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Perenniporia maackiae (polypores, Hymenomycetes)

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Abstract: The morphology, cultural characters and distribution of *Perenniporia maackiae* are described. The species is heterothallic and tetrapolar as are the other nine species of the genus *Perenniporia* studied in this respect. Spores of *P. maackiae* are little variable, and the correlation between their mean length and mean width is weak and insignificant.

Kokkuvõte: A. Kollom ja E. Parmasto. *Perenniporia maackiae* (polypores, Hymenomycetes).

Kirjeldatakse liigi *Perenniporia maackiae* morfoloogilisi ja kultuuritunnuseid ning levikut. See seen on heterotallistlik, tetrapolaarse ristumistüübiga - nagu ka kõik üheksa seni uuritud *Perenniporia* liiki. *P. maackiae* eosed on vähevarieeruvad, nende keskmise pikkuse ja laiuse korrelatsioonikordaja on madala väärtusega ja mitteusaldatav.

INTRODUCTION

Fomitopsis maackiae Bondartsev & Ljub. was described in 1962 (Bondartsev, 1962) but has rarely been mentioned afterwards. Bondartsev found it to be related to *F. unita* (= *Perenniporia medulla-panis* (Fr.: Fr.) Donk). However, there are some lapses in the original description (absence of clamps on hyphae was asserted; truncate shape and dextrinoidity of spores was not mentioned) which made it difficult to identify the specimens of this species. Recently Dai & Niemelä (1995) published a good description of this species found in China; numerous collections from the Russian Far East, kept in the Tartu herbarium (TAA) made it possible to describe its variation and to study its cultural characters.

MATERIALS AND METHODS

Basidiomata of the species were described in the field and in the laboratory; in both cases colour notations were made in accordance with Munsell's Book of Color (1942). Specimens were examined microscopically as hand sections or as squash mounts in 2% KOH solution at magnifications x 700 and x 1000. Polysporous isolates were obtained from spore prints; for isolation of monosporous isolates, basidiospores were suspended in sterile distilled water and plated on 2% malt agar at appropriate dilution. Single germinated basidiospores were checked microscopically and transferred manually with the aid of shortened (6 mm) flame-sterilized hypodermic needle on to the fresh malt-agar medium in Petri plates. The cultures were studied using the methods described by Nobles (1965). Both isolates in five replicas were grown in 90 mm Petri plates on 1.5% malt-extract agar (MEA) in the dark at 24±1 °C and were studied at weekly intervals. Mat description is based on 14-day- and six-week-old cultures. Hyphae were examined microscopically in 3% potassium hydroxide (KOH) and stained with 0.5% aqueous solution of phloxin or erythrosin. Species codes (of six-week-old cultures) are indicated according to the system of Nobles (1965) with modifications proposed by Boidin (1966) and Boidin & Lanquetin (1983), and Stalpers (1978). Colour notations are given after Kornerup & Wanscher (1978). Drop tests for extracellular oxidases follow Marr's (1979) directions. Incompatibility system was determined by the occurrence of clamp connections on hyphae resulting from the intracollection pairings of 11 and 12 monokaryotic isolates from two collections in all possible combinations. Paired isolates were examined two to three weeks after the confronted mycelia had met. For interincompatibility study the representatives of four mating types of both collections were crossed in all possible combinations. All crosses and subsequent subcultures originating from contact zones were examined microscopically for clamp connections. The cultures are maintained in Tartu Fungal Collection (TFC), Institute of Zoology and Botany of the Estonian Agricultural University.

TAXONOMY

Perenniporia maackiae (Bondartsev & Ljub.) Parmasto
in Dai & Niemelä, Ann. Bot. Fenn. 32: 223, f. 6 (1995); Bondartseva, Def. fung. Rossiae. Aphyll. 2: ... (1998). - *Trametes maackiae* Ljub. in Biologicheskie resursy Dal'nego Vostoka. Moskva, 1959: 100 *(nom. nud.)*. - *Fomitopsis maackiae* Bondartsev & Ljub., Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 15: 103, f. 1-3 (1962); Ljub. & Vasilyeva, Derevorazrushayushchie griby Dal'nego Vostoka. Novosibirsk, 1975: 89, tab.17 A. - *F. mellea* Bondartsev & Ljub., Bot. Mater. Otd. Sporov. Rast. Bot. Inst. Komarova Akad. Nauk S.S.S.R. 15: 108 (1962).

Basidiomata perennial (sometimes annual), resupinate or effused-reflexed, 1.5-3 x 1.3-5 x 0.2-1 cm, sometimes imbricate, resupinate part up to 1.2 cm thick; corky or woody. Pileal surface concentrically sulcate, uneven, radially cracked when old, grayish, soon brown, then blackish (Munsell: 7.5 YR-10 YR 4-5/2), when old covered with distinct crust up to 0.1 mm thick, shiny dark brown or blackish in section; margin obtuse, usually concolorus with the pore surface; sterile margin of the resupinate part of the basidioma rather thick, up to 1 mm in width. Context up to 5 mm thick, cream- or wood-coloured (10 YR-2.5 Y 9/4). Tube layer up to 1 cm thick, concolorous with the pore surface, indistinctly stratified, each stratum up to 2 mm thick; pores round or rounded angular, 0.1-0.2(-0.3) mm in diam., (4)-5-7(-8) per mm, dissepiments thickened; pore surface vivid luteous or saffron-luteous (10 YR-2.5 Y 8/12), and yellowish isabelline or cremeous apricote when dry (10 YR 7-8/7-8 or 10 YR 8/10), fading slowly in herbarium.

Hyphal system trimitic, hyphae densely interwined. Generative hyphae scanty, difficult to observe, branched, with clamps, thin-walled, hyaline, 1.5-3.5 μm in diam; skeletal hyphae rare, yellowish, thick-walled or almost solid, flexuous, some weakly branched (similar to skeleto-binding hyphae), 2-4.5 μm in diam. in tube trama, 2-6 μm in context; binding hyphae dominating, yellowish, more or less thick-walled, flexuous, branched, with rare simple septa, 1.8-3.5 μm in trama, up to 4 μm in context. Skeletal and binding hyphae cyanophilous, weakly dextrinoid. Cystidioles (or leptocystidia) rare but present in all specimens, embedded, ventricose, thin-walled, 12-20 x 5-8 μm. Probasidia podobasidioid, basidia barrel-shaped, thin-walled, 12-20 x (6-)7-9.5 μm, with (2) 4 thin sterigmata 4-5 μm long; basidiospores ellipsoid, some irregular, thick-walled, truncate, some with 1 guttula, smooth, hyaline, strongly dextrinoid, 5.5-7.5 x 4-5.5 μm in 2% KOH. Spore print white.

Causes a fibrous light-coloured rot of wood.

Distribution and hosts. Russian Far East: Amursk and Sakhalin Provinces, Khabarovsk and Primorsk Territories, in all regions where *Maackia* occurs; China, Jilin Prov., Antu, Fushong and Huinan Co. On dead (very rarely living) trunks and fallen logs of *Maackia amurensis* Rupr. & Maxim. (Leguminosae), very rarely on *Acer barbinerve* Maxim., *Padus* sp., *Quercus mongolica* Fisch. ex Ledeb. and *Tilia amurensis* Rupr.

Reported from the Russian Far East also by Ljubarski (1959: 100), Bondartsev (1962: 103-106), Vasilyeva (1972: 148), Ljubarski & Vasilyeva (1975: 82) and Bondartseva (1998: 290).

Specimens studied: RUSSIA (32 collections; on *Maackia amurensis*, collected and identified by E. Parmasto where not mentioned otherwise). Amursk Prov.: *Distr. Khingano-Arkharinsk,* near Urilsk, 20 Aug 1959 Nikolajsk (LE, **holotype** of *Fomitopsis maackiae;* TAA, **isotype**). Khabarovsk Terr.: Arsenyevo, 19 Sep 1979 leg. K. Kalamees and M. Vaasma (TAA 120979); *Distr. Obluchye,* Yadrino, 9 and 11 Aug 1961 (TAA 13801, det. Y.-C. Dai; TAA 13823, 13954, 13956); *Distr. Komsomolsk,* Selikhino, Kabansopka, 16 and 18 Aug 1961 (TAA 14315, 14692); *Distr. Khabarovsk,* Bolshekhekhchirsk Nature Reserve, 4 Sep 1979 (TAA 102312), 22 Aug 1982 (TAA 105055, det. Y.-C. Dai), 28 Jul 1982 (TAA 104341, 162099); *Distr. Lazo,* Mukhen, 28 Sep 1961 (TAA 14692), Bichevaya, 14 and 15 Aug 1982 (TAA 104808, 104819). Primorsk Terr.: *Distr. Ternei,* Sikhote-Alin Nature Reserve, Rivlet Cheshchevityj, 23 Sep 1979 leg. A. Kollom (TAA 112972); *Distr. Kavalerovo,* Kavalerovo, 7 and 8 Oct 1977 leg. M. Saar (TAA 110578, 110580, 110623), Khrustalnyj, 7 Oct 1977 (TAA 101192, 101874, 101879); *Distr. Olga,* Olga, on dead and living trunks, 28 Aug 1961 (TAA 15261); *Distr. Lazo,* Lazo (Sudzukhe) Nature Reserve, Amerika, 7 and 14 Aug 1986 (TAA 107439, 107454, 107650) and on *Quercus mongolica,* 8 Aug 1986

(TAA 107483), Lazo Nature Reserve, Sandagou, 5 Sep 1961 (TAA 15097) and 28 Sep 1991 leg. K. Kalamees (TAA 145229); *Distr. Khasan*, Kedrovaya Pad Nature Reserve, on *Acer barbinerve* and *Quercus mongolica*. 7 Aug 1979, det. Y.-C. Dai (TAA 125126, 125086) and on *Tilia amurensis*, 10 Aug 1979 leg. I. Parmasto, det. Y.-C. Dai (TAA 125211); same locality, 22 Jul 1985 (TAA 106202).

Cultural characters

Cultures examined: TFC 82-37 (herbarium specimen: TAA 104 341) and TFC 85-20 (TAA 106202).

Growth characteristics: Growth moderately rapid to medium, plates covered in three to four weeks (46 to 62 mm in 14 days). Margin even, narrowly hyaline, marginal hyphae appressed to raised, mostly tensely situated; mat at two weeks thin, even, appressed, translucent, cottony to subfelty-felty, sometimes slightly floccose, sometimes zonate, pale to pastel yellow (Kornerup & Wanscher: 3A2 - 3A3), locally near inoculum with butter to maize yellow (4A5 to 4A6) patches or with yellow zones; mycelium in the marginal zone white or whitish, very thin, appressed or raised, thinly cottony, but sometimes downy or even silky; by 6 weeks mat thin, sometimes very thin, low, appressed, tough and felty (TFC 85-20) or subfelty (TFC 82-22), mostly even but occasionally with white or yellowish cottony mounds scattered over the whole mat, or with white cottony overgrowth, sometimes floccose, in some plates slightly zonate, yellowish white to pale, pastel or light yellow, sometimes straw or wax yellow (2A2-5, 3A2-5 or 3B4-6) or forming butter, maize or amber yellow (4A5-7, 4A6-4B6) patches or zones (TFC 85-20); in some plates near the inoculum or near the edges of the plates some small yellow pored areas developed in both studied cultures. Reverse darkened at first, later the yellow or orange colour slowly faded off. Odour absent.

Hyphal characteristics. Advancing zone. Marginal hyphae thin-walled, hyaline, with clamp connections, (1-)1.5-3.5(-4.5) μm in diam., moderately to frequently branched, branches often arising at right angles from main hyphae. *Aerial mycelium.* Generative hyphae mainly hyaline, moderately to frequently branched, (1-)1.5-3(-6) μm in diam. (Fig. 1, A), in two-week-old cultures mainly thin-walled, often covered with yellow amorphous or resinous material, in older cultures the walls of broader hyphae often thickened; some broader hyphae unbranched or rarely branched, irregularly swollen or of uneven diameter; some hyphae pigmented, yellowish, rarely branching; hyphae with many short or much-branched laterals often present. Fiber hyphae hyaline, moderately to frequently branched, aseptate, in vegetative areas mostly 0.5-1(-1.2) μm in diam., apparently thick-walled; in preparations from poroid areas wider (Fig. 1, D), mostly 1-2(-3) μm in diam., thick-walled, walls hyaline to yellowish, moderately to frequently branched, sometimes with rather long unbranched side-branches, leaving the impression of the presence of unbranched skeletal hyphae. In the isolate TFC 85-20 these binding (or skeleto-binding) hyphae became very numerous, densely intervowen and dominating after 2-3 weeks, in the isolate TFC 82-37 they were present only in small poroid areas. Chlamydospores (Fig. 2, D) mostly intercalary, of various shape, thick-walled, staining, 7.5-12.5 x 5-7.5 μm; crystals numerous. Basidiomata at the end of 6 weeks absent but probasidia were found in preparations from poroid areas and in eight-week-old tube cultures. *Submerged mycelium.* Generative hyphae hyaline, moderately to frequently branched, mostly thin-walled but later walls of the broader hyphae sometimes slightly thickened, (1.0-)1.5-4.5(-5.5) μm in diam.; some hyphae covered with yellow amorphous (resinous) material, some with many short laterals; rare pigmented hyphae present as in aerial mycelium. Chlamydospores and crystals as in aerial mycelium.

Oxidase reactions: positive with syringaldazine, *a*-naphthol and gum guaiac, no reaction with pyrogallol, L-tyrosine or phenol. Syringaldazine and *a*-naphthol produced immediate strong reaction in both studied isolates, the pinkish red colour, caused by syringaldazine, faded slowly off after 20 minutes. Gum guaiac coloured the mycelia after 5 to 10 minutes.

Monosporous cultures. Culture characters of four studied monosporous isolates of TFC 85-20 and two monosporous isolates of TFC 82-37 were rather similar to polysporous isolates differing macroscopically in the later appeareance of pale yellow colour of the mat and microscopically mainly in the absence of clamp connections on hyphae (Fig. 1, B).

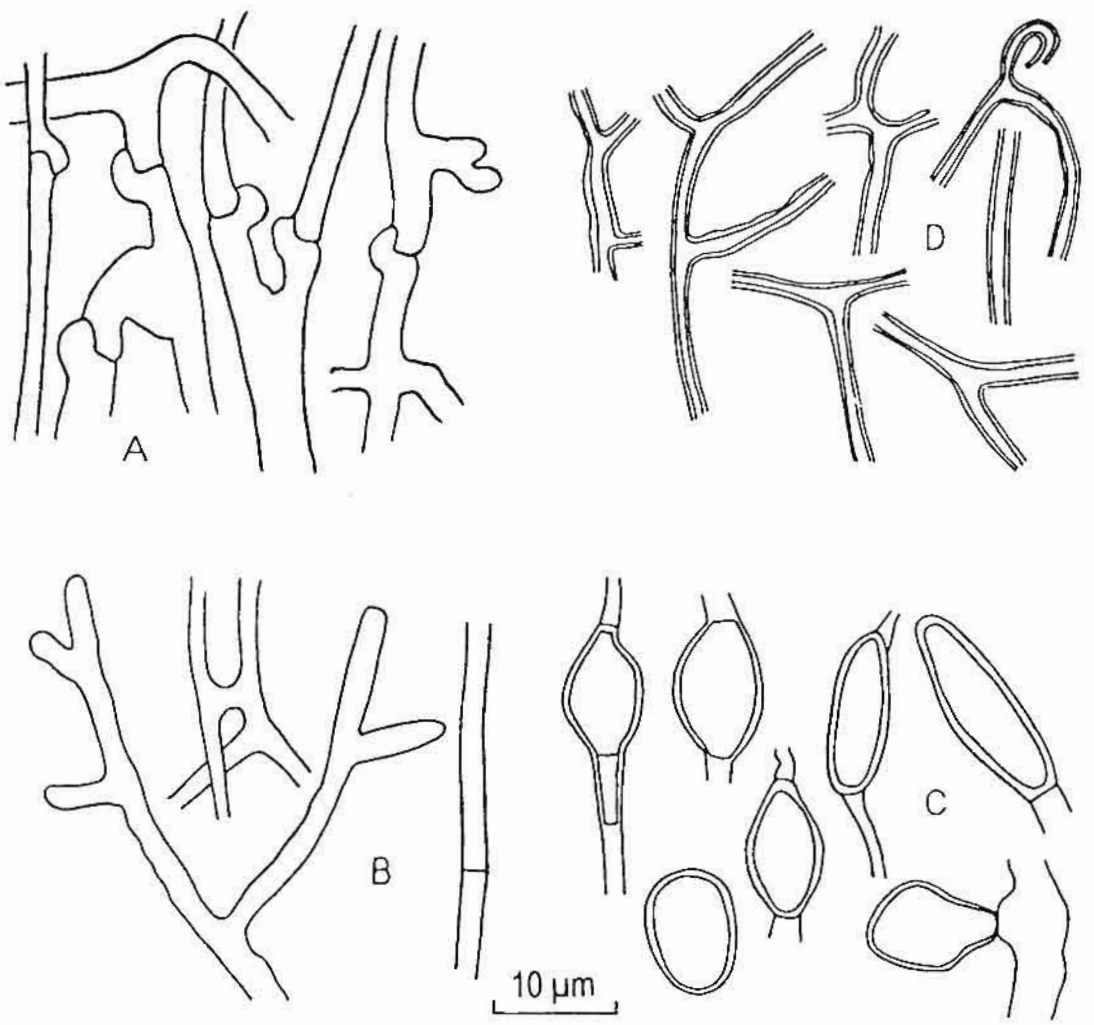

Fig. 1. *Perenniporia maackiae*. Microscopic structures of polysporous (A, C, D) and monosporous (B) cultures. A - generative hyphae, B - thin-walled simple-septate hyphae in monosporous cultures, C - chlamydospores, D - skeleto-binding hyphae from poroid areas. x 1600.

Species codes. Species codes according to Nobles' (1965) system: 2a.3c.8.(21). 26.34.37.(38).(39).43.-44.54.60; and Stalpers' (1978) system: 1, 7, (12), 13, (14), (17), (19), (20), 21, 24, 25, (29), 35, (38), 39, 45, (46), 47, 51, 52, (53), (54), (58), (61), (67), 80, 82, 83, 85, 89, 94.

Type of incompatibility system. 12 monokaryotic isolates of the collection TFC 82-37 and 11 monokaryotic isolates of the collection TFC 85-20 were mated between themselves. The mating system of both collections was ascertained to be bifactorial (heterothallic and tetrapolar). Isolate mating type assignment: **TFC 82-37** - A_1B_1 = isolates 1, 8; A_2B_2 = isolates 3, 12 ; A_1B_2 = isolates 2, 5, 11, 13, 15; A_2B_1 = isolates 4, 7, 10 (Fig. 2) and **TFC 85-20** - A_3B_3 = isolates 1, 4, 11; A_4B_4 = isolate 7; A_3B_4 = isolates 2, 3, 8, 9; A_4B_3 = isolates 5, 6, 10 (Fig. 3). The results of intracollection matings between monokaryons 2 x 10 and 5 x 7 of the collection TFC 82-37 were negative in spite of repeated confrontations.

		A_1B_1		A_2B_2		A_1B_2					A_2B_1		
		1	8	3	12	2	5	11	13	15	4	7	10
A_1B_1	1		-	+	+	-	-	-	-	-	-	-	-
	8	-		+	+	-	-	-	-	-	-	-	-
A_2B_2	3	+	+		-	-	-	-	-	-	-	-	-
	12	+	+	-		-	-	-	-	-	-	-	-
A_1B_2	2	-	-	-	-		-	-	-	-	+	+	-
	5	-	-	-	-	-		-	-	-	+	+	+
	11	-	-	-	-	-	-		-	-	+	+	+
	13	-	-	-	-	-	-	-		-	+	+	+
	15	-	-	-	-	-	-	-	-		+	+	+
A_2B_1	4	-	-	-	-	+	+	+	+	+		-	-
	7	-	-	-	-	+	+	+	+	+	-		-
	10	-	-	-	-	-	+	+	+	+	-	-	

Fig.2. Intracollection pairings for *Perenniporia maackiae* TFC 82-37. Symbols: +, compatible pairing with clamp connections on all hyphae; -, incompatibile pairing with no clamp connections observed.

		A_3B_3			A_4B_4	A_3B_4				A_4B_3		
		1	4	11	7	2	3	8	9	5	6	10
A_3B_3	1		-	-	+,+	-	-	-	-	-	-	-
	4	-		-	-,+	-	-	-	-	-	-	-
	11	-	-		+,+	-	-	-	-	-	-	-
A_4B_4	7	+,+	+,-	+,+		-	-	-	-	-	-	-
A_3B_4	2	-	-	-	-		-	-	-	+,+	+,+	+,+
	3	-	-	-	-	-		-	-	+,+	+,+	+,+
	8	-	-	-	-	-	-		-	+,+	+,-	+,+
	9	-	-	-	-	-	-	-		-,+	-,+	-,+ (+)
A_4B_3	5	-	-	-	-	+,+	+,+	+,+	+,-		-	-
	6	-	-	-	-	+,+	+,+	+,+	-,+	-		-
	10	-	-	-	-	+,+	+,+	+,+	(+),+	-	-	

Fig. 3. Intracollection pairings for *Perenniporia maackiae* TFC 85-20. Symbols: +, compatible pairing with abundant clamp connections; (+), few clamp connections observed; -, incompatible pairing, no clamp connections observed. In the compatible pairings the central symbol represents the presence of clamp connections in the zone of contact. The symbols in the lower left and upper right corners show whether clamp connections were found in the area of monokaryotic component of the pair indicated in the vertical or horizontal row.

Intercollection matings. For the interincompatibility study, the four monokaryotic isolates, each representing the four mating types of both collections, were mated in all combinations (Fig. 4). Two studied collections were intercompatible and in most pairs abundant clamp connections were observed. The pairs 82-37/8 x 85-20/1 and 82-37/10 x 85-20/2 revealed only few clamp connections in the zone of contact and in the mating between monokaryotic isolates 82-37/8 x 85-20/7 no clamp connections were detected. Unfortunately, since monokaryon 85-20/7 was the only representative of its mating type (A_4B_4), the reasons for the negative result obtained, for example, strain specific phenomena, small number of monokaryotic tester strains used, heterogenic incompatibility, etc., described thoroughly by several authors (Boidin, 1977, 1986; Petersen, 1995), remain still unclear.

		TFC 85-20			
		A_1B_1 1	A_4B_4 7	A_3B_4 2	A_4B_3 6
TFC 82--37	A_1B_1 8	(+)	-	+	+
	A_2B_2 12	+	+	+	+
	A_1B_2 13	+	+	+	+
	A_2B_1 10	+	+	(+)	+

Fig. 4. *Perenniporia maackiae*, intercollection pairings between monokaryotic tester strains of the collections TFC 82-37 and TFC 85-20. See Fig. 3 for symbols.

DISCUSSION

P. maackiae is easily identifiable owing to the conspicuous vivid luteous colour of its basidiomata as well as specialization. It appears to be the only species in the genus *Perenniporia* whose binding hyphae are more numerous than skeletals in its basidioma.

Polarity type has been studied earlier in several *Perenniporia* species: in *P. compacta* (Overh.) Ryvarden & Gilb., *P. ellisiana* (Anderson) Gilb. & Ryvarden; *P. fraxinea* (Bull: Fr.) Ryvarden, *P. fraxinophila* (Peck) Ryvarden, *P. medulla-panis* (Jacq.: Fr.) Donk, *P. phloiophila* Gilb. & M. Blackw., *P. robiniophila* (Murr.) Ryvarden, *P. rosmarini* A. David & Malençon, *P. tenuis* (Schw.) Ryvarden var. *tenuis*, *and P. tenuis* var. *pulchella* (Schw.) J. Lowe, which have all been found to be heterothallic and tetrapolar (David & Malencçon, 1978: 405; Flott & Gilbertson, 1991: 1118; Lindsey & Gilbertson, 1978: 309; Montgomery, 1936; Nobles et. al., 1957: 378, 381, 386; Sterner in Gilbertson & Ryvarden, 1987: 530). This demonstrates once more that polarity type is a characteristic at the genus level.

Mean spore size and spore form index Q are intraspecifically little variable in *P. maackiae* compared with the mean spore variability of the Hymenomycetes; the variation coefficients for mean spore length, mean spore width and Q are v= 5.8, 6.3 and 6.5, respectively. Mean spore measurements (in μm) are given in Table 1; 30 spores were measured in each specimen. According to the data given in Table 1, the 90-percent expected tolerance limits (Parmasto & Parmasto, 1988) of mean spore size are 5.81-7.13 x 4.11-5.15 μm; the tolerance limits of Q values are 1.24-1.56.

It is peculiar to *P. maackiae* that the correlation between mean spore length and mean spore width is weak (r = 0.20) and quite insignificant (at the 0.05 level: $t = 0.85 < 2.09 = t_{19;\,0.05}$). In this respect the spores of this species are different from all other studied holobasidiomycetous Hymenomycetes (see Parmasto & Parmasto, 1988).

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Table 1. Spore size (μm) in *Perenniporia maackiae*.

TAA no.	Length	Width	Q
102312	6.18	4.48	1.38
104808	6.25	4.89	1.28
isotype	6.30	4.49	1.40
109874	6.30	4.52	1.40
13823	6.36	4.65	1.37
110623	6.38	4.84	1.32
15097	6.39	4.54	1.41
106202	6.41	4.65	1.39
101874	6.42	4.47	1.44
112977	6.43	4.88	1.32
125907	6.44	4.52	1.43
13956	6.56	4.51	1.46
104341	6.59	4.30	1.54
107467	6.59	4.57	1.44
14315	6.60	4.55	1.45
15261	6.63	4.64	1.43
14399	6.65	4.61	1.44
110580	6.65	4.94	1.35
14692	6.87	4.91	1.41
Species mean	6.47	4.63	1.40

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Neotypification of *Phellinus chrysoloma*

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Abstract: *Phellinus chrysoloma* is neotypified with a basidioma collection from Sweden. Nucleotide sequences are presented for a haploid isolate from the neotype and an isolate from decayed wood. A brief discussion of the relationships of *P. chrysoloma* to other segregates/members of the *P. pini* complex is presented.

Kokkuvõte: M. J. Larsen ja J. Stenlid. *Phellinus chrysoloma* neotüpiseerimine.

Toetudes Rootsist korjatud seene viljakehale neotüpiseeritakse liik *Phellinus chrysoloma*. Artiklis esitatakse neotüübist ja lagunevast puidust eraldatud isolaatide ribosomaalse DNA ITS regioonide nukleotiidne järjestus. Lühidalt iseloomustatakse liigi *P. chrysoloma* sugulussuhteid teiste kompleksliiki *P. pini* kuuluvate taksonitega.

We dedicate this paper to and in honor of Dr. E. Parmasto on the occasion of his 70th birthday and his lifelong study of and contributions to our understanding of the Aphyllophorales.

INTRODUCTION

Fries (1861) described *Polyporus* (*Resupinatus*) *chrysoloma* as "...effusus..." "...Resupinatorum...", "...numquam reflexo...", and "Ad corticem siccum abiegnum lignorum coacervatorum." There was little doubt in Fries' mind that his fungus was a resupinate polypore. Numerous authors, however, have subsequently emended Fries' (1861) concept to include pileate effused-reflexed forms. Bondartsev's (1953) treatment of *Phellinus pini* var. *abietis* cites *Poria chrysoloma* (Fr.) Cooke, Domanski et al. (1967) list *Phellinus abietis* (P. Karst.) H. Jahn, and Gilbertson and Ryvarden (1994) list *Fomes* (*Phellinus*) *abietis* P. Karst as synonyms of *P. chrysoloma*. Fischer (1987) reported on two populations of *P. chrysoloma* that were not compatible with each other (in vitro) or with what he called *Phellinus pini* (Brot.: Fr.) A. Ames.

In other reports, Larsen et al. (1979) separated *Phellinus cancriformans* (M. J. Larsen et al.) M. J. Larsen et Cobb-Poule from the *P. pini* complex and neotypified *Phellinus pini* with a basidioma from Portugal (Larsen and Melo, 1996). Cerny (1985) studied type basidiomata for other known names in the *P. pini* complex, e. g., *Phellinus vorax* (Harkn.) Cerny (nom. inval.), *Phellinus piceinus* (Peck) Pat., and *Phellinus laricis* (Jacz. in Pilát) Pilát. However, Cerny (1985) did not see nomenclatural type material of *P. chrysoloma*, which according to Donk (1971) and Romell (1911), does not exist, nor did he see type material of *P. pini*. Larsen and Cobb-Poule (1990) summarized the proposed facultative synonymy for *P. chrysoloma*.

Our own efforts to uncover original Friesian material have not been fruitful. Thus, our purpose here is to neotypify *Polyporus chrysoloma* Fr. with a basidioma collected in the vicinity of Uppsala, Sweden.

MATERIALS AND METHODS

Data on microscopic characteristics were obtained from free hand sections of basidioma mounted in Melzer's reagent (Melzer 1924), distilled water, 5% KOH (w/v), or lactophenol-cotton blue (Johansen 1940). Capital letters used to designate herbaria are those of Holmgren et al. (1990). Colour designations are those of the Munsell Color Co. (1929-1942).

Basidiospores were collected by suspending portions of the neotype basidioma (UPS, MJL no. 135592) over 2% malt agar (w/v) in the laboratory. Spores were collected and placed in

suspension in sterile distilled water with 0.01% Tween 80 (v/v) to reduce surface tension, diluted further to a suitable concentrations, and spread on 2% malt agar in 90 mm Petri dishes. Petri dishes flooded with spore suspensions were used to obtain monokaryotic isolates. Twenty monokaryotic isolates from neotype of *Phellinus chrysoloma* were crossed in all combinations. Isolates were first cultivated on 2% (w/v) potato dextrose agar (Difco Co.) and pairings made 3-5 mm apart and incubated in the dark at 24 C. Initial screening of putative positive or negative matings was done at 6 wk.

Rot isolates were obtained by aseptically dissecting small pieces of decayed woody tissue and transferring these pieces to Petri plates containing 2% (w/v) malt agar. Upon growth, actively growing mycelia were transferred to test tube culture.

The DNA extractions and PCR reactions using the ITS1 and ITS4 primers (Gardes and Bruns, 1993) were done according to the procedures described by Kårén et al. (1997). Sequencing reactions were performed in an Applied Biosystems (Foster City, Ca, USA) 310 sequencer using the Big Dye Terminator cycle system according to the producer's instructions.

RESULTS AND DISCUSSION

Neotypification of *Polyporus chrysoloma* Fr. *Phellinus chrysoloma* (Fr.) Donk, Proc. Kon. Ned. Akad. Wetensch. C 74: 25-41. 1971.

° *Polyporus chrysoloma* Fr., Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 18: 30. 1861.

° *Daedalea chrysoloma* (Fr.) Cooke et Quél., Clavis Synopt. Hym. Europ., p. 191. 1878.

° *Physisporus chrysoloma* (Fr.) P. Karst., Bidrag Kännedom Finlands Natur Folk 37: 58. 1882.

° *Poria chrysoloma* (Fr.) Cooke, Grevillea 14: 112. 1886.

° *Porodaedalea chrysoloma* (Fr.) Fiass. et Niem., Karstenia 24: 25. 1984.

Neotype: Sweden, Fiby, west of Uppsala, on *Picea abies* (L.) Karst., September 16, 1997, coll. J. Stenlid (MJL 135951), UPS.

Fig. 1

Basidioma mostly effuse, somewhat narrowly reflexed, annual to (?) perennial. *Upper surface* dull ferruginous brown, faintly sulcate, barely tomentose, a thin black layer of tissue separating context from upper tomentum. *Pore surface* at first poroid but rapidly become irregular and

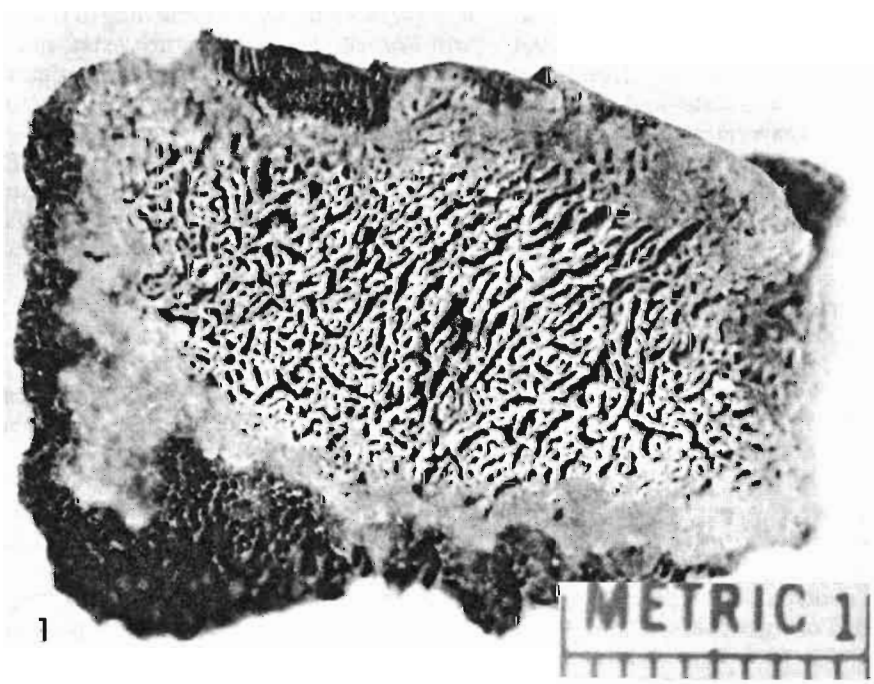

Fig. 1. Neotype basidioma of *Phellinus chrysoloma* (scale bar = 1 cm).

finally becoming daedaloid, pores 3-5 per mm, shallow, older tubes stuffed with pale rusty brown hyphae. *Context* 0.25 mm thick, dull ferruginous brown.

Hyphal system dimitic. *Contextual skeletal hyphae* 2.5-3 (-3.5) μm diam, some adventitious septa present, branching limited, hyphae parallel in direction of growth, pale brown in Melzer's reagent. *Contextual generative hyphae* 2-2.5 μm diam, pale tan to hyaline, commonly simple-septate, frequently branched. *Tramal skeletal hyphae* 2.5-3 μm diam, mostly interwoven but sometimes parallel, septation and branching absent, pale brown in Melzer's reagent. *Tramal generative hyphae* 2-2.5 μm diam, pale tan, frequently branched and septate. *Tramal setae* absent. *Hymenial setae* up to 80 x 10 μm, but mostly 37-55 x 7-8 μm, lanceolate and often slightly swollen at the base, frequently bifurcate at base, becoming thick-walled, dull brown in Melzer's reagent. *Basidia* 8-13 x 4-5 μm, clavate but slightly attenuated at the base, frequently with a slight median constriction, many basidia either in clusters or arising singly from variably formed generative hyphae that are thin- to thick-walled and short celled with numerous septa, hyaline. *Basidiospores* 5 x 4.5 μm, globose to subglobose, hyaline in H_2O, no colour change or staining in Melzer's, KOH or cotton blue; spore print white.

The above description is based on the neotype.

Type of rot: White pocket rot, according to most authors. Eventually becoming noticeably stringy (see specimen no. 135952).

ADDITIONAL SPECIMENS EXAMINED: Sweden, on *Picea abies* (old growth forest), Fiby IX 97 (MJL 135953), and IX 97 (stringy rot of *P. abies*) (MJL 135952), and on living *P. abies* (MJL 135954), J. Stenlid. All deposited at UPS.

Monosporus isolates of the neotype (135951) and rot isolate (135952) are on file at CFMR and the American Type Culture Collection (ATCC).

We also examined the holotype of *Polyporus piceinus* Peck (NYS) described from the Adirondack Mountains in New York State, and original material of *Daedalea vorax* Hark. (NYS, FH) from coastal California.

The nucleotide sequences presented below were obtained from a haploid isolate (135951-7) of the neotype [MJL 135951; National Center for Biotechnology Information (NCBI) Genbank no. AF123440 639 bp. and a rot isolate (MJL 135952.). When these two sequences are aligned, there are only two anomalies suggesting strongly that they represent the same species.

```
Rot is.   TTCGCGTTTTAAAATCGAGGGCTTGATGCTGGCGTGGAAACACGCACTGTGCTCGGCCTTTCGTGCTTAATC
Neotype   ????????????????????????????????????????????????????????????????????

Rot is.   CACTCAACACCTGTGCACCTTATCGAAGTTAGTAGTCTTTCCTCCTTAGTTGGAGCCGCCGGGGTTGACTTT
Neotype   A...........................................................X............

Rot is.   GTTAGTAGTGTTTCGACGCGAAAGCATATGGTCGGCCTTGGCTGGGATCGGCGAACACTTTGACTTCATTAT
Neotype   ....................................................................

Rot is.   ACACACTTTAATTGTCTTGTAGAATGTAATGCTCCTTGTGGGCGAAATGAAATACAACTTTCAACAACGGAT
Neotype   ....................................................................

Rot is.   CTCTTGGCTCTCGCATCGATGAAGAACGCAGCGAAATGCGATAAGTAATGTGAATTGCAGAATTCAGTGAAT
Neotype   ....................................................................

Rot is.   CATCGAATCTTTGAACGCACCTTGCGCCCCTTGGTATTCCGAGGGGCATGCCTGTTTGAGTGTCATGTTAAC
Neotype   ....................................................................

Rot is.   ATCAAACCCCTTGCTTGTAAAGGCTCGGGGCTTGGATTTGGAGGTTGTGCTGGCTGGCCTACTTCATTGTCG
Neotype   ....................................................................

Rot is.   GTTGTCGGCTCCTCTTAAATGGATTAGCTGGACTTTGGTCTGCGTGTCGGTGTAATAGTTTATTCACCAATC
Neotype   ....................................................................

Rot is.   GCTTGCCTAATGGGTCTGCTTCTAATAGTCTTTGGACAAGGTCTTAACAGCCTTCTTGACTCTTTGACCTCA
Neotype   ....................................................................

Rot is.   AATCAGGTAGGACTACCCGCNANNT
Neotype   ....??????????????????????
```

We have also examined two other sequence submissions to NCBI Genbank of *Phellinus chrysoloma*, AF053976 and AF055370, both of which possess 661 bp. Both sets of nucleotide sequences are ninety percent similar to that of *Phellinus chrysoloma* presented here, when similarities are analyzed through NCBI's Blast 2 sequence (version 2.0.6) This comparison suggests that these two sequences, derived from Korean isolates, represent different species. In fact, when these two sequences are compared to each other, there is only a ninety-three percent similarity, indicating that they may represent two different species.

There appears to be an important issue that we should consider here, namely that deposition of nucleotide sequence data with organizations such as NCBI must be based on precise identification of the biological material from which it is obtained. If not, an undesirable high level of confusion would be created.

Results of pairing tests among single-spore isolates from the neotype of *P. chrysoloma* were not interpretable and thus inconclusive (data not presented). No well defined mating pattern was apparent, though in numerous instances compatible crosses were observed suggesting heterothallism, using the criteria of Fischer (1994). He (loc. cit.) also could not come to a firm conclusion with regard to sexuality because A = and A ≠ pairing results were not always reliable or interpretable (assuming a unifactorial mating system).

A morphological comparison of the nomenclatural types of *P. chrysoloma*, *P. piceinus*, and *P. pini* follows.

	P. chrysoloma	**P. piceinus**	**P. pini**
Basidiospores	5x4.5 µm globose to subglobose spore print white	5.0-5.5-6x4.5 µm ellipsoid to subglobose	5-6(-6.5)x4-5(-5.5) µm broadly ellipsoid to sometimes subglobose
Pores/mm	3-5/mm	4-6/mm	1-2(-3)/mm
Tramal setae	absent	ca. 40x6 µm	infrequent 70-75x10-12.5 µm
Hymenial setae	80x10 µm lanceolate, frequently bifurcate at base	30-40x5-6 µm lanceolate	(30-)40-60x(15-)30-40 µm subulate to rostrate
Contextual skeletal hyphae	2.5-3(-3.5) µm diam	2.5-5 µm diam	(3.5-)4-5 µm diam
Hyphal system	dimitic	(?) dimitic with branched thick-walled hyphae	dimitic
Annual/ perennial	annual to becoming (?) perennial	annual	at first annual to becoming perennial
Basidiocarp(s)	mostly effuse to slightly reflexed	distinctly pileate to somewhat effuse-reflexed	pileate
Host	*Picea abies*	*Picea* sp.	*Pinus* sp.

It would be premature at this time to draw any firm conclusions for identification of these three species since there appears to be considerable over-lap with regard to measurements of many of the microscopical characteristics. However, host and distribution of these *Phellinus* species along with the nature of the mitic system and size, shape, and position of setoid elements may prove useful.

We have purposely omitted comparisons with "*Daedalea vorax*", for that name was never validly published. This interpretation confirms

Niemelä's observations and annotations that were deposited with "original" specimens of Harkness' "vorax."

Finally, Fischer's (1987, 1994, 1996) data on *Phellinus pini* and *P. chrysoloma* is suspect because neither name at the time of those publications was associated with a nomenclatural type. Thus, it is difficult to interpret his data nomenclaturally. However, there does appear to be one group that Fischer (1994) identified as intersterility group N-III occurring on *Pseudotsuga menziesii* (Mirb.) Franco from coastal Oregon and California. We have not had the opportunity to examine Fischer's collections and strongly suspect that what Fischer had was earlier called "vorax" by Harkness. Cerny's (1985) paper suffers partially from the same problem since he also had no reference point with regard to nomenclatural types of *P. chrysoloma* and *P. pini*.

ACKNOWLEDGMENTS

We want to thank Hans-Olov Pettersson for help with the DNA analyses and sequencing, Ms. J. Hoff for capable technical assistance and Dr. N. Klopfenstein for helpful discussions. We also thank the herbarium curators of NYS and FH for the loan of specimens.

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The genus *Hypomyces* (Hypocreales, Ascomycota) and allied fungicolous fungi in Estonia

I. Species growing on aphyllophoralean basidiomycetes

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Abstract: 24 species of *Hypomyces* and closely related fungicolous fungi that grow on basidiomata of aphyllophores in Estonia are reported. Seven out of the fourteen holomorphic *Hypomyces* species have been found only as anamorphs. In addition to the four considered asexual species, a new *Cladobotryum* species is described. The survey also covers species of *Arachnocrea*, *Hypocrea* and *Sphaerostilbella* that grow on aphyllophores and are known to be closely related to *Hypomyces*. A previously unknown anamorph is described for *A. stipata*. 20 of the taxa are reported as only recently discovered in Estonia.

Kokkuvõte: K. Põldmaa. Perekond *Hypomyces* (Hypocreales, Ascomycota) ja lähedased seentel kasvavad seened Eestis. I. Torikulaadsetel kasvavad liigid.

Ülevaates Eestis torikulaadsetel kasvavate perekonna *Hypomyces* ja satelliitperekondade kohta esitatakse andmeid 24 liigi esinemisest. Neist 20 liiki pole Eesti seenestiku varasemate ülevaadete kohaselt Eestist leitud. Perekondi *Arachnocrea* ja *Sphaerostilbella* mainitakse Eestist esmakordselt. Neljateistkümnest holomorfsest liigist on seitse leitud vaid anamorfina. Käsitlemist leiab ka viis seniste teadmiste kohaselt anamorfset liiki, millest üks kirjeldatakse kui teadusele uus. Samuti kirjeldatakse anamorf liigile *Arachnocrea stipata*, millel varem mittesugulist paljunemist ei tuntud.

INTRODUCTION

The group of fungicolous fungi forms an ecological dimension superimposed on other ecological groups of fungi (Gams et al., 2000). Fungi that grow on carposomata of macromycetes, form only one part of that group, among which the ascomycete genus *Hypomyces* Tul. is definitely the most species-rich taxon. It is characterized by forming light-coloured perithecia in a subiculum, cylindrical asci thickened at the top, 0-1-septate warted ascospores and fungicolous, mostly basidiomycetous habit. The ascigerous state is usually preceded by diverse conidial forms of sporulation that have been named in several anamorphic genera. Four groups have been recognized in recent monographic treatments of *Hypomyces* (Rogerson & Samuels, 1985, 1989, 1993, 1994) characterized by the range of hosts and by morphological variation. The largest number of *Hypomyces* species have been described from aphyllophores, around ten species are known on agarics and boletes, and a few species have been found on discomycetes. While these papers are based mainly on American material, overviews of the genus and related fungicolous species in different European countries are also available (Arnold, 1963, 1969a,b; Bitner, 1953; Eckblad & Torkelsen, 1974; Fassiatova, 1958; Helfer, 1991; Moravec, 1960) or records can be found in surveys of fungal biota (Cannon et al., 1985; Eriksson, 1992; Munk, 1957; Smitskaja, 1991).

Collecting fungi growing on fruitbodies of other fungi has been a "secondary hobby" for several local mycologists since the beginning of mycological activities in Estonia. While first records of *Hypomyces* in Estonia date from the middle of the last century (Dietrich, 1856, 1859), most of the specimens have been collected during the last five decades by several mycologists working at the Institute of Zoology and Botany in Tartu. While studying different groups of macromycetes that serve as hosts for *Hypomyces* species, they occasionally also brought along the injured fruitbodies from their expeditions. The most keen collector, however, was Peeter Põldmaa

whose research focused on phytopathogenic fungi and parasites attacking them. With the exception of the overview of the fungicolous species parasitising rusts and powdery mildews in Estonia (Põldmaa, 1966), he never got as far as publishing his material and observations of other fungicolous fungi. However, he regularly sent Estonian material to Günter Arnold (Weimar, Germany) who isolated some of the fungi into pure culture and also reported several of the Estonian collections (Arnold 1970a,b, 1971b, 1989).

Despite the extensive collecting activities, literature records about Estonian *Hypomyces*, in addition to those mentioned above, are scarce. In a paper by Heinrichson-Normet (1969) six species have been examined from Estonia, some of which were commented on by Arnold (1972). Koval (1983) reported five holomorphic and one anamorphic species. Moreover, until recently any of the mycologists in Estonia had isolated and studied the *Hypomyces* collections in pure culture, a method that is often indispensible for reliable identification. The author of the present paper has concentrated on studying this group of fungi, culturing the majority of the specimens collected. In course of this work three new anamorphic species and a new teleomorph were described (Põldmaa, 1996) and the taxonomy as well as the geographic distribution of some aphyllophoricolous species of *Hypomyces* was revised (Põldmaa & Samuels, 1999).

The aim of the present study is to give an overview of the species of *Hypomyces* and closely related genera occurring in Estonia, with remarks upon their abundance and phenology as well as on morphology of less known taxa. The first part covers species growing on basidiomata of aphyllophores, and *H. armeniacus* that, although growing exlusively on agarics, is known to be closely related to the aphyllophoricolous species with *Cladobotryum* Nees anamorphs (Põldmaa et al., 2000). Out of the 24 species considered four, all of them holomorphic *Hypomyces* species, have been reported from Estonia by earlier authors. The paper deals with fourteen holomorphic *Hypomyces* species (seven of these collected only as anamorphs in Estonia) and five related anamorphic species, one of which is described as new for science. *Hypocrea pallida*, species of *Arachnocrea* Moravec and *Sphaerostilbella* Sacc., that all grow on aphyllophores and have been shown to be closely related to *Hypomyces* (Põldmaa et al., 2000; Rehner & Samuels, 1995), are also treated. *Arachnocrea* is the only genus out of the ones mentioned above for which no anamorph has yet been described. We obtained ascospore germination of one collection of *A. stipata* and are illustrating the anamorph that formed in culture.

MATERIALS AND METHODS

The present survey is based on specimens collected during the last six years by the author and mycologists of the Institute of Zoology and Botany (Tartu), as well as on some earlier collections preserved in the Mycological Herbarium at this Institute. The asterisk marks species that are absent from the lists of Estonian fungi (Järva & Parmasto, 1980; Järva et al., 1998). Abbreviation "A" stands before the name of the anamorph and collections containing only the conidial stage. All the recorded substrata have been presented; their frequency can be estimated by counting the reported collection numbers. Precise collecting data for each specimen are given only for apparently rare species with less than five (teleomorphic) collections known. The specimens as well as the cultures are deposited at the Institute of Zoology and Botany; the two numbers reported refer to the Mycological Herbarium (TAA) and the Culture Collection (TFC numbers with a hyphen in the middle), respectively. Representative strains are also deposited in the culture collection of the Centraalbureau voor Schimmelcultures (CBS, Baarn). The superscript 1 indicates collections with unripe perithecia where ascospore formation could not be induced, and superscript 2 anamorphic collections that produced perithecia in culture.

Fresh material was studied in water, herbarium material was briefly rehydrated in 3% (aq.) KOH. Ascospores or conidia were isolated onto 1.5% MEA and the descriptions were made of colonies grown at 22-24 C in darkness. The measurements reported for ascospores and conidia represent the limits of 90% range of estimated normal distribution and the mean values of specimens; in other cases the extreme values are reported.

TAXONOMY

Hypomyces

* **H. albidus** Rehm, Hedwigia Beibl. 42: 291. 1903.
A: *Cladobotryum sphaerocephalum* (Berk.) Rogerson & Samuels, Mycologia 85: 241. 1993.

A: On *Fomitopsis pinicola* (Sw.: Fr.) P. Karst. - 161653 (95-98); *Hymenochaete tabacina* (Sowerby: Fr.) Lév. - 161314 (94-201), 161824 (95-148), 169564; *Steccherinum ochraceum* (Pers.: Fr.) Gray - 161231b (94-31); *Stereum rugosum* (Pers.: Fr.) Fr. - 169883 (97-124), 169904; *Stereum* sp. - 169878; *Tremella encephala* Willd.: Fr. - 169881 (97-123); *Trichaptum abietinum* (Dicks.: Fr.) Ryvarden - 167256 (97-42).

The species has been found only from Europe. Its teleomorph is known from six collections, most of which are from basidiomata of *Stereum* spp. (Põldmaa & Samuels, 1999). The anamorph appears to be quite common in Estonia and it seems likely that the teleomorph will also be found from here in future. The anamorph has been found to grow on basidiomata of different host species that inhabit the same or adjacent logs (Põldmaa & Samuels, 1999). All the specimens have been collected between the end of August and the beginning of October.

H. armeniacus Tul. Ann. Sci. Nat. Bot. Ser. IV, 13: 12. 1860.
A: *C. verticillatum* (Link) S. J. Hughes, Canad. J. Bot. 36: 750. 1958.

On a cone of *Picea abies* (L.) Karst., Läänemaa Co., between Mihkli and Koonga, 16 Aug. 1960, leg. A. Raitviir, det. G. Arnold, 40949; on leaf litter, Hiiumaa Island, Tahkuna peninsula, 1 Sep. 1960, leg. A. Raitviir, det. G. Arnold, 41182.

A: *Lactarius helvus* (Fr.) Fr. - 161823 (95-154), 169546, 169572, 169972 (98-56); *L. mitissimus* (Fr.) Fr. - 161213 (94-20), 161830 (95-156); *L. piperatus* (L.: Fr.) Gray - 169819; *L. pyrogalus* (Bull.: Fr.) Fr. - 161436 (94-52); *L. rufus* (Scop.: Fr.) Fr. - 31241, 31255, 32884, 161822 (95-130), 169508; *L. subdulcis* (Bull.: Fr.) Gray - 85918; *L. thejogalus* (Bull.: Fr.) Fr. - 161993, 161942; *L. torminosus* (Schaeff.: Fr.) Gray - 160927 (93-127), 161264; *L. trivialis* (Fr.: Fr.) Fr. - 169503, 169507, 169565; *L. vietus* (Fr.: Fr.) Fr. - 169509, 169834; *Lactarius* sp. - 86928, 160916 (93-120), 161638 (95-94), 169778, 169788, 169933 (98-82), 169948; *Russula decolorans* (Fr.) Fr.- 169525; *R. delica* Fr. - 161797 (95-151); *R. emetica* (Schaeff.: Fr.) Pers. - 85917; *R. paludosa* Britzelm. - 169510; *R. xerampelina* (Schaeff.) Fr. - 85906; *Russula* sp. - 32752, 32648, 32873, 32889, 36716, 36743, 160890 (93-112), 161212 (94-19), 161986, 161988, 169528, 169553, 169779; decayed agarics - 32747, 32867, 161639 (95-95), 169940.

This species, also known as *H. ochraceus* (Pers.: Fr.) Tul. (Rogerson & Samuels, 1994) or under the various synonyms of the anamorph (Gams & Hoozemans, 1970), is very common in Europe as well as in Asia and North America. Also in Estonia, high numbers of basidiomata of *Lactarius* and *Russula* species become destroyed by its conidial stage. The teleomorph seems to be far more rare and has been found on other substrata near the decayed agarics, as characteristic of this species (Rogerson & Samuels, 1994). Although *H. armeniacus* is restricted to inhabiting the basidiomata of agarics, mostly from the family of *Russulaceae*, it is closely related to species of *Hypomyces* that have a *Cladobotryum* anamorph and grow mostly on aphyllophores, as concluded from its 28S rDNA data (Põldmaa et al., 2000).

It is characterized by producing mainly one-celled conidia but in several strains made from Estonian collections also 1-septate conidia can be found. In some strains (95-94, 161646) we observed secondary proliferation of conidiogenous cells, as described for *H. albidus* and *H. rostratus* (Gams & Hoozemans, 1970; Põldmaa & Samuels, 1999). Sympodial proliferation of the conidiogenous cell that has never been observed for this species was noticed in strains 98-56 and 98-82. Several of the strains that have been isolated from collections growing on basidiomata of *Lactarius* species (e.g. 94-52, 95-154, 95-156) produce sweet odour while growing on MEA and also the conidia tend to be more slender (10-30 x 6-8 (-12) μm) and attenuated at the base. These remind the conidia of *C. apiculatum* (Tubaki) Gams & Hoozemans, suggesting a host-dependent morphological dimorphism in this species. The occurrence of *H. armeniacus* depends of the phenology of its hosts and is therefore most frequently encountered in Estonia throughout August and

in September when the production of basidiomata of *Lactarius* and *Russula* species is at its peak.

H. aurantius (Pers.: Fr.) Tul., Ann. Sci. Nat. (Bot.)., Sér. IV, 13: 12. 1860.
A: *C. varium* Nees, Syst. Pilze Schwämme 56. 1816.

On *Bjerkandera adusta* (Willd.: Fr.) P. Karst. - 161421 (94-70), 161767; *Fomitopsis pinicola* - 161755 (95-171); *Pleurotus ostreatus* (Jacq.: Fr.) P. Kumm. - 161097 (93-81); *Polyporus squamosus* (Huds.: Fr.) Fr. - 160770 (93-41), 160874, 161165[1], 161548 (94-223); *Trametes versicolor* (L.: Fr.) Pilat - 36681, 88843, 161440 (94-221); a fallen rotten trunk - 167399.
A: *Auricularia mesenterica* Pers. - 161550a (94-94); *Bjerkandera adusta* - 161181 (94-21), 161932, 161973, 169567, 169596; *Cerrena unicolor* (Bull.: Fr.) Quél. - 161606 (95-14), 161615 (95-15); *Flammulina velutipes* (Curtis: Fr.) Singer - 161601 (95-11); *Fomes fomentarius* (L.: Fr.) Fr. - 161083; *Inonotus leporinus* (Fr.) Gilb. & Ryvarden - 36702; *Laetiporus sulphureus* (Bull.: Fr.) Murrill - 160913 (93-74); *Phaeolus schweinitzii* (Fr.: Fr.) Pat. - 161829b (95-161); *Phellinus ferruginosus* (Fr.) Pat. - 161576 (94-80); *Ph. tremulae* (Bondartsev & Borissov) Bondartsev - 161974, 169983; *Piptoporus betulinus* (Bull.: Fr.) P. Karst. - 161598 (94-191); *Polyporus squamosus* - 32658, 32755, 36371, 161165 (94-12), 161549 (94-78), 160770 (93-41), 161901; *Ramaria eumorpha* (P. Karst.) Corner - 160978 (93-136); *Trametes hirsuta* (Wulfen: Fr.) Pilat - 161605 (95-13), 161740; *T. ochracea* (Pers.) Gilb. & Ryvarden - 161492 (94-69), 161818 (95-129); *T. versicolor* - 161602 (95-12); *Trametes* sp. - 161642 (95-96); *Trichaptum abietinum* - 161329 (94-44), 169560, 169671; the base of a stump of *Picea abies* - 161679 (95-109); decayed branch of a deciduous tree - 161989; agarics on a living tree of *Acer platanoides* L. - 169919; agarics on a living trunk of *Fraxinus excelsior* L. - 32654.

H. aurantius is a very common species in Estonia as well as worldwide, often occurring in both stages. We have found it growing on a diversity of aphyllophoraceous hosts and also on wood-decaying agarics. The telomorph has been collected mostly in August and September but there are single collections also from June and October. Anamorphic specimens originate from April to November. In addition to the typical 1-septate conidia, a few 2- and 3-septate conidia can be found in some of the specimens and/or their cultures.

***H. broomeanus** Tul., Sel. Fung. Carp. 3: 108. 1865.
A: *Gliocladium microspermum* (Sacc.) W. Gams, *Neth. J. Pl. Path.* 88: 73.

All collections on *Heterobasidion annosum* (Fr.) Bref. - Pärnumaa Co., Varbla, Mereäärse, 27 Sep. 1994, K. Põldmaa, 161513 (94-62); Ida-Virumaa Co., 4 km SSW of Virunurme, Kaukvere primeval forest, 3 Sep. 1996, K. Põldmaa, 169547 (96-72); Tartumaa Co., Järvselja Forest Division, Rõkka, 1997, E. Parmasto, 166707; Tartumaa Co., Laeva Comm., Laeva forestry, south-eastern part of the forest Suur Peenar, 10 Sep. 1997, K. Põldmaa, 169844 (97-167).
A: Tartumaa Co., 1 km N of Vorbuse, 1993, K. Põldmaa, 161194.

The specimen TAA 169844 was collected as a small conidial patch, 2 cm diam, on the hymenophore of the host. While it was kept in a moist chamber in the laboratory, it grew over the whole hymenophore of two adjacent basidiomata and developed abundant perithecia with ripe ascospores. Most of the exuded ascospores had germinated while still on the papillae of the perithecia. The disarticulation of lots of mature ascospores into equal partspores was observed in some overmature specimens. All the isolates develop mature perithecia also in culture.
H. broomeanus has been found only in Germany (Arnold, 1963; Gams & van Zaayen, 1982; Helfer, 1991) and in Great Britain (Petch, 1938, 1939), exclusively on the basidiomata of *Heterobasidion annosum*. Arnold (1963) found it rather frequent in one forest near Weimar. According to our observations, it is probably not rare but rather a species easy to overlook mainly due to the usually hidden basidiomata of its host. We have found this species only in September.

*** H. chrysostomus** Berkeley & Broome, Jour. Linn. Soc. London, Bot. 14. 113. 1875.
A: *Acremonium lindtneri* (Kirschtein) Samuels & Rogerson, Mycologia 85: 248.

All on *Ganoderma applanatum* (Pers.) Pat. -

161857[1] (96-40), 169577 (96-193), 169588, 161976[1], 161992 (96-74), 169512[1], 169534[1], 169806, 169929[1], 169963 (98-77).
A: 161255 (94-37), 161431 (94-92), 161788, 161947 (96-59), 169941, 169961.

There are many reports of this species from North America, as well as from different tropical and subtropical regions. The only records of its occurrence in Europe are a few holomorphic and anamorphic collections from Yugoslavia on *Ganoderma lucidum* (Curtis: Fr.) P. Karst., and anamorphic specimens from one location near St. Petersburg (Russia) on *Ganoderma applanatum* (Arnold, 1970b,c, 1971b). According to our observations, *H. chrysostomus* is very common in Estonia, growing loosely attached to the hymenophore of *G. applanatum*. We have never recorded it on *G. lucidum*, which itself is rare in Estonia. Most of the specimens have been collected in August and September, some also in May and July. *G. applanatum* inhabits the base of dead trunks of deciduous trees, and the parasite has to be searched for almost next to the ground; this may be one reason why it has been so infrequently recorded. The overlooking of this fascinating fungus may also be due to the mycologists, studying aphyllophoralean fungi, considering the byssus formed as the result of germination of the host basidiospores. In reality, the mycelium of *H. chrysostomus* traps host basidiospores, penetrating these, and the whole subiculum is attached to the host hymenophore only in its center, being peeled away very easily. Most of the Estonian collections contain either only the anamorph, or when the perithecia are found, these are immature, as noted also by C. T. Rogerson (Parker, 1990). I failed to induce ascospore formation in a moist chamber. In the few collections with mature perithecia two types of asocospores can be found - finely ornamented, mostly one-celled, and smoooth-walled, 1-septate ascospores that are often found to disarticulate after being discharged.

***H. corticiicola** K. Põldmaa, Mycologia 91: 185. 1999.
A: *Cladobotryum* sp.

On *Phanerochaete velutina* (Fr.) P. Karst. and on surrounding bark of a fallen trunk of *Betula pendula* Roth Jõgevamaa Co., Alam-Pedja Nat. Reserve, Võivik, 5 Nov. 1996, I. Parmasto, 162565 (96-205).

This is the paratype specimen of a recently described species, comments on which can be found in Põldmaa & Samuels (1999).

H. odoratus G. Arnold, Česká Mykol. 18: 144. 1964.
A: *C. mycophilum* (Oudem.) W. Gams & Hoozem., Persoonia 6: 102. 1970.

On *Boletus bovinus* L.: Fr. (perithecia produced on *Polyporus* sp., induced in culture by G. Arnold), Hiiumaa Island, Emmaste, 18 Sep. 1967, P. Põldmaa (JE, NY).

A: *Cortinarius odorifer* Britzelm. - 32882; *Cortinarius* sp. - 169949 (98-55), 169950, 169979; *Fomes fomentarius* - 160893 (93-64), 161261, 161398 (94-83); *Fomitopsis pinicola* - 161523 (94-63); *Hyphoderma puberum* (Fr.) Wallr. - 161243 (94-32); *Inocybe* sp. - 169780 (97-35); *Megacollybia platyphylla* (Pers.: Fr.) Kotl. & Pouzar - 161242 (94-18), 169511; *Phellinus laevigatus* (Fr.) Bourdot & Galzin - 169810; *Ph. nigricans* (Fr.) P. Karst. - 161507 (94-98); *Ph. tremulae* - 161852 (96-37), 169798; *Physisporinus vitreus* (Pers.: Fr.) P. Karst. - 169801, 169803; *Rigidoporus crocatus* (Pat.) Ryvarden - 169799 (97-38); *Tricholoma album* (Schaeff.: Fr.) P. Kumm. - 169980; *Tricholoma* sp. - 169934 (98-53); *Tricholomopsis rutilans* (Schaeff.: Fr.) Singer - 32905, 160906 (93-73); on a decayed agaric - 161500 (94-72), 169990 (98-57); on a fallen rotten trunk of *Betula pubescens* Ehrh. - 153837, 163328 (94-190); on a fallen rotten trunk of *Populus tremula* L. - 167020; on a log of a deciduous tree - 169800.

In the recent monographic works on *Hypomyces, H. odoratus* has been dealt with under the agaricolous group (Rogerson and Samuels, 1994). Also other authors (e. g. Arnold, 1964) report it mainly from agarics. Among the recent collections of this species from Estonia, specimens that have grown on different aphyllophores or decaying wood are as common as those found on agarics. The majority of the specimens have been collected during August and September, a few in June and October.

The anamorph of *H. odoratus* is characterized by having mainly 1-septate conidia. However, in some collections, e. g. 169934, 169949, 2- and 3-septate conidia are also common. The teleomorph of this species has been described from culture (Arnold, 1964) being known only from isolates originating from

Germany and the one reported herein. The anamorphs described for the few teleomorphic collections from America (Rogerson and Samuels, 1994) do not correspond to the descriptions in literature and our concept of this species, and thus probably represent another still undescribed species.

* **H. orthosporus** K. Põldmaa, Mycotaxon 59: 390. 1996.
A: *Cladobotryum orthosporum* (W. Gams) K. Põldmaa, Mycotaxon 59: 390. 1996.

On *Gloeophyllum sepiarium* (Wulfen: Fr.) P. Karst. -169879 (97-30); *Inonotus leporinus* - 161459 (94-200, CBS 235.95, TYPE); *Phellinus nigricans* - 169775[1]; *Pycnoporellus fulgens* (Fr.) Donk - 161760 (95-166), 169568 (96-78)[1].

A: *Daedalea quercina* L.: Fr. - 160997 (93-79); *Fomitopsis pinicola* - 169513, 169668; *F. rosea* (Alb. & Schwein.: Fr.) P. Karst. - 161252 (94-39); *Gloeophyllum sepiarium* - 161819 (95-129), 169667; *Inonotus radiatus* (Sowerby: Fr.) P. Karst. - 161784 (95-118); *Phellinus chrysoloma* (Fr.) Donk - 161401 (94-61); *Ph. tremulae* - 161744 (95-122); *Pycnoporellus fulgens* - 169500 (96-61); *Stereum subtomentosum* Pouzar - 161779 (95-128).

The few records of this species in literature are summarized by Põldmaa & Samuels (1999). However, it is common in Estonia, from where its teleomorph was also described. *H. orthosporus* has been collected from a variety of aphyllophores, half of which belong to the family Hymenochaetaceae. Often the fungus spreads itself over the basidiomata of different host species growing nearby (Põldmaa & Samuels, 1999). The teleomorph has been found at the end of August and throughout September whereas the anamorph from the end of May until the end of September.

* **H. polyporinus** Peck, Bull. Buffalo Soc. Nat. Hist. 1: 72. 1873.
A: *Cladobotryum clavisporum* (Gray & Morgan-Jones) Rogerson & Samuels, Mycologia 85: 241. 1993.

A: On a corticioid basidiomycete growing on *Fomitopsis pinicola*, Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nat. Reserve, Umbusi-Epruraba zone, Võisiku Forest, 25 Aug. 1997, K. Põldmaa, 169787 (97-37).

H. polyporinus, although very common in North America on *Trametes versicolor*, has only a few times been recorded from Europe (Põldmaa & Samuels, 1999).

* **H. pseudopolyporinus** Samuels & Rogerson, Mycologia 85: 241. 1993.
A: *Cladobotryum arnoldii* Rogerson & Samuels, Mycologia 85: 241. 1993.

On *Mycoacia fuscoatra* (Fr.: Fr.) Donk and on dead wood of *Populus tremula* surrounding it, Jõgevamaa Co., Puurmanni Comm., Alam-Pedja Nat. Reserve, Rokka, 27 Aug. 1997, I. Parmasto - 162807, (97-40, CBS 100357).

The specimen of this species, which was previously known only from its type locality in Brazil is commented upon in Põldmaa & Samuels (1999).

* **H. rosellus** (Alb. & Schwein.: Fr.) Tul., Ann. Sci. Nat. (Bot.)., Sér. IV, Bot. 13: 12,13. 1860.
A: *C. dendroides* (Bulliard) W. Gams & Hoozemans, Persoonia 6: 103. 1970.

On *Armillaria* sp., the adjacent bark of *Betula* sp. - 169928; *Hyphoderma radula* (Fr.: Fr.) Donk - 161043 (93-159); *Phellinus nigricans* - 169776 (97-41), 169846; *Piptoporus betulinus* - 6090; *Trichaptum abietinum* - 169845; on a resupinate polypore - 40665; on wood of a fallen trunk of *Betula verrucosa* - 36682; on bark of *Betula* sp. - 169556, 169557; on a stump of *Quercus robur* L. - 43268.

A: *Armillaria* sp. - 161533 (94-53), 169920; *Collybia peronata* (Bolton: Fr.) P. Kumm. - 86844; *Fomitopsis pinicola* - 160695; *Hydnellum mirabile* (Fr.) P. Karst. - 159720; *Hydnellum* sp. - *161480 Hymenochaete rubiginosa* (Dicks.: Fr.) Lév. - 161414 (94-71); *Inocybe fastigiata* (Schaeff.) Quél. - 169554; *Inonotus leporinus* - 161458 (94-93); *I. radiatus* - 161250 (94-224); *Lactarius necator* (J.F. Gmel.: Fr.) P. Karst. - 161833 (95-162); *Onnia tomentosa* (Fr.: Fr.) P. Karst. - 161761 (95-117); *Polyporus varius* Pers.: Fr. - 161971; *Stereum rugosum* - 169910; *S. sanguinolentum* (Alb. & Schwein.: Fr.) Fr. - 169840; *S. subtomentosum* - 160831 (93-57), 161802 (95-120), 169501, 169896; on an agaric - 169915; ??169887.??

H. rosellus in a very common species in Estonia as well as worldwide. We have found it growing on basidiomata of different

aphyllophores as well as on wood, bark and agarics. The anamorph, that has been recorded from May till October, is more common than the teleomorph, which is also not rare, and is encountered from the end of August until the end of October.

*** H. semitranslucens** G. Arnold, Novit. Syst. Plant. Non-Vasc. 8: 132. 1971.
A: *Cladobotryum fungicola* (G. Arnold) Rogerson & Samuels, Mycologia 85: 241. 1993.

On *Auricularia mesenterica* - 161550 (94-95); *Fomitopsis pinicola* - 161406 (94-65[2]), 169781 (97-36[2]); *Inonotus radiatus* - 169524[1]; *Lentinus* sp. - 161843[1] (96-28); *Stereum subtomentosum* - 167099 (97-240[2]).

A: *Cantharellus tubaeformis* (Bull.: Fr.) Fr. - 169945 (98-54); *Cerrena unicolor* - 161855 (96-32); *Datronia mollis* (Sommerf.: Fr.) Donk - 160706 (93-27), 161570 (94-79), 169894; *Fomes fomentarius* - 161768 (95-126), 161867 (96-35), 161990; *Fomitopsis pinicola* - 160684 (93-14), 161745 (95-124); *Hydnellum aurantiacum* (Batsch: Fr.) P. Karst. - 128130 (98-49); *Hymenochaete tabacina* - 169669; *Hydnum repandum* L.: Fr. - 161772 (95-127); *Junghuhnia* sp. - 169537; *Leptoporus mollis* (Pers.: Fr.) Quél. - 161997; *Oligoporus caesius* (Schrad.: Fr.) Gilb.& Ryvarden - 169600 (96-83); *Peniophora nuda* (Fr.) Bres. - 161563 (94-96); *Phellinus alni* (Bondartsev) Parmasto - 161415 (94-66); *Ph. chrysoloma* - 169506; *Ph. punctatus* (P. Karst.) Pilat - 169831, 169937; *Ph. tremulae* - 161744 (95-122), 161852 (96-36), 161852 (96-37), 161860 (96-34), 161956 (96-56); *Polyporus varius* - 161585 (95-92); *Rigidoporus* sp.? - 169991; *Scytinostroma portenosum* (Berk. & Curt.) Donk - 161535 (94-74), 161925 (96-48); *Stereum rugosum* - 161418 (94-68), 169672; *S. sanguinolentum* - 161808 (95-121); *S. subtomentosum* - 161246 (94-38); *Tomentella crinalis* (Fr.) M.J. Larsen - 169597 (96-84); *Trametes hirsuta* - 169538; *T. ochracea* - 161790 (95-119); *Trichaptum abietinum* - 161807 (95-125), 161924 (96-53), 161945, 167256; *T. biforme* (Fr.) Ryvarden - 161825 (95-155); on a corticioid basidiomycete 169804; on a decaying branch of *Corylus avellana* L. - 161476 (94-208); on a decaying trunk of *Picea abies* - 170003.

H. semitranslucens, probably a cosmopolitan species, is very common in Estonia. It grows on a variety of aphyllophorous basidiomata and sometimes also on bare wood and wood-inhabiting agarics. In contrast to the morphologically very similar *H. orthosporus*, representatives of Hymenochaetaceae form less than one third of its hosts. The fungus is far more often found in its conidial form of sporulation, occurring from May till October. The teleomorph has been picked up from August till October (one collection also in May), mostly while still in an immature condition.

*** H. subiculosus** (Berk. & M.A. Curtis) v. Höhnel, Ann. Mycol. 8: 468. 1910.

A: On *Scytinostroma* sp., Järvamaa Co., Türi forestry, Pällastvere, 21 Sep. 1995, K. Põldmaa, 161791a.

There is only one published record of the occurrence of *H. subiculosus* outside the tropical and subtropical regions, where it is considered to be one of the most common species of *Hypomyces* (Rogerson & Samuels, 1993). Besides the one report of the anamorph from Germany (Helfer, 1991), we are aware of only one more anamorphic collection from Finland (K. Põldmaa, unpubl.).

In the collection from Järvamaa, scarce mycelium is effused over some parts of the host hymenophore. The conidiophores are not differentiated from vegetative hyphae and bear singly displaced conidiogenous cells or branches which are 69-76 μm long and 1-1.5 μm wide. The conidia are 1-septate, clavate with a central hilum, or elliposidal to cylindrical with a wider and laterally displaced basal hilum, suggestive of retrogressively proliferating conidiogenous cells, and measure 10.4-19.5 x 4.0-6.5 μm, M = 15.0 x 5.2 μm (n=30). All these features permit the identification of this specimen as *H. subiculosus*, even though it was not possible to study it in culture.

*** H. sympodiophorus** Rogerson & Samuels, Mycologia 85: 241. 1993.
A: *Cladobotryum uniseptatum* (Castañeda) K. Põldmaa, Mycologia 91: 193. 1999.

A: on *Stereum sanguinolentum* - 169982 (98-65); on *S. subtomentosum* - 161955 (96-58), 167271, 169535 (96-71), 169898 (97-122), 169908 (97-126), 169982 (98-65).

H. sympodiophorus was known from a few collections from the U. S. A. and one specimens

from France (Põldmaa & Samuels, 1999). In all these collections the host is a species of *Stereum*. The deviations of the cultural characters of the Estonian strains have been described by Põldmaa & Samuels (1999).

* **H. viridigriseus** K. Põldmaa & Samuels, Sydowia 49: 88. 1997.
A: *Cladobotryum viridigriseum* (G. Arnold, Illman & G. P. White) K. Põldmaa & Samuels, Sydowia 49: 89. 1997.

A: On *Fomitopsis pinicola*, Viljandimaa Co., Kolga-Jaani Comm., Võisiku Forest, 26 Aug. 1997, K. Põldmaa, 169776 (97-34); same collecting data, on *Phellinus nigricans*, 169782.

The species was previously known with a few collections from Canada and U. S. A. (Põldmaa et al., 1997). The records from Estonia indicate that it may be an overlooked species, expected to be found also in other parts of at least the temperate region.

Hypomyces sp.

A.: *Cladobotryum* sp.
Fig. 1

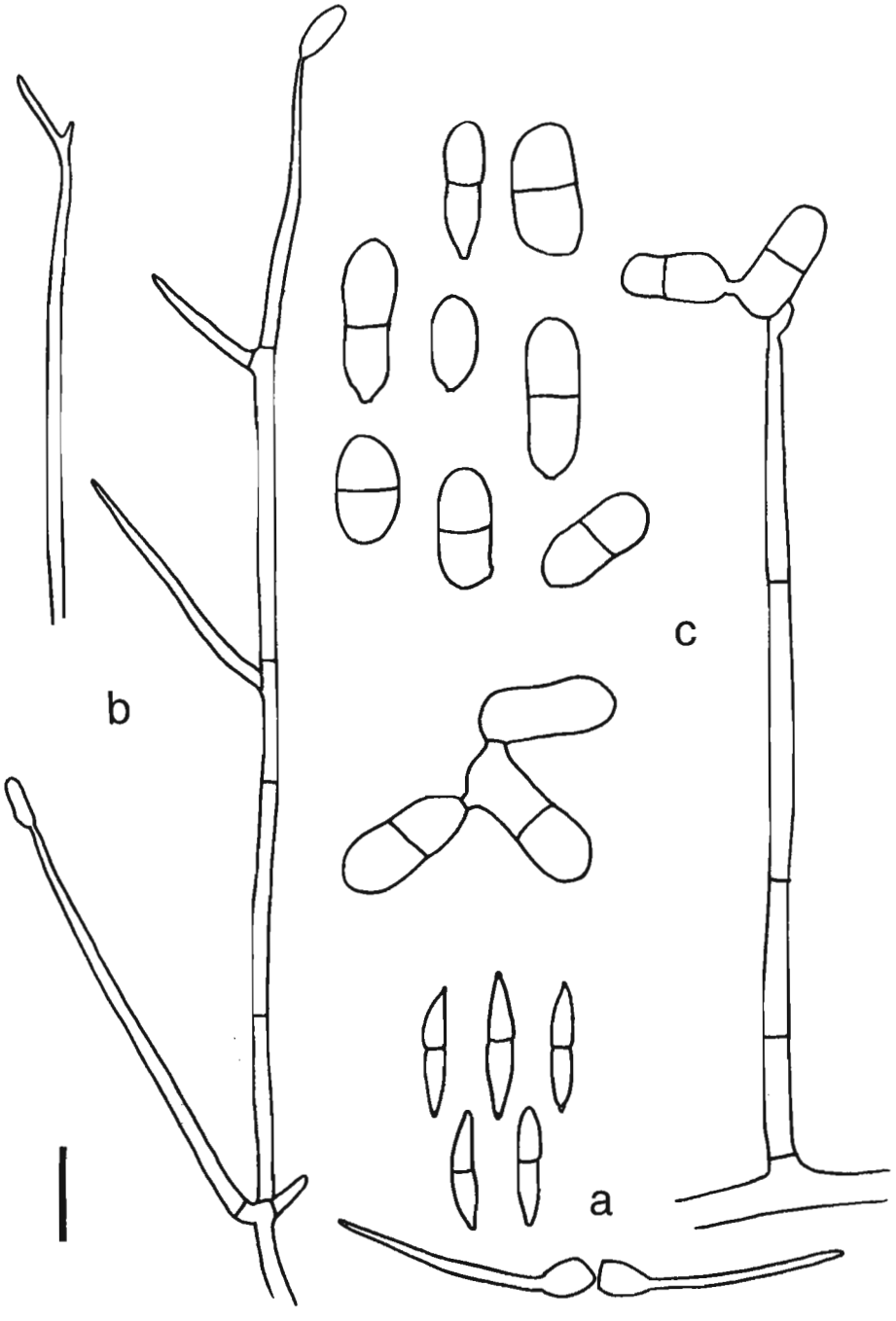
On the bark of a decaying trunk of a deciduous tree, next to the hymenophore of a cyphellaceous basidiomycete, Tartumaa Co., Laeva Comm., Alam-Pedja Nature Reserve, Tõllassaare zone, 28 Aug. 1997, K. Põldmaa, 169800 (97-39).

Subiculum white, effused, subicular hyphae slightly swollen, 4-7 μm in diam. Perithecia semiimmersed on the subiculum, amber to pale yellowish, KOH-, 250-320 x 160-230 μm; papilla conical, 70-100 μm high. Asci cylindrical, 96-120 x 4-5.5 μm; ascospores uniseriate, with ends overlapping. Ascospores fusiform, 13.1-18.3 x 2.3-3.8 μm, M = 15.7 x 3.1 μm (n=80), hyaline, 1-septate, septum median, smooth-walled, with small apiculi, 1-1.5(-2) μm long. Many ascospores have germinated and some have also disarticulated into part-spores.

Characteristics in culture. Colonies spreading comparatively slowly, reaching 10-15 mm diam in 7 d; cottony, margin even; pure white, reverse not coloured or turning pale creamish yellow. Conidiation abundant. Odour absent. Aerial mycelium becoming compacted; hyphae 2.5-3.5 μm diam, hyaline, smooth-walled. Conidiophores arising from aerial or submerged mycelium, not differentiated from aerial hyphae, ascending, 2.5-3.0 μm wide, irregularly branched. Conidiogenous cells or branches borne singly on conidiophores, 32-83 μm long, attenuated from 2-3 μm at the base to 1 μm at the tip; with a terminal or sometimes also two additional intercalary conidiogenous loci, producing up to 100 conidia from the topmost but only a few from the intercalary loci. Conidia 11.1-18.9 x 5.2-7.4 μm, M = 15.0 x 6.3 (n=30), straight, those formed first clavate and longer, with a central basal hilum, the successive ones becoming more ellipsoidal or cylindrical and broader, with a centrally displaced hilum; 1(-2)-septate, hyaline; held in long imbricate chains. Some ot the topmost conidia have germinated producing "secondary conidia" on short branches while still attached in the chain. Chlamydospores not observed.

Notes. The anamorph of the present species is almost identical to the anamorph of *Hypomyces subiculosus*. The only differences are the lack of chlamydospores and the formation of one or two intercalary loci on the conidiogenous cell. However, I have observed this also in some ascosporic isolates of *H. subiculosus*. The subiculum and perithecia, on the other hand, lack the yellow to orange colour and subsequent reaction with KOH, characteristic of *H. subiculosus*. Our collection could be considered as an albinotic form of *H. subiculosus*, particularly as such have been observed in several other species of *Hypomyces* (Arnold, 1989). This idea is challenged by differences in ascospores that are much wider, with their wall prominently verrucose in *H. subiculosus*. The ascospores resemble those of *H. sibirinae* and *H. sympodiophorus* which both differ from the present collection in other teleomorphic characters. The anamorph also resembles *Cladobotryum compactum* K. Põldmaa and *Pseudohansfordia irregularis* G. Arnold that are characterized by forming conidiogenous cells in verticils, and also by the 1-3-septate conidia in the latter species.

Due to our inability to differentiate between the anamorph of the described collection and that of *H. subiculosus*, and the availability of only one specimen, we prefer not to describe it as a new species here.



Figs. 1. *Hypomyces* sp. 169880. a. ascospores, a germinated ascospore below. b. the upper part of a conidiophore with conidiogenous cells, on the left a conidiogenous cell with an apparently additional locus on a denticle; c. a conidiogenous branch with conidia; from MEA. Scale bar: a,c = 10 μm; b = 15 μm.

Species for which no teleomorph is known.

*** Cladobotryum compactum** K. Põldmaa, Mycotaxon 59: 393. 1996.

On *Steccherinum ochraceum*, Tartumaa Co., Lääniste, 28 Aug 1994, K. Põldmaa, 161231 (94-66).

This conidial fungus shows great similarities to the anamorph of *H. subiculosus*. Both form white colonies with low texture and an irregular margin on MEA. In *H. subiculosus* perithecial production is preceded by the aerial mycelium becoming compacted and turning orange. This was not observed in *C. compactum*, but pigmentation of colonies was observed when the strain was opposed with a monosporic strain of *H. subiculosus* (G.J.S. 83-288), although the dual cultures did not reach perithecial formation.

The retrogressively proliferating conidiogenous cells that produce lots of conidia that are held in long imbricate chains, as well as the morphology of the conidia are very similar to *H. subiculosus* and to some anamorphic species (Põldmaa, 1996). The only difference observed in *C. compactum* compared to *H. subiculosus* is in the production of more than three conidiogenous cells from one point, thus forming verticils. Whether *C. compactum* is conspecific with *H. subiculosus*, or one of the several anamorphic species with similar conidiogenesis, has yet to be proved by new collections or by the use of methods other than morphological.

*** C. croceum** K. Põldmaa, Mycotaxon 59: 396. 1996.

On *Stereum rugosum*, Pärnumaa Co., Parasmaa, 25 Sep 1994, K. Põldmaa, 161418 (94-67).

*** C. dimorphicum** K. Põldmaa, Mycotaxon 59: 398. 1996.

Both on *Thelephora terrestris* Pers.: Fr., Pärnumaa Co., Palivere, 24 Sep 1994, K. Põldmaa, 161405 (94-76); Tartumaa Co., Võnnu, Terikeste., 18 Aug 1996, V. Kastanje, 161972 (96-70).

Unlike the abundant material in the type collection, in TAA 161972 there is only very scarce mycelium bearing the conidial apparatus on the base of the host fruitbodies. The colony as well as the morphological characters observed in culture correspond to those described for the type material.

C. gracile K. Põldmaa, sp. nov.

Fig. 2, 3, 4

Coloniae in agaro maltoso ad 40-50 mm diam. post 7 dies; lanosae, albae, reverso flavo. Hyphae aeriae hyalinae. Conidiophora adscendentia, 2.5-3 μm lata, verticillatim ramosa. Cellulae conidiogenae in ultimo verticillo ad 12, subulatae, 19-34 μm longae, prope basin 1.5 μm latae; ex uno loco ad tria conidia producentia. Conidia ellipsoidea vel fusiformia, recta, 7.2-16.5 x 2.1-3.9 μm, 0(-1)-septata, hyalina. Chlamydosporae adsunt. Teleomorphosis ignoto.

Holotypus. Ad basidiomata *Scytinostroma* sp., Estonia, K. Põldmaa (TAA).

Characteristics in culture. Colonies spreading moderately fast, reaching 40-50 mm diam in 7 d; cottony, margin even; whitish, reverse not coloured or turning bright sulphur yellow. Conidiation moderate. Odor absent. Aerial mycelium sparse, loose; hyphae hyaline, smooth-walled. Conidiophores arising from aerial hyphae, not differentiated from these, ascending, 2.5-3.0 μm wide, verticillately branched. Conidiogenous cells borne on conidiophores or on lateral branches, that are up to 15 μm long, by 4-12 in a verticil; subulate, 19-34 μm long, attenuated from 1.5 μm at the base to 0.5 μm at the tip; with a terminal conidiogenous locus that produces 1-2(-3) conidia. Conidia ellipsoidal to fusiform, straight, abruptly attenuated at base, often also at tip, 7.2-16.5 x 2.1-3.9 μm, M = 11.9 x 3.0 μm (n=60), 0(-1)-septate, hyaline, with a protuberant centrally displaced inconspicuous basal hilum; held singly or by few in imbricate position. Chlamydospores not observed.

Holotype. ESTONIA. Järvamaa Co.: Türi forestry, Pällastvere, on *Scytinostroma* sp., 21 Sep. 1995, K. Põldmaa, 161791, 95-170, preserved as a dried culture.

Notes. The species differs from *Cladobotryum* anamorphs of *Hypomyces* as well as from anamorphic *Cladobotryum* species by the very delicate structures of the conidial apparatus. It resembles *Cladobotryum obconicum* W. Gams & Schroers (Gams et al., 1998) that differs from *C. gracile* in having wider

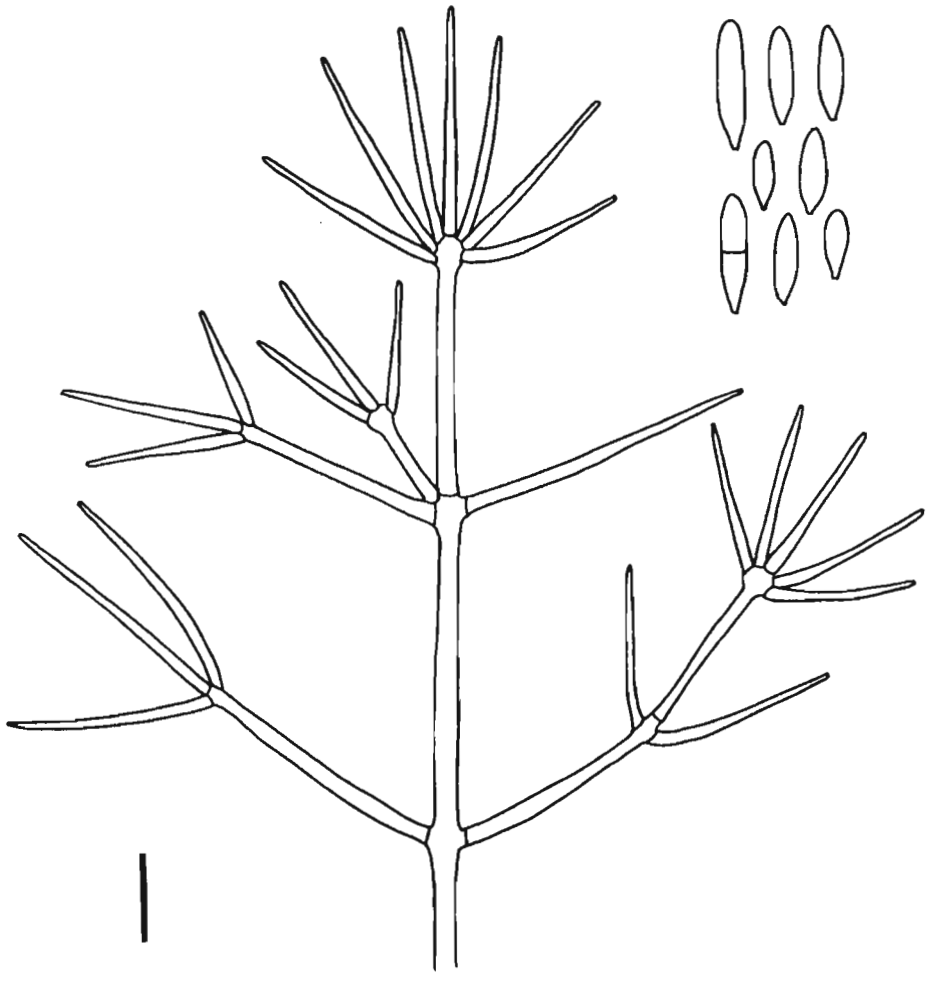


Fig. 2. *Cladobotryum gracile*, TAA 161791b. The upper part of a conidiophore with conidiogenous cells, conidia; from MEA. Scale bar = 10 μm.

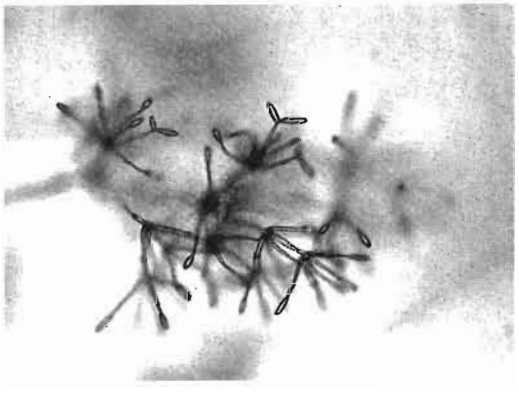


Fig. 3. *Cladobotryum gracile,* TAA 161791b. Conidiophores with conidiogenous cells and conidia; from MEA.

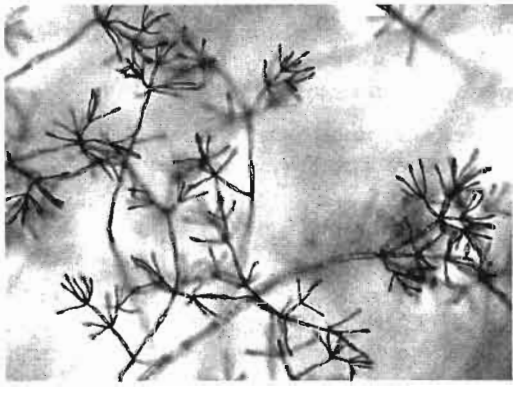


Fig. 4. *Cladobotryum gracile*, TAA 161791b. Top of a conidiophore with conidiogenous cells and conidia held singly or in pairs in imbricate position; from MEA.

and shorter conidiogenous cells, exceptionally aseptate conidia and in producing chlamydospores. *C. gracile* is reminiscent also of species of *Verticillium*, e.g. *V. psalliotae* and the conidial synanamorphs of *Mycogone*, e.g. *M. calospora* (Gams, 1983). However, *C. gracile* is shown to be closely related to aphyllophoricolous species of *Hypomyces* according to the analyses of 28S rDNA sequences (Põldmaa et al., 2000). It forms a strongly supported clade with *H. aurantius*. These two species resemble each other mainly in producing a bright yellow pigment in the agar medium. Unfortunately, there is no material of this fungus left on the natural host and therefore a dried culture was designated as the holotype.

***C. stereicola** (G. Arnold) Rogerson & Samuels, Mycologia 85: 241. 1993.

A: On *Chondrostereum purpureum* (Pers.: Fr.) Pouzar - 161922 (96-55), 161811 (95-146), 161816 (95-147), 161950 (96-57), 169593 (96-82), 169655, 169656 (97-2); on *Stereum hirsutum* (Willd.: Fr.) Gray - 161842; *S. rugosum* ? - 169966 (98-81); *Stereum* sp. - 169957 (98-80).

These collections helped to solve the taxonomic confusion that has accompamied the species since it was described (Põldmaa & Samuels,1999). *Cladobotryum stereicola* has been reported only a few times from Germany and once from Poland (Arnold, pers. comm.), the Netherlands (Gams & Hoozemans, 1970) and near St. Petersburg in Russia (Arnold, 1971a). My observations in Estonia suggest that it is not a rare but rather an overlooked species that favours *Chondrostereum purpureum* as its host.

Species from allied genera.

***Arachnocrea stipata** (Fuckel) Moravec, Bull. Soc. Mycol. Fr. 72: 162. 1956.

A: *Verticillium*-like
Fig. 5, 6

On a fallen trunk of *Picea abies*, Pärnumaa Co., Saarde, Viisireiu, 19 Oct. 1996, leg. U. Kõljalg, 159558; on mycelial ropes of a basidiomycete, Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nature Reserve, Umbusi-Epruraba zone, 25 Aug. 1997, leg. U. Kõljalg & K. Põldmaa, 159677 (97-43).

The genus, containing two species, differs from *Hypomyces* mainly due to its disarticulating ascospores. We observed small apiculi (1-2 μm) in both collections. These have probably been overlooked by earlier authors (e.g. Arnold, 1985; Doi, 1972; Moravec, 1956). *Arachnocrea stipata* grows mainly on wood or bark of decaying logs, some collections have been reported also from polypores. In 159677 mycelial ropes of an unidentified basidiomycete are seen in close proximity to the subiculum of *A. papyracea*. In the case where there is no hint of a fungal host we still can not rule out the possibility that the fungus may obtain nutrients from hyphae inside the wood. The species is known from North America and several countries in Europe.

Besides one culture, isolated by Walter Gams from mass of ascospores (CBS 356.80), it has not been possible to germinate the ascospores of *A. stipata* despite attempts with several collections (Arnold, pers. comm.) and its anamorph has not been described. While observing the ascospores from 159677 on MEA their very slow germination was noticed. The cultures inoculated from mass of ascospores, on the other hand, grow moderately fast, reaching 10-20 mm diam in a week. The colonies are cottony, white, reverse not coloured; the margin is even or irregular in some parts. Conidiation is good. There is no odour. Conidiophores arise from aerial hyphae, not differentiated from these, ascending, 2.5-5.5 μm wide, verticillately branched. Conidiogenous cells are borne on conidiophores but mostly on lateral branches that are 11-75 μm long and 2-3 μm wide, arising

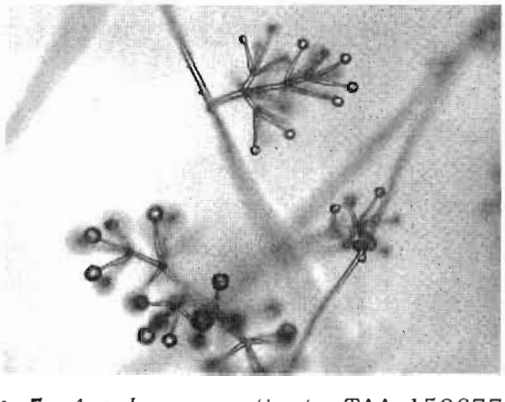


Fig. 5. *Arachnocrea stipata*, TAA 159677. Intercalary parts of conidiophores with conidiogenous cells and conidia in drops of liquid; from MEA.

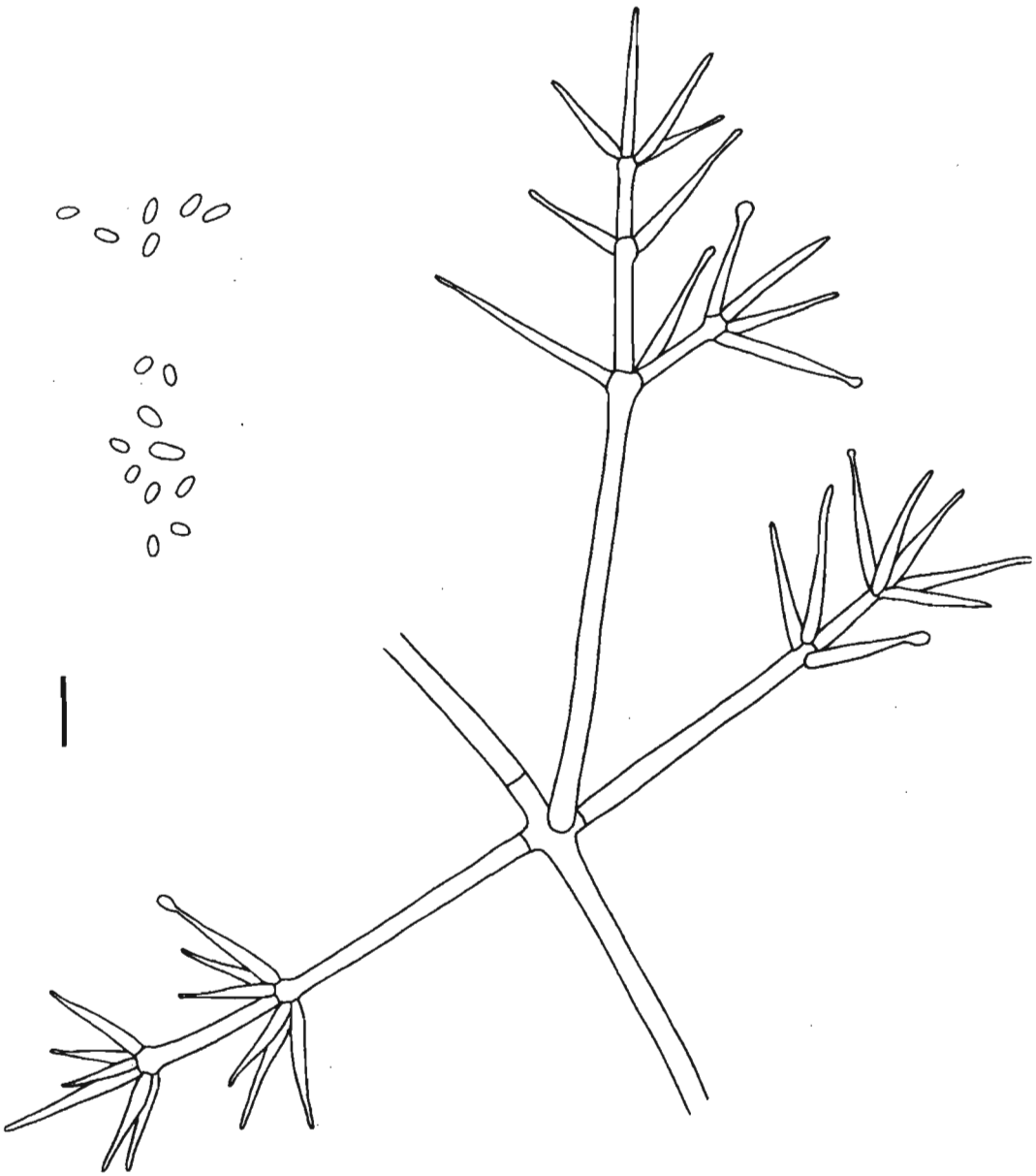


Fig. 6. *Arachnocrea stipata*, TAA 159677. An intercalary part of the conidiophore with conidiogenous cells, conidia; from MEA. Scale bar = 10 μm.

at right angles, usually in opposite position or seldom three or four formed from one point on the conidiophore, simple or giving additional side branches. Conidiogenous cells are placed by 3-8 in a verticil; subulate, 13-26 μm long, attenuated from 1.5-2.5 μm at the base to 1 μm at the tip; with a terminal conidiogenous locus that produces several conidia. Conidia ellipsoidal, straight, some slightly attenuated at base, top rounded, 2.9-5.0 x 1.3-2.4 μm, M = 3.9 x 1.8 μm (n=60), aseptate, hyaline, without a basal hilum; held in slimy heads. Chlamydospores not observed.

The isolate described above agrees well with that observed in CBS 356.80 (W. Gams, pers. comm.). The anamorph shows similarities to the

species of *Trichoderma* in the repeatedly verticillate branching of the condiophores and the branches arising mostly at right angles. Regarding the verticillately displaced conidiogenous cells it reminds species of *Verticillium* and the anamorph of *Protocrea delicatula* (Tul.) Petch that has been described to be of the *Verticillium*-type (Doi, 1972).

***Hypocrea pallida** Ellis & Everhart, Journ. Myc. 2: 65. 1886.
A: *Gliocladium* sp.

On *Oligoporus caesius* (?), Pärnumaa Co., Nigula Nat. Reserve, 17 Sep. 1996, 169600 (96-85); on *Trametes* sp., Võrumaa Co., Paganamaa, 2 Oct. 1997, K. Põldmaa, 169906 (97-168); Võrumaa Co., Paganamaa, 2 Oct. 1997, K. Põldmaa, 169917 (97-135²).

A: *Oligoporus* sp. - 169075 (97-129); on *Trametes ochracea* - 170006; on a polypore - 169985 (98-67), 169977 (98-70), 169998.

Despite possessing a *Gliocladium* anamorph that is almost identical to the anamorph of *S. aureonitens*, the taxonomic position of *Hypocrea pallida* is yet unknown. However, it has been shown to be more closely related to the species of *Hypomyces* and *Sphaerostilbella* than to other species of *Hypocrea* (Põldmaa et al., 2000; Rehner & Samuels, 1995; Spatafora & Blackwell, 1993).

H. pallida has been collected from Europe (Denmark, Germany), Canada, U. S. A., Guiana, Gabon, Japan and New Zealand. Doi & Yamatoya (1989) have reported the formation of perithecia in some ascosporic isolates but generally the species is not known to produce perithecia in culture (Samuels, pers. comm.). I obtained mature perithecia in a culture that was inoculated from conidia (97-135) on MEA although there was no perithecial formation observed on the host.

Sphaerostilbella

The genus is characterized by producing yellow to orange perithecia on a concolorous, thin, effused subiculum that is formed on wood-decaying aphyllophores (Seifert, 1985). It differs from *Hypomyces* in having comparatively small, naviculate to ellipsoidal non-apiculate ascospores with an echinulate wall, and *Gliocladium* anamorphs. Both species treated below have originally been described as belonging to *Hypomyces*, and have only recently been considered to be congeneric with *S. lutea*, the type species of the previously monotypic *Sphaerostilbella*. Analyses of ribosomal genes have revealed the close relationship of the species of *Sphaerostilbella* to *Hypomyces* (Rehner & Samuels, 1995; Spatafora & Blackwell, 1993).

***S. aureonitens** (Tul.) Seifert, Samuels & W. Gams, Stud. Mycol. 27: 145. 1985.
A: *Gliocladium penicilloides* Corda, Ic. Fung. 4: 31. 1840.

On *Stereum hirsutum* - Tartumaa Co., Laeva Comm., Alam-Pedja Nat. Reserve, Tõllassaare zone, Laeva Forestry, sq. 219, 28 Aug. 1997, E. Parmasto, 169817; on *Stereum subtomentosum* - Tartumaa Co., Võnnu, Terikeste., 26 Aug 1996, K. Põldmaa, 169515 (96-77); Tartumaa Co., Laeva Comm., Alam-Pedja Nat. Reserve, Tõllassaare zone, 15 Sep. 1997, E. Parmasto, 167271 (97-144); Võrumaa Co., Paganamaa, 2 Oct. 1997, K. Põldmaa, 169897.

A: On *S. hirsutum* - 169912; on *S. rugosum* - 169885; on *S. sanguinolentum* - 161419 (94-88); *S. subtomentosum* - 161265, 169899, 169909, 169994.

S. aureonitens, probably a cosmopolitan species, is rather common in Estonia, especially in its conidial stage. It grows mostly on the basidiomata of *Stereum* species and has been collected from the end of August till beginning of October. Although being reported from several European countries (Arnold, 1970b, Samuels, 1976), *S. aureonitens*, especially its teleomorph, is only rarely mentioned in the local lists that usually contain the well-known species of *Hypomyces*.

S. berkeleyana (Plowr. & Cooke) Samuels & Candoussau, Mycologist 9: 12. 1995.

A (associated): *Gliocladium* sp.
Fig. 7

On *Stereum hirsutum* - Jõgevamaa Co., Alam-Pedja Nat. Reserve, Nõmmeotsa, 24 Oct. 1998, K. Põldmaa, 169996; Tartumaa Co., Alam-Pedja Nat. Reserve, Võiviku Bog Island, 24 Oct. 1998, K. Põldmaa, 170004; on *Stereum* sp., Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nat. Reserve, Umbusi-Epruraba zone, 25

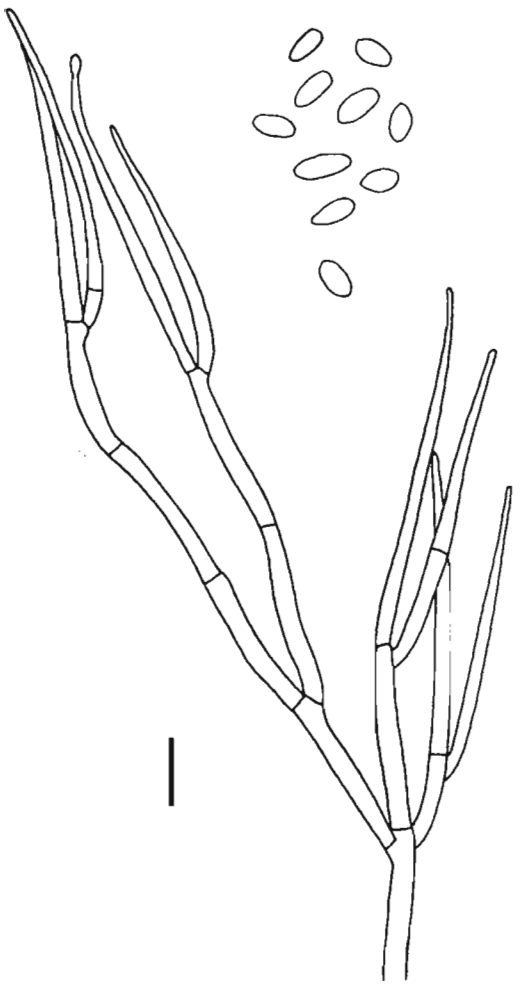


Fig. 7. *Sphaerostilbella berkeleyana*, TAA 169786. The upper part of a conidiophore with conidiogenous cells, conidia. Scale bar = 10 μm.

Aug. 1997, K. Põldmaa, 169786 (97-47);

A: On *Stereum hirsutum* - 169838, 169901 (97-134), 169902; Jõgevamaa Co., Alam-Pedja Nat. Reserve, Võiviku Bog Island, 24 Oct. 1998, K. Põldmaa, 170005; on *Stereum subtomentosum* - 169670; Tartumaa Co., Võnnu, Terikeste, 26 Aug. 1996; 169900.

S. berkeleyana is known from Europe (Denmark, Germany, Great Britain, Russia), Asia (Russia) and New Zealand growing on basidiomata of *Stereum* species. It has been considered to be an uncommon species (Candoussau and Magni, 1995). We have found the teleomorph only twice but presume that the anamorph may be more common though overlooked because of the confusion with its name and the description. *Acremonium berkeleyanum* (Karsten) W. Gams (= *Verticillium berkeleyanum* Karsten) is the anamorph of *Nectria vilior* Starb., not of *S. berkeleyana* (Gams, 1997) as considered by Arnold (1970b), who also briefly described the anamorph in culture. An anamorph, similar both to *Gliocladium* and *Verticillium* species was found growing next to the perithecia in the teleomorphic collections as well as in the reported conidial collections. The colonies of 97-47 grow slowly, reaching 7-10 mm diam in 7 d, salmon. Conidiophores are penicillately branched in the upper part. Conidiogenous cells are borne by 2-4, 40-80 μm long and 2.7-3.5 μm wide at the base. Conidia are ellipsoidal, hyaline, 5.3-8.0 x 2.5-3.8 μm, M = 6.6 x 3.1 (n=30), one-celled. I was not able to germinate the ascospores and therefore cannot confirm the conspecifity of these anamorphs with *S. berkeleyana*, that though seems very likely.

DISCUSSION

The data reported in the present paper considerably increase the number of species of *Hypomyces* and related fungicolous genera known to occur in Estonia. This broadens our knowledge of the geographic distribution of several species either on the European or also on the world scale. Finding *H. polyporinus*, *H. sympodiophorus* and *H. viridigriseus* (though only as anamorphs) in Estonia confirms that their distribution is not restricted to North America as might have been assumed. Estonian records of the anamorph of *H. pseudopolyporinus* and *H. subiculosus* show that these species, previously known only or mainly from tropical and subtropical regions, are present also in the temperate zone. The seeming rarity of some species owing to the scarcity of records in literature may be misleading too. *Hypomyces broomeanus* and *H. chrysostomus* are host-specific species for both of which only limited localities in Europe are known. Our

observations show that their real frequency, though, can be estimated by purpose-directed search of the host basidiomata.

Although this paper is not dealing with the taxonomic problems of the species considered, the problem of distinguishing between morphologically very similar species could not been avoided. *Cladobotryum compactum* and *Hypomyces* sp. were found to possess anamorphs almost identical to that of *H. subiculosus*, known as a common species in tropical and subtropical regions. It remains unclear whether all these three anamorphic specimens are conspecific or represent closely related sibling species of *H. subiculosus*. The great similarities may be also caused by convergent evolution of the anamorphs, a phenomenon common among pleomorphic fungi. In a group of aphyllophoricolous *Hypomyces* species the diagnostic value of teleomorphic characters has been shown to be limited with characteristic anamorphs appearing to be more informative for species recognition (Põldmaa & Samuels, 1999). However, the present example adds evidence for the opposite case, reported for a couple of species also in the previous paper.

One of the aims of the paper was to find phenological differences among the species dealt with. We did not carry out special field observations or experiments but only collected and compared the dates on the labels of the specimens. The only resulting conclusion is the strong dependence of the recording of considered species on the active field work periods of mycologist in Estonia (mainly from the end of August till the end of October). The occurrence is also dependent of the formation of basidiomata of the host. It seems safe to say that species growing on tough perennial basidiomata of polypores and sometimes also on wood or bark of decaying trees, could be found almost throughout the year. Species of *Hypomyces* occurring on the soft ephemeral basidiomata of agarics are found mostly in August and September when the formation of host basidiomata is most abundant.

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Lichens from Qeqertarsuaq/Godhavn, Disko, Central West Greenland

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Abstract: A total of 219 taxa of lichens are reported from Qeqertarsuaq on Disko in Central West Greenland. Their substrate preferences are shortly stated, and an account of some lichen communities of particular interest is provided. 42 species of lichens are new to the Qeqertarsuaq area. 36 species of lichens are new to Disko.

Kokkuvõte: E. S. Hansen. Qeqertarsuaq/Godhavni, Disko (Lääne-Gröönimaa keskosa) samblikud.

Lääne-Gröönimaa keskosast, Qeqertarsuaq/Godhavnist on teada 219 samblikuliiki . Liikide tähestikulises nimekirjas märgitakse ära substraat, millel liik kasvab, samuti osade liikide esinemissagedus antud piirkonnas. Iseloomustatakse ka suuremat huvi pakkuvaid samblikukooslusi. 42 liiki on esmasleiud Qeqertarsuaqi ja 36 liiki Disko piirkonnale.

INTRODUCTION

The most important lichen collections from Disko in the nineteenth century were made by Th. M. Fries (Lynge, 1937). The foundation of the Arctic Station at Godhavn in 1906 by M. Porsild strongly promoted the research on the nature of Disko, and numerous scientists and students have used the station as base for their studies in the present century. Porsild himself worked primarily on animals and higher plants, but he was also interested in lichens. In fact he prepared an (unpublished) key to common Greenland lichens. K. Hansen (1962) collected many macrolichens around Godhavn, and Böcher (1963) also reports on some lichens from this area. However, P. Gelting has brought home the most extensive lichen collections from Godhavn in his capacity of scientific leader of the Arctic Station from 1946 to 1954. Gelting himself published only a small part of these collections (Gelting, 1954, 1955, 1956) However, many of them have been cited and mapped by Breuss & E. S. Hansen (1988), E. S. Hansen (1983, 1984, 1986), E. S. Hansen, Poelt & Søchting (1987), Moberg & E. S. Hansen (1986) and Thomsen (1984, 1997). Additional revisions of Gelting's extensive lichen collections doublessly will result in many new reports. Gelting's paper on a West Greenland *Dryas integrifolia* community rich in lichens (Gelting, 1955) deals with a very thorough investigation of this interesting Greenland plant community. V. Alstrup has published notes on selected lichens from the Godhavn area (Alstrup, 1981, 1986), and together with D. L. Hawksworth he published many lichenicolous fungi from Godhavn (Alstrup & Hawksworth, 1990). From 22 July to 12 August 1996, the author carried out studies of the lichen flora of the surroundings of the town. The present paper deals with the lichen material collected in connection with these studies.

Qeqertarsuaq/Godhavn (69°15´N, 53°22´W) is located in an area dominated by Archaean gneisses at the south coast of Disko (Fig. 1). The mountains, Lyngmarksfjeld and Skarvefjeld, which are both composed of Tertiary basalts (Escher & Stuart Watt, 1976), rise to altitudes of about 1.000 m north and north east of the town. A north-south valley, Blæsedalen with the river Røde Elv, separates the two mountains. Strongly weathered and very sculptural rocks composed of basalt breccia represent a conspicuous feature of the area near the entrance of Røde Elv. Homotermic springs with a luxuriant vegetation of higher plants and mosses occur in the area near the Arctic Station.

The Godhavn area has a low arctic and oceanic climate. According to measurements made by Asiaq/Grønlands Forundersøgelser the mean temperature of the warmest month, July, is 7°C, whereas the mean temperature of the coldest month, March, is -15°C. The mean annual precipitation is 377 mm (1993-1997). Storms and fog occur frequently in the summer. Foehn winds are a characteristic winter feature. The

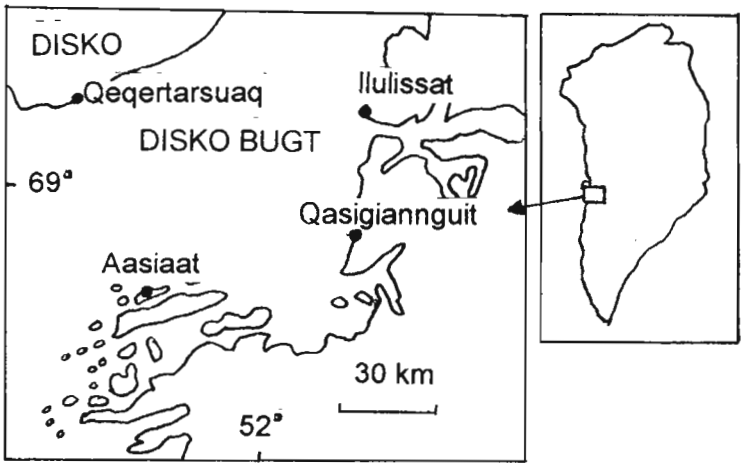

Fig. 1. Location of study area in Central West Greenland. The small map to the right shows the situation of the study area in Greenland.

sea is covered by ice from December until June.

The following plant communities at Qeqertarsuaq are more or less rich in lichens: dwarf shrub heaths dominated by *Betula nana, Cassiope tetragona, Dryas integrifolia, Ledum decumbens, Empetrum hermaphroditum* and *Vaccinium uliginosum;* snowbeds dominated by *Salix herbacea* or *Sibbaldia procumbens;* fell-fields; ornithocoprophilous lichen communities on gneiss, basalt or rocks composed of basalt breccia and epilithic lichen communities without visible influence of guano.

MATERIAL AND METHODS

Lichens were collected at about 100 sample plots situated in the gneissic area around Qeqertarsuaq, on the basal part of Lyngmarksfjeld, in Blæsedal and in the basalt breccia area east of the Arctic Station. The collected material, a total of 426 lichen specimens, was studied with Zeiss light microscopes. Standard TLC methods were used for identification of some specimens of *Cladonia, Lepraria, Leprocaulon, Leproloma* and *Stereocaulon.* The material is deposited at the Botanical Museum, University of Copenhagen (C). A study and reference collection of lichens established at the Arctic Station in 1974 by the author was increased and supplemented with new material.

RESULTS AND DISCUSSION

About 300 lichens have previously been reported from the Godhavn area. More than half of them have been found by the author in connection with the present investigation. They are indicated by the relevant references in the annotated list of lichens. Among the remaining lichens several taxa are of particular interest. These taxa, most of which are very rare in Greenland, are listed together with the references in the following:

Arctomia interfixa (Nyl.) Vain. (E.S. Hansen, 1983).
Aspicilia verrucigera Hue (E.S. Hansen, 1986).
Buellia immersa Lynge (Lynge, 1937).
Caloplaca approximata (Lynge) H. Magn. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca arenaria (Pers.) Müll. Arg. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca borealis (Vain.) Poelt (E. S. Hansen, Poelt & Søchting, 1987).

Caloplaca celata Th. Fr. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca citrina (Hoffm.) Th. Fr. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca diphyodes (Nyl.) Jatta (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca epiphyta Lynge (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca exsecuta (Nyl.) Dalla Torre & Sarnth. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca fulvolutea (Nyl.) Jatta (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca jemtlandica H. Magn. var. *cerinospora* E. S. Hansen, Poelt & Søchting (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca leptocheila H. Magn. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca lithophila H. Magn. var. *elaeophora* E. S. Hansen, Poelt & Søchting (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca phaeocarpella (Nyl.) Zahlbr. (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca psoricida E. S. Hansen, Poelt & Søchting (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca soropelta (E. S. Hansen, Poelt & Søchting) Søchting (E. S. Hansen, Poelt & Søchting, 1987).
Caloplaca trachyphylla (Tuck.) Zahlbr. (E. S. Hansen, Poelt & Søchting, 1987).
Gyalecta jenensis (Batsch) Zahlbr. (E. S. Hansen, Poelt & Vezda, 1987).
Gyalecta peziza (Mont.) Anzi (E. S. Hansen, Poelt & Vezda, 1987).
Lecanora maxima Lynge (Lynge, 1937).
Lecidea convallium Lynge (Lynge, 1937).
Lecidea rufofusca (Anzi) Nyl. (Lynge, 1937).
Lecidea tecta Lynge (Lynge, 1937).
Parmeliella oblongata Lynge (Lynge, 1937).
Rhizocarpon arctogenum Gelting (Gelting, 1954).
Rhizocarpon occidentalis Lynge (Lynge, 1937).
Rinodina mucronatula H. Magn. (E.S. Hansen, 1986).
Sarcogyne rugosa Lynge (Lynge, 1937).
Thelidium pyrenophorum (Ach.) Mudd (Lynge, 1937).

Lichen vegetation

The terricolous lichen vegetation at Qeqertarsuaq is generally extremely well-developed. Different types of mixed dwarf shrub and lichen heaths are of great importance. *Empetrum*, *Salix herbacea* and *Vaccinium uliginosum* are the dominant dwarf shrubs in the heaths in the gneissic area just south of the town. The heaths are usually covered by an up to 1 m thick layer of snow during winter and are characterized by lichen species such as *Arctocetraria andrejevii*, *Cetrariella delisei*, *Cladonia bellidiflora*, *C. cyanipes*, *C. macrophylla*, *C. mitis*, *C. pleurota*, *C. squamosa*, *C. stygia*, *C. sulphurina*, *Flavocetraria nivalis* and *Trapeliopsis granulosa*. The two first-mentioned lichens cover areas of several square metres near the coast! Some distance away from the coastline *Betula nana* and *Ledum decumbens* form very luxuriant heath patches together with *Empetrum* and *Vaccinium*. A mixed dwarf shrub heath of this type near Røde Elv contains the following lichens: *Cladonia mitis*, *C. stygia*, *Dactylina arctica*, *Flavocetraria nivalis*, *Nephroma expallidum* and *Stereocaulon alpinum*. *Dactylina ramulosa* was found growing in a *Cassiope* heath. Heaths exposed to strong winds appear to be rich in fell-field lichens such as *Alectoria ochroleuca*, *A. nigricans*, *Bryoria chalybeiformis*, *Cladonia amaurocraea*, *Flavocetraria nivalis* and *Sphaerophorus globosus* (E. S. Hansen, 1997). A S-facing *Dryas integrifolia-Carex rupestris* heath on soil and gravel originating from basalt breccia near the entrance of Røde Elv is characterized by lichens with preference for neutral and slightly alkaline soil in Greenland, for example, *Catapyrenium lachneum*, *Cladonia pocillum*, *Peltigera rufescens*, *P. venosa*, *Psora decipiens*, *P. rubiformis*, *Solorina bispora*, *S. octospora* and *Toninia sedifolia* (E. S. Hansen, 1991). *Arthrorhaphis alpina*, *Candelariella placodizans* and *Ochrolechia upsaliensis* are among the first lichens to colonize the soil in this community. Snowbeds dominated by *Salix herbacea* or *Sibbaldia procumbens* are primarily characterized by lichens, which occur most frequently in the near-shore areas of Greenland, for example, *Cetrariella delisei*, *Cladonia ecmocyna*, *Pertusaria oculata* and *Solorina crocea* (K. Hansen, 1971).

A saxicolous lichen community of particular interest occurs on the rocks composed of basalt breccia near Røde Elv. The combination of the strongly weathered basalt-clay minerals and the influence of guano results in a very rich lichen vegetation. *Caloplaca castellana*, *C. epithallina*, *Endocarpon pulvinatum*, *Lecanora marginata*, *L.*

muralis and *Physconia detersa* are some characteristic examples. The surface of these rocks often has a distinct red colour because of the abundant occurrence of members of *Teloschistaceae*, for example, *Xanthoria elegans*. The often very hard basaltic boulders on the talus slopes of Lyngmarksfjeld support a quite different nitrophilous lichen vegetation consisting of taxa such as *Lecanora rupicola* ssp. *arctoa*, *Protoparmelia badia*, *Umbilicaria decussata* and *U. virginis*. The contribution of nutritious matters from the basalt minerals to the lichens is supposed to be small in comparison with the basalt breccia minerals.

In 1974 V. Alstrup and the author analysed the lichen vegetation on a gneissic rock with high concentrations of copper near the Arctic Station (Alstrup & E. S. Hansen, 1977). We concluded that three species, viz. *Lecanora pubescens*, *Pseudephebe pubescens* and *Umbilicaria lyngei*, are able to survive on this rock surface. The rock was studied again by the author in the summer of 1996. After this study ten species, viz. *Acarospora smaragdula*, *Bellemerea alpina*, *Lecanora argopholis*, *L. chloroleprosa*, *L. intricata*, *Miriquidica atrofulva*, *Orphniospora moriopsis*, *Pseudephebe minuscula*, *Rhizocarpon praebadium*, *Sporastatia testudinea*, *Umbilicaria decussata* and *U. torrefacta*, can be added as examples of lichens growing on and among the green, so far unidentified copper-containing mineralogical crusts on the rock. Like many other rocks in the area the basal zone is coated with a thin layer of iron-hydroxides. This zone is colonized by *Miriquidica atrofulva*, *M. nigroleprosa*, *Rhizocarpon geminatum*, *R. inarense* and *Tremolecia atrata*. *Porpidia flavicunda* and *P. melinodes* are additional examples of lichens growing on such rock faces in the Godhavn area just as in other parts of Greenland (E. S. Hansen, 1998).

Annotated list of lichens

The following list of lichens is based on the author's collections, all of which are deposited in C. Nomenclature follows Santesson (1993) with a few exceptions. Annotations are provided as regards the substrate of the lichens and presence of apothecia (ap) or perithecia (pe). "St" means that the specimen is sterile. The frequency is stated for selected lichens. "Common" means that more than ten finds have been made in the Godhavn area, while "rare" indicates that only one or two finds have been made. Collections, which have been distributed previously from herbarium C as part of "Lichenes Groenlandici Exsiccati" (LGE), are stated by their numbers. Selected references are cited.

ACAROSPORA MOLYBDINA (Wahlenb.) A. Massal. - on gneissic rock and rock composed of basalt breccia; ap; common; LGE No. 647. (Lynge, 1937).

A. RHIZOBOLA (Nyl.) Alstrup - on soil and gravel; ap. New to Qeqertarsuaq.

A. SMARAGDULA (Wahlenb.) A. Massal. - on gneissic rock; ap. New to Qeqertarsuaq.

ALECTORIA NIGRICANS (Ach.) Nyl. - on soil; st; common. (K. Hansen, 1962).

A. OCHROLEUCA (Hoffm.) A. Massal. - on soil; st; common. (K. Hansen, 1962).

ALLANTOPARMELIA ALPICOLA (Th. Fr.) Essl. - on gneissic rock; ap; common; LGE No. 636. (K. Hansen, 1962).

AMANDINEA CONIOPS (Wahlenb.) Scheid. - on gneissic rock; ap; common. (Thomson, 1997).

AMYGDALARIA PANAEOLA (Ach.) Hertel & Brodo - on gneissic rock and rock composed of basalt breccia; ap. (Lynge, 1937).

ARCTOCETRARIA ANDREJEVII (Oxner) Kärnefelt & A. Thell - on soil; st; common; LGE No. 628. (E. S. Hansen, 1978).

ARCTOPARMELIA CENTRIFUGA (L.) Hale - on gneissic rock; st; common. (Thomson, 1984).

A. INCURVA (Pers.) Hale - on gneissic rock and rock composed of basalt breccia; st; common. (Lynge, 1937).

ARTHRORHAPHIS ALPINA (Schaer.) R. Sant. - on soil; st. (Lynge, 1937).

A. CITRINELLA (Ach.) Poelt - on soil; ap. New to Qeqertarsuaq.

ASPICILIA AQUATICA Körb. - on gneissic rock; st. (E. S. Hansen, 1983).

A. CAESIOCINEREA (Nyl. ex Malbr.) Arnold - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap. (E. S. Hansen, 1986).

A. MASTRUCATA (Wahlenb.) Th. Fr. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap. New to Qeqertarsuaq.

BAEOMYCES RUFUS (Huds.) Rebent. - on soil; st. New to Disko.

BELLEMEREA ALPINA (Sommerf.) Clauzade & Cl. Roux - on gneissic rock and basaltic rock; st. (Thomson, 1997).

B. CINEREORUFESCENS (Ach.) Clauzade & Cl. Roux - on gneissic rock; ap. New to Disko.

BRODA OROARCTICA (Krog) Goward - on rock composed of basalt breccia; st. (K. Hansen, 1962).

BRYONORA PRUINOSA (Th. Fr.) Holt.-Hartw. - on *Andreaea rupestris*; ap; rare. New to Disko.

BRYORIA CHALYBEIFORMIS (L.) Brodo & D. Hawksw. - on rock composed of basalt breccia; st; common. (Thomson, 1984).

B. NITIDULA (Th. Fr.) Brodo & D. Hawksw. - on soil; st; common; LGE No. 630. (K. Hansen, 1962).

BUELLIA DISCIFORMIS (Fr.) Mudd - on mosses and plant remains; ap. (Lynge, 1937).

B. PAPILLATA (Sommerf.) Tuck. - on dead mosses and plant remains; ap. (Thomson, 1997).

B. PULVERULENTA (Anzi) Jatta - on *Physcia tenella* var. *marina*; ap; rare. (Alstrup & Hawksworth, 1990).

CALOPLACA ALCARUM Poelt - on *Lecanora contractula* on gneissic rock and rock composed of basalt breccia; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. AMMIOSPILA (Wahlenb.) H. Olivier - on soil, mosses and plant remains; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. CASTELLANA (Räsänen) Poelt - on *Rhizocarpon geminatum* and *Placynthium asperellum* on gneissic rock and rock composed of basalt breccia; ap; common; LGE No. 641. (E. S. Hansen, Poelt & Søchting, 1987).

C. CERINA (Ehrh. ex Hedw.) Th. Fr. - on mosses, plant remains and old bone; ap; common. (E. S. Hansen, Poelt & Søchting, 1987).

C. EPITHALLINA Lynge - on *Rhizoplaca melanophthalma*; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. FRAUDANS (Th. Fr.) H. Olivier - on gneissic rock; ap; common; LGE No. 633. (E. S. Hansen, Poelt & Søchting, 1987).

C. JUNGERMANNIAE (Vahl) Th. Fr. - on mosses and plant remains; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. NIVALIS (Körb.) Fr. - on *Andreaea rupestris*; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. TETRASPORA (Nyl.) H. Olivier - on mosses and plant remains; ap. (E. S. Hansen, Poelt & Søchting, 1987).

C. TIROLIENSIS Zahlbr. - on mosses and plant remains; ap; common. (E. S. Hansen, Poelt & Søchting, 1987).

CANDELARIELLA ARCTICA (Körb.) R. Sant. - on gneissic rock; ap. New to Qeqertarsuaq.

C. PLACODIZANS (Nyl.) H. Magn. - on gravel originating from basalt breccia; st. (Lynge, 1937).

C. VITELLINA (Hoffm.) Müll. Arg. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common. (Gelting, 1955)

CATAPYRENIUM LACHNEUM (Ach.) R. Sant. - on gravel originating from basalt breccia; pe; common; exs. No. 648. (Breuss & E. S. Hansen, 1988).

CETRARIA ISLANDICA (L.) Ach. - on soil; st; common. (K. Hansen, 1962).

C. MURICATA (Ach.) Eckfeldt - on soil; st. New to Disko.

C. NIGRICANS Nyl. - on soil; st. (K. Hansen, 1962).

CETRARIELLA DELISEI (Bory ex Schaer.) Kärnefelt & A. Thell - on soil; ap; common. (K. Hansen, 1962).

CHAENOTHECA FURFURACEA (L.) Tibell - on mosses; ap; common; rare. (Thomson, 1997).

CLADONIA AMAUROCRAEA (Flörke) Schaer. - among mosses on soil; st; common. (K. Hansen, 1962).

C. BELLIDIFLORA (Ach.) Schaer. - on soil; ap; common. (Böcher, 1963).

C. BOREALIS S. Stenroos - on soil; st; common. New to Disko.

C. CARNEOLA (Fr.) Fr. - on soil; st. New to Disko.

C. CENOTEA (Ach.) Schaer. - among mosses on soil; ap; common; LGE No. 634. (Lynge, 1937).

C. CHLOROPHAEA (Flörke ex Sommerf.) Spreng. - on soil; st; common. (K. Hansen, 1962).

C. CORNUTA (L.) Hoffm. - among mosses on soil; st. (Lynge, 1937).

C. CYANIPES (Sommerf.) Nyl. - on soil; st; common; LGE No. 638. (K. Hansen, 1962).

C. DAHLIANA Kristinsson - among mosses on soil; st. Thallus contains atranorin and psoromic acid (TLC). New to Disko.

C. ECMOCYNA Leight. - on soil; ap; common. (K. Hansen, 1962).

C. FIMBRIATA (L.) Fr. - on soil; st. (K. Hansen, 1962).

C. GRACILIS (L.) Willd. - on soil; st; common. (K. Hansen, 1962).

C. MACROCERAS (Delise) Hav. - on soil; st. New to Disko.

C. MACROPHYLLA (Schaer.) Stenh. - on soil; st; common; LGE No. 629. (K. Hansen, 1962).

C. MACROPHYLLOIDES Nyl. - on soil; st. (Thomson, 1984).

C. MITIS Sandst. - on soil; ap; common. (K. Hansen, 1962).

C. PHYLLOPHORA Hoffm. - among mosses on soil; st; common; LGE No. 639. (K. Hansen, 1962).

C. PLEUROTA (Flörke) Schaer. - on soil; st; common. New to Disko.

C. POCILLUM (Ach.) Grognot - on soil and mosses; st; common. (K. Hansen, 1962).

C. PYXIDATA (L.) Hoffm. - on soil; ap; common. (K. Hansen, 1962).

C. RANGIFERINA (L.) Weber ex F. H. Wigg. - on soil; ap. (K. Hansen, 1962).

C. SQUAMOSA Hoffm. - on soil; ap. (K. Hansen, 1962).

C. STELLARIS (Opiz) Pouzar & Vezda - on soil; st. New to Disko.

C. STRICTA (Nyl.) Nyl. - on soil; ap; common. (Böcher, 1963).

C. STYGIA (Fr.) Ruoss - on soil; st; common. New to Disko.

C. SULPHURINA (Michx.) Fr. - on soil; st; common. (Thomson, 1984).

COLLEMA UNDULATUM Laurer ex Flot. var. GRANULOSUM Degel. - on rock composed of basalt breccia; st. New to Disko.

DACTYLINA ARCTICA (Hook.) Nyl. - among mosses on soil; st. (Lynge, 1937).

D. RAMULOSA (Hook.) Tuck. - among mosses on soil; st. (Lynge, 1937).

DERMATOCARPON MINIATUM (L.) W. Mann var. COMPLICATUM (Lightf.) Th. Fr. - on rock composed of basalt breccia; pe. (Thomson, 1984).

DIBAEIS BAEOMYCES (L. fil.) Rambold & Hertel, Syn.: Baeomyces roseus Pers. - on soil and gravel originating from basalt breccia; ap. (Thomson, 1984).

DIMELAENA OREINA (Ach.) Norman - on gneissic rock; st. New to Disko.

DIPLOSCHISTES MUSCORUM (Scop.) R. Sant. - on rock composed of basalt breccia; ap. New to Disko.

D. SCRUPOSUS (Schreb.) Norman - on gneissic rock and rock composed of basalt breccia; ap. (Lynge, 1937).

ENDOCARPON PULVINATUM Th. Fr. - on rock composed of basalt breccia; st; common; LGE No. 640. (E. S. Hansen, 1984).

EPHEBE HISPIDULA (Ach.) Horw. - on gneissic rock; st; common. New to Disko.

EPILICHEN SCABROSUS (Ach.) Clem. - on *Baeomyces rufus* and autonomous; ap; common; LGE No. 637. New to Disko.

EUOPSIS PULVINATA (Schaer.) Vain., Syn.: *Pyrenopsis pulvinata* (Schaer.) Th. Fr. - on gneissic rock; ap. (Lynge, 1937).

FLAVOCETRARIA CUCULLATA (Bellardi) Kärnefelt & A. Thell - on soil and mosses; st; common. (K. Hansen, 1962).

F. NIVALIS (L.) Kärnefelt & A. Thell - on soil; st; common. (K. Hansen, 1962).

HYPOGYMNIA AUSTERODES (Nyl.) Räsänen - on gneissic rock and rock composed of basalt breccia and on gravel originating from basalt breccia; st. (K. Hansen, 1962).

H. SUBOBSCURA (Vain.) Poelt - on mosses soil; st. (Thomson, 1984).

LECANORA ARGOPHOLIS (Ach.) Ach. - on gneissic rock and rock composed of basalt breccia; ap; common; LGE No. 645. (Thomson, 1997).

L. ATROSULPHUREA (Wahlenb.) Ach. - on gneissic rock; ap; rare. (Thomson, 1997).

L. CHLOROLEPROSA (Vain.) H. Magn. - on gneissic rock; ap. (E. S. Hansen, 1983).

L. CONTRACTULA Nyl. - on gneissic rock and rock composed of basalt breccia; ap. (Lynge, 1937).

L. EPIBRYON (Ach.) Ach. - on plant remains; ap; common. (Thomson, 1997).

L. FUSCESCENS (Sommerf.) Nyl. - on dead twigs of *Salix glauca*; ap. New to Disko.

L. INTRICATA (Ach.) Ach. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap. (Thomson, 1984).

L. MARGINATA (Schaer.) Hertel & Rambold - on rock composed of basalt breccia; ap. New to Disko.

L. MURALIS (Schreb.) Rabenh. - on rock composed of basalt breccia; ap. (Thomson, 1997).

L. POLYTROPA (Ehrh. ex Hoffm.) Rabenh. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common. (Alstrup & E. S. Hansen, 1977).

L. REAGENS Norman - on rock composed of basalt breccia; st; rare. (E. S. Hansen, 1983).

L. RUPICOLA ssp. ARCTOA Leuckert & Poelt - on gneissic rock; ap. (Thomson, 1997).

L. STRAMINEA Ach. - on gneissic rock and rock composed of basalt breccia; ap; common. (Thomson, 1997).

L. SYMMICTA (Ach.) Ach. - on dead twig of *Salix glauca*; ap. New to Disko.

LECIDEA ATROBRUNNEA (Ramond ex Lam. & DC.) Schaer. - on gneissic rock and basaltic rock; ap; common. (Thomson, 1997).

L. LAPICIDA (Ach.) Ach. var. LAPICIDA - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common. (Thomson, 1997).

L. LAPICIDA (Ach.) Ach. var. PANTHERINA Ach. - on gneissic rock and basaltic rock; ap. (Lynge, 1937).

LECIDOMA DEMISSUM (Rutstr.) Gotth. Schneid. & Hertel - on soil; ap; common. (Lynge, 1937).

LEPRARIA NEGLECTA (Nyl.) Lettau - on mosses, plant remains and soil; common. Thallus contains alectorialic acid and atranorin (TLC). (Lynge, 1937).

LEPROCAULON SUBALBICANS (I. M. Lamb) I. M. Lamb & A.M.Ward - on mosses on gneissic rock. The specimens belong to strain IV with squamatic and baeomycesic acids and atranorin (TLC). New to Disko.

LEPROLOMA VOUAUXII (Hue) J. R. Laundon - on mosses on soil. Thallus contains atranorin (TLC). New to Disko.

LEPTOGIUM LICHENOIDES (L.) Zahlbr. - on mosses and plant and plant remains; st. (Thomson, 1984).

LOBOTHALLIA MELANAPSIS (Ach.) Hafellner, syn.: *Aspicilia melanaspis* (Ach.) Poelt & Leuckert - on rock composed of basalt breccia; ap; rare. (Lynge, 1937).

MEGASPORA VERRUCOSA (Ach.) Hafellner & V. Wirth - on dead mosses; ap. (Lynge, 1937).

MELANELIA DISJUNCTA (Erichsen) Essl. - on basaltic rock and rock composed of basalt breccia; st. (Thomson, 1984).

M. HEPATIZON (Ach.) A. Thell - on gneissic rock and rock composed of basalt breccia; st; common. (K. Hansen, 1962).

M. INFUMATA (Nyl.) Essl. - on gneissic rock, basaltic rock and rock composed of basalt breccia; st; common. (Thomson, 1984).

MICAREA LIGNARIA (Ach.) Hedl. - on dead twig of *Salix glauca*; ap. New to Disko.

MIRIQUIDUCA ATROFULVA (Sommerf.) A. J. Schwab & Rambold - on gneissic rock; st; common. New to Disko.

M. NIGROLEPROSA (Vain.) Hertel & Rambold - on gneissic rock and rock composed of basalt breccia; ap; common. (E. S. Hansen, 1983).

NEPHROMA ARCTICUM (L.) Torss. - among mosses on soil; st; common. (Lynge, 1937).

N. EXPALLIDUM (Nyl.) Nyl. - among mosses on soil; st. (K. Hansen, 1962).

N. PARILE (Ach.) Ach. - on mosses; st. New to Disko.

OCHROLECHIA ANDROGYNA (Hoffm.) Arnold - on dead mosses; st. (Thomson, 1997).

O. FRIGIDA (Sw.) Lynge - on soil, mosses and plant remains; ap; common. (Lynge, 1937).

O. GRIMMIAE Lynge - on *Racomitrium lanuginosum*; ap. (E. S. Hansen, 1984).

O. INAEQUATULA (Nyl.) Zahlbr. - on plant remains; st. (Lynge, 1937).

O. TARTAREA (L.) A. Massal. - on basaltic rock and rock composed of basalt breccia; st. New to Disko.

O. UPSALIENSIS (L.) A. Massal. - on mosses and plant remains; ap. (Thomson, 1997).

OMPHALINA ALPINA (Britzelm.) Bresinsky & Stangl - on mosses together with *Botrydina vulgaris*. New to Disko.

OPHIOPARMA VENTOSA (L.) Norman - on gneissic rock; ap; common; LGE No. 631. (Lynge, 1937).

ORPHNIOSPORA MORIOPSIS (A. Massal.) D. Hawksw. - on gneissic rock; ap; common. (Alstrup & E. S. Hansen, 1977).

PANNARIA HOOKERI (Borrer ex Sm.) Nyl. - on rock composed of basalt breccia; ap; rare. (Lynge, 1937).

P. PEZIZOIDES (Weber) Trevis. - on soil and mosses; ap. (Lynge, 1937).

PARMELIA OMPHALODES (L.) Ach. - on basaltic rock; st. (K. Hansen, 1962).

P. SAXATILIS (L.) Ach. - on gneissic rock, basaltic rock and rock composed of basalt breccia; st; common. (Thomson, 1997).

P. SULCATA Taylor - on gneissic rock and basaltic rock; st. New to Disko.

PELTIGERA BRITANNICA (Gyeln.) Holt.-Hartw. & Tønsberg - on mosses; ap. New to Disko.

P. CANINA (L.) Willd. - on mosses; ap; common. (K. Hansen, 1962).

P. DIDACTYLA (With.) J. R. Laundon - on soil, mosses and plant remains; st; common; LGE No. 643. The species is infected by *Illosporium carneum*. (K. Hansen, 1962).

P. LEPIDOPHORA (Nyl. ex Vain.) Bitter - on soil and mosses; st; rare. (Thomson, 1984).

P. LEUCOPHLEBIA (Nyl.) Gyeln. - among mosses on soil; ap; common. (K. Hansen, 1962).

P. MALACEA (Ach.) Funck - on soil; st; common. (Lynge, 1937).

P. RUFESCENS (Weiss) Humb. - on soil and mosses; ap; common. (K. Hansen, 1962).

P. SCABROSA Th. Fr. - among mosses on soil; st. (Lynge, 1937).

P. VENOSA (L.) Hoffm. - on soil and mosses; ap; rare. (Thomson, 1984).

PERTUSARIA CORIACEA (Th. Fr.) Th. Fr. - on mosses and plant remains; ap. (Thomson, 1997).

P. DACTYLINA (Ach.) Nyl. - on mosses and soil; ap. (Thomson, 1997).

P. GEMINIPARA (Th. Fr.) C. Knight ex Brodo - on *Racometrium lanuginosum*; st. New to Disko.

P. OCULATA (Dicks.) Th. Fr. - on soil and mosses; st; common. (Lynge, 1937).

P. PANYRGA (Ach.) A. Massal. - on plant remains; ap. (Thomson, 1997).

PHAEOPHYSCIA SCIASTRA (Ach.) Moberg - on gneissic rock and rock composed of basalt breccia; also on gravel originating from basalt breccia; st; common. (Moberg & E. S. Hansen, 1986).

PHYLLISCUM DEMANGEONII (Moug. & Mont.) Nyl. - on gneissic rock and rock composed of basalt breccia; ap. (E. S. Hansen, 1984).

PHYSCIA CAESIA (Hoffm.) Fürnr. - on gneissic rock and basaltic rock; rarely on mosses; ap; common. (Moberg & E. S. Hansen, 1986).

P. DUBIA (Hoffm.) Lettau - on gneissic rock and rock composed of basalt breccia and gravel originating from basalt breccia; rarely on plant remains; st; common; LGE No. 635. (Moberg & E. S. Hansen, 1986).

P. MAGNUSSONII Frey - on rock composed of basalt breccia; ap. (Moberg & E. S. Hansen, 1986).

P. TENELLA (Scop.) DC. var. MARINA (E. Nyl.) Lynge - on rock composed of basalt breccia; st; common; LGE No. 649. (Moberg & E. S. Hansen, 1986).

PHYSCONIA DETERSA (Nyl.) Poelt - on rock composed of basalt breccia; st. (Moberg & E. S. Hansen, 1986).

P. MUSCIGENA (Ach.) Poelt - on rock composed of basalt breccia and gravel originating from basalt breccia; also on mosses; ap; common. (Moberg & E. S. Hansen, 1986).

PLACOPSIS LAMBII Hertel & V. Wirth - on basaltic rock and rock composed of basalt breccia; st; rare. New to Disko.

PLACYNTHIUM ASPERELLUM (Ach.) Trevis. - on rock composed of basalt breccia; ap; exs. No. 642. (Lynge, 1937).

PLEOPSIDUM CHLOROPHANUM (Wahlenb.) Zopf - on gneissic rock; st; rare. New to Disko.

PORPIDIA FLAVICUNDA (Ach.) Gowan - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap. (Thomson, 1997).

P. MACROCARPA (DC.) Hertel & A. J. Schwab - on basaltic rock; ap. (Lynge, 1937).

P. MELINODES (Körb.) Gowan & Ahti - on gneissic rock, basaltic rock and rock composed of basalt breccia; st; common. New to Disko.

PROTOPARMELIA BADIA (Hoffm.) Hafellner - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common; LGE No. 644. (Lynge, 1937).

PSEUDEPHEBE MINUSCULA (Nyl. ex Arnold) Brodo & D. Hawksw. - on gneissic rock, basaltic rock and rock composed of basalt breccia; st; common. (Lynge, 1937).

P. PUBESCENS (L.) M. Choisy - on gneissic rock; st; rare. (K. Hansen, 1962).

PSORA DECIPIENS (Hedw.) Hoffm. - on soil; ap. (Lynge, 1937).

P. RUBIFORMIS (Ach.) Hook. - on soil; ap. (Lynge, 1937).

PSOROMA HYPNORUM (Vahl) Gray - on mosses; ap; common. (Lynge, 1937).

RHIZOCARPON BADIOATRUM (Flörke ex Spreng.) Th. Fr. - on gneissic rock and basaltic rock; st. (Thomson, 1997).

R. BOLANDERI (Tuck.) Herre - on gneissic rock and rock composed of basalt breccia; st. (Gelting, 1955).

R. DISPORUM (Nägeli ex Hepp) Müll. Arg. - on gneissic rock; ap. New to Disko.

R. GEMINATUM Körb. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common. (Gelting, 1955).

R. GEOGRAPHICUM (L.) DC. - on gneissic rock and rock composed of basalt breccia; ap; common; LGE No. 650. (Lynge, 1937).

R. GRANDE (Flörke) Arnold - on gneissic rock; ap. (Gelting, 1955).

R. INARENSE (Vain.) Vain. - on gneissic rock and rock composed of basalt breccia; ap; common. (Lynge, 1937).

R. PRAEBADIUM (Nyl.) Zahlbr. - on gneissic rock; ap. New to Disko.

R. PUSILLUM RUNEMARK - on *Sporastatia testudinea* on gneissic rock; ap. (E. S. Hansen, 1984).

R. RITTOKENSE (Hellb.) Th. Fr. - on gneissic rock; ap. (Gelting, 1955).

R. SUPERFICIALE (Schaer.) Vain. - on gneissic rock; ap. (Thomson, 1997).

RHIZOPLACA MELANOPHTHALMA (DC.) Leuckert & Poelt - on rock composed of basalt breccia; ap. (Lynge, 1937).

RINODINA ARCHAEA (Ach.) Arnold - on dead twig of *Salix glauca*; ap; rare. New to Disko.

R. MNIARAEA (Ach.) Körb. - on dead mosses; ap. (Lynge, 1937).

R. ROSCIDA (Sommerf.) Arnold - on dead *Silene acaulis*; ap. (Thomson, 1997).

R. TURFACEA (Wahlenb.) Körb. - on soil, mosses and plant remains; ap; common. (Lynge, 1937).

SOLORINA BISPORA Nyl. - on soil and gravel originating from basalt breccia; ap; common. (Thomson, 1984).

S. CROCEA (L.) Ach. - on soil and mosses; ap; common. (Lynge, 1937).

S. OCTOSPORA Arnold - among mosses on soil; ap; common; LGE No. 646. (K. Hansen, 1962).

S. SACCATA (L.) Ach. - on soil; ap. (Thomson, 1984).

SPHAEROPHORUS FRAGILIS (L.) Pers. - on gneissic rock; rarely on soil; ap; common. (Lynge, 1937).

S. GLOBOSUS (Huds.) Vain. - on soil, mosses and plant remains; ap; common. (K. Hansen, 1962).

SPORASTATIA TESTUDINEA (Ach.) A. Massal. - on gneissic rock and basaltic rock; ap. (Lynge, 1937).

STEREOCAULON ALPINUM Laurer - among mosses on soil; ap; common. (K. Hansen, 1962).

S. ARCTICUM Lynge - on soil and basaltic gravel; st. Thallus contains atranorin and stictic acid (TLC). Norstictic acid was not found (Lamb, 1977). (K. Hansen, 1962).

S. BOTRYOSUM Ach. - on gneissic rock; st; common; exs. No. 632. (Lynge, 1937).

S. GLAREOSUM (Savicz) H. Magn. - on soil; ap. (Thomson, 1984).

S. PASCHALE (L.) Hoffm. - among mosses on soil; st. (Böcher, 1963).

S. RIVULORUM H. Magn. - on soil; ap. (K. Hansen, 1962).

TEPHROMELA AGLAEA (Sommerf.) Hertel & Rambold - on rock composed of basalt breccia; ap. (Thomson, 1997).

T. ARMENIACA (DC.) Hertel & Rambold - on gneissic rock, basaltic rock and rock composed of basalt breccia; st. (Thomson, 1997).

THAMNOLIA VERMICULARIS (Sw.) Schaer. - on mosses on soil; common. (K. Hansen, 1962).

TONINIA SEDIFOLIA (Scop.) Timdal - on soil; ap. (Thomson, 1997).

TRAPELIOPSIS GRANULOSA (Hoffm.) Lumbsch - on soil; ap; common; LGE No. 627. (Thomson, 1997).

TREMOLECIA ATRATA (Ach.) Hertel - on gneissic rock and rock composed of basalt breccia; ap; common. (Thomson, 1997).

UMBILICARIA ARCTICA (Ach.) Nyl. - on gneissic rock; ap; common. (Lynge, 1937).

U. CINEREORUFESCENS (Schaer.) Frey - on gneissic rock; st. New to Disko.

U. CYLINDRICA (L.) Delise ex Duby - on gneissic rock; st; common. (K. Hansen, 1962).

U. DECUSSATA (Vill.) Zahlbr. - on gneissic rock; st. (Gelting, 1955).

U. DEUSTA (L.) Baumg. - on gneissic rock; st; common. (Thomson, 1984).

U. HYPERBOREA (Ach.) Hoffm. - on gneissic rock, basaltic rock and rock composed of basalt breccia; ap; common. (K. Hansen, 1962).

U. LYNGEI Schol. - on rock composed of basalt breccia; ap; common. (K. Hansen, 1962).

U. PROBOSCIDEA (L.) Schrad. - on gneissic rock; ap; common. (K. Hansen, 1962).

U. TORREFACTA (Lightf.) Schrad. - on gneissic rock and rock composed of basalt breccia; ap; common. (K. Hansen, 1962).

U. VELLEA (L.) Hoffm. - on gneissic rock; ap; common. (Lynge, 1937).

U. VIRGINIS Schaer. - on gneissic rock and basaltic rock; ap; common. (Thomson, 1984).

USNEA SPHACELATA R. Br. - on basaltic rock; st; common. (K. Hansen, 1962).

VERRUCARIA CEUTHOCARPA Wahlenb. - on gneissic rock; pe; common. (Lynge, 1937).

XANTHORIA BOREALIS R. Sant. & Poelt - on gneissic rock and rock composed of basalt breccia; rarely on plant remains; st; common. New to Disko.

X. ELEGANS (Link) Th. Fr. - on gneissic rock and rock composed of basalt breccia gravel originating from basalt breccia; ap; common. (Lynge, 1937).

X. SOREDIATA (Vain.) Poelt - on gneissic rock; st; common. (Lynge, 1937).

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Supplement to the list of lichen species of Naissaar Island (Gulf of Finland, Estonia)

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Abstract: In the course of revising the lichen collections from Naissaar Island, 39 new species for this island were identified. Several species were floristically interesting. Among them *Vezdaea aestivalis* is representing a new genus and *Umbilicaria nylanderiana* - a new species in Estonian lichen flora. *Umbilicaria cinerascens* is also considered as a very rare lichen in Estonia. Four species among the new findings are included in the Red Data Book of Estonia.

Kokkuvõte: L. Martin, M. Temina & J. Martin. Täiendused Naissaare (Soome laht, Eesti) samblike nimekirjale.

Naissaarelt 1996. aastal kogutud herbaarmaterjali täiendaval läbitöötamisel leiti 39 saare lihhenofloorale uut samblikuliiki. Huvipakkuvaiks osutusid neist *Vezdaea aestivalis*, mis esindab Eesti jaoks uut samblikuperekonda, ja *Umbilicaria nylanderiana* kui uus liik Eesti lihhenofloorale. *Umbilicaria cinerascens* on samuti Eestis väga haruldane. Neli Naissaarele uut samblikku kuuluvad Eesti Punase Raamatu liikide hulka.

The first list of lichen species published for Naissaar Island (Randlane et al., 1997) included 165 species and two subspecies. Revision of the ICEB collections made in connection with compiling the Second Checklist of Lichenized, Lichenicolous and Allied Fungi of Estonia (1999, in print) allowed us to identify additional 39 lichen species for Naissaar Island. All specimens listed below were collected on this island in 1996 and are deposited in the Herbarium of the International Center for Environmental Biology, Tallinn (ICEB).

Several lichen species collected on Naissaar are of special interest.

Vezdaea aestivalis represents a new genus in Estonian lichen flora. B. J. Coppins (1987) noted that all the British *Vezdaea* species inhabit plant debris, moribund bryophytes or lichens or soil in a variety of situations. *V. aestivalis* – the most common and widespread species from this genus in the British Isles is usually found associated with old mortar on walls and frequently also with soils rich in metals (Coppins, 1987; Purvis et al., 1992). The closest locality to Estonia known for this lichen species is in the southern part of Sweden (Santesson, 1993). On Naissaar this lichen was found on the thalli of *Peltigera* sp., growing on an embankment in the south-western part of the island.

Umbilicaria nylanderiana is a new species for Estonia. It is widely distributed in Finland (Vitikainen et al., 1997). On Naissaar this lichen was found on siliceous boulder. Upon revising the herbarium materials at the Institute of Botany and Ecology, University of Tartu (TU), it appeared that *U. nylanderiana* has been collected by H. Trass on the Aegna Island in 1973 already but the specimen had erroneously been identified as *U. decussata* (Trass & Randlane, 1994). Still, we have found true *U. decussata* again on Aegna (collected by J. Martin in 1996) (ICEB), and today this is the only locality for that species in Estonia.

Umbilicaria cinerascens is also considered as a very rare[1] lichen in Estonia (1-2 localities). This species has earlier been collected in two localities in Estonia – in Nõmme at the beginning of this century by P. Wasmuth and later in Vääna by H. Trass (Trass & Randlane, 1994). Neither of these collections are available today and therefore could not be verified. Now three collections of *U. cinerascens* were found on Naissaar.

Acarospora smaragdula, Biatoropsis usnearum, Bryoria chalybeiformis, Catillaria chalybeia, Hypocenomyce friesii, Leptogium gelatinosum, Micarea melanobola, Rhizocarpon macrosporum, Umbilicaria hyperborea, Usnea diplotypus and *Xylographa vitiligo* are rare

[1] frequency estimations are cited according to *Second Checklist.....*, 1999.

lichens in Estonia (recorded in 3-5 localities).

Acarospora veronensis, Aspicilia simoënsis, A. verrucigera, Melanelia disjuncta, Micarea nitschkeana, Porpidia macrocarpa, Rhizocarpon lecanorinum, Rinodina gennarii and *Scoliciosporum umbrinum* are classified as rather rare lichens in Estonia (known in 6-10 localities).

Four species among the new findings are included in the Red Data Book of Estonia (Lilleleht, 1998; Randlane, 1998).These species are marked by asterisks in the list presented below.

1. ACAROSPORA SMARAGDULA (Wahlenb.) A. Massal. – on siliceous pebbles and on siliceous boulders.
2. A. VERONENSIS A. Massal. – on siliceous stones.
3. ACROCORDIA GEMMATA (Ach..) A. Massal. - on bark of *Tilia cordata.*
4. ASPICILIA SIMOËNSIS Räsänen – on siliceous boulder.
5. A. VERRUCIGERA Hue – on siliceous boulder.
6. BACIDIA BAGLIETTOANA (A. Massal. & De Not.) Jatta – on mosses over old concrete.
7. B. RUBELLA (Hoffm.) A. Massal. - on bark of *Tilia cordata.*
8. B. SABULETORUM (Schreb.) Lettau - on mosses over old concrete.
9. BIATOROPSIS USNEARUM Räsänen – lichenicolous on thallus of *Usnea.*
10. *BRYORIA CHALYBEIFORMIS (L.) Brodo & D. Hawksw. - on siliceous boulders.
11. CALOPLACA HOLOCARPA (Hoffm.) A. E. Wade – on bark of *Populus tremula.*
12. CATILLARIA CHALYBEIA (Borrer) A. Massal. - on siliceous boulders.
13. CLIOSTOMUM GRIFFITHII (Sm.) Coppins – on bark of *Alnus glutinosa.*
14. HYPOCENOMYCE FRIESII (Ach.) P. James & Gotth. Schneid. – on bark of *Pinus sylvestris.*
15. LECANORA HELICOPIS (Wahlenb.) Ach. – on cement wall in the harbour.
16. L. INTRICATA (Ach.) Ach. - on siliceous boulders.
17. L. MURALIS (Schreb.) Rabenh. - on siliceous pebbles
18. L. RUPICOLA (L.) Zahlbr. - on siliceous boulder on the seashore.
19. L. SULPHUREA (Hoffm.) Ach. – on siliceous boulder.
20. *LEPTOGIUM GELATINOSUM (With.) J. R. Laundon - on mosses over old concrete.
21. MELANELIA DISJUNCTA (Erichsen) Essl. - on siliceous boulders.
22. MICAREA DENIGRATA (Fr.) Hedl. – on bark of *Pinus sylvestris*, on wood.
23. M. MELAENA (Nyl.) Hedl. – on wood of *Pinus sylvestris*
24. M. MELANOBOLA (Nyl.) Coppins – on bark of *Picea abies.*
25. M. NITSCHKEANA (J. Lahm ex Rabenh.) Harm. – on wood.
26. M. PELIOCARPA (Anzi) Coppins & R. Sant. – on mosses over old concrete.
27. M. PRASINA Fr. – on bark of *Pinus sylvestris* and *Betula* sp.
28. PORPIDIA MACROCARPA (DC.) Hertel & A. J. Schwab – on siliceous stones.
29. RHIZOCARPON LECANORINUM Anders - on siliceous boulders.
30. R. MACROSPORUM Räsänen - on siliceous pebbles.
31. RINODINA GENNARII Bagl. – on driftwood on the seashore.
32. R. PYRINA (Ach.) Arnold – on bark of *Betula* sp.
33. SCOLICIOSPORUM UMBRINUM (Ach.) Arnold - on siliceous boulders.
34. *UMBILICARIA CINERASCENS (Arnold) Frey - on siliceous boulders.
35. *U. HYPERBOREA (Ach.) Hoffm. - on siliceous boulders.
36. U. NYLANDERIANA (Zahlbr.) H. Magn. – on siliceous boulder.
37. U. POLYRRHIZA (L.) Fr. – on siliceous boulder.
38. VEZDAEA AESTIVALIS (Ohl.) Tsch.-Woess & Poelt – on *Peltigera* sp.
39. XYLOGRAPHA VITILIGO (Ach.) J. R. Laundon – on driftwood on the seashore.

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Lichen flora of Osmussaar Island (north-western Estonia)

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Abstract: Osmussaar Island (4,7 km^2) is situated in the western part of the Gulf of Finland. The materials for this survey were collected in 1993 and are kept in TU. The list of lichen species found on Osmussaar Island includes 152 species; three of them (*Anaptychia runcinata, Diplotomma ambiguum* and *Trapelia placodioides*) have been reported in Estonia only from this island. Some other lichens collected from Osmussaar (*Acarospora smaragdula, Diplotomma venustum, Rhizocarpon petraeum, Xylographa parallela*) are also rare in our region. The lichen flora of Osmussaar Island is characterized by the abundance of calciferous and suboceanic species. Alvars appear to be the most interesting locality for lichens where unique associations of xerocontinental species together with arcto-apline or hypo-arcto-montane lichens occur. Several usually epiphytic lichen species grow unexpectedly on the ground. In conclusion, the lichen flora of the Isle of Osmussaar can be treated as typical for the medium-sized western islands of Estonia.

Kokkuvõte: T. Randlane & I. Jüriado. Osmussaare (Loode-Eesti) samblike floora.

Antakse lühike ülevaade Osmussaare lihhenofloorast ja võrreldakse selle liigirikkust teiste Eesti saarte samblike flooradega. Uurimuse aluseks on 1993. a. kogutud materjalid, mida säilitatakse Tartu Ülikooli lihhenoloogilises herbaariumis (TU). Esitatakse Osmussaare samblike nimekiri; see sisaldab 152 liiki, neist kolme (*Anaptychia runcinata, Diplotomma ambiigum* ja *Trapelia placodioides*) on seni Eestis leitud ainult Osmussaarelt. Ka mitmed teised samblikuliigid (*Acarospora smaragdula, Diplotomma venustum, Rhizocarpon petraeum, Xylographa parallela*) kuuluvad Eestis väga haruldaste või haruldaste hulka. Saare lihhenofloorale tervikuna on iseloomulik kaltsifiilsete ja subokeaaniliste liikide suhteliselt suur osakaal. Kõige huvitavamaks lihhenoloogiliseks kasvukohaks tuleb pidada loopealseid neile tüüpiliste kserokontinentaalsete ja arktoalpiinsete-hüpoarktomontaansete samblike segakooslustega; mitmed tavaliselt epifüütidena kasvavad liigid leiduvad siin loopealsetel maas.

INTRODUCTION

Osmussaar Island (*Odinsholm* in Swedish) is situated near the north-western coast of Estonia (59°18'N 23°22'E), in the most western part of the Gulf of Finland (Fig. 1). There are more than a hundred Estonian islets and islands in the Gulf of Finland, the biggest of which are: Naissaar (18,6 km), Väike-Pakri (12,9 km^2), Suur-Pakri (11,6 km^2), Prangli (6,4 km^2), Osmussaar (4,7 km^2) and Aegna (2,9 km^2) (Ratas & Nilson, 1997).

Osmussaar Island is mainly covered with open vegetation communities – alvars with junipers, meadows and mires; forests with *Betula* and *Sorbus* are also common. Other trees (*Picea abies, Pinus sylvestris, Fraxinus excelsior, Populus tremula, Salix* spp.) are rather scattered. Several rare and protected plants (*Botrychium lunaria, Cochlearia danica*, many orchid species) have been reported (Kukk & Leht, 1995).

The island has not been permanently inhabited by locals for the last 50 years but belonged to the military forces during the Soviet period. Therefore, the possibilities to research the nature and make scientific collections on that territory were practically non-existent. The first more detailed list of vascular plants growing in Osmussaar was presented by Ole Eklund (1936-37) and contained 318 species. The next list including 524 taxa was published almost 60 years later (Kukk & Leht, 1995).

Lichen flora of Osmussaar Island has not been investigated till now. We could not find any earlier herbarium specimens collected from this island or any published data about the lichens of Osmussaar.

MATERIAL AND METHODS

The materials for the present review (more than 200 specimens) were collected by the authors in Osmussaar in July, 1993. The taxa were identified using the routine morphological, anatomical and chemical methods (incl. hand-made cross-sections of fruitbodies and colour tests with potassium hydroxide and sodium hypochlorite in water, p-phenylenediamine in ethanol). In a few cases secondary compounds were analysed according to the standardized TLC methods. The specimens

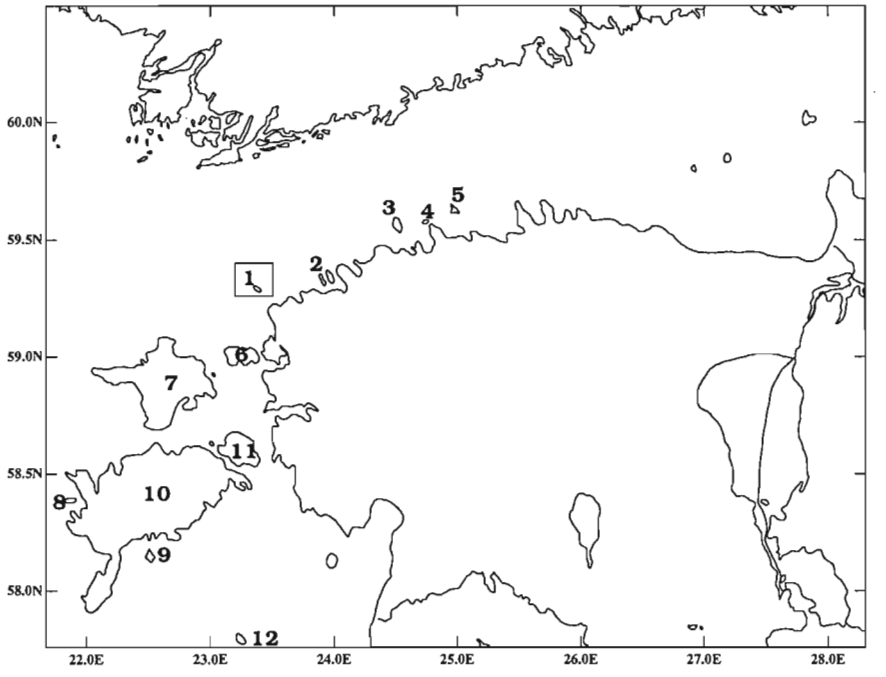

Fig. 1. Location of major northern and western islands of Estonia. Northern islands: 1 – Osmussaar Island; 2 – Pakri Islands; 3 – Naissaar Island; 4 – Aegna Island; 5 – Prangli Island. Western islands: 6 – Vormsi Island; 7 – Hiiumaa Island; 8 – Vilsandi Island; 9 – Abruka Island; 10 – Saaremaa Island; 11 – Muhu Island; 12 – Ruhnu Island.

are kept in the herbarium of the Institute of Botany and Ecology, University of Tartu (TU).

RESULTS

A total of 152 species and one variety of lichenized and lichenicolous fungi have been identified from Osmussaar Island. This constitutes less than 1/5 of the whole lichen flora of Estonia which includes more than 850 species according to our present knowledge (Randlane & Saag, 1999).

To evaluate the richness of the lichen flora of Osmussaar Island, the number of species should be compared to that of other islands of similar size situated along the coast of Estonia (Table 1). Data for that are available in a number of publications and manuscripts. Western islands of Estonia have been investigated lichenologically in detail for some decades – species lists of lichens have been published for Vilsandi Island and surrounding islets (Randlane, 1981, 1988; additions by Laansoo et al., 1991), Abruka (Randlane, 1984) and Ruhnu (Randlane, 1993). Unpublished and incomplete lists exist for Saaremaa, Hiiumaa, Muhu, Kassari, Hanikatsi (Randlane, 1986) and Vormsi (Allmäe, 1988). Lichen flora of the northern islands has been a subject of studies in the 1990s – lists of species have been compiled for the islets of Kolga Bay (Piin & Nilson, 1991, unpublished) and Naissaar Island (Randlane et al., 1997; additions by Martin et al., 1999). Further information about lichens on these islands has been published recently (Martin et al., 1997; Nilson & Piin, 1998). General survey concerning biological diversity (incl. lichenized fungi) in small islands of Estonia is presented by Ratas & Nilson (1997). Still, most of these lichen lists need revision and supplementing, and thus the comparison of the numbers of species is not too representative.

Table 1. Richness of lichen floras in species of some Estonian islands

Island	Area	Species no.	Authors
Naissaar	18,6 km^2	204	Randlane et al., 1997 + Martin et al., 1999
Ruhnu	11,4 km^2	115	Randlane, 1993
Vilsandi	8,9 km^2	181	Randlane, 1988
Abruka	8,8 km^2	179	Randlane, 1984
Osmussaar	4,7 km^2	152	Randlane & Jüriado, 1999
Kõinastu	2,6 km^2	124	Ratas & Nilson, 1997
Saarnaki	1,5 km^2	103	Randlane, 1986

The majority of species found on Osmussaar Island belong to the boreal, nemoral or multizonal elements as typical to the Estonian lichen flora in general (Trass, 1970). Most of those species are common inhabitants of our territory. Still, some very usual epiphytic lichen species, e.g. *Hypogymnia physodes, Evernia prunastri, Platismatia glauca, Pseudevernia furfuracea* grow on alvars on the ground. The same kind of adaptation to the ecological factors of certain epiphytic lichens has been noticed on the sandy dunes of Ruhnu Island and alvars of the peninsula of Harilaid, Saaremaa Island.

The presence of a number of calciferous lichens is characteristic of the flora of Osmussaar as well as of the majority of the western islands of Estonia, while most of them are absent from the northern islands. The unique associations of xerocontinental species together with arcto-alpine or hypo-arcto-montane lichens occur along the seashore and on the alvars of Osmussaar. *Cladonia pocillum, Diploschistes muscorum, Flavocetraria nivalis, Fulgensia bracteata, Toninia sedifolia, Umbilicaria torrefacta* belong to the group of species that are distributed on the western islands and on the north-western coastal regions of the mainland but are missing in the other parts of our country. *Vulpicida tubulosa*, that has earlier been treated as neoendemic of the big islands of the Baltic Sea, is also present on Osmussaar. According to the contemporary data (Mattsson, 1993) this lichen has a disjunct distribution, being found besides the Baltic Isles also in the alpine regions of Central Europe.

The other characteristic feature of the lichen flora of Osmussaar is the occurence of oceanic species. *Anaptychia ciliaris* var. *melanosticta, A. runcinata, Caloplaca scopularis, Diplotomma ambiguum, Ramalina polymorpha* represent that group of lichens that are distributed in the coastal regions only.

Several lichen species reported from Osmussaar Island are of special floristical interest. Osmussaar is the only known locality in Estonia for *Anaptychia runcinata, Diplotomma ambiguum* and *Trapelia placodioides*. *Xylographa parallela* also belongs to the group of very rare lichens (with 1-2 localities in Estonia); *Acarospora smaragdula, Diplotomma venustum* and *Rhizocarpon petraeum* are rare (3-5 localities), while *Acarospora veronensis, Arthonia punctiformis, Aspicilia simoënsis, Protoblastenia calva, Ramboldia insidiosa, Rhizocarpon obscuratum, Rinodina gennarii, Rinodina immersa* and *Verrucaria calciseda* are rather rare (6-10 localities) species in the Estonian lichen flora, according to our present knowledge.

In conclusion, the lichen flora of Osmussaar Island is rather typical for medium-sized Estonian western islands, although geographically it is grouped together with the northern islands. The extensive alvar territories all over the isle and a remarkable steep bank on the north coast are valuable elements of seashore landscape in Estonia. The rare lichen communities inhabiting these localities are worth of protective measures in every place they occur. The presence of many uncommon lichen species in Osmussaar mentioned above confirms that opinion. Various man-made substrata (e.g. mortar and bricks in the ruins of old houses, old wooden fences but also driftwood on the seashore) seem to increase the diversity of suitable habitats for lichens. Still, the first task for the local authorities in the nature conservation activities in Osmussaar lies in the cleaning of the island from all the military trash including the explosive objects left behind by the Soviet army.

List of species

The following list includes 152 lichen species and one variety from Osmussaar Island. Species are arranged in alphabetic order; in nomenclature mainly Santesson (1993) is followed with a few deviations in fam. Cladoniaceae and Parmeliaceae. For each species the substrate in Osmussaar is presented; the frequency of every taxon in Estonia in general is stated according to the following scale (Randlane & Saag, 1999): rr – very rare (1-2 localities); r – rare (3-5 localities); st r – rather rare (6-10 localities); st fq – rather frequent (11-20 localities); fq – frequent (21-50 localities); fqq – very rare (51 or more localities).

1. Acarospora smaragdula (Wahlenb.) A. Massal. – on granite on the seashore; r.
2. A. veronensis A. Massal. – on granite pebbles along the road; st r.
3. Amandinea punctata (Hoffm.) Coppins & Scheid. – on wood; fq.
4. Anaptychia ciliaris (L.) Körb. var. ciliaris – on *Salix sp.*; fqq.
   A. c. var. melanosticta (Ach.) Boistel – on crumbling granite rock on the seashore; st fq.
5. A. runcinata (With.) J. R. Laundon – on granite rock in marine zone; rr.
6. Arthonia punctiformis Ach. – on *Fraxinus excelsior*; st r.
7. Aspicilia calcarea (L.) Mudd – on calcareous pebbles; st fq.
8. A. contorta ssp. hoffmanniana Ekman & Fröberg – on old walls and on calcareous pebbles; fq.
9. A. simoënsis Räsänen – on granite rock; st r.
10. Bacidia bagliettoana (A. Massal. & De Not.) Jatta – on mosses growing on old calcareous stones and eternite, on plant debris on calcareous ground; st fq.
11. B. fraxinea Lönnr. – on *Fraxinus excelsior*; fqq.
12. B. sabuletorum (Schreb.) Lettau – on an old stump; fq.
13. Bryoria capillaris (Ach.) Brodo & D. Hawksw. – on decaying branches of *Betula*; fqq.
14. B. fuscescens (Gyeln.) Brodo & D. Hawksw. – on a fallen tree; fqq.
15. B. subcana (Nyl. ex Stizenb.) Brodo & D. Hawksw. – on dry branches of old *Salix*; st fq.
16. Calicium viride Pers. – on *Betula pendula*; fqq.
17. Caloplaca citrina (Hoffm.) Th. Fr. – on granite pebbles; fq.
18. C. holocarpa (Hoffm. ex Ach.) A. E. Wade – on granite rocks and calcareous pebbles; fq.
19. C. lactea (A. Massal.) Zahlbr. – on calcareous pebbles; fq.
20. C. saxicola (Hoffm.) Nordin – on mortar; fq.
21. C. scopularis (Nyl.) H. Magn. – on granite rock on the seashore; st fq.
22. C. vitellinula auct. – on granite and calcareous pebbles; st fq.
23. Candelariella aurella (Hoffm.) Zahlbr. – on calcareous pebbles; fq.
24. C. coralliza (Nyl.) H. Magn. – on granite rock; fq.
25. C. vitellina (Hoffm.) Müll. Arg. – on granite rocks; fq.
26. Cetraria aculeata (Schreb.) Fr. – on alvar ground; fqq.
27. C. islandica (L.) Ach. – on alvar ground; fqq.
28. C. sepincola (Ehrh.) Ach. – on dry branches of *Juniperus communis*; fqq.
29. Chaenotheca chrysocephala (Turner ex Ach.) Th. Fr. – on trunk of *Betula*; fqq.
30. C. trichialis (Ach.) Th. Fr. – on *Betula*; fqq.
31. Cladina ciliata f. tenuis (Flörke) Ahti – on alvar ground; fq.
32. C. mitis (Sandst.) Hustich – on alvar ground; fqq.
33. C. rangiferina (L.) Nyl. – on alvar ground; fqq.
34. C. stellaris (Opiz) Brodo – on ground in the ruins of an old farm; fqq.
35. Cladonia bacillaris (Leight.) Arnold – on decaying wood; fq.
36. C. botrytes (K. G. Hagen) Willd. – on driftwood on the coast; fqq.
37. C. cariosa (Ach.) Spreng. – on alvar ground; fqq.
38. C. cenotea (Ach.) Schaer. – on decaying wood and on alvar ground; fqq.
39. C. coniocraea (Flörke) Spreng. – on decaying wood; fqq.
40. C. cornuta (L.) Hoffm. – on alvar ground among mosses; fqq.
41. C. crispata (Ach.) Flot. – on decaying wood and on alvar ground among mosses; fqq.
42. C. fimbriata (L.) Fr. – on decaying wood; fqq.
43. C. floerkeana (Fr.) Sommerf. – on decaying wood; fqq.
44. C. foliacea (Huds.) Willd. – on alvar ground; st fq.

45. C. FURCATA (Huds.) Schrad. – on soil accumulated on granite rock; fqq.
46. C. GRACILIS ssp. TURBINATA (Ach.) Ahti – on alvar ground among the mosses; fqq.
47. C. MACILENTA Hoffm. – on decaying wood; fqq.
48. C. OCHROCHLORA Flörke – on decaying wood; fq.
49. C. POCILLUM (Ach.) Grognot – on alvar ground; st fq.
50. C. PYXIDATA (L.) Hoffm. – on alvar ground and on soil accumulated on rocks; fqq.
51. C. RANGIFORMIS Hoffm. – on alvar ground; fq.
52. C. SUBRANGIFORMIS Sandst. – on alvar ground; fq.
53. C. SUBULATA (L.) F. H. Wigg. – on decaying wood; fqq.
54. C. SULPHURINA (Michx.) Fr. – on decaying wood; fq.
55. CLIOSTOMUM GRIFFITHII (Sm.) Coppins – on bark of *Betula*, on wood; st fq.
56. COLLEMA CRISTATUM (L.) Weber ex F. H. Wigg. – on calcareous ground; st fq.
57. C. FUSCOVIRENS (With.) J. R. Laundon – on calcareous pebbles, old walls, rocks; fq.
58. C. TENAX (Sw.) Ach. – on alvar ground; st fq.
59. DIPLOSCHISTES MUSCORUM (Scop.) R. Sant. – on mosses and on the thallus of *Cladonia*; st fq.
60. DIPLOTOMMA AMBIGUUM (Ach.) Flagey – on granite rock; rr.
61. D. VENUSTUM Körb. – on calcareous pebble; r.
62. EVERNIA PRUNASTRI (L.) Ach. – on alvar ground; on *Fraxinus excelsior*; fqq.
63. FLAVOCETRARIA NIVALIS (L.) Kärnef. & A. Thell – on alvar ground; fqq.
64. FULGENSIA BRACTEATA (Hoffm.) Räsänen – on alvar ground; fq.
65. HYPOCENOMYCE SCALARIS (Ach.) M. Choisy – on wood; fqq.
66. HYPOGYMNIA FARINACEA Zopf – on *Rhamnus cathartica*; fq.
67. H. PHYSODES (L.) Nyl. – on alvar ground and on the soil accumulated on rocks; fqq.
68. H. TUBULOSA (Schaer.) Hav. – on wood; on the soil accumulated on granite rocks; fqq.
69. IMSHAUGIA ALEURITES (Ach.) S. L. F. Meyer – on wood; fqq.
70. LECANIA CYRTELLA (Ach.) Th. Fr. – on branches of *Viburnum opulus*; fq.
71. LECANORA ALBESCENS (Hoffm.) Branth & Rostr. – on calcareous pebbles and mortar; fqq.
72. L. CARPINEA (L.) Vain. – on *Populus, Ribes, Salix, Sorbus, Viburnum*, also on wood; fqq.
73. L. CHLAROTERA Nyl. – on *Betula, Fraxinus, Ribes, Sorbus, Viburnum*; fqq.
74. L. CONIZAEOIDES Nyl. ex Cromb. – on wood in the ruins of an old farm; st fq.
75. L. CRENULATA Hook. – on calcareous pebbles; st fq.
76. L. DISPERSA (Pers.) Sommerf. – on calcareous pebbles and old walls; fqq.
77. L. HAGENII (Ach.) Ach. – on dry *Fraxinus excelsior*; fqq.
78. L. LEPTYRODES (Nyl.) Degel. – on *Populus tremula*; fqq.
79. L. MURALIS (Schreb.) Rabenh. – on crumbling granite rocks; fqq.
80. L. PULICARIS (Pers.) Ach. – on wood and branches of *Sorbus aucuparia* and *Juniperus communis*; fqq.
81. L. RUGOSELLA Zahlbr. – on *Populus tremula*; fqq.
82. L. RUPICOLA (L.) Zahlbr. – on crumbling granite rocks; fq.
83. L. SULPHUREA (Hoffm.) Ach. – on granite rocks; fq.
84. L. SYMMICTA (Ach.) Ach. – on driftwood on the coast and on dry *Fraxinus excelsior*, fqq.
85. L. VARIA (Hoffm.) Ach. – on wood; on dry tree roots; fqq.
86. LECIDEA FUSCOATRA (L.) Ach. – on crumbling granite rock; st fq.
87. L. LAPICIDA var. PANTHERINA Ach. – on granite rock; st fq.
88. LECIDELLA ELAEOCHROMA (Ach.) Choisy – on *Salix* and on dry *Fraxinus excelsior*; fqq.
89. L. STIGMATEA (Ach.) Hertel & Leuckert – on calcareous pebbles, on eternite; fq.
90. LEPRARIA LOBIFICANS Nyl. – on the shaded side of a granite rock, covered with mosses; fq.
91. LEPTOGIUM LICHENOIDES (L.) Zahlbr. – on mosses growing on an old wall; st fq.
92. MELANELIA EXASPERATA (De Not.) Essl. – on *Salix* and *Fraxinus excelsior*; fq.
93. M. EXASPERATULA (Nyl.) Essl. – on *Fraxinus excelsior*; fqq.
94. M. FULIGINOSA (Fr. ex Duby) Essl. – on granite rock; fqq.
95. M. OLIVACEA (L.) Essl. – on wood and on twigs of *Rhamnus cathartica*; fqq.
96. NEOFUSCELIA LOXODES (Nyl.) Essl. – on granite rock, fqq.

97. N. PULLA (Ach.) Essl. – on granite rock; fqq.
98. PARMELIA SAXATILIS (L.) Ach. – on granite rock, fqq.
99. P. SULCATA Taylor – on crumbling granite rock on alvar; fqq.
100. PARMELIOPSIS AMBIGUA (Wulfen) Nyl. – on wood; fqq.
101. PELTIGERA CANINA (L.) Willd. – on soil and on mossy stones; fqq.
102. P. MALACEA (Ach.) Funck – among mosses on the soil accumulated on granite rock; fq.
103. P. RUFESCENS (Weiss) Humb. – on alvar soil; fqq.
104. PERTUSARIA AMARA (Ach.) Nyl. – on *Sorbus aucuparia*; fqq.
105. P. COCCODES (Ach.) Nyl. – on *Betula pendula*; fqq.
106. PHAEOPHYSCIA ORBICULARIS (Neck.) Moberg – on calcareous rock on alvar; fqq.
107. PHLYCTIS ARGENA (Spreng.) Flot. – on *Sorbus aucuparia*; fqq.
108. PHYSCIA ADSCENDENS (Fr.) H. Olivier – on calcareous and granite rocks; on *Fraxinus excelsior*; fqq.
109. P. CAESIA (Hoffm.) Fürnr. – on granite rocks; fqq.
110. P. DUBIA (Hoffm.) Lettau – on crumbling granite rock; fqq.
111. P. STELLARIS (L.) Nyl. – on *Sorbus* and *Salix*; fqq.
112. P. TENELLA (Scop.) DC. – on *Fraxinus excelsior* and *Salix*; fqq.
113. PHYSCONIA DISTORTA (With.) J. R. Laundon – on *Salix*, on granite rock; fqq.
114. PLACYNTHIELLA ICMALEA (Ach.) Coppins & P. James – on wood; fqq.
115. PLACYNTHIUM NIGRUM (Huds.) Gray – among mosses on calcareous rocks; fq.
116. PLATISMATIA GLAUCA (L.) W. L. Culb. & C. F. Culb. – on a small piece of wood on alvar ground; fqq.
117. PORPIDIA CRUSTULATA (Ach.) Hertel & Knoph – on granite rock; fq.
118. PROTOBLASTENIA CALVA (Dicks.) Zahlbr. – on calcareous pebbles; st r.
119. P. RUPESTRIS (Scop.) J. Steiner – on old walls, on calcareous pebbles; fq.
120. PSEUDEVERNIA FURFURACEA (L.) Zopf – on alvar ground; fqq.
121. RAMALINA FARINACEA (L.) Ach. – on dry bushes; fqq.
122. R. FASTIGIATA (Pers.) Ach. – on *Fraxinus excelsior*, *Salix*, dry trees; fqq.
123. R. FRAXINEA (L.) Ach. – on *Salix*; fqq.
124. R. POLYMORPHA (Lilj.) Ach. – on crumbling granite rock; fq.
125. RAMBOLDIA INSIDIOSA (Th. Fr.) Hafellner – parasitic on *Lecanora varia*; st r.
126. RHIZOCARPON GEOGRAPHICUM (L.) DC. – on granite rock and pebbles; st fq.
127. R. OBSCURATUM (Ach.) A. Massal. – on granite rock and pebbles; st r.
128. R. PETRAEUM (Wulfen) A. Massal. – on calcareous pebbles, on sandstone; r.
129. RIMULARIA INSULARIS (Nyl.) Hertel & Rambold – parasitic on *Lecanora rupicola*; st fq.
130. RINODINA BISCHOFFII (Hepp) A. Massal. – on calcareous pebbles; st fq.
131. R. GENNARII Bagl. – on calcareous pebbles; st r.
132. R. IMMERSA (Körb.) Arnold – on calcareous pebbles; st r.
133. R. SOPHODES (Ach.) A. Massal. – on *Fraxinus excelsior, Rhamnus cathartica* and branches of a dry tree; fq.
134. SCOLICIOSPORUM CHLOROCOCCUM (Stenh.) Vezda – on *Pinus silvestris*; fq.
135. STEREOCAULON TOMENTOSUM Fr. – on alvar ground, on calcareous rocks and old bricks; fqq.
136. TEPHROMELA ATRA (Huds.) Hafellner ex Kalb – on crumbling granite rock; fqq.
137. TONINIA SEDIFOLIA (Scop.) Timdal – on alvar ground; st fq.
138. TRAPELIA PLACODIOIDES Coppins & P. James – on an old brick in the ruins of a farm; rr.
139. TUCKERMANNOPSIS CHLOROPHYLLA (Willd.) Hale – on driftwood on the coast; fqq.
140. UMBILICARIA TORREFACTA (Light.) Schrad. – on crumbling granite rock; st fq.
141. USNEA HIRTA (L.) Weber ex F. H. Wigg. – on driftwood on the coast; fqq.
142. U. SUBFLORIDANA Stirt. – on driftwood on the coast; fqq.
143. VERRUCARIA CALCISEDA DC. – on calcareous pebbles; st r.
144. V. NIGRESCENS Pers. – on calcareous pebbles, on an old wall; fq.
145. VULPICIDA PINASTRI (Scop.) J.-E. Mattsson & M. J. Lai – on an old stump; fqq.
146. V. TUBULOSA (Schaer.) J.-E. Mattsson & M. J. Lai – on alvar ground; st fq.

147. XANTHOPARMELIA CONSPERSA (Ach.) Hale – on granite rock; fqq.
148. X. SOMLOËNSIS (Gyeln.) Hale – on granite rock; st fq.
149. XANTHORIA CANDELARIA (L.) Th. Fr. – on granite rock; fqq.
150. X. PARIETINA (L.) Th. Fr. – on granite rocks; fqq.
151. X. POLYCARPA (Hoffm.) Rieber – on twigs of *Populus tremula, Salix, Rosa*; fqq.
152. XYLOGRAPHA PARALLELA (Ach.: Fr.) Behlen & Desberg – on driftwood on the coast; rr.

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The genus *Lepraria* (*Lichenes imperfecti*) in Estonia

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Abstract: Ten species of the genus *Lepraria* are reported from Estonia – *Lepraria borealis*, *L. crassissima*, *L. eburnea*, *L. elobata*, *L. frigida*, *L. incana*, *L. jackii*, *L. lobificans*, *L. neglecta* and *L. umbricola*. A key to these species is presented together with short descriptions, distribution and substrata in Estonia.

Kokkuvõte: Lauri Saag & Andres Saag. Löövesamblikud Eestis (teissamblikud).

Eestist on praeguseks teada 10 löövesambliku (*Lepraria*) liiki – *Lepraria borealis*, *L. crassissima*, *L. eburnea*, *L. elobata*, *L. frigida*, *L. incana*, *L. jackii*, *L. lobificans*, *L. neglecta* ja *L. umbricola*. Esitatakse nende liikide määramistabel, lühikirjeldused ja andmed leviku ning kasvukoha kohta Eestis.

INTRODUCTION

The first checklist of Estonian lichens included eight *Lepraria* species: *L. aeruginosa*, *L. candelaris*, *L. chlorina*, *L. cinereosulphurea*, *L. farinosa* and *L. incana* (Trass, 1970). Today *L. candelaris and L. chlorina* are transferred to the genus *Chrysothrix* Mont.; the name *L. aeruginosa* has been commonly misapplied to *L. incana* (Laundon, 1992), and *L. cinereosulphurea* and *L. farinosa* are excluded because the identity of these taxa is uncertain.

Thus only one species from among the eight – *L. incana* – is now recognized in Estonia in this genus; two further species were recently reported from our territory by the Swedish lichenologists: *L. eburnea* and *L. lobificans* (Thor & Nordin 1998).

All species in *Lepraria* are asexual and have neither ascomata nor conidiomata; their morphology is also rather primitive and only a few morphological characters can be used to describe the taxa. The most important morphological features are: the character of hyphae in the soredia (loosely or tightly packed); the presence of medulla; the presence and length of hyphae projecting out from the soredia. A number of characters which are easily recognized – e.g. the colour of the thallus and diameter of the soredia – are infraspecifically too variable and therefore not representative for the identification of species (Table 1).

Secondary chemistry of *Lepraria* species is – contrary to the morphology – complicated and advanced, with several substances in every taxon. Most of the species have their unique chemotype (although accessory compounds also occur); determination of the chemotype using TLC is of great help in identification the species (Fig. 1).

Species of *Lepraria* are not strongly substrate specific: taxa usually growing on rocks can also inhabit bark of the trees or ground, and *vice versa*. They often overgrow mosses and thalli of other lichens. Bark of coniferous and deciduous trees, mosses, lichens, soil, granite, calcareous rocks and sandstone – everything is suitable substrate for *Lepraria*. Shaded and moist localities are especially suitable for the species of this genus. Specimens of different taxa can grow closely together without any visible border, and this makes the identification still more complicated (Tønsberg 1992).

MATERIALS AND METHODS

Estonian herbarium materials from International Center for Environmental Biology, Tallinn (ICEB), Institute of Ecology, Tallinn University of Educational Sciences (IE) and Institute of Botany & Ecology, University of Tartu (TU) have been used for the present study. Reference specimens were received from the Botanical Museum, University of Lund (LD) and from the Botanical Museum, University of Helsinki (H); some unidentified Estonian specimens from H have also been included. Altogether, over 400 specimens have been studied; 360 of them have been chemically analysed using standardized

Table 1. Main characters of the Estonian *Lepraria* species. "+" — substance always present; "(+)" — substance may occur; "((+))" — rare substance; "–" — absence of substance.

Character	*L. borealis*	*L. crassissima*	*L. eburnea*	*L. elobata*
Color of thallus	White or light grey	Green or greenish grey	Whitish grey with greenish to yellowish tinge	Grey or greenish grey
Thallus type; marginal lobes	Granular; obscure marginal lobes	Leprose; obscure marginal lobes	Byssoid; no marginal lobes	Leprose; no marginal lobes
Hyphae in soredia	Loosely packed	Loosely packed	Loosely packed	Loosely packed
Diameter of soredia	~70 µm	60-90(100) µm	up to 200 µm	30-40 µm
Projecting hyphae from soredia	Short or absent	Long	Short	Short
Medulla		May be present	Thick, white	Absent
Substrate	Rock (often on mosses)	Saxicolous or corticolous; sometimes on mosses	Saxicolous, corticolous, muscicolous	Corticolous or saxicolous
Colour tests	C-; K±; Pd-	C+ red; K-; Pd-	C-; KC+ orange; K± yellow; Pd+ orange or yellow becoming orange	C-;K+ yellow; Pd+ yellowish orange
Substances				
Alektorialic acid	–	–	+	–
Atranorin	+	–	(+)	+
Stictic acid complex	–	–	–	+
Divaricatic acid	–	+	–	–
Nordivaricatic acid	–	+	–	–
Protocetraric acid	–	–	+	–
Rangiformic acid	+	–	–	–
Roccellic acid	(+)	–	–	–
Thamnolic acid	–	–	–	–
Zeorin	–	+	(+)	(+)

L. frigida	*L. incana*	*L. jackii*	*L. lobificans*	*L. neglecta*	*L. umbricola*
White or yellowish grey	Green or greenish grey	Light green	Light green	Dark or light grey	Greenish grey or green
Byssoid; obscure marg. lobes may be present	Leprose; no marginal lobes	Leprose; no marginal lobes	Byssoid; no marginal lobes	Granular; obscure marg. lobes may be present	Leprose; no marginal lobes
Loosely packed	Loosely packed	Loosely packed	Loosely packed	Tightly packed	Loosely packed
60-80(150) µm	50(100) µm	~40 µm	~50 µm	~100(300) µm	up to 100 µm
Short	Short or medium	Short	Long	Absent	Short
White	May be present	White, thick	Always present	Greyish white	Absent
Corticolous, saxicolous or muscicolous, on soil	Corticolous, saxicolous, lignicolous; on soil	Corticolous or muscicolous, rarely saxicolous	On mossy bark or rock; sometimes on the ground	Saxicolous (usually on granite)	Corticolous, saxicolous, lignicolous
C-; KC+ orange; K± yellow; Pd+ lemon yellow	C-; K± red; Pd- or rarely + orange	C-; K+ yellow; Pd-	C-; KC± yellow K± yellow; Pd+ orange	C+red; K±; Pd+ yellow	C-; KC-; K+ yellow; Pd+ orange

+	–	–	–	+	–
–	(+)	+	+	(+)	–
–	–	–	+	–	–
–	+	–	((+))	–	–
–	((+))	–	–	–	–
–	–	–	–	–	–
–	–	+	–	–	–
–	–	(+)	((+))	(+)	(+)
–	(+)	–	–	–	+
–	+	–	(+)	–	–

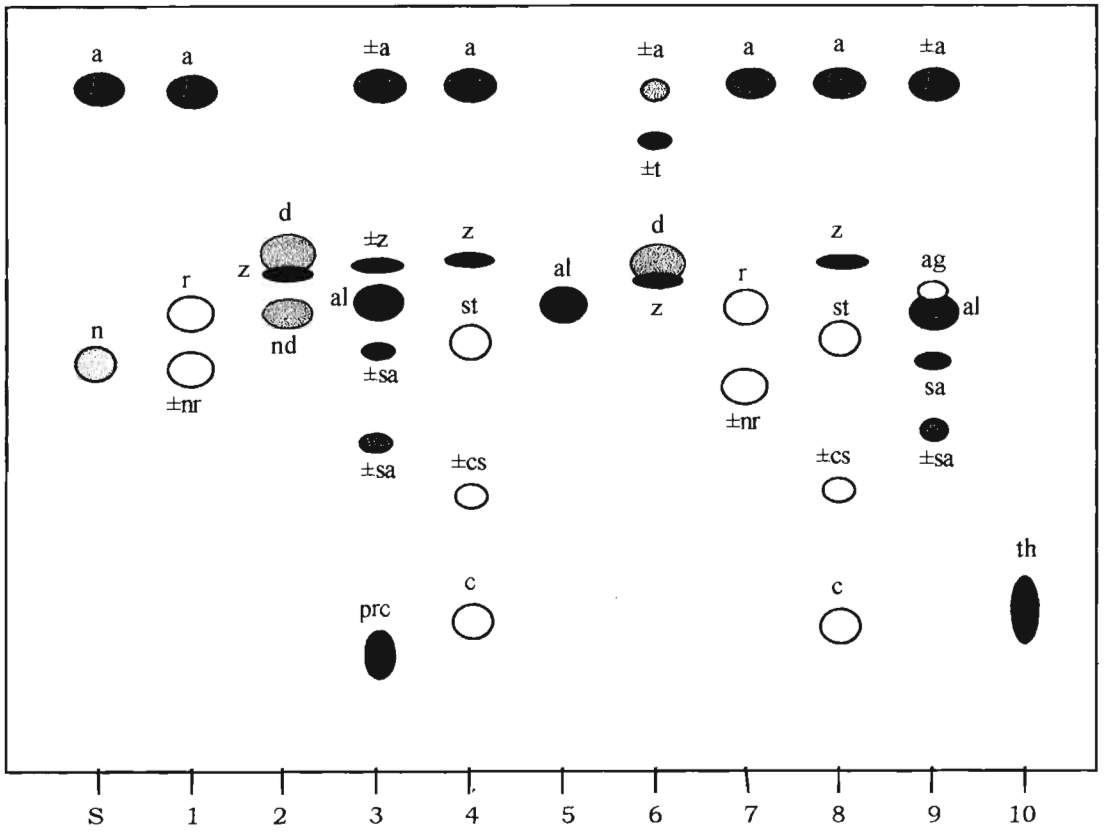

Fig. 1. TLC-chromatograms of the Estonian *Lepraria* species in solvent system A. **S:** control of *Platismatia glauca* and *Pleurosticta acetabulum*; **1:** *Lepraria borealis*; **2:** *L. crassissima*; **3:** *L. eburnea;* **4:** *L. elobata*; **5:** *L. frigida*; **6:** *L. incana*; **7:** *L. jackii*; **8:** *L. lobificans*; **9:** *L. neglecta*; **10:** *L. umbricola*. **a:** atranorin; **ag:** angardianic acid; **al:** alectorialic acid; **c:** constictic acid; **cs:** cryptostictic acid; **d:** divaricatic acid; **nd:** nordivaricatic acid; **nr:** norrangiformic acid; **prc:** protocetraric acid; **r:** rangiformic acid; **sa:** satellitic substance; **st:** stictic acid; **t:** unidentified triterpenoid; **th:** thamnolic acid; **z:** zeorin.

TLC methods (Culberson & Kristinsson 1970, White & James, 1985).

The following publications have been used to compile the descriptions of taxa: Laundon, 1992; Lindblom 1995; Lohtander, 1994; Tønsberg, 1992. Original comments have also been added.

RESULTS

Today we can list 10 *Lepraria* species that occur in Estonia: *Lepraria borealis* Lohtander & Tønsberg; *L. crassissima* (Hue) Lettau; *L. eburnea* (de Lesd.) J. R. Laundon; *L. elobata* Tønsberg; *L. frigida* J. R. Laundon; *L. incana* (L.) Ach.; *L. jackii* Tønsberg; *L. lobificans* Nyl.; *L. neglecta* (Nyl.) Erichsen; *L. umbricola* Tønsberg.

Lepraria species are distributed all over Estonia; more taxa have been collected from the northern coast (coast of the Gulf of Finland), from Saaremaa Island and from the Soomaa National Park (Fig. 2). Some species are quite common in Estonia but the distribution of most of these taxa is still insufficiently studied. Central and southern parts of Estonia are especially poorly investigated.

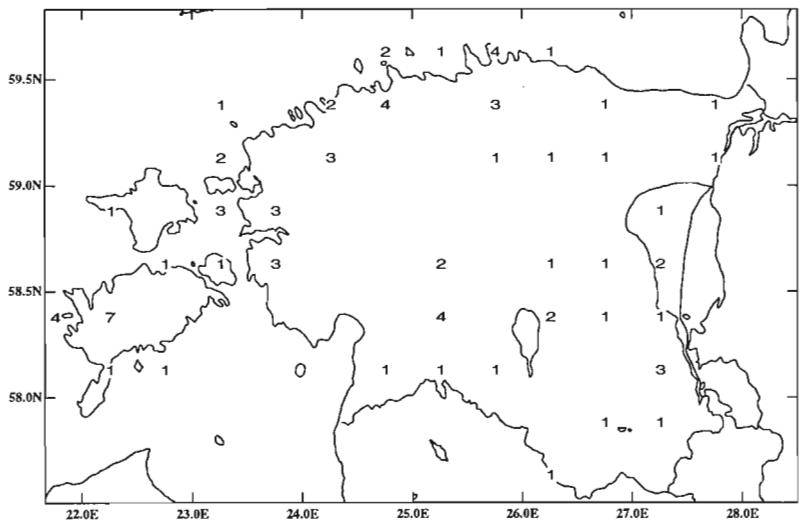

Fig. 2. The known distribution of *Lepraria* species in Estonia. Numbers indicate the abundance of species in the squares (length of the square side is 30' from east to west, and 15' from north to south).

KEY TO THE SPECIES OF THE GENUS *LEPRARIA* IN ESTONIA

1. Thallus granular. 2
- Thallus leprose or byssoid. 3
2.(1) C+ red, Pd+ yellow (alectorialic acid present); forms rosettes, soredia tightly packed, thallus relatively hard. ..... *Lepraria neglecta*
- C-, Pd- (alectorialic acid absent, contains atranorin); soredia loosely packed, thallus relatively soft. ..... *L. borealis*
3.(1) Pd-. 4
- Pd+. 5
4.(3) C+ red, K- (divaricatic and nordivaricatic acids present, rangiformic acid absent); hyphae projecting from soredia long. ..... *L. crassissima*
- C-, K+ yellow (divaricatic and nordivaricatic acids absent, contains atranorin and rangiformic acid); projecting hyphae short. ..... *L. jackii*
5.(3) Pd+ lemon yellow; thallus contains only alectorialic acid (TLC). ..... *L. frigida*
- Pd- or Pd+ orange or red (or + yellow > red); alectorialic acid absent or present together with protocetraric acid (TLC). 6
6.(5) Alectorialic acid present together with protocetraric acid (TLC). ..... *L. eburnea*
- Alectorialic and protocetraric acids absent (TLC). 7
7.(6) Stictic, norstictic, constictic and cryptostictic acids absent (TLC). 8
- Stictic acid present, thallus may also contain norstictic, constictic and/or cryptostictic acids (TLC). 9
8.(7) Divaricatic acid absent, thallus contains only thamnolic acid (TLC). ..... *L. umbricola*
- Divaricatic acid present, thamnolic acid may occur together with divaricatic acid and zeorin (TLC). ..... *L. incana*
9.(7) Medulla thick and soft, always differentiated. ..... *L. lobificans*
- Medulla absent. ..... *L. elobata*

DESCRIPTIONS OF THE SPECIES

Lepraria borealis Lohtander & Tønsberg

Thallus leprose-granular, white or light grey, consisting of quite loosely packed soredia of about 70 μm diam. Short projecting hyphae are usually present in soredia but may also be absent, especially in the centre of the thallus. Forms small rosettes (from a few mm to 2–3 cm diam.); the thallus margin may be obscurely lobed. Medulla may be present (Tønsberg 1992), it was absent or uncertain on the specimens checked.
Chemistry. C-; K± yellow; Pd-. Thallus contains atranorin, rangiformic acid, additionally often norrangiformic acid. Roccellic acid may also be present.
Substrate. L. borealis has been collected mainly from granite in Estonia, one corticolous specimen is also known.
Distribution in Estonia. Known from four localities scattered over the territory. New for Estonia.
Comments. L. borealis and *L. jackii* have almost identical chemistry, but they can be recognized by morphology - *L. jackii* has a leprose soft green thallus while the thallus of *L. borealis* is granular, harder and usually white.
Specimens examined. ESTONIA. Harjumaa Co., Käsmu, 15 July 1974 (TU 6085); Saaremaa Co., Viidumäe, 10 Aug. 1976 (TU 6086); Saaremaa Co., Viidumäe, 29 June 1980 (TU 6087); Jõgevamaa Co., Nütsa, 06 June 1967 (TU 6084). SWEDEN. Skåne, Dalby par., Billebjär; 26 Nov. 1991, T. Lindegren & U. Arup (LD). Skåne, Billebjär; 26 Nov. 1991 (LD).

Lepraria crassissima (Hue) Lettau

Thallus leprose, green to greenish grey; irregularly shaped, usually thick and soft. The soredia are loosely packed, 60-90(100) μm diam.; projecting hyphae are usually long. Still, soredia of various sizes and with projecting hyphae of different length may occur on the same thallus. Medulla may be differentiated. The thallus margins are often lobed.
Chemistry. C+ red; K-; Pd-. Thallus contains zeorin, divaricatic and nordivaricatic acids.
Substrate. Grows on bark, mosses, soil and rocks (prefers calcareous substrate). All Estonian specimens were collected from bark.
Distribution in Estonia. A rare species – known only from the western islands (Saaremaa Island) and northern coast of the mainland. New for Estonia.
Comments. Chemotype of *L. crassissima* is rather similar to that of *L. incana* – both contain divaricatic acid and zeorin as main substances; still, *L. crassissima* always contains also nordivaricatic acid while *L. incana* may include atranorin and an unidentified triterpenoid as accessory compounds. Clear morphological characters of *L. crassissima* enable the identification of this taxon rather surely. The species has been treated as a separate taxon by Poelt (1969), Santesson (1993) and Lindblom (1995).
Selected specimens. ESTONIA. Harjumaa Co., Stroomi, 26 July 1996, L. Martin (ICEB); Saaremaa Co., Viidumäe 13 July 1993, E. Nilson (IE); Saaremaa Co., Vilsandi, 21 July 1979 (TU 6104). SWEDEN. Skåne, Brunnby par., Kullaberg 25 April 1990, L. Lindblom, (LD); Skåne, Riseberga par., Skäralid, 24 April 1990, L. Lindblom (LD).

Lepraria eburnea (de Lesd.) J. R. Laundon

Thallus byssoid; whitish grey with a greenish to yellowish tinge; without marginal lobes. Medulla thick and white. Thallus usually forms a thick irregular crust on the substrate. Loosely packed soredia (up to 200 μm diam.) are sparsely cowered by hyphal material; projecting hyphae are usually short.
Chemistry. C-; KC+ reddish orange; K- or + yellow; Pd+ yellow, turns slowly or immediately orange. Thallus contains alectorialic and protocetraric acids, sometimes barbatolic acid, rarely atranorin and/or zeorin.
Substrate. Grows both on bark and rock, sometimes may grow over mosses and other lichens. In Estonia collected from bark and mosses.
Distribution in Estonia. Six localities scattered over the territory.
Comments. L. eburnea is morphologically similar to *L. frigida* but can easily be chemically separated from that species.
Selected specimens. ESTONIA. Harjumaa Co., Keila; 08 Aug. 1960 (TU 6110); Järvamaa Co., Kõrveküla; 05 Aug. 1994, L. Martin (ICEB); Tartumaa Co., Alatskivi, 20 Sept. 1958 (TU 6109); Viljandimaa Co., Vastsemõisa, 19 Sept. 1998, (TU 6111); Viljandimaa Co., Vastsemõisa, 19 Sept. 1998 (TU 6112). FINLAND. Vanda,

Västerkulla, Råbacka; 26 Aug. 1979, R. Pekanpalo (H 10859); Kisko, Orijärvi, Korkianiemi, 2 Nov. 1969, O. Vitikainen (H 11827).

Lepraria elobata Tønsberg

Thallus leprose; grey to greenish grey, often with bluish tinge; usually thin, sometimes thick; irregulary shaped. Soredia more or less loosely arranged, projecting hyphae short. Soredia relatively small (diam. 30–40 μm). Without medulla and marginal lobes.
Chemistry. C-; K+ yellow; Pd+ yellowish orange. Contains atranorin, zeorin and stictic acid, often also norstictic, constictic and/or cryptostictic acids.
Substrate. Usually grows on naked bark, sometimes on rock or soil. In Estonia the species is collected from bark (both of coniferous deciduous trees) and rock (granite).
Distribution in Estonia. Five localities are known, four of them from the western coast of the mainland and the western islands. New for Estonia.
Comments. L. elobata has the same chemistry as *L. lobificans* but differs from it morphologically – the former has no medulla, while the medulla of the latter is thick and always differentiated; in addition, the projecting hyphae of *L. lobificans* are much longer than those of *L. elobata*.
Selected specimens. ESTONIA. Läänemaa Co., Haapsalu; 16 Sept.1995, L. Martin (ICEB); Läänemaa Co., Vormsi, Hoitberg, July 1982 (TU 6058); Saaremaa Co., Leisi, Nov. 1995, E. Nilson (IE); Saaremaa Co., Viidumäe, 18 Aug. 1976 (TU 6059). SWEDEN. Skåne, Riseberga par., Skäralid; 24 April 1990, L. Lindblom (LD); Skåne, Veberöd par., Rokmeleklint; 04 Feb. 1990, L. Lindblom (LD).

Lepraria frigida J. R. Laundon

Thallus byssoid; white or yellowish grey; irregularly shaped; thin or thick. Diameter of the loosely packed soredia 60–80(150) μm; projecting hyphae short. Soredia are covered by hyphal material forming a loose network. Medulla white. Laundon (1992) mentions obscure marginal lobes but these have not been observed on the Estonian material.
Chemistry. C-; KC± reddish orange; K± pale yellow; Pd+ lemon yellow. Thallus contains alectorialic acid.
Substrate. Grows on bark (deciduous trees preferred), also on rock and soil. In Estonia collected from the bark of deciduous trees and from wood.
Distribution in Estonia. Four localities scattered over the mainland of Estonia. New for Estonia.
Comments. Morphologically *L. frigida* resembles *L. eburnea* but dissimilarly to *L. frigida* the latter always contains protocetraric acid (performing Pd+ reddish orange).
Specimens examined. ESTONIA. Ida-Virumaa Co., Hirmuse; 26 June 1961 (TU 6107); Jõgevamaa Co., Kursi, 10 Jan. 1999 (TU 6108); Läänemaa Co., Sipa 08 Aug. 1963 (TU 6106); Pärnumaa Co., Mustla, 24 Sep. 1996, L. Martin (ICEB). FINLAND. Juuka, Polvela, 06 Apr. 1971, K. Takala (H 15472).

Lepraria incana (L.) Ach.

Thallus leprose; green or greenish grey; irregularly shaped, sometimes areolate, thin or thick; without marginal lobes. Medulla may be differentiated. Soredia 50(100) μm in diam., loosely packed, projecting hyphae short or of medium size.
Chemistry. C-; K± red; Pd- or rarely + orange (Laundon 1992). Thallus contains divaricatic acid and zeorin, sometimes atranorin, rarely thamnolic acid; according to Laundon (1992) parietin, gyrophoric acid and traces of nordivaricatic acid may also occur (not found in Estonia).
Substrate. Usually grows on bark, sometimes on soil, rocks or wood. In Estonia mainly collected from the bark of coniferous and deciduous trees, rarely also from wood and soil.
Distribution in Estonia. Common in Estonia, most of the localities are on islands and on the northern part of the mainland.
Comments. L. incana is variable in morphology but chemically it is rather uniform. The species can be confused with *L. elobata* and rarely with *L. umbricola* without TLC.
Selected specimens. ESTONIA. Hiiumaa Co., Kõpu, 20 June 1957 (TU 6069); Hiiumaa Co., Sarve, 28 July 1998, E. Nilson (IE); Tartumaa Co., Tartu, Raadi 17 March 1973, (TU 6073); Põlvamaa Co., Taevaskoja, 27 Apr. 1991, T. Ahti

49684 (H). Lääne-Virumaa Co., Palmse, 5 Oct. 1977, T. Ahti 32213 (H). SWEDEN. Skåne, Sövde par., Sövdeborg; 02 Apr. 1990, L. Lindblom (LD); Skåne, Örkened par., Nytebodaskogen, 14 June 1990, L. Lindblom (LD); Skåne, Brunnby par., Kullaberg, 25 Apr. 1990, L. Lindblom (LD).

Lepraria jackii Tønsberg

Thallus leprose; light green; usually thick and soft; irregularly shaped. Soredia about 40 μm in diam., loosely packed, projecting hyphae are short. Medulla white, usually relatively thick but may be absent in some parts of the thallus. No marginal lobes observed.
Chemistry. C-; K+ yellow; Pd -. Thallus contains atranorin and rangiformic acid, sometimes roccellic or norrangiformic acids.
Substrate. Common on the bark of *Picea* or *Pinus*, sometimes on mosses and on deciduous trees, rarely saxicolous. In Estonia grows mainly on coniferous trees, rarely on deciduous trees, occasionally over mosses.
Distribution in Estonia. Rather frequent species, scattered on the mainland. New for Estonia.
Comments. L. jackii has the same chemistry as *L. borealis* but differs from it morphologically – soredia of *L. jackii* are smaller, with longer projecting hyphae, and its thallus is usually green while *L. borealis* is grey or white.
Selected specimens. ESTONIA. Harjumaa Co., Naissaar, 23 July 1996, L. Martin (ICEB); Harjumaa Co., Tallinn, Pääsküla, 21 June 1957 (TU 6082); Ida-Virumaa Co., Alutaguse-Kivinõmme, 22 Sept. 1995, L. Martin (ICEB); Tartumaa Co., Tartu, Tähtvere, 18 Aug. 1948, (TU 6081); Valgamaa Co., Aheru lake, 27 July 1994 (TU 6083). SWEDEN. Skåne, Veberöd par., Romeleklint, 02 Apr. 1990, L. Lindblom (LD). NORWAY. Nord-Trøndelag, Flatanger, Røythaugfjellet, 27 July 1993, L. Lindblom (LD).

Lepraria lobificans Nyl.

Thallus byssoid; usually light green; irregularly shaped, thick and soft. Soredia loosely packed (ca 50 μm in diam.), projecting hyphae long. Medulla is always differentiated, thick and soft. Thallus margins are not lobed.
Chemistry. C-; KC± yellow; K± yellow (Laundon 1992) or K+ (Kümmerling & Leuckert 1993); PD+ orange. Thallus contains atranorin, zeorin and stictic acid, often also norstictic, cryptostictic, connorstictic or constictic acids.
Substrate. On mossy bark (both of coniferous and deciduous trees), on rock, sometimes on soil. In Estonia it has been collected from bark, sandstone, mosses and soil.
Distribution in Estonia. A common species that occurs all over the territory.
Comments. Chemically identical with *L. elobata*. Still, *L. lobificans* has always a well differentiated medulla, while *L. elobata* has not.
Selected specimens. ESTONIA. Ida-Virumaa Co., Toila, July 1994 (TU 6054); Läänemaa Co., Ridala, 21 July 1960 (TU 6051); Põlvamaa Co., Kiidjärve, 23 Nov. 1958 (TU 6057); Saaremaa Co., Abruka, 02 July 1980 (TU 6039); Saaremaa Co., Viidumäe, 11 Aug. 1973 (TU 6041). SWEDEN. Skåne, Sövde par., Sövdeborg, 02 Apr. 1990, L. Lindblom (LD); Skåne, Para par., Torup, 20 Apr. 1990, L. Lindblom (LD).

Lepraria neglecta (Nyl.) Erichsen

Thallus granular; dark or light grey, with reddish tinge in old herbarium specimens (Lohtander 1994); forms small rosettes (up to 4–5 cm). Soredia 100(300) μm in diam., tightly packed, no projecting hyphae. The thallus margins may be obscurely lobed. Medulla greyish white (Laundon 1992).
Chemistry. C+ red; KC+ red; K± yellow (Kümmerling et al. 1993); Pd+ yellow. Thallus contains alectorialic acid and its satellite substances, usually angardianic acid, rarely gyrophoric acid and/or atranorin.
Substrate. Saxicolous, often overgrowing mosses. All Estonian specimens have been collected from granite.
Distribution in Estonia. Five localities on the western islands, evidently not rare in this region.
Comments. L. neglecta may resemble *L. borealis* but is chemically easily distinguished from the latter.
Selected specimens. ESTONIA. Hiiumaa Co., Sarve, 28 July 1998, E. Nilson (IE). Läänemaa Co., Vormsi, Diby; July 1987 (TU 6114); Saaremaa Co., Viidumäe, 18 Aug. 1976 (TU 6093); Saaremaa Co., Vilsandi, 30 May 1981 (TU 6096). SWEDEN. Skåne, Veberöd par., Romeleklint, 02 Apr. 1990, L. Lindblom (LD); Skåne, Dalby par., Billebjär, 02 Apr. 1990, L. Lindblom (LD); Skåne, S. Mellby par., Stenshuvud, 05 Apr. 1990, L. Lindblom (LD).

Lepraria umbricola Tønsberg

Thallus leprose; greenish grey or green; usually thin, irregularly shaped. Soredia up to 100 μm in diam., loosely packed, projecting hyphae short. Medulla not differentiated. The thallus margins not lobed.

Chemistry. C-; KC-; K± yellow; Pd+ orange. Thallus contains thamnolic acid; according to Laundon (1992) roccellic acid sometimes occurs.

Substrate. Grows in shaded and humid habitats on acid rocks, soil, mosses and tree bases. In Estonia collected mostly from bark, rarely from wood and sandstone.

Distribution in Estonia. Rather rare, all known localities are on the mainland. New for Estonia.

Comments. L. umbricola is morphologically similar to *L. incana* but unlike the latter does not contain divaricatic acid nor zeorin.

Selected specimens. ESTONIA. Harjumaa Co., Vihasoo, 14 Aug. 1995, L. Martin (ICEB); Läänemaa Co., Hanila 15 Sept. 1995, L. Martin (ICEB); Põlvamaa Co., Meeksi, 20 Oct. 1957 (TU 6088); Viljandimaa Co., Karksi, 11Aug. 1967 (TU 6092). SWEDEN. Skåne, Brunnby par., Kullaberg, 25 Apr. 1990, L.Lindblom (LD); Skåne, Örkened par., Nytebodaskogen 14 June 1990, L. Lindblom (LD).

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Comparison of the lichen flora of different broad-leaved trees in Estonia

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Abstract: Lichen floras of the English oak (*Quercus robur*), small-leaved lime (*Tilia cordata*), European ash (*Fraxinus excelsior*), Norway maple (*Acer platanoides*) and Scotch elm (*Ulmus glabra*) were compared. These tree species can be divided into two groups on the basis of the frequency of lichen species and the percentages of lichen species with different ecological indication values – oak and lime constitute one group, and ash, maple and elm another. This result could be considered as the basis for choosing sample trees and interpreting the data upon estimating the air quality by epiphytic lichens.

Kokkuvõte: E. Sander. Laialehiste puude samblikufloorade võrdlus Eestis.

Võrreldi hariliku tamme (*Quercus robur*), hariliku pärna (*Tilia cordata*), hariliku saare (*Fraxinus excelsior*), hariliku vahtra (*Acer platanoides*) ja hariliku jalaka (*Ulmus glabra*) samblikufloorat. Need puuliigid võib samblike esinemissageduse ja erinevate ökoloogiliste näitarvudega samblike osatähtsuse alusel jagada kahte gruppi – pärn ja tamm ning saar, vaher ja jalakas. Tulemus võiks olla proovipuude valiku ja andmete interpreteerimise aluseks õhu saastatuse lihhenoindikatsioonilisel kaardistamisel.

INTRODUCTION

Most studies dealing with the epiphytic differentiation have addressed conifers versus broad-leaved trees or smooth- versus rough-barked trees, but the differentiation between similar tree species has received little attention (Loppi & Putorti, 1995). These authors compare the lichen flora of lime and oak trees in Italy. Watson et al. (1988) present some data about the similarity of the lichen flora of broad-leaved trees on the British Isles. Sõmermaa (1972) has compared the lichen flora of the pine, fir, birch and alder in Estonian forests.

The aim of this paper is to compare the lichen flora of the English oak (*Quercus robur* L.), small-leaved lime (*Tilia cordata* Mill.), European ash (*Fraxinus excelsior* L.), Norway maple (*Acer platanoides* L.) and Scotch elm (*Ulmus glabra* Huds. emend. Moss) in the former manor parks in Estonia.

The lichen flora of the lime has been investigated by Liiv (1987) in connection with estimating the air quality by lichens. The distribution of lichen species on the lime and maple in Estonia has been mapped by Liiv & Sander (1998).

The results of the comparison of the lichen flora of the oak, lime, ash, maple and elm are useful to take into consideration upon interpreting the data of the estimation of air quality by lichens, if several of the above-mentioned trees have been used as sample trees.

MATERIAL AND METHODS

This study is based on the data collected during field works in 1984–1990. Lichen flora was investigated on the trunks of 341 oaks, 378 limes, 308 ashes, 396 maples and 196 elms growing in former manor parks outside towns (Fig.1). In every park 2-5 sample trees from each species were examined. Mapping of the distribution of lichen species was carried out according to standardized methods (Liiv, 1987). Straight trees without injuries, with the circumference of 100–130 cm, growing outside the area directly influenced by the road dust were chosen as sample trees. All lichens growing on the trunks of the sample trees at the height of 0,5–2 m were registered.

The comparison of the lichen flora of the oak, lime, ash, maple and elm is based on the frequency of lichen species and the percentages of lichen species with different indication values characterising the preference of lichen species

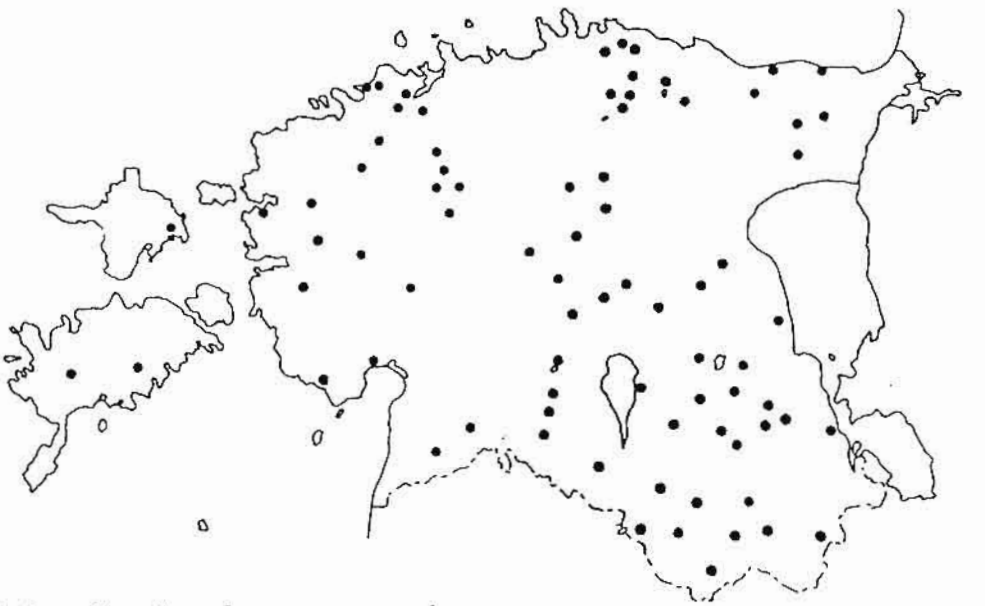

Fig. 1. Sampling sites – former manor parks.

in relation to the acidity and the content of nutrient minerals (Wirth, 1991) on every tree species. The frequency of a lichen species means the percentage of sample trees carrying this lichen species in all sample trees. The percentages of lichen species with different indication values are calculated taking into consideration the number of all lichen records and the number of records of lichens with the certain indication value. A lichen record means an occurrence of a lichen species on a sample tree. Only the lichen species which occurred with the frequency of at least 10% on at least one tree species were taken into account. The nomenclature of lichens follows Trass and Randlane (1994) and Santesson (1993).

RESULTS

The species composition of the lichen flora of the oak, lime, ash, maple and elm is rather similar. All the lichen species treated in this study were found on all the tree species (Table 1). The most frequent lichen species were *Phlyctis argena*, *Anaptychia ciliaris*, *Ramalina farinacea* and *Physcia tenella* – the frequency of these lichens was over 50% on all the tree species.

Lichens on the oak. Seven lichen species occur on the oak with the frequency of over 50%. *P. argena*, *R. farinacea*, *Parmelia sulcata*, *Evernia prunastri* and *Ramalina pollinaria* grow mostly on the moderately acid mesotrophic bark – their indication value of the acidity of the substrate R is 4–5 and that of the content of nutrient minerals N is 3–4. *P. tenella* and *A. ciliaris* prefer subneutral eutrophic bark (R 6–7 and N 5–6) (Table 1).

The lichens which prefer acid and moderately acid bark (R 1–5) constitute 59% of the lichen records on the oak. The lichens which prefer subneutral and neutral bark (R 6–8) account for 41% (Table 2). The proportion of the lichens which prefer oligotrophic and mesotrophic bark (N 1–4) is 61% and that of the lichens preferring eutrophic and eutrophicated bark (N 5–7) is 39% (Table 3).

Lichens on the lime. The same seven lichen species with the frequency of over 50% were detected on the lime and on the oak. On the lime also *L. carpinea* which prefers moderately acid mesotrophic bark (R 5, N 3) occurred with the frequency of 56% (Table 1).

The lichens which prefer acid and moderately acid bark (R 1–5) constitute 56% of all the lichen

Table 1. Frequency of lichens on different trees and indication values of the acidity (R) and those of the content of nutrient minerald of the substrate (N) of lichens.

Lichen	Frequency %					R	N
	Oak	Lime	Ash	Maple	Elm		
Anaptychia ciliaris (L.) Körb.	**52***	**55**	**76**	**69**	**54**	7	5
Bacidia rubella (Hoffm.) A. Massal.	6	18	31	25	27	7	5
Buellia punctata (Hoffm.) A. Massal.	48	47	8	26	14	5	5
Candelaria concolor (Dicks.) B. Stein	14	17	2	9	2	6	5
Candelariella xanthostigma (Ach.) Lettau	31	46	49	38	35	5	4
Evernia prunastri (L.) Ach.	**56**	**64**	33	43	36	4	3
Hypogymnia physodes (L.) Nyl.	21	19	7	8	13	3	2
Lecanora allophana Nyl.	1	1	19	3	4	6	4
L argentata. (Ach.) Malme	5	5	36	19	13	5	3
L. carpinea (L.) Vain.	43	**56**	26	30	22	5	3
L. chlarotera Nyl.	13	9	15	10	5	6	4
L. expallens Ach.	14	14	2	3	2	4	4
L. hageníi (Ach.) Ach.	9	14	18	18	13	8	6
Lecidella elaeochroma (Ach.) M. Choisy	15	16	23	12	8	5	4
Lepraria incana (L.) Ach.	34	27	1	5	6	3	3
Melanelia exasperatula (Nyl.) Essl.	30	29	23	41	22	5	4
M. glabratula (Lamy) Essl.	22	13	7	10	11	3	3
M. subargentifera (Nyl.) Essl.	15	22	29	34	44	7	6
Parmelia sulcata Taylor	**80**	**76**	47	**69**	**67**	5	4
Pertusaria albescens (Huds.) M. Choisy	34	42	30	29	16	6	4
P. amara (Ach.) Nyl.	13	14	7	4	2	3	2
Phaeophyscia nigricans (Flörke) Moberg	3	6	16	12	14	8	7
P. orbicularis (Neck.) Moberg	14	25	**53**	**65**	**60**	7	7
Phlyctis argena (Spreng.) Flot.	**98**	**99**	**89**	**92**	**90**	4	3
Physcia adscendens (Fr.) H. Olivier	4	6	8	21	20	7	6
P. aipolia (Ehrh. ex Humb.) Fürnr.	4	6	16	9	6	7	5
P. tenella (Scop.) DC.	**61**	**65**	**74**	**87**	**83**	6	6
Physconia distorta (With.) J. R. Laundon	31	29	**71**	**65**	**66**	7	6
P. enteroxantha (Nyl.) Poelt	36	46	**52**	**81**	**61**	6	5
P. perisidiosa (Erichsen) Moberg	26	36	39	**66**	**65**	6	4
Ramalina farinacea (L.) Ach.	**88**	**62**	**71**	**80**	**73**	5	3
R. fastigiata (Pers.) Ach.	11	11	14	15	14	6	5
R. fraxinea (L.) Ach.	40	46	36	**55**	40	6	5
R. pollinaria (Westr.) Ach.	**52**	**62**	**52**	**65**	47	4	4
Xanthoria candelaria (L.) Th. Fr.	10	13	5	20	9	6	7
X. parietina (L.) Th. Fr.	41	45	**81**	**74**	**74**	7	6
X. polycarpa (Hoffm.) Th. Fr. ex Rieber	28	29	11	49	21	6	6

*Frequencies over 50% are printed in **bold.**

Table 2. Percentage of lichens with different indication values of the acidity of the substrate (R) on different trees.

R	Oak	Lime	Ash	Maple	Elm
1–3	8.2	6.5	1.9	2.0	2.7
4	19.8	19.6	14.9	14.9	15.1
5	31.0	29.6	24.0	23.1	21.9
6	24.8	25.8	25.2	31.1	27.5
7–8	16.2	18.5	34.0	28.8	32.8

Table 3. Percentage of lichens with different indication values of the content of nutrient minerals of the substrate (N) on different trees.

N	Oak	Lime	Ash	Maple	Elm
1-2	3.1	2.7	1.2	0.9	1.2
3-4	58.1	56.3	47.7	45.1	44.9
5-6	36.3	37.4	44.8	46.8	46.7
7	72.4	3.6	6.3	7.2	7.2

records on the lime. The lichens which prefer subneutral and neutral bark (R 6–8) account for 44% (Table 2). The proportion of the lichens which prefer oligotrophic and mesotrophic bark (N 1–4) is 59% and that of the lichens preferring eutrophic and eutrophicated bark (N 5–7) is 41% (Table 3).

Lichens on the ash. Nine lichen species occur on the ash with the frequency of over 50%. *A. ciliaris, Phaeophyscia orbicularis, P. tenella, Physconia distorta, P. enteroxantha* and *Xanthoria parietina* prefer subneutral eutrophic bark (R 6–7, N 5–7). *P. argena, R. farinacea* and *R. pollinaria* prefer moderately acid mesotrophic bark (R 4–5, N 3–4) (Table 1).

The lichens which prefer subneutral and neutral bark (R 6–8) constitute 59% of all the lichen records on the ash, whereas those preferring acid and moderately acid bark (R 1–5) constitute 41% (Table 2).

The proportion of the lichens which prefer eutrophic and eutrophicated bark (N 5–7) is 51% and that of the lichens preferring oligotrophic and mesotrophic bark (N 1–4) is 49% (Table 3).

Lichens on the maple. Twelve lichen species occur on the maple with the frequency of over 50%. *A. ciliaris, P. orbicularis, P. tenella, P. distorta, P. enteroxantha, R. fraxinea* and *Xanthoria parietina* prefer subneutral eutrophic bark (R 6–7, N 5–7) and *P. perisidiosa* prefers subneutral mesotrophic bark (R 6, N 4). *P. argena, P. sulcata, R. farinacea* and *R. pollinaria* prefer moderately acid mesotrophic bark (R 4–5 and N 3–4) (Table 1).

The lichens which prefer subneutral and neutral bark (R 6–8) account for 60% in all lichen records on the maple. The lichens preferring acid and moderately acid bark (R 1–5) constitute 40% (Table 2). The proportion of the lichens which prefer eutrophic and eutrophicated bark (N 5–7) is 54% and that of the lichens preferring oligotrophic and mesotrophic bark (N 1–4) is 46% (Table 3).

Lichens on the elm. Ten lichen species were found on the elm with the frequency of over 50%. *A. ciliaris, P. orbicularis, P. tenella, P. distorta, P. enteroxantha* and *X. parietina* prefer subneutral eutrophic bark (R 6–7, N 5–7). *P. perisidiosa*

prefers subneutral mesotrophic bark (R 6, N 4). *P. argena, P. sulcata* and *R. farinacea* prefer moderately acid mesotrophic bark (R 4–5, N 3–4) (Table 1).

The percentage of lichens which prefer subneutral and neutral bark (R 6–8) is 60% of all lichen records on the elm. The lichens preferring acid and moderately acid bark (R 1–5) constitute 40% (Table 2). The lichens which prefer eutrophic and eutrophicated bark (N 5–7) account for 54% and those preferring oligotrophic and mesotrophic bark (N 1–4) for 46% (Table 3).

DISCUSSION

The five broad-leaved tree species studied can be divided into two groups on the basis of the frequency of the lichens and the percentages of lichen species with different ecological indication values – oak and lime constitute one group, and ash, maple and elm another.

Seven lichen species occur with the frequency of over 50% both on the oak and lime (Table 1). Five of them prefer moderately acid mesotrophic bark (R 4–5, N 3–4). *E. prunastri* occurs with the frequency of over 50% only on the oak and lime. Eight lichens occur with the frequency of over 50% on the ash, as well as on the maple and elm; six of them prefer subneutral eutrophic bark (R 6–7, N 5–7). *P. orbicularis, P. distorta. P. enteroxantha* and *X. parietina* occur with the frequency of over 50% only on the ash, maple and elm.

When comparing the percentages of lichens with different ecological indication values among the lichens found on each tree species, the difference between the two tree groups is even more obvious.

The lichen floras of the oak and lime as the trees with the moderately acid mesotrophic bark are rather similar. The lichen species which grow on both oak and lime mostly include species which prefer acid and moderately acid (R 1–5) oligotrophic and mesotrophic (N 1–4) bark. Data concerning the similarities between the lichen floras of these trees can be found also in Loppi & Putorti (1995).

The lichen floras of the maple and elm, trees with subneutral eutrophic bark, also exhibit similar ecological preferences. The lichen species which grow on these trees prefer mostly subneutral and neutral bark (R 6–8) as well as eutrophic and eutrophicated bark (N 5–7). Also Watson et al. (1988) note that the maple carries a lichen flora remarkably similar to that of the elm.

On the basis of the lichen flora, the ash belongs in the same group with the maple and elm. The lichen species which grow on the ash also include mostly those which prefer subneutral and neutral (R 6–8) as well as eutrophic and eutrophicated bark (N 5–7).

The lime and oak as trees with similar lichen floras can be used together as sample trees to estimate the air quality by epiphytic lichens. The same applies to the ash, maple and elm.

When interpretating the data we should take into account that the acidity of the oak bark is somewhat higher than that of the lime bark (Wirth, 1995). For that reason lichens growing on the oak are a little more sensitive to acid pollution than lichens growing on the lime.

The barks of the maple and elm are subneutral and eutrophic (Wirth, 1995). For that reason lichens growing on the maple and elm should be a little more tolerant of acid pollution than those growing on the oak and lime.

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Lichenicolous fungi from the Putorana plateau, Siberian Subarctic

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Abstract: 46 species of lichenicolous fungi and one lichenicolous lichen from 26 genera are reported from the subarctic Putorana Plateau in north Central Siberia. *Dactylospora rhyparizae, Epibryon conductrix, Neolamya peltigerae, Nesolechia cetraricola, Protothelenella santessonii,* and *Stigmidium rivulorum* are new to Russia.

Kokkuvõte: M. P. Zhurbenko ja J. Hafellner. Putorana platoo (Siberi subarktika) lihhenikoolsed seened.

Putorana platoolt Kesk-Siberi põhjaosas on teada 46 lihhenikoolset seeneliiki ja üks lihhenikoolne samblik. Esindatud on 26 perekonda. *Dactylospora rhyparizae, Epibryon conductrix, Neolamya peltigerae, Nesolechia cetraricola, Protothelenella santessonii,* ja *Stigmidium rivulorum* on esmasleiud Venemaale.

INTRODUCTION

The lichenicolous fungi of the Russian Arctic have traditionally received little attention from lichenologists. Andreev et al. (1996), for example, in a recent literature review of the lichens and lichenicolous fungi of this region, listed only nine lichenicolous fungi, though the same list included 1067 lichen species. Indeed, the first comprehensive study of lichenicolous fungi from the Russian Arctic appeared in the same year (Zhurbenko & Santesson, 1996), and listed 74 species from a region extending from Franz Josef Land to the Chukchi Peninsula. Zhurbenko (1996, 1998) reported a total of 68 species from north Central Siberia, mainly from the Taimyr Peninsula.

In the present paper we report on collections made on the Putorana Plateau, in the vicinity of the Taimyr Peninsula, and in the northernmost Central Siberian uplands. The northern boundary of the plateau corresponds to the northern limit of continuous treeline. The area falls within the "meta-arctic" (Yurtsev, 1977) - a floristically rather homogenous area comprising both the arctic proper, and the adjacent mountain systems. The Putorana Plateau is an elevated basaltic plateau that is dissected by deep and narrow lake valleys. Mean elevation of the plateau is about 1000-1200 m, with the highest peak being 1701 m. The area has a severe Siberian climate (*Atlas Arktiki,* 1985). The mean annual temperature is about - 10° C, with mean daily temperatures exceeding 0° C on 110-120 days each year. The vegetation of the plateau can be subdivided into three altitudinal belts: the northern taiga, the subalpine, and the alpine.

MATERIAL AND METHODS

The specimens reported here were collected by the first author during his studies on the lichen flora of the Putorana Plateau in 1983-1985. As lichenicolous fungi were not a primary focus of his research at that time, the resulting list is doubtless incomplete. Likewise, the host lichens are not always reliably identified. Specimens are on deposited at LE, unless otherwise indicated.

The collection sites

The site numbers appear both in the list of taxa and on the accompanying map (Fig. 1).

1. Center of the Putorana Plateau, southern shore of Ayan Lake, 69° 00' N, 94° 15' E, elev. 470-1300 m.
2. Center of the Putorana Plateau, northern shore of Ayan Lake, 69° 18' N, 93° 35' E, elev. 470-1200 m.
3. Northwest of the Putorana Plateau, eastern shore of Lama Lake at the mouth of the Bunisyak River, 69° 23'N, 91° 39' E, elev. 55-700 m.
4. Northwest of the Putorana Plateau, near the town of Talnakh, 69° 29'N, 88° 32' E, elev. 80-500 m.

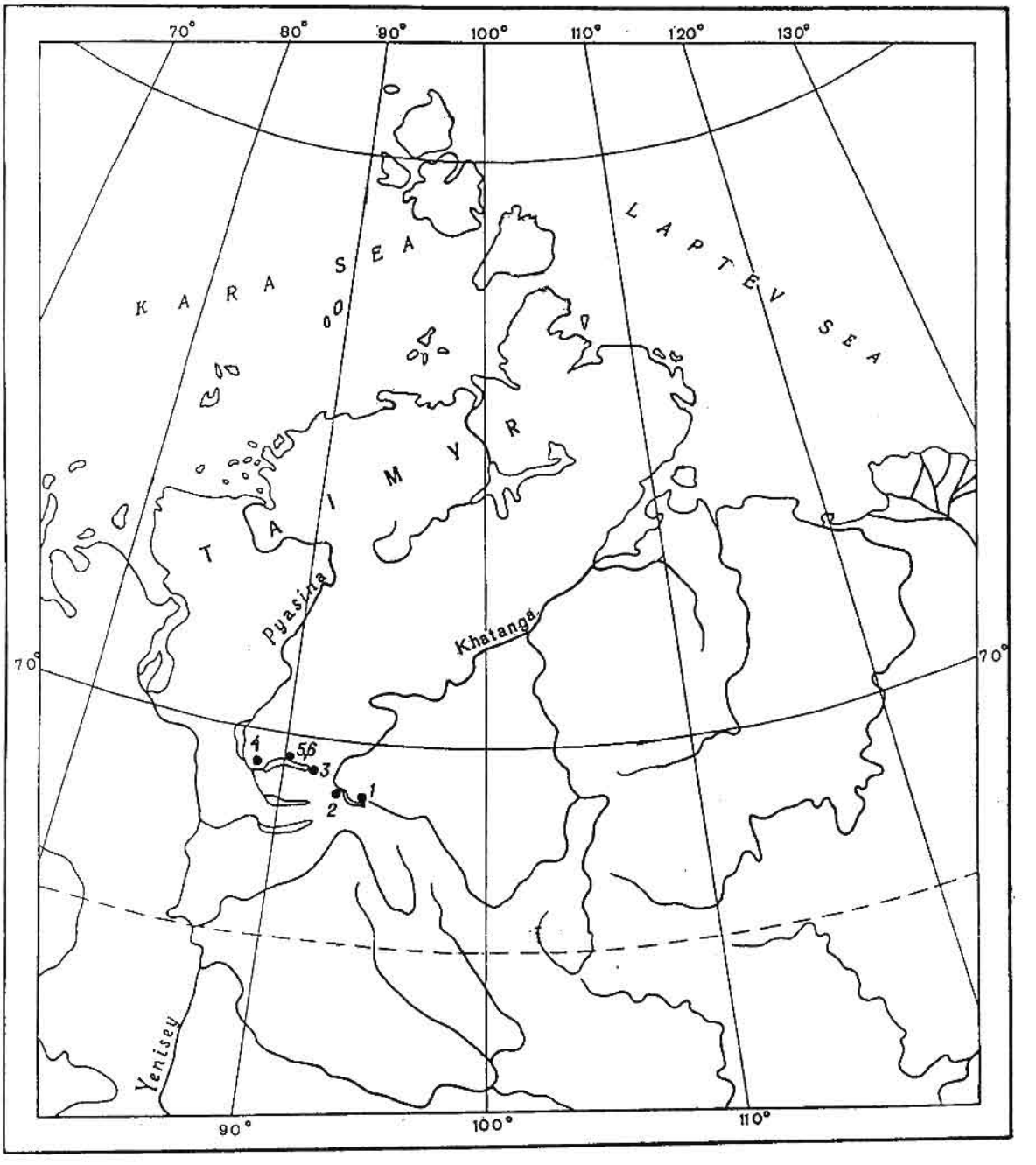

Fig. 1. Location of the Taimyr Peninsula, Siberia, and map of the collection sites. Numbers 1-6 are collection sites listed in Material and Methods section.

5. Northwest of the Putorana Plateau, Kapchuk Lake, 69° 29' N, 91° 00' E, elev. 55-1000 m.
6. Northwest of the Putorana Plateau, central part of Lama Lake, 69° 30' N, 90° 42' E, elev. 55-1200 m.

RESULTS AND DISCUSSION

Our study has yielded 46 species of lichenicolous fungi in 25 genera, as well as one species of endoparasitic lichenicolous lichen. Six of these are new to Russia. Based on these findings, 120 species of lichenicolous fungi in 49 genera are currently known from the Russian meta-arctic (including some unpublished records of the first author).

Annotated list of taxa

The annotations include information on collecting localities (1-6), host lichens, date of collection, collector, known occurrence in the Russian meta-arctic (frequent, rare, very rare, etc.), and some occasional notes. Species denoted by an asterisk are new to Russia.

ABROTHALLUS PARMELIARUM (Sommerf.) Arnold - 5: on *Parmelia* cf. *fraudans* (thallus), 8 VIII 1983, Zhurbenko 83174. Very rare.

ARTHONIA FUSCOPURPUREA (Tul.) R. Sant. - 1: on *Solorina* sp. (thallus), VIII 1984, Zhurbenko 84215. Very rare.

A. MOLENDOI (Frauenf.) R. Sant. - 2: on *Xanthoria elegans* f. *subfruticulosa* Zhurb. (ined.) (thallus), 5 VIII 1984, Zhurbenko 83144; on *Xanthoria elegans* (thallus), 5 VIII 1984, Zhurbenko 83153. Rare.

A. STEREOCAULINA (Ohlert) R. Sant. - 2: on *Stereocaulon alpinum* (thallus), 30 VII 1984, Zhurbenko 84201 (LE 206941). 6: on *Stereocaulon groenlandicum* (thallus), 25 VII 1985, Zhurbenko 8578 (LE 206952). Frequent.

BISPORA CHRISTIANSENII D. Hawksw. - 5: on *Lecanora* sp. (apothecia), VIII 1983, Zhurbenko 8344. Rare.

BUELLIA PULVERULENTA (Anzi) Jatta - 5: on *Phaeophyscia sciastra* (thallus), 2 VIII 1982, A.N.Titov s. n. Rare. B. pulverulenta is a lichen that builds its thallus within the lobes of foliose *Physciaceae* (Hafellner & Poelt 1980). Principally the species shows a bipolar arctic-alpine distribution pattern (Northern Europe: e.g. Fries, 1860, 1867, Stizenberger, 1876, Santesson, 1993, Nordin, 1996, Elvebakk & Hertel, 1997, Purvis et al., 1994; North America: e.g. Hafellner & Poelt, 1980, Noble et al., 1987, Alstrup & Hawksworth, 1990, Thomson, 1997; Central Europe: e.g. Olivier, 1906, Nimis, 1993, Turk & Poelt, 1993, Wirth, 1994; Antarctica: Olech & Alstr p 1996), but it is also known from some Mediterranean mountain ranges (Maire & Werner 1937, Navarro-Rosines & al. 1994, Etayo & Breuss 1996, Nimis & Poelt 1987) and the Canary islands (Hafellner 1995). In Russia it was previously reported from the Krasnoyarsk Territory and Novaya Zemlya (Keissler 1928 as *Leciographa muscigenae*, Zhurbenko 1996).

CARBONEA AGGREGANTULA (Mull. Arg.) Diederich & Triebel ined. - 5: on *Lecanora* cf. *intricata* (margin of apothecia, thallus), 5 VIII 1983, Zhurbenko 83195. Rather rare.

C. VITELLINARIA (Nyl.) Hertel - 1: on *Candelariella vitellina* (apothecia, thallus): 16 VIII 1984, Zhurbenko 84130; 24 VIII 1984, Zhurbenko 8484a. 2: on *Candelariella vitellina* (apothecia, thallus): 1 VIII 1984, Zhurbenko 84211; 9 VIII 1984, Zhurbenko 84208. 5: on *Candelariella vitellina* (thallus), 13 VIII 1983, Zhurbenko 83146; on *Candelariella placodizans* (thallus), 15 VIII 1983, Zhurbenko 83147. Frequent.

CERCIDOSPORA DECOLORELLA (Nyl.) O. E. Erikss. & Yue - 5: on *Pannaria pezizoides* (moribund, bleached thallus) and adjacent algal crust, 3 VIII 1983, Zhurbenko 83173. Frequent. Perithecia completely or 3/4- immersed, 0.15-0.20 mm diam. Ascospores (5)-8 x ascus, colourless, 3-5- septate, 17-25 x 5-5.5 μm (n=20, in water).

C. EPIPOLYTROPA (Mudd) Arnold - 4: on *Lecanora polytropa* (apothecia, thallus), 2 VIII 1985, Zhurbenko 8564. Rare.

C. STEREOCAULORUM (Arnold) Hafellner - 5: on *Stereocaulon depressum* (thallus: stems of pseudopodetia), 3 VIII 1983, Zhurbenko 83183; 13 VIII 1983, Zhurbenko 83186; 15 VIII 1983, Zhurbenko 83188. 6: on *Stereocaulon botryosum* (thallus: stem), 25 VII 1985, Zhurbenko 8579 (LE 207045). Frequent.

DACAMPIA ENGELIANA (Saut.) A. Massal. (syn. *Pleospora engeliana* (Saut.) G. Winter) - 6: on *Solorina* sp. (thallus), 25 VII 1985, Zhurbenko 8563. Rare.

DACTYLOSPORA AMYGDALARIAE Triebel - 5: on *Amygdalaria panaeola* (thallus), 28 VII 1982, A. N. Titov s. n. (LE 207078); on *Amygdalaria* cf. *elegantior* (apothecia?, cephalodia, thallus), 28 VII 1982, A. N. Titov s. n. (LE 207079). Not rare. Spores are somewhat bigger than reported by Triebel (1989:207): 7.5-12.5 x 3.5-6 μm (n=30, in KOH). Although known from scattered localities from all over the Holarctic since its original description (Triebel, 1989), *D. amygdalariae* was a rarely collected species in Russia so far. It was there previously reported only by Zhurbenko & Santesson (1996).

D. ATTENDENDA (Nyl.) Arnold - 5: on *Pilophorus dovrensis* (thallus), 13 VIII 1983, Zhurbenko 83179 (LE 207081). Rather rare. Spores (2)-4 septate, 10-15 x 5-5.5 μm (n=10, in KOH). *D. attendenda* is regarded to be little host specific by Triebel (1989) and Rambold et al. (1993). Originally found on *Pilophorus cereolus*, it was lateron not only recorded on further *Pilophorus species*, but also on taxa of *Amygdalaria*, *Porpidia* and *Icmadophila*. The description of the species is based on Russian material originating from the Arkhangelsk area (Nylander, 1866, Triebel, 1989). Recently it was also found on the Taimyr Peninsula (Zhurbenko, 1998).

D. DEMINUTA (Th. Fr.) Triebel - 1: on *Pannaria pezizoides* (thallus), 30 VIII 1984, Zhurbenko 84214 (LE 207085). 2: on thallus of unidentified crustose lichen, 5 VIII 1984, Zhurbenko 84134. 5: on *Rinodina turfacea* (thallus), 15 VIII 1983, Zhurbenko 83181 (LE 207089). Very frequent. Ascospores 3-7- septate, 15-26 x 5-7.5 μm (n=20, in water).

D. GLAUCOMARIOIDES (Willey ex Tuck.) Hafellner - 5: on muscicolous sorediate *Ochrolechia* sp. (thallus), 13 VIII 1983, Zhurbenko 83172b (LE 207209b). Rather rare. Apothecia black, 0.15-0.50 mm diam. Epithecium reddish brown, hypothecium light to medium brown, excipulum dark reddish brown. Hymenial gel JLugol + red in lower part, blue in upper part. Asci cylindrical, 68-75 x 12,5 μm. Ascospores 8 x ascus, brown, 3-septate, sometimes constricted at septae, 15.5-20 x 5.5-7.5 μm (n=10, in water).

D. PURPURASCENS Triebel - 5: on *Amygdalaria pelobotryon* (apothecia, thallus), 19 VII 1985, Zhurbenko 8562 (LE 207214). Rather rare. Ascospores gray then brownish, 11-15 x 5-6.5 μm (n=10, in water).

*D. RHYPARIZAE Arnold - 5: on *Bryonora rhypariza* (apothecia: disc, thalline margine), 11 VIII 1982, A.N.Titov s. n. (LE 207216). Rare. Apothecia 0.05-0.25 mm diam. Ascospores olive brownish, 1-3-septate, smaller then reported by Keisler (1930:247) and Clauzade et al. (1989:67): 9-12.5 x 5-5.5 μm (n=10, in water) vs. "12-14 x 6-8 μm". *D. rhyparizae* has been found twice in the Eastern Alps by Arnold (summarized by Magnus, 1905) and remained then a widely overlooked species until the second author became familiar with it. These records from Iceland, Norway, Switzerland, Austria, and Slovakia, partly also based on historical collections, were then published by Poelt & Obermayer (1991). Further specimens originate from different localities in Norway, Sweden, and Austria (Hafellner, 1993, Hafellner & Turk, 1995, Hofmann et al., 1998, Obermayer, 1993, Santesson, 1993).

DACTYLOSPORA sp. - 5: on *Mycobilimbia berengeriana* (thallus), 3 VIII 1983, Zhurbenko 83150. Apothecia black, up to 0.6 mm diam. Hymenium K-. Ascospores 8 x ascus, brown, 1-septate, 10-15 x 5-6.5 μm (n=10, in KOH).

ENDOCOCCUS NANELLUS Ohlert - 1: on *Stereocaulon tomentosum* (apothecia, thallus - phyllocladia, also stem), 28 VIII 1984, Zhurbenko 84247 (LE 207673). Rather rare.

E. PROPINQUUS (Korb.) D. Hawksw. - 4: on sorediate *Porpidia* sp. (thallus), 2 VIII 1985, Zhurbenko 8567, 8568 (LE 207246, 207245). 5: on *Porpidia flavocoerulescens* (thallus), 5 VIII 1983, Zhurbenko 83190; on sorediate *Porpidia* sp. (thallus), 17 VII 1985, Zhurbenko 8565 (LE 207243). Frequent.

E. RUGULOSUS Nyl. - 5: on *Amygdalaria consentiens* and *A. pelobotryon* (thallus), 28 VII 1982, A.N.Titov s. n. (LE 207251). 6: on unidentified crustose epilithic lichen (thallus), 25 VII 1985, Zhurbenko 8568 (LE 207261). Not rare.

*EPIBRYON CONDUCTRIX (Norman) Nik.Hoffm. & Hafellner ined. (syn. *Stigmidium catapyrenii* Cl. Roux & Triebel) - 5: on *Catapyrenium cinereum* (thallus), 13 VIII 1983, Zhurbenko

83156 (LE 207511). Very rare. Perithecia 1/4-3/4 immersed, 0.07-0.10 mm diam. Asci 33-38 x 10 mkm. Ascospores 8 x ascus, colourless, 1-3-septate, 13-15 x 3.5-5 μm (n=6, in water). The species will be treated in detail by Hoffmann & Hafellner (in prep.). It is restricted to *Catapyrenium* and is so far known from Iceland, Norway, and Austria.

LASIOSPHAERIOPSIS STEREOCAULICOLA (Linds.) O. E. Erikss. & R. Sant. - 2: on *Stereocaulon paschale* (thallus), 31 VII 1984, Zhurbenko 84239 (LE 207120). 5: on *Stereocaulon depressum* (thallus), 3 VIII 1983, Zhurbenko 83182:b. Frequent.

LICHENOCONIUM LECANORAE (Jaap) D. Hawksw. - 5: on *Bryonora rhypariza* (disc of apothecia), 2 VIII 1982, A. N. Titov s. n. (LE 207143); on *Melanelia hepatizon* (apothecia), 15 VIII 1983, Zhurbenko 83174 (LE 207142). Not rare.

LIMONIELLA NEGLECTA (Vain.) Triebel & Rambold - 3: on *Lepraria* sp. (thallus), 12 VII 1984, Zhurbenko 84193 (LE 207159). 5: on *Lepraria* sp. (thallus), 13 VIII 1983, Zhurbenko 83166 (LE 207158). Rather rare. The generic position of this species is currently revised by Diederich & Etayo (in prep.).

MERISMATIUM DECOLORANS (Rehm ex Arnold) Triebel - 2: on *Cladonia pyxidata* (podetia), 30 VII 1984, Zhurbenko 84202 (LE 207172). 5: (cf.) on *Arthrorhaphis alpina* (thallus), 15 VIII 1983, Zhurbenko 83145. Rather rare. Identification of the last specimen is not certain: perithecia crowded up to 15 on host areolae, 1/2 immersed, 0.05-0.07 mm diam. Ascospores colourless to brownish, 11-15 x 4.5-5 μm, (2)-3- septate, slightly constricted at septae.

M. HETEROPHRACTUM (Nyl.) Vouaux - 3: on *Cladonia* sp. (thallus - cup), 17 VII 1984, Zhurbenko 84224 (LE 207173). Rather frequent. Ascospores pale gray, 12-15 x 6-7 μm (n=10, in water).

MUELLERELLA LICHENICOLA (Sommerf.: Fr.) D. Hawksw. - 1: on *Lecidella* sp. on drift-wood (thallus), 27 VIII 1984, Zhurbenko 84220 (LE 207175). 3: on muscicolous *Ochrolechia* sp. (thallus), 14 VII 1984, Zhurbenko 84222 (LE 207176). Frequent.

M. PYGMAEA (Korb.) D. Hawksw. var. *athallina* (Mull. Arg.) Triebel - 5: on saxicolous *Lecidea* sp. (thallus), 13 VIII 1983, Zhurbenko 83196 (LE 207179). Not rare.

M. PYGMAEA (Korb.) D. Hawksw. var. *pygmaea* - 5: on saxicolous *Lecidea* sp. (thallus), 3 VIII 1983, Zhurbenko 83191 (LE 207178). Frequent.

*NEOLAMYA PELTIGERAE (Mont.) Theiss. & Syd. - 5: on *Peltigera didactyla* (thallus), 3 VIII 1983, Zhurbenko 83176 (LE 207332). Very rare. Ascospores colourless, acicular, straight or curved, (2)-3- septate, 58-83 x 2.5 μm (n=8, in water). The species seems to be definitely rare, nevertheless it is widely distributed. The scattered records range from Scandinavia (Eriksson, 1992, Kummerling & Alstrup, 1992, Santesson, 1993) and Canada (Alstrup & Cole, 1998) in the north to Great Britain (Hawksworth, 1980), France (Montagne, 1845), Austria (Arnold, 1878), Italy (De Notaris, 1867), and Hungary (Gyelnik, 1940). Surprisingly it was also found recently in New Guinea (Aptroot et al., 1997).

*NESOLECHIA CETRARICOLA (Linds.) Arnold - 5: on *Cetraria rassadinae* (upper surface of lobes), 13 VIII 1983 Zhurbenko 83158 (LE 207333). Very rare. Material from the Putorana Plateau is scanty. Abundant additional material has been collected by the first author from Khibiny Mts at the Kola Peninsula (Zhurbenko 9720, LE 207334, on *Cetraria ericetorum* - mostly on basal parts of lobes, rarely on their upper portions). Apothecia dark brown to blackish, shiny, convex, consticted at base when mature, 0.15-0.50 mm diam, often numerous, sometimes aggregated in groups. Asci clavate, 43-55 x 10-15 μm (n=4, in KOH), with tholus up to 10 μm tall KJLugol+ blue. Ascospores 8 x ascus, fusiform, colourless, 0-1-septate, bigger than reported by Keissler (1930:144 - "6.3 x 2 μm") 8.5-15 x 3-4 μm (n=10, in KOH). Evidently parasymbiotic. The species, originally described very fragmentary ("Spores very small, ellipsoid.") (Lindsay, 1869) has *Cetraria islandica* as type host. Lindsay (1871a) depicted both infested *Cetraria* lobes and hymenial details. A more detailed description including measurements of asci and ascospores is given by Lindsay (1871b). *N. cetraricola* is not mentioned by Triebel et al. (1995).

N. OXYSPORA (Tul.) A. Massal. - 2: on *Parmelia omphalodes* (thallus): 30 VII 1984, Zhurbenko 84200 (LE 207342); 2 VIII 1984, Zhurbenko 84199 (LE 207338). On *Parmelia saxatilis* (thallus), 2 VIII 1984, Zhurbenko 84221 (LE 207336). 3: on *Melanelia infumata* (thallus), 17 VII 1984, Zhurbenko 84210 (LE 207339), 84231, 84225 (LE 207341). 5: on *Parmelia sulcata* (thallus), VIII 1983, Zhurbenko 8342 (LE 207340). Not rare.

PHAEOSPORA PELTIGERICOLA D. Hawksw. - 3: on *Peltigera* sp. (decaying thallus), 11 VII 1984, Zhurbenko 84192 (LE 207348). Very rare. Spores 11-14 x 5 μm (n=10, in water).

PHAEOSPOROBOLUS ALPINUS R. Sant., Alstrup & D. Hawksw. - 3: on terricolous *Ochrolechia* sp. (thallus), 17 VII 1984, Zhurbenko 84194 (LE 207295). Very frequent.

POLYCOCCUM BRYONTHAE (Arnold) Vezda - 2: on *Lecanora epibryon* (apothecia), 30 VII 1984, Zhurbenko 84120 (LE 207370). Very rare. Ascospores 11-12 x 4-5 μm (n=10, in water).

P. TRYPETHELIOIDES (Th. Fr.) R. Sant. - 1: on *Stereocaulon* sp. on sandy soil (thallus), 15 IX 1984, Zhurbenko 84191 (LE 207378). 5: on *Stereocaulon groenlandicum* (thallus), 21 VII 1985, Zhurbenko 8581 (LE 207380). Not rare.

*PROTOTHELENELLA SANTESSONII H. Mayrhofer - 5: on *Cladonia coccifera* (basal squamules, cups), 13 VIII 1983, Zhurbenko 83164 (LE 207392). Very rare. Perithecia black, shiny, 0.15-0.40 mm diam., 1/2-3/4 immersed. Paraphyses simple. Asci cylindrical, 95 x 13 μm. Ascospores (2-)6-8 x ascus, colourless, at the beginning sometimes simple, then submuriform (with 5 transseptae, 1 longitudinal septum), bigger than reported by Mayrhofer (1987: 332) - 13-30 x 7.5-15 μm (n=26, in water) vs. "18-24 x 10-12 μm". The description of *P. santessonii* is based on a specimen from the United States (Mayrhofer, 1987) with *Cladonia squamosa* being the host. A further North American record was published by Alstrup (1995) from Greenland. All other certain records published so far are from the Eastern Alps in Central Europe (Berger, 1996, Hafellner, 1994, Hafellner & Turk, 1995, Hafellner & Wittmann, 1996). Rasanen (1926: 345) reported *Thelenella leucothelia* upon *Cladonia* from Finland, which may also refer to *P. santessonii*.

SAGEDIOPSIS ASPICILIAE (Vain.) Nik.Hoffm. & Hafellner ined. - 4: on *Aspicilia* sp. (thallus), 8 VIII 1985, Zhurbenko 8572 (GZU). Very rare. The species will be treated in detail by Hoffmann & Hafellner (in prep.). It was described from Karelia close to the Finland border by Vainio (1883) and is so far known only from the Russian North, being restricted to the *Aspicilia myrinii*-group. Special attention is necessary as a second species of *Sagediopsis* grows on *Aspicilia myrinii*, *S. fissurisedens* Hafellner (1993), which is much more common than *S. aspiciliae* both in Northern and Central Europe. Under the microscope that species is easily distinguis red by its mostly 3-septate ascospores.

SCUTULA STEREOCAULORUM (Anzi) Korb. - 1: on saxicolous *Stereocaulon* sp. (thallus), 13 VIII 1984, Zhurbenko 84196. 2: on *Stereocaulon alpinum* (phyllocladia), 3 VIII 1984, Zhurbenko 84237 (LE 207447). 5: on *Stereocaulon depressum* (phyllocladia), 3 VIII 1983, Zhurbenko 83182a; on *Stereocaulon groenlandicum* (phyllocladia), 13.VIII 1983, Zhurbenko 83185; on saxicolous *Stereocaulon* sp. (phyllocladia), 15 VIII 1983, Zhurbenko 83187 (LE 207419). Very frequent.

SPHAERELLOTHECIUM ARANEOSUM (Rehm ex Arnold) Zopf - 1: on *Ochrolecia upsaliensis* (apothecia, thallus), 29 VIII 1984, Zhurbenko 84226 (LE 207495); on *Stereocaulon paschale* (phyllocladia), 13 VIII 1984, Zhurbenko 84244 (LE 207640). 5: on muscicolous *Ochrolechia* sp. (thallus), 15 VIII 1983, Zhurbenko 83171 (LE 207506). Frequent.

S. MINUTUM Hafellner - 5: on *Sphaerophorus globosus* (thallus), 13 VIII 1983, Zhurbenko 83189 (LE 207504). Frequent.

SPHAERELLOTHECIUM SP. - 5: on *Cladonia pyxidata* (thallus), 13 VIII 1983, Zhurbenko 83161 (LE 207221); on *Cladonia* cf. *cariosa* (thallus), Zhurbenko 83162 (LE 207220). Rare. Ascospores (6)-8 x ascus, colourless, 1-septate, 10 x 3-4.5 μm (n=8, in water).

STIGMIDIUM CONSPURCANS (Th. Fr.) Triebel & R. Sant. - All specimens on *Psora rubiformis* (thallus). 1: 24 VIII 1984, Zhurbenko 84217b (LE 207525b); 15 IX 1984, Zhurbenko 84172

(LE 207514). 5: 3 VIII 1983, Zhurbenko 83180 (LE 207517). Rather frequent.

*S. RIVULORUM (Kernstock) Cl. Roux & Nav.-Ros. - 5: on *Verrucaria* sp. (thallus), 15 VII 1985, Zhurbenko 8558 (LE 207560). Ascospores colourless, 1-septate, 11-15 x 5-6 μm (n=5, in water). Very rare. *S. rivulorum* is specialized on freshwater *Verrucaria*- and *Staurothele*-species. The species has been described based on a specimen from northern Italy (Arnold, 1893, Kernstock, 1895). Further records from the Austrian Alps have been published by Arnold (1896) and Hafellner & Turk (1995). In Luxembourg it was found by Molitor & Diederich (1997) and the only finding in northern Europe so far was on the Faroes (Alstrup et al., 1994).

STIGMIDIUM sp.- 1: on *Lecidoma demissum* (thallus), 13 VIII 1984, Zhurbenko 84219a (GZU). Very rare.

ZWACKHIOMYCES BERENGERIANUS (Arnold) Grube & Triebel - 5: on *Mycobilimbia berengeriana* (thallus), 3 VIII 1983, Zhurbenko 83151 (LE 207604). Rare. Ascospores 16-30 x 5-10 μm (n=16, in KOH).

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Folia Cryptog. Estonica, Fasc. 34: 81-89 (1999)

NEW ESTONIAN RECORDS: FUNGI

Pezizales

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A part of the specimens presented here were isolated and studied in pure culture by Öpik (1998). The latter specimens are marked with an asterix (*) followed by the number of isolate. The cultures are preserved and available in the pure culture collection of the Institute of Zoology and Botany, Estonian Agricultural University, 181 Riia St., 51014 Tartu, Estonia

Length (l) and width (w) of spores are presented in the following form: $(l_{min})l_{mean}(l_{max})$ x $(w_{min})w_{mean}(w_{max})$ μm, where l_{mean} and w_{mean} denote the mean values of lengths and widths of 10 spores from a specimen, and l_{min}, w_{min} and l_{max}, w_{max} denote the minimum and maximum absolute values of length and width, respectively.

ANTHRACOBIA MACROCYSTIS (Cooke) Boud. - Hiiumaa Co., Hüti (58°55'N 22°29'E), on burnt ground, 3 Oct 1995 M. Öpik & A. Jakobson (TAA 163099*: 95-196).
Spores from herbarized specimen (17.6)19.1(19.5) x (8.2)8.1(8.8) :m; from fresh fuitbodies growing in pure culture on two different media (PDA and PCA) (15.1)17.2-18.0(19.4) x (7.6)8.2-8.6(8.8) :m; and (17.6)19.1(20.2) x (8.2)8.7(8.8) :m respectively.

GEOPORA CERVINA (Velen.) T. Schumach. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Kursi Forestry, in *Fraxinus excelsior* and *Ulmus*-forest, block no. 95 (58°32'N 26°16.5'E), on wet soil, 8 Oct 1997 M. Öpik (TAA 171109); Tartumaa Co., Tartu (58°20.5'N 26°43.5'E), on damp soil, 7 July - 14 Aug 1998 B. Kullman (TAA 157797).

G. TENUIS (Fuckel) T. Schumach. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Kursi Forestry, in *Fraxinus excelsior* and *Ulmus*-forest, block no. 95 (58°32'N 26°16.5'E), on wet soil, 8 Oct 1997 B. Kullman (TAA 157730), M. Öpik (TAA 171108).

NEOTTIELLA HETIERI Boud. - Harjumaa Co., Leistu (59°09'N 24°32'E), 28 Sept 1995 A. Jakobson (TAA 157447*: 95-185).

PACHYELLA BABINGTONII (Berk.) Boud. - Põlvamaa Co., Laane (58°12.5'N 26°52'E), on fallen stick, 13 Aug 1997 B. Kullman & M. Öpik (TAA 157648*: 97-80, 157649).

PEZIZA ARVERNENSIS Boud. - Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nature Reserve, Vaibla Forestry, block no. 29 (58°27.0'N 26°08.5'E), on ground, 11 Sept 1997 B. Kullman (TAA 157677).

P. BADIOCONFUSA (Boud.) Dennis. - Tartumaa Co., Tartu (58°20.5'N 26°43.5'), on damp soil, 22 and 31 July, 6 Aug 1998 (TAA 157835, 157845, 157886).

P. DEPRESSA Pers. - Pärnumaa Co., Häädemeeste Comm., Nigula Nature Reserve, Salupeaksi island in Nigula smash, (58°01,2'N 24°41'), on ground, 28 June 1998 B. Kullman (TAA 157793).

P. ECHINISPORA P. Karst. - Tartumaa Co., Tõravere (58°16'N 26°27'E), on burnt ground, 28 July 1998 M. Öpik (TAA 165081*: 96-119), Põlvamaa Co., Võnnu Comm., Kurista (58°15'N 26°59'E), in pine forest, on burnt ground, 24 June 1998 B. Kullman & H. Rämma, det B. Kullman (TAA 157781).

P. GERARDII Cooke . - Tartumaa Co., Tartu (58°20.5'N 26°43.5'), on damp soil, 20 July -1 Aug 1998 B. Kullman (TAA 157820).

P. GRANULOSA T. Schumach. - Põlvamaa Co., Laane (58°12.5'N 26°52'E), 29 June 1996 B. Kullman & H. Rämma, det. B. Kullman (TAA 157507*: 96-153).

P. LIMNAEA Maas Geest. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Altnurga, Kursi Forestry, in *Fraxinus excelsior* and *Ulmus*-forest, block no. 95 (58°32'N 26°16.5'E), on wet soil, 8 Oct 1997 B. Kullman, det. B. Kullman & M. Öpik (TAA

157731); Võrumaa Co., Uigumägi (57°39.0'N 27°5.0'E), on wet soil, 1 Oct 1997 E. Ohenoja, det. B. Kullman (TAA 157702).

P. LOBULATA (Velen.) Svrcek - Tartumaa Co., Tõravere (58°16'N 26°27'E), on burnt ground, 11 May 1997 M. Öpik (TAA 165093*: 97-56).

P. MICROPUS Pers.: Fr. - Võrumaa Co., Rõuge Comm., 5 km E of Kangsti, block no. 139 (57°41.5'N 26°48.5'E), on fallen trunk, 11 Oct 1996 U. Kõljalg, det. B. Kullman (TAA 157591*: 96-186); Jõgevamaa Co., Altnurga (58°34'N 26°19'E), on fallen trunk, 12 Aug 1997 M. Öpik (TAA 171060*: 97-77).

P. MOSERI Aviz.-Hersh. & Nemlich. - Lääne-Virumaa Co., Väike-Maarja Comm. (59°03.2'N 26°14.2'E)., on sandy ground, 29 July 1998 B. Kullman, det. M. Öpik (TAA 157833).

P. MUSCICOLA Donadini. - Tartumaa Co., Alam-Pedja Nature Reserve (58°30.5'N 26°12'E), on soil alongside of track, 30 July 1998 B. Kullman & H. Rämma, det. B. Kullman (TAA 157846).

P. PHLEBOSPORA Le Gal. - Valgamaa Co., Aakre Forestry, block nr. 32/9 (58°02.86'N 26°02.56'), pine forest, on soil, 5 Aug 1998 K. Leenurm, det. B. Kullman (TAA 157842).

P. VARIA (Hedw.: Fr.) Fr. - Tartumaa Co., Tartu, 181 Riia St., (58°20.5'N 26°41'E), on plaster, 17 Jan 1995 B. Kullman (TAA 157256*: 95-184), on floor of concrete, 29 Sept 1995 B. Kullman (TAA 165010*: 95-199); Tartu (58°20.5'N 26°43.5'), in greenhouse, on damp soil, 4 May 1998 B. Kullman (TAA 157756); Tartumaa Co., Mustametsa (59°28.5'N 25°35'E), on dung, 16 June 1996 K. Kukk & M. Öpik, det. B. Kullman (TAA 157494*: 96-149); Võrumaa Co., Kütiorg (57°46.5'N 27°9.5' E), on ground, 3 Oct 1997 B. Kullman (TAA 157754*: 97-84).

PLECTANIA MELASTOMA (Fr.) Fuckel. - Tartumaa Co., Tõravere (58°16'N 26°27'E), on deciduous-wood stick, 11 May 1997 M. Öpik (TAA 165095*: 97-73).

PULVINULA CONSTELLATIO (Berk. & Broome) Boud. - Lääne-Virumaa Co., Karepa (59°32.5'N 26°24'E), on damp soil alongside a track, 27 July 1998 B. Kullman & H. Rämma, det. B. Kullman (TAA 157837); Võrumaa Co., Uigumägi (57°39.0'N 27°5.0'E), on wet soil, 1 Oct 1997 B. Kullman (TAA 157704). Apothecia up to1 mm in diameter.

P. MILTINA (Berk.) Rifai. - Lääne-Virumaa Co., Karepa (59°32.5'N 26°24'E), on damp soil alongside a track, 27 July 1998 B. Kullman & H. Rämma, det. B. Kullman (TAA 157838); Valgamaa Co., Puka Comm., Aakre Forestry, block no 183 (58°00.85'N 26°04.20'E), on damp soil alongside a track, 9 Aug 1998 B. Kullman (TAA 157857, 157858). Apothecia up to10 mm in diameter.

SARCOSCYPHA AUSTRIACA (Beck in Sacc.) Boud. - Hiiumaa Co., Emmaste, near Harju (58°45.0'N 22°35.0'E), in spruce-mixed forest, on dead stick of *Betula* sp., 12 May 1997 K. Leenurm (TAA157610); Ida-Virumaa Co., Avinurme Comm., Kaevussaare (58°58'N 26°48'5E), on sticks,18 Apr 1999, K. Põldmaa, T. Tammaru, det B. Kullman (TAA 179029); Kaevussaare (58°58'N 26°48'E), on sticks, 18 Apr 1999, K. Põldmaa, T. Tammaru, det B. Kullman (TAA 179028); Tudulinna Comm., (58°59.4'N 27°13.8'E), on sticks of deciduous tree, 10 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179005); Jõgevamaa Co., near the Jõgeva Plant Breeding Institute (58°46'N 26°26'E), 2 May 1997 K. Kalamees, det B. Kullman (TAA 147691); near the Mustvee (58°52.3'N 26°56.3'E), 10 Apr 1999 B. Kullman & H. Rämma (TAA 179004); Põltsamaa Comm., Anikvere (58°38.9'N 25°00.22'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179018); Esku (58°38.61'N 25°54.88'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179015); Neanurme (58°37.37'N 26°90.6'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179017); Siimusti cemetery (58°43.4'N 26°19.3'E), 2 May 1997 K. Kalamees, det B. Kullman (TAA 147692); Tabivere Comm., Maarja (58°37.8'N 26°47.4'E), 10 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179003); Põlvamaa Co., Laane (58°12.43'N 26°53.63'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179021); Laane (58°38.9'N 25°00.22'E), on sticks of *Alnus* sp., 17 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179022);Taevaskoja (58°7'N 27°3'E), on sticks of deciduous tree, 29 May 1996 A. Aader, det B. Kullman (TAA 157477*: 96-135); Tartumaa Co., Alaküla (58°15.7'N 26°55.54'E), on sticks of *Alnus*

sp., 17 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179020); Haage (58°21'N 26°34.5'E), on fallen trunk, 24 Apr 1996 B. Kullman & R. Uuk, det. B. Kullman (TAA157452*: 96-124); Ilmatsalu (58°22.8'N 26°32.8'E), on sticks, 15 Apr 1999 M. Vaasma, det B. Kullman (TAA 179027); Kodijärve (58°10.5'N 26°34'E), on sticks of deciduous tree, 26 Apr 1997, M. Vaasma, det. B. Kullman (TAA 157607); Külitse (58°19.5'N 26°38'E), on fallen trunk; 19 & 22 Apr 1997 B. Kullman (TAA 157757, 157605); Mõisanurme (58°20'N 26°23'E), on dead stick of *Tilia cordata*, 27 Apr 1997 A. Raitviir, det. B. Kullman (157606*: 97-55,147683b*: 97-62); Pilka (58°25'N 26°53.5'E), on fallen trunk, 11 March 1997 K. Kalamees, det. M. Öpik (TAA 147675*: 97-51, 147678*: 97-52); Rannu Comm., Suure-Rakke (58°21.91'N 26°02.44'E), on sticks of deciduous tree, 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179008); Tähtvere Comm., Rõhu brook (58°20.78'N 26°28.91'E), on sticks of deciduous tree, 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179006); Tänassilma (58°19.7'N 26°17.8'E), 11 Apr 1999 B. Kullman & H. Rämma, det. B. Kullman (TAA 179007); Tõravere (58°16'N 26°27'E), on dead stick of *Betula* sp., 20 Apr 1997 M. Öpik (TAA 165091*: 97-54); Tõrvandi (58°29'N 26°42'E), on fallen trunk, 27 Apr 1996 B. Kullman (TAA 157453); Variku (58°20'N 26°41'E), on fallen trunk, 27 Apr 1996 B. Kullman (TAA 157451*: 96-123), 28 Apr 1996 B. Kullman (157452*: 96-124); 16 May 1996 B. Kullman & M. Öpik (TAA 157456*: 96-126); B. Kullman & M. Öpik, det. B. Kullman (TAA 157462*: 96-130, 157463, 157464*: 96-131,157466*: 96-133); Variku (58°17'N 26°41'E), on sticks of *Salix* sp. and *Populus tremula*, 20 Apr 1999, K. Leenurm, A. Raitviir, det B. Kullman (TAA 179030); Villemi (58°16.47'N 26°49.87'E), on sticks of Betula sp., 17 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179026); Viljandimaa Co., Kolga-Jaani Comm., Leie (58°24.91'N 26°3.39'E), on sticks *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179009); Kõo Comm., Arussaare (58°38.38'N 25°39.94'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179016); Tõrvaaru (58°35.40'N 25°34.30'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179014); Saarepeedi Comm., Aindu (58°24.41'N 25°35.69'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179013); Suure-Jaani Comm., Rannu, (58°21.9'N 25°02.44'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179008); Võhmassaare (58°37.3'N 25°33.2'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179015); Viiratsi Comm., Aruküla (58°22.04'N 25°38.74'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179012); Loime (58°23.54'N 25°55.19'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179010); Tusti (58°23.90'N 25°45.50'E), on sticks of *Alnus* sp., 11 Apr 1999 B. Kullman & H. Rämma, det B. Kullman (TAA 179011).

Xylosaprotroph. Earlier Estonian *Sarcoscypha* collections have been referred to as *S. coccinea* (Jacq.: Fr.) Lambotte. The spores of *S. austriaca* germinate by producing conidia on short germ tubes, sometimes while still being on the hymenium, or when the spore print is inserted in a drop of tap water for a some days. However this phenomenon has not been observed by Baral (1984), Harrington (1990) and Butterfill & Spooner (1995) in collections of *S. coccinea* sensu stricto. For identification, the type of spore germination and anamorph characters appear most reliable (Öpik, 1998).

SCUTELLINIA CRINITA (Bull.: Fr.) Lambotte. - Jõgevamaa Co., Altnurga (58°34'N 26°19'E), on fallen trunk, 12 Aug 1997 M. Öpik, det. B. Kullman (TAA 171059*: 97-78), Puurmani Comm., Alam-Pedja Nature Reserve, Umbusi-Epruraba Zone, Kursi Forestry, block no 300 (58°28.5'N 26°9.0'E), 27 Aug 1997 K. Leenurm, det B. Kullman (TAA 157643); Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nature Reserve, Vaibla Forestry, block no 29 (58°27.0'N 26°08.5'E), on wet ground, 11 Sept 1997 B. Kullman (TAA 157679).

Forest saprotroph. Common in northern temporate and boreo-alpine regions of Europe. Evidently not very rare in Estonia but not collected earlier. The species is closely related to *S. scutellata*.

Spores from fresh fuitbodies (TAA 171059) growing in the field (20.2)20.7 (21.4) x (12.0)12.9(14.5) :m; from fresh fuitbodies growing in the pure cultures on PDA medium (97-78) (20.2)21.8 (23.9) x (11.3)13.0(13.9) :m.

S. CRUCIPILA (Cooke & W. Phillips) J. Moravec. - Põlvamaa Co., Laane (58°12.5'N 26°52'E), on rich soil, 8 July, 27 Aug 1996 B. Kullman (TAA 157522*: 96-157, 157561/2); 10 Sept 1996 B. Kullman & M. Öpik (157567/5*: 96-174); 28 May 1998 B. Kullman, det. M. Öpik (TAA 157769, 157770, 157773, 157774); Saaremaa Co., centre of Viidumäe Nature Reserve (52°17.5'N22°6'E); on sandy soil, 21 & 23 Aug 1992 B. Kullman (TAA 117784, 117810, 117813-117815).

Humus saprotroph. The species is commonly treated as a member of the genus *Cheilymenia* but was incorporated in *Scutellinia* by Moravec (1984) because it has short hairs and a sculptured ascospore wall. This was also accepted by Schumacher (1990).

Evidently not very rare in Estonia but not collected earlier.

S. KERGUELENSIS (Berk. in Hook. f.) Kuntze. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Altnurga, Kursi Forestry, in *Fraxinus excelsior* and *Ulmus*-forest, block no. 95 (58°32'N 26°16.5'E), on wood, M. Öpik, det. B. Kullman & M. Öpik (TAA 171042); block no. 368/109 (58°32'N 26°16.5' E), on fallen rotten trunk of *Populus tremula*, 8 Oct 1997 B. Kullman (TAA157728); Põlvamaa Co., Laane (58°12.5'N 26°52'E), 21 Sept 1996 B. Kullman, (TAA 157572/3 on bark, 157572/4 on litter,157572/5*: 96-184 on litter,157572/6 on litter, 157572/7 on litter,157572/8 on wood); Võrumaa Co., Kütiorg (57°46.5'N 27°9.5' E), on wet sandy soil, 3 Oct 1997 B. Kullman (TAA 157716*: 97-85).

Forest saprotroph. Hygrophilous species with preference of cool climate at high altitudes and latitudes (Schumacher 1979, 1990). On sandy soil, litter or rotten wood of persistent moisture.

S. NIGROHIRTULA (Svrcek) Le Gal. - Põlvamaa Co., Laane (58°12.5'N 26°52'E), on forest litter, 13 Aug 1997 B. Kullman (TAA 157646*: 97-79, 157647, 157650); 17 Sept 1997 B. Kullman (TAA 157688/1, 157688/4, 157688/5); 24 June 1998 B. Kullman & H. Rämma, det. B. Kullman (TAA 157779/1).

Forest saprotroph; in highly humid habitats (Schumacher, 1990). Found only in one excessively moist locality in Estonia.

S. VITREOLA Kullman. - Põlvamaa Co., Laane (58°12.5'N 26°52'E), on ground, 16 June 1996 B. Kullman (TAA 157493/1*: 96-142, 157493/3*: 96-143, 157493/5, 157493/7, 157493/11, 157493/12*: 96-144, 157493/13*: 96-145, 157493/14, 157493/15, 157493/17, 157493/21*: 96-146); on herb litter, 16 June 1996 B. Kullman (TAA 157493/22*: 96-147); on wood, 16 June 1996 B. Kullman (TAA 157493/23*: 96-148); on ground, 27 Aug 1996 B. Kullman (TAA 157554); on wood, 10 Sept 1996 B. Kullman (TAA 157567/9*: 96-175); on ground, 24 May 1998 B. Kullman & H. Rämma, det. B. Kullman & M. Öpik (TAA157772); 28 May 1998 B. Kullman & H. Rämma, det B. Kullman & M. Öpik (TAA 157771,157775, 157776, 157777); 24 June 1998 B. Kullman & H. Rämma, det B. Kullman (TAA 157779/2).

Forest saprotroph.

TARZETTA CATINUS (Holmsk.: Fr.) Korf & Rogers. - Jõgevamaa Co., Altnurga (58°34'N 26°19'E), on bare ground, 12 Aug 1997 M. Öpik (TAA 171056, 171057); Tartumaa Co., Tõravere (58°16'N 26°27'E); on bare ground under *Urtica dioica*, 25 June 1998 M. Öpik (TAA 171133); Tartu (58°20.5'N 26°43.5'), on damp soil, 7 July 1998 B. Kullman, det. M. Öpik (TAA 157796), 14 Aug 1998 B. Kullman (TAA 157882).

TRICHOPHAEA HEMISPHAERIOIDES (Mouton) Graddon. - Võrumaa Co., Kolepi (57°46.5'N 27°04'E), on burnt ground 1 June 1997, A. Raitviir & M. Öpik (TAA 147708*: 97-71).

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Species of parasitic microfungi on the leaves of woody plants

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The first finds of microfungi on woody plants in Estonia date back to the last century. Up until now, powdery mildews (*Erysiphales*) and rusts (*Uredinales*) have been studied in detail but there is little information about *Deuteromycotina*.
Between 1981 and 1985 29 species of parasitic micromycetes were found on the leaves of trees and bushes in Tallinn, for the first time. 10 of them were first collections in Estonia.
The following species of *Melanconiales* are new for Estonia:

DISCELLA ACERINA (Westend.) Arx - on *Acer tataricum* L. Tallinn, Tallinn Botanical Garden (TBG), 26 Sep. 1984 and 27 Sep. 1984.

DISCULA BETULINA (Westend.) Arx - on *Betula papyrifera* Marsh Tallinn, Saare Road, 27 Aug. 1985; on *Betula pendula* Roth Tallinn, Aianduse Street, 27 Aug. 1985.

DISCULA CAMPESTRIS (Pass.) Arx - on *Acer platanoides* L. Tallinn, Theatre Square, 25 Sep. 1984.

DISCULA CYTOSPORA (Pass.) Arx - on *Populus tremula* L. Tallinn, Õismäe, 8 Sep. 1986.

GLOEOSPORIDELLA VARIABILIS (Laub.) Nannf. (Teleomorph: *Drepanopeziza variabilis* E. Müll., Hütter & Schüepp) - on *Ribes alpinum* L. Tallinn, TBG, 23 Sep. 1984 and 26 Sep. 1984.

GLOEOSPORIUM FERRUGINEUM Dearn. - on *Rhododendron smirnowii* Trautv. Tallinn, TBG, 7 Aug. 1980.

KABATIELLA BERBERIDIS (Cooke) Arx - on *Berberis vulgaris* L. Tallinn, Männiku, 13 Nov. 1984 (leg. M. Kruus).

MARSSONINA SALICIGENA (Bubák & Vleugel) Nannf. - on *Salix alba* L. Tallinn, Marja Street, 2 Oct. 1984.

MARSSONINA SALICICOLA (Bres.) Magnus (Teleomorph: *Drepanopeziza sphaeroides* (Pers.: Fr.) Höhn. - on *Salix caprea* L. Tallinn, Mustamäe, 2 Oct. 1984.

PHAEOSPORA ROBINIAE (Lib.) Höhn. - on *Robinia pseudoacacia* L. Tallinn, TBG, 12 July 1983 and 30 Aug. 1983.

Hymenomycetes and Auriculariales

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ABORTIPORUS BIENNIS (Bull.: Fr.) Singer. - Jõgeva Co., Alam-Pedja Nature Reserve, Rokka (58E28.4' N 26E08.7' E), under *Populus tremula* trees in a flooded plain *Populus* forest, 27 Aug 1997 L. Järva, det. E. Parmasto (TAA 167001).
Possibly the northernmost locality of this species, not yet found in Finland.

ALBATRELLUS SUBRUBESCENS (Murrill) Pouzar. - Saaremaa Co., Kihelkonna Forestry, block no. 204 (58E20.6' N 22E 20.1' E), on sandy ground in a dry pine forest of *Cladina* type, 18 Aug 1998 M. Vaasma, det. E. Parmasto (TAA 171 997); Raplamaa Co., Kabala (58E55' N 24E39' E) and Raikküla (58E56' N 24E43' E), in a spruce forests of *Oxalis*

acetosella type, 20 and 21 Sep 1984 E. Parmasto (TAA 105 971, 105988); Rangu Nature Reserve near Märjamaa, in an alvar pine forest, 21 Aug 1991 B. Kullman, det. E. Parmasto (TAA 151897).

Only found in Northwest and West Estonia. For identification of herbarium specimens, amyloidity of spores seems to be the only reliable characteristics.

ALEURODISCUS CERUSSATUS (Bres.) Höhn. & Litsch. - Valgamaa Co., Sangaste Comm., NE of Restu (57E56.9' N 26E32.2' E) on a fallen twig of *Picea abies* in a spruce forest, 6 Sep 1998 E. Parmasto (TAA 174 177).

ALEURODISCUS LAPPONICUS Litsch. - Raplamaa Co., Loodna Comm., Sarapiku (between Loodna and Sipa) (58E04.2' N 24E16.7' E), on a dead twig of *Juniperus communis* in a Juniperus stand, 23 Sep 1994 E. Parmasto (TAA 153 652); Tartumaa Co., Laeva Comm., NE of Palupõhja, Alam-Pedja Nature Reserve, Kaha zone (58E26.0' N 26E14.0E), on a fallen rotten twig in a spruce forest of *Oxalis acetosella* type, 15 Sep 1997 E. Parmasto (TAA 167 276).

Possibly northernmost localities of this species (not found yet in Finland).

ANOMOPORIA ALBOLUTESCENS (Romell) Pouzar. - Valgamaa Co., Põdrala Comm., N of Raudsepani (58E4.2' N 25E54.5' E), under a strongly rotten log of *Picea abies* in a nemoral forest, 15 Oct 1998 E. Parmasto (TAA 174 473).

ANTRODIA MELLITA Niemelä & Penttilä. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Võiviku Reservate (58E29.5' 26E13.5'), on a fallen rotten trunk of *Populus tremula* in a spruce forest, 27 Sep 1997 E. Parmasto (TAA 167 416); Umbusi-Epruraba zone, NW of Rokka (58E28.5' N 26E09' E), on a rotten log of *Populus tremula*, 27 Aug 1997 I. Parmasto, det. E. Parmasto (TAA 162 799, 162 800).

Until this known only from Finland.

ANTRODIELLA AMERICANA Ryvarden & Gilb. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Võiviku Reservate (58E29.5' 26E14'), on dead basidiomata of *Hymenochaete tabacina* on a fallen rotten trunk of *Populus tremula* in a spruce forest, 510 Oct 1996 E. Parmasto (TAA 154 386).

Until this found of northern countries only in Norway.

ASTEROSTROMA CERVICOLOR (Berk. & M.A. Curtis) Mass. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Madise zone, W of Utsali (58E33' N 26E14' E), on bark of a fallen trunk of *Picea abies* in a spruce forest, 5 Sep 1996 E. Parmasto (TAA 164 987).

Possibly the northernmost locality of this species in Europe.

BREVICELLICIUM OLIVASCENS (Bres.) K.H. Larsson & Hjortstam. - Valgamaa Co., Sangaste Comm., NE of Restu (57E56.9' N 26E32.2' E), on a fallen twig of *Corylus avellana* in a spruce forest, 6 Sep 1998 E. Parmasto (TAA 174 176).

Possibly not very rare in Estonia but not identified earlier.

CALATHELLA ERUCIFORMIS (Fr.) D.A. Reid. - Valgamaa Co., Põdrala Comm., N of Raudsepani (58E04.2' N 25E54.4' E), on a fallen twig of an angiospermic tree in a nemoral forest, 15 Oct 1998 I. Parmasto, det. E. Parmasto (TAA 169 237).

CANDELABROCHAETE SEPTOCYSTIDIA (Burt) Burds. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Võiviku Reservate (58E29.5' N 26E14' E), on a fallen rotten trunk of *Populus tremula* in a spruce forest, 10 Oct and 5 Nov 1996 E. Parmasto (TAA 154 391, 154 597); Umbusi-Epruraba zone, NW of Rokka (58E28.5' N 26E09' E), on a rotten log of *Populus tremula*, 27 Aug 1997 I. Parmasto and E. Parmasto (TAA 162 806, 167 038).

Not found earlier in northern Europe.

DENDROTHELE ALLIACEA (Quél.) Lemke. - Saaremaa Co., Ruhnu Is., Austerenge (57E47.2' N 23E15.3' E), on bark of a living *Tilia cordata*, 17 Sep 1998 E. Parmasto (TAA 174 346).

Northeasternmost, possibly also northernmost locality of this species.

GALZINIA INCRUSTANS Parmasto. - Tartumaa Co., Laeva Comm., NW of Palupõhja, Alam-Pedja Nature Reserve, Pede zone (58E25.5' N 26E11' E), on a fallen trunk of *Populus tremula* and on a dead basidioma of *Phellinus tremulae* in an oak forest, 17 Oct 1996 (TAA 154 511, 154 500).

GLOBULICIUM HIEMALE (Laurila) Hjortstam - Pärnumaa Co., Mihkli oak forest (58E37.2' N 24E06.5' E), 28 Aug 1989 (L. Ryvarden, *in litt.);* Saaremaa Co., Kärla Comm., SE of Jõempa (58E20.6' N 22E20.4 E), on a fallen trunk of *Pinus sylvestris* in a dry pine forest

of *Cladina* type, 10 Sep 1998 E. Parmasto (TAA 174 225); Ruhnu Is., E of Ruhnu village (57E48.5' N 23E15.0' E), on a fallen trunk of *Picea abies* in an old pine forest, 13 Sep 1998 I. Parmasto, det. E. Parmasto (TAA 169179).

HYPHODERMA ALBOCREMEUM (Höhn. & Litsch.) J. Erikss. & Strid. - Raplamaa Co., Virita nõmm near Märjamaa (58E58.1' N 24E22.6' E), on a fallen trunk of *Juniperus communis* in a dry spruce forest of alvar type, 23 Sep 1994 E. Parmasto, ident. confirmed by K.H. Larsson (153 648); Saaremaa Co., Torgu Comm., NE of Mässa (58E01.0' N 22E10.3' E), on a rotten stump of *Picea abies* in a wet *Alnus glutinosa - Picea abies* forest, 26 Aug 1998 E. Parmasto (TAA 167974).
Northernmost localities in Europe.

HYPOCHNICIELLUM CREMEOISABELLINUM (Litsch.) Hjortstam. - Saaremaa Co., Torgu Comm., W of Mässa (58E01' N 22E08' E), on a fallen rotten trunk of *Picea abies* in a mixed spruce forest, 25 Aug 1998 E. Parmasto, det. K.H. Larsson (TAA 167 882).

LINDTNERIA LEUCOBRYOPHILA (Henn.) Jülich. - Saaremaa Co., Papisaare (58E21.6' N 21E59.2 E), on mosses in a dry pine forest, 15 Sep 1993 E. Parmasto (TAA 152 773).
Northernmost locality of this species.

LINDTNERIA TRACHYSPORA (Bourdot & Galzin) Pilát. - Saaremaa Co., Kuressaare Comm., N of Kudjapä (58E16.3' N 22E33.4' E), on a fallen rotten trunk in a nemoral oak forest, 27 Aug 1998 E. Parmasto (TAA 174 001); Läänemaa Co., Lihula Comm., Matsalu Nature Reserve, 3 km W of Meelva (58E42.5' N 23E39' E), on a fallen rotten twig in a nemoral Tilia - Fraxinus forest, 17 Aug 1997 E. Parmasto (TAA 167 097).

LUELLIA RECONDITA (Jacks.) K.H. Larss. & Hjortstam. - Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nature Reserve, Võisiku zone (58E30.4' N 26E06.9' E), on fallen trunks of *Picea abies*, 25 Aug 1997 U. Kõljalg, det. E. Parmasto (TAA 159 685, 159 690); Tartumaa Co., Laeva Comm., Alam-Pedja Nature Reserve, Laeva soo zone (58E29' N 26E19.5' E), 10 Sep 1997 E. Parmasto (TAA 167 162).
Northernmost localities of this species in Europe.

MELZERICIUM UDICOLA (Bourdot) Hauerslev. - Saaremaa Co., Muhu Comm., Kesselaid Is. (58E38.2' N 23E25.3' E), on a dead twig of *Picea abies* in a spruce forest, 28 Aug 1998 E. Parmasto (TAA 174 042).

PHLEBIA LINDTNERI (Pilát) Parmasto. - Jõgevamaa Co., Puurmani Co., Alam-Pedja Nature Reserve, Madise zone (58E32.3' N 26E11.7' E), 21 Aug 1997 A. Kollom, det. E. Parmasto (TAA 128 092); Tartumaa Co., Laeva Comm., Alam-Pedja Nature Reserve, Tõllassaare zone (58E28' N 26E10' E), on fallen rotten trunks of *Betula pubescens* in a flooded plain Betula forest, 28 Aug 1997 E. Parmasto (TAA 167 059, 167 070).

PILODERMA LANATUM (Jülich) J. Erikss. & Hjortstam. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Võiviku Reservate (58E29.5' 26E13.5'), on a fallen rotten trunk of *Betula pubescens* in a spruce forest of *Oxalis acetosella* type, 27 Sep 1997 E. Parmasto (TAA 167 421); Valgamaa Co., Põdrala Co., N of Raudsepani (58E04.2' N 25E54.5' E), 15 Oct 1998 E. Parmasto, confirm. by K. Hjortstam (TAA 174 467).
Eathernmost locality of this very rare species.

REPETOBASIDIUM CONICUM (Oberwinkler) J. Erikss. & Hjortstam. - Tartumaa Co., NE of Selgise (58E35.6' N 27E00' E), in a rotten trunk of *Pinus sylvestris* in a pine-spruce forest of *Oxalis acetosella* type, 23 Jul 1998 E. Parmasto (TAA 167771).
Eathernmost locality of this species.

SARCODON FULIGINEOVIOLACEUS (Kalchbr.) Pat. - Saaremaa Co., Kaarma Comm., NE of Liiva-Putla (58E23.5' N 22E39.4' E), in a pine forest of *Cladina* type, 10 Sep 1998 I. Parmasto, det. E. Parmasto (TAA 174 201).

SARCODON LEUCOPUS (Pers.) Maas Geest. & Nannf. - Saaremaa Co., Kaarma Comm., NE of Liiva-Putla (58E23.5' N 22E39.4' E), in a pine forest of *Cladina* type, 10 Sep 1998 V. Liiv, det. E. Parmasto (TAA 169 157); same locality, 10 Sep 1998 E. Parmasto (TAA 174 203)

SEBACINA DIMITICA Oberwinkler. - Valgamaa Co., Sangaste Comm., NE of Restu (57E56.9' N 26E32.2' E), on a fallen trunk of *Picea abies* in an *Alnus* forest, 6 Sep 1998 I. Parmasto, det. E. Parmasto (TAA 169 135).
Northeasternmost locality of this very rare species, found until in Germany (S. Bavaria), Poland and once in Sweden.

SISTOTREMA ALBOLUTEUM (Bourdot & Galzin) Bondartsev & Singer. - Pärnumaa Co., Mihkli

oak forest (58E37.2' N 24E06.5' E), on wood of *Quercus*, 28 Aug 1989 (I. Dunger, *in litt.*); Saaremaa Co., Torgu Comm., NE of Mässa (58E00' N 22E10.3' E), on a fallen rotten trunk of *Picea abies* in a spruce forest of *Oxalis acetosella* type, 26 Aug 1998 E. Parmasto (TAA 167 982); Viieristi (58E01.9' N 22E10.8' E), on a fallen trunk of *Pinus sylvestris* in a dry pine forest of *Calluna vulgaris* type, 27 Aug 1998 E. Parmasto (TAA 174 016); Pihtla Comm., NE of Liiva-Putla (58E23.5' N 22E39.3' E), in forest litter in a dry pine forest, 10 Sep 1998 E. Parmasto (TAA 174 221).

SPHAEROBASIDIUM MINUTUM (J. Erikss.) Oberwinkler. - Valgamaa Co., Pühajärve Comm., Vidrike, Otepää Landscape Reserve (58E00' N 26E30' E), on a rotten log of *Picea abies* in a spruce forest of *Oxalis acetosella* type, 23 Aug 1996 E. Parmasto (TAA 164 484); Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Madise zone (58E32.5' N 26E11' E), on a fallen rotten trunk of *Picea abies* in a spruce forest, 20 Aug 1997 E. Parmasto (TAA 166 922).

TRECHISPORA COHAERENS (Schwein.) Jülich & Stalpers. - Tartumaa Co., Laeva Comm., Ristsaare, Alam-Pedja Nature Reserve, Sooküla zone (58E26' N 26E19.5' E), on a fallen rotten trunk of *Salix caprea* in a spruce forest of *Vaccinium myrtillus* type, 20 Aug 1997 E. Parmasto (TAA 166 939); Viljandimaa Co., Kolga-Jaani Comm., Alam-Pedja Nature Reserve, Umbusi-Epruraba zone (58E30' N 26E06.5' E), on forest litter and under mosses in a spruce forest, 25 Aug 1997 E. Parmasto (TAA 166 961); Saaremaa Co., Torgu Comm., NE of Mäebe (57E59.2' N 22E09.0' E), on dead petioles of *Athyrium filix-femina* in a spruce forest, 25 Aug 1998 E. Parmasto (TAA 167 951); Saaremaa Co., Kuressaare Comm., N of Kudjapä (58E16.3 N 22E33.5 E), on a fallen trunk of *Quercus robur* in a nemoral oak forest, 27 Aug 1998 E. Parmasto (TAA 174021).

TRECHISPORA INVISITATA (H. Jacks.) Liberta. - Jõgevamaa Co., Puurmani Comm., Alam-Pedja Nature Reserve, Umbusi-Epruraba zone (58E30' N 26E06.5' E), under mosses in a pine forest of *Vaccinium myrtillus* type, 25 Aug 1997 E. Parmasto (TAA 166 980).

TRECHISPORA INVISITATA ssp. HAUERSLEVII K.H. Larsson. - Saaremaa Co., Kuressaare Comm., Järve (58E11.2' N 22E15.8' E), in forest litter in a pine forest of *Cladina* type, 24 Aug 1998 E. Parmasto (TAA 167 873).

TRECHISPORA KAVINIOIDES de Vries. - Saaremaa Co., Pihtla Comm., Kangruselja (58E21.3' N 24E47.2' E), on rotten wood of *Picea abies* in a spruce forest, 29 Aug 1998 E. Parmasto (TAA 174 087).

TRECHISPORA TENUICULA (Litsch.) K.H. Larsson. - Saaremaa Co., Kuressaare Comm., Järve (58E11.2' N 22E15.8' E), on fallen needles of *Pinus sylvestris* in a dry pine forest of *Cladina* type, 24 Aug 1998 E. Parmasto (TAA 167 876).

TUBULICRINIS BOREALIS J. Erikss. - Jõgevamaa Co., Puurmani Comm., SE of Utsali (58E31.8' N 26E15.5'), on a fallen trunk of *Picea abies* in a spruce forest of *Oxalis acetosella* type, 26 May 1997 I. Parmasto, det. E. Parmasto (TAA 162 600).

VUILLEMINIA MACROSPORA (Bres.) Hjortstam. - Saaremaa Co., Kuressaare Comm., N of Kudjapä (58E16.3' N 22E33.4' E), on a dead twig of *Rhamnus cathartica* in a nemoral oak forest, 27 Aug 1998 E. Parmasto (TAA 174 028).

Of northern countries, found until very rarely in Denmark and Sweden.

Puccinia scillae Linh.

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All on *Scilla sibirica* Andr.: Tartu, various locations, April, May 1998, 1999, TAA 170013, 170014, 170015, 170016, 170075, 171122; Põlvamaa, Värska cemetery, 17 May 1998, K. Põldmaa, TAA 170018; Tallinn, Metsakalmistu cemetery, 25 Apr 1999, K. Põldmaa, TAA 170033.

In all recorded places many of the plants were strongly infected. The leaves of the host had become wrinkled and yellowish at the site of infection. Dark brown powder of teliospores, released in large numbers from telia, covered the

infected spots. *P. scillae* has not been found earlier either in the Baltics (Minkevicius & Ignataviciute, 1991) or in the Nordic countries (Gjærum, 1974). It is known to occur on *Scilla bifolia* L. in South and Central Europe and on *S. sibirica* in the Ukraine and in the districts of Saratov and Voronezh in Russia (Müller, 1977). Accordingly, specimens from Estonia represent the northernmost known localities of *P. scillae*. Despite searching for it in some places in Central Estonia and Ruhnu Island, the rust could not be found there. Thus the issue concerning the distribution of *P. scillae* in Estonia is left for future studies.

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