Lichenologist **20**(1): 11–17 (1988)

TWO NEW SPECIES OF *PELTIGERA*

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Abstract: Two new lichen species *Peltigera frippii* Holt.-Hartw. and *P. scabrosella* Holt.-Hartw. are described. Their morphology, chemistry, and ecology are discussed, and their distribution in Norway is mapped. New chemical data are also given for the related species *P. lyngei* Gyelnik, *P. malacea* (Ach.) Funck, *P. neckeri* Müll. Arg., and *P. scabrosa* Th. Fr.

Introduction

A key to the European species of *Peltigera* Willd., was recently provided by Vitikainen (1981). Two new species were later recognized in Europe by Tønsberg & Holtan-Hartwig (1983) and Vitikainen (1985). During my studies on the taxonomy of *Peltigera* in Norway, two additional species were discovered which are described below.

Material and Methods

The present study is based on all relevant material of *Peltigera* in BG, O, TRH and TROM. Field work was carried out in Norway between 1980 and 1984. My own collections are deposited in O. I was also permitted to examine several collections in the private herbarium of Mr H. C. Gjerlaug (Ridabu, Norway).

Lichen substances were identified by thin-layer chromatography, mainly according to the techniques described by Culberson & Kristinsson (1970), Culberson (1972), and those modified by Menlove (1974). For study of the triterpenoid chemistry, small thallus fragments were extracted for 5 min in diethyl ether or hexane. Extracts were spotted on to pre-coated Merck Silica gel 60 F_{254} aluminum plates and developed in the standard solvent system TA (toluene:acetic acid = 200:30) and the solvent system EHF (diethyl ether:hexane:formic acid = 300:100:3) (cf. Tønsberg & Holtan-Hartwig 1983). Separation of substances was improved by running the plates twice in each solvent system (cf. Walker & James 1980). For two-dimensional chromatography, EHF was used for the first solvent direction and TA for the second solvent direction. Plates were run twice in each direction.

The Species

Peltigera frippii Holt.-Hartw. sp. nov.

(Fig. 1)

Thallus ad 15 cm diam, fragilis; lobis sat angustis, plus minusve imbricatis, irregularibus et plerumque profunde incisis; margine sinuoso, adscendente vel involuto; superne cinereofuscus, laevigatus, glaber, madefactus distincte maculatus; subtus in centro atrobrunneus, marginem versus pallidus vel incoloratus; venis incoloratis vel atrobrunneis, parallelis vel flabelliformibus; rhizinis brunneis vel atrobrunneis, aspergilliformibus saepe confluentibus. Photobiontis cyaneus. Apothecia et pycnidia ignota.

Typus:—Norway, Hedmark, Rendalen, south of the river Neka, east of the County road, UTM-grid ref. 32V PP 0782, alt. 460 m, 11 August 1981, *H. C. Gjerlaug* 2233 (O–holotypus).

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0024-2829/88/010011+07 $03.00/0

FIG. 1. *Peltigera frippii* (Norway, Gjerlang 2233, O–holotype). A, Upper side; B, lower side. Scale = 5 mm.

Thallus to 15 cm diam, fragile. *Lobes* rather narrow, to 1 cm wide, ± imbricate, irregularly and frequently deeply incised; margins sinuous, ascending to involute. *Upper side* greyish brown to brown, ± dull to glossy, smooth, etomentose, distinctly maculate when moist, often faintly pruinose towards lobe tips.

Underside blackish brown centrally, pale brown to colourless towards margins; veins colourless to blackish brown, parallel to fan-shaped. *Rhizines* medium brown to blackish brown, brush-shaped, frequently confluent. *Photobiont* blue-green. *Apothecia* and *pycnidia* unknown.

Chemistry (major substances): tenuiorin, methyl gyrophorate, hopane-6α, 22-diol (zeorin), 28-acetoxy-22-hydroxyhopane-23-oic acid (phlebic acid A), 22-hydroxyhopane-23-oic acid (phlebic acid B), unidentified triterpenoids 14 and 39 (see Fig. 2 for triterpenoids).

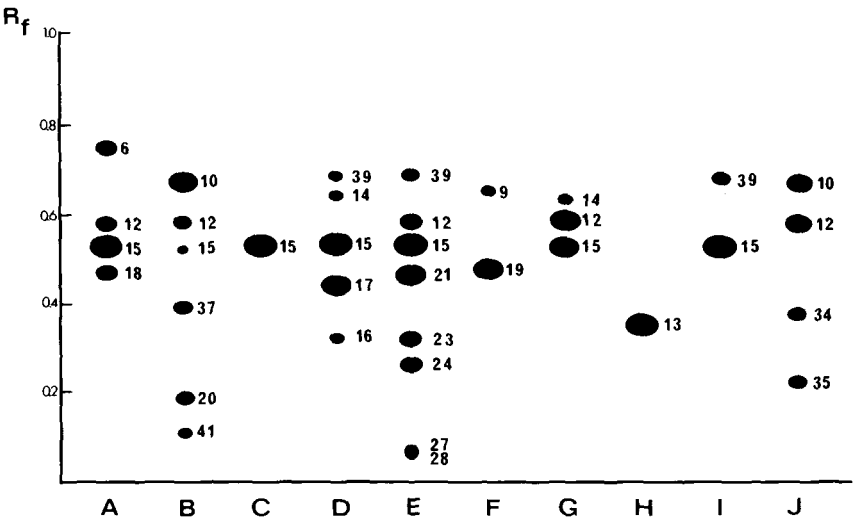

FIG. 2. Chromatogram of the triterpenoid composition in some *Peltigera* species, developed twice in solvent system EHF. A, *P. scabrosella*; B–C, *P. scabrosa*, chemotypes I and II, respectively; D, *P. frippii*; E, *P. neckeri*; F–I, *P. malacea*, chemotypes I, II, III, and IV, respectively; J, *P. lyngei*. Identified triterpenoids: 10, 7β-acetoxyhopane-22-ol (peltidactylin); 12, 15α-acetoxyhopane-22-ol (dolichorrhizin); 15, hopane-6α,22-diol (zeorin); 16, 28-acetoxy-22-hydroxyhopane-23-oic acid (phlebic acid A); 17, 22-hydroxyhopane-23-oic acid (phlebic acid B); 20, hopane-6α,7β,22-triol; 34, hopane-7β,22-diol; 35, hopane-15α,22-diol. Unidentified triterpenoids: 6, 9, 13, 14, 18, 19, 21, 23, 24, 27, 28, 37, 39, 41.

Affinities: Peltigera frippii is characterized by short and narrow lobes with irregularly sinuous and undulating margins, the maculate upper side, and parallel to fan-shaped veins. It may be confused with *P. malacea* (Ach). Funck, and *P. neckeri* Müll. Arg., but differs morphologically from the former mainly in the absence of tomentum on the upper side and the presence of more or less distinct veins on the underside. It differs morphologically from the latter mainly in the maculate upper side and its more crispy appearance.

There are four chemical strains of *P. malacea* containing: (I) unidentified triterpenoids 9 and 19; (II) 15α-acetoxyhopane-22-ol (dolichorrhizin), hopane-6α,22-diol (zeorin), and unidentified triterpenoid 14; (III) unidentified triterpenoid 13; and (IV) hopane-6α,22-diol (zeorin) and unidentified

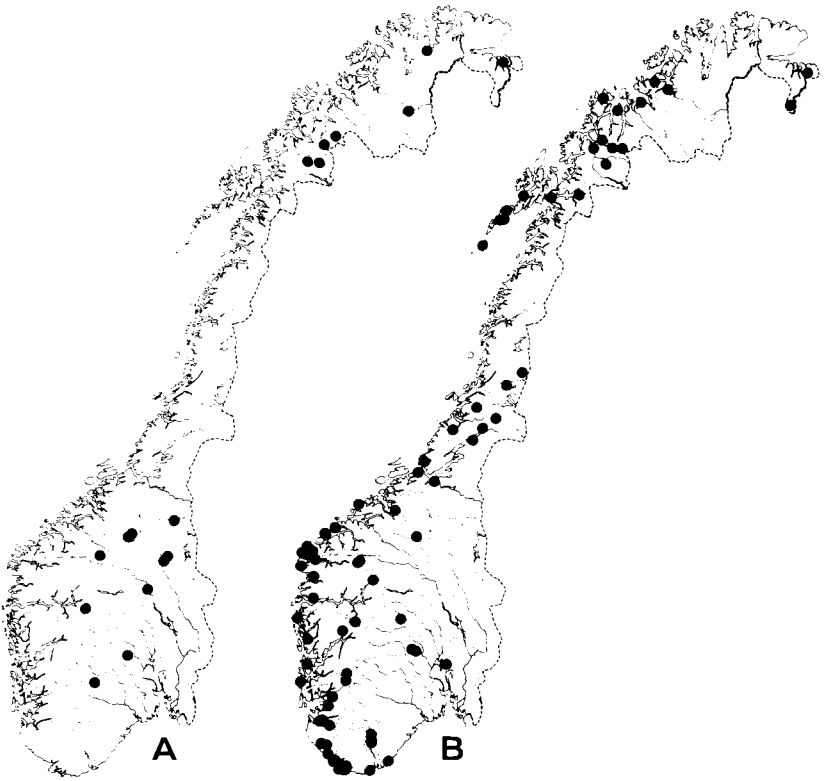

FIG. 3. Norwegian distribution of (A) *Peltigera frippii* and (B) *P. scabrosella*.

triterpenoid 39 (major triterpenoids only; see Fig. 2). The major triterpenoids of *P. neckeri* are 15α-acetoxyhopane-22-ol (dolichorrhizin), hopane-6α,22-diol (zeorin), and the unidentified triterpenoids 21, 23, 24, 27, 28, and 39 (Fig. 2). *Peltigera frippii* is chemically distinct from all European species of the genus, except from chemotype I of *P. aphthosa* (L.) Willd. The unidentified triterpenoid 39, however, is possibly absent from *P. aphthosa* (cf. Tønsberg & Holtan-Hartwig 1983). *Peltigera frippii* differs from the blue-green phycotype of this species especially in the absence of tomentum on the upper side, the more fragile thallus, and the narrower and more incised lobes.

Ecology and distribution: Peltigera frippii apparently has a wide ecological amplitude. It grows on thin moss covers on both sandy and humus-rich soil and is most frequently collected in low dwarf-shrub vegetation, on road-gravels, and on riverbanks. It is presently known from inland localities in the boreal, and alpine regions of Norway (Fig. 3A), and is apparently a rare species. Its altitudinal distribution ranges from 130 to 1600 m.

Selected specimens examined (all in O):—**Norway:** Hedmark (see type); Oppland: Lesja, the slope SW of Storsætri, alt. 1050 m, 30 July 1970, *Elven*; Buskerud: Sigdal, Solevatnet, at the base Mt Urdeåsen, NM 2369, alt. 180 m, *Holtan-Hartwig* 774; Telemark: Rauland, Sognvikvatnet, alt. 700 m, *Rui* 6923; Sogn og Fjordane: Lærdal, between Galdane and Nedre Hegg, MN 322695, alt.

300 m, *Holtan-Hartwig* 4259; Sør-Trøndelag: Oppdal, Vårstigen, MQ 3212, alt. 920 m, *Holtan-Hartwig* 2852; Troms: Målselv, Dividalen, Høgskardet, DB 4136, alt. c. 400 m, *Timdal* 4112; Finnmark: Karasjok, *c.* 2 km SW of Jer'gul, MT 0600, alt. 280 m, *Timdal* 4793.

Peltigera scabrosella Holt.-Hartw. sp. nov.

(Fig. 4)

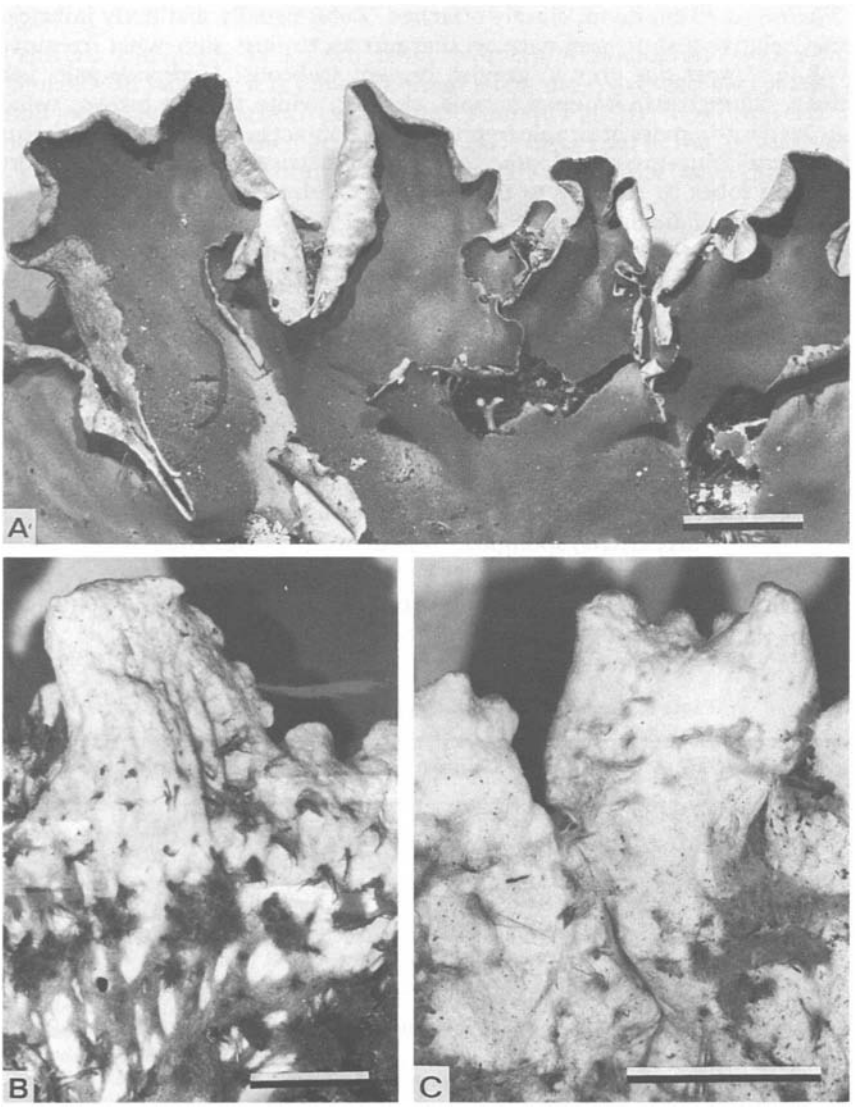

FIG. 4. A, *P. scabrosella* (Norway, *Holtan-Hartwig* 224, O), habit. B, *P. scabrosa* (Norway, *Holtan-Hartwig* 630, O), part of lower side showing dark rhizinae and veins. C, *P. scabrosella* (Norway, *Holtan-Hartwig* 422, O), part of lower side showing pale rhizinae and indistinct veins. Scale = 5 mm.

Thallus ad 25 cm diam; lobis vulgo distincte imbricatis, acutis, sat brevibus et angustis; margo adscendente, plus minusve involuto; superne cinereus vel cinereofuscus, scabrosus; subtus pallidus; venis diffusis, ochraceis; rhizinis simplicibus, tenuibus, incoloratis vel dilute fuscis. Photobiontis cyaneus. Apothecia plus minusve isodiametra, ad lobos breves affixa; sporis 3–septatis, 80–95 × 3·5–4 µm.

Typus:—Norway: Nord-Trøndelag: Grong, Sanddøldalen, Hansmoen, UTM grid ref. 32V UM 5985, alt. 230 m, 16 September 1981, *J. Holtan-Hartwig* 1655 (O–holotypus).

Thallus to 25 cm diam, closely attached. *Lobes* usually distinctly imbricate, acute, relatively short and narrow; margins ascending, somewhat irregularly involute. *Upper side* grey to greyish brown, scabrous. *Underside* pale, veins diffuse, ochraceous. *Rhizines* simple, slender, white to pale brown, usually dissolved into a mass of simple hyphae at the contact area with the substratum. *Photobiont* blue-green. *Apothecia* ±isodiametrical, attached to shortly elongated lobes or directly to the main lobes. *Ascospores* 3-septate, 80–95 × 3·5–4 µm. *Pycnidia* not seen.

Chemistry (major substances): tenuiorin, methyl gyrophorate, hopane-6α,22-diol (zeorin), 15α-acetoxyhopane-22-ol (dolichorrhizin), unidentified triterpenoids 6 and 18 (see Fig. 2 for the triterpenoids).

Affinities: Peltigera scabrosella belongs to the scabrous species of *Peltigera*, and is most likely to be confused with the closely allied *P. scabrosa* Th. Fr. The two species are easily distinguished by their young rhizines which are pale brown to white in *P. scabrosella* (Fig. 4C) and brownish black in *P. scabrosa* (Fig. 4B). Additional distinguishing characters are summarized in Table 1.

The original material of *P. scabrosa* was not available to me, but from part of the description given in the protologue ('. . ., subtus carneo-albido venis nigro-fuscis (junioribus carneis) spongioso-reticulato; . .'; Fries 1860) it appears that these specimens belong in the species here regarded as *P. scabrosa*.

The holotype of the scabrous, etomentose, species *P. lyngei* Gyelnik lacks

TABLE 1. *Characters distinguishing* P. scabrosa *and* P. scabrosella

Character	*P. scabrosa*	*P. scabrosella*
Thallus	To 35 cm diam, loosely attached to substratum	To 25 cm diam, closely attached to substratum
Lobes	Rounded, ascending, to 40 mm wide	Acute, involute, to 25 mm wide
Veins	±Distinct, brownish black towards the central part of the underside	±Indistinct, ochraceous
Rhizines	Brownish black, thick, brush-shaped	White to pale brown, slender, simple
Apothecia	Attached to distinctly elongated lobes	Attached to barely elongated lobes, or directly to the main lobes
Triterpenoids	Strain I: 10, 12, 15, 20, 37, 41 Strain II: 15	6, 12, 15, 18
Norwegian distribution	Ubiquitous	Mainly along the coast, more scattered in wet sites inland

distinct veins on the underside and contains the triterpenoids 7β-acetoxy-hopane-22-ol (peltidactylin), 15α-acetoxyhopane-22-ol (dolichorrhizin), hopane-7β,22-diol, and hopane-15α,22-diol. This taxon should be included in a study of the morphological and chemical heterogeneity of *P. malacea*.

Ecology and distribution: Peltigera scabrosella is most frequently found closely attached to mosses on steep to vertical rock walls, especially where water is trickling. In alpine regions it may also occur among terricolous mosses in snow-beds.

Peltigera scabrosella is known from Norway, Finland, and south-west Greenland. In Norway it is fairly common along the coast, and also occurs in humid localities in the eastern parts of the country (Fig. 3B). It is often accompanied by *P. scabrosa*, which generally occupies drier sites at the localities and has a more ubiquitous distribution in Norway. Its altitudinal range varies from almost sea-level to 1600 m.

Selected specimens examined (all in O):—**Norway:** Oslo: Sørkedalen, the river Heggelielva by Karidalsåsen, alt. 280 m, 15 May 1980, *Timdal*; Oppland: Vestre-Slidre, Raudebekken, on the west side of lake Flyvatn, MN 8555, alt. 920 m, *Holtan-Hartwig* 3059; Buskerud: Sigdal, Mt Kvelvsanatten, NM 1586, alt. *c.* 1000 m, *Holtan-Hartwig* 837; Aust-Agder: Valle, Stavdalen, ML 179627, alt. 770 m, *Nordnes* 557; Vest-Agder: Farsund, by the road to Håvika, LK 7241, alt. 20 m, *Timdal* 1250; Rogaland: Sandnes, Høle, Mt Krusafjellet, LL 28–29, 31–32, alt. 70 m, *Holtan-Hartwig* 257; Hordaland: Fitjar, Sandviksvåg, by the ferry, KM 9553, alt. 0–40 m, *Holtan-Hartwig* 306; Sogn og Fjordane: Vågsøy, near Kråkenes lighthouse, alt. 40 m, *Holtan-Hartwig* 674; Møre og Romsdal, Brattlandsdalen, 7 July 1906, *Lynge*; Sør-Trøndelag: Agdenes, Sætren, east of Malivika, NR 2850, alt. 10 m, *Holtan-Hartwig* 423; Nord-Trøndelag: (see type); Troms: Storfjord, between Lundeng and Dalheim, DB 6468, alt. 100 m, *Holtan-Hartwig* 4349b; Finnmark: Øksfjord, 1892, *Bauer*. —**Finland:** Koillismaa: Kuusamo par., Mt Rukavaara, 66°10′N, 29°10′E, 5 July 1981, *Gjerlaug*. —**Greenland:** Julianehåb District, Qagssimiut, 4 July 1937, *Dahl*.

I am grateful to Mr E. Timdal for comments on the manuscript and valuable discussions; and to Mr H. C. Gjerlaug for placing his collections at my disposal. Thanks are also due to the curators of BG, TRH, and TROM for the loan of specimens, and to the curator of UPS for the loan of type material of *P. lyngei*.

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Accepted for publication 2 June 1987