

New Zealand Rhodymeniales: a new name for *Gloioderma saccatum* (J. Agardh) Kylin

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Abstract — The red alga *Chrysymenia saccata* was first discussed by J. Agardh in 1876, and described in 1877. In subsequent publications there has been confusion about the type material, as well as the identity, and correct taxonomic placement of this species, currently referred to the genus *Gloioderma*. We consider the nomenclatural and taxonomic history of this species, and conclude that *Chrysymenia saccata* was based on poorly preserved material of *Hymenocladia sanguinea*. The species that was documented in detail by Sparling (1957), and is currently known as *Gloioderma saccatum*, is described as *G. sparlingiae* sp. nov.

***Chrysymenia saccata* / *Gloioderma sparlingiae* sp. nov. / New Zealand / Rhodymeniales**

INTRODUCTION

The Rhodymeniales are well represented in New Zealand with approximately 18 genera (Nelson, 2012) and more than 35 species found in the region. Six genera in the Faucheaceae have been reported from the New Zealand region, including *Gloioderma saccatum* (J. Agardh) Kylin, the focus of this current paper. This species is considered to be endemic to New Zealand and is commonly found from Cook Strait south, occurring in the southern North Island, around the South Island, as well as in the Chatham Islands and Stewart Island. It has not been found on the New Zealand subantarctic islands.

Agardh (1876: 316) made reference to a new species of *Chrysymenia* from New Zealand in a section on the genus *Gloiosaccion* — “...novam speciem Chrysymeniae (*Chr. saccata* J. Ag. mscr.)”. However, Agardh (1876) did not include *C. saccata* as one of the listed species under the entry for the genus *Chrysymenia*, and there was no reference provided to any particular specimens or localities from which material had been collected other than New Zealand.

In Agardh’s later treatment of the New Zealand flora (1877: 19, no.163) *Chrysymenia saccata* J. Ag. mscr. is listed and a description provided, citing a

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Berggren collection from Bluff (“Bluff: Berggren!”). Agardh (1899: 89) also discusses *Chrysymenia saccata*, but in this publication only cites Berggren material from Warrington (“Hab. ad Warrington, Otago, pauca Specimina a Berggren lecta descripsi”). De Toni (1900: 547) transferred *Chrysymenia saccata* to *Bindera* (now *Webervanbossea*) based on the specimen from Bluff. Later, De Toni (1924: 303) accepted *C. saccata* and, although referring to Agardh’s papers (1876, 1877, 1899), he cited the locality as “ad “Bluff” (Berggren) nec non as “Warrington” Otago”, thus recognising the type status of the material from Bluff.

In a monograph of the Rhodymeniales, Kylin (1931:7) transferred *Chrysymenia saccata* to *Gloioderma* based on the structure of the thallus and the cystocarp. He stated he was unable to find the “Original exemplare dieser Art”. He examined the material collected by Berggren from Warrington, and commented that the thallus was solid, not saccate. Kylin (1931) in making the new combination, *Gloioderma saccatum* (J.Agardh) Kylin, listed both Agardh’s 1876 and 1899 publications in the synonymy, but did not include reference to the 1877 treatment. He stated “Original exemplare von Warrington, Otago, New Zealand” providing an illustration of part of this Berggren specimen (Kylin: pl. 2, Fig. 4), two central fronds of Hb. Agardh #26599, thus not following De Toni’s understanding of the type material.

Sparling (1957) provided the first detailed study of the anatomy and reproduction of *Gloioderma saccatum*, based on specimens collected from Eastbourne Wellington, and she also described the obligate parasite *Gloiocolax novae-zelandiae* (Sparling, 1957: 335). Sparling traced the nomenclatural history of *Gloioderma saccatum* as well as the uncertainty about the type specimen, and the fact that Kylin had been unable to locate the Bluff material on which the 1877 account had been based. She stated “Clearly until the original specimen from Bluff is found and it is studied it cannot be determined whether two species were concerned in J. Agardh’s description of *G.* (sic) *saccata*.” The current understanding of this taxon in New Zealand is based on Sparling’s anatomical and morphological investigations.

Norris (1991) considered *Gloioderma* (Agardh, 1851) to be a heterotypic synonym of *Gloiocladia* (Agardh, 1842) and transferred species in this genus either to *Gloiocladia* if they had tetrasporangia evenly dispersed (as in the case of *G. saccatum*) or accumulated in slightly raised sori, or to *Faucheia* if the tetrasporangia were in raised nemathecia. Although Norris (1991: 592) made the formal combination, *Gloiocladia saccata* (J. Agardh) Norris, this transfer was not accepted by some subsequent workers (e.g. Adams 1994). Norris differed from Kylin in citing Agardh (1877) as the date of publication of the basionym of this taxon, that is, when the combinations *Gloioderma saccatum* and *Gloiocladia saccata* were made the respective authors cited different type material.

In this paper we consider the nomenclatural and taxonomic history of the New Zealand species, currently referred to as *Gloioderma saccatum*, report on our examination of specimens collected by Berggren that are housed in the Agardh Herbarium (LD) and cited by Agardh, and compare our findings with recently collected specimens identified as *G. saccatum* in the light of recent work on members of the Faucheaceae (e.g. Saunders *et al.*, 1999; Sanchez & Rodriguez-Prieto, 2005; Dalen & Saunders, 2007; Rodriguez-Prieto *et al.*, 2007; Le Gall *et al.*, 2008; Sanchez *et al.*, 2010; Filloramo & Saunders, 2015, 2016).



Figs 1-4. Type material of *Chrysymenia saccata* J. Agardh, LD26192-94, Berggren 1874.

MATERIALS AND METHODS

Specimens of *Chrysymenia saccata* collected by Berggren and annotated by J. Agardh were borrowed from LD, sectioned and compared with specimens housed in WELT. Specimens of *Gloioderma saccatum* lodged in CHR that are duplicates of specimens studied by Sparling (1957) were borrowed and examined. (Herbarium abbreviations — Thiers, 2016).

RESULTS

Examination of Specimens

The following observations were made on specimens within the Agardh collections at LD:

LD26192-94: Bluff, Berggren. (Figures 1-4) This material consists of three separate cards of specimens. The specimens are unbranched or fragments of thalli. When sectioned the material was found to be *Hymenocladia sanguinea* (Harv.) Sparling, based on the arrangement of medullary cells and cortical filaments. In some specimens the medullary cells had broken down giving the thallus a saccate appearance, and the condition of some of the individual specimens suggested that they were in a deteriorated state when originally pressed. Cystocarps referred to by De Toni (1924) were found on specimen LD26193 (Fig. 2).

LD26594-99a: Warrington, Berggren. This herbarium material includes text written by Agardh, and four numbered sheets that were found to be a mixture of several species: LD26594-5 — text; LD26596 — mixed but predominantly *Gloioderma*; LD26597 — *Webervanbossea tasmanensis* Womersley; LD26598 — mixed material; LD26599 — *Gloioderma*.

There is no information about the date of collection on the Berggren specimens. Berggren visited New Zealand in 1874-1875 supported by both the Royal Academy of Sweden and the New Zealand Government and his collections of marine algae were given to J.G. Agardh in Lund (Nelson *et al.*, 1998). Although the specimens are not dated, based on information from Berggren's diaries (Bagnall, 1970), he travelled to Dunedin and Invercargill between March and June 1874, and it is in this period that specimens from both Bluff and Warrington would have been collected.

Observations on material housed in New Zealand herbaria:

CHR: CHR 64553, Eastbourne, Wellington, drift, N.M.Adams, 20 March 1949; also duplicate material CHR 64554 and CHR 64547, G.F. Papenfuss, 20 March 1949. Duplicate material from this collection event (with collectors L.B. Moore, N.M. Adams and G.F. Papenfuss), is also housed at the University of California Berkeley, and cited and illustrated in Sparling as UC920751 (pl. 48) and UC920752 (Figs 1 and 2, pl. 49b).

WELT: collections of *Gloioderma saccatum* from the southern North Island, Chatham, South, and Stewart Islands were examined and found to be consistent with the species treated by Sparling (1957) as *G. saccatum*.

Material identified as *G. saccatum* from both CHR and WELT differed from the Berggren specimens of *Chrysomenia saccata* from Bluff in terms of the width of thalli, branching, as well as the internal anatomy, and the position of cystocarps (marginal surrounded by crown-like proliferations in the WELT material, compared with hemispherical cystocarps scattered in the thallus e.g. Fig. 2, LD26193). Collections from the northern North Island and the Three Kings Islands differed from specimens collected in the south identified as *Gloioderma saccatum*. These northern collections have been provisionally associated with the genus *Gloiodermatopsis* established by Lindauer (1949), although this genus remains poorly characterised.

DISCUSSION

The reason the epithet ‘*saccata*’ was selected by Agardh for New Zealand *Gloioderma* has been unclear until this investigation. When Agardh first referred to this species (Agardh, 1876) it was within the section *Gloiosaccion*, a genus of saccate species. In 1877, when Agardh described *Chrysymenia saccata*, he referred to the saccate nature of the specimens from Bluff, and noted “speciminibus facillime dissolutis et vix praeparandis”. The material cited by Agardh (1877) has been shown here to be poorly preserved material of *Hymenocladia sanguinea*, a species that is not normally saccate but appears hollow when material deteriorates and the medulla breaks down.

We have established that there is a need for a new name for the species that was documented in detail by Sparling, and is currently known as *Gloioderma saccatum*, a species that is easily distinguished and widely distributed in New Zealand. Although there has been confusion about the type material to which the epithet *saccata* belongs, the material from Bluff cited by Agardh (1877) is not the species treated by Sparling.

The generic placement of this species must be regarded as provisional. Although Norris (1991) reduced *Gloioderma* to synonymy with *Gloiocladia* this view has not been supported by subsequent research. Rodríguez-Prieto *et al.* (2007) reassessed the genera *Fauchea* and *Gloiocladia*, transferred the type and all other species of *Fauchea* to *Gloiocladia*, and emended the description of *Gloiocladia*. In a review of the genus *Leptofauchea*, Dalen and Saunders (2007) recognised the genera *Gloiocladia* (represented by *G. furcata* (C. Agardh) J. Agardh) and *Gloioderma* (represented by *G. australe* J. Agardh and *G. polycarpum* (Harv.) Dalen & G.W. Saunders) as separate lineages. *Gloioderma* has also been shown to be clearly distinct from *Gloiocladia* in other phylogenetic analyses of the order Rhodymeniales (e.g. Le Gall *et al.*, 2008; Filloramo & Saunders, 2015).

In characterising a new species of *Gloiocladia*, Sanchez *et al.* (2010), included data from New Zealand in their analyses, stating: “*Gloioderma saccatum* was resolved as the basal lineage in all analyses; however this position was only poorly supported”. The material analysed by Sanchez *et al.* (2010) was from northern New Zealand and is thus not the same as the species treated in this paper. It is probable that the taxon represented in the analyses of Sanchez *et al.* (2010) is *Gloiodermatopsis setchellii* Lindauer, a species that has been infrequently collected and remains poorly known.

Nomenclature

Based on the examination of the Berggren collection from Bluff cited by Agardh (1877: 19, no.163) in his description of *Chrysymenia saccata*, we propose that this species is a heterotypic synonym of *Hymenocladia sanguinea* (Harv.) Sparling. The entity that has been known by the name *Gloioderma saccatum* (J. Agardh) Kylin requires a new name, established here:

Gloioderma sparlingiae W.A. Nelson & Dalen

Fig. 5

Diagnosis: Dichotomous to slightly irregularly branched, lying in one plane, often with marginal proliferations; to ca 15 cm in height. Branches approximately 1 cm wide at maximum, narrowing to the tips. Attachment by a small holdfast with a short lower axis. Colour ranges from greenish pink to pink-brown. Very slippery texture. Large hyaline cells of the medulla (2-5 times as long as wide) extend almost to the



Fig. 5. Holotype of *Gloioderma sparlingiae* sp. nov. WELT A006493.

apex. Smaller outer medullary cells bear anticlinal, dichotomously branched cortical filaments. Cystocarps are almost exclusively marginal and surrounded by a ring of projections giving a crown like appearance. No male thalli have been observed. Tetrasporangia are produced on cells near the base of cortical filaments and are cruciately divided, scattered over both surfaces of the thallus, and not produced synchronously.

Holotype: WELT A006493, Muritai (Eastbourne), Wellington, New Zealand, drift, N.M.Adams, 25 Oct 1971 (both cystocarpic and tetrasporangial specimens present on sheet)

Isotypes: WELT A006491, A006492. In addition WELT A006494, with the same collection details, is registered as *Gloiocolax novae-zelandiae*, the parasite restricted to this host species and described by Sparling (1957).

Additional collections examined: North Island: CHR64547, CHR64554, Eastbourne, Wellington, G.F. Papenfuss, 20 March 1949, drift; CHR64553, Eastbourne, Wellington, N.M. Adams & G.F. Papenfuss, 20 March 1949, drift; WELT A003006, Island Bay, Wellington, N.M. Adams, 17 March 1970; WELT A003734, Muritai, N.M. Adams, 5 July 1970 (with parasite). Chatham Islands: WELT A018433, Mangere Island, M. Foster, 11 March 1987; WELT A031704, Te One Creek, Owenga, Chatham Island, W.A. Nelson, 19 February 2004. South Island: WELT A026638, Wharariki Beach, Cape Farewell, W.A. Nelson & J. Dalen, 19 March 2003; WELT A028689, Brighton, Otago, J.E.S. Broom, 12 March 1998; WELT A022568, entrance to Facile Harbour, Dusky Sound, Fiordland, C.H. Hay, 25 Oct 1992. Stewart Island: WELT A006599, Ringaringa, E.A. Willa, 26 April 1963; WELT A007973, Bragg's Beach, Halfmoon Bay, N.M. Adams, 11 Jan 1973.

Etymology: in recognition of the contributions of Dr Shirley Sparling to our understanding of the Rhodymeniales.

Habitat: subtidal on rock.

Distribution: southern North Island, South Island, Chatham Islands, Stewart Island.

Comments: Sparling (1957) provides a detailed description of the anatomy and morphology of this species including the development of cystocarps and tetrasporangia.

Neto *et al.* (2001) treated the species from Madeira referred to as *Chrysymenia saccata* Schmitz ex Menezes (Menezes, 1926), as a synonym of *Gloioderma saccatum* (J. Agardh) Kylin, and this species was included in the catalogue for western Africa and adjacent islands by John *et al.* (2004). It is unclear which taxon Menezes (1926) was referring to, but it is most unlikely to be *G. sparlingiae* based on distribution.

Acknowledgements. We would like to thank Zonta for funds that enabled WN to visit Lund and work in the Agardh herbarium; Pers Lassen, Curator at Lund for access to specimens and information; staff at CHR for access to material; Ant Kusabs and Jean Claude Stahl for assistance with specimens and images at WELT; Erika MacKay for assistance with images; funding from NIWA Coasts & Oceans National Centre, Programme 2 Marine Biological Resources (WN).

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