IRIDACEAE

A NEW SPECIES OF *HESPERANTHA* FROM THE OVERBERG, WESTERN CAPE, AND OBSERVATIONS ON A NOVEL MODE FOR POLLEN TRANSFER IN THE GENUS AND FAMILY BY A HESPERID BUTTERFLY

INTRODUCTION

Plants of an unknown species of *Hesperantha* Ker Gawl., discovered in the Rûens Hills northeast of Bredasdorp, Western Cape, South Africa, present some unusual features in the genus. *Hesperantha*, a sub-Saharan African genus of some 85 species of Iridaceae subfamily Crocoideae Burnett, extends from Western Cape to Ethiopia and Cameroon (Goldblatt 2003; Goldblatt & Manning 2007; Goldblatt & Manning *in prep*.). The genus is recognized by ± woody corm tunics and a spicate inflorescence of radially symmetric flowers with the style branches dividing close to the mouth of the perianth tube into long, spreading style branches. The new species, *H. kiaratayloriae*, has diurnal, small pink, salver-shaped flowers that are remarkable for the erect stamens tightly enclosing the exserted style. The style divides well above the mouth of the perianth tube near the apices of the anthers, thus unlike any other species in the genus, and the three style branches, which are loosely twisted or coiled around one another, are held well above the mouth of the perianth tube. Although the exserted style and erect style branches are unique for the genus, the bell-shaped corms, with an oblique flat base and floral bracts united basally around the spike, are consistent with sect. *Radiatae* Goldblatt. Three days of observation for pollinators have shown that the flowers, which begin to open at about 6:00 and close after 12:30, are visited and pollinated by the small butterfly *Tsitana tulbagha* (Hesperidae), not before recorded as an agent for pollen transfer in any sub-Saharan species of Iridaceae (Goldblatt & Manning 2006). We describe the new species here, discuss its relationships within *Hesperantha*, and present evidence for this novel pollination system within Iridaceae.

TAXONOMY

Hesperantha kiaratayloriae *Goldblatt & J.C.Manning*, sp. nov.

TYPE.—Western Cape, 3420 (Bredasdorp): Rûens Hills, northeast of Bredasdorp, Farm Plaatjieskraal, upper slopes of ridge in stony quartzite gravel over shale, (–AC), 8 Nov. 2011, *Goldblatt & Porter 13729* (NBG, holo.; K, MO, PRE, iso.).

Plants mostly 150–200 mm high, rarely to 300 mm, erect, unbranched. *Corm* obliquely bell-shaped, 6–8 mm diam. at base, tunics ± woody, dark grey, fragmenting from lower margins into tile-like segments. *Leaves* several, dry at flowering time, sheaths imbricate, blades

linear, mostly 10–60 × 1.0–1.5 mm, margins smooth, uppermost 2 or 3 leaves sheathing for entire length. *Spike* 2–4(–7)-flowered, flexuose; bracts dry and pale brown at flowering, outer mostly 12–15 mm long with margins connate near base for 1–2 mm and sheathing spike axis, inner slightly shorter than outer and forked apically. *Flowers* diurnal, pink with white throat, unscented, anthers bright yellow and prominently displayed; perianth tube cylindric, slightly expanded at apex, 13–16 mm long, distal half exserted from bracts; tepals subequal, spreading horizontally, elliptic, ± 12 × 4–5 mm, outer slightly larger than inner. *Stamens* symmetrically disposed, erect; filaments 2.5 mm long, exserted ± 1 mm from mouth of tube; anthers ± 5 mm long, dehiscing longitudinally, yellow, remaining coherent around style. *Ovary* ovoid-oblong, ± 6 mm long; style exserted and dividing just below anther apices, branches ± 5 mm long, remaining erect, slightly twisted and often interlaced, papillate and stigmatic in upper 2/3. *Capsules* subcylindric, 7–8 mm long. *Seeds* angular, ± 0.7 × 0.4 mm, with membranous raphal ridge expanded into a wing at micropylar end, surface cells colliculate. *Flowering time*: (late October) November. Figure 1.

Distribution & ecology: known from a single south-facing ridge in Eastern Rûens Shale Renosterveld (Mucina & Rutherford 2006), ± 40 km northeast of Bredasdorp (Figure 2), *Hesperantha kiarataylorae* grows among silcrete-quartzite stones over a shale substrate among tufts of the graminoids *Pentachistis* and *Merxmuellera* (Poaceae) and *Bobartia* (Iridaceae), and the shrubs *Elytropappus rhinocerotis* (L.f.) Less. (Asteraceae), *Amphithalea violacea* (E.Mey.) Benth and *Aspalathus mundiana* Eckl. & Zeyh. (Fabaceae). It shares this unique habitat with several threatened quartz-specialists, including *Gibbaeum haagei* Schwantes (Aizoaceae: *Endangered*), *Elegia verreauxii* Mast. (Restionaceae: *Vulnerable*), *Notobubon striatum* (Thunb.) Magee (Apiaceae: *Near Threatened*), *Otholobium curtisiae* C.H.Stirt. & Muasya *ined.* (Fabaceae, proposed status *Endangered*), as well as the recently described *Xiphotheca rosemarinifolia* A.L.Schutte (Fabaceae: *Critically Endangered*), which is known only from this single locality. We estimate that the population comprises about 90 plants of flowering size. The site was not examined for juveniles.

Although there is thus a good probability that *H. kiarataylorae* may likewise be restricted to this single locality, additional surveys are required to establish this. Silcrete-quartz outcrops are restricted to Eastern Rûens Shale Renosterveld, a *Critically Endangered* vegetation type, with < 12% remaining (SANBI & DEAT 2009). Renosterveld remnants are vulnerable to mismanagement, including inappropriate use of fire and over-grazing and trampling by livestock (Schutte-Vlok 2011; O. Curtis pers. obs.). Given the evident rarity of the species and the threats from agriculture to the single known locality, which remains unprotected, we propose a conservation status of *Critically Endangered* (CE). To date, no seeds have been collected for seed-banking.

The leaves of *Hesperantha kiarataylorae* are dry and withered at flowering, a feature not known elsewhere in the genus and evidently associated with its late spring / early summer flowering. The pink, unscented flowers last three days (determined by maintaining cut stems in water in the laboratory), and open early in the morning each day, ± 06:00, beginning to close after 12:30 and are fully closed by 13:30.

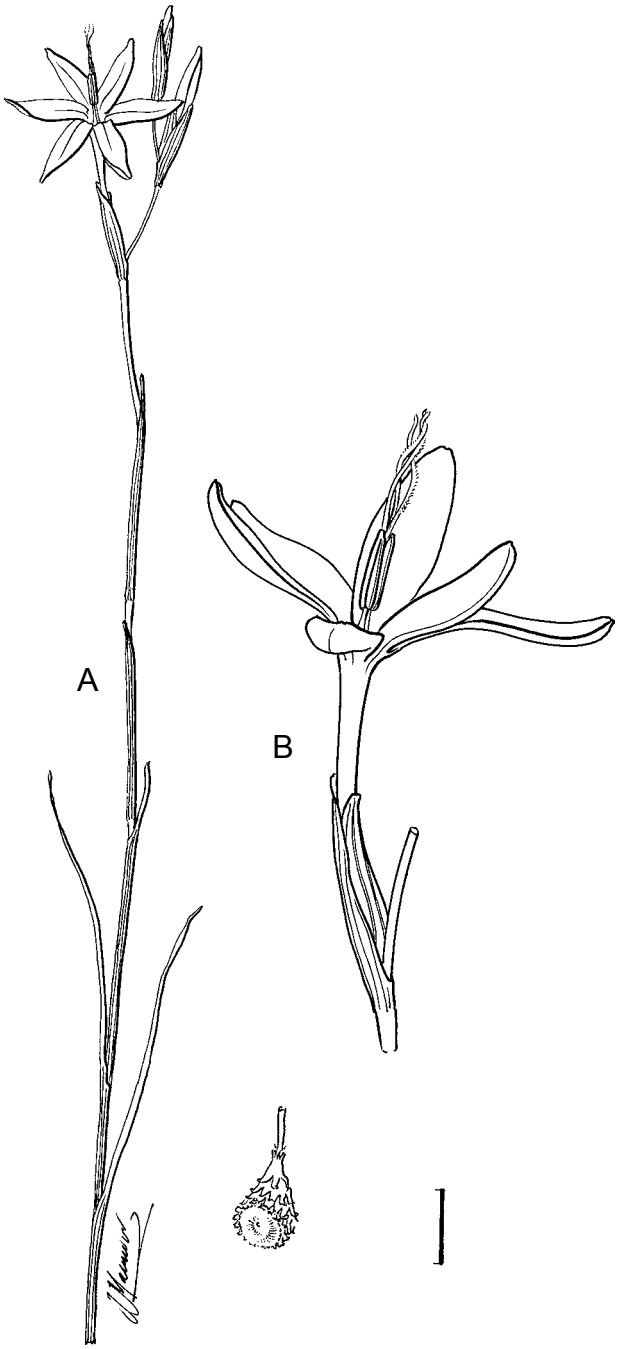

FIGURE 1.—*Hesperantha kiarataylorae, Goldblatt & Porter 13729*. A, flowering plant; B, detail of stamens and stigma. Scale bar: A, 10 mm; B, 2 mm. Artist: John Manning.

Diagnosis and relationships: a small plant, *Hesperantha kiarataylorae* has small pink flowers with a relatively long perianth tube, 13–16 mm long and slightly longer than the tepals, erect stamens with the anthers connate around the style, and an erect style that divides opposite the anther apices into three erect, slightly twisted branches. The short, linear leaves are ± dry at flowering and the floral bracts are united for 1–2 mm

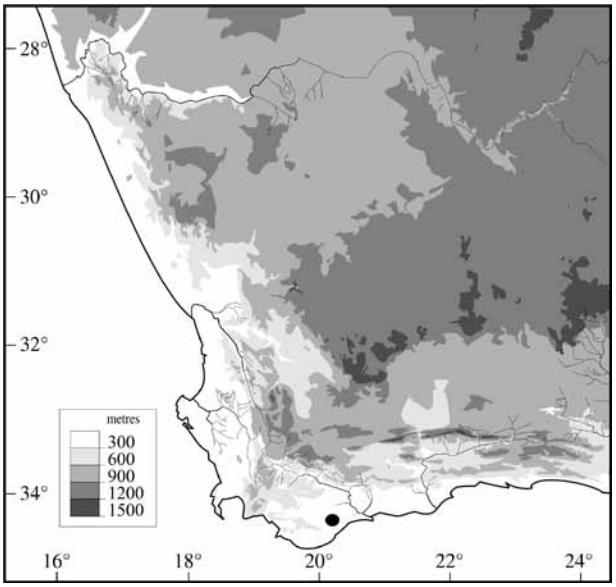

FIGURE 2.—Distribution of *Hesperantha kiarataylorae*.

around the spike axis. The general aspect of *H. kiarataylorae* is that of sect. *Radiata*, diagnosed by the flat-based corms with hard tunics fragmented at the base and the partial union of the outer floral bract margins around the spike axis (Goldblatt 2003). A well developed perianth tube is common in the genus and not unusual in sect. *Radiata*, but pink flowers are otherwise known in the section only in *H. elsiae* Goldblatt from the southern Cedarberg, which in other features, including a long perianth tube, is very different to *H. kiarataylorae* (Goldblatt 1984). The southern Cape *H. muirii* (L.Bolus) G.J.Lewis is most like *H. kiarataylorae* in the twisted style branches (although spreading in the former) and we see the two as a species pair within the section. The relatively long style enclosed by the erect stamens and dividing well above the mouth of the perianth tube close to the anther apices significantly expands the circumscription of *Hesperantha.*

The species is named for Kiara May-Leen Taylor in honour of the generous donation to renosterveld conservation by her father, Oren Taylor.

POLLINATION

Only a single insect species, the skipper butterfly *Tsitana*, cf. *T. tulbagha* (Hesperidae), a relatively common species of southern Africa, was seen visiting flowers of *Hesperantha kiarataylorae* over three days of observations, for three to four hours each day. The bright pink flowers evidently lack floral odour as determined from open flowers held indoors in a warm, still room. Several (< 10 individuals) *Tsitana* butterflies (sexes not established) were observed visiting the flowers after 6:30, soon after the perianth expanded fully, moving directly from one opened flower to another. On alighting on a flower, the frons of the insect first contacted the style branches, the upper two thirds of which are ciliate, sticky and stigmatic throughout the lifespan of a flower. The insect then inserted its proboscis into the floral tube, evidently foraging for nectar present in the lower part of the perianth tube (nectar concentration and chemistry not examined, but we confirm the presence of nectar, sweet to the taste). Nectar in *Hesperantha*, as in other genera of Iridaceae: Crocoideae, is secreted from septal nectaries, but we did not confirm presence of these nectaries in this species. During foraging activity, the frons of the insects (but not other body parts) became visibly covered with a dense accumulation of bright orange pollen from contact with the anthers. Butterflies were seen flying from one open flower to another and stigmas that were devoid of pollen before visits by *T.* cf. *tulbagha* were seen to bear heavy deposits of pollen after visits by the butterfly. The butterfly was identified by entomologists, M. Picker and D. Edge, from photographs. No insects were trapped and killed for vouchers.

Our observations show that this butterfly is an active and effective agent for pollen transfer for *Hesperantha kiarataylorae.* We also note that we observed no other insect visitors to the flowers either in the early morning or later (three to four hours of observation on different days). From this we then infer that *Tsitana* cf. *tulbagha* is at least one, but possibly the sole, pollinator of the species at this locality. The possibility of autogamy in this species can be eliminated because the flowers are herkogamous, the pollen and stigmatic part of the style branches are physically separated from one another; the latter held about 1.5 mm above the anthers and exposed pollen. The species may also be self-incompatible, but this was not determined for our study.

Butterfly pollination is evidently rare among southern African Iridaceae apart from the guild of species with large red flowers, mostly species of *Gladiolus* and *Tritoniopsis*, pollinated predominantly by *Meneris tulbaghia* (Satyridae) (Goldblatt & Manning 2002, 2006), a very different system to that reported here. Pollination by the painted lady, *Cynthia cardui* (Pieridae), has been observed in yellow-flowered *Ixia acaulis* Goldblatt & J.C.Manning and *Nivenia parviflora* Goldblatt & J.C.Manning, and this butterfly is the only recorded visitor to *I. acaulis* (Goldblatt & Manning 1993, 2006, 2011). Several other species of Iridaceae are visited by butterflies as part of a generalist pollination system also involving nectar-feeding bees and sometimes hopliine beetles (Sarabaeidae: Hopliini). These include *I. orientalis* L.Bolus*,* reported as pollinated by the butterfly *Colias electo* (Pieridae) (Goldblatt *et al*. 2000), and *Micranthus* spp., visited by *Cynthia cardui*, *Pieris helice* (Pieridae) and *Colias electo*, but these plants are generalists and are also visited and pollinated by hopliine beetles and large anthophorine bees (Goldblatt & Manning 2006). *Colias electo* has also been captured while visiting flowers of *Geissorhiza foliosa* Baker and *G. heterostyla* L.Bolus, but its role in the pollination of these relatively short-tubed species is uncertain (Goldblatt & Manning 2009). Other *Hesperantha* species are pollinated by settling moths (mostly Noctuidae), long-proboscid flies (mostly species of *Prosoeca*) or large-bodied bees and *Apis* (Goldblatt *et al.* 2004). Just one species is known to be pollinated by hopliine beetles. Pollination of *H. kiarataylorae* thus represents a novel pollination strategy in the genus.

ACKNOWLEDGEMENTS

We extend our thanks to Lendon Porter for his assistance and companionship in the field and Cameron and Rhoda McMaster for helping in the collection of *Hesperantha kiaratayloriae* at our study site in the Rûens Shale Renosterveld. Mike Picker, University of Cape Town, and David Edge provided the insect identification. We also recognize the generous donation to the Overberg Lowlands Conservation Trust for renosterveld conservation made by Oren Taylor, London, United Kingdom, facilitated by Fauna and Flora International (United Kingdom). Collecting permits were provided by the Nature Conservation authorities of Western Cape Province.

REFERENCES

GOLDBLATT, P. 1984. A revision of *Hesperantha* (Iridaceae) in the winter rainfall area of southern Africa. *Journal of South African Botany* 50: 15–141.

GOLDBLATT, P. 2003. A synoptic review of the African genus *Hesperantha* (Iridaceae: Crocoideae). *Annals of the Missouri Botanical Garden* 90: 390–443.

GOLDBLATT, P. & MANNING, J.C. 1993. *Ixia acaulis*, a new acaulescent species of Iridaceae: Ixioideae from the Knersvlakte, Namaqualand, South Africa. *Novon* 3: 148–153.

GOLDBLATT, P. & MANNING, J.C. 2000. The long-proboscid fly pollination system in southern Africa. *Annals of the Missouri Botanical Garden* 87: 146–170.

GOLDBLATT, P. & MANNING, J.C. 2002. Evidence for moth and butterfly pollination in *Gladiolus* (Iridaceae: Crocoideae). *Annals of the Missouri Botanical Garden* 89: 110–124.

GOLDBLATT, P. & MANNING, J.C. 2006. Radiation of pollination systems in the Iridaceae of sub-Saharan Africa. *Annals of Botany (London)* 97: 317–344.

GOLDBLATT, P. & MANNING, J.C. 2007. New species and notes on *Hesperantha* (Iridaceae) in southern Africa. *Bothalia* 37: 167–182.

GOLDBLATT, P. & MANNING, J.C. 2009. New species of *Geissorhiza* (Iridaceae: Crocoideae) from the southern African winter-rainfall zone, nomenclatural changes, range extensions and notes on pollen morphology and floral ecology. *Bothalia* 39: 123–152.

GOLDBLATT, P. & MANNING, J.C. 2011. Systematics of the southern African genus *Ixia* (Iridaceae): 3. Sections *Hyalis* and *Morphixia*. *Bothalia* 41: 83–134.

GOLDBLATT, P., MANNING, J.C. & BERNHARDT, P. 2000. Adaptive radiation of pollination mechanisms in *Ixia* (Iridaceae: Crocoideae). *Annals of the Missouri Botanical Garden* 87: 564–577.

GOLDBLATT, P., NÄNNI, I., BERNHARDT, P. & MANNING, J.C. 2004. Floral biology of *Hesperantha* (Iridaceae: Crocoideae): how minor shifts in floral presentation change the pollination system. *Annals of the Missouri Botanical Garden* 91: 186–206.

GOLDBLATT, P., MANNING, J.C. & GEREAU, R.E. 2013. The Cape genus *Micranthus* (Iridaceae: Crocoideae): nomenclature and taxonomy. *Bothalia* 43,2: 127–144.

MANNING, J.C. & GOLDBLATT, P. 2005. Radiation of pollination systems in the Cape genus *Tritoniopsis* (Iridaceae: Crocoideae) and the development of bimodal pollination strategies. *International Journal of Plant Sciences* 166: 459–474.

MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

SANBI & DEAT. 2009. *Threatened Ecosystems in South Africa: descriptions and maps*. DRAFT for comment. South African National Biodiversity Institute, Pretoria.

SCHUTTE-VLOK, A.L. 2011. A new species of *Xiphotheca* from the Western Cape, South Africa. *Bothalia* 41: 298–300.

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MS. received: 2012-12-27