiques françaises, TAAF), *S. apetala* Ard. in Crozet (Frenot *et al.* 2001), the introduced *S. procumbens* L., found in Crozet, Amsterdam and Kerguelen islands (Frenot *et al.* 2001), and *S. diffusa* (Hook.f.) Timaná, an endemic species of Île Saint-Paul (Timaná 2018). In the course of studying the taxonomy and appropriate nomenclature for *S. diffusa* (Timaná 2018), a new species was detected in this genus. Thus, *Sagina hookeri* Timaná, sp. nov. is reported as a new endemic species to Île Amsterdam in the southern Indian Ocean (37°50'S, 77°33'E; Fig. 1A).

MATERIALS AND METHODS

Specimens of *Sagina* were observed, photographed and collected in the wild during the 'IPEV 1167 BIODIV_AMS' summer expedition to the islands of Amsterdam and Saint-Paul (22 Nov.-22 Dec. 2016). The expedition aimed at completing inventories of flora and fauna of those two islands both, to improve knowledge on the biodiversity of these localities and to fully integrate these small, geographically isolated islands in studies on the processes of dispersal and colonization in the southern hemisphere.

The morphological description of the new species is based on examination of the type specimen, herbarium material and photographs of living specimens in nature; photographs are all freely available online (<http://science.mnhn.fr>) in the database of the Paris Herbarium (P; acronym according to Thiers 2018) of the Muséum national d'Histoire naturelle. All P specimens previously determined as *Sagina* or *Colobanthus* from Kerguelen, Amsterdam and Saint-Paul islands were examined by the first author. No specimens ascribed to *S. apetala* Ard. were found, although the species was mentioned by Frenot *et al.* (2001) for Possession Island (Crozet Archipelago).

Measurements were performed with *ImageJ* software (Rasband 1997-2016; Abramoff *et al.* 2004), using the ruler included in the image of the herbarium specimen to set the scale and calibrate the software. All linear measurements are based on herbarium specimens.

TAXONOMIC TREATMENT

Sagina hookeri Timaná, sp. nov.
(Figs 2; 3; 4)

Sagina hookeri Timaná, sp. nov. is morphologically close to *Sagina diffusa* (Hook.f.) Timaná but differs in its caespitose life form, much smaller overall size, and wide obtuse petals.

TYPUS. — Terres australes et antarctiques françaises. District de Saint-Paul et Amsterdam, Île Amsterdam, Del Cano, Terres Rouges,



FIG. 2. — Close-up of type specimen of *Sagina hookeri* Timaná, sp. nov. (specimen P02434524; Rouhan et al. 1841).

37°52'26"S, 77°32'23"E, alt. 48 m, 16.XII.2016, G. Rouhan, D. Ertz, J. Mieusset, C. Ollive, B. Van de Vijver 1841 (holo-, P[P02434524]!).

ADDITIONAL SPECIMENS EXAMINED. — **Terres australes et antarctiques françaises.** Île Amsterdam, Plaques terreuses sur coulée basaltique près du Camp, 15.XII.1963, A. Lourteig et P. Cour 57, (P[P04937011]!); Haut de la falaise de la Pearl, 13.III.1970, P. Noël s.n. (P[P00915539]!); Cratère Hébert, alt. 180 m, 26.I.1985, J.-C. Jolinon 1060 (P[P04937000]!).

PHENOLOGY. — Found flowering and fruiting from December to March (austral summer).

DESCRIPTION

Caespitose, compact herb; plant upright, 1.2-3.0 cm high (including inflorescence). Leaves opposite, sometimes arching backwards, fleshy, glabrous, sessile, lanceolate, 5.2-8.8 mm long; apex acute, mucronate; midvein barely noticeable; surface smooth, shiny, margin entire. Inflorescences axillary, flowers solitary, pedicel 5.6-9.2 mm long, glabrous, upright even during fruit dehiscence, green to pale green. Flowers tetramerous, rarely pentamerous; sepals 4(5), imbricate, cymbiform, broadly ovate, 1.9-2.8 mm

long, 1.1-1.5 mm wide, margins slightly hyaline, apex obtuse, green then turning pale yellow when fruiting, shorter or almost as long as capsule valves, persistently appressed to valves; petals present, 4(5), alternisepalous, thin, white, orbicular, apex wide obtuse to truncate, with a short claw at the base, much shorter than sepals, 1.3-1.5 mm long, 0.8 mm wide, probably deciduous after anthesis; stamens episepalous, as long as petals. Fruit a 4(5)-valved multiseeded capsule, 2.3-3 mm long, pale yellow at maturity, with valve apices arching backwards when mature; seeds blackish.

REMARK

The specimens collected by P. Cour (Cour s.n., s.d. [P04937002!]) and E. Aubert de la Rue s.n. [P04937003!]) may also belong to the new species described here, however, their limited quality does not allow a definitive assessment. The specimen A. Lourteig & P. Cour 67 (P04938223!) is supposed to have been collected in Kerguelen Island, according to the printed label added after the gathering arrived at the P herbarium. By contrast, the original la-

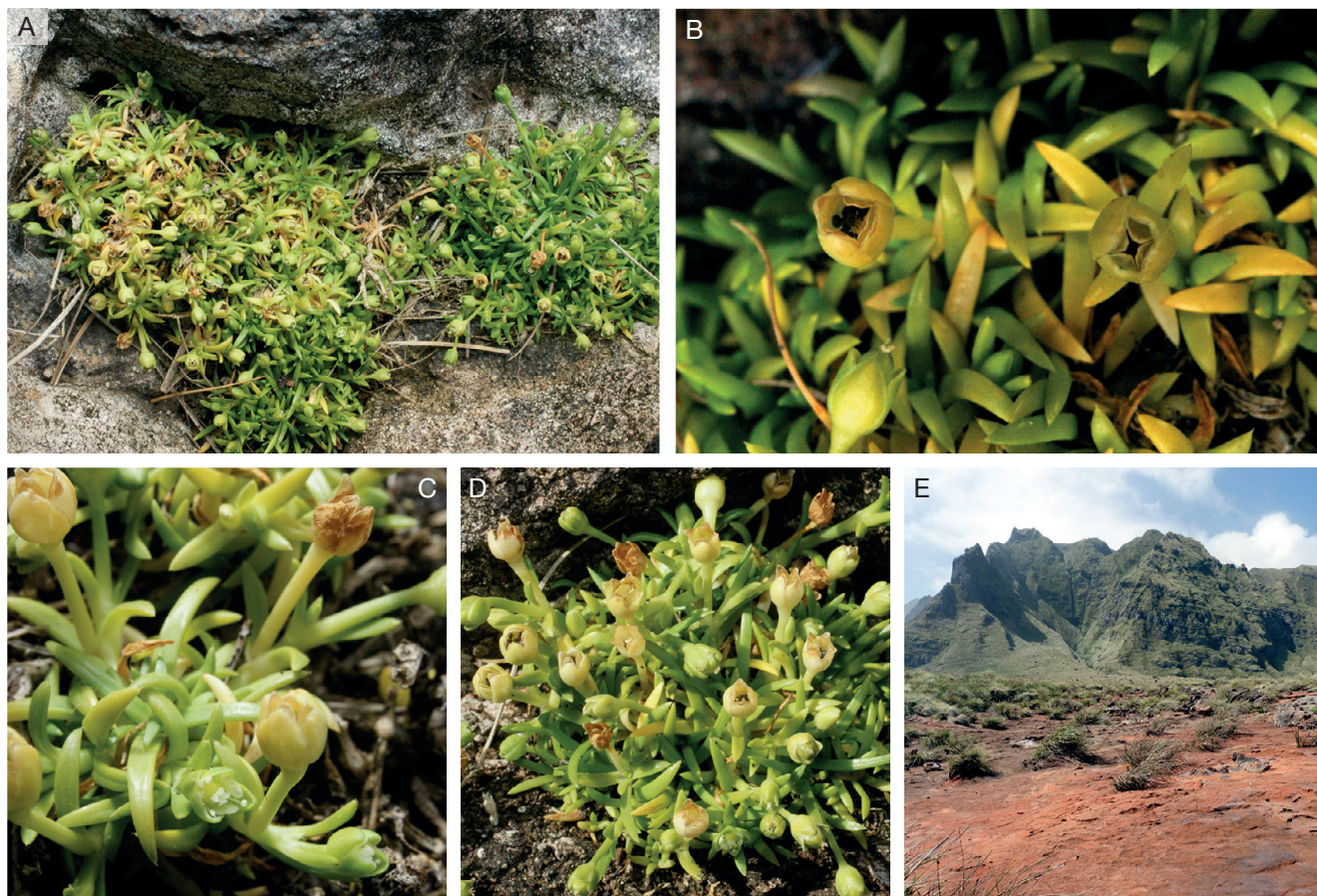


FIG. 3. — Living specimens and habitat of *Sagina hookeri* Timaná, sp. nov. in Île Amsterdam: **A**, habit; **B**, fruit close-up; **C**, flower close-up; **D**, fruiting individual; **E**, habitat of type specimen at Point Del Cano, in the middle of 'Terres Rouges'. Photos: MNHN – Germinal Rouhan, 2016.

bel handwritten by the collectors does not mention any island, and the precise locality mentioned on both labels is in Amsterdam island; furthermore, collectors were on Amsterdam island on that date (15 Dec. 1963) as evidenced by other collection's number right before and after collection' number *Lourteig* 67. For these reasons, we definitely consider this mention 'Kerguelen' as an obvious label error, and *Sagina hookeri* Timaná, sp. nov. is not known to occur in Kerguelen.

ETYMOLOGY

Sagina hookeri Timaná, sp. nov. is named after the British botanist Sir Joseph Dalton Hooker (1817-1911), plant taxonomist, explorer and pioneer plant geographer. His monumental work "*The Botany of the Antarctic Voyage of H.M. discovery ships Erebus and Terror in the years 1839-1843*" was a turning point in the study of the plant biogeography of the southern continents. He examined the flora of Île Amsterdam and Île Saint-Paul in his *Flora Antarctica* (Hooker 1844-1847).

KEY TO THE *SAGINA* L. SPECIES PRESENT IN AMSTERDAM AND SAINT-PAUL ISLANDS

The following key, applicable to all known species of *Sagina* in Amsterdam and Saint-Paul Islands, is included here to help future field researchers working in the area.

1. Sepals appressed to capsule valves during capsular development, then diverging following dehiscence; pedicel recurved during capsular development *Sagina procumbens* L.
- Sepals appressed to capsule valves during capsular development and during dehiscence; pedicel never recurved 2
2. Plants caespitose, short, less than 3 cm tall (including inflorescence); flowers mostly tetramerous, rarely pentamerous; petal apex broadly ovate; capsule valve arching backwards at maturity *Sagina hookeri* Timaná, sp. nov.
- Plants diffuse, loosely spreading, 5–8 cm tall (including inflorescence); flowers tetramerous or pentamerous, even on the same individual; petal apex acute to obtuse; capsule valve erect at maturity *Sagina diffusa* (Hook.f.) Timaná

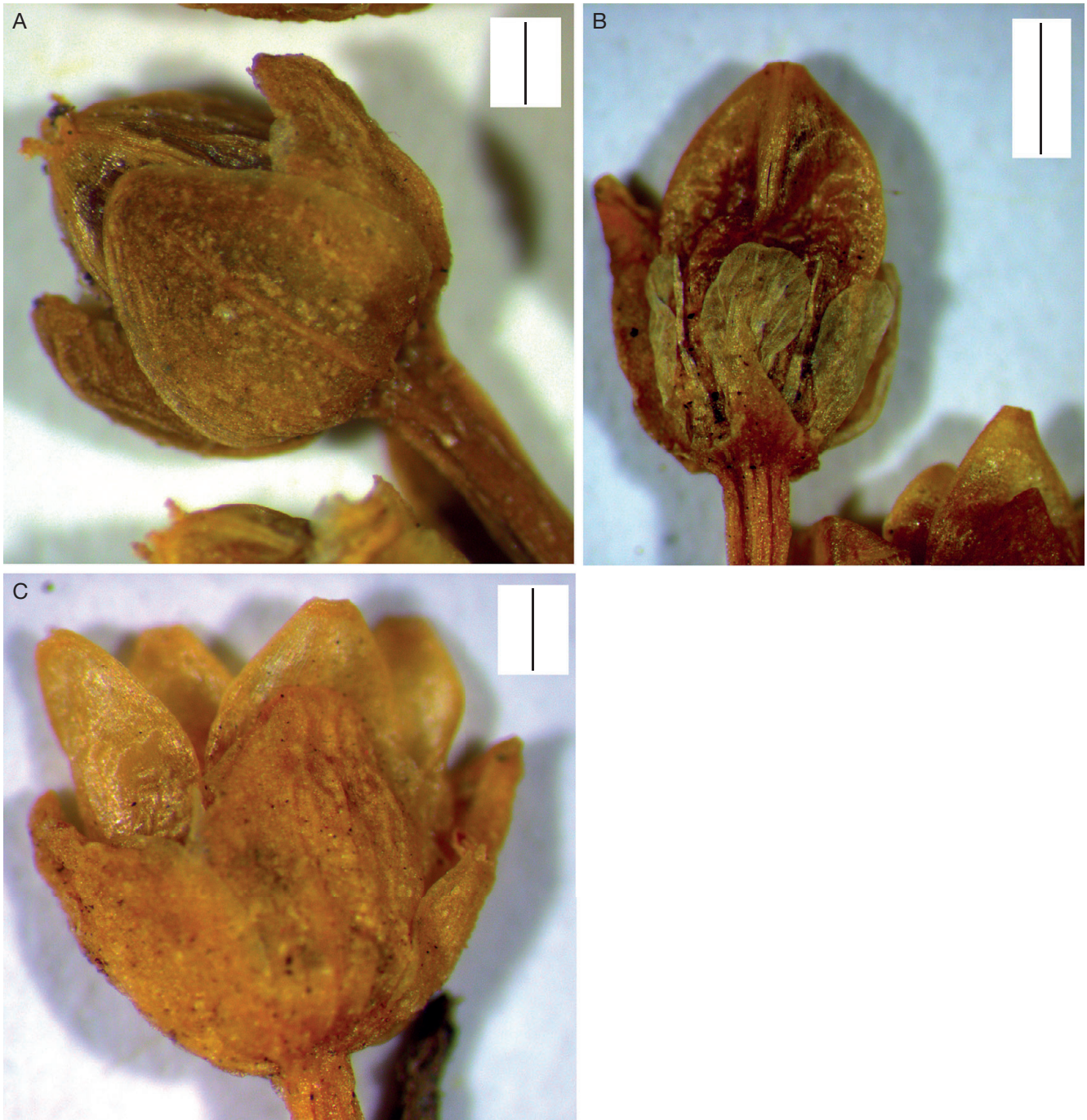


FIG. 4. — Fruit close-up: **A**, fruit before dehiscence; **B**, fruit before dehiscence, with sepals removed, showing petals; **C**, mature fruit at dehiscence. *Lourteig & Cour 57*. Photo credits: MNHN – Germinal Rouhan, 2018. Scale bars: A, C, 500 μ m; B, 1 mm.

DISTRIBUTION AND HABITAT

The species is endemic to Île Amsterdam and it is currently known from two distant places, in the north-west part near the cliff of La Pearl, and in the south-south-west part of the island, near Pointe Del Cano and crater Hébert including an area called ‘Terres Rouges’ (Fig. 1B) where it has been most often observed; this latter area is made of basalt-rich red soils along a unique narrow coastal strip of the island between Del Cano and Pointe Vlaming (Fig. 3E). Within the area, the species grows in hollows of ground in the middle of flat basalt rocks of lava flows.

Sagina hookeri Timaná, sp. nov. has never been observed in Île Amsterdam closely mixed with *S. procumbens* L., that was observed for the first time in 1985 in another station, i.e., Entrecasteaux (*Jolinon 934* [P04937010!]).

CONSERVATION AND THREATS

Sagina hookeri Timaná, sp. nov. is rare on the island, or maybe overlooked: it is known from the type population near Del Cano extending from Terres Rouges to crater Hébert, and from an area of high cliffs. There is no known threat to the type locality in

Del Cano, but the number of mature individuals (or cushion-like clumps) found here is estimated to be less than 250, thus the species is assessed as Endangered (EN) under criterion D (IUCN 2012). The population in cliffs of La Pearl might be threatened by likely landslide and crumbling substrate.

Given the Extend of Occurrence (EOO) and Area of Occupancy (AOO) estimated to 5.330 km², and 1.900 km² respectively (IUCN 2012), and the restricted size of the two known populations, inventories focused on these small flowering plants are needed in an effort to confirm the population size and its fluctuation. Any continuing decline observed or extreme fluctuation in the number of mature individuals could drive the species to become Critically Endangered in a very short time following criterion D of the IUCN Red List Categories and Criteria.

DISCUSSION

Although being geographic neighbors, *Sagina hookeri* Timaná, sp. nov. (Amsterdam Island) and *S. diffusa* (Hook.f.) Timaná (Saint-Paul Island) show clear morphological differences that justify recognition of the former as a distinct species. The most evident difference is habit: *Sagina hookeri* Timaná, sp. nov. produces a short, caespitose (cushion-like) growth form (Fig. 3A), while the stems of *S. diffusa* are spreading, similar to *S. procumbens* L., with branches up to 8 cm long (Timaná 2018). In the case of *S. hookeri* Timaná, sp. nov. the entire plant size, including inflorescence, does not exceed 3 cm tall. The inflorescence of the new species described here is single-flowered, while in *S. diffusa* it tends to form a two-flowered cyme. Petals in *S. hookeri* Timaná, sp. nov. are wide obovate, much shorter than sepals, while those in *S. diffusa* are acute, rarely obtuse, and in some cases nearly as long as the sepals. In nature the capsule valve apex of the new species described here tends to arch backwards. Differences between *S. hookeri* Timaná, sp. nov. and *S. procumbens* include pedicel length, being less than 10 mm in the former and from 12 to 16 mm long in the latter; in addition branches in *S. procumbens* are filiform, less than 0.3 mm wide, and tangled, giving the plant a mat-like appearance (as in *Cour* 313 [P04970735!]). *Sagina hookeri* Timaná, sp. nov. individuals instead form robust, almost upright, discrete cushions (see Fig. 3A). Flower bud length is also quite different between these species: it is much smaller in *S. procumbens* (less than 2.5 mm long), while in *Sagina hookeri* Timaná, sp. nov. it can reach 3.5 mm long. Finally, the pedicel in *S. procumbens* is recurved during capsular development, at least in most cases.

While *Sagina* L. is a mostly northern hemisphere genus (Crow 1978), the new species here described adds to a group of species endemic to the southern hemisphere that has been reported in Chile (Marticorena & Quezada 1985), Australia (Adams 1996) and New Guinea (Larsen 1998).

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