



Massonia dentata (Asparagaceae, Scilloideae), a new species from the Nuweveldberge, and typification of the Sneeuberg endemic *M. calvata* (southern Great Escarpment, South Africa)

MARIO MARTÍNEZ-AZORÍN^{1,2}, VINCENT RALPH CLARK³, MICHAEL PINTER¹, ANTHONY P. DOLD⁴, MANUEL B. CRESPO², NIGEL P. BARKER³, MARTIN PFOSSER⁵ & WOLFGANG WETSCHNIG^{1*}

¹Institute of Plant Sciences, NAWI Graz, Karl-Franzens-University Graz, Holteigasse 6, A-8010 Graz, Austria; e-mail: wolfgang.wetschnig@uni-graz.at

²CIBIO (Instituto Universitario de la Biodiversidad), Universidad de Alicante, P. O. Box 99, E-03080 Alicante, Spain.

³Great Escarpment Biodiversity Programme, Department of Botany, Rhodes University, Grahamstown, 6140 South Africa.

⁴Selmar Schonland Herbarium, Department of Botany, Rhodes University, Grahamstown 6140 South Africa.

⁵Biocenter Linz, J.-W.-Klein-Str. 73, A-4040 Linz, Austria.

*author for correspondence

Abstract

As part of a taxonomic revision of the genus *Massonia* Houtt., a new species, *Massonia dentata* Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig, is here described from the Nuweveldberge on South Africa's southern Great Escarpment. This new species is, at first sight, related to *M. calvata* Baker and *M. echinata* L.f., but it differs in floral and vegetative characters, such as the dentate perigone segments and bracts, leaves with numerous emergences, each bearing a thickened trichome, as well as in its ecology and distribution. A complete description of the new species and data on its biology, habitat, and distribution are presented. The close relative *Massonia calvata* Baker, an overlooked endemic from the Sneeuberg Centre of Floristic Endemism in South Africa, is lectotypified.

Key words: Flora of Southern Africa, Hyacinthaceae, Massonieae, Taxonomy.

Introduction

Hyacinthaceae *sensu* APG (2003) comprises ca. 1000 species of bulbous plants distributed through Africa and Europe extending to Asia, with only *Oziroë* Rafinesque (1837: 53) occurring in South America (Speta 1998a, b, APG 2003). Four monophyletic clades are accepted as the subfamilies Hyacinthoideae, Ornithogaloideae, Oziroëoideae and Urgineoideae within Hyacinthaceae (Speta 1998b, Pfosser & Speta 1999, Manning *et al.* 2004, Martínez-Azorín *et al.* 2011). Alternatively Hyacinthaceae is treated as Asparagaceae subfamily Scilloideae, and consequently the former subfamilies are reduced to the tribes Hyacintheae, Ornithogaleae, Oziroëeae and Urgineae (APG 2009, Chase *et al.* 2009). However, we favour Hyacinthaceae at family rank based on morphological grounds.

As in other groups in Hyacinthaceae, generic circumscription within tribe Massonieae has been a matter of controversy during the last decades (see Wetschnig *et al.* 2014 for a general overview on this point). The taxonomic history of the genus *Massonia* and the species concepts are discussed in Pinter *et al.* (2013) and Martínez-Azorín *et al.* (2013).

Baker (1878) described *Massonia calvata* Baker (1878: 321) (Fig. 1). This species was characterized as follows: “Leaves 2, [...] face when young tuberculato-hispid, when older smooth and glabrous” an uncommon behavior reflected in the specific epithet. A single collection was cited in the original description, *Bolus* 749! from the “Cape Colony, eastern district”. The study of the type collection *Bolus* 749, which was mounted on two herbarium sheets with different labels (K 000257142!, K 000257143!), evidence that it includes plants collected from at least two different localities and at different elevations, and probably collected at different times. Therefore, lectotypification of this species is required, and is effected below.

Massonia calvata has been synonymized into *Massonia echinata* Linnaeus (1782: 193) by Jessop (1976), Van der Merwe (2002) and Summerfield (2004), in which the latter taxon included 24, 17 and 19 names respectively under synonymy. In those concepts, *Massonia echinata* was circumscribed as extremely variable in morphology, including a very large variation on leaf morphology and indumentum, and therefore being very difficult to characterize. Müller-Doblies & Müller-Doblies (1997) circumscribed *M. echinata* in a much narrower sense, citing the following

combination of morphological characters “sigmoid curve at the base of the tepals segments combined with a more or less open throat of the filament tube and with pustulate leaves, bearing one to few short stiff hairs on each pustule”. Moreover, they commented: “It is in fact not easy to tackle the *M. echinata* group. It appears, however, that sufficient discontinuity exists together with geographic evidence to recognize at least three or four further species.” and they cited “We have only found it [*Massonia echinata*] at two localities, Vanrhynspas and the Karoo National Park”. Furthermore, they illustrated flowers from both localities in comparison with the type of *M. echinata*. It is worth mentioning that the drawing of the flower from the Karoo National Park (Müller-Doblies leg n° 84057c; Fig. 5e, pag. 71), shows at least one of the tepals with two teeth, differing from the flower from Vanrhynspas (Müller-Doblies leg n° 77060c; Fig. 5d, pag. 71), in which the perigone segments are entire.

As a result of the field work carried out by Clark (2010) and Clark *et al.* (2011a, b), plants at first sight related to *M. calvata* and *M. echinata* were found growing on rocky places at high elevation in two localities in the Nuweveldberge (Western Cape Province). They show clear morphological and ecological differences which warrant description of a new species, *Massonia dentata* Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig, as done below.

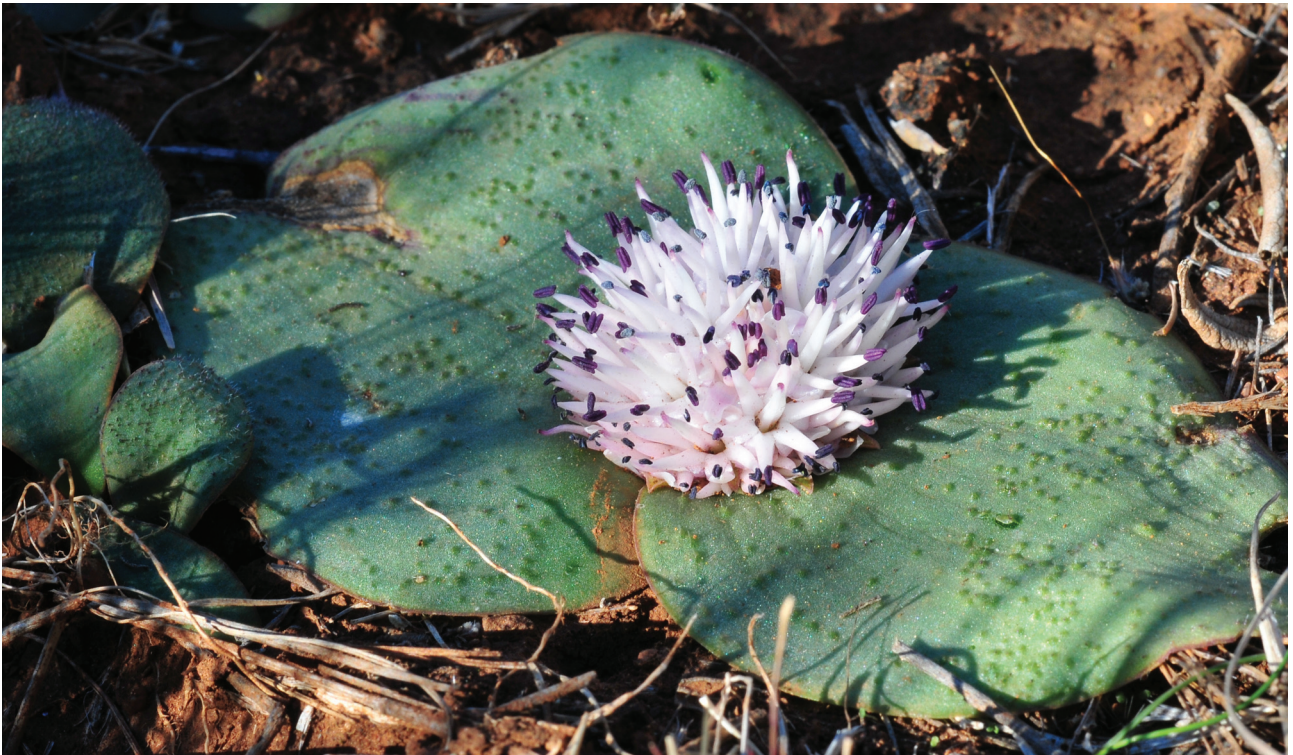


FIGURE 1. *Massonia calvata* Baker from near the type locality showing immature plants on the left side bearing numerous pustules and hairs and a flowering plant with leaves bearing scarce pustules and almost absent hairs (Eastern Cape, Graaff Reinet, Camdeboo National Park, Valley of Desolation, corresponding to *A.P.Dold 14008* (GRA); Photographed 10 June 2014).

Materials and Methods

Detailed morphological studies of *Massonia dentata*, *M. calvata* and *M. echinata* were undertaken from natural populations and cultivated specimens as detailed in Martínez-Azorín *et al.* (2007, 2009). Details on number of species, populations and individuals studied in this work are provided in Table 1. Plants were grown and they flowered in Grahamstown, South Africa. Morphological measurements of flower parameters were performed on fresh material from cultivated plants. It has been proved that flowers obtained in a greenhouse keep the size and proportions of in situ flowers, as they are addressed to the fixed size of their pollinators (Müller-Doblies & Müller-Doblies 2002, Wetschnig *et al.* 2012, Martínez-Azorín *et al.* 2013, 2014, Pinter *et al.* 2013). For SEM-micrographs of the leaf-surface, an 8 × 5 mm section of one leaf was fixed in 70% ethanol. After substitution of ethanol by acetone, critical point drying was performed using a Baltec CPD030. The leaf then was mounted on aluminium stubs and coated with gold in an Agar sputter coater. Electron micrographs were obtained with a Philips XL 30 ESEM scanning electron microscope (SEM) operating at 20 kV. Herbarium specimens were studied from the herbaria ABH, GZU, K, GRA, and LI (acronyms according to Thiers 2014). Author names of the cited taxa follow IPNI (2014). *Massonia echinata* L.f. is treated in the sense of Müller-Doblies & Müller-Doblies (1997).

TABLE 1. List of investigated taxa in the present study, with voucher, locality information and number of specimens studied per population. All vouchers are deposited at ABH, GRA and GZU herbaria. Abbreviations: APD = Anthony P. Dold; VRC = V. Ralph Clark; WW = Wolfgang Wetschnig.

Taxon	Voucher	N° of plants studied	Locality
<i>Massonia dentata</i> Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig.	VRC & Cerros 471 (GRA, NBG)	5	ZAF: Nuweveldberge, Farm Grootvlei
	VRC & Cerros 591 (GRA, NBG)	2	ZAF: Nuweveldberge, Karoo National Park
<i>Massonia calvata</i> Baker	APD 14008 (GRA)	6	ZAF: Sneeuberge, Valley of Desolation
	VRC & McKenzie 459 (GRA)	3	ZAF: Sneeuberge, Pearston, Blinkberg
<i>Massonia echinata</i> L.f.	WW01161 (GZU)	3	ZAF: Nieuwoudtville, Vanrhynspas
	WW03970 (GZU)	6	ZAF: Nieuwoudtville, Vanrhynspas
	WW03974 (GZU)	3	ZAF: Nieuwoudtville, Hantam Bot. Garden
	WW03975 (GZU)	5	ZAF: Nieuwoudtville, Hantam Bot. Garden

Description of the new species

Massonia dentata Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig, *sp. nov.* (Figs. 2–8)

Ab *M. calvata* et *M. echinata* similis, sed eis et omnibus speciebus generis facile distinguitur et precipue differt segmentis perianticis bracteisque dentatis; foliis semper ad margines ciliis inequalibus munitis atque supra 80–230 pustulis (ca. 0.5 mm diametro) pro cm² obsitis quae minutae sunt et trichomate 100–300 µm longo, suberecto, incrassato, anguste conico ferens; filamentis insuper tubo periantico brevissime connatis (minus quam 1 mm long.).

Type:—SOUTH AFRICA. Western Cape, Beaufort West (3222AB): Nuweveldberge, ca. 20 km NW Beaufort West, Farm Grootvlei 193, ex hort. in Grahamstown on 15 May 2010, *V.R. Clark & R. Cerros 471b* (holotype: GRA!; isotypes: ABH!, GZU!).

Herbaceous perennial plant. Bulb ovoid, 15–18 × 14–16 mm, inner scales fleshy and white, outer tunics papery and brownish. Leaves 2, deciduous, opposite, spreading and appressed to the ground, synanthous, (2.5–)3–6(–6.5) × (2–)2.5–4.5(–5) cm, ovoid to suborbicular with acute to obtuse apex, with a short apiculum 0.5–1 mm long, narrowed into a petiole 10–15 mm long that clasps the peduncle and the inflorescence, green on both sides, all leaves (from first year to mature plants) with 80–230 emergences/cm² and ca. 0.5 mm in diameter only present on the adaxial side, which bear a thickened, suberect to declinate, narrowly conical trichome on top, 100–300 µm long, sometimes bearing 2–3 trichomes when some emergences are placed together, with a narrow membranous margin of 0.2–0.3 mm wide bearing minute papillae on the adaxial side, and short and much longer hairs placed together on the edge. Inflorescence a dense, subcapitate raceme, 1–3 cm long, with (7–)9–16(–20) flowers, shortly overtopping ground level. Bracts membranous, green with a purplish flush and purplish margins in the upper half and white below, translucent after flowering, glabrous with distinctly dentate and denticulate margins, acuminate; lower bracts obovate, 14–17 × 8–10 mm; upper bracts narrowly obovate, 13–16 × 6–10 mm. Pedicels of flowers 2–6 mm long. Flowers tubular. Perigone white, free segments (6–)7–8(–9) × 1.5–2 mm, toothed, greenish at the tip and in the middle longitudinally, first straight and erect, later spreading and finally reflexed and infolded at the base at anthesis, but not strongly rolled in. Perigone-filaments tube 9–13 × 2–4 mm, cylindrical and slightly widening at the upper portion, white. Filaments white, (6–)7–9 mm long, rather fleshy and thickened, suberect to spreading, straight, attenuate, shortly connate at the base for less than 1 mm above the perigone segments, with an hexagonal mouth of the tube with slightly convex sides; anthers 2–2.5 mm long when closed, oblong, dark blue, dorsifixed, with dark blue pollen. Gynoecium cenocarpous-syncarpous. Ovary narrowly oblong, green, 4–5 × 1–1.5 mm, gradually tapering into the style. Style white with purple tip, thickened, gradually tapering to the apex, 15–17 mm long at anthesis, ending about at the same level than the stamens or shortly overtopping them. Capsule and seeds unknown (Figs. 2–8).



FIGURE 2. *Massonia dentata* Mart.-Azorin, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig *in situ*. Above, plant at the type locality at the farm Grootvlei 193, NW of Beaufort West (corresponding to Clark & Cerros 471 GRA); below, eastern-most specimen (corresponding to Clark & Cerros 591 GRA).



FIGURE 3. Bulb with young leaves of *Massonia dentata* Mart.-Azorín. V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. Scale bar: 1 cm.

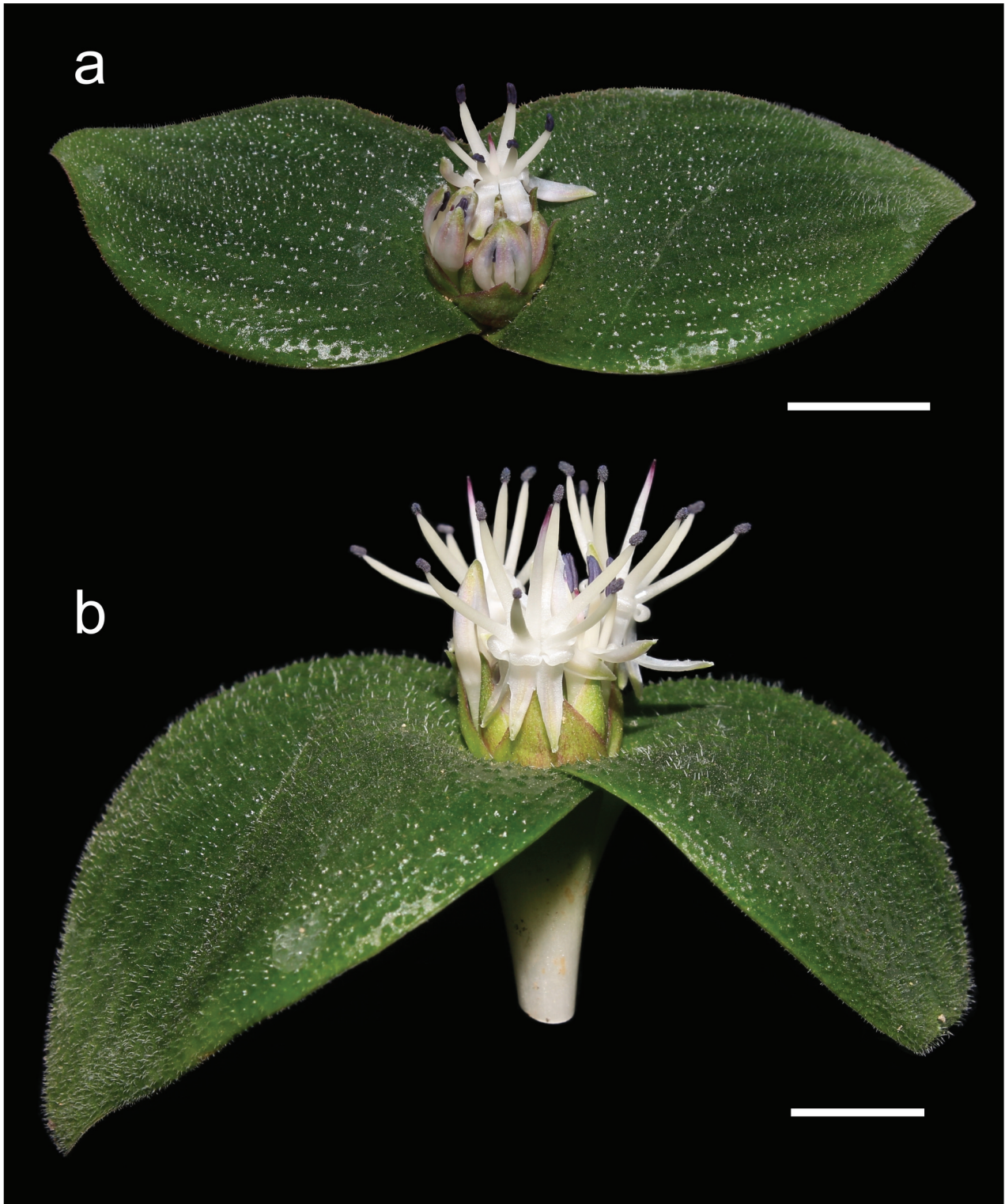


FIGURE 4. *Massonia dentata* Mart.-Azorín. V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. A. General view; B. Inflorescence and leaves, lateral view. Scale bars: 1 cm.

Etymology:—Named after the toothed margins of the perigone segments and bracts, a character unknown in any other species of *Massonia*; (*dentatus*, *-a*, *-um* = toothed) (Fig. 5–7).

Biology:—Leaves are found in March in wild populations. *Massonia dentata* flowers in May in cultivation in Grahamstown, South Africa.

Habitat:—*Massonia dentata* is confined to the summit plateau of the eastern Nuweveldberge, between 1500 and 1800 m. It occurs in dolerite rock crevices at the base of cliffs, and in rocky doleritic soils alongside seasonal

streams. The vegetation of the eastern Nuweveldberge at these higher elevations is a blend of marginal grassland (forming part of Mucina & Rutherford's 2006 Karoo Escarpment Grassland), Upper Karoo Hardeveld (Nama-Karoo Biome; Mucina & Rutherford 2006), and an unclassified 'Renosterveld'-type of montane shrubland dominated by *Elytropappus rhinocerotis* Lessing (1832: 344) (Fig. 9). This region shows a seasonal rainfall mainly in autumn and summer peaking in March, with a mean of annual rainfall of 250–350 mm (Mucina & Rutherford 2006).



FIGURE 5. *Massonia dentata* Mart.-Azorin. V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. A. Inflorescence, lateral view; B. Bracts. Scale bars: 1 cm.

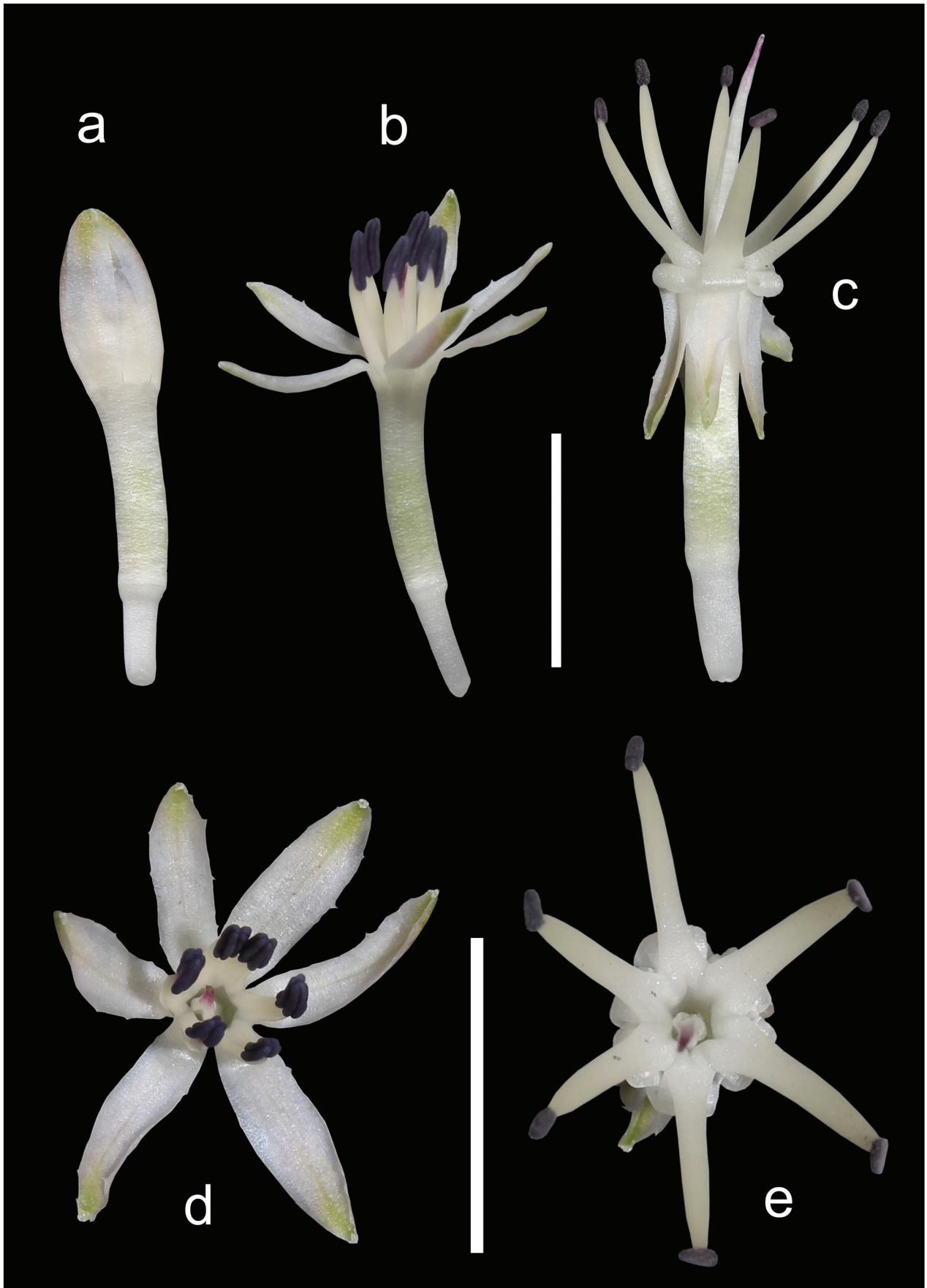


FIGURE 6. Flower morphology and their stages of development in *Massonia dentata* Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. A. Flower in bud, lateral view; B. Open flower with spreading perigone segments, lateral view; C. Mature flower with dehiscent anthers and enrolled and sigmoid perigone segments; D. Flower after opening, apical view; E. Mature flower, apical view. Scale bars: 1 cm.



FIGURE 7. Dissected flowers of *Massonia dentata* Mart.-Azorin, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. A. Dissected flower after opening, lateral view; B. Dissected mature flower, lateral view. Scale bar: 1 cm.

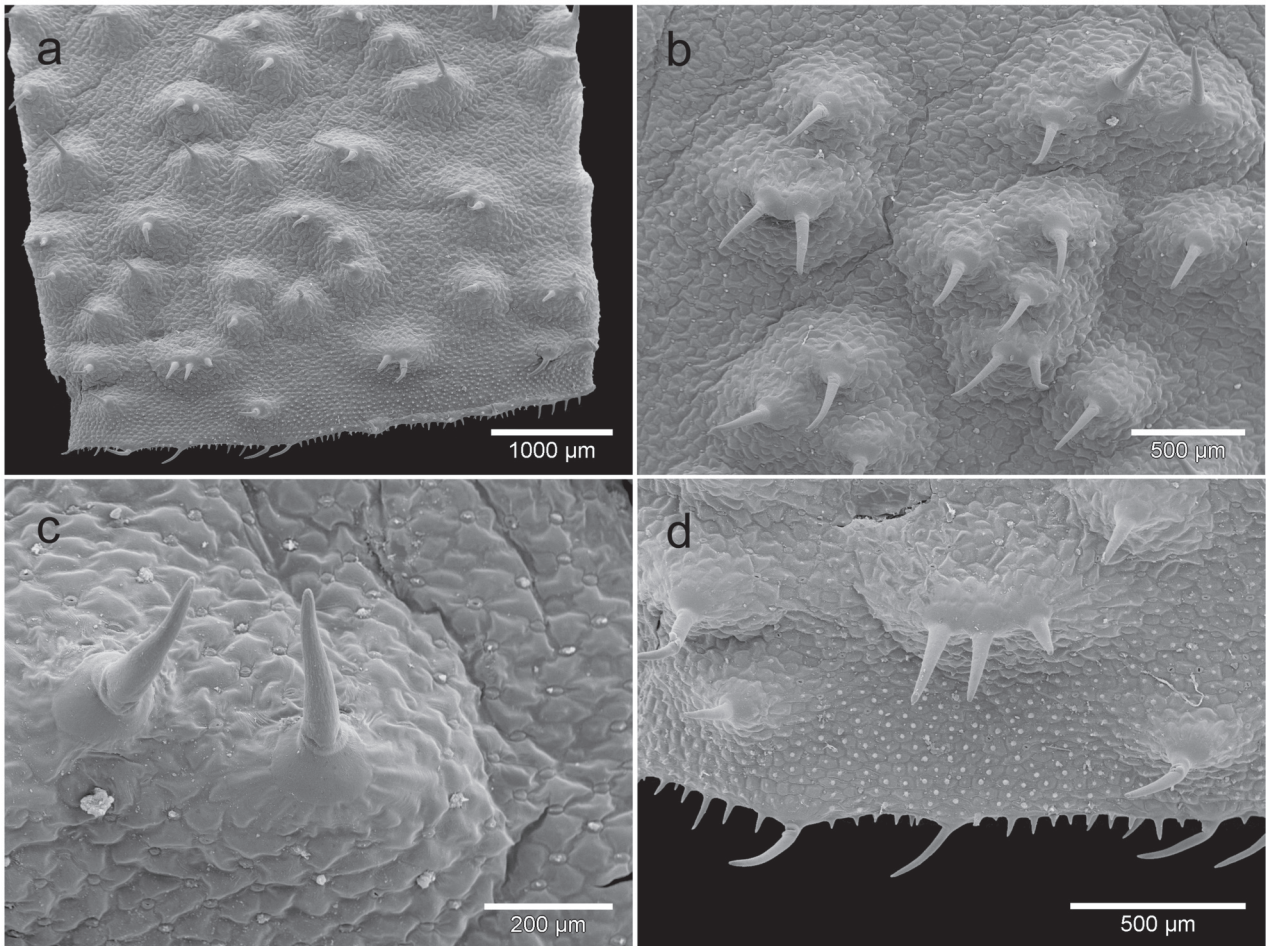


FIGURE 8. SEM image of leaf surface in *Massonia dentata* Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. A. Section of a leaf showing leaf emergences with trichomes and leaf margin on the lower edge; B. Detail of several emergences with trichomes; C. Detail of two emergences with trichomes; D. Detail of a leaf margin with minute papillae and hairs of different length.

Distribution:—Known from two localities 10 km apart in the far eastern Nuweveldberge, Western Cape Province, South Africa. This distribution includes the highest elevations of the Karoo National Park (Fig. 10). It is only the seventh endemic plant species known from the drought-prone Nuweveldberge, after the six listed by Clark *et al.* (2011a). It is worth mentioning that Van der Merwe (2002) cited the collection “3320 (Montagu): Mountainview, Karoo National Park, (-BA), *Bruyns 3358* (BOL!)” under *Massonia pustulata* Jacq. (1791: 177). Although it seems that the quarter degree given was an error, the locality in the Karoo National Park, and the fact that the specimen was included in *M. pustulata* (therefore most probably bearing pustules) points out that it could represent the third known locality of *Massonia dentata*. As the *Massonia* specimens kept at BOL are currently on loan, we were not able to study that specimen and it should be considered in future works.

Taxonomic relationships:—*Massonia dentata* can be easily distinguished from all other species in the genus by the combination of toothed perigone segments and bracts, leaves in all stages with numerous emergences, each bearing a thickened trichome, and margins with hairs of different lengths (Figs. 2–8). Its closest known relative appears to be *M. calvata*, but the latter differs by the leaves in flowering individuals with almost absent or scarce emergences and trichomes, the entire perigone segments and bracts, and the shorter and wider ovary, among other characters (Table 1, Fig. 1). *Massonia echinata* sensu Müller-Doblies & Müller-Doblies (1997) differs from *M. dentata* by the usually larger leaves, with scarce small pustules, the minutely denticulate leaf margin, the entire perigone segments and bracts, the reflexed, infolded and spirally curled in perigone segments, the mouth of the perigone-filaments tube with 6 gibbositities and its different distribution (see Wetschnig *et al.* 2012) (Table 2). Furthermore, remarkable differences exist in the distribution of the cited taxa. *Massonia echinata* appears to be endemic to a small area in the surroundings of Nieuwoudtville and the Vanrhynspas, whilst *M. dentata* is only known from the eastern Nuweveldberge, being more than 300 km apart. Finally, according to our data *Massonia calvata* is endemic to the Sneeuberge, a different mountain range located ca. 150 km to the east of the Nuweveldberge (Fig. 10). As explained before, the collection *Bruyns 3358* (BOL!) was identified as *Massonia pustulata*, however, the latter species clearly differs from *M. dentata* by distinct characters (Wetschnig *et al.* 2012).



FIGURE 9. Habitat of *Massonia dentata* Mart.-Azorin, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig. Above, view over the eastern Nuweveldberge plateau in the Karoo National Park, showing the typical combination of Karoo Escarpment Grassland, Upper Karoo Hardeveld and (unnamed) montane renosterveld; below, the seasonal/episodic watercourse on the summit of the Nuweveldberge next to which the type specimen was collected.

Additional specimens studied (paratypes):—South Africa. Western Cape: Beaufort West (3222AB): Nuweveldberge, ca. 20 km NW Beaufort West, Farm Grootvlei 193, alt. 1720 m, 08 March 2008, *V.R. Clark & R. Cerros 471a* (GRA!, NBG!); Beaufort West (3222BA): Nuweveldberge, Karoo National Park, 12 March 2008, alt. 1670 m, SANParks, *V.R. Clark & R. Cerros 591* (GRA!, NBG!).

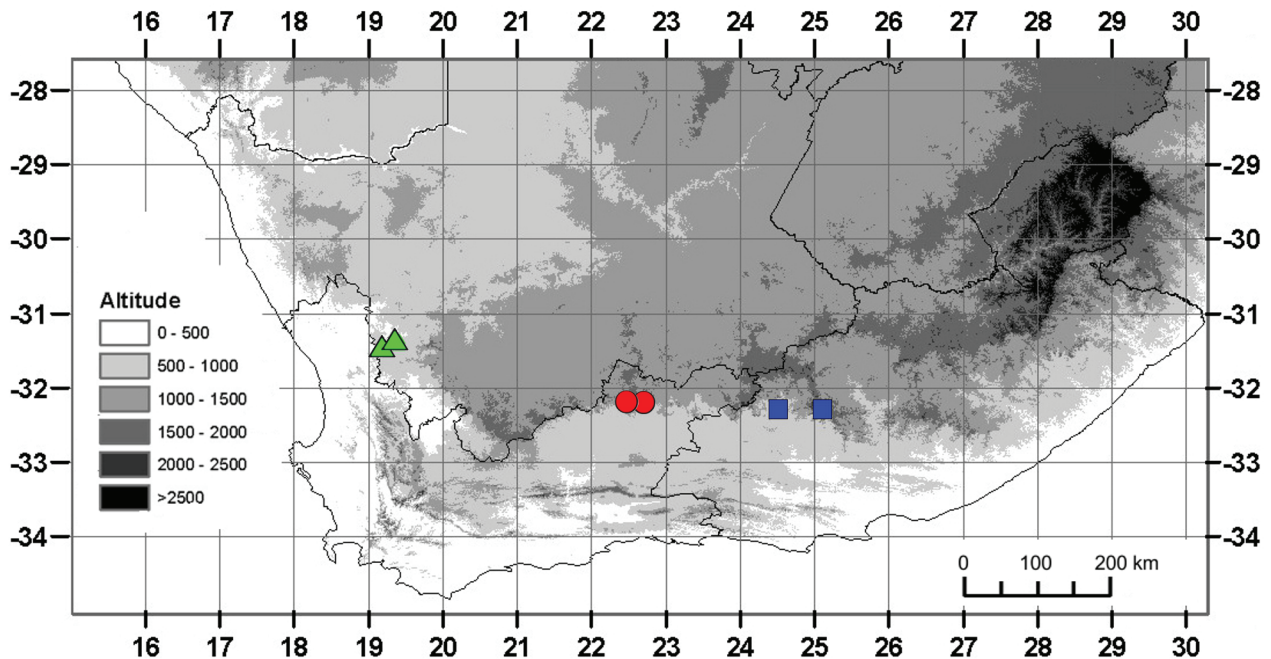


FIGURE 10. Known distribution of *Massonia dentata* Mart.-Azorín, V.R.Clark, M.Pinter, M.B.Crespo & Wetschnig (red circles), *M. calvata* Baker (blue squares) and *M. echinata* L.f. (green triangles) in South Africa.

Typification of *Massonia calvata*

The original description of *Massonia calvata* (Baker 1878) includes the following information: “Leaves 2, [...] face when young tuberculato-hispid, when older smooth and glabrous” an uncommon behavior reflected in the specific epithet. Furthermore, the flowers were described as “Perianth white, 1/3 in. long; segments lanceolate, equaling the tube. Filaments as long as the perianth-segments; anthers minute, oblong.” A single herbarium specimen was cited in the protologue, *Bolus 749!* collected in the “Cape Colony, eastern district”. Baker (1897) added further data as follows: “leaves [...] glabrous when mature, slightly tuberculato-hispid when young, [...] perianth white, ½ in. long [...] Central Region: mountains near Graaff Reinet, 4400-5500 ft., *Bolus, 749!*”. The study of the type collection *Bolus 749* (K 000257142!, K 000257143!) provides further information. The label of the herbarium sheet K 000257142! shows: “Rec. 12/70; H. Bolus Austro-Africanæ; N° 749, Flor Junio, Alt. 4400 ped; *Massonia* between *echinata* v *sanguinea*; In montibus prope Graaff Reinet; Foliis junioribus tuberculato-hispidis; *M. calvata* Baker in Journ. Bot. 1878/321”. Moreover, a hand written annotation in pencil reads “4400 ft; large specimens on Sneeberg (sic.) 5500 ft”. Furthermore, a solid line in pencil separates the much larger plants in the upper part of the sheet from the lower much smaller plants, this agreeing with the information given in pencil about two different collections. A second herbarium sheet exists under the number *Bolus 749* (K 000257143!). The label of this collection says: “*Massonia* cf. *versicolor*; near Graaff Reinet; n° 749 *Bolus 7/76*; *M. calvata*, Baker”. It is evident therefore that the collection *Bolus 749* includes plants collected from at least two different localities and elevations and most probably collected at different times. According to Art. 40.2 of the ICN (*Melbourne Code*; McNeill & al., 2012), typification of one taxon is achieved “by reference to an entire gathering, or a part thereof, even if it consists of two or more specimens”, and assuming that a specimen is “a gathering, or part of a gathering, of a single species or infraspecific taxon made at one time, disregarding admixtures” (Art. 8.2). Therefore we select below a lectotype among the original material of the species (K 000257142!, K 000257143!). Our selection confirms that this name applies to a previously overlooked species endemic to the Sneeberg Centre of Floristic Endemism (Clark *et al.* 2009).

Massonia calvata Baker (1878: 321). Type (designated here):—South Africa. Eastern Cape: In montibus prope Graaff Reinet, June, alt. 4400 ped, *Bolus 749* (lectotype, K 000257142!, only the small specimens placed in the lower portion of the sheet separated by a solid pencil line and corresponding to “alt. 4400 ped”).

TABLE 2. Comparison of main characters of *Massonia dentata*, *M. calvata* and *M. echinata* sensu Müller-Doblies & Müller-Doblies (1997).

	<i>M. dentata</i>	<i>M. calvata</i>	<i>M. echinata</i>
Leaf length (cm)	(2.5–)3–6(–6.5)	(4–)5–9	(4–)6–14
Leaf width (cm)	(2–)2.5–4.5(–5)	(2.5–)3.5–6	3–8
Emergences number/cm ² in leaves of immature plants	80–230	30–60	0–30
Emergences number/cm ² in leaves of flowering plants	80–230	0–50	0–30
Emergences diameter (mm)	ca. 0.5	0.1–0.5	0.3–0.4
Leaf trichomes length (µm)	100–300	100–300	100–500
Leaf margin	ciliate, with short and much longer hairs on the edge and minutely papillate on the narrow membranous margin	denticulate in smooth-glabrous leaves or ciliate with short and longer hairs in leaves with emergences and trichomes	minutely denticulate-papillate on margin and edge
Bracts	distinctly dentate and denticulate	denticulate	entire
Free perigone segments	dentate reflexed and infolded at the base at anthesis	entire reflexed, infolded and spirally curled in at the base at anthesis	entire reflexed, infolded and spirally curled in at the base at anthesis
Perigone-filaments tube length (mm)	9–13	8–11	8–14
Perigone-filaments tube width (mm)	2–4	3–3.5	2–4
Filament length (mm)	(6–)7–9	7–10	8–13
Filaments-tube length (mm)	< 1	< 1	0–0.5
Anther length before opening (mm)	2–2.5	2–2.5	2–3
Anther colour	dark blue	dark blue	pale blue-violet
Ovary length (mm)	4–5	3–4	4–5
Ovary width (mm)	1–1.5	(1.5)2–2.5	2
Style length (mm)	15–17	9–16	14–20
Distribution	Nuweveldberge	Sneeuberge	Nieuwoudtville area

Acknowledgements

This work was partly supported by Fundación Ramón Areces (Spain), University of Alicante (Spain) and Karl-Franzens-University (Austria). Rhodes University (Dept. of Botany) and the Selmar Schonland Herbarium (GRA) also provided working facilities to the first author between 2009 and 2011. The Department of Environment and Nature Conservation of Northern Cape Province and CapeNature of Western Cape Province provided permission to collect herbarium specimens (collecting permits numbers FLORA069/2011, and AAA008-00031-0028 respectively). A grant from the Republic of South Africa to the senior author in 1987 to collect materials for this study is highly appreciated. We thank D. Bellstedt and L. Mucina for their invaluable help on our field trip in 2009. We also thank E. Stabentheiner and S. Laure for providing the SEM micrographs. Sincere thanks also go to A. Martínez-Soler and C. Huber who kindly helped in the field work. *Massonia dentata* was collected by the second author during fieldwork towards his PhD, with study and fieldtrip funding variously from the National Research Foundation (NRF; Grant GUN 2069059), a freestanding South African Biosystematics Initiative (SABI) grant, Buk'Indalo Consultancy cc (Durban), the National Geographic Society, and the Cape Tercentenary Foundation. The South African National Parks

and CapeNature kindly granted permissions to collect material in the Karoo National Park and Western Cape Province respectively. Mr. Richard Wilmot of the Farm 'Grootvlei' is thanked for permission to access and collect specimens on his property. We also thank Neil Crouch for sharing with us photographs of wild populations of *Massonia calvata*.

References

- Angiosperm Phylogeny Group (2003) An update of the Angiosperm Phylogeny Group Classification for the orders and families of flowering plants: APG II. *Botanical Journal of the Linnean Society* 141: 399–436.
<http://dx.doi.org/10.1046/j.1095-8339.2003.t01-1-00158.x>
- Angiosperm Phylogeny Group (2009) An update of the Angiosperm Phylogeny Group Classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society* 161: 105–121.
<http://dx.doi.org/10.1111/j.1095-8339.2009.00996.x>
- Baker, J.G. (1878) Descriptions of new and little known Liliaceae. *Journal of Botany, British and Foreign*. London 16: 321–326.
- Baker, J.G. (1897) Liliaceae. In: Thiselton-Dyer, W.T. (Ed.) *Flora Capensis* 6. Reeve and Co., London, pp. 253–525.
- Chase, M.W., Reveal, J.L. & Fay, M.F. (2009) A subfamilial classification for the expanded asparagalean families, Amaryllidaceae, Asparagaceae and Xanthorrhoeaceae. *Botanical Journal of the Linnean Society* 161: 132–136.
<http://dx.doi.org/10.1111/j.1095-8339.2009.00999.x>
- Clark, V.R., Barker, N.P. & Mucina, L. (2009) The Sneeuberg: a new centre of endemism on the Great Escarpment, South Africa. *South African Journal of Botany* 75: 196–238.
<http://dx.doi.org/10.1016/j.sajb.2008.10.010>
- Clark, V.R. (2010) *The Phytogeography of the Sneeuberg, Nuweveldberge and Roggeveldberge (Great Escarpment): Assessing Migration Routes and Endemism*. PhD Thesis, Rhodes University, 337 pp.
- Clark, V.R., Barker, N.P. & Mucina, L. (2011a) A phytogeographic assessment of the Nuweveldberge, South Africa. *South African Journal of Botany* 77: 147–159.
<http://dx.doi.org/10.1016/j.sajb.2010.07.011>
- Clark, V.R., Barker, N.P. & Mucina, L. (2011b) The Great Escarpment of southern Africa a new frontier for biodiversity exploration. *Biodiversity Conservation* 20: 2543–2561.
<http://dx.doi.org/10.1007/s10531-011-0103-3>
- IPNI (2014) *The International Plant Names Index*. Available at <http://www.ipni.org> (accessed March 2014).
- Jacquin, N.J. (1791) *Collectanea ad Botanicam, Chemiam, et Historiam Naturalem, Spectantia, cum Figuris* 4. Wappler, C.F., Vindobonae, 359 pp.
- Jessop, J.P. (1976) Studies in the bulbous Liliaceae in South Africa 6. The taxonomy of *Massonia* and allied genera. *Journal of South African Botany* 42: 401–437.
<http://dx.doi.org/10.5962/bhl.title.51470>
- Lessing, C.F. (1832) *Synopsis generum compositarum earumque dispositionis novae tentamen monographiis multarum capensium interjectis*. Druncker & Humblot, Berlin, 473 pp.
- Linnaeus, C. fil. (1782) *Supplementum plantarum Systematis vegetabilium editionis decimae tertiae, Generum plantarum editionis sextae, et Specierum plantarum editionis secunda*. Brunsvigae, 468 pp.
<http://dx.doi.org/10.5962/bhl.title.555>
- Manning, J.C., Goldblatt, P. & Fay, M.F. (2004) A revised generic synopsis of Hyacinthaceae in Sub-Saharan Africa, based on molecular evidence, including new combinations and the new tribe Pseudoprosperaeae. *Edinburgh Journal of Botany* 60: 533–568.
<http://dx.doi.org/10.1017/s0960428603000404>
- Martínez-Azorín, M., Crespo, M.B. & Juan, A. (2007) Taxonomic revision of *Ornithogalum* subg. *Cathissa* (Salisb.) Baker (Hyacinthaceae). *Anales del Jardín Botánico de Madrid* 64: 7–25.
<http://dx.doi.org/10.3989/ajbm.2007.v64.i1.47>
- Martínez-Azorín, M., Crespo, M.B. & Juan, A. (2009) Taxonomic revision of *Ornithogalum* subg. *Beryllis* (Hyacinthaceae) in the Iberian Peninsula and the Balearic Islands. *Belgian Journal of Botany* 142: 140–162.
- Martínez-Azorín, M., Crespo, M.B., Juan, A. & Fay, M.F. (2011) Molecular phylogenetics of subfamily Ornithogaloideae (Hyacinthaceae) based on nuclear and plastid DNA regions, including a new taxonomic arrangement. *Annals of Botany* 107: 1–37.
<http://dx.doi.org/10.1093/aob/mcq207>
- Martínez-Azorín, M., Pinter, M., Crespo, M.B., Pfosser, M. & Wetschnig, W. (2013) *Massonia mimetica* (Hyacinthaceae, Hyacinthoideae), a new remarkable species from South Africa. *Stapfia* 99: 187–197.

- Martínez-Azorín, M., Pinter, M., Deutsch, G., Brudermann, A., Dold, A.P., Crespo, M.B., Pfosser, M. & Wetschnig, W. (2014) *Massonia amoena* (Asparagaceae, Scilloideae), a striking new species from the Eastern Cape, South Africa. *Phytotaxa*: in press.
- McNeill, J., Barrie, F.R., Buck, W.R., Demoulin, V., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Marhold, K., Prado, J., Prud'homme van Reine, W.F., Smith, G.F., Wiersma, J.H. & Turland, N.J. (Eds.) (2012) *International Code of Nomenclature for algae, fungi, and plants (Melbourne Code)*. Adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011. [Regnum Vegetabile 154]. A.R.G. Gantner, Ruggell, 240 pp.
- Mucina, L. & Rutherford, M.C. (2006) *The vegetation of South Africa, Lesotho and Swaziland. Strelitzia* 19. South African National Biodiversity Institute, Pretoria, 807 pp.
- Müller-Doblies, U. & Müller-Doblies, D. (1997) A partial revision of the tribe Massonieae (Hyacinthaceae). *Feddes Repertorium* 108: 49–96.
- Müller-Doblies, U. & Müller-Doblies, D. (2002) De Liliifloris Notulae 7. De decuria altera specierum novarum generis *Androcymbium* (Colchicaceae) in Africa Australi s.l. *Feddes Repertorium* 113: 545–599.
<http://dx.doi.org/10.1002/fedr.19981090712>
- Pinter, M., Brudermann, A., Crespo, M.B., Deutsch, G., Martínez-Azorín, M., Müller-Doblies, U., Müller-Doblies, D., Pfosser, M. & Wetschnig, W. (2013) *Massonia citrina* (Hyacinthaceae, Hyacinthoideae) - a new species from the Western Cape Province (South Africa). *Phytotaxa* 112: 50–56.
<http://dx.doi.org/10.11646/phytotaxa.112.2.3>
- Pfosser, M. & Speta, F. (1999) Phylogenetics of Hyacinthaceae based on plastid DNA sequences. *Annals of the Missouri Botanical Garden* 86: 852–875.
<http://dx.doi.org/10.2307/2666172>
- Rafinesque, C.S. (1837) *Flora Telluriana* 3. H. Probasco, Philadelphia, PA, 100 pp.
- Speta, F. (1998a) Hyacinthaceae. In: Kubitzki, K. (Ed.) *The families and genera of vascular plants* 3. Springer, Berlin, pp. 261–285.
- Speta, F. (1998b) Systematische Analyse der Gattung *Scilla* L. s.l. (Hyacinthaceae). *Phyton. Annales rei Botanicae. Horn* 38: 1–141.
- Summerfield, A. (2004) A synopsis of the biosystematic study of the seven minor genera of the Hyacinthaceae. *Bulbs. Bulletin of the International Bulb Society* 6: 24–36.
- Thiers, B. (2014) *Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium*. Available from: <http://sweetgum.nybg.org/ih/> (accessed: March 2014)
- Van der Merwe, A. (2002) *A biosystematic study of the seven minor genera of the Hyacinthaceae*. Ph.D. Thesis, Stellenbosch University, 107 pp.
- Wetschnig, W., Brudermann, A., Knirsch, W., Pinter, M. & Pfosser, M. (2012) *Massonia pustulata* Jacq. 1791 and *M. longipes* Baker 1897 (Hyacinthaceae), two frequently misunderstood species - or how *M. pustulata* became depressed. *Stapfia* 97: 210–221.
- Wetschnig, W., Martínez-Azorín, M., Pinter, M., Brudermann, A., Deutsch, G., Crespo, M.B., Dold, A.P. & Pfosser, M. (2014) *Massonia saniensis* (Asparagaceae, Scilloideae), a new species from Lesotho, southern Africa. *Phytotaxa* 173: 181–195.
<http://dx.doi.org/10.11646/phytotaxa.173.3.1>