

IRIDACEAE

NIVENIA ARGENTEA MISUNDERSTOOD, AND THE NEW SPECIES *NIVENIA INAEQUALIS* (NIVENIOIDEAE)

INTRODUCTION

The genera *Nivenia* Vent. (10 spp.), *Klattia* Baker (3 spp.) and *Witsenia* Thunb. (1 sp.) are the only truly shrubby members of the family Iridaceae, and comprise the monophyletic subfamily Nivenioideae (Goldblatt *et al.* in press). All are endemic to the southwestern Cape, South Africa, and were recently monographed by Goldblatt (1993). Since then a single additional species, *Nivenia parviflora* Goldblatt, has been described (Goldblatt 1997). Species of *Nivenia* are largely restricted to montane habitats at middle elevations and most are narrow local endemics, occurring on a single mountain range or at most on adjacent ranges. A striking exception is *N. argentea* Goldblatt, which was until now considered to occur on both the coastal Langeberg and Riviersonderend Mtns as well as inland on the Rooiberg range in the Little Karoo (Goldblatt 1993). Our current knowledge of this species, however, was based almost entirely on the populations from the Rooiberg, which are readily accessible by road.

In May 2005 an unidentified *Nivenia* was photographed on the Riviersonderend Mountains by plant enthusiast David Gwynne-Evans. The photographs showed a species with the congested, pseudoracemose inflorescence typical of *N. argentea* but the dark (rather than pale) blue flowers appeared to lack the short, sub-orbicular style arms that were regarded as characteristic of that species, as well as the conspicuous silvery bracts that gave the species its name (Goldblatt 1993). In addition, the inflorescence appeared to be well exerted from the leaf cluster, unlike the Rooiberg populations in which it is typically only shortly extended beyond the leaves. The form of the inflorescence in the Riviersonderend plants is, however, a close match for the Langeberg popu-

lations of *N. argentea*, as well as the type of the species, which was collected on the Riviersonderend Mtns.

Further examination of the Langeberg material at our disposal raised the strong possibility that it was not in fact conspecific with the Rooiberg collections after all, although most specimens available lacked well-preserved flowers. Efforts were therefore made to obtain good flowering material of the Langeberg or Riviersonderend plants and in December 2006 members of the Friends of the Outeniquas, under the guidance of Di Turner, succeeded in locating ample flowering plants. The following year Martin Grantham secured material from both the Langeberg and Riviersonderend Mountains. These collections confirm that the Langeberg and Riviersonderend plants are a close match for the type of *Nivenia argentea* and are distinct from the Rooiberg populations.

This confirms that *Nivenia argentea* is typical of the other members of the genus in having a limited distribution and that the Rooiberg populations comprise an undescribed species that we name *N. inaequalis*, for the markedly unequal stamens that characterize the species. We also provide a full description of true *N. argentea*, flowers and fruits of which have not been available for detailed examination until now.

Nivenia now comprises 11 species, all of rocky sandstone habitats in the southern African winter rainfall zone. Of these, seven species are distylous and four are homostylous.

***Nivenia argentea* Goldblatt**, The woody Iridaceae: 54 (1993), as a substitute name for *Nivenia capitata* (Klatt) Weim.: 366 (1940), nom illeg. non *N. capitata* R.Br. (Proteaceae). *Witsenia capitata* Klatt: 546 (1866). Type: South Africa, [Western Cape], banks of the Riviersonderend,

Appelskraal, Eksteen, and surrounding mountains, 500–4000' [150–1 200 m], *Ecklon & Zeyher Irid. 62* (B, holo.; MO!, S!, iso.).

Rounded shrubs up to 400 mm high, branching from base, forming dense cushions. *Stems* ascending, compressed, leafy portions 2–4 mm diam. *Leaves* crowded apically, linear-lanceolate, (20–)40–80 × 1.5–3.0 mm. *Inflorescence* a congested, branched pseudoraceme, up to 15-flowered, lateral branches short, 3-flowered, each node bearing a short-stalked, 1-flowered rhipidium; peduncle axis compressed, extending (10–)20–40 mm from leaf cluster, ultimate branches ± 2 mm long; inflorescence bracts lanceolate-attenuate, keeled, outer bracts 15–25 mm long, dry and brown with brown membranous margins, inner bracts about two thirds as long as outer, with narrow transparent membranous margin; spathes tightly enclosing flower, lanceolate-attenuate, 13–18 mm long, dry and papery, brown below and in midline, margins and apices transparent-membranous; floral bracts tubular, 18–25 mm long, dry and membranous, usually silvery transparent in upper half or third, brown in lower half to two thirds, sometimes ± entirely shining brown, becoming torn apically. *Flowers* salver-shaped, heterodistylous, deep blue, darker in centre and white in throat and tube; perianth tube 14–20(–25) mm long, widening gradually towards mouth; tepals oblong-ob lanceolate, 13–18 × 4–6 mm, spreading. *Stamen filaments* inserted in mouth of tube, either 4–5 mm long (thrum flower) or 1.0–1.5 mm long (pin flower); anthers 1.0–1.5 mm long before anthesis, yellow; pollen yellow. *Ovary* ± 1.5 mm long; style either included 0.5–4.0 mm below mouth of tube (thrum flower) or exserted ± 7 mm and reaching ± 5 mm beyond anthers, dividing into filiform branches ± 1.5 mm long. *Capsules* obovoid, 6–7 × 3–4 mm, typically with just a single fertile locule containing a solitary seed. *Seeds* one per locule, ± 4.5 × 1.8 mm, scutiform, papillate-rugulose. *Flowering time*: mainly October to December, occasionally out of season in March and April. Figure 3.

Distribution and ecology: a montane species occurring at middle to upper elevations, 500–1 000 m, along the Riviersonderend and adjacent Langeberg Mountains (Figure 4), *Nivenia argentea* has been recorded from the eastern Riviersonderend Mtns above the town of Riviersonderend and from several sites along the southern length of the Langeberg, from Tradouwberg and Grootvadersbos north of Heidelberg in the west to Garcia's Pass and Paardeberg near Riversdale in the east. Plants grow on exposed, rocky ridges, forming densely leafy, rounded shrubs up to 400 mm high. Populations are usually small.

Diagnosis and relationships: *Nivenia argentea* is distinguished by its congested, pseudoracemose inflorescence with lanceolate-attenuate subtending bracts that are entirely brown and dry. The ultimate branches bear single-flowered rhipidia, and each flower is surrounded by a tubular bract 18–25 mm long that is dry and membranous, usually silvery transparent in the upper half and brown in the lower half but sometimes entirely shining brown. The species is heterodistylous, as are most species of *Nivenia*, and the flowers have a perianth tube 14–25 mm long with the anthers exserted on filaments either 4–5 mm long (thrum flowers) or 1.0–1.5 mm long

(pin flowers). The style branches are slender and typical of most other species in the genus, and differ from those of *N. inaequalis*, which are short and rounded.

In the structure of the compound inflorescence *Nivenia argentea* closely resembles *N. inaequalis* from the Rooiberg but in this species the inflorescence bracts and spathes have broad, silvery margins and the floral bracts are entirely silver-transparent. The rhipidia in *N. inaequalis*, unlike those of *N. argentea*, are 2-flowered and the flowers themselves are distinctive in their longer tubes, 30–40 mm long vs 14–20(–25) mm long in *N. argentea*; in their unequal stamens in which one filament is notably shorter than the other two; and in the unique, short, rounded style branches. The tubular floral bract of *N. argentea*, in which the lower margins are fused to form a closed cylinder (Figure 3F), have not been recorded in the genus before. The bract margins in *Nivenia* species are usually free to the base, although overlapping and enclosing the perianth tube. Closer examination of the bracts of the remaining species reveals that *N. fruticosa* (L.f.) Baker, also from the Langeberg Mountains, is the only other species with tubular floral bracts, possibly indicating a close relationship between it and *N. argentea*.

History: *Nivenia argentea* has been misunderstood almost since its first description by F.W. Klatt in 1866, and its early history has been well documented by Goldblatt (1993). First described under the name *Witsenia capitata*, the species was based on immature specimens collected in bud by C.F. Ecklon & C.L. Zeyher in the Riviersonderend Mountains. Although subsequently included in a second species, *N. fruticosa*, by both J.G. Baker (1877, 1896) and N.E. Brown (1933), the species was later resuscitated by Weimarck (1940), unfortunately under the illegitimate combination *Nivenia capitata* (Klatt) Weim., a homonym for *N. capitata* R.Br. [now *Paranomus capitatus* (R.Br.) O.Kuntze, Proteaceae]. By this time, further specimens from Garcia's Pass in the Langeberg had been collected by E.E. Galpin in 1897, enabling Weimarck to describe the flowers more fully. Weimarck's illustration (1940: fig. 2A) clearly shows the extremely short filaments (of the pin morph), and his interpretation of the inflorescence as comprising several solitary flowers led him to place the species in his section *Singulares*, erected for those taxa with single-flowered rhipidia. The species remained poorly collected, however, and it is thus not surprising that when a *Nivenia* species with a similar congested, pseudoracemose inflorescence and silvery floral bracts was collected in 1957 from the Rooiberg in the Little Karoo, inland of the Langeberg, it was referred to the same species (Goldblatt 1993). The Rooiberg locality is easily reached by vehicle and plants from there thus served as the basis for the description and fine illustrations that appeared under the new name *N. argentea* Goldblatt, coined to replace the illegitimate *N. capitata* (Goldblatt 1993). In the absence of any further collections of the species from west of the Langeberg, Goldblatt followed Weimarck in concluding that the locality of the type collection on the Riviersonderend Mountains was most probably incorrect. More recent collections of the species from the Langeberg, largely lacking flowers, did nothing to change this interpretation but the photographic evidence of plants from the



FIGURE 3.—*Nivenia argentea*, *Custodians of Rare and Endangered Wildflowers s.n.* A, two flowering branches; B, outer inflorescence bract; C, inner inflorescence bract; D, single rhipidium; E, spathes; F, floral bract; G, floral bract flattened; H, pin flower flattened; I, thrum flower flattened; J, style branches. Scale bars, A–I, 10 mm; J, 1 mm. Artist: John Manning.

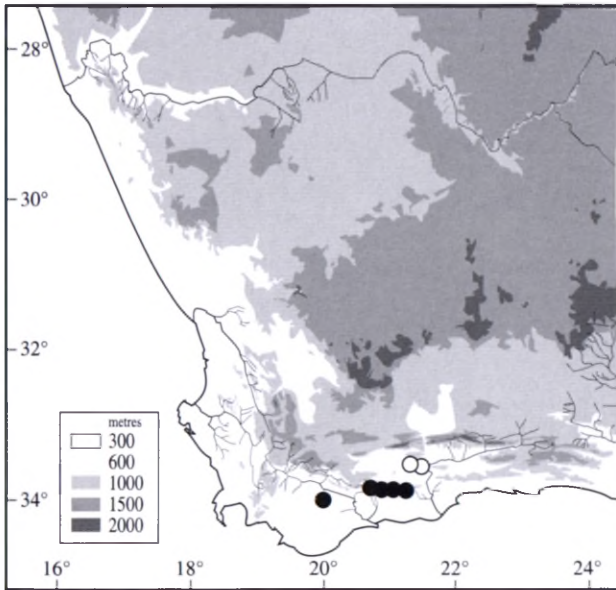


FIGURE 4.—Known distribution of *Nivenia argentea*, ●; *N. inaequalis*, ○.

Riviersonderend Mountains suggests that the type locality of the species is indeed this mountain range.

The name *Nivenia argentea* is thus correctly applied only to the populations of the species from the Langeberg and Riviersonderend Mountains, and the Rooiberg populations represent an unnamed species that we describe here as *N. inaequalis*.

Other material seen

WESTERN CAPE.—3320 (Montagu): Swellendam, Tradouwberg, (–DD), without date, *J. Bowie s.n.* (K); Langeberg East MCA, Compartment 8, S slopes of Horingberg, 3800' [1 160 m], (–DD), December 1984, *T.J. van der Merwe 31* (NBG, WICHT). 3321 (Ladismith): Garcia's Pass, (–CC), October 1926, *C. Thorne SAM38856* (NBG, SAM); Garcia State Forest Reserve, approaching Aasvoelkrans, 1 151 m, (–CC), 18 December 1988, *D.J. McDonald 1797* (NBG); Garcia Forest Reserve, Rooiwaterspruit overlooking Oudebosch, 600 m, (–CC), 21 November 1991, *D.J. McDonald 2107* (NBG); near Rooiwaterspruit huts, (–CC), 9 January 2007, *M. Grantham s.n.* (NBG); mountains at Garcia's Pass, (–CC), 2 October 1897, *Galpin 4664* (PRE), October 1931, *M.A. Pockock s.n.* (BOL); southern slope next to path from Rooiwaterspruit huts heading east, about 1 km from huts, 517 m, (–CC), 13 December 2006, *Custodians of Rare and Endangered Wildflowers s.n.* (MO, NBG); Sandkraal, Rooielsberg, (–CD), 5 December 1982, *Viviers 292* (PRE); northern Langeberg, northeast of Langkloof, 2 km west of Waterval Peak and 12 km east of Garcia's Pass, 1 100 m, (–CD), 3 July 2000 (fr.), *N.A. Helme 1730* (NBG); eastern Langeberg, summit ridge 1.5 km west of Doodkiesberg, 900 m, (–DC), 29 April 2006, *N.A. Helme 3922* (NBG); summit ridge of Perdeberg [Paardeberg], northwest of Bergfontein Farm, 1 120 m, (–DC), 27 April 2001, *N.A. Helme 1972* (NBG). 3420 (Bredasdorp): eastern Riviersonderend Mtns, 34°05'41.7"S 19°55'47.5"E, (–BB), 17 January 2007, *M. Grantham s.n.* (NBG). Without precise locality: Cape of Good Hope, *J. Niven s.n.* (BM), *W. Roxburgh s.n.* (BM); 'very high in the Swellendam Mountain', *Mackrill s.n.* (BM).

***Nivenia inaequalis* Goldblatt & J.C.Manning, sp. nov.**

Nivenia argentea sensu Goldblatt (1993), in part.

Plantae 400–800 mm altae, sempervirentes, caulibus pluribus e caudice lignoso compressis ellipticis, foliis distichis anguste lanceolatis (40–)55–90 × 2–3 mm, inflorescentia composita ex rhipidiis binatis bifloris in pseudoracemum congestum dispositis constanter, spathis

13–15 mm longis, bracteis siccis papyraceis albotranslucentibus, floribus caeruleis sessilibus heterodistylis, tubo perianthii 30–40 mm longo, tepalis patentibus lanceolato-ellipticis ± 18 × 5–6 mm, filamentis 7–8 mm longis (plantis brevistylis) vel 3 mm longis (plantis longistylis), antheris 1.0–1.5 mm longis flavis, ovario ± 1.5 mm longo, stylo in tubo incluso (plantis brevistylis) vel 6–8 mm exserto (plantis longistylis), lobulis styli 0.5 mm longis.

TYPE.—Western Cape, 3321(Ladismith): Rooiberg Mtns, next to forestry track near Bailey's Peak, 3300–4600' [1 000–1 400 m], (–CB), 29 December 1986, *J.H.J. Vlok 1794* (NBG, holo., K, MO, PRE, iso.).

Rounded evergreen shrubs, 400–800 mm high, branching from base. *Stems* ascending, with short spur-shoots in upper part, leafy portions ± 3 mm diam. *Leaves* crowded apically, narrowly lanceolate, (40–)55–90 × 2–3 mm. *Inflorescence* a congested, branched pseudoraceme, up to 20-flowered, lateral branches short, each node bearing a short-stalked, 2-flowered binate rhipidium; peduncle axis compressed, exserted (10–)15–30 mm from leaves, ultimate branches 3–4 mm long; inflorescence bracts lanceolate-attenuate, keeled, outer bracts ± 17 mm long, dry and white-translucent membranous and somewhat shorter; spathes tightly enclosing flower, lanceolate-attenuate, 13–15 mm long, dry and membranous, brown below and in midline, margins white-transparent; floral bracts enveloping tube, open to base, 22–25 mm long, dry and white-translucent throughout, becoming torn apically. *Flowers* salver-shaped, heterodistylous, blue, darker at tepal bases and white in throat and tube; perianth tube 30–40 mm long, widening gradually towards mouth; tepals elliptic-lanceolate, ± 18 × 5–6 mm, spreading. *Stamen filaments* inserted in mouth of tube, unequal with one shorter than others, either two 7–8 mm long and one ± 5 mm long (thrum flower) or two 3 mm long and one 1.5–2.5 mm long (pin flower); anthers 1.0–1.5 mm long before anthesis, yellow; pollen yellow. *Ovary* ± 1.5 mm long; style either included 2–3 mm below mouth of tube (thrum flower) or exserted 6–8 mm and reaching 2–4 mm beyond anthers, dividing into rounded lobes 0.5 mm long. *Fruit* a subglobose capsule, ± 6 × 4.0–4.5 mm. *Seeds* one per locule, shield-shaped, rugose, ± 4.5 × 3.5 mm. *Flowering time*: mainly November and December, occasionally out of season in February and March.

Distribution and ecology: *Nivenia inaequalis* is restricted to the upper reaches of the Rooiberg (Figure 4), an isolated massif southeast of Ladismith, where it occurs above 1 000 m on rocky ridges and summits in arid fynbos, usually in exposed sites in rock outcrops.

Diagnosis and relationships: *Nivenia inaequalis* is instantly recognized in the genus by its unequal stamens, with one filament shorter than the other two, and by the short, rounded, rather than linear or ± filiform style branches. The species is heterodistylous and in the pin morph the shorter stamen is included in the elongate perianth tube, which is 30–40 mm long. The floral bracts are very conspicuous, being silver-translucent throughout their length.

Nivenia inaequalis is most likely to be confused with *N. argentea* from the Langeberg and Riviersonderend

Mountains. Both species have a similar general aspect, forming rounded, leafy, cushion-like shrubs, and similar dry, lanceolate-attenuate bracts and a distinctive, compact, pseudoracemose inflorescence. This inflorescence type, however, is probably ancestral, being matched among the woody Iridaceae in *Witsenia* and, moreover, most like the inflorescence of *Aristea*, which is sister to the *Nivenioideae*–*Crocoideae* clade (Reeves *et al.* 2001). The 2-flowered, binate rhipidia of *N. inaequalis* represents the ancestral condition, whereas the single-flowered rhipidia of *N. argentea* are clearly derived. *Nivenia argentea* also differs from *N. inaequalis* in its slightly shorter perianth tube, 14–25 mm long, and specialized tubular bracts that are partially or completely brown. The equal stamens and linear style branches of *N. argentea* are unspecialized in the genus.

History: although first collected by T.M. Wurts in 1957, *Nivenia inaequalis* was invariably confused with *N. argentea* Goldblatt, and the fine illustrations published under the name *N. argentea* in *The woody Iridaceae* (Goldblatt 1993) actually represent this species.

Other material seen

WESTERN CAPE.—3321 (Ladismith): crest of Rooiberg west of Rooiberg Pass, 3600' [1 100 m], (–CB), 13 November 1957, *T.M. Wurts 1618* (NBG); Rooiberg crest road, 1 159 m. (–CB), 10 May 1983, *A.H. Marshall 30* (NBG); Ararat Ridge, 4100' [1 250 m], (–CB), 18 December 1977, *H.C. Taylor 9773* (NBG); south-facing slopes approaching Mount Ararat, 900 m, (–CB), 15 December 1989, *D.J. McDonald 1903* (NBG); upper north slopes of Rooiberg, forestry track, (–CB), 12 February 1997, *P. Goldblatt 10614* (MO); ridge west of Teeboskop above Assegaaiiboskloof, 3000' [915 m], (–DA), 9 November 1974, *E.G.H. Oliver 5351* (NBG, PRE); Teeboskop area, 3000' [915 m], (–DA), 2 November 1987, *P. Goldblatt & J.C. Manning 8558* (MO, NBG).

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