

# The occurrence of myxomycetes on different decay stages of trunks of *Picea abies*, *Pinus sylvestris* and *Betula* spp. in a small oldgrowth forest in southern Finland

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The occurrence of myxomycetes was studied on fallen trunks of *Picea abies*, *Pinus sylvestris*, and *Betula* spp. (*B. pendula* and *B. pubescens*) in a small oldgrowth forest in southern Finland in May 1998 – September 1999. The study site is located in Luukkaa Recreation Area, and was left in pristine state in 1966. The sample trunks were chosen to represent different stages of decomposition and checked every second or fourth week in all for 17 times. A total of 325 myxomycete specimens representing 44 taxa in 16 genera were observed. Four taxa, *Comatricha pulchella* var. *fusca*, *Lycogala exiguum*, *Licea* cf. *pusilla*, and *Physarum bethelii* are new records to Finland. During the study, myxomycetes were most abundant on decomposing trunks of *Betula* spp. (123 specimens), especially on well-decayed trunks. The species diversity was about the same on all studied tree species: 27 taxa were recorded on *P. abies* and *P. sylvestris*, and 22 on *Betula* spp. The largest diversity was on two pine trunks with fairly soft wood (a total of 19 taxa). The common myxomycetes, *Ceratiomyxa fruticulosa* and *Lycogala epidendrum*, represent generalists in this study, being abundant and present at nearly all decay stages of all studied tree species. *Leocarpus fragilis* and *Tubifera ferruginosa* are examples of species that preferred well-decayed wood, and *Stemonitopsis reticulata* and *S. typhina* were found only on hard to fairly hard wood. The peak of the number of taxa and abundance of myxomycetes occurred from July through to September.

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## Introduction

A fallen trunk is a temporally changing, heterogeneous resource unit, a substrate in a dynamic state (Rayner & Boddy 1988, Renvall 1995b). The decomposing process of wood usually starts within a living tree, the first invaders being bacteria, ascomycetes and certain pathogenic polypores (Swift 1977, Roll-Hansen & Roll-Hansen 1979, Rayner & Boddy 1988, Hallaksela & Salkinoja-Salonen 1992, Renvall 1995a). There are some suggestions that the colonization of wood by myxomycetes also may occur before the trunks fall down, e.g. through the presence of active myxomonads of lignicolous species within the

interstitial spaces of branches of still living trees (Ing 1994). Ostrofsky and Shigo (1981) have isolated *Comatricha aequalis* Peck from discoloured wood chips of living red maple (*Acer rubrum* L.).

Soon after the death and fall of the tree it will be inhabited by a variety of saprotrophic fungi, and especially Basidiomycetes, make up the majority of organisms responsible for the wood decay (Swift 1977, Rayner & Boddy 1988, Renvall 1995a). Myxomycetes are regarded rather as scavengers than decomposers, but some species can produce extracellular amylases and even cel-

lulase (Ali et al. 1992, Ing 1994). Decomposition changes the structure and chemical conditions of the wood and the water potential increases, which in turn increases the availability of water to organisms growing on the substratum (Dix 1985). Also the nutrient contents of the wood changes during the decay. The trunks become more or less covered with mosses and lichens which, for their part, increase the water-holding capacity of the logs. The species composition of bryophytes, hepatics and lichens also changes in relation to the stage of decay (Söderström 1988, Ing 1994). Some myxomycetes seem to be associated with terrestrial mosses (e.g., Gray & Alexopoulos 1968, Martin & Alexopoulos 1969, Stephenson & Studlar 1985, Nannenga-Bremekamp 1991, Ing 1994, 1999).

The fallen, decomposing trunks provide a diversity of ecological niches for lignicolous myxomycetes in forest ecosystems. Even though dead wood is a common substrate for slime moulds, and it is known that species on slightly decayed wood are different from those on well-decayed wood, there are only a few studies about the succession of myxomycetes on decomposing wood. Elliot and Elliot (1920) observed the succession of fungi and myxomycota for eight years on a large, initially sound oak branch that was blown down. In their study the first myxomycete

(*Physarum nutans* Pers.) appeared after seven years of observation. According to them the wood was still very hard and dense. The only recent studies were made by Takahashi (1999, 2000b, 2001). He studied myxomycete colonies on decaying wood of *Pinus densiflora* Siebold & Zucc. and *Quercus acutissima* Carruth. in three localities in southwestern Japan, in a pine forest (*Pinus densiflora*) in Rashomon, and in a sub-alpine coniferous forest in central Japan.

The purpose of the present study was to document the succession, species diversity and abundance of myxomycetes on fallen Norway spruce (*Picea abies* (L.) Karst.), Scots pine (*Pinus sylvestris* L.) and birch (*Betula pendula* Roth and *B. pubescens* Ehrh.) trunks representing different stages of decomposition and to make observations about the phenology of the lignicolous species in a southern boreal oldgrowth forest.

## Material and methods

### The study area

The field work was carried out in a small (ca. 200 hectares) oldgrowth forest area in Luukkaa, Espoo in southern Finland in May 1998 – September 1999 (Figs. 1–2). The area is located in the northeastern corner of the Luukkaa Recreation Area 23 km NW of the centre of Helsinki, and has been unmanaged by forestry since

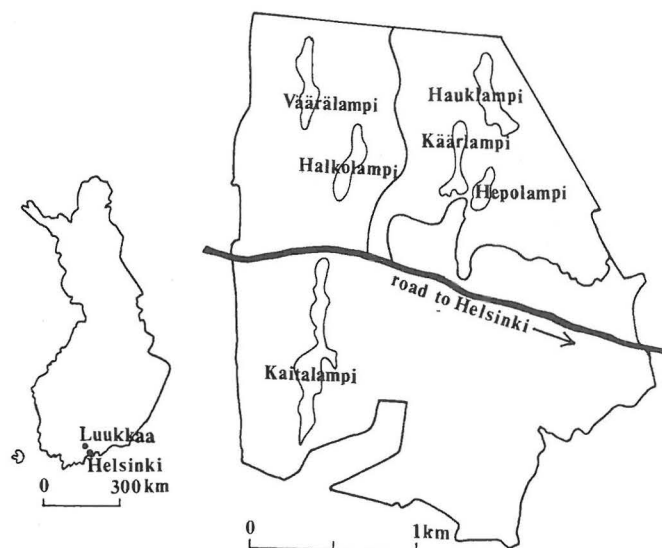


Fig. 1. The location of the research area. The lined area with Hauklampi, Käärlampi and Hepolampi ponds in the northeastern corner of the Luukkaa Recreation Area is the oldgrowth forest where the fallen sample trunks were located. The map is compiled from brochures of Luukkaa and from Anonymous (1988).

1966. The study area is naturally regenerating southern boreal forest with *Picea abies*, *Pinus sylvestris*, and *Betula pendula* as dominating trees. Because the forest is not very old, the number of natively fallen trees, and especially the number of extensively or almost completely decomposed trunks is not as high as in true oldgrowth forests e.g. in northern Finland. The complete decomposition of a large, fallen spruce or pine takes over 100 years in boreal climate (Renvall 1995a). The diameter of the trunk, moisture, and height above the ground affect the speed of decay. Logs lying off the ground (supported by branches or lying on a slope) dry out more easily because of the increased wind and less moist support from the ground below (Söderström 1988).

### The sample trunks

The sample trunks were chosen to represent successive decay stages. They were divided into four different stages of decomposition (Table 1). The decay classification used is according to Renvall (1995a) with some modifications. The main character used in the evaluation of the stage of decay was the hardness of the wood. It was tested by sticking a knife into different parts of the trunk.

A total of 24 fallen trunks of *Picea abies*, *Pinus sylvestris*, and *Betula* spp. (*B. pendula* and *Betula pubescens*) were studied, two trunks of each tree species and

each decay stage. The diameter of the selected trunks varied from 10 cm to 27 cm when measured approximately at the middle of the trunk. The length of the trees varied from a 3.5 metre long block to 20.4 metres. Most of the tree trunks lay totally on the ground, some recently fallen ones were still partly above the ground supported by branches.

### Collection of specimens

The sample trunks were studied with a flashlight twice per month in July – October 1998, and once in May, June, and December 1998, and in April – September 1999. In November 1998 and January – March 1999 the trunks were covered by snow.

When the same species occurred on different points of a same trunk on the same observation day, the fructifications were considered as different specimens if they grew at least at the distance of 30 cm from each other (see Eliasson 1981). When the same species was detected on the same trunk on consecutive collecting times near the previous growing place, it was considered as a separate specimen only if it was fresh and in good condition. Common and easily recognized myxomycete species (mostly *Ceratiomyxa fruticulosa* (F. Muell.) T. Macbr.) were occasionally identified directly in the field and were not collected for a specimen. The specimens are deposited in the Botanical Museum, University of Helsinki (H).



Fig. 2. Boreal spruce forest in the study area of Luukkaa.

Table 1. The four-point scale used for dividing the sample trunks of *Picea abies*, *Pinus sylvestris*, and *Betula* spp. into different stages of decay in Luukkkaa oldgrowth forest area. Decay classification modified from Renvall (1995a).

Decay stage	Trunk characters
I	Wood hard, pushed knife penetrates only a few mm into the wood. Recently fallen trunks, bark intact or nearly intact. Epiphytic flora chiefly the same as in standing, living trees.
II	Wood fairly hard, knife penetrates ca. 1–2 cm into the wood. Bark starting to break up or trunk already more or less decorticated. Epiphytes usually scanty, in patches.
III	Wood fairly soft, knife penetrates fairly easily ca. 3–5 cm into the wood; small areas already decomposed, but harder parts exist especially in the upper part of the trunk. Trunks decorticated or only partly corticated (except birch). Epiphytic cryptogams fairly abundant on parts of the trunk surface.
IV	Wood soft, partly very soft, the whole blade of the knife easily penetrates into the trunk. Wood extensively decayed and large sections nearly completely decomposed. Usually decorticated or only small patches of bark left. Trunk covered by bryophytes and lichens, some to many of them typical forest ground inhabitants, occasionally also covered with some vascular plants.

Table 2. The weather conditions in Luukkkaa oldgrowth forest area during the research period. The data is based on the statistics published by the Finnish Meteorological Institute (Helminen et al. 1998a–h, 1999a–g). The nearest weather observation station locates on the airport of Helsinki-Vantaa, ca.18 km from the study area.

	Mean monthly temperature (°C)	Highest temp. of the month (°C)	Lowests temp. of the month (°C)	Rainfall mm/month	Collecting date
<b>1998</b>					
May	10.4	23.5 (1 May)	0.9 (21 May)	50	28
June	14.4	27.1 (15 June)	4.5 (7 June)	117	20
July	16.2	23.6 (12 July)	7.1 (5 July)	125	2, 21
August	13.6	21.2 (3 Aug.)	5.6 (28 Aug.)	107	2, 19
September	11.5	20.9 (9 Sep.)	0.2 (30 Sep.)	49	6, 26
October	5.8	11.9 (23 Oct.)	–4.4 (7 Oct.)	135	11, 24
November	–3.4	3.7 (1 Nov.)	–17.2 (21 Nov.)	33	–
December	–2.2	5.0 (19 Dec.)	–15.8 (24 Dec.)	51	5
<b>1999</b>					
April	5.7	20.0 (20 Apr.)	–5.4 (5 Apr.)	55	13
May	8.0	21.4 (22 May)	–4.0 (3 May)	11	13
June	18.4	28.1 (26 June)	3.6 (1 June)	25	27
July	19.1	31.0 (14 July)	9.3 (5 July)	25	21
August	15.4	29.5 (4 Aug.)	5.1 (23 Aug.)	66	8
September	12.8	23.8 (5 Sep.)	–0.2 (27 Sep.)	40	5

### Weather conditions

The weather conditions during the research are compiled in Table 2. The year 1998 was a rainy one. On 5 Nov. the first snow came, and the temperature fell below zero. In southern Finland the thickness of the snow was exceptionally high for the time of the year: 15–30 cm (Helminen et al. 1998g), and the trunks could not be checked. At the end of the month the snow melted and the trunks were checked on 5 Dec. In January – March 1999 the trunks were totally covered by snow and could not be studied until mid April. The summer 1999 was exceptionally dry and sunny, in southern and south-western Finland the growing season was one of the driest

for 50 years (Helminen et al. 1999g), and the trunks were studied only once per month.

### Results and discussion

A total of 325 myxomycete specimens were observed. They belong to 44 taxa in 16 genera (Tables 3–5). Some of the collected specimens (18 out of 325) were in bad condition (e.g. excessively mouldy) or otherwise puzzling, and could be

identified only to genus level. These specimens are not included to the lists in Tables 3–5. Four of the taxa, viz. *Comatricha pulchella* (C. Bab.) Rostaf. var. *fusca* Lister, *Licea* cf. *pusilla* Schrad., *Lycogala exiguum* Morgan, and *Physarum bethelii* T. Macbr. are new records for Finland. Of *Stemonitis lignicola* Nann.-Bremek there is one (unpublished) earlier collection from Finland (Varsinais-Suomi, Kimito, on decayed wood of *Pinus sylvestris*, 1995 Wikström 5353, H)

Most *Licea* species are very small and difficult to detect in the field, and all *Liceas* listed here grew mixed with other myxomycete species and were detected when these other species were examined under microscope in the laboratory. It is probable that *Liceas* (especially *Licea minima* Fr.) were more abundant on the sample trunks than the figures given in Tables 3–5 indicate.

The only fallen trunk on which I did not detect any myxomycetes during the whole research was a fairly small, recently fallen trunk of *Betula*. The whole log lay on the ground on a blanket of *Sphagnum* in a wet place. The corresponding recently fallen *Betula* trunk selected as a second sample tree was a large one, laying partly off the ground because of many strong branches. It produced a great number of myxomycete specimens.

### *Myxomycetes on different decay stages*

The myxomycete taxa observed on different stages of decay of *Picea abies*, *Pinus sylvestris*, and *Betula* spp. trunks are compiled in Tables 3–5.

Takahashi (1999, 2000b, 2001) reported in his studies in Japan that the species composition of myxomycete changed as the wood (of *Quercus acutissima*, *Pinus densiflora* and other conifers) decayed. In my study it is not possible to draw any accurate conclusions from the changes in the species composition in relation to the different stages of decay, since I found only one to few specimens of many myxomycete species during the research period. The summer 1999 was unfavourable for slime moulds, from mid April to early September I found only 58 specimens growing on the studied trunks. The results in Luukkaa oldgrowth forest agree with the known fact that there are species that prefer certain stages of decay, but there are also generalists, common species with a long growing season occurring on different decay stages on conifer and birch trunks.

The most common species in this study was *Lycogala epidendrum* (L.) Fr. It grew from late May to late October, and was detected on all other studied tree trunks except on *Picea abies* representing decomposition stage I, and on *Betula* representing decay stage IV. The only *Lycogala* species observed growing on the latter was *L. exiguum*. *Ceratiomyxa fruticulosa* was also common, especially on *Pinus sylvestris*, and also on *Picea abies*. It grew on all stages of decomposition on both of the species, but was less abundant on *Betula* and grew only on trunks representing decay stages III and IV. Takahashi (2000b, 2001) obtained similar results with *C. fruticulosa* and *L. epidendrum* in coniferous forests in Japan: they grew on slightly or moderately decayed to strongly decayed wood from May through October, however, dominating in summer. In the dry summer 1999, *Lycogala epidendrum* was the only common myxomycete growing on the following trunks: *Picea abies* II–III, *Pinus sylvestris* I–III, and *Betula* II–IV.

*Didymium melanospermum* (Pers.) T. Macbr. occurred on slightly to well-decayed wood on conifer trunks, on birch it was detected only twice on decay stage IV. *Trichia botrytis* (J. F. Gmel.) Pers. seems not to be specially dependent on the stage of decomposition, most common, however, it occurred on *Picea* on only slightly decayed wood. *Trichia decipiens* (Pers.) T. Macbr. preferred decay stage II on conifer trunks, on birch it was common on decay stage IV. The species of the genus *Arcyria* grew on slightly to moderately decayed wood, no specimens were found on decay stage IV. *Leocarpus fragilis* (Dicks.) Rostaf. preferred well-decayed wood, as also did *Tubifera ferruginosa* (Batsch) J. F. Gmel. The latter species was detected only on well-decayed conifer wood.

In Takahashi's (1999, 2000b, 2001) studies only a few taxa of myxomycetes occurred on hard, slightly decayed wood. Schnittler and Novozhilov (1998) obtained similar results when studying late-autumn myxomycetes on bark and decomposing wood in northern Ammergauer Alps (in October). They seldom found slime moulds on slightly decayed wood which, according to them, was due to the absence of most *Stemonitales*. According to Takahashi (1999, 2000b, 2001) the species diversity (and colony areas) increased on softer, more decayed wood, but on the softest, significantly decayed wood the number of species again decreased. In this study

Table 3. Myxomycetes observed on fallen trunks of *Picea abies* in Luukkaa oldgrowth forest area in May 1998–September 1999.

Taxa	Stage of decay				Total number of specimens
	I	II	III	IV	
<i>Arcyria cinerea</i>		2			2
<i>Arcyria incarnata</i>	1				1
<i>Arcyria nutans</i>		1	1		2
<i>Arcyria pomiformis</i>		1			1
<i>Ceratiomyxa fruticulosa</i>	1	3	2	8	14
<i>Comatricha ellae</i>		1			1
<i>Cribraria rufa</i>		1	1	1	3
<i>Cribraria vulgaris</i>	1				1
<i>Didymium melanospermum</i>	1	2	1	2	6
<i>Enerthenema papillatum</i>	1				1
<i>Fuligo septica</i>	2				2
<i>Leocarpus fragilis</i>				2	2
<i>Licea minima</i>	1	1			2
<i>Licea variabilis</i>				1	1
<i>Lycogala epidendrum</i>		8	1	3	12
<i>Physarum bethelii</i>			1		1
<i>Physarum nutans</i>		4	5		9
<i>Reticularia intermedia</i>		1			1
<i>Stemonitis axifera</i>				1	1
<i>Stemonitis fusca</i>		2			2
<i>Stemonitis lignicola</i>				2	2
<i>Stemonitis pallida</i>			1		1
<i>Stemonitopsis hyperopta</i>			1	2	3
<i>Stemonitopsis reticulata</i>		1			1
<i>Trichia botrytis</i>	6	2	1	1	10
<i>Trichia decipiens</i>		3			3
<i>Tubifera ferruginosa</i>				2	2

Table 4. Myxomycetes observed on fallen trunks of *Pinus sylvestris* in Luukkaa oldgrowth forest area in May 1998–September 1999.

Taxa	Stage of decay				Total number of specimens
	I	II	III	IV	
<i>Arcyria cinerea</i>			1		1
<i>Arcyria incarnata</i>	3	1	1		5
<i>Arcyria nutans</i>		2			2
<i>Arcyria pomiformis</i>	1		1		2
<i>Ceratiomyxa fruticulosa</i>	2	8	8	4	22
<i>Comatricha elegans</i>			1		1
<i>Comatricha nigra</i>	3		1	1	5
<i>C. pulchella</i> var. <i>fusca</i>			2		2
<i>Cribraria personi</i>				1	1
<i>Cribraria rufa</i>			1		1
<i>Didymium melanospermum</i>	1	2	3		6
<i>Didymium nigripes</i>				1	1
<i>Enerthenema papillatum</i>	2		1		3
<i>Fuligo septica</i>	1		1	1	3
<i>Leocarpus fragilis</i>				2	2

<i>Lepidoderma tigrinum</i>			2	2	4
<i>Licea minima</i>	1	2	2		5
<i>Licea cf. pusilla</i>			3		3
<i>Lycogala epidendrum</i>	3	5	1	5	14
<i>Physarum nutans</i>			3		3
<i>Reticularia intermedia</i>			1		1
<i>Stemonitis lignicola</i>			2		2
<i>Stemonitis virginensis</i>		1			1
<i>Stemonitopsis reticulata</i>	1	2			3
<i>Trichia botrytis</i>		1	2		3
<i>Trichia decipiens</i>		6			6
<i>Tubifera ferruginosa</i>				3	3

Table 5. Myxomycetes observed on fallen trunks of *Betula* spp. in Luukkaa oldgrowth forest area in May 1998–September 1999.

Taxa	Stage of decay				Total number of specimens
	I	II	III	IV	
<i>Arcyria affinis</i>	3	1			4
<i>Arcyria nutans</i>		1	1		2
<i>Ceratiomyxa fruticulosa</i>			1	5	6
<i>Comatricha elegans</i>				1	1
<i>Comatricha nigra</i>				1	1
<i>Didymium melanospermum</i>				2	2
<i>Leocarpus fragilis</i>		1	3	11	15
<i>Licea minima</i>				2	2
<i>Lycogala exiguum</i>				3	3
<i>Lycogala epidendrum</i>	4	8	5		17
<i>Physarum cinereum</i>	2				2
<i>Physarum leucophaeum</i>	1		1		2
<i>Physarum leucopus</i>	4		1		5
<i>Physarum nutans</i>	4		3	3	10
<i>Reticularia lycoperdon</i>		1			1
<i>Stemonitis axifera</i>			3	3	6
<i>Stemonitopsis typhina</i>	6				6
<i>Trichia botrytis</i>		1		2	3
<i>Trichia decipiens</i>			2	15	17
<i>Trichia favoginea</i>		1			1
<i>Trichia scabra</i>	3			2	5
<i>Trichia varia</i>			2	2	4

I had similar results only on pine trunks, but one must take account that the softest, almost completely decomposed trunks were not yet existing in Luukkaa.

The increasing of decay increases the water potential of wood and the amount of mosses and lichens growing on the trunks which, for their part, increase the water-holding capacity and reduce evaporation (Dix 1985, Renvall 1995b). That is why one would expect that the most productive trunks in the dry summer 1999 would have been the softest, most decayed logs. This was

seen only on birch trunks, on spruce and pine the total number of collections during June–September 1999 was highest on decay stage II.

#### *Myxomycetes on different decay stages of different tree species*

On the eight decomposing trunks of *Picea abies* studied, I discovered a total of 93 specimens representing 27 species (Table 3). Four specimens were identified only to genus level and are not included in Table 3. The *Picea* trunks representing



decay stage II produced the most myxomycetes on spruce. Also the number of different species was highest on this stage of decomposition, but not considerably higher than on stages III and IV. *Ceratiomyxa fruticulosa* was common and grew on all stages of decay, as also did *Trichia botrytis*. *Lycogala epidendrum* was also common on spruce, it grew on decay stages II to IV, being most common on decay stage II. *Didymium melanospermum* and *Physarum nutans* were fairly common on spruce trunks. The first one grew on all stages of decay, the second on stages II and III.

The trunks of *Pinus sylvestris* produced a total of 109 specimens and 27 species (five specimens were identified only to genus level) (Table 4). Myxomycetes were most abundant on trunks with fairly soft wood (decay stage III). The number of different species was also highest on this decay stage. Fallen pine trunks with fairly hard wood (decay stage II) produced nearly as many specimens, but the species diversity was lower. *Ceratiomyxa fruticulosa* was the commonest species on fallen pine trunks, and it grew on all stages of decomposition, being, however, most common on decay stages II and III. *Lycogala epidendrum* was common and was observed on all stages of decay. Fairly common species on pine were *Arcyria incarnata* (Pers.) Pers. (grew on decay stages I–III), *Comatricha nigra* (Pers.) Schroet. (on decay stages I, III, IV), *Didymium melanospermum* (on decay stages I–III), *Licea minima* (on decay stages I–III), and *Trichia decipiens* (only on decay stage II). *Lepidoderma tigrinum* (Schröd.) Rostaf. grew on fairly soft (decay stage III) to soft (decay stage IV) logs covered by mosses.

A total of 123 specimens and 22 species were observed on fallen trunks of *Betula* spp. (nine specimens were identified only to genus level) (Table 5). Trunks representing decay stage IV produced the most specimens and the most species on birch. The species diversity, however, was not much lower on decay stage III. Common species on birch were *Lycogala epidendrum* (grew on decay stages I–III), *Leocarpus fragilis* (II–IV, mostly on IV), *Physarum nutans* (I, III, IV), and *Trichia decipiens* (III–IV, mostly on IV). *Ceratiomyxa fruticulosa* was less common than on spruce and pine trunks, and it grew only on decay stages III and IV. *Stemonitopsis typhina* (F. H. Wigg.) Nann.-Bremek. is usually considered to prefer more decayed wood (see Ing 1994), but in

this study it was detected only on recently fallen birch trunk (decay stage I).

On *Betula* trunks there were more *Physarum* and *Trichia* species than on conifer logs. All *Cribraria* species observed grew on spruce and pine, as also *Tubifera ferruginosa*, which was collected only from well-decayed trunks.

### Phenology

In Luukkaa oldgrowth forest area on spruce trunks the slime moulds were most abundant and the species diversity was highest in July (22 specimens and 11 species) and August (29 specimens and 18 species). On pine trunks the most productive months were July (28 specimens and 12 species), August (28 specimens and 12 species), and September (27 specimens and 17 species). Even though the peak of the abundance of myxomycetes on birch trunks also occurred in July (27 specimens and 14 species) and September (35 specimens and 13 species), the peak was not as sharp as it was on spruce and pine. On birch the abundance and species diversity of myxomycetes distributed more evenly between different months. For some reason in this study, August was a less favourable month for myxomycetes on birch trunks (15 specimens and 7 species) than it was on spruce and pine.

According to Ing (1994) the myxomycete species are seasonal, but the seasonality of a species may vary in different climatic zones. In the boreal forest of Luukkaa *Comatricha nigra*, *Leocarpus fragilis*, *Licea minima*, *Lycogala epidendrum*, *Trichia botrytis*, and *T. decipiens* were observed from spring to late autumn; *L. minima* (on pine II), *T. botrytis* (on spruce I), and *T. decipiens* (on birch IV) even on early December when there was a thin snow cover on the ground and the temperature was minus 3.8°C. On the same day also *Stemonitopsis reticulata* (H. C. Gilbert) Nann.-Bremek. & Y. Yamam. was collected (from pine II). In Stephenson's (1988) study in southwestern Virginia only a few species could be collected during the whole field season: e.g. *L. epidendrum* and *Stemonitopsis typhina* grew from May through October. Also Eliasson (1981) and Takahashi (2000b) reported that *L. epidendrum* occurs from May to October (in a spruce forest in south Sweden and in a pine forest in Japan), and Hamashima (1964) noted that the growing season of the genus *Lycogala* was long on shiitake-



cultivating wood-logs in Aichi Prefecture in Japan. In Luukkaa oldgrowth forest *S. typhina* occurred from mid May to mid October, but was not observed in June and July. Eliasson (1981) reported that in a spruce forest in southern Sweden *Trichia botrytis* and *T. decipiens* were restricted to autumn, they were observed in September–October, as also, at least mainly, *Leocarpus fragilis* and *Didymium melanospermum*. All of these species were observed also in the spring and summer in this study, being, however, more abundant in the autumn, especially the three first mentioned species. *Cribraria rufa* (Roth) Rostaf., was collected already in May, but the next specimens were not observed until September and October. *Ceratiomyxa fruticulosa* was collected from late May through August and *Trichia scabra* Rostaf. from mid April to early September. The occurrence of *Lepidoderma tigrinum* (only on pine) emphasised on spring, one collection originates from late September.

Most of the other observed taxa usually grew from July through September. When all observations of all trunks and all stages of decomposition are counted, the clear peak time for seasonal appearance of fruiting bodies, and highest number of different taxa occurred during these three months. In Stephenson's (1989) study in Virginia the highest monthly totals for both the number of collections and the number of different species were recorded for July and August. In a study in sub-alpine forest in the southern Alps in central Japan the total number of collected species was highest in August, but not considerably higher than in September and October (Takahashi 2000a). In the same study the number of total collections was clearly highest in September. Hamashima (1964) obtained similar results from Aichi Prefecture, Japan: the seasonal peak time of myxomycete fructifications occurred from July to early September.

### Taxonomy

The three *Licea* specimens determined here as *Licea* cf. *pusilla* were detected on consecutive collecting times on a trunk of *Pinus sylvestris* representing decay stage III. One of the specimen (TU 838A) seems to be a typical *Licea pusilla* with olive-brown, densely warted, (13–)13.5–15.0–16(–17) µm large spores. In two other specimens (TU 797B and 819B) the spores are slight-

ly lighter, 12–13.4–14 µm in diameter. The spore size of *L. pusilla* is usually 15–17 µm, but varies from 13 to 20 µm (Martin & Alexopoulos 1969, Nannenga-Bremekamp 1991, Neubert et al. 1993, Ing 1999). The author has earlier studied the lectotype of *Licea pusilla* Schrad. var. *pygmaea* Meyl. (Switzerland, Canton Vaud, La Gittaz, Oct. 1930, Meylan, LAU). The spore colour and ornamentation in that specimen is the same as in specimens TU 797B and 819B, but the spores are slightly smaller, 11.0–11.5–12(–13) µm. Since all three *Licea* specimens grew on the same trunk and were discovered on consecutive collecting times, I decided to put them all under the name *Licea* cf. *pusilla*.

One of the five *Trichia scabra* specimens (TU 885), reported here has somewhat atypical capillitial threads. The spiral ornamentation of the elaters is coarse, and the spines are up to 2 µm tall. All other characters fit to *T. scabra*.

*Trichia favoginea* (Batsch) Pers. in this paper was recognized following Farr (1958). In the only specimen found the spore ornamentation is as if intermediate of typical *T. favoginea* and *T. persimilis* P. Karst., and the 4.5–5 µm thick elaters are spiny.

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