Phytotaxa 188 (3): 153–161
www.mapress.com/phytotaxa/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

http://dx.doi.org/10.11646/phytotaxa.188.3.4

Nomenclatural entanglements associated with *Racomitrium chlorocarpum* (Grimmiaceae)

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Abstract

A nomenclatural history of one of the most neglected and misunderstood species *Racomitrium chlorocarpum* is presented. Valid publication of this species name was incorrectly ascribed to M. Fleischer and *R. chlorocarpum* of 1904 is merely a younger isonym of *R. chlorocarpum* Paris of 1897. The species name is lectotypified with a specimen from Tasmania, Australia, deposited in the Hooker herbarium (BM), and an isolectotype is present in the herbarium of W. Mitten (NY). *Racomitrium chlorocarpum* is a typical representative of the genus *Bucklandiella*, the largest segregate of the broadly interpreted genus *Racomitrium* and the relevant transfer to this genus is effected as *Bucklandiella chlorocarpa*, *comb. nov*. The diagnostic characters of the species are briefly summarised. This is a hydrophytic species, endemic to Australasia and is known from SE Australia, Tasmania and New Zealand.

Key words: Australia, author citation, Bryophyta, *Bucklandiella*, lectotypification, New Zealand, nomenclature, Tasmania, taxonomy

Introduction

The genus *Racomitrium* Bridel (1818[1819]: 78) is well represented in Australasia, both in terms of frequency of species and cover. However, the real number of species in this region is still unknown because the genus has not been carefully and critically revised to provide a sound taxonomic framework for Australasian material. In addition, the traditionally conceived genus *Racomitrium* was split into four genera (Bednarek-Ochyra *et al.*, 2001; Ochyra *et al.*, 2003), three of which are present in Australasia, including *Racomitrium* s. str. (2 species), *Niphotrichum* Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 137) (2 species) and *Bucklandiella* Roivainen (1972: 116). The latter is the largest and least understood segregate of *Racomitrium*. Almost all species described in the nineteenth century from Australia and New Zealand, as well as from other regions of the Southern Hemisphere, and correctly belonging within this genus, were lumped with *Bucklandiella crispula* (Hooker & Wilson 1844: 544) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 144) [as *Racomitrium crispulum* (Hook.f. et Wilson) Wilson (1854: 75)] (Dixon, 1926; Clifford, 1955; Lawton, 1973). However, various authors have shown that many of these are distinct and well defined species which are only distantly related to *B. crispula* (e.g. Roivainen, 1955; Bell, 1974; Deguchi, 1984; Bednarek-Ochyra *et al.*, 1999; Bednarek-Ochyra & Ochyra, 1998, 2010, 2011, 2012a,b,c, 2013a,b; Ochyra *et al.*, 2008a,b; Blockeel *et al.*, 2009; Ellis *et al.*, 2011a, 2012a,b, 2013a,b; Larraín *et al.*, 2011; Ochyra & van Rooy, 2013).

One of species which was merged with *Bucklandiella crispula* is *Racomitrium chlorocarpum* (Dixon, 1926). During the course of ongoing revisionary studies of Australasian *Bucklandiella* it became evident that this neglected species has an exceptionally chequered taxonomic and nomenclatural history. Although this name has often been used in the Australasian bryological literature, it is not certain who actually was the first to publish it validly. Consequently, this name has not been lectotypified, nor is the correct circumscription of this species known. For that reason the authority is abandoned on the first appearance of this name in this account and, in addition, the nomenclatural issues associated with *Racomitrium chlorocarpum* are thoroughly discussed.

Accepted by Lars Söderström: 7 Oct. 2014; published: 12 Dec. 2014

Nomenclatural history of *Racomitrium chlorocarpum*

It is currently accepted (Wijk *et al.*, 1967) that *Racomitrium chlorocarpum* was validly published by Fleischer (1904: 377). When describing the new Javanese species *R. microphyllum* Fleischer (1904: 377), he stated: "Diese Art steht dem *R. chlorocarpum* (Mitt.) Par. aus Neu-Seeland nahe, welches aber verlängerte, stark buchtige Blattzellen hat". This very brief diagnosis is utterly uninformative since elongate and strongly sinuose-walled laminal cells are typical for all species of the broadly circumscribed *Racomitrium*. Yet, it constitutes a valid description of this species, even though *R. chlorocarpum* should be considered as a kind of a *nomen subnudum* in this publication. Although Fleischer (1904) ascribed this name to "(Mitt.) Par.", the compilers of *Index muscorum* gave "Mitt. *ex* Fleisch." as the authorship of this name. They accepted that Mitten (in Mueller, 1881) was the first to propose the epithet *chlorocarpum* as a *nomen nudum* in the combination with the generic name *Dryptodon* Bridel (1826: 191) and no valid diagnosis of this species was ever published (Wijk *et al.*, 1967).

The name *Racomitrium chlorocarpum* was published for the first time in *Flora Novae Zelandiae* by Hooker (1867: 426). He described *Racomitrium crispulum* and distinguished two varieties within it: [var.] α which he diagnosed by "Leaves gradually attenuated; cells of upper portion rounded" and [var.] β having "Leaves with a suboval base, obtuse and apiculate". At the end of the line describing the latter variety Hooker appears to be including "*R. chlorocarpum*, Mitten, mss." as a synonym. The status of this binomial is clearly confirmed in the index to this opus where, on p. 792, *Racomitrium chlorocarpum* is printed in italics and this type is used for synonyms as explained at the beginning of the index on p. 770.

In the following paragraph dealing with the distribution of these varieties, Hooker (1867) has "Var. β. Northern Island: on alpine rocks, *Colenso*" and then the note that Mitten had distinguished "the Northern Island form as a species (*R. chlorocarpum*)". In addition, "Tasmania and Kerguelen's Land" are indicated as parts of the range of this variety. On the other hand, var. α is shown to occur only on "Campbell's Island, *J.D.H.*", so it is clearly the type variety of this species since the cited specimen evidently represents the type material of *Dryptodon crispulus* Hooker & Wilson (1844: 544), collected by J.D. Hooker on Campbell Island during the Antarctic voyage of 1839–1843.

The placement of the binomial *Racomitrium chlorocarpum* after the diagnosis of var. β could seemingly suggest that the epithet *chlorocarpum* may be used as the name of this variety following Art. 24.2 of the current Code (McNeill *et al.*, 2012). However, a closer analysis of this entry clearly shows that Art. 35.2 is more applicable in this case. Yet, because the epithet *chlorocarpum* is not immediately associated with var. β, it must be rejected as a name for this variety and, accordingly, this taxon must be considered as an unnamed variety of *R. crispulum*. This interpretation is directly confirmed by the way Hooker (1867) named varieties in other parts in this publication. A closer analysis of the text shows that he described a number of varieties for various species and for some of them he used names but some remained unnamed. Unfortunately, infraspecific taxa are not indexed in this work at all. Nevertheless, there are a few cases in this work which are very instructive and confirm the correctness of the interpretation of the varietal name for *Racomitrium crispulum* var. β. For example, Hooker (1867: p. 412) distinguished *Dicranum robustum* Hooker & Wilson (1844: 542) var. β. *pungens* (Hooker & Wilson 1844: 541) Hooker (1867: 412) and at the end of this entry he placed *Dicranum pungens* Hooker & Wilson (1844: 541) as a synonym. The same scheme is also accepted for two varieties of *Sphagnum cuspidatum* Ehrhart *ex* Hoffmann (1796: 22) (p. 401) and one variety of *Fissidens viridulus* (Swartz *ex* anon. 1801: 538) Wahlenberg (1812: 334) (p. 408).

Although the name *Racomitrium chlorocarpum* Mitt. *ex* Hook.f. of 1867 was not validly published and is a classical *nomen nudum*, this epithet was used several times in various contemporaneous publications. Mitten (1876a, b) used the name *Grimmia* (*Dryptodon*) *chlorocarpa* Mitten (1876a: 70; 1876b: 194) for specimens collected from subantarctic Îles Kerguelen and Marion Island. Given the view expressed above it is obvious that "*Grimmia* (*Dryptodon*) *chlorocarpa* Mitt." does not constitute "a clear (if cryptic) indication" (Art. 38.14) that Hooker's description of *Racomitrium crispulum* var. β. applies to *Grimmia chlorocarpa* Mitt., so it must be considered not validly published. Clearly, exactly the same applies to Tasmanian *Dryptodon chlorocarpus* Mitten *ex* Mueller (1881: 114), *Grimmia chlorocarpa* Mitten (1882: 56) and *Racomitrium chlorocarpum* Mitten *ex* Bastow (1887: 60).

The next work in which *Racomitrium chlorocarpum* appeared is *Index bryologicus* (Paris, 1898), where it is accepted as a species in its own right and its name, *Rhacomitrium chlorocarpum*, is ascribed to "(Mitt.) Paris". Three synonyms are cited for this name, including *Dryptodon chlorocarpus* Mitt. *ex* F.Muell. of 1881, *Grimmia chlorocarpa* Mitt. of 1882 and *Racomitrium crispulum* var. β of Hook.f. of 1867. The placement of the latter synonym may be interpreted as a direct reference to the description of this unnamed variety given by Hooker (1867) and consequently this represents the first valid publication of *Racomitrium chlorocarpum*. From the entry in Paris's (1898) *Index bryologicus*

one can conclude that the citation of this name is simply *Racomitrium chlorocarpum* Paris (1897: 108). It is because in Art. 46.3 the second sentence makes it clear that Paris's (1898) reference to Mitten's use of the epithet *chlorocarpus* or *chlorocarpa* does not constitute ascription since it appears in a list of synonyms.

The first edition of *Index bryologicus* is a compilation of 17 articles which were originally published separately in *Actes de la Société Linnéenne de Bordeaux* from May 1894 to May 1898, each with a separate journal pagination. The compilation was published in five parts with a consecutive pagination, usually several months later after the original publication (Stafleu & Cowan, 1983). It is a generally accepted custom that numerous nomenclatural novelties proposed in this opus are ascribed to the compilation which is available as a single massive book. However, it can happen that considering only the compilation can be misleading (Lücking *et al.*, 2007). Therefore the effective date and place of publication is given here (Paris, 1897), along with the alternative bibliographic data from the compilation (Paris, 1898).

If the above argumentation regarding the validation of *Racomitrium chlorocarpum* Paris is accepted, it means that the name *R. chlorocarpum* Mitt. *ex* M.Fleisch. must be considered merely as a later isonym which has no nomenclatural standing (see also Ochyra *et al.*, 2006). It is worth noting that Dixon (1926) was the only author who correctly ascribed *R. chlorocarpum* to Paris. However, he placed this name without any comment in synonymy with *R. crispulum*.

Typification of *Racomitrium chlorocarpum*

According to Art. 7.7 of the current Code (McNeill *et al.*, 2012) *Racomitrium chlorocarpum* "is to be typified by an element selected from the entire context" of Hooker's (1867) description of *R. crispulum* var. β. This author cited in the protologue the specimens from three distant regions, including the North Island of New Zealand, Tasmania and Îles Kerguelen. During the course of revisionary studies of austral taxa of *Bucklandiella* some specimens annotated by W. Mitten as *Grimmia* (*Rhacomitrium*) *chlorocarpa* have been located on the sheet stamped "Herbarium Hookerianum" in BM and on the sheet labelled "*Rhacomitrium chlorocarpum* (Mitt.) Paris" in the Mitten Herbarium in NY. Many of them are eligible for selection of a lectotype of *R. chlorocarpum*.

Of the specimens cited in the protologue no material collected by Colenso from the North Island was found. In the Wilson herbarium in BM there is only a small scrap collected by Colenso in New Zealand (No. 2074), named with a question mark *Dryptodon rupestris* Hooker & Wilson (1844: 544) and cited by Wilson (1854) and Hooker (1867) under this name. Therefore this specimen cannot be considered as potential material for lectotypification.

The only material from Îles Kerguelen which was cited by Hooker (1867) in the protologue of *Racomitrium crispulum* var. β is the specimen collected by J. D. Hooker in this archipelago from May to July 1840 and cited in his *Flora antarctica* as *Racomitrium protensum* A.Braun *ex* Duby (1830: 573) var. 3 (Wilson & Hooker, 1847). No other moss collections were made from this isolated archipelago until 1874 when H. N. Moseley, a naturalist to the *Challenger* Expedition, collected the specimen named by Mitten (1876a) as *Grimmia chlorocarpa*. In addition, in January 1875, A. E. Eaton recorded in this archipelago during the British Transit-of-Venus Expedition the specimen named by Mitten (1876b) as *Grimmia chlorocarpa*. Nevertheless, the latter two specimens are also not eligible for lectotypification of *R. chlorocarpum*.

The specimen collected by Hooker on Îles Kerguelen was described by Müller (1889) as *Grimmia suborthotrichacea* Müller (1883: 81) var. *robustissima* Müller (1889: 30) and this variety is identical to *Bucklandiella pachydictyon* (Cardot 1908: 113) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 147) (Ochyra *et al.*, 2008b). Acceptance of this material as lectotype of *R. chlorocarpum* could seriously disturb the current nomenclature because this name could have priority over *R. pachydictyon* Cardot (1908: 113), the basionym of *Bucklandiella pachydictyon*, described in 1908 (Cardot, 1908). The latter name is firmly rooted in moss taxonony (Ochyra *et al.*, 2008a,b; Blockeel *et al.*, 2008; Müller, 2009; Larraín, 2012) and such a change would destabilise the nomenclature.

A good number of specimens which were annotated by W. Mitten as *Grimmia chlorocarpa* originate from Tasmania and these are available in the Hooker herbarium in BM and in the Mitten herbarium in NY. In fact, these are almost all specimens cited in *Flora Tasmaniae* under the name *Racomitrium crispulum* (Wilson, 1858). One of the specimens in fine fruiting condition collected by Gunn at St. Patrick's River is here selected as lectotype of *Racomitrium chlorocarpum* (Fig. 1). At the same time this species is transferred to *Bucklandiella* Roiv. as it exhibits all diagnostic features of this genus including smooth laminal cells, short lanceolate peristome teeth irregularly divided in the distal part into 2–3 branchlets, and a smooth and dextrorse seta.

FIGURE 1. The lectotype specimen of *Racomitrium chlorocarpum* Paris selected from the Hooker herbarium (BM).

Bucklandiella chlorocarpa (Paris) Bednarek-Ochyra & Ochyra, *comb. nov.*

Racomitrium chlorocarpum Paris, *Actes Soc. Linn. Bordeaux* 51: 108. 1897 (September) and *Index Bryol*.: 1072. 1898 (February) [*Grimmia chlorocarpa* Mitt., *J. Linn. Soc. Bot*. 15: 66, 70, 194. 1876, *nom. nud.*; *Dryptodon chlorocarpus* Mitt. *ex* F.Muell., *Fragm. Suppl*. 11: 114. 1881, *nom. nud.*; *Grimmia chlorocarpa* Mitt., *Trans. Proc. R. Soc. Victoria* 19: 56. 1882, *nom. nud.*; *Racomitrium chlorocarpum* Mitt. *ex* Bastow, *Pap. Proc. Roy. Soc. Tasmania* 1886: 60. 1867 [‘*chlorocarpa*’], *nom. nud.*]. Type citation: [New Zealand] Northern Island: on subalpine rocks, *Colenso*. ..... (Tasmania, Kerguelen’s Land). Lectotype (*selected here*): “W. 11. Rhacomitrium crispulum Hf & W. St. Patrick’s River, V.D.L. 1845 Gunn. 1608. (manu Wilson) Grimmia (Rhacomit^{m}) chlorocarpa, m. (manu Mitten)” – BM-Hooker 000962320!; isolectotype: NY-Mitten! Syntypes: (*1*) “W.W. Rhacomitrium crispulum Hf & W. St. Patrick’s River, V.D.L. 1844 (on rock) *Gunn*. (manu Wilson) Grimmia (Rhacomit^{m}) chlorocarpa, m. (manu Mitten)” – BM-Hooker 000962319!; (*2*) “V. D^{s}. Land. 1844 *Gunn 21*. Rhacomitrium crispulum Hf & W. in Fl. Tasm. Grimmia (Rhacomit^{m}) chlorocarpa, m. (manu Mitten)” – BM-Hooker 000962321!; (*3*) 1312. Rhacomitrium crispulum H.f & W. Fl. Tasm. p. 181 Lake Echo. V. D^{s}. L. on stones 2. *J.D.H.*” – BM-Hooker 000962324!; (*4*) 1308. V. D^{s} L^{d}. On stones near Lake Echo Rhacomitrium crispulum H.f & W. Fl. Tasm. p. 181 Lake Echo. Grimmia (Rhacomit^{m}) chlorocarpa, m. (manu Mitten)” – BM-Hooker 000962323!; (*5*) [The sheet labelled: The New York Botanical Garden Herbarium of William Mitten *Rhacomitrium chlorocarpum* (Mitt.) Paris: “Inundated rock Mountain River N. Huon Tasmania Mr Oldfield” – NY-Mitten!; (*6*) same sheet: “Tasmania Oldfield” – NY-Mitten!; (*7*) same sheet: “On rocks Rivulet behind Cummings H^{d}. Western Mts. Tasmania Mr Archer” – NY-Mitten (2 specimens)!; (*8*) same sheet: “Tasmania Archer” – NY-Mitten!

Concluding remarks

Bucklandiella chlorocarpa is a very distinct species which can be easily distinguished from all congeners in Australasia by a combination of both gametophyte and sporophyte characters. The leaves have a wide, 2–3(–4)-seriate basal marginal border of hyaline, pellucid cells which is usually obscured by the distinct recurvature of the leaf margins near the base. The costa is short-excurrent as a stout, massive and brown awn. The capsules are large, ellipsoid, to 2 mm long and the peristome teeth are massive, 460–580 μm long on average and 100–125 μm wide near their base, deeply purple below and strongly papillose with large warty papillae. The spores are large, 25–30(–40) μm in diameter. This is a hydrophytic species, growing typically on wet, often inundated rocks in stream beds in SE Australia, Tasmania and New Zealand. A detailed taxonomic circumscription of this species, with detailed illustrations, will be published in a separate account.

Bucklandiella is currently represented by 13 species in Australasia. Of these, 12 species are known to occur in New Zealand, seven from Tasmania and Australia, and *B. lamprocarpa* (Müller 1849: 802) Bed.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 145) is the only species which occurs in Australasia exclusively on subantarctic Macquarie Island (Blockeel *et al.*, 2007), although this species has a much wider range in the Subantarctic (Bednarek-Ochyra & Ochyra, 1998; Ellis *et al.*, 2010, 2011b) as well as in South Africa (Ochyra & van Rooy, 2013) and South America and Europe (Ochyra *et al.*, 1988; Blockeel *et al.*, 2002). However, it is very likely that this number may still increase with progress in ongoing monographic studies on this genus. It is evidenced by the recent discoveries of some new species to New Zealand (Bednarek-Ochyra & Ochyra, 2010, 2011) and resurrection of some species from oblivion including *B. elegans* (Müller 1898: 168) Bednarek-Ochyra & Ochyra (2010: 254) (Ellis *et al.*, 2011a) and *B. chlorocarpa* in the present account. Moreover, several species previously known from elsewhere have been added to the moss flora of New Zealand (Blockeel *et al.*, 2008; Ellis *et al.*, 2011a, 2014), Tasmania (Blockeel *et al.*, 2010; Ellis *et al.*, 2011b) and Australia (Blockeel *et al.*, 2008). On the other hand, some species reported from Australia (Streimann & Klanzenga, 2002), such as *B. affinis* (Weber & Mohr 1807: 127) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 144), *B. heterosticha* (Hedwig 1801: 109) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 145), *B. obtusa* (Bridel 1801: 290) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 146) and *B. rupestris* (Hooker & Wilson 1844: 544) Bedn.-Ochyra et Ochyra *in* Ochyra *et al.* (2003: 147) must be excluded from the bryoflora of this continent.

Acknowledgements

This work was financially supported by the Polish National Centre of Sciences through grant No. N N 303 796 940 for the author and, partly, through the statutory fund of the Institute of Botany of the Polish Academy of Sciences. I am indebted to the Curators of the herbaria at BM and NY for kindly allowing me to study their herbarium holdings of Bucklandiella. Special thanks are due to Dr John McNeill, Edinburgh, for his priceless suggestions regarding nomenclatural matters, to my husband Ryszard Ochyra for critical comment on the manuscript and valuable additions and to Rod Seppelt, Hobart, Tasmania for checking the English.

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