Massonia gypsicola (Asparagaceae, Scilloideae), a new species from the Knersvlakte in South Africa

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Asparagaceae (subfamily Scilloideae, tribe Hyacintheae) is alternatively regarded as Hyacinthaceae subfam. Hyacinthoideae, an option of our choice. Additional information on generic circumscriptions in Hyacinthoideae can be found in Martínez-Azorín et al. (2013, 2014a, 2014b), Pinter et al. (2013) and Wetschnig et al. (2014).

The genus Massonia Houttuyn (1780: 424) occurs in South Africa and in southwestern Namibia and it belongs to subfamily Hyacinthoideae, tribe Massonieae (Speta 1998a, 1998b, Wetschnig et al. 2002, Pfösser et al. 2003, Manning et al. 2004). Originally, this genus was described to include a single species, Massonia depressa Houttuyn (1780: 424). However, botanical exploration of South Africa in the nineteenth century led Baker (1897) to accept 33 species in the genus. Recent studies in Massonia reduced the number of accepted species to 6 (van der Merwe 2002, Manning & Goldblatt 2003, Summerfield 2004), 8 (Jessop 1976), 12 (Müller-Doblies & Müller-Doblies 1997), or 14 (Species-2000 2017).

Our studies on Massonia revealed that the taxonomy of the genus, as accepted in recent revisions, is not satisfactory and several species have been overlooked and misunderstood (Wetschnig et al. 2012, 2014, 2016, Martínez-Azorín et al. 2013, 2014a, 2014b, 2015a, 2015b, Pinter et al. 2013, 2015).

Within the framework of a taxonomic revision of Massonia, the study of natural populations, cultivated material as well as herbarium vouchers, revealed existence of some populations of Massonia growing on gypcrete outcrops in Knersvlakte (Western Cape Province) that represent a distinct undescribed species based on clear morphological characters, ecology, and biogeography. Therefore, a formal description for this species, named Massonia gypsicola, is presented below including data on morphology, habitat, biology and distribution.

Materials and Methods
Detailed morphological studies of Massonia were undertaken on natural populations, cultivated specimens and herbarium vouchers, following the terminology used for species of Hyacinthaceae in Martínez-Azorín et al. (2007, 2009). Herbarium specimens from the herbaria ABH, B, BLFU, BM, BOL, E, G, GZU, GRA, HAL, K, L, LINN, M, MO, NBG, NU, NY, P, PRE, S, TCD, UPS, WU, Z, ZSS and ZT (acronyms according to Thiers 2017) were studied. Authors of the cited taxa follow IPNI (2017). Orthography of geographical names and grid-number system follows Leistner & Morris (1976). Morphological data given in Table 1 are obtained from living plants and herbarium vouchers (M. gypsicola: 18 specimens from 2 populations; M. pseudoechinata: 74 specimens from 11 populations; M. roggeveldensis: 56 specimens from 6 populations; M. bakeriana: 17 specimens from 7 populations; M. mimetica: 25 specimens from 5 populations). The WW numbers correspond to the accession numbers of the living plant collection cultivated at the Botanical Garden of the Institute of Plant Sciences of the University of Graz.
TABLE 1. Comparison of main characters of *Massonia gypsicola* and related species. Morphological data are obtained from living plants from the wild and cultivated and also herbarium vouchers as detailed in the Material and Methods section.

<table>
<thead>
<tr>
<th></th>
<th><em>M. gypsicola</em></th>
<th><em>M. pseudoechinata</em></th>
<th><em>M. roggeveldensis</em></th>
<th><em>M. bakeriana</em></th>
<th><em>M. mimetica</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leaf blade size (cm)</strong></td>
<td>2.5–9 × 1.5–5</td>
<td>3–12 × 2.5–8</td>
<td>2–5 × 2–3.5</td>
<td>4–10 × 5–10</td>
<td>3.5–10 × 3–9</td>
</tr>
<tr>
<td><strong>Leaf emergences</strong></td>
<td>15–40</td>
<td>1–60</td>
<td>absent</td>
<td>11–42</td>
<td>10–25</td>
</tr>
<tr>
<td><strong>Leaf emergences per cm²</strong></td>
<td>conical to hemispherical, 0.4–0.8 mm in diameter, with a deflexed, thickened, smooth trichome on top, 0.2–0.5 mm long</td>
<td>cone-like, 0.2–0.4 mm in diameter, with a deflexed, thickened, smooth trichome on top</td>
<td>absent</td>
<td>symmetrical, cone-like, dark green, with a small apical papilla</td>
<td>slightly asymmetrical, conical, 1–2 mm in diameter, with a short obtuse conical cell on top</td>
</tr>
<tr>
<td><strong>Leaf margin</strong></td>
<td>entire to minutely denticulate</td>
<td>minutely papillose-denticulate</td>
<td>entire to minute papillose</td>
<td>entire</td>
<td></td>
</tr>
<tr>
<td><strong>Number of flowers</strong></td>
<td>10–25</td>
<td>5–8 × 1.5–2 mm</td>
<td>6–10 × 1.5–2 mm</td>
<td>6–8 × 1.2–2 mm</td>
<td>6–9 × 1.5–2 mm</td>
</tr>
<tr>
<td><strong>Free perigone segments at anthesis</strong></td>
<td>white with a short greenish central band at the tip, reflexed with a slight sigmoid curve at the base but not inrolled</td>
<td>pure white, with a short greenish central band at the tip, strongly reflexed and inrolled with a distinct sigmoid curve at the base</td>
<td>white at anthesis, but not distinctly inrolled</td>
<td>with a short greenish central band at the tip, strongly reflexed with a slight curve at the base</td>
<td></td>
</tr>
<tr>
<td><strong>Perigone-filaments tube</strong></td>
<td>6–7 × 2–3 mm narrowly cylindrical, not widening at the upper portion, with a circular mouth with no gibbosities</td>
<td>10–15 × 2–3 mm narrowly cylindrical, not widening at the upper portion, with a hexagonal mouth showing strongly convex sides, giving the appearance of having 6 gibbosities</td>
<td>10–14 × 2.2 mm narrowly cylindrical, not widening at the upper portion, with an almost closed mouth enveloping the style</td>
<td>9–13 × 2–4 mm, cylindrical below, funnel-shaped above, bearing a wide open mouth that shows the ovary in apical view</td>
<td>6–15 × 2.5–4 mm, cylindrical or slightly widening at the upper portion, tinged with reddish above the segments insertion, with 6 gibbosities at the mouth of the tube</td>
</tr>
<tr>
<td><strong>Free portion of filaments length (mm)</strong></td>
<td>10–15</td>
<td>8–12</td>
<td>8–12</td>
<td>12–18</td>
<td>6–13</td>
</tr>
<tr>
<td><strong>Filaments-tube length (mm)</strong></td>
<td>ca. 0.5</td>
<td>ca. 1</td>
<td>ca. 0.5</td>
<td>ca. 0.5</td>
<td>1–2</td>
</tr>
<tr>
<td><strong>Anther colour</strong></td>
<td>pale yellow</td>
<td>pale blue</td>
<td>pale blue</td>
<td>yellow</td>
<td>purple-orange</td>
</tr>
<tr>
<td><strong>Pollen colour</strong></td>
<td>yellow</td>
<td>blue</td>
<td>blue</td>
<td>yellow</td>
<td>yellow</td>
</tr>
<tr>
<td><strong>Ovary (mm)</strong></td>
<td>3–4 × 1.5–2</td>
<td>4–6 × 1.8–2.1</td>
<td>4–6 × 1.8–2.1</td>
<td>5–6 × 1.7–2, slightly contracted at the joint with the style</td>
<td>3–4.5 × 2–2.5, gradually tapering to the style</td>
</tr>
<tr>
<td><strong>Style length (mm)</strong></td>
<td>10–14</td>
<td>15–17</td>
<td>18–22</td>
<td>16–20</td>
<td>11–20</td>
</tr>
<tr>
<td><strong>Capsule (mm)</strong></td>
<td>7–12 × 3–7</td>
<td>10–17 × 4–9</td>
<td>18–22</td>
<td>10–12 × 7–10</td>
<td>6–14 × 4–8</td>
</tr>
<tr>
<td><strong>Seed (mm)</strong></td>
<td>1.6–2.0 × 1.5–1.8</td>
<td>1.5–2.1 × 1.3–2</td>
<td>not studied</td>
<td>1.4–1.6 × 1.3–1.6</td>
<td>1.5–1.8 × 1.3–1.6</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Knersvlakte</td>
<td>Boekkeveld</td>
<td>Roggeveld</td>
<td>Kamiesberg, Boekkeveld, Jan Swartsberge and Slangberge</td>
<td>Surroundings of Platbakkies, Loxton and Victoria West</td>
</tr>
</tbody>
</table>

**MASSONIA GYPsicola** (Asparagaceae, Scilloideae) *Phytota* 308 (1) © 2017 Magnolia Press
FIGURE 1. Massonia gypsicola Mart.-Azorín et al. in cultivation from the type locality in Knersvlakte, Western Cape province of South Africa (corresponding to the holotype MMA1298 pressed on 14/11/2016). A. Plant in flower, lateral view; B. Inflorescence, lateral and apical views; C. Bracts; D. Flowers from bud to full anthesis, lateral views; E. Dissected flowers, lateral views; F. Gynoecia from bud to full anthesis, lateral views. Scale bars 1 cm.
Description of the new species

**Massonia gypsicola** Mart.-Azorín, M.Pinter, M.B.Crespo, M.A.Alonso & Wetschnig, *sp. nov.* (Figs. 1, 2)

Species notabilis combinatione propria characterum ab ceteris speciebus Massoniae bene distincta. Folia pustulata pustulis leviter asymmetricis conicis vel hemisphaericis 0.4–0.8 mm diametro plus minusve numerosis (15–40) obsita, quae ad apicem papilla late vel anguste conica et valida 0.1–0.8 mm long. munitas. Flores albidis, ad apicem segmentorum fascia longitudinali viridi instructis; tubo brevi (ad 7 mm long.) et strictissimo, ad faucem egibbosse, longitudine ovarium valide occultante; et segmentis perigonii 5–8 × 1.5–2 mm, reflexis sed non revolutis, a basi vix sigmoideo-cuvatis. Antherae statu clauso ca. 2 × 1 mm, luteoleae; polline luteo subconcoloro. Ovarium conicum vel suboblongum, ca. 3–4 × 1.5–2 mm, in stylo gradualiter desinente. Semina 1.6–2.0 × 1.5–1.8 mm, globosa, nigra, laevia.

Type:—SOUTH AFRICA. Western Cape. Vanrhynsdorp (3118): Knersvlakte, ca. 4 km SW of N7 on the gravel road parallel to the railway, farm Quaggas Kop 215 (-BC), crevices and shallow soil on gypcrete outcrops, 135 m elevation, 14 November 2016 ex hort. in Graz (Austria), M. Martínez-Azorín, M. Pinter, M.B. Crespo & M.A. Alonso MMA1298 (holotype GRA!; isotypes ABH!, GZU!).

Deciduous geophyte. Bulb ovoid to subglobose, 1.4–4.3 × 0.9–4 cm, hypogeal, with white, fleshy bulb scales covered by pale brown, papery or slightly leathery outer tunicis. Leaves 2, synanthous, opposite, appressed to the ground, ovoid, with an acute apex and a short apicule about 2–3 mm long, limb 2.5–9 × 1.5–5 cm (up to 15 cm long in cultivation), with narrow, membranous, entire to minutely denticulate margins; adaxial side green, with 15–40 slightly asymmetrical, conical to hemisphaerical, emergences per cm², which are 0.4–0.8 mm in diameter, with a conical to elongated and slightly deflexed, thickened, smooth trichome on top, 0.1–0.8 mm long; abaxial side smooth, green; petiolo 0.5–2.5 cm long. Inflorescence a dense, subcapitate raceme, up to 2–3 cm long, with 10–25 flowers, shortly overtopping ground level. Bracts narrowly obovate, attenuate at the apex, 15–25 × 5–9 mm, green in the upper half with white membranous margins and base, glabrous, entire. Pedicels at anthesis 8–16 mm long. Flowers pentacyclic, trimerous. Perigone pure white; tepals 6, free segments 5–8 × 1.5–2 mm, entire, with a short greenish central band at the tip, straight and erect in bud, reflexed with a sigmoid curve at the base but not distinctly inrolled at anthesis; perigone-filaments tube 6–7 × 2–3 mm, narrowly cylindrical, not widening in the upper portion, with a circular mouth with no gibbosities, the ovary included in the tube and not visible. Stamens 6, filaments long-attenuate, spreading at anthesis, slightly arcuate, white, 10–15 mm long, shortly connate at the base for ca. 0.5
mm above the perigone segments; anthers oblong, pale yellow, ca. 2 × 1 mm when closed, dorsifixed, with yellow pollen. Gynoecium obclavate, compound, tricarpellar, with axile placentation. Ovary superior, conical to suboblong, white to pale green with a purple tinge, 3–4 × 1.5–2 mm, gradually tapering to the style, with 12–14 ovules per locule. Style white, erect, 10–14 mm long at anthesis, narrowly conical, gradually tapering from the ovary to the acute, simple stigma. Capsule ovate in lateral view, trigonous with blunt edges in apical view, 7–12 × 3–7 mm. Seeds globose, black, 1.6–2.0 × 1.5–1.8 mm, smooth.

Etymology.—The specific epithet (gypsicola: growing in gypsum substrate) refers to the distinct and unique habitat of this new species; this is so far the only taxon in Massonia occurring on gypcrete outcrops.

Phenology.—Massonia gypsicola flowers between May and July in the wild and fruits appear from July to August. In cultivation in Graz (Austria) it flowers around November and fruits appear in late December.

Habitat.—Massonia gypsicola occurs in crevices and shallow soil on eroding outcrops of gypcrete (deep weathering gypsum rich duripans; see also Francis 2008), rich in calcium sulphate, from 100 to 150 m of elevation. The surrounding vegetation is classified as Knersvlakte Quartz Vygieveld (SKk3) and Central Knersvlakte Vygieveld (SKk2). The region is characterised by winter rainfall peaking from May to August, and dry hot summers, with a mean annual precipitation of 110 mm and rare occurrence of frost (Mucina & Rutherford 2006). Knersvlakte is a worldwide well known area for succulents including many endemic taxa, and this new Massonia species increases the value of this region.

Distribution.—The new species is known to us only from two localities west of N7 in Knersvlakte, and appears to be endemic to this area (Fig. 3). Further populations are expected to be found on similar habitats close-by.

![FIGURE 3. Known distribution of Massonia gypsicola Mart.-Azorín et al. in Knersvlakte in South Africa and related species (red circle: M. gypsicola; blue square: M. pseudoechinata Mart.-Azorín et al.; green triangle: M. bakeriana M.Pinter et al.; yellow diamond: M. mimetica Mart.-Azorín et al., orange triangle: M. roggeveldensis Mart.-Azorín et al.).](image-url)
**Taxonomic relationships:**—*Massonia gypsicola* can be easily distinguished by the leaves covered by distinct conical to hemisphaerical emergences that usually bear a distinct trichome on top; white flowers with short and narrow perigone-filaments tube; yellow anthers and pollen; and obclavate gynoecium (Table 1). Its morphologically closest relative appears to be *Massonia pseudoechinata* Mart.-Azorin, M.Pinter & Wetschnig in Martinez-Azorin et al. (2015b: 124), but the latter differs by leaves with scarce to numerous small emergences; flowers with much longer perigone-filaments tube; strongly reflexed and inrolled perigone segments; shorter filaments, the blue anthers and pollen; longer ovary and style; and bigger capsules (Table 1; Martinez-Azorin et al. 2015b). *Massonia pseudoechinata* grows on top of the Bokkeveld Plateau near Nieuwoudtville and the Vanhyns Pass, at elevations of about 700–800 m a.s.l. and vegetation classified as Bokkeveld Sandstone Fynbos and Nieuwoudtville Shale Renosterveld (Mucina & Rutherford 2006). The general flower morphology of *M. gypsicola*, especially the obclavate gynoecium, links this species to *M. pseudoechinata*, *M. roggeveldensis* Mart.-Azorin, M.Pinter & Wetschnig in Martinez-Azorin et al. (2015b: 122), *M. bakeriana* M.Pinter, Mart.-Azorin & Wetschnig in Pinter et al. (2015: 52), *M. mimetica* Mart.-Azorin, M.Pinter, M.B.Crespo & Wetschnig in Martinez-Azorin et al. (2013: 191), *M. jasminiflora* Burch. ex Baker (1870: 390) and related species (Table 1; Martinez-Azorin et al. 2013, 2014b, 2015b, Pinter et al. 2015). However, none of the related species shows the distinct combination of character-states occurring in *Massonia gypsicola* (Table 1).

**Additional material studied (paratypes):**—SOUTH AFRICA. Western Cape. Vanhyns dorpe (3118): Knysnvakte, ca. 8 km W of N7 from the railway crossing, farm Wolvenest 212 (-BC), gypcrete outpost south of the gypsum mine, 125 m elevation, 6 June 2015 in flower, *A. Le Roux* (photo!); Vanhynsdorp (3118): Knysnvakte, ca. 4 km SW of N7 on the gravel road parallel to the railway, farm Quaggas Kop 215 (-BC), 125 m elevation, 7 July 2015 in fruit and in bud, *N. Helme* (iSpot photo!, https://www.ispotnature.org/node/697552); a photograph of *M. gypsicola* from the Knysnvlakte in flower (as “Knerts *Massonia echinata*”) mounted on a herbarium sheet together with a photograph identified as *Brunsvigia radulosa* (NBG!).

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