

INTRODUCTION

Fruiting specimens of *Geosiris* H.Baill., a genus until now thought to be restricted to the island of Madagascar and to be monospecific (Perrier 1946; Goldblatt 1991), were discovered in 1989 in the Comoro Archipelago on the island of Mayotte, which lies some 320 km northwest of northern Madagascar. Plants were recollected there in bloom in 1999. Not only is the presence of *Geosiris* a significant range extension for the genus, but the plants on Mayotte represent a different species from the endemic Madagascan *G. aphylla* H.Baill.

Geosiris, an achlorophyllous and leafless saprophyte, was initially referred to Iridaceae (Baillon 1894) but was subsequently believed to belong to Burmanniaceae, a family of saprophytic plants, or to be a separate family Geosiridaceae (Jonker 1939) because of its specialized life history and distinctive, dust-like seeds. The genus was, however, anomalous in Burmanniaceae because it has three stamens, characteristic of the Iridaceae among the petaloid monocots. *Geosiris* was referred with confidence to that family in 1997 as a result of anatomical and flavonoid investigation (Goldblatt *et al.* 1987), which showed it to have all the important synapomorphies of Iridaceae: an inferior ovary; three stamens opposite the outer tepals; extrorse anther dehiscence; calcium oxalate crystals in the form of styloids in some tissues (but not in the scale-like leaves); and a flavonoid profile consistent with Iridaceae. Styloids and other calcium oxalate crystals are absent in Burmanniaceae, as are flavonoid compounds, although the family is poorly sampled for this feature.

The assignment of *Geosiris* to Iridaceae was subsequently confirmed by molecular study: plastid DNA sequences place the Australasian *Patersonia* R.Br. as sister to *Geosiris*, in turn sister to the Afro-Madagascan *Aristea* Aiton (± 55 species), which is sister to a dichotomy yielding the remaining Nivenioideae (*Klattia* Baker, *Nivenia* Vent. and *Witsenia* Thunb.) and the large, old-World and predominantly sub-Saharan African Crocoideae (Reeves *et al.* 2002; Goldblatt *et al.* 2006, 2008). *Geosiris* remains unique in Iridaceae in being achlorophyllous, having non-green, scale-like leaves, minute seeds and a mycosaprophytic life form.

Geosiris is currently the only genus of subfamily Geosiridoideae (Goldblatt *et al.* 2008). Using molecular clock techniques for dating the age of genera of Iridaceae, *Geosiris* has variously been postulated to have diverged from the Australasian *Patersonia* ± 55 mya (Goldblatt *et al.* 2008) or as much as 70 mya (Janssen & Bremer 2004). Age estimates for *Geosiris* are, however, only marginally relevant to the occurrence of *Geosiris* on Mayotte as the island, of volcanic origin, is estimated to be ± 7.7 my in age (Schlüter 2006). Dispersal of the genus across the relatively short distance of ± 320 km from the northwest coast of Madagascar to Mayotte must then have occurred later than this.

Geosiris aphylla (Figure 4) is a small plant ± 100 mm high, with minute, scale-like leaves, a simple or branched stem, and a few to several biseriate inflorescences crowded at the branch tips. The small, blue-violet flowers are sometimes described as purple. The tepal bases and throat are white with darker violet edges, and the outspread tepals

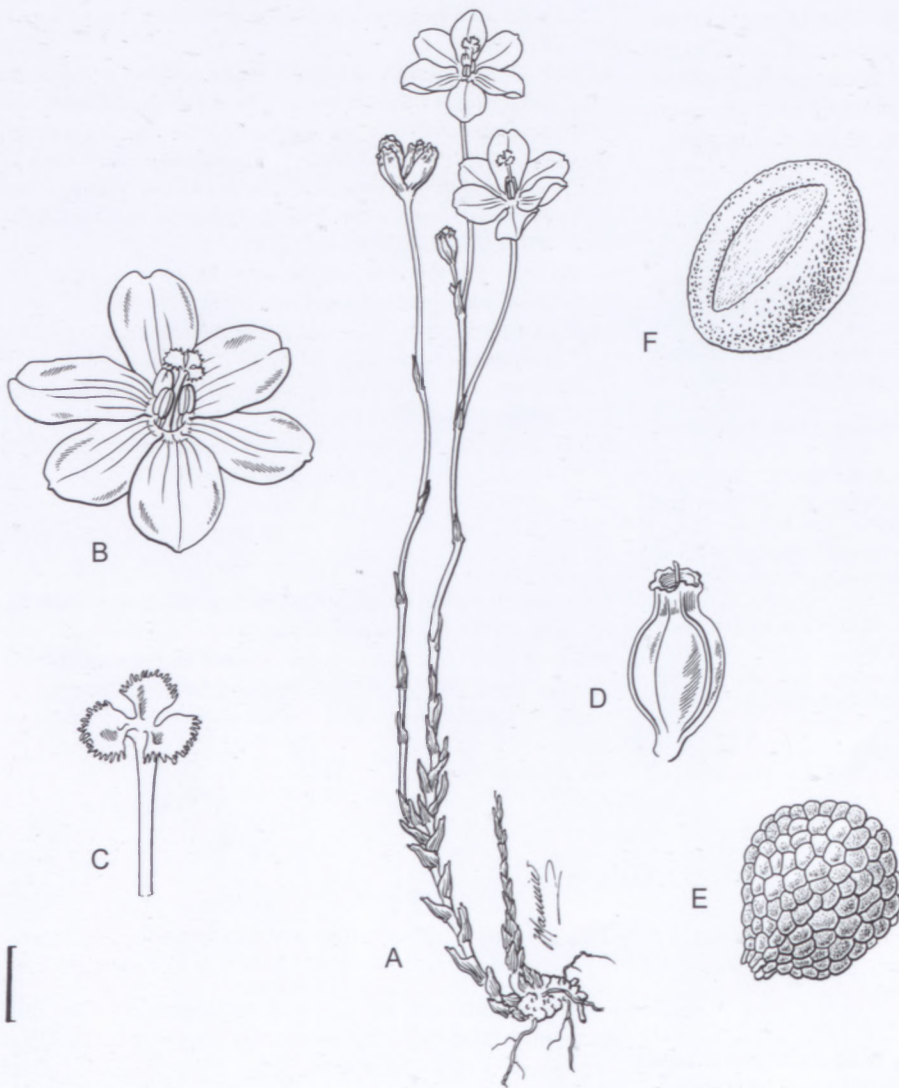


FIGURE 4.—*Geosiris aphylla* (from Goldblatt & Manning 2008). A, whole plant; B, flower; C, stigma; D, capsule; E, seed; F, pollen grain. Scale bar: A, 10 mm; B, 4 mm; C, 2 mm; D, 5 mm; E, 0.1 mm; F, much enlarged. Artist: John Manning.

are basally united in a rudimentary tube, ± 1.5 mm long. The three stamens are erect and initially appressed to the erect style, which exceeds the anther tips and terminates in three, broad, fringed stigmatic lobes. Unusual for the Iridaceae, the axile placentas are branched and accommodate hundreds of ovules. Recent collections have confirmed that the flowers are sweetly scented (e.g. *Zjhra* & *Hutcheon* 170 MO; *Dorr et al.* 4431 MO). After flowering, the short-lived perianth collapses but remains attached to the developing capsule as a dry, spirally twisted cap. The three-locular capsules have dry-membranous walls (on herbarium specimens they are translucent) and are evidently indehiscent. The walls fragment irregularly, releasing hundreds of minute seeds, sometimes described as dust-like. Microscopically, the seeds are ovoid with reticulate sculpturing, and measure 0.25×0.2 mm.

Plants from Mayotte are vegetatively similar to *Geosiris aphylla* apart from their inflorescence spathes, which are streaked with brown when dry in contrast to the unmarked spathes of *G. aphylla*. The flowers of the Mayotte plants, however, are significantly different from those of *G. aphylla*. A photograph (F. Barthelat pers. comm.) shows a uniformly white perianth, narrowly lanceolate or \pm elliptic tepals, ascending stamens diverging away from the style, which is notched apically into minute stigmatic branches. This contrasts markedly with the broadly lobed and fringed style branches of *G. aphylla*, evident in photo-

graphs of the species (Goldblatt & Manning 2008). Examination of herbarium specimens of the Mayotte plants also shows that the style reaches the level of the anther tips, whereas the style of *G. aphylla* overtops the anthers by about the length of the anthers, ± 1.2 mm.

We note here that one more species of *Geosiris* has been discovered in Madagascar (P.B. Phillipson pers. comm.) but material for study and for drawing up a formal description is not yet available.

SYSTEMATICS

Geosiris albiflora Goldblatt & J.C. Manning, sp. nov.

Plantae achlorophyllosae, *Geosiris aphyllae* similis sed floribus albis, tepalis anguste lanceolatis-ellipticis, staminibus divergentibus, antheris ± 1 mm longis, stylo apices antherarum attingente ad apicem minute trifurcato.

TYPE.—Mayotte: Mt Choungi, under trees in humus, 2 May 1999, M. Pignal, A. Pibot & C. Mas 1433 (P, hol.).

Plants 60–100 mm high, achlorophyllous, with slender, simple or branched stems arising from a short thick underground rhizome, ± 10 mm long, up to 5 mm diam. Leaves scale-like, clasping stem, 2.5–3.5 mm long, membranous, translucent with lines of brown pigment.

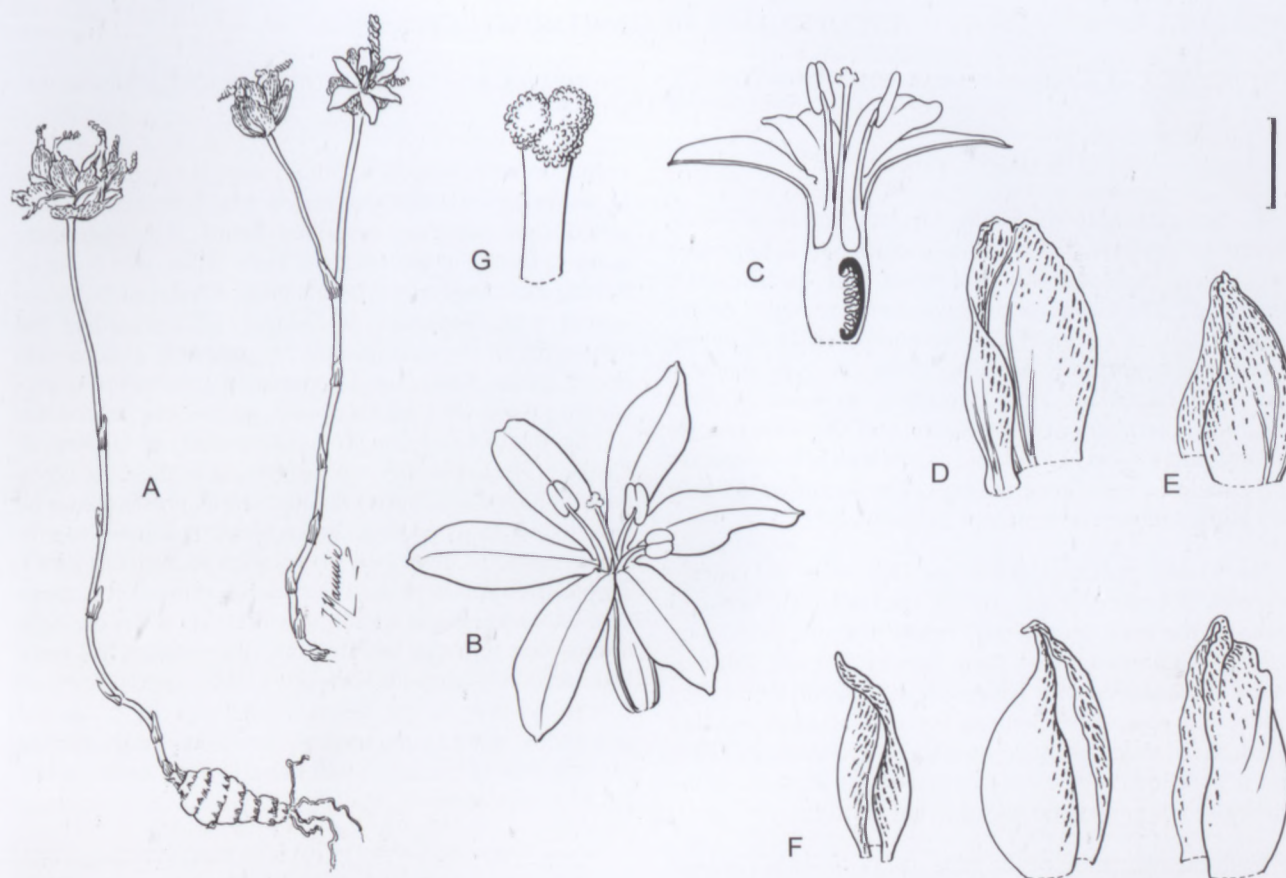


FIGURE 5.—*Geosiris albiflora*, Tinguy 1097 (P) and Mas 118 (P). A, whole fruiting plant and flowering stem; B, flower; C, half-flowers; D, outer spathe; E, inner spathe; F, floral bracts from first, second and third flowers of partial rhizidium (in series from right to left); G, stigma. Scale bar: A, 10 mm; B–F, 2 mm; G, 1 mm. Artist: John Manning.

Inflorescences biseriate, crowded, with subsessile flowers; outer spathes opposed, 4–5 mm long, membranous with lines of brown pigment; floral bracts similar. *Flowers* white, erect, radially symmetric; perianth tube ± 1.8 mm long; tepals lanceolate-elliptic, subequal, $\pm 3 \times 1$ mm. *Stamens* diverging; filaments exserted ± 1 mm from tube; anthers ± 1.2 mm long, sub-basifixed. *Ovary* ovoid, ± 1.5 mm long; style erect, ± 4 mm long, reaching level of anther tips, minutely 3-fid. *Capsules* broadly ovoid to globose, dry membranous, $\pm 2 \times 1.5$ –2.0 mm. *Seeds* numerous, ovoid, $\pm 0.25 \times 0.2$ mm, reticulate, seeming dark to the naked eye, but light brown with darker muri under $50\times$ magnification. Figure 5.

Additional specimens examined

MAYOTTE.—Mt Choungi, under trees in leaf litter, 29 Dec. 1989 (fr.), *H. Tinguy 1097* (P), in humus, 2 May 1999, *C. Mas 118* (P).

REFERENCES

- BAILLON, H. 1894. Une Iridacée sans matière verte. *Bulletin Mensuel de la Société Linnéenne de Paris* 2,146: 1149–1150.
- GOLDBLATT, P. 1991. Iridaceae—Famille 45 (2me édition). *Flore de Madagascar et des Comores*: 1–45. Museum National d'Histoire Naturelle, Paris.
- GOLDBLATT, P. & MANNING, J.C. 2008. *The iris family: natural history and classification*. Timber Press, Portland, OR.
- GOLDBLATT, P., DAVIES, T.J., MANNING, J.C., POWELL, M.P., VAN DER BANK, M. & SAVOLAINEN, V. 2008. Iridaceae 'Out of Australasia'? Phylogeny, biogeography, and divergence time based on plastid DNA sequences. *Systematic Botany* 33: 495–508.
- GOLDBLATT, P., DAVIES, T.J., MANNING, J.C., VAN DER BANK, M. & SAVOLAINEN, V. 2006. Phylogeny of Iridaceae subfamily Crocoideae based on combined multigene plastid DNA analysis. In J.T. Columbus, E.A. Friar, J.M. Porter, L.M. Prince & M.G. Simpson, *Monocots: comparative biology and evolution* 1: 399–411. Rancho Santa Ana Botanical Garden, Claremont, California.
- GOLDBLATT, P., RUDALL, P., CHEADLE, V.I., DORR, L.J. & WILLIAMS, C.A. 1987. Affinities of the Madagascan endemic *Geosiris*, Iridaceae or Geosiridaceae. *Bulletin du Muséum d'Histoire Naturelle*, 4 sér., sect. B. *Adansonia* 9: 239–248.
- JANSSEN, T. & BREMER, K. 2004. The age of major monocot groups inferred from 800+ rbcL sequences. *Botanical Journal of the Linnean Society* 146: 385–398.
- JONKER, F.P. 1939. Les Géosiridacées, une nouvelle famille de Madagascar. *Recueil Travaux Botaniques Néerlandais* 36: 473–479.
- PERRIER DE LA BÂTHIE, H. 1946. Iridacées. In H. Humbert, *Flore de Madagascar et des Comores* 45: 1–41. Imprimerie Officielle, Tananarive.
- REEVES, G., CHASE, M.W., GOLDBLATT, P., RUDALL, P.J., FAY, M.F., COX, A.V., LEJEUNE, B. & SOUZA-CHIES, T. 2001. Molecular systematics of Iridaceae: evidence from four plastid DNA regions. *American Journal of Botany* 88: 2074–2087.
- SCHLÜTER, T. 2006. *Geological atlas of Africa*. Springer, Berlin.

P. GOLDBLATT* and J.C. MANNING**

* Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166-0299, USA. E-mail: peter.goldblatt@mobot.org.

** Compton Herbarium, South African National Biodiversity Institute, Kirstenbosch, Private Bag X7, 7735 Cape Town. E-mail: j.manning@sanbi.org.za.

MS. received: 2010-02-05.