

## Antipodal mosses: VIII. *Valdonia* gen. nov. (Seligeriaceae) from the Kerguelen Province in the Subantarctic

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**Abstract** – The taxonomic position of the Subantarctic species *Blindia microcarpa* Mitt. is discussed. It is reinstated as a distinct species, definitely different from *B. contecta* (Hook. f. & Wilson) Müll. Hal. from the antipodal islands of Campbell and Auckland in the cool temperate zone of the Australasian sector. *B. microcarpa* is considered to be a discordant element in the genus *Blindia* Bruch & Schimp. which differs from all other congeners by its very small capsules which are turbinate when dry and empty and hemispheric when wet; strongly modified, convolute-sheathing perichaetial leaves; straight or flexuose-secund leaves on drying; peristome teeth granulose on both ventral and dorsal surfaces; lack of prostome and stomata; heterogeneous costal elements; shortly rectangular to subquadrate laminal cells sheathing the long-excurrent costa; and longitudinal cuticular ridges on the leaf cells giving them a papillose appearance in cross-section. A new monotypic genus, *Valdonia* Ochyra, is established which is placed in the subfamily Dicranoweisioideae within the Seligeriaceae. The single species of the genus, *V. microcarpa* (Mitt.) Ochyra, endemic to the Kerguelen Province of the Subantarctic, is a constituent of fellfield vegetation and is particularly common on Prince Edward Island and Marion Island in the Prince Edward Islands archipelago. It appears to be less frequent on Îles Kerguelen from where it was actually described. The relationships of *Valdonia* are discussed and the details of the gametophytes and sporophytes of *V. microcarpa* are illustrated.

**Bryophyta / Musci / Seligeriaceae / *Blindia* / Subantarctica / Kerguelen Province / Prince Edward Islands / taxonomy / distribution**

### INTRODUCTION

Periodic, but infrequent, taxonomic studies on mosses in the subpolar region of the Southern Hemisphere reveal again and again our imperfect knowledge of that region's fascinating moss flora. One of the main reasons which has considerably hampered taxonomic assessment of some taxa has been the paucity of good herbarium specimens on which all taxonomically important characters could be observed. This situation is a result of an underexploration of the bryoflora of the more remote islands in the Southern Ocean, from which only scanty specimens collected during a few exploratory expeditions in the 19<sup>th</sup> century are available in the world herbaria.

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During the field work on the Prince Edward Islands in the Kerguelen Province in the Subantarctic in 1999 and 2001 I collected several dozens of specimens of the neglected and poorly known species *Blindia microcarpa* Mitt. It was originally described from Îles Kerguelen by Mitten (1876) on the basis of a specimen collected in 1874 by H. N. Moseley, naturalist to *Challenger* Expedition of 1873–1876. Until the late 1960s *B. microcarpa* was known to be endemic to this, the largest of the Subantarctic islands, and was represented by only four specimens collected in 1913–1914 by M. Rallier du Baty and M. Bossière (Cardot, 1916). Later, Zanten (1971) reported additional 12 specimens from Prince Edward Island and Marion Island in the Prince Edward Islands archipelago and at the same time transferred *B. microcarpa* to the genus *Verrucidens* Cardot. Finally, Ochyra & Hertel (1990) added one more specimen from Marion Island and considered *Blindia microcarpa* to be conspecific with *B. contecta* (Hook. f. & Wilson) Müll. Hal., a species known from Campbell Island and Auckland Island in the cool temperate zone of the Australasian sector and reported also from the Kerguelen Province.

During the course of a taxonomic revision of *Holodontium* (Mitt.) Broth. which had customarily been placed in the Dicranaceae, I discovered that this monotypic genus is a relative of *Dicranoweisia* Lindb. ex Milde and that both genera should correctly be placed in the Seligeriaceae on account of their peristome structure (Ochyra, 1993). Because of several peculiarities in the structure of both gametophytes and sporophytes, both genera have been placed in a separate subfamily Dicranoweisioideae I. Hagen (Ochyra, 1993, 1994). I also suggested that other antipodal taxa possibly fit into that subfamily. The present paper provides a taxonomic re-assessment of *Blindia microcarpa* which is here reinstated as a distinct species. Additionally, it is considered to be misplaced in *Blindia* and a separate genus, *Valdonia*, is established to accommodate *B. microcarpa*, still within the subfamily Dicranoweisioideae.

## DESCRIPTION OF THE GENUS

### *Valdonia* Ochyra, gen. nov. Seligeriacearum

**Diagnosis** – *Pulvinatim caespitosum, aureo-viride vel luteo-fuscum in parte superiore, inferne nigricans vel olivaceo-viride. Caulis erectus, subfragilis, superne fastigiatim ramosus, dense foliosus, in sectione transversali fasciculo centrali distincto praeditus. Folia erecto-patentia, stricta vel leniter flexuosa, ad apicem caulis sicca interdum falcato-curvata, e basi lanceolata sensim lineari-subulata vel lanceolato-setacea, canaliculata, acuta, marginibus integerrimis, basi inflexis, costis latis, depressis, quartam vel minus parte basis occupantibus, apice excurrentibus, in sectione transversali e strato centrali ab eurycystis magnis compositis et utraque pagina stereidis tecto constatis, cellulis alaribus ventricosis, magnis, fuscis, parietibus crassis, caeteris lutescentibus, angustissime linearibus, parietibus incrassatis, haud porosis, in subulam subquadratis vel breviter rectangularibus. Inflorescentia monoica. Flores masculini ad basin foeminei, gemmiformes; antheridia paraphysibus plurimis, filiformibus, luteis immixta. Folia perichaetialia foliis caulibus valde dissimilia, minora, convoluta-vaginata. Capsula in pedicello brevi gracilique, foliis caulinis dimidio breviora erecta parva sicca turbinata, madida hemisphaerica,*



*operculo rostrato demum ore dilatato cyathiformis fusca. Peristomii dentes lanceolati, in parte superiore hyalini, dense granulosi. Sporae sphaericae, minute papillo-sae.*

*Genus ad diem e species unum compositum* – *Valdonia microcarpa* (Mitt.) *Ochyra* – cuius locis permultis in insulis subantarcticis Provinciae Kerguelensis incolit.

**Description** – **Plants** acrocarpous, medium-sized to relatively large and robust, lustrous, densely caespitose. **Stems** erect, irregularly and sparsely branched, radiculose mostly at the base, in transverse section with a medulla composed of large, moderately thick-walled cells, sharply grading to a unistratose cortex of small, thick-walled, brown cells; **central strand** small but distinct; **axillary hairs** frequent, hyaline, 3–5-celled. **Leaves** erect-spreading, straight to flexuose-second or occasionally slightly twisted when dry, long subulate to setaceous from a broader, concave, oblong-ovate to ovate-lanceolate base, with a subula up to 2 times as long as the base, in transverse section crescent to semicircular; **margins** entire, erect; **costa** single, mostly diffuse, smooth, about 1/4 or less the width of the leaf base, filling the subula but sheathed with 2–4 rows of the laminal cells, in transverse section with dorsal and ventral stereid bands separated by a median row of enlarged guide cells; **laminal cells** unistratose throughout, markedly thick-walled, yellow, smooth but appearing papillose in transverse section due to numerous lengthwise cuticular ridges on both surfaces; cells in the subula short-rectangular to rounded-quadrate; cells in the sheathing base linear or elongate-rectangular, very narrow, straight, non-porose, becoming gradually narrowed towards the margins and forming an indistinct border; **alar cells** mostly sharply differentiated, thick-walled, orange-brown to brown, forming distinct, rounded or oval, inflated, decurrent auricles not reaching the costa.

**Autoecious. Perigonia** sessile, lateral just below the perichaetium. **Perichaetia** terminal; **perichaetial leaves** smaller than vegetative leaves, convolute-sheathing at the base, not extending to the capsule. **Seta** single per perichaetium, erect, short, relatively slender, not twisted to dextrorse. **Capsule** immersed to emergent, erect, symmetric, smooth, brown, turbinate when dry, hemispheric to obloid when wet; **annulus** absent; **operculum** obliquely long-rostrate, remaining attached for a short length of time to the columella; **exothecial cells** isodiametric, irregular in shape, thick- and sinuose-walled, becoming oblate, thick-walled and brown at the mouth; **stomata** absent; **peristome teeth** well developed, lanceolate, undivided to slightly split or broken at the tips with age, yellow-brown below, hyaline above, densely and roughly papillose on both ventral and dorsal surfaces, with prominent dorsal trabeculae and not trabeculate at the ventral surface. **Spores** spherical, papillose. **Calyptra** naked, cucullate.

**Generitype** – *Valdonia microcarpa* (Mitt.) *Ochyra*

**Etymology** – The generic name honours Valdon R. Smith, professor at the University of Stellenbosch, South Africa, in recognition of his great contribution, over thirty years, toward understanding the botany and ecology of Marion and Prince Edward Islands. He has consistently made efforts to involve researchers from throughout the world in the biological investigations being conducted at the islands and this has resulted in many important contributions to Subantarctic botany.



ON THE RELATIONSHIPS OF *VALDONIA*

A re-evaluation of *Blindia microcarpa* clearly indicates that it is an anomalous element in the genus *Blindia*. In the Southern Hemisphere it has served as a "catch-all" genus for a variety of small or medium-sized acrocarpous mosses, mostly associated with moist, acidic rock substrates. For a long time the generic concept of *Blindia* has been obscure and different authors had only vague ideas of its limits and species concepts. Bartlett & Vitt (1986) thoroughly circumscribed this genus and found it to be closely related to *Seligeria* Bruch & Schimp., a genus found mainly in the Northern Hemisphere. According to those authors, *Blindia* includes the species characterized by, amongst other things, the presence of (i) homogeneous costal elements as seen in transverse section of the leaves; (ii) costae excurrent as a long subulae not sheathed with laminal cells; (iii) peristome teeth, if present, smooth on both ventral and dorsal surfaces; (iv) smooth laminal cells; (v) perichaetial leaves not differentiated from the vegetative leaves.

In contrast to all species currently placed in *Blindia*, *B. microcarpa* differs strikingly in having (i) heterogeneous costal elements that include a median row of enlarged guide cells and two stereid bands composed of very small and strongly incrassate cells; (ii) quadrate to short-rectangular laminal cells sheathing the costa in the subulate part of the leaves; (iii) coarsely and densely granulose peristome teeth on both ventral and dorsal surfaces; (iv) longitudinal cuticular ridges on both faces of the laminal cells, giving them a papillose appearance in cross-section. This combination of characters precludes any closer alliance of this species with *Blindia* in its present circumscription and warrants the recognition of the separate monotypic genus *Valdonia* to accommodate it.

Despite this, *Valdonia microcarpa* shares some structural characters with *Blindia contecta*, with which it was once erroneously united (Ochyra & Hertel, 1990), including the internal differentiation of the costa, the presence of the cuticular ridges over the laminal cells, a lack of stomata, a similar shape of exothecial cells and peristome teeth. However, the two species differ fundamentally in the shape of the perichaetial leaves, which are strongly differentiated in *Valdonia microcarpa* versus undifferentiated ones in *Blindia contecta*. The taxonomic position of the latter needs careful evaluation and it will be presented in a forthcoming account.

*Valdonia* is a distinct monotypic genus clearly belonging within the Seligeriaceae on account of its peristome teeth which are distinctly seligerioid in structure, i.e. they have well-developed and prominent *dorsal* trabeculae and thin and *not* trabeculate ventral layer (Fig. 3). The peristome in this genus is undisputedly haplolepidous with the secondary deposition occurring on the inner tangential walls of the PPL and outer tangential walls of the IPL and having a 2:3 PPL to IPL ratio. However, the prostome has not been observed in this genus, although it is frequent in various species of *Dicranoweisia* and *Seligeria*. The teeth are deeply inserted within the capsule mouth and the lowermost lamellae of the teeth are weakly thickened, smooth and hyaline. In general, the upper lamellae are also not particularly thickened and the teeth quickly become "hyalinized" and as a result they are very fragile and often break at the base. Although sporophytes are produced by *Valdonia microcarpa* in profusion, deoperculate capsules rarely have intact peristome teeth.

The genus is warranted by the following combination of characters: (i) acrocarpous habit; (ii) erecto-patent, straight, long-subulate and never crispate and/or contorted leaves; (iii) lengthwise cuticular ridges on the surface of the



leaves; (iv) differentiation of the internal structure of the costa into two stereid bands and a median row of enlarged guide cells; (v) strongly differentiated alar cells forming ventricose auricles reaching half-way to the costa; (vi) linear to elongate-rectangular, thick-walled laminal cells; (vii) short-rectangular to subquadrate laminal cells in the subulate acumen; (viii) convolute-sheathing perichaetial leaves; (ix) short and relatively slender setae which are twisted to the right on drying; (x) immersed capsules which are turbinate when dry and hemisphaeric when wet; (xi) irregular exothelial cells with strongly incrassate and sinuose cells; (xii) lack of stomata; (xiii) coarsely papillose peristome teeth, trabeculate on the dorsal face; (xiv) lack of prostome.

Zanten (1971) transferred *Blindia microcarpa* to the genus *Verrucidens* as *V. microcarpus*, although formally this name is illegitimate since that author did not cite the basionym in full when making the new combination. *Verrucidens* was established by Cardot (1908) to accommodate two species, *V. turpis* (Cardot) Cardot from Tierra del Fuego and *V. immersus* (Broth.) Cardot from Îles Kerguelen. Ochyra (1999a) proved that *Verrucidens* is congeneric with *Dicranoweisia* Lindb. ex Milde because both genera share all essential diagnostic characters, including the verrucose peristome teeth which are known, for example, in *Dicranoweisia compacta* (Schwägr.) Schimp. and *D. antarctica* (Müll. Hal.) Paris. Also, monoecism, the internal structure of the costa, an absence (or only occasional presence) of stomata, the crisped leaves, as well as the leaf areolation and papillosity of laminal cells in transverse section (because of longitudinal cuticular lamellae) are common features of the two genera. In fact, Paris (1895) was the first to transfer *B. microcarpa* to *Dicranoweisia* and this transfer necessitated the change of the specific epithet *microcarpa* to *kerguelensis* because the former had been used for a Tasmanian species which is currently known as *Brachydontium microcarpum* (Hook. f. & Wilson) Ochyra (Ochyra, 1999b).

*Valdonia* actually shares many characters with *Dicranoweisia*; for example, the anatomical differentiation of the costa, the monoecious sexual condition, the presence of the cuticular ridges on the laminal cells, the verrucose peristome teeth and the convolute-sheathing perichaetial leaves. However, the leaves in *B. microcarpa* are straight to eventually flexuose-second or only occasionally slightly twisted when dry, but never strongly crisped and contorted as is the typical state in all species of *Dicranoweisia*. The greatest difference between the two genera is in the capsule form. In *Valdonia* the capsules are funnel-shaped when dry and empty and become globular to shortly globose-obloid when wet. This shape of the capsules does not occur in any species of *Dicranoweisia* but it is typical of many species of the genus *Seligeria* Bruch & Schimp., for example *S. tristichoides* Kindb., *S. donniana* (Sm.) Müll. Hal. and *S. oelandica* C. E. O. Jensen & Medelius. In addition, the exothelial cells are never sinuose-walled in any species of *Dicranoweisia*, although in some species the walls of the exothelial cells remain variously thickened and the prostome is always present. These three characters warrant the distinction of *Valdonia* from *Dicranoweisia*.

*Valdonia* is best placed in the subfamily Dicranoweisioideae of the Seligeriaceae which was reinstated for *Dicranoweisia* and *Holodontium* (Ochyra 1993, 1994). The genus has a perfect seligerioid peristome and such characters as strongly papillose peristome teeth, internal differentiation of the costa, the length-wise cuticular ridges on both faces of the lamina cells and the sheathing-convolute perichaetial leaves are all typical of that subfamily. Such a placement was already suggested by Paris (1895) and Zanten (1971), who transferred *Blindia microcarpa* to *Dicranoweisia* and *Verrucidens*, respectively, which are now considered to be congeneric taxa. *Valdonia* appears to be rather distantly related to *Holodontium*



and is distinctive in the smaller stature of plants, immersed capsules and the laminal cells sheathing the costa in the subula.

*Valdonia* is a monotypic genus including only a single species, *V. microcarpa*.

## DESCRIPTION OF THE SPECIES

*Valdonia microcarpa* (Mitt.) Ochyra, *comb. nov.* (Figs 1–3)

**Basionym** – *Blindia microcarpa* Mitt., *J. Linn. Soc. Bot.* **15**: 65. 1876. – *Dicranoweisia kerguelensis* Paris, *Ind. Bryol.*: 341. 1895 (non *Dicranoweisia microcarpa* (Hook. f. & Wilson) Paris, *Ind. Bryol.*: 341. 1895). – *Verrucidens microcarpus* (Mitt.) Zant. in Zanderen Bakker, Winterbottom & Dyer, *Marion Prince Edward Isl. Rep. S. Afr. Exp.* 1965–1966: 191, f. 7.1a–g. 1971, *comb. inval. basion. non citat.* – **Type**: This species is included in the section of Mitten's (1876) paper entitled "Kerguelen's Island" [**Holotype**: "(*Blindia microcarpa* – on the cover) Kerguelens Island Moseley Challenger Expedition." – NY-MITT! (accompanied by two Mitten's pencil drawings); **Isotypes**: "*Blindia microcarpa*, Mitt. Kerguelen Island. Moseley. Challenger Expedition" – BM-HOOK! (2 specimens)].

**Description** – **Plants** small, medium-sized to large, slender to relatively robust, strongly glistening, yellow to yellow-brown or golden- to yellow-green above, brown, blackish- or olive-brown below, in compact but not coherent tufts, often forming moss balls. **Stems** erect, (1.0–)1.5–3.0(–6.5) cm long, stiff but rather fragile, simple or sparsely fastigiately branched, radiculose mostly at the base with smooth, brown, shining, branched rhizoids, sometimes rhizoids scattered in the lower part of the stem, in transverse section oval to round, having a small but distinct central duct, surrounded by 3–4 layers of large, hyaline medullary cells with rather thick walls and unistratose, or in places bistratose, cortex of small cells with strongly incrassate, reddish-brown cells; **axillary hairs** frequent, filiform, composed of 3–5 elongate, hyaline cells. **Leaves** densely set, rather stiff, little altered, loosely erect-spreading, straight to slightly flexuose-secund or occasionally somewhat twisted when dry, erect-spreading to slightly patent when wet, (2.5–)3.0–5.0(–6.0) mm long, 0.5–0.7 mm wide, from a lanceolate, ovate-lanceolate to oblong-ovate, concave, decurrent base abruptly to gradually long subulate or setaceous, with slender, smooth, subtubulose subulae, about 2 times the lamina length, acute to narrowly obtuse, in transverse section crescent-shaped below, semicircular to almost circular above; **margins** entire, plane below, inflexed above; **costa** single, diffuse, yellow-brown to brownish, often subconcolorous with the laminal cells, 90–120  $\mu$ m wide, occupying 1/4 or less the width of the leaf base, gradually narrowed toward the apex, not filling the entire subula but sheathed with 2–4 rows of the laminal cells, except for the uppermost part, in transverse section flattened and not prominent dorsally below, more convex on the dorsal surface in the subula, densely covered with longitudinal cuticular thickenings, consisting of a median row of enlarged guide cells and dorsal and ventral bands of small, strongly incras-

Fig. 1. *Valdonia microcarpa* (Mitt.) Ochyra. — 1. Habit, dry. 2. Habit, wet. 3. Cross-section of stem. 4–5. Axillary hairs. 6–10. Leaves. 11. Laminal cells in subula. 12. Laminal cells at the shoulders. 13. Mid-leaf cells. 14. Auricle and basal leaf cells. 15–22. Cross-section of leaves, a sequence from base to apex. [1–3, 6–22 from isotype of *Blindia microcarpa*, BM; 4–5 from Ochyra 432/99, KRAM]. Scale bars: a – 1 mm (1–2, 6–10); b – 100  $\mu$ m (4–5); c – 100  $\mu$ m (3, 11–22).







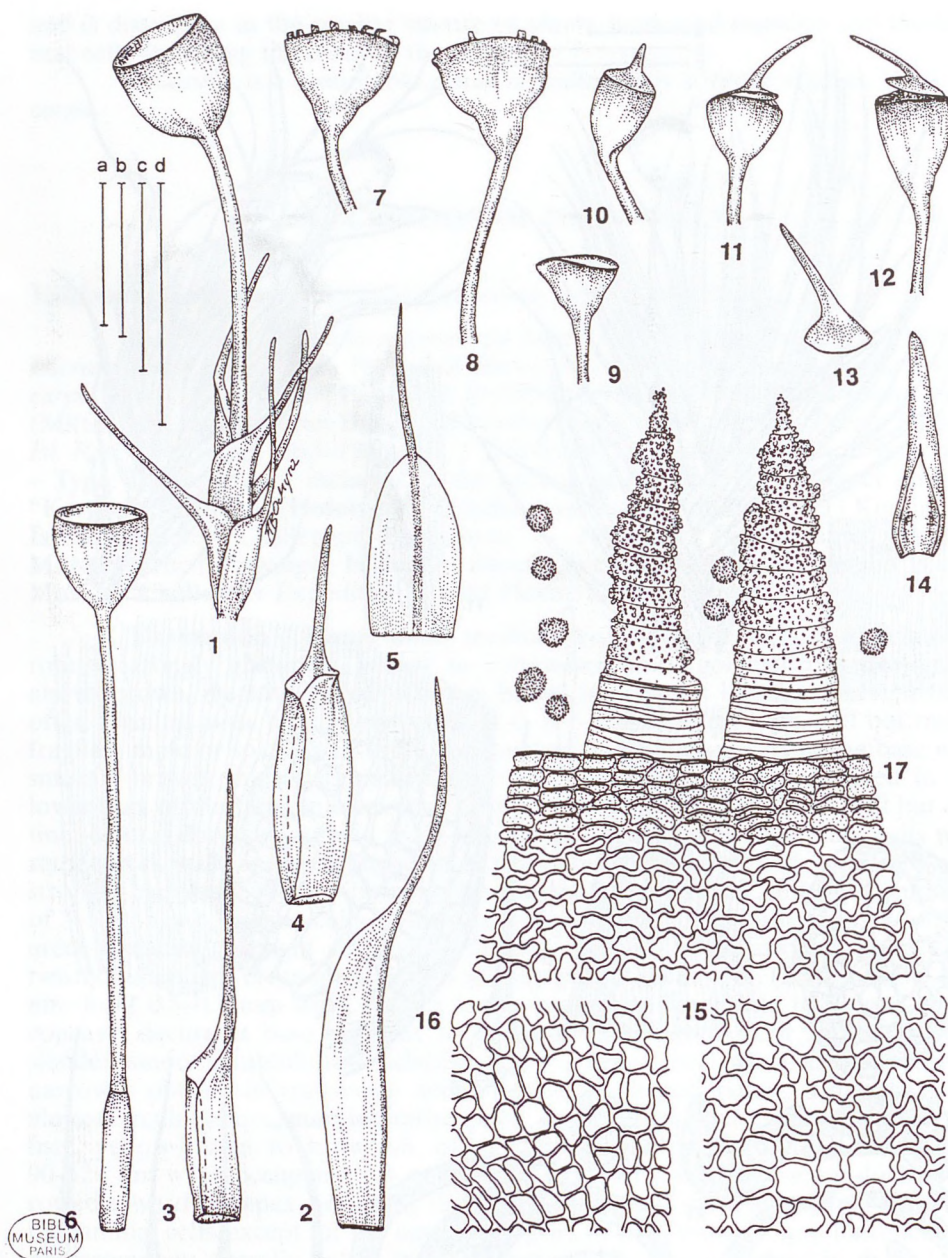


Fig. 2. *Valdonia microcarpa* (Mitt.) Ochyra. — 1. Perichaetium and mature capsule, wet. 2-5. Perichaetial leaves. 6. Mature capsule with destroyed peristome, seta and vaginula, wet. 7-9. Capsules, dry and empty with destroyed peristome. 10-12. Operculate capsules, wet, showing systylous lids. 13. Operculum. 14. Calyptra. 15. Exothelial cells at mid-urn. 16. Exothelial cells at base of urn. 17. Exothelial cells at mouth, peristome teeth and spores. [1-5, 9-12, 17 from Ochyra 432/99, KRAM; 6 from Huntley 623, KRAM; 7-8 from Ochyra 555/99, KRAM; 13-14 from Hertel 24688a, KRAM; 15-16 from isotype of *Blindia microcarpa*, BM]. Scale bars: a – 100  $\mu$ m (15-17); b – 1 mm (1, 7-14); c – 1 mm (6); d – 1 mm (2-5).



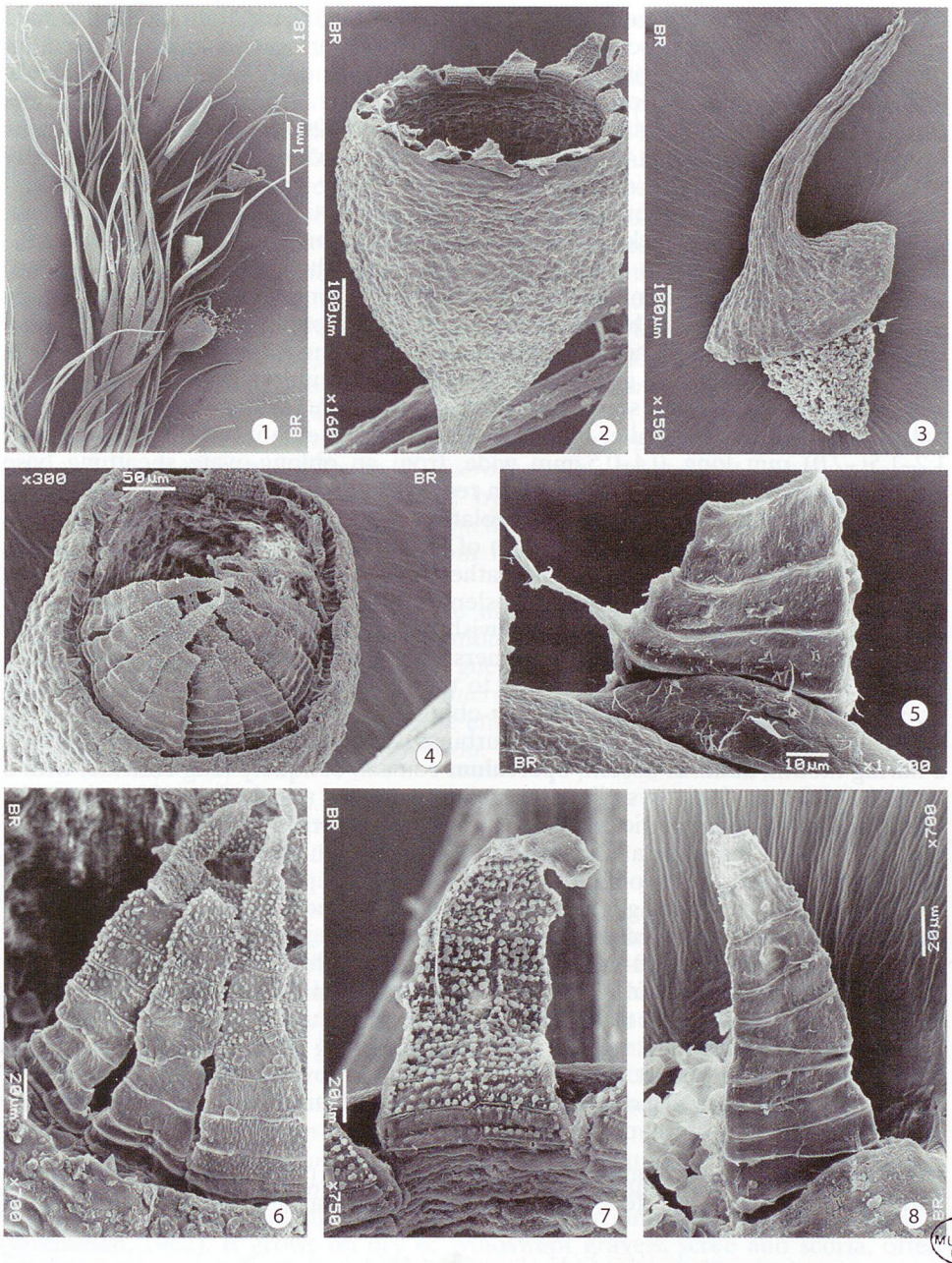


Fig. 3. SEM micrographs of *Valdonia microcarpa* (Mitt.) Ochyra. — 1. Habit. 2. Deoperculate capsule. 3. Systylious operculum after dehiscence. 4. Peristome. 5. Outer surface of the basal portion of peristome tooth. 6. Outer surface of three peristome teeth. 7. Inner surface of peristome tooth. 8. Outer surface of "hyalinized" peristome tooth. (All taken from *Ochyra* 432/99, KRAM).



sate stereid cells; **laminal cells** unistratose throughout, transparent, yellow to pale yellowish, smooth but appearing papillose on both surfaces in transverse section owing to numerous longitudinal cuticular ridges, non-porose, strongly thick-walled, in transverse section becoming thinner toward the margins; **upper cells** rounded-quadrate, quadrate to short-rectangular, 8–20  $\mu\text{m}$  long, 4–8  $\mu\text{m}$  wide; **lower cells** (40–)60–120(–140)  $\mu\text{m}$  long, 2–4(–6)  $\mu\text{m}$  wide, linear, straight, mostly with truncate or oblique apices, becoming narrower towards the margins and forming an indistinct border; **alar cells** sharply differentiated, large, 20–45  $\mu\text{m}$  long, 15–35  $\mu\text{m}$  wide, mostly thick-walled, brown to orange-brown, forming distinct, usually inflated and decurrent auricles not extending to the costa.

**Autoecious. Perigonia** bud-like, about 1 mm long, sessile, lateral just below the perichaetia; **perigonial bracts** concave, ovate to oblong-ovate, acuminate, with a single, excurrent costa or costa indistinct on the innermost bracts; **antheridia** few, claviform, brown, 400–500  $\mu\text{m}$  long, intermixed with numerous, filiform, yellow to yellow-brown paraphyses, somewhat exceeding the antheridia. **Perichaetia** terminal; **perichaetial leaves** smaller than the vegetative leaves, not reaching the capsule, 1.2–1.5(–2.0) mm long, 0.4–0.5 mm wide, from an oblong-ovate sheathing base abruptly narrowed into a subulate, often recurved point mostly as long as the base, distinctly convolute-sheathing, with areolation in the upper part similar to that in the vegetative leaves and lax areolation of large but moderately thick-walled cells in the lower half and a thinner and rather indistinct, long excurrent costa. **Seta** singly per perichaetium, 2–4 mm long, slender, straight to somewhat flexuose, not or twisted to the right, yellow to yellowish-brown; **vaginula** smooth, about 1 mm long, dark brown. **Capsule** deeply immersed in the leaves or scarcely emergent, without a neck and sharply contracted to the setae, erect and symmetric, smooth, brown, dull, hemispheric to globose-obloid when moist, 0.5–0.7 mm long, 0.5–0.6 mm wide, becoming distinctly turbinate when old and dry, sometimes with a flaring mouth; **annulus** absent; **operculum** conical, obliquely long-rostrate, with a beak 0.8–1.0 mm long, systylious, remaining shortly attached to the columella; **exothecial cells** isodiametric, irregular in shape, with strongly incrassate and sinuous walls, 15–35  $\mu\text{m}$  wide at the mid-urn, becoming smaller towards the rim, cells at the orifice quadrate to oblate in 5–8 rows, with deeply brown, incrassate walls, forming a dark brown ring; **stomata** absent; **peristome teeth** 16, deeply inserted below the mouth, undivided, lanceolate, often with uneven margins, reflexed when dry, incurved when wet, 180–240  $\mu\text{m}$  long, 80–90  $\mu\text{m}$  wide at the base, yellow-brown, coarsely and densely granulose on both dorsal and ventral surfaces in the median and upper parts, strongly trabeculate at the dorsal surface, with the lowermost lamellae weakly thickened, smooth or striate, becoming hyaline and mostly broken with age; **prostome** absent. **Spores** spherical, light brown, papillose, 18–24  $\mu\text{m}$  in diameter. **Calyptra** small, coriaceous, brownish, cucullate, naked, entire at the base, scarcely reaching the base of the operculum.

**Etymology** – The species name signifies the small fruits (from Greek *micros* = small and *karpos* = fruit) and refers to the markedly small capsules of this moss species.

## TAXONOMIC DISCUSSION

In his original description of *Blindia microcarpa* Mitten (1876) did not discuss the taxonomic affinities of the species, nor did he provide information on its ecology or the precise locality where it was collected on Îles Kerguelen. From another source (Lourteig & Cour, 1963) it is known that the *Challenger* Expedition operated in the north-western part of Îles Kerguelen, at Péninsule



Loranchet and Île Howe, i.e. in the region where the first moss collection was made by J.D. Hooker during the J.C. Ross expedition of 1839–1843 on the ships *Terror* and *Erebus* (Wilson & Hooker, 1847). Later, Mitten (1879) redescribed *B. microcarpa* and illustrated some details of its gametophyte and sporophyte. The species was subsequently mentioned by Hemsley (1884) in the enumeration of the mosses known from Îles Kerguelen and in practice this exhausted all reports of this species in the bryological literature in the XIX<sup>th</sup> century.

Throughout its wide Subantarctic range, populations of *Valdonia microcarpa* are remarkably homogeneous and show little interpopulational variation in the diagnostic features. The differences in the robustness and coloration of the plants, leaf size and shape, seta length or costa width can be considered environmental modifications not deserving taxonomic recognition.

*Valdonia microcarpa* is an almost unmistakable species which can be easily recognized in the field by its characteristic small, turbinate and immersed capsules which are usually produced in great profusion. It may possibly be mistaken for *Ditrichum strictum* (Hook. f. & Wilson) Hampe, which grows in similar habitats and is externally similar to *V. microcarpa* by its straight, subulate leaves. However, *D. strictum* is distinguished by its obloid capsules which are long exserted on the elongate setae and distinctly twisted leaf subulae. Microscopically, this species is very easily separated from *V. microcarpa* by the total lack of auricles.

Deeply-immersed capsules are also a diagnostic feature of *Ditrichum subaustrale* Broth. which is also a common constituent of the fellfield vegetation on the Subantarctic islands in the Kerguelen Province. This species is generally more robust and rigid than *Valdonia microcarpa* and the capsules are immersed on a very short seta, 1–2 mm long, in the enlarged perichaetial leaves and are often not easy to find without closer inspection.

## ECOLOGY

*Valdonia microcarpa* is a component of fellfield and polar desert habitats which are typical of the higher elevations in the Subantarctic (for detailed descriptions of the vegetation and soils of the terrestrial habitats of Marion Island see Smith & Steenkamp, 2001). Climatic conditions are especially harsh and severe at higher altitudes and there is a high frequency of nights with frost. Additionally, strong winds contribute to drought stress and wind abrasion. Consequently, fellfield and polar desert habitats are dominated by cushion-forming species which possess a relatively high resistance to water loss and an ability to retain heat.

*Valdonia microcarpa* is a constant constituent of the association *Andreaea acutifoliae-Racomitrium crispuli* which is the most widespread, most sparse, and a pioneer plant community on Marion and Prince Edward Islands (Gremmen, 1982). It grows on dry or windswept gravels, scree and scoria, often overlying a loamy soil. Quite often, it forms typical moss balls which cover large expanses of the terrain on rock ledges, stabilized scree of scoria and volcanic ash and on lava fields. It is frequently associated with other ball- or cushion-forming mosses, most notably with one or more of the following: *Ditrichum strictum*, *D. subaustrale*, *D. conicum* (Mont.) Mitt., *Andreaea acutifolia* Hook. f. & Wilson, *Grimmia kidderi* James, *Racomitrium membranaceum* (Mitt.) Paris, *Dicranoweisia antarctica*, and *Kiaeria pumila* (Mitt.) Ochyra.



## DISTRIBUTION

As well as occurring on Marion and Prince Edward Islands, *Valdonia microcarpa* occurs on Îles Kerguelen (Mitten, 1876, 1879; Hemsley, 1884; Cardot 1916) and Îles Crozet (Boudry & Masse, 1993). It is thus restricted to the Kerguelen Province of the Subantarctic region (Fig. 4). On Marion and Prince Edward Islands it is common and locally very abundant whereas it seems to be uncommon on Îles Crozet and Îles Kerguelen. However, the latter two localities are bryologically very undercollected (in contrast to the Prince Edward Islands archipelago, where the moss flora has been thoroughly and systematically investigated) and it is impossible to evaluate the frequency of a moss species on the basis of casual collections. Interestingly, *V. microcarpa* was not recorded on Îles Kerguelen by F. C. Naumann during the German Transit of Venus Expedition on the ship *Gazelle* (Müller, 1883, 1889) or by the German South Polar Expedition of 1901–1903 (Brotherus, 1906). The species was also not found at Îles Crozet or Îles Kerguelen by Hébrard (1970).

*Valdonia* is presently the only moss genus endemic to the Subantarctic, which leads to interesting speculation regarding its origin. Probably, the taxon evolved on Îles Kerguelen which, along with Heard Island, are ancient emerged portions of the Kerguelen Plateau. Îles Kerguelen has a complex history that commenced with subaerial basaltic volcanism 115 m.y. BP, i.e. about 10 m.y. after the separation of India and Antarctica. It sank below sea level in the mid-Cretaceous, when Broken Ridge and Kerguelen Plateau separated 43 m.y. ago in the Eocene in the early Tertiary and the Indian subcontinent migrated northwards (Giret, 1982; Quilty & Wheller, 2000). Îles Kerguelen has thus been continuously available for plant colonization since 43 m.y. BP, which is a sufficient time for generic

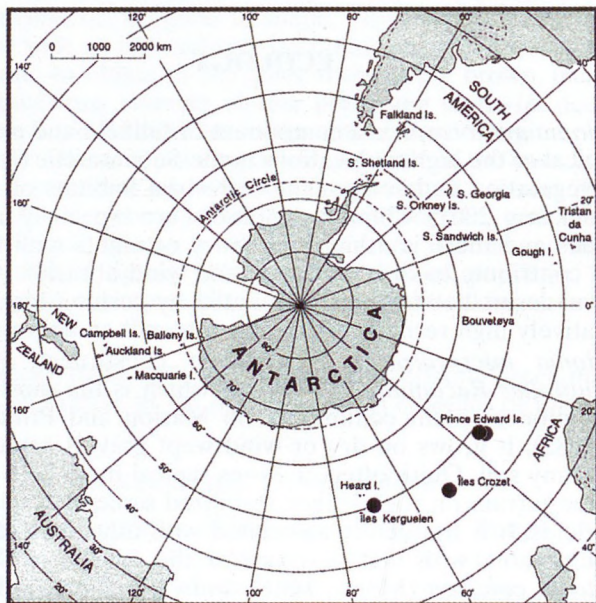


Fig. 4. Global distribution of *Valdonia microcarpa* (Mitt.) Ochyra.



endemism. It is notable that the Kerguelen Province is a remarkable centre of endemism of the Seligeriaceae since, apart from *Valdonia microcarpa*, at least three distinct species of *Dicranoweisia* (*D. insularis* (Mitt.) Ochyra, *D. dryptodontoides* (Müll. Hal.) Broth. and *D. tortifolia* (Hook. f. & Wilson) Paris) are endemic there. The latter of these occurs only on Îles Kerguelen. *Ditrichum subaustrale*, better known as *D. immersum* Zant. (Seppelt, 1996), is another example of a local endemic which additionally is very isolated taxonomically. It is likely that these mosses evolved on Îles Kerguelen and spread to the other, much younger, Îles Crozet and Prince Edward Islands. However, because of the paucity of taxonomic studies, generic endemism of the mosses in the Subantarctic region is still poorly known and the scenario suggested above must remain speculation until the region has been studied more intensively and systematically. What is likely is that careful study of the moss taxa on other Subantarctic islands, especially Îles Kerguelen and Heard Island, which are the oldest and largest of the Kerguelen Province islands, will reveal more local genera. An analogy from the Hepaticae that supports this assumption is the monotypic liverwort genus *Invisocaulis* R. M. Schust. recently described from Prince Edward Island (Schuster, 2002).

**Specimens examined** – PRINCE EDWARD ISLANDS. **MARION ISLAND. Northern coast:** Rondekop, 210 m, *Ochyra* 2045/01 (KRAM); Bomkop, 330 m, *Ochyra* 2082/01 (KRAM); Laekop, 120 m, *Ochyra* 1996/01 (KRAM); Repetto's Hill, 250 m, *Ochyra* 2488/99 (KRAM); stream at the east foot of Repetto's Hill, 100–180 m, *Ochyra* 2476/99 (KRAM); western part of Goney Plain between Repetto's Hill and Prinslomeer, 100 m, *Ochyra* 2437/99, 2441/99 & 2449/99 (KRAM); eastern part of Goney Plain between Diving Petrel Stream and the first stream falling into Prinslomeer, 120 m, *Ochyra* 2380/99 & 2403/99 (KRAM); Gordon's Hill, 230 m, *Ochyra* 2244/01 (KRAM) and 260 m, *Ochyra* 2275/01 (KRAM); Eduard Hill, 390 m, *Ochyra* 2309/01 (KRAM); Long Ridge South, 500 m, *Ochyra* 2150/01 (KRAM) and 540 m, *Ochyra* 2192/01 & 2195 (KRAM); Bill Briggs Beacon, 380 m, *Ochyra* 1866/99 (KRAM); Three Sister Hills, the lowest cone, 150 m, *Huntley* 708a (GRO, PRE), 180 m, *Ochyra* 1851/99 (KRAM) and 210 m, *Ochyra* 1872/99 (KRAM); same locality, the middle cone, 280 m, *Ochyra* 1889/99 (KRAM); same locality, the highest cone, 320 m, *Ochyra* 1913/99 & 1916/99 (KRAM). **Eastern coast:** between Junior's Kop and the highest cone of Three Sister Hills, 180 m, *Ochyra* 1922/99 (KRAM); between Junior's Kop and the middle cone of Three Sister Hills, 180 m, *Ochyra* 1911/99 & 1926/99 (KRAM); between Tafelberg and First Red Hill, 450 m, *Ochyra* 895/99 (KRAM); Hendrik Fister Kop, 250–300 m, *Ochyra* 904/99 (KRAM); between Hendrik Fister Kop and Piew Crag, 175 m, *Ochyra* 950/99 (KRAM); Piew Crag, 250 m, *Ochyra* 981/99 (KRAM); Halfway Kop, 500–550 m, *Ochyra* 1012/99 (KRAM); Trypot stream near Tom, Dick and Harry, 100 m, *Ochyra* 1034/99 (KRAM); north part of Stony Ridge, 110 m, *Ochyra* 1748/99 (KRAM); Fred's Hill, 240 m, *Ochyra* 1104/99 (KRAM), 280 m, *Ochyra* 1129/99 (KRAM) and 300 m, *Ochyra* 1133/99 (KRAM); Hoë Roikop, 490 m, *Ochyra* 1200/99 (KRAM); between Hoë Roikop and Middelrooikop, 390–430 m, *Ochyra* 1228/99 (KRAM); Middelrooikop, 350 m, *Ochyra* 1280/99 (KRAM). **Southern coast:** between La Grange Kop and Vrystaat Point, 80 m, *Ochyra* 1569/01 (KRAM); Vrystaat Point, 70 m, *Ochyra* 1215/01 (KRAM); Saagtand, 560 m, *Ochyra* 1128/01 (KRAM); north-east slope of Water Tunnel Stream valley, 580 m, *Ochyra* 1084/01 (KRAM) and 600 m, *Ochyra* 1082/01 (KRAM); Boulder, 470 m, *Ochyra* 1944/99 (KRAM); Feldmark Plateau, 450 m, *Ochyra* 1974/99 (KRAM). **Western coast:** Neville, 240 m, *Ochyra* 389/99 (KRAM); hill 270 over Kamskoppie, 270 m, *Ochyra* 279/99 (KRAM); Kamskoppie, 120 m, *Ochyra* 555/99 (KRAM); between Saalrug and Wolfie, 650 m, *Ochyra* 989/01 (KRAM); Hunchback, 480 m, *Ochyra* 1505/01 (KRAM); Kaalkoppie, 90 m, *Ochyra* 1477/01 (KRAM); north-west foot of Cola Ridge, 350 m, *Ochyra* 1516/01 (KRAM); Skuinskop, 320 m, *Ochyra* 1547/01 (KRAM); La Grange Kop, 150 m, *Ochyra* 1324/01 (KRAM). **Central highland:** First Red Hill, 550 m, *Ochyra* 775/99 (KRAM); between First Red Hill and Katedraalkrans, 650 m, *Ochyra* 744/99 (KRAM); Katedraalkrans, 700 m, *Ochyra* 623/99 (KRAM) and 750 m, *Ochyra* 630/99, 637/99 & 649/99 (KRAM); Ned's Kop, 880 m, *Hertel* 24688a (KRAM, M). **Without specific locality:** "montane cryptogametum", *Huntley* 833, 894d, 909a & 910a





(GRO, PRE); fjaeldmark 34, *Huntley 744b* (GRO, PRE); fjaeldmark 322, *Huntley 938b* (GRO, PRE). **PRINCE EDWARD ISLAND.** South of Cave Bay, 50 m, *Zinderen Bakker 608* (BM, GRO, KRAM, PRE); Golden Gate, 60 m, *Ochyra 136/01* (KRAM) and 60 m, *Ochyra 139/01* (KRAM); stream between Golden Gate and McAll Kop, 60 m, *Ochyra 199/01* (KRAM) and 85 m, *Ochyra 200/01* (KRAM); eastern slope of Platkop, 220 m, *Ochyra 219/01* (KRAM); summit of Platkop, 230 m, *Ochyra 228/01* (KRAM); western foot of Platkop, 210 m, *Ochyra 515/01* (KRAM); between Platkop and Hoedberg, 245 m, *Ochyra 232/01* (KRAM); Kraterkoppie, 135 m, *Ochyra 541/01* (KRAM); east slope of Van Zidderen Bakker Peak, 600 m, *Ochyra 239/01* (KRAM) and 670 m, *Ochyra 262/01* & *264/01* (KRAM); at west foot of Horingberg, 550 m, *Ochyra 287/01* & *290/01* (KRAM); eastern slope of Horingberg, 450 m, *Ochyra 314/01* (KRAM); Albatros Valley, 280 m, *Ochyra 351/01* (KRAM); south foot of Boggel, 160 m, *Ochyra 372/01* (KRAM); stream at the east foot of Hoedberg, 250 m, *Ochyra 418/01* (KRAM); summit of Hoedberg, 348 m, *Ochyra 430/01* (KRAM); south-eastern slope of Wolkberg, 530 m, *Ochyra 447/01* (KRAM); summit of Wolkberg, 593 m, *Ochyra 500/01* (KRAM); eastern ridge of Wolkberg, 430 m, *Ochyra 506/01* (KRAM); Rock Pinacle, 500 m, *Ochyra 472/01* (KRAM); NE Highland Landmark, 300 m, *Zinderen Bakker 638* (BM, GRO, KRAM, LE, PRE); Feldmark, 150 m, *Huntley 622* & *623* (GRO, KRAM, PRE); east part of Kent Crater rim, 230 m, *Ochyra 815/01* (KRAM); Moeder-en-kind, median cone, 270 m, *Ochyra 893/01* (KRAM); Moeder-en-kind, south-east cone, 220 m, *Ochyra 903/01* (KRAM) and 200 m, *Ochyra 905/01* (KRAM); Vaalkop, 180 m, *Ochyra 852/01* (KRAM).

**ÎLES CROZET. ÎLE DE LA POSSESSION.** East-facing slopes of Mont Branca, 200 m, *Bell 1424* (AAS, KRAM); summit of Mont Branca, 380 m, *Bell 1456* (AAS, KRAM); Rivière du Camp Valley, 200 m, *Bell 1782* (AAS, KRAM); in the valley south of Pointe du "Bougainville", 80 m, *Bell 2398* (AAS, KRAM); La Grotte du Géographe, 290 m, *Bell 2257* (AAS, KRAM); Plateau des Petrels, north of Pt. 455, 500 m, *Bell 2264* (AAS, KRAM); valley leading to Cirque du Sphinx, 60 m, *Bell 2287* (AAS, KRAM); upper north slope of Malpassée Rivière, 240 m, *Bell 3028* (AAS, KRAM).

**ÎLES KERGUELEN.** *Sine loco*, 1874, *Moseley s.n.* (BM, NY, type of *Blindia microcarpa*), *Bossière 18* (H-BROTH, PC-THÉR) and 1913–1914, *Rallier du Baty 26, 64* & *76* (PC); Cirque du Château, 25 Oct 1952, *Aubert de la Rüe s.n.* (US).

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