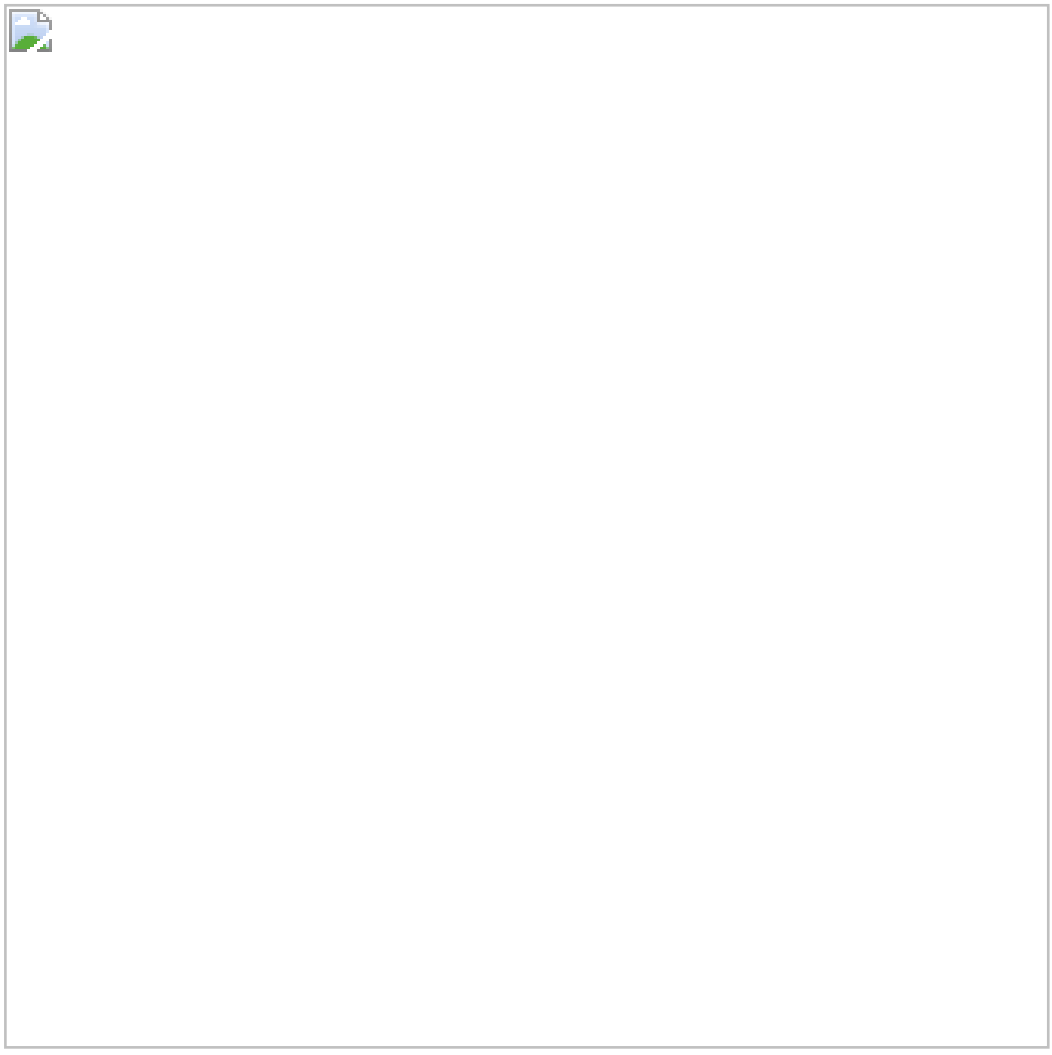

First record of Geosiris (Iridaceae: Geosiridoideae) from Australasia : a new record and a new species from the Wet Tropics of Queensland, Australia

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First record of Geosiris (Iridaceae: Geosiridoideae) from Australasia : a new record and a new species from the Wet Tropics of Queensland, Australia

Bruce Gray & Yee Wen Low

Abstract

GRAY, B. & Y.W. LOW (2017). First record of Geosiris (Iridaceae: Geosiridoideae) from Australasia: a new record and a new species from the Wet Tropics of Queensland, Australia. *Candollea* 72 : 249-255. In English, English abstract. DOI: http://dx.doi.org/10.15553/c2017v722a2

Geosiris Baill. is a small genus of achlorophyllous, mycoheterotrophic herbs that until now consisted of only two species, *Geosiris albiflora* Goldblatt & J.C. Manning and *Geosiris aphylla* Baill., the latter being the type species of the genus. Prior to this study, the genus was known only from two islands off the southeast coast of Africa, Madagascar and Mayotte. A recent discovery in Australia reported here expands its geographic range to the Pacific. The Australian taxon represents a species distinct from the two African taxa based on the key morphological characters for species distinction in the genus, namely stigma characteristics. *Geosiris albiflora* has a somewhat club-like stigma with three coherent lobes, *Geosiris aphylla* with a stigma terminates in three fringed broad and flat stigmatic lobes, and the Australian *Geosiris* has a truncate stigma with a short fimbriate margin. Hence, the Australian taxon is formally described here as *Geosiris australiensis* B. Gray & Y.W. Low.

Keywords

IRIDACEAE – *Geosiris* – Australia – Queensland – Taxonomy – Mycoheterotrophy – New generic record – New species

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Introduction

Geosiris Baill. was established in 1894 to accommodate an achlorophyllous, mycoheterotrophic plant gathered by M. Lantz in Madagascar. A monotypic genus typified by *Geosiris aphylla* Baill., it was included in the *Iridaceae* (Baillon, 1894). Due to its mycoheterotrophy in a family otherwise consisting of largely photosynthetic plants, *Geosiris* was considered to be closely related to *Burmanniaceae* Blume (Engler, 1897) but otherwise distinct, and placed in its own family, *Geosiridaceae* Jonker (Jonker, 1939). However, Perrier de la Bâthie (1946) continued to treat it as a member of *Iridaceae*, and subsequent work eventually confirmed its familial placement in *Iridaceae* (Goldblatt, 1991a; Goldblatt et al., 1998) based on evidence from detailed floral anatomical and flavonoid studies (Goldblatt et al., 1987). In 2010 a second species, *Geosiris albiflora* Goldblatt & J.C. Manning was described from Mayotte Island, a French Overseas Department located northwest of Madagascar in the Mozambique Channel (Goldblatt & Manning, 2010). Currently, these are the only two species enumerated for the genus, both confined to the islands off the southeast coast of Africa.

Phylogenetic studies have further reaffirmed the placement of *Geosiris* in *Iridaceae* instead of *Burmanniaceae* (Reeves et al., 2002; Goldblatt et al., 2006; Lam et al., 2016). In *Iridaceae*, seven subfamilies are recognised, and *Geosiris* is placed in its own subfamily *Geosiridoideae* (Goldblatt et al., 2008; Stevens, 2017). It has been suggested that ancestors of *Geosiris* could have dispersed to Africa (Madagascar-Mayotte) from an Australian origin for the Iridaceae about 55 mya by long distance dispersal (LDD) across the Proto-Indian Ocean. Although the distance between Australia and Madagascar is currently about 5,400 km, substantial evidence indicates that many Asian taxa have dispersed to the Hawaiian Islands fairly recently, a distance of about 8,000 km (Raven, 1979).

The yearly Australian monsoon typically occurs from November to March, and this provides precipitation for North Queensland (Fox, 1999; Robertson et al., 2006). The monsoon that started in December 2016 after an intense El Niño episode triggered a spectacular flowering episode for many plants in the rainforests, including a flowering specimen of an unidentified mycoheterotrophic plant collected from the vicinity of Little Cooper Creek, within the Daintree National Park. An initial attempt using the *Australian Tropical Rainforest Plants* identification system (Hyland et al., 2017) failed to provide a positive identification of the specimen. Subsequent careful inspection of a flowering specimen revealed that it has three outer tepals, three inner tepals, three stamens opposite the outer tepals, extrorse anther dehiscence, and an inferior ovary, placing the specimen in the Iridaceae. Through literature, we managed to match the specimen to *Geosiris*, the only mycoheterotrophic genus of *Iridaceae*, and not until now recorded for Australia.

Key morphological characters useful for species distinction in *Geosiris*, as noted by Goldblatt & Manning (2010), are based on stigma characteristics. *Geosiris albiflora* has a somewhat club-like stigma with three coherent lobes, while *G. aphylla* has a stigma terminated by three fringed, broad, flattened stigmatic lobes. In contrast, the Australian *Geosiris* taxon has a truncate stigma with short fimbriate margin, and thus distinct from the two African species. Hence, the Australian taxon is new and described here as *Geosiris australiensis* B. Gray & Y.W. Low. Stigma characteristics of all three *Geosiris* taxa are illustrated in Fig. 1. Apart from stigma characteristics, *Geosiris australiensis* also differs from the other two taxa in a suite of other morphological characters (see below). The discovery of *Geosiris australiensis* in Australia expands the distribution of the genus to the western Pacific rim.

Materials and Methods

A review of all known Australian mycoheterotrophic plants was conducted using the online identification key, *Australian Tropical Rainforest Plants* (Hyland et al., 2017). Conventional methods of herbarium taxonomy were applied for this study. All measurements were taken from materials preserved in spirit collection. Field observations and photographic documentation were conducted by the first author, and also by Tim Hawkes and Tony de Groot. Botanical terms used in the study for the description of the new species largely follow Goldblatt & Manning (2010). Provisional conservation assessments were made using the methodology in IUCN (2012) following recommendation adopted for the Nature Conservation Act [NCA] 1992 and the Environment Protection and Biodiversity Conservation [EPBC] Act 1999 in Australia.

Key to *Geosiris* species

1. Stamens diverging and not forming a ring around the style; flowers white (endemic to Mayotte, Comoros Archipelago) ..... ***G. albiflora***

1a. Stamens forming a tight ring around the style just below the stigma and above the corolla throat **2**

2. Flower blue-violet to purple with a darker band at the base of the corolla lobes; stigma with 3 distinct flat, fringed lobes (endemic to Madagascar)..... ***G. aphylla***

2a. Flower pale mauve to white; stigma truncate without any lobes or club-like notches, the margin shortly fimbriate (endemic to Northeast Queensland, Australia) ..... ***G. australiensis***

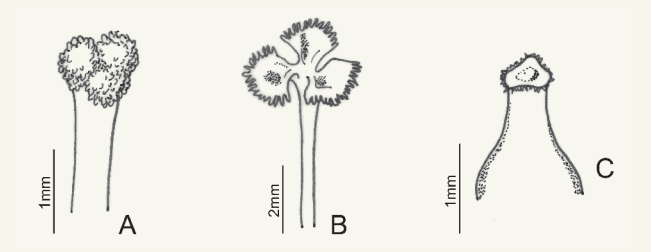

Fig. 1. – Stigmatic heads. **A.** *Geosiris albiflora* Goldblatt & J.C. Manning; **B.** *G. aphylla* Baill. **C.** *G. australiensis* B. Gray & Y.W. Low. [Drawings: **A, B:** Y.W. Low (redrawn from Goldblatt & Manning, 2010); **C:** B. Gray]

Taxonomy

Geosiris australiensis B. Gray & Y.W. Low, **spec. nova** (Fig. 1C, 2-3).

Typus: Australia. Queensland: N Queensland, Cook District, Little Cooper Creek, Daintree National Park, 15.I.2017, *Gray, Hawkes & de Groot BG 9763* (holo-: BRI!; iso-: CNS!)

Geosiris australiensis B. Gray & Y.W. Low is morphologically close to G. albiflora Goldblatt & J.C. Manning but differs in having stamens forming a tight ring around the style just above the throat of the corolla tube (vs diverging stamens in G. albiflora), and truncate stigma with short fimbriate margin (vs club-like stigma with three lobes cohered together in G. albiflora).

Plant perennial, achlorophyllous, mycoheterotrophe, 50-120 mm high, with slender, simple or rarely branched, purplish, stems arising from an underground rhizome c. 20-60 mm long with several tuber like thickened sections. *Roots* filiform arising from rhizome tubers. *Leaves* scale-like, 3-4.5 mm long, clasping the stem, pale creamy mauve. *Inflorescence* a head-like (possibly a contracted rhipidium) with 1-3 subsessile flowers opening sequentially; floral bracts membranous, maroon. *Flowers* erect, actinomorphic and opening widely, c. 15-16 mm diameter, very pale mauve to white, bright orange in the throat of the perianth tube. *Perianth tube* 2.1-2.3 mm long. *Tepals* lanceolate-elliptic to narrowly obovate, 6-7 × 3.5-4 mm, spreading. *Stamens* 3, filaments included in perianth tube, filiform, free, c. 1.8 mm long. *Anthers* c. 1.5 mm long, basifixed, coherent and clasping style. *Ovary* ovoid c. 2.1-2.2 mm long. *Style* erect, 4.7-4.8 mm long, fusiform above the anthers and triangular in cross section but becoming only slightly triangular at the apex and finely fringed. *Capsules* not seen.

Etymology. – The species epithet refers to Australia, as it is the first generic record for the continent.

Distribution and habitat. – *Geosiris australiensis* is only known from the tropical rainforests of north-east Queensland, Australia (Fig. 4). The only known specimens were growing on a moist forest floor covered with thick organic litter under shaded conditions in the Daintree National Park, a UNESCO World Heritage site.

Phenology. – The only known flowering specimens of *Geosiris australiensis* were collected in early January, during the annual monsoon that occurs from November to March. Fruiting period unknown.

Conservation status. – *Geosiris australiensis* is known only from a single location, protected within Daintree National Park. We assign a preliminary conservation status under the Nature Conservation Act (NCA) 1992, and the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 of "Vulnerable" [VU D2] (IUCN, 2012). This preliminary conservation status will require reassessment as more efforts to locate the species for conservation purposes are initiated by local authorities.

Notes. – The first discovery of *G. australiensis* was an immature inflorescence about 50 mm long bearing a single flower bud, found amongst leaf litter in mid-December 2016 during a survey for mycoheterotrophic plants in the Daintree rainforests. Subsequently, numerous trips were made to the same site, until a flowering specimen was finally collected. Numerous and extensive surveys around the type locality have located only 15 individuals to date, all located in a restricted area which is extremely wet (average annual rainfall about 4700 mm), within a tall and dense lowland rainforest. *Geosiris australiensis* is a perennial, as are *G. aphylla* and *G. albiflora*. It produces flowers soon after the onset of the wet season, each flower withering soon after anthesis. No fruiting plants have been observed. The discovery of this genus in Australia, perhaps further supports the hypothesis of the southern origin of the family (Goldblatt, 1991b; Goldblatt et al., 2008).

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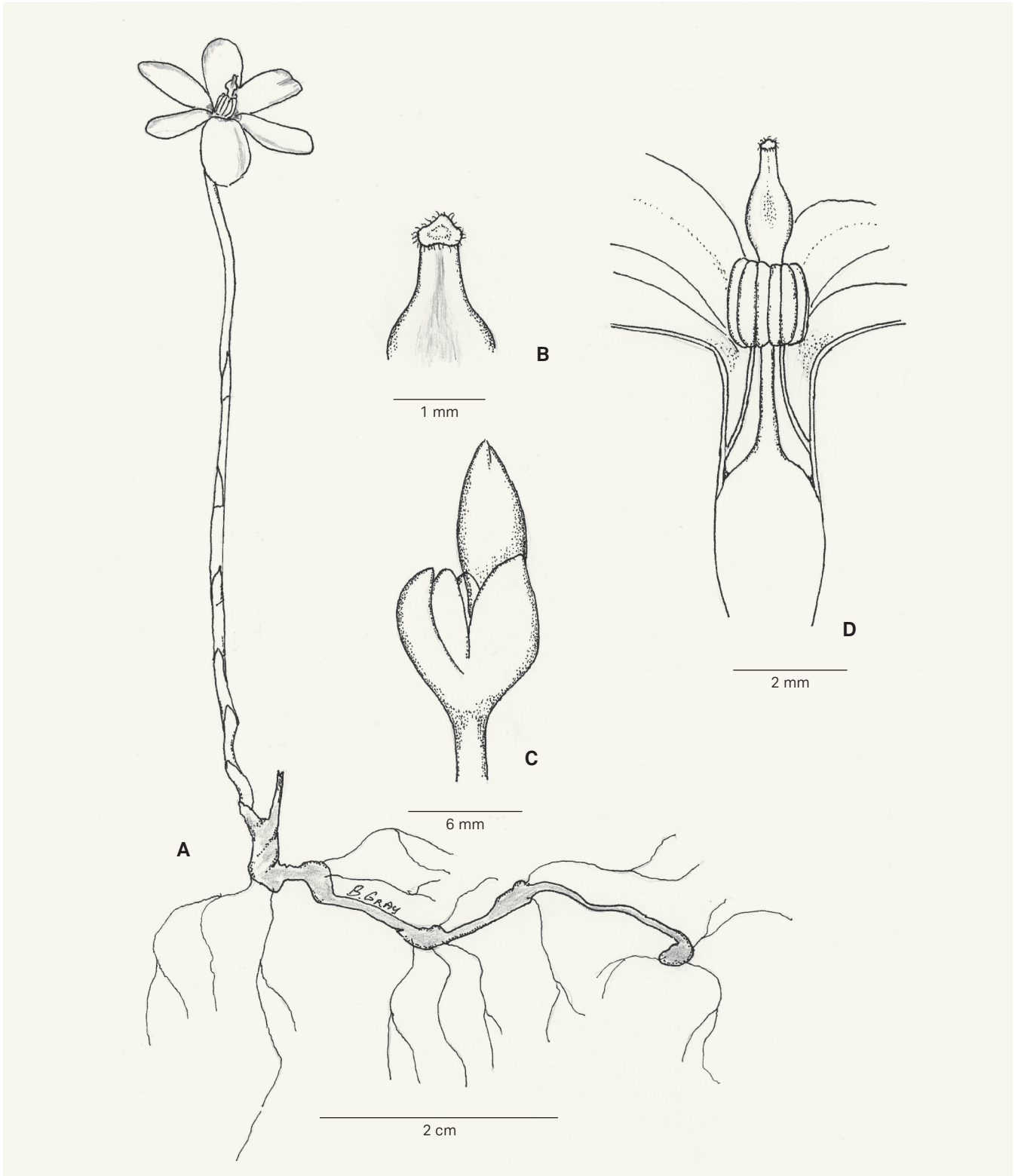

Fig. 2. – *Geosiris australiensis* B. Gray & Y.W. Low. **A.** Habit showing underground rhizome; **B.** Close-up of stigma with a truncate apex; **C.** Side view of a flowering head with an unopened flower bud; **D.** Cross section of an open flower showing stamens in a tight ring around the style just above the corolla throat.
[Drawing: B. Gray]

Fig. 3. – *Geosiris australiensis* B. Gray & Y.W. Low. **A.** Habit; **B.** Close-up of a flower bud with bracts; **C.** Close-up of extrorse stamens showing anthers with a longitudinal slit and forming a tight ring around the style; **D.** Top view of stigma showing truncate apex with short fimbriate margin.
[Photos: **A-B, D:** B. Gray; **C:** T. Hawkes]

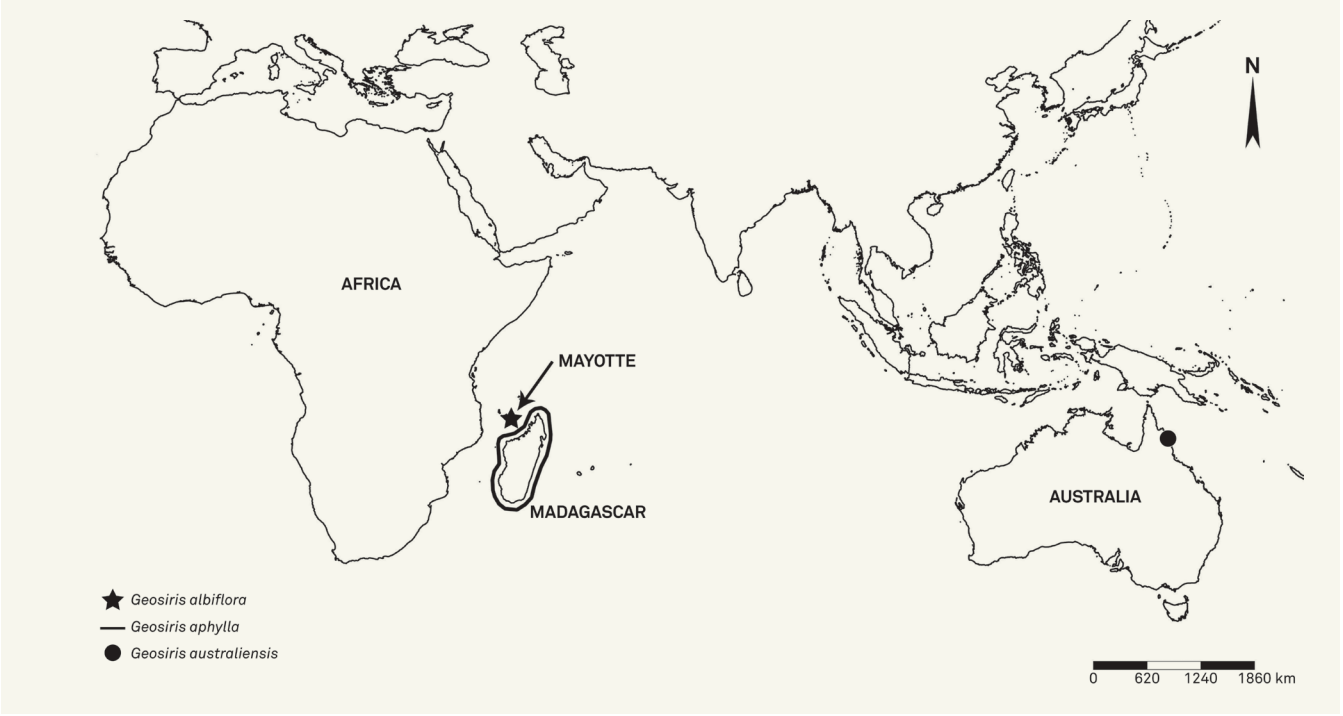

Fig. 4. – Distribution of the three *Geosiris* Baill. species.

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References

Baillon, H.E. (1894). Une Iridacée sans matière verte. *Bull. Mens. Soc. Linn. Paris* 2 : 1149-1150.

Engler, A. (1897). Burmanniaceae. *In :* Engler, A. & K. Prantl (ed.), *Nat. Pflanzenfam., Nachträge zum Teil* II-IV. Leipzig.

Fox, M.D. (1999). Present environmental influences on the Australian flora. *In :* Orchard, A.E. (ed.), *Fl. Australia* ed. 2, 1 : 205-249.

Goldblatt, P. (1991a). Iridaceae. *In* : Humbert, H. (ed.), *Fl. Madagascar Comores* 45 ed. 2.

Goldblatt, P. (1991b). An overview of the systematics, phylogeny and biology of the southern African Iridaceae. *Contr. Bolus Herb.* 13.

Goldblatt, P. & J.C. Manning (2010). Geosiris albiflora (Geosiridoideae), a new species from the Comoro Archipelago. *Bothalia* 40 : 169-171.

Goldblatt, P., P. Rudall, V.I. Cheadle, L.J. Door & C.A. Williams (1987). Affinities of the Madagascan endemic Geosiris, Iridaceae or Geosiridaceae. *Bull. Mus. Natl. Hist. Nat., B, Adansonia* 9 : 239-248.

Goldblatt, P., J.C. Manning & P. Rudall (1998). Iridaceae. *In :* Kubitzki, K. et al. (ed.), *The families and genera of vascular plants* 3. *Flowering Plants, Monocotyledons : Lilianae (except Orchidaceae) :* 295-333. Springer-Verlag, Berlin.

Goldblatt, P., T.J. Davies, J.C. Manning, M. van der Bank & V. Savolainen (2006). Phylogeny of Iridaceae subfamily Crocoideae based on combined multigene plastid DNA analysis. *Aliso* 22 : 399-411.

Goldblatt, P., A. Rodriguez, M.P. Powell, T. Jonathan Davies, J.C. Manning, M. van der Bank & V. Savolainen (2008). Iridaceae 'Out of Australasia'? Phylogeny, biogeography, and divergence time based on plastid DNA sequences. *Syst. Bot.* 33 : 495-508.

Hyland, B.P.M., T. Whiffin, F.A. Zich, S. Duffy, B. Gray, R. Elick, F. Venter & D. Christophel (2017). *Australian Tropical rainforest Plants, ed. 6, ver. 6.1. Trees, shrubs, vines, herbs, grasses,*

sedges, palms, pandans & epiphytes. CSIRO [http://keys.trin.org.au/key-server/data/0e0f0504-0103-430d-8004-060d07080d04/media/Html/index.html].

IUCN (2012). *IUCN Red List Categories and Criteria : Version 3.1* ed. 2. IUCN, Gland and Cambridge.

Jonker, F.P. (1939). Les Géosiridacées, une nouvelle famille de Madagascar. *Recueil Trav. Bot. Neerl.* 36 : 473-479.

Lam, V.K.Y., V.S.F.T. Merckx & S.W. Graham (2016). A few-gene plastid phylogenetic framework for mycoheterotrophic monocots. *Amer. J. Bot.* 103 : 692-708.

Perrier de la Bâthie, H. (1946). Iridaceae. *In* : Humbert, H. (ed.), *Fl. Madagascar Comoros* 45.

Raven, P.H. (1979). Plate tectonics and Southern Hemisphere biogeography. *In :* Larsen, K. (ed.), *Tropical botany :* 1-24. Academic Press, London.

Reeves, G., M.W. Chase, P. Goldblatt, P. Rudall, M.F. Fay, A.V. Cox, B. Lejeune & T. Souza-Chies (2002). Molecular systematics of Iridaceae : evidence from four plastid DNA regions. *Amer. J. Bot.* 88 : 2074-2087.

Robertson, A.W., S. Kirshner, P. Smyth, S.P. Charles & B.C. Bates (2006). Subseasonal-to-interdecadal variability of the Australian monsoon over North Queensland. *Q. J. R. Meteorol. Soc.* 132 : 519-542.

Stevens, P.F. (2017). *Angiosperm phylogeny website, Version 13.* Missouri Botanical Garden [http://www.mobot.org/MOBOT/research/APweb].