Abstract

The correct binomial for the type species of *Naemacyclus* is *N. fimbriatus* comb. nov. *Lasiostictis fimbriata* is a synonym. The common pine needlecast fungi hitherto called *N. niveus* and *N. minor* are not congeneric with this species and are therefore redisposed in *Cyclaneusma* gen. nov. (Rhytismataceae) as *C. niveum* and *C. minus* combs. nov. *Cyclaneusma minus* is illustrated and the taxonomic position of the new genus is discussed.

1 Introduction

Many outbreaks of pine needlecast disease have been attributed to fungi of the genus *Naemacyclus* Fuck. (Ascomycotina, Discomycetes) (GIBSON 1979). At first only one species, *N. niveus* (Pers.: Fr.) Fuck. ex Sacc., was thought to be involved, but recent taxonomic studies have shown that a second species, *N. minor* Butin, exists. It is similar to *N. niveus*, but differs in size, cultural appearance and host range (BUTIN 1973; PEREDO 1973). Both species are common and the distinction between them is now widely accepted by forest pathologists and taxonomists alike (DENNIS 1978; Gibson 1979). During taxonomic studies of the family Phacidiaceae Fr., and the preparation of a guide to fungi inhabiting pine tissues, it became necessary to re-investigate these fungi and the genus in which they were placed.

2 Results

Naemacyclus was established by FUCKEL (1874) to accommodate one species, *N. pinastri* (DeLacr. in Desm.) Fuck. This species must be the type of the genus because it was the only one cited in the original publication. SACCARDO (1884) suggested that *N. pinastri* was the same species as *N. niveus*, and for almost a century after FUCKEL's (1874) work, it was assumed that *N. pinastri* and *N. niveus* were the same fungus, since descriptions of both referred to filiform septate ascospores in apothecia embedded in pine needles which split open to reveal the immersed hymenium. *Naemacyclus pinastri* was therefore listed as a synonym of *N. niveus* and generally forgotten, because the older epithet "*niveus*" seemed nomenclaturally preferable (SACCARDO 1889).

BUTIN (1973) has shown, however, that this assumption is not justified. In addition to distinguishing a new species, *N. minor*, he discovered that the binomials *N. niveus* and *N. pinastri* referred to two superficially similar, but fundamentally different fungi. Our investigations confirm his observations. *Naemacyclus pinastri* produces 7-septate, club-shaped ascospores enveloped in mucilaginous sheaths, and its hymenium is protected by a thick, black clypeus from which characteristic, hyaline, often incrusted periphysoids

protrude. *Naemacyclus niveus*, however, produces 2-septate, sub-cylindrical, curved ascospores with gelatinous caps at each end, in a hymenium bordered by a reduced, immersed margin covered solely by host tissue.

All recent taxonomic treatments of this group of immersed, inoperculate discomycetes have regarded differences of this nature as significant at the generic level (KORF 1973; SHERWOOD 1974; DENNIS 1978; DICOSMO 1981). It seems clear therefore that *N. niveus* (and *N. minor* which is very similar) is not congeneric with *N. pinastri*. Since *N. pinastri* is the type species of *Naemacyclus, N. niveus* and *N. minor* cannot correctly remain in this genus. No genus known to us can accommodate these two species, and so a new generic name *Cyclaneusma*, is introduced here for them.

In addition, it is necessary to make a minor nomenclatural change for the type species of *Naemacyclus*. As BUTIN (1973) correctly pointed out, this fungus is at present known as *Lasiostictis fimbriata* (Schw.) Bäuml. and represents the type species of that genus. The same fungus is therefore the type species of both *Naemacyclus* and *Lasiostictis* and, since *Naemacyclus* is the older name, it follows that *Lasiostictis* is a later synonym of *Naemacyclus*. The correct name for this fungus is therefore obtained by recombining the epithet *fimbriata* (which is older than *pinastri*) with the generic name *Naemacyclus*.

It is unfortunate that these name changes involve two needlecast fungi familiar to forest pathologists. The possibility of invoking nomenclatural conservation measures to preserve widely accepted use of the generic name *Naemacyclus* for these two species has been carefully considered. Advice from various experts on nomenclature, including Dr. B. C. SUTTON, the Chief Mycologist at C. M. I., indicates that a conservation proposal in this case would be highly likely to fail. The proposed changes are necessary so that these fungi do not become sources of persistent confusion but have names which are in accord with the International Code of Botanical Nomenclature.

3 Taxonomy

Naemacyclus Fuck., Jahrb. d. nassauischen Ver. Naturkde. **27/28**, 49–50 (1874).
Lasiostictis (Sacc. and Berl.) Sacc., Syll. Fung. **8**, 696 (1889).
Type species: *N. pinastri* (DeLacr. in Desm.) Fuck.

Twenty-two species have been described in, or redisposed to this genus to date. Almost all are obscure, known only from the original and often inadequate collection and description. A revision of the genus is long overdue. The recent accounts of the telemorph of the type species of the genus (under the name *Lasiostictis fimbriata*) by DICOSMO (1979, 1981) indicates that this genus should be placed in the family Rhytismataceae Chev. (i. e. the Hypodermataceae Rehm sensu DARKER 1932, 1967).

Naemacyclus fimbriatus (Schw.) comb. nov.
Stictis fimbriata Schw., Syn. Fung. Amer. bor. 179 (1834) (basionym).
Lasiostictis fimbriata (Schw.) Bäuml., Ann. K. K. naturh. Hofmus. Wien 16 (1901).
Propolis pinastri DeLacr. in Desm., Pl. Crypt. France Exs. **2**, 791 (1861).
Naemacyclus pinastri (DeLacr. in Desm.) Fuck., Jahrb. d. nassauischen Ver. Naturkde. **27/28**, 50 (1874).
Stictis (Lasiostictis) conigena Sacc. and Berl., Atti Reale Ist. Veneto Sci., Lett., Arti **6**, 734 (1885).
Lasiostictis conigena (Sacc. and Berl.) Sacc. Syll., Fung. **8**, 696 (1889).
Stictis maritima Rolland, Bull. Soc. Myc. France **14**, 84 (1898).
Coccomyces maritimus (Rolland) Müller and Hütter, Rev. mycol. **27**, 71 (1962) (teste SHERWOOD 1974).
Non *Naemacyclus fimbriatulus* Sacc., Syll. Fung. **10**, 47 (1892).
Anamorph: *Eriosporopsis albida* Petr., Sydowia **1**, 94 (1947).

Naemacyclus fimbriatus is the correct binomial for the type species of this genus, and *Naemacyclus pinastri* is a synonym. This fungus is rarely collected on needles (hence the initial confusion with *N. niveus*), but is fairly common as a saprophyte on apophyses and scales of fallen female cones. SHERWOOD (1974) provided a modern description based on examination of the type material. The anamorph which often occurs intermixed with the teleomorph was described by PETRAK (1947). It is similar in general appearance and structure to other anamorphs of the Rhytismataceae, especially to some species of *Leptostroma* Fr.: Fr. In his original description of the genus *Naemacyclus*, Fuckel (1874) wrongly described the anamorph of this fungus as having filiform conidia produced in a superficial sporodochium. Examination of the specimens he cited shows that the fungus he observed was the cupulate deuteromycete *Linodochium hyalinum* (Lib.) Höhn., anamorph of *Pseudohelotium pineti* (Batsch: Fr.) Fuck., a species belonging in the discomycete order Helotiales (MINTER and HOLUBOVÁ-JECHOVÁ 1981).

Selected specimens examined: on needles of *Pinus nigra*: Desm. Pl. Crypt. France **2**, 791 (1861), type of *Propolis pinastri*, FH, K; Petrak, Myc. gen. 678; on cones of *Pinus sylvestris*: Petrak, Myc. gen. 252; Sydow, Myc. germanica 706; Ellis, N. American Fungi 72; Rabenhorst-Winter Fungi Eur. 4070; Rehm ascomyceten 1094 a and b; Vestergren Micromycetes Rariores Selecti 115; IMI 223383, 223391, 223395, 229737, 231803, 236739, 243758, 243759, 243761; on cones of *Pinus brutia*: IMI 239393; on cones of *Pinus resinosa*: ex herb. DiCosmo 70, WAT.

Cyclaneusma gen. nov. Rhytismatacearum (etym.: *Naemacyclus*, anagram).
Naemacyclus auct. non Fuckel.

Apothecia in acubus emortuis coniferarum sunt, amphigena, materiei acuum concoloria, immersa, rima longitudinali singulari tegentem acus materiem fragentia et ita reflectentia ut sit materies ipsa modo portarum minutissimarum duarum visu. In sectione verticali et transversali clypeus abest; subhymenium e textura angulari vel oblita compositum, margo e cellulis gelatinifactis tegentem acus materiem aperitur et claudit. Asci subcylindrici, nil in iodo caerulescentes, octospori, apice fracti ab ascosporis dispersandis. Ascosporae filiformes, hyalinae, leves, 2-septatae, in muco involutae terminorum respectu. Paraphyses simplices vel ramosae, septatae, leves, nonnumquam anastomosae, in muco involutae.

Species typica: *Cyclaneusma minus* (Butin) DiCosmo, Peredo and Minter.

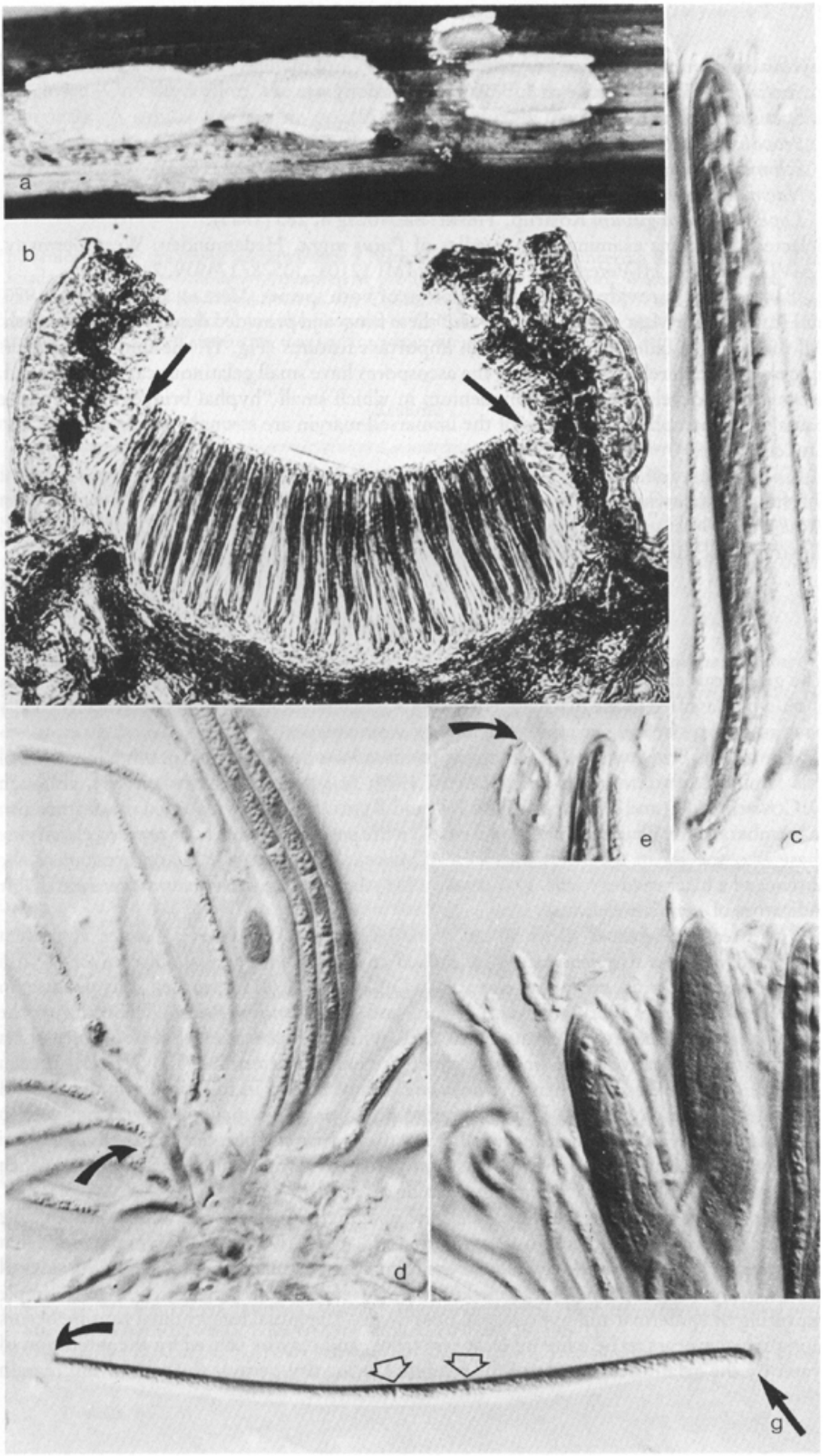
Apothecia on dead needles of conifers, amphigenous, concolorous with the needles, immersed, breaking open the covering layer of needle material with a single median longitudinal split and turning it back in the form of two flaps. In vertical transverse section clypeus absent; subhymenium composed of textura angularis or oblita, margin composed of gelatinised cells which provide an opening and closing mechanism for the flaps. Asci subcylindrical, iodine negative, 8-spored, ruptured at the apex during ascospore dispersal. Ascospores filiform, hyaline, smooth, 2-septate, with mucous caps at each end. Paraphyses unbranched or branched, septate, smooth, sometimes anastomosing, enveloped in mucus.

Cyclaneusma minus (Butin) comb. nov. Fig. 1.

Naemacyclus minor Butin, Eur. J. For. Path. **3**, 160 (1973) (basionym).

Selected specimens examined: on needles of *Pinus radiata*, Valdivia, Chile, 12. XI. 1969, leg. H. Peredo, ZT, holotypus; on needles of *Pinus sylvestris*, IMI 224261, 225823, 229735, 229736, 230371, 230372, 232182, 233581b; Saccardo Myc. Ital. 681, FH.

Fig. 1. Cyclaneusma minor. a. Open ascocarps on *Pinus sylvestris* × 40. *b.* Ascocarp on *Pinus sylvestris* in vertical transverse section (arrows indicate gelatinized marginal tissues) × 250. *c.* Ascus × 1000. *d.* Squash preparation showing base of hymenium (arrow indicates hyphal bridge) × 1000. *e.* Ascus apices (arrow indicates ruptured apex of empty ascus) × 1000. *f.* Ascus apices and branched paraphyses tips × 1000. *g.* Ascospore (black arrows indicate mucilaginous sheaths, white arrows indicate septa) × 1000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Cyclaneusma niveum (Pers.: Fr.) comb. nov.
Stictis nivea Pers., Myc. eur. **1**, 339 (1822) (basionym).
Stictis nivea Pers.: Fr., Syst. mycol. **2**, 196 (1822).
Propolis nivea (Pers.: Fr.) Fr., Summ. veg. Scand. 372 (1849).
Schmitzomia nivea (Pers.: Fr.) De Not., Comm. soc. critt. 562 (1863).
Naemacyclus niveus (Pers.: Fr.) Fuck. ex Sacc., Botan. Centralbl. **18**, 251 (1884).
Lophodermium gilvum Rostrup, Tidskr. Skovbrug **6**, 283 (1883).
Selected specimens examined: on needles of *Pinus nigra*, Hedemünden, West Germany, 17. VI. 1971, leg. H. Peredo, ZT, neotypus; IMI 12104, 30578, 174939, 243596.

Butin (1973) provided a useful description of both species. Millar and Minter (1980) and Minter and Millar (1980) illustrated these fungi and provided descriptions in English. All these works failed to record certain important features (Fig. 1): the thin-walled ascus apices rupture to release ascospores; the ascospores have small gelatinous caps on each end; ascus initials develop from a subhymenium in which small "hyphal bridges" occur at the bases of the paraphyses; the cells of the immersed margin are strongly gelatinised (see also DiCosmo 1981).

The correct typification of *C. niveum* is not clear. Butin (1973) designated a neo-type for this fungus, observing that Persoon's material was "lost or unobtainable". It is not clear from these words whether the original specimen still exists. Even if it does not, Persoon's (1822) illustration of the fungus could perhaps serve as a lectotype.

4 Discussion

The gelatinous caps on the ascospores of *C. minus* and *C. niveum* suggest that these fungi should be classified in the discomycete family Rhytismataceae, members of which typically have ascospores bearing gelatinous sheaths of various types.

The hyphal bridges at the base of the hymenium have been observed in other members of this family (Morgan-Jones and Hulton 1979; Minter and Hettige 1983), although DiCosmo (1981) and DiCosmo, Nag Raj and Kendrick (1983) recorded this feature also in members of the Phacidiaceae sensu stricto. In the past researchers have avoided classifying these two species in the Rhytismataceae (Darker 1932; Korf 1973) on account of the absence of a blackened clypeus. DiCosmo (1981) showed that such features were unreliable indicators of familial relations.

The breaking open of ascus apices to release ascospores is not a feature at present associated with the Rhytismataceae, or indeed any of the inoperculate discomycetes with which this family is normally classified. DiCosmo (1981) recorded this feature in *Macroderma curtisii* (Berk. & Rav.) Höhn. and *M. uleanum* (Rehm) DiCosmo of the Rhytismataceae. The few observations on the Rhytismataceae made by previous researchers refer to iodine negative pores or plugs which are hard to determine (Korf 1973). If such observations prove correct then *Cyclaneusma* cannot belong in this family on the basis of ascus dehiscence alone. The iodine negative pores or plugs may, however, be hard to determine simply because they are in reality not there. It would be interesting to examine asci of other well established members of this family, to provide more information against which the present observation of *Cyclaneusma* can be assessed.

No previous researcher has elucidated the opening and closing mechanism responsible for the dehiscence of apothecia in *C. niveum* and *C. minus*. Darker (1932) commented that the covering layer opens widely and the epidermal tissue remains hinged along the sides of the ascocarp. The opening mechanism is, however, more sophisticated than a simple rupturing of epidermal and hypodermal host tissue. The initial longitudinal rupture occurs along what appears to be a line of least resistance, and may be caused by the inbibition of water by the gelatinised margin of the fungus. During dry periods the cells of this margin

dehydrate and shrink, the resultant loss of volume causing the covering flaps to be pulled in and closed. On rehydration, the margin cells swell rapidly and force the covering layer to open again. A similar mechanism operates in members of the Phacidiaceae sensu stricto (DiCosmo 1981; DiCosmo et al. 1983).

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Résumé

Cyclaneusma gen. nov., Naemacyclus et Lasiostictis, un problème de nomenclature résolu

Le binome correct pour l'espèce type de *Naemacyclus* est *N. fimbriatus* comb. nov., *Lasiostictis fimbriata* constituant un synonyme. Le champignon courant causant des dégâts sur les aiguilles des pins, jusqu'à présent appelé *N. niveus* et *N. minor* n'appartient pas au même genre que l'espèce précédente et doit être dès lors replacé dans les *Cyclaneusma* gen. nov. (Rhytismataceae), sous les noms de *C. niveum* et *C. minus* combs. nov. Le *Cyclaneusma minus* est illustré et la nouvelle position taxonomique de ce nouveau genre est discutée.

Zusammenfassung

Cyclaneusma gen. nov., Naemacyclus und Lasiostictis, ein nomenklatorisches Problem ist gelöst

Der korrekte Name des Typus von *Naemacyclus* ist *N. fimbriatus* comb. nov. *Lasiostictis fimbriata* ist ein Synonym. Die Kiefernschüttepilze *N. niveus* und *N. minor* gehören nicht in diese Gattung und werden zu *Cyclaneusma* gen. nov. (Rhytismataceae) gestellt als *C. niveum* und *C. minus* combs. nov. *Cyclaneusma minus* wird dargestellt, die taxonomische Stellung der neuen Gattung wird diskutiert.

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