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The genus *Tremella* (Basidiomycota, Tremellales) in Finland

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Sixteen species of *Tremella* Pers. are currently known from Finland. Fifteen of them are illustrated and described, and a key to all Finnish species is given. *Tremella cetrariicola* Diederich & Coppins, *T. cladoniae* Diederich & M.S. Christ., *T. giraffa* Chee J. Chen, *T. globispora* D.A. Reid, *T. phaeophysciae* Diederich & M.S. Christ., *T. polyporina* D.A. Reid and *T. ramalinae* Diederich are reported as new to Finland.

Key words: Basidiomycota, fungicolous, heterobasidioid, lichenicolous, parasitism, taxonomy, *Tremella*, Tremellales

Introduction

Heterobasidioid fungi are poorly known in Finland. They have largely been overlooked since the early studies of P. A. Karsten (1834–1917), except for fragmentary notes in the literature (e.g., Laurila 1939, Lowy 1960, Ryman & Holmåsen 1987, Ohenoja 1996, Hansen & Knudsen 1997, Salo *et al*. 2006) and studies of resupinate heterobasidiomycetes (Kotiranta & Saarenoksa 1993, 2005). As a result there is not even much data on basic species composition. When we began the study of the genus *Tremella*, only nine species had been reported in Finland (Torkelsen 1997, Kotiranta & Saarenoksa 2000). The number of species was low as compared with the 25 *Tremella* species reported in the Nordic countries, and the distribution and abundance of the species were insufficiently known (Torkelsen 1997). The species were also commonly confused with other heterobasidioid fungi, especially those in the genus *Exidia* and in the order Dacrymycetales. The former group is easily distinguished from *Tremella* species by their allantoid spores and the latter group by their forked basidia.

Material and methods

Approximately 600 *Tremella* specimens were examined for the present study. The material is preserved in the herbaria H, JYV, K, KUO, O, OULU, S, TUR, UPS and/or in the personal herbarium of Heikki Kotiranta (H.K.).

Data on the distribution, abundance and ecology of *Tremella* species in Finland are based on these collections. For each species, except *T. cladoniae* which was added at the last moment, seven to nine specimens were selected for accurate measurements. Where less than seven specimens

exist, all were included. At least thirty spores per specimen were measured, where present. None of the measurements derives from spore prints. Basidia measurements do not include stalks. All measurements were made using ×1000 or ×1500 magnification and oil immersion. An eyepiece scale bar with 1 μm grid was used, and dimensions were estimated subjectively with an accuracy of 0.1 μm. The basic mountant medium used was 5% KOH. The spore measurements for each specimen are given in Table 1.

In the table, text and illustrations selected specimens are marked with the collector's name and collecting number or year; the herbarium label data is included if needed to separate specimens of the same species. The following abbreviations are used in the table and text: L = mean length, W = mean width, $Q = L/W$, Q^* = mean L/W ratio,

Table 1. Spore dimensions (µm) of selected specimens except for *Tremella cladoniae*. Specimens are marked with collector's name and collecting number or year; herbarium label is included if needed to separate specimens of the same species. n = number of measured spores. The values set in boldface include at least 90% of the spores.

Species/specimen	n	Spore length (L)		Spore width (W)		L/W	
		Range	Mean	Range	Mean	Range (Q)	Mean (Q^*)
T. cetrariicola							
Hirvenoja 1951	30	(5.2–)**5.8–9.6**(–9.6)	6.5	(3.8–)**4.0–7.8**(–8.2)	5.3	1.0–1.5	1.3
Linkola 1909	30	(5.9–)**6.1–10.4**(–10.4)	7.7	(5.5–)**5.7–9.6**(–9.8)	6.9	0.9–1.9	1.1
Hyvärinen 2006	30	(4.2–)**5.8–8.2**(–8.3)	6.3	(3.9–)**3.9–6.9**(–7.7)	5.2	1.0–1.7	1.2
Hyvärinen 2005	30	(6.1–)**6.1–8.4**(–9.6)	7.5	(3.9–)**4.4–6.5**(–6.6)	5.8	1.1–1.7	1.3
T. encephala							
Haikonen 23835	31	(7.6–)**7.6–11.1**(–11.7)	9.4	(6.3–)**7.4–9.6**(–9.8)	8.5	1.0–1.3	1.1
Karsten 1881	30	(6.5–)**7.4–11.6**(–11.6)	9.1	(6.0–)**6.2–9.9**(–10.4)	8.4	1.0–1.3	1.1
Tiensuu 1962	31	(6.4–)**7.6–11.6**(–12.0)	9.3	(5.9–)**7.1–9.8**(–10.4)	8.3	0.9–1.3	1.1
Pippola 456	30	(6.0–)**6.0–9.8**(–9.9)	7.8	(5.0–)**5.9–9.8**(–9.8)	7.5	0.9–1.2	1.1
Jäppinen 1987	30	(7.6–)**7.8–10.1**(–10.2)	9.2	(6.0–)**6.5–9.2**(–9.6)	8.0	1.0–1.3	1.2
Metsänheimo 1984	30	(6.5–)**7.8–10.4**(–11.8)	9.1	(6.2–)**6.4–9.9**(–11.6)	8.2	1.0–1.4	1.1
Ohenoja 1977	30	(7.4–)**7.9–11.2**(–11.2)	9.5	(6.5–)**7.4–10.0**(–10.1)	8.8	1.0–1.2	1.1
T. foliacea							
Stenlid 668	30	**6.2–8.2**(–8.6)	7.4	(5.8–)**5.9–7.9**(–8.0)	6.6	1.0–1.3	1.1
Oittinen 1966	30	(8.0–)**8.1–10.3**(–10.5)	9.3	**7.2–9.6**(–9.8)	8.4	1.0–1.2	1.1
Malmström 39	30	(6.0–)**6.2–9.4**(–9.5)	8.0	(5.8–)**6.0–8.2**(–9.6)	7.1	1.0–1.3	1.1
Kankainen 1966	30	(6.3–)**6.9–9.9**(–10.0)	8.5	**5.9–9.2**(–9.8)	7.7	1.0–1.3	1.1
Koskela 1970	30	(6.4–)**7.3–10.1**(–11.4)	8.3	(5.8–)**6.0–9.4**(–9.8)	7.6	0.9–1.3	1.1
Ohenoja & Ohenoja 1972	30	(7.4–)**7.6–9.7**(–9.8)	8.1	(6.0–)**6.1–8.2**(–8.5)	7.4	1.0–1.5	1.1
Pippola 376	30	(6.0–)**6.1–8.3**(–8.4)	7.5	(4.5–)**5.7–7.6**(–7.9)	6.3	1.0–1.4	1.2
T. giraffa							
Alanko 132586	31	(5.7–)**6.1–8.2**(–8.3)	7.3	(5.0–)**5.5–7.8**(–8.0)	6.6	0.9–1.4	1.1
Alanko 132671	30	(6.2–)**7.0–9.1**(–9.9)	8.0	(6.0–)**6.1–9.7**(–9.8)	6.6	0.9–1.3	1.1
T. globispora							
Söderholm 2752	30	(5.9–)**6.0–9.2**(–9.6)	7.5	(5.9–)**6.1–9.6**(–9.7)	7.9	0.8–1.1	1.0
Karsten 1867	30	(5.8–)**7.4–10.2**	8.3	(5.4–)**6.9–11.6**(–12.0)	9.1	0.8–1.1	0.9
Karsten 1862	30	(5.4–)**5.8–9.2**(–9.8)	7.0	**5.9–9.7**(–9.9)	7.3	0.8–1.2	1.0
T. hypocenomycis							
Leppälä 1947	5	**4.6–7.8**	6.3	**4.0–8.1**	6.2	0.9–1.2	1.0
Norrlin 1867	15	**5.4–7.3**	6.4	**5.3–7.6**	6.2	0.9–1.2	1.0
T. hypogymniae							
Häyrén 1919	30	(4.5–)**5.1–7.9**(–8.0)	6.5	(4.9–)**5.1–8.3**(–8.6)	7.1	0.7–1.1	0.9
Takala 73	32	(5.1–)**5.3–8.2**(–8.2)	6.8	(6.1–)**6.2–9.7**(–9.8)	8.0	0.6–1.2	0.9
Takala 82	30	**5.6–7.8**(–8.1)	6.6	(5.8–)**5.9–8.6**(–9.5)	7.6	0.7–1.3	0.9
Takala 3	30	(4.9–)**5.5–7.6**(–7.7)	6.4	(5.5–)**5.9–8.1**(–8.3)	7.4	0.7–1.0	0.9
Räsänen 1936	18	**4.1–7.9**	6.1	**5.5–8.2**	7.1	0.7–1.0	0.9
Linkola 1930	30	(4.2–)**5.0–7.3**(–7.9)	5.9	(5.3–)**5.7–7.8**(–8.2)	6.8	0.7–1.0	0.9
Takala 103	9	**5.9–8.3**	6.4	**6.3–10.0**	8.6	0.7–1.0	0.8

continued

Table 1. Continued.

Species/specimen	*n*	Spore length (*L*)		Spore width (*W*)		*L*/*W*	
		Range	Mean	Range	Mean	Range (*Q*)	Mean (*Q**)
T. indecorata							
Haikonen 1866	30	(4.9–)**5.6–8.0**(–9.8)	7.0	(5.7–)**5.9–9.2**(–9.4)	7.2	0.8–1.2	1.0
Söderholm 2686	30	(5.9–)**6.0–9.8**(–9.9)	7.8	(5.9–)**6.1–10.0**(–11.2)	8.0	0.9–1.3	1.0
Karsten 1865	30	(5.5–)**5.6–8.8**(–9.0)	7.1	(5.9–)**5.9–9.8**(–9.9)	7.6	0.8–1.0	0.9
Pippola 80	30	(5.9–)**6.0–8.3**(–9.4)	7.4	(5.7–)**5.9–9.8**(–10.9)	7.7	0.8–1.1	1.0
Pippola 115	30	(5.9–)**6.0–9.4**(–9.8)	7.7	(5.9–)**6.2–9.8**	7.8	0.8–1.2	1.0
T. karstenii							
Karsten	30	(2.7–)**3.6–5.9**(–7.6)	4.5	(3.3–)**3.9–6.0**(–6.1)	4.8	0.7–1.4	0.9
Fagerström 1976	30	(3.9–)**4.0–6.4**(–6.5)	5.4	(3.9–)**4.3–7.1**(–7.5)	5.5	0.8–1.3	1.0
Holm & Holm 1969	30	(3.7–)**4.0–5.7**(–6.1)	4.6	(4.2–)**4.5–6.3**(–6.5)	5.6	0.7–1.0	0.8
Karsten 1869	30	(3.2–)**3.3–5.2**(–5.9)	3.9	**3.4–5.2**(–5.9)	4.1	0.8–1.1	0.9
Pippola 449	30	**3.7–5.9**	4.3	(3.7–)**3.8–5.8**(–5.9)	4.5	0.8–1.3	1.0
Torkelsen 106/78	30	**3.9–5.6**(–6.1)	4.4	(3.0–)**3.8–5.9**(–6.5)	4.9	0.7–1.3	0.9
Pippola 231	30	(2.5–)**3.9–6.0**	4.7	(3.7–)**3.9–6.3**(–6.7)	5.1	0.7–1.1	0.9
T. mesenterica							
Pippola 282	30	(8.0–)**8.8–13.1**(–13.9)	11.0	**7.8–13.3**(–13.4)	10.1	0.9–1.3	1.1
Korhonen 6307	30	(9.5–)**9.6–13.7**(–14.0)	11.7	(7.7–)**8.1–11.7**(–11.8)	9.8	1.0–1.4	1.2
Haikonen 1942	30	(9.2–)**9.8–15.0**(–15.6)	12.2	(7.4–)**7.8–12.1**(–12.9)	9.6	1.0–1.6	1.3
Särkkä 169	30	(9.9–)**10.1–13.7**(–15.5)	11.9	(7.5–)**7.9–11.7**(–14.0)	9.8	1.0–1.6	1.2
Ulvinen 1986	30	(11.7–)**11.8–15.6**(–17.4)	13.8	(10.2–)**10.4–14.9**(–15.6)	12.4	0.9–1.4	1.1
Pippola 439	30	(9.6–)**10.1–14.4**(–15.6)	12.9	**9.6–13.1**(–13.7)	11.7	1.0–1.2	1.1
Kallio 1960	30	**9.6–14.5**(–15.6)	12.0	(7.6–)**7.8–13.5**(–13.7)	10.1	1.0–1.4	1.2
T. mycetophiloides							
Kotiranta 11860	0	–	–	–	–	–	–
T. obscura							
Pippola 292	1	8.2	8.2	7.8	7.8	1.1	1.1
Laurila 1936	30	(6.1–)**6.3–9.8**(–10.4)	8.0	(6.0–)**6.1–9.6**(–9.8)	7.7	0.9–1.2	1.0
Ulvinen 1972	34	(4.3–)**4.5–8.0**(–8.2)	6.3	**3.9–7.6**(–7.8)	4.8	1.1–1.7	1.3
Pippola 394	30	(5.9–)**6.0–8.2**(–8.4)	7.3	(5.4–)**5.5–7.5**(–7.7)	6.6	1.0–1.3	1.1
T. phaeophysciae							
Laine 1989	30	(4.3–)**4.9 –7.0**(–7.1)	6.0	(5.3–)**5.4–8.0**(–8.9)	6.8	0.8–1.0	0.9
Hinneri 1970	19	**5.7–7.8**	6.7	**5.9–8.6**	7.3	0.8–1.0	0.9
Hausen 1925	30	(4.2–)**4.9–6.9**(–7.3)	6.0	**5.1–8.0**(–8.2)	6.8	0.7–1.1	0.9
Hausen 1927 (OULU F073618)	30	**4.3–7.6**	6.1	(4.5–)**4.6–7.8**(–8.4)	6.6	0.7–1.1	0.9
Hausen 1927 (OULU F073615)	30	(4.3–)**5.1–7.9**(–8.0)	6.2	**5.9–7.9**(–9.4)	6.9	0.7–1.0	0.9
Räsänen 1935	9	**5.7–7.8**	6.3	**6.2–8.0**	7.0	0.8–1.0	0.9
Räsänen 1918	2	**5.8–6.9**	6.4	**6.3–7.1**	6.7	0.8–1.1	1.0
Räsänen 1920	30	(4.9–)**5.0–7.0**(–7.2)	6.1	(5.3–)**5.8–8.1**	7.1	0.7–1.1	0.9
Leppälä 1948	30	(5.2–)**5.7–8.1**(–9.1)	6.9	(6.2–)**6.3–8.4**(–9.3)	7.5	0.7–1.1	0.9
T. polyporina							
Kiema 176	30	(4.5–)**5.1–6.0**(–6.3)	5.6	**4.4–5.9**(–6.0)	5.1	1.0–1.3	1.1
Miettinen 7833,3 & Pippola	30	(4.8–)**4.9–7.0**(–7.1)	5.6	(4.4–)**5.0–7.0**	5.5	0.9–1.2	1.0
Kytömäki 3/05	30	(4.4–)**4.5–6.4**	5.8	(4.1–)**4.3–6.1**	5.4	0.8–1.3	1.1
Risunen & Jakobsson 1877	30	**3.9–4.8**(–4.9)	4.3	(3.3–)**3.5–4.4**(–4.7)	4.0	1.0–1.2	1.1
T. ramalinae							
Haakana 1964	30	(4.5–)**4.9–7.4**(–7.7)	6.1	(5.7–)**5.8–7.8**(–7.9)	6.6	0.8–1.1	0.9
Seppälä 1914	30	**4.3–6.0**(–6.1)	5.5	(4.0–)**4.5–6.6**(–6.7)	5.8	0.8–1.3	1.0

n = number of measured structures from given number of specimens (e.g., 210/7 means 210 structures measured from seven specimens). In case of size, the entire range is given in parentheses. The 90% range excluding the extreme 5% values from both ends is given outside parentheses. Where values are identical, parentheses are omitted. The entire Q range is given without parentheses.

Biogeographical provinces and collecting sites are indicated according to Heikinheimo and Raatikainen (1981). The name "spruce" or "*Picea*" refers to *Picea abies*, "pine" or "*Pinus*" to *Pinus sylvestris* and "birch" or "*Betula*" to both *Betula pendula* and *B. pubescens*. The distribution maps were created by Raino Lampinen (Botanical Museum, Finnish Museum of Natural History) using the DMAP for Windows software by Dr. Alan Morton. The maps show the collecting sites in the 10 × 10 km squares of the Finnish uniform grid coordinate system (KKJ3) as well as the boundaries of the biogeographical provinces. If more than one collection of the same species comes from the same 10 × 10 km square, only one spot is shown. The illustrations are based on microscope drawings made with a drawing tube. Photographs are taken with an Olympus Camedia C-7070 attached to a binocular microscope or Sony Cyber-shot DSC-W15.

The nomenclature of *Tremella* is provided in the text, along with descriptions of the species. The nomenclature of other fungi, including lichenized species, follows *Index Fungorum* (http://www.indexfungorum.org) whilst the nomenclature of vascular plants follows Tutin *et al.* (1964–1980). The authors of the names are given in these sources and are not generally repeated here. In citations of the type specimens, nomenclature is given in its original format, and an exclamation mark (!) after herbarium acronym indicates that the type specimen was examined. The species are arranged in alphabetical order.

Tremella Pers.

Neues Mag. Bot. 1: 111. 1794, *nom. cons.*

Species of the cosmopolitan genus *Tremella* are extremely variable in appearance, including size, form and colour. Some of the species have large, gelatinous, foliose, lobate or cerebrifom basidiomata looking like traditional jelly fungi, whilst the basidiomata of others are cryptic or even macroscopically invisible. Lichenicolous species often grow within galls induced in the host lichen. Nonetheless, all have characteristics in common. All the species in the genus appear to be parasitic: they grow on, in association with, or in the hymenium of other fungi.

Microscopically the genus is characterised by globose to subglobose or ovoid basidia which become longitudinally or irregularly (e.g. obliquely or transversely) septate. Basidia are two- to four-celled or exceptionally one-celled, and each cell bears an elongated sterigma variable in length. The hymenium is typically amphigenous with abundant probasidia. Spores are globose to ellipsoid, smooth, thin-walled, hyaline to slightly coloured and have a distinctive apiculus. Some spores form secondary spores or germinate by germ tubes. The yeast phase occurring in the life cycle originates via budding of the spores or secondary spores. Hyphae are typically clamped, but simple-septate hyphae occur in a few species. Haustoria are normally present, clamped and consisting of a haustorial mother cell with one or more haustorial filaments. Hyphidia are observed in a few species, but usually they are reduced or absent. Swollen cells are present in many species, and vesicles are occasionally observed. Cystidia are absent. Most of the species have a conidial stage. Conidia, or in the case of some lichenicolous species asteroconidia, typically originate from conidiogenous cells.

Key to the Finnish species of *Tremella*

1. Basidiomata not macroscopically visible, in the hymenium of other fungi ..... 2.
1. Distinct basidiomata or galls ..... 4.
2. In the hymenium of polypores ..... *T. polyporina*
2. In the hymenium of heterobasidioid *Dacrymyces* species ..... 3.
3. Basidia typically without stalks, conidia present, hyphae with real clamps ..... *T. obscura*
3. Basidia typically with stalks up to 18 μm long, conidia absent, hyphae with pseudoclamps ..... *T. giraffa*
4. On lichens ..... 5.
4. On wood or on non-lichenized fungi ..... 10.
5. Spores typically ellipsoid (Q^* = 1.2), basidiomata pale

brown to almost black, on *Cetrariella delisei* or *Tuckermanopsis chlorophylla* ..... *T. cetrariicola*
5. Spores globose to subglobose, often wider than long (Q^* = 0.9), basidiomata or galls on other lichens ..... 6.
6. Basidia always four-celled, uppermost septum in each basidium longitudinal or oblique and two lower septa transverse, basidiomata pale rose to pale brown, on *Ramalina fraxinea* ..... *T. ramalinae*
6. Basidia two-celled or very rarely four-celled, all septa parallel, basidiomata or galls on other lichens ..... 7.
7. Basidia typically with one transverse septum, asteroconidia abundant in some specimens ..... 8.
7. Basidia longitudinally or obliquely septate ..... 9.
8. Basidiomata or galls olive brown to almost black, on *Phaeophyscia* spp. ..... *T. phaeophysciae*
8. Basidiomata or galls pale brown to reddish brown, on *Cladonia* spp. ..... *T. cladoniae*
9. Basidial cells elongated, variable in size, basidiomata almost black, on *Hypocenomyce scalaris* ..... *T. hypocenomycis*
9. Basidia globose, irregularly ellipsoid, oblong or ovoid, basidiomata or galls pink to brownish orange, on *Hypogymnia physodes* ..... *T. hypogymniae*
10. Basidiomata mostly more than 1 cm in diam. ..... 11.
10. Basidiomata smaller, only over 1 cm in diam. via coalescence ..... 13.
11. Basidiomata with a firm core, rose-coloured, cerebriform ..... *T. encephala*
11. Basidiomata lacking a firm core, cream, yellow, brown or almost black, becoming foliose or lobate in maturity ..... 12.
12. Basidiomata cream, yellow or orange-yellow ..... *T. mesenterica*
12. Basidiomata pale brown to almost black ..... *T. foliacea*
13. On *Juniperus communis* ..... *T. karstenii*
13. On hosts other than *Juniperus communis* ..... 14.
14. On *Aleurodiscus amorphous* on *Abies sibirica* ..... *T. mycetophiloides*
14. On deciduous trees, usually on or together with pyrenomycetes (Ascomycota) ..... 15.
15. Basidiomata less than 3 mm in diam., basidia long-stalked ..... *T. globispora*
15. Basidiomata 3–10 mm in diam., basidia mostly stalkless ..... *T. indecorata*

Tremella cetrariicola Diederich & Coppins (Plate 1a, Figs. 1–2)

in Diederich, Bibl. Lichenol. 61: 57. 1996. — TYPE: UK. Scotland, Easterness (VC 96), NW of Fort Augustus, Ceannacroc Forest, Torgyle Bridge (28/31.13), on *Tuckermanopsis chlorophylla* on *Pinus sylvestris*, 1.VI.1987 *P. Diederich 8864 & B. Coppins* [11654] (holotype E; isotypes LG, herb. Diederich).

Basidiomata cushion-like, discoid or somewhat spherical, 0.2–1.5 mm in diam., typically with a central depression and, especially in larger basidiomata, basally constricted, surface smooth, gelatinous, brown to dark brown or almost black, rose or pale brown when young, white interior consisting of lichen thallus.

Spores hyaline, thin-walled, ellipsoid, (4.2–)5.8–9.6(–10.4) × (3.8–)4.2–7.9(–9.8) μm, L = 7 μm, W = 5.8 μm, Q = 0.9–1.9, Q^* = 1.2 (n = 120/4), apiculus at least partially refractive, germinating by germ tubes or forming secondary spores.

Basidia very rarely stalked, 2.4–13.3 × 1.6–2.4 μm (n = 5/2), two- or infrequently four-celled, smooth, hyaline, longitudinally, obliquely or infrequently almost transversely septate, usually subglobose or ellipsoid, occasionally oblong, (9.8–)10.2–17.4(–23.1) × (6.5–)6.7–11.9(–12.2) μm, L = 13.2 μm, W = 9 μm, Q = 1.0–2.9, Q^* = 1.5 (n = 58/4), sterigmata up to ca. 32 μm long, (1.4–)1.8–3.9(–4.1) μm in diam.

Conidia-like cells observed in all specimens, but they could be secondary spores or haustorial mother cells. Conidia-like cells smooth, hyaline, thin-walled, subglobose to oval or ellipsoid, (2.8–)2.9–6.3(–7.3) × (1.8–)2.3–4(–4.5) μm, L = 4.3 μm, W = 3 μm, Q = 1.0–2.4, Q^* = 1.5 (n = 45/4).

All hyphae simple-septate, smooth, hyaline, (0.8–)1.5–4.1(–5.5) μm in diam. (n = 65/4), thin- to slightly thick-walled (up to 0.6 μm), occasionally with oil drops. Occasional basidia and haustoria with a basal clamp or clamp-like structure.

Haustoria abundant. Haustorial mother cells smooth, hyaline, subglobose to ellipsoid, (2.2–)2.4–4.9(–5.5) × (1.9–)2.1–3.7(–4) μm, L = 3.5 μm, W = 2.8 μm, Q = 0.8–2.4, Q^* = 1.3 (n = 55/4), each mother cell bearing a single haustorial filament 0.5–1 μm in diam., up to 12 μm long, rarely branched.

Swollen cells, vesicles and hyphidia absent.

ECOLOGY. In Finland *T. cetrariicola* is found on the thalli of *Cetrariella delisei* and *Tuckermanopsis chlorophylla*. In addition to these hosts, it is known to occur on *Tuckermanopsis americana* and *Tuckermanopsis ciliaris* (Diederich 1996). The former is not reported from Finland and the latter is extinct (Vitikainen *et al*. 1997).

The Finnish collections of *T. cetrariicola* were made from June to October, and it seems to prefer spruce-dominated forests.

Plate 1. — **a**: *Tremella cetrariicola* (arrows), specimen *Hyvärinen* 2005, photographed dry. — **b**: *Tremella encephala*, specimen *Pippola 456* with *Stereum sanguinolentum* (arrow), photographed fresh. — **c**: *Tremella foliacea*, specimen Inarin Lappi: Inari, Otsamo, on *Betula*, 2005 *Pippola 343B* (OULU F069518), photographed fresh. — **d**: *Tremella globispora* (arrows), specimen *Söderholm 2752*, photographed dry. — **e**: *Tremella hypocenomycis* (arrow), specimen *Norrlin* 1867 (holotype), photographed dry. — **f**: *Tremella hypogymniae* (arrows), specimen *Takala 3*, photographed dry.

Distribution and abundance. Though there are only four collections of *T. cetrariicola* from Finland (Fig. 2), we do not consider it a threatened species. Even on the basis of these few specimens, the distribution of *T. cetrariicola* seems to be wide. In addition to the Finnish collections, there is one collection in H from Russia close to the Finnish border. The host species *C. delisei* and *T. chlorophylla* are widespread and common in Finland (Vitikainen *et al*. 1997), and it supports the idea that the distribution of *T. cetrariicola* is wide as well. *Tremella cetrariicola* has been reported from Sweden, Scotland, Canary Islands, Canada, the U.S.A. (Diederich 1996), Austria (Triebel 1999), Estonia (Suija 2005) and Russia (Zhurbenko 2007). This is the first Finnish record.

Notes. The brown basidiomata with a central depression and constricted base as well as the ellipsoid spores with refractive apiculus are characteristic of *T. cetrariicola*. The other lichenicolous *Tremella* species have differently shaped spores.

Specimens examined. — **Finland**. Etelä-Häme: Riihimäki, on *Tuckermanopsis chlorophylla* on *Picea*, 1951 *Hirvenoja* (OULU F073608). Pohjois-Savo: Kuopio, Räsälä, Mustikkasaari, cliff, on *Cetrariella delisei*, 1909 *Linkola* (OULU F073610). Oulun Pohjanmaa: Oulu, Sanginjoki, Kinnunen, spruce-dominated forest, on *T. chlorophylla* on *Picea*, 2006 *Hyvärinen* (OULU F073600). Perä-Pohjanmaa: Tornio, Nivavaara, spruce forest, on *T. chlorophylla* on twig of *Picea*, 2005 *Hyvärinen* (OULU F073606).

Tremella cladoniae Diederich & M.S. Christ.

in Diederich, Bibl. Lichenol. 61: 65. 1996. — Type: Ger-

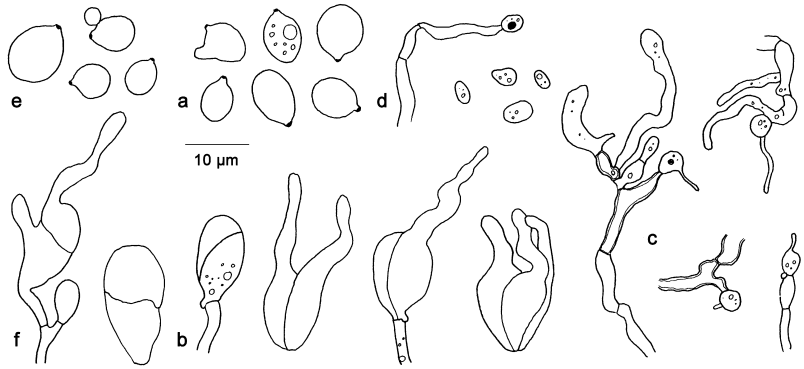

Fig. 1. *Tremella cetrariicola* (**a**–**d** from *Hyvärinen* 2005, **e**–**f** from *Hirvenoja* 1951). — **a** and **e**: Spores, of which one forms a secondary spore and one germinates by a germ tube. — **b** and **f**: Basidia at different stages of development. — **c**: Hyphae with haustoria. — **d**: Conidia-like cells.

many. Schwarzwald, Bernau, Spiesshorn, on *Cladonia* sp., 1.VIII.1916 *G. Lettau s.n.* (holotype B 93630; isotype herb. Diederich).

This is the first record from Finland. For a detailed description of the species, *see* Diederich (1996).

Specimen examined. **Finland**. Varsinais-Suomi: Halikko, Vaisakko, rich grass-herb forest, on *Cladonia coniocraea* on decaying wood, 2007 *Hyvärinen 586 & Syrjänen* (H).

Tremella encephala Pers. : Fr. (Plate 1b, Figs. 2–3)

Syn. Meth. Fung. 2: 623. 1801. — *Naematelia encephala* (Pers. : Fr.) Fr., Observ. mycol. 2: 370. 1818; Syst. mycol. 2 (Lundae): 227. 1822.

Tremella encephaliformis Willd., Bot. Mag. (Römer & Usteri) 2(4): 17. 1788. — *Naematelia encephaliformis* (Willd.) Coker, J. Elisha Mitchell Sci. Soc. 35: 137. 1920.

For further synonyms, *see* Bandoni (1961).

Basidiomata rose- or brownish orange, sometimes slightly greyish, gelatinous, cerebriform, up to 3 cm in diam., with a white firm core consisting of the hyphae of *Stereum sanguinolentum*.

Spores hyaline, subglobose, (6–)7.4–11(–12) × (5–)6.2–9.9(–11.6) µm, L = 9.1 µm, W = 8.2 µm, Q = 0.9–1.4, Q^* = 1.1 (n = 212/7), apiculus distinctive, oil drops common, some forming subglobose to ellipsoid secondary spores or germinating by germ tubes.

Basidia four- or occasionally two-celled, mostly longitudinally septate, basally clamped, hyaline, globose or subglobose, (11.8–)12.1–17.8(–19.8) × (10.5–)12.3–19.6(–21.6) µm, L = 15.1 µm, W = 16 µm, Q = 0.8–1.2, Q^* = 1.0 (n = 114/7), oil drops common, sterigmata up to ca. 100 µm long, (1.7–)1.9–3.7(–3.9) µm in diam., frequently apically swollen up to 6.1 µm in diam.

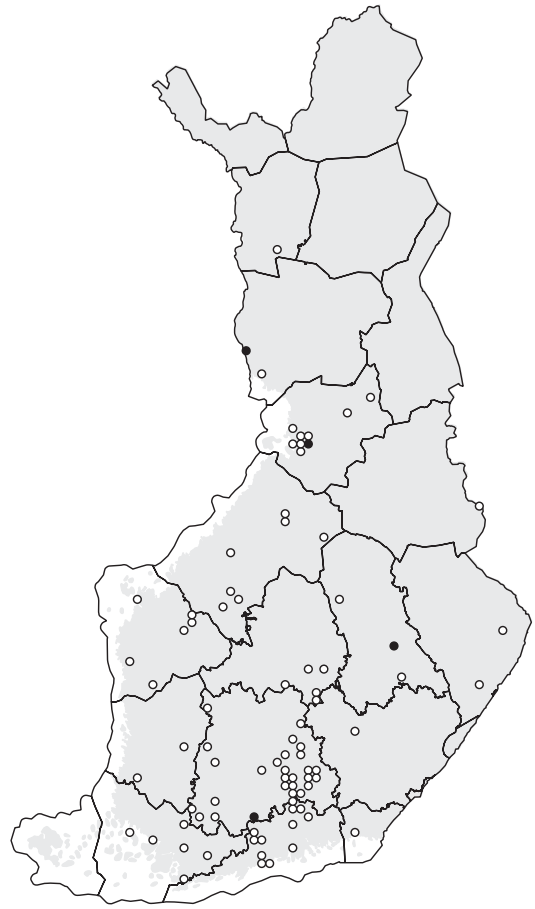

Fig. 2. Distribution of *Tremella cetrariicola* (●) and *T. encephala* (○) in Finland. The lines show the boundaries of the biogeographical provinces.

Terminal and subterminal swollen cells abundant close to the substrate and the core, occasional elsewhere. Swollen cells smooth, hyaline, globose, ellipsoid, citriform, ovoid or oblong,

(5.1–)5.9–13.6(–14.8) × (4.1–)5.3–9.6(–12) μm, L = 9.5 μm, W = 7 μm, Q = 1.0–2.4, Q^* = 1.4 (n = 106/7), walls normally up to 0.6 μm, occasionally up to 1.8 μm thick.

Hyphae clamped, smooth, hyaline, (1.2–)1.8–4.4(–6) μm in diam. (n = 112/7), mostly thin- to slightly thick-walled (up to 0.6 μm), here and there very thick-walled (up to 1.8 μm), anastomoses frequent, especially close to the dense core where the hyphae are intermixed with those of *S. sanguinolentum*.

Hyphidia abundant close to the substrate, to some extent also in hymenium and subhymenium. Hyphidia smooth, hyaline, (2.1–)2.4–5.8(–7.1) μm in diam. (n = 107/7), thin- to slightly thick-walled (up to 0.4 μm), occasionally thick-walled (up to 1.6 μm). The hyphidia may be confused with hyphal tips or elongated swollen cells.

Haustoria abundant close to the core, rare elsewhere. Haustorial mother cells hyaline, globose, ellipsoid or oblong, 2.4–5.5(–6.1) × (1.9–)2.1–4.5(–5.5) μm, L = 3.9 μm, W = 3 μm, Q = 0.9–2.5, Q^* = 1.4 (n = 99/7), each bearing one to four haustorial filaments, not more than 1 μm in diam., up to 14 μm long, rarely branched.

Conidial stage and vesicles absent.

Ecology. *Tremella encephala* parasitizing *Stereum sanguinolentum* was the first *Tremella* species proved to be a parasite (Bandoni 1961). In almost half of the Finnish collections *T. encephala* occurs either on (3 specimens studied) or with (47 specimens studied) basidiomata of *S. sanguinolentum*.

The habitats of *T. encephala* are coniferous and mixed forest of various ages, and it seems to be restricted to coniferous wood (Table 2). Even though *T. encephala* is occasionally reported to grow on angiosperms (e.g. Olive 1946a, Bandoni 1961), the single Finnish collection from birch may be a misidentification. Basidiomata are visible all year round, but are most commonly found from September to November.

Distribution and abundance. In Finland *T. encephala* is commonly found in the boreal zone where *Pinus* and *Picea* occur (Fig. 2). Worldwide it is recorded in most parts of Europe (Jülich 1984, Krieglsteiner 2000), North America (Ban-

Table 2. Substrates of *Tremella encephala*, *T. foliacea* and *T. mesenterica*.

	T. encephala	*T. foliacea*	*T. mesenterica*
Conifers			
Picea abies	17	11	
Pinus sylvestris	91	8	
Unidentified conifers	1	1	
Angiosperms			
Alnus spp.		25	30
Betula spp.	1	33	41
Caragana arborescens			1
Corylus avellana		8	2
Fraxinus excelsior			5
Phellodendron amurense			1
Populus tremula		5	7
Prunus padus		1	12
Quercus robur		7	2
Rhamnus frangula		1	
Ribes alpinum			1
Salix spp.		3	16
Sambucus racemosa			4
Sorbus aucuparia		1	1
Syringa vulgaris			1
Tilia spp.			2
Ulmus spp.			1
Unidentified angiosperms		7	23
Unknown substrates	9	26	12
Total	119	137	162

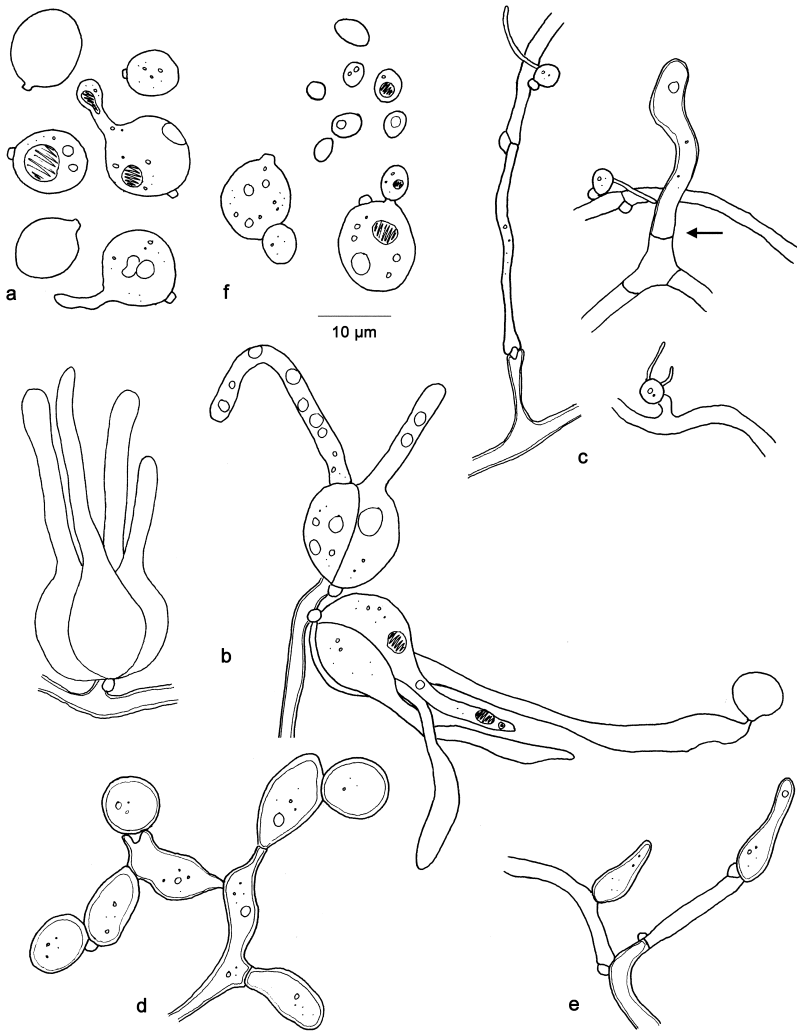

Fig. 3. *Tremella encephala* (**a**–**e** from *Pippola 456*, **f** from *Jäppinen* 1987). — **a** and **f**: Spores, of which some germinate by a germ tube or form secondary spores. — **b**: Basidia. — **c**: Hyphae with haustoria, of which one is attached to the host hyphae (arrow). — **d**: Swollen cells. — **e**: Hyphidia.

doni 1961, Krieglsteiner 2000), Japan (Kobayasi 1939, Bandoni 1961, Krieglsteiner 2000), Taiwan (Chen 1998) and Argentina (Lowy 1971).

NOTES. The parasitic relationship gives the rose-coloured basidiomata of *T. encephala* a characteristic feature: the white, firm core is composed of host hyphae. In addition, basidiomata of the host are often present.

SELECTED SPECIMENS EXAMINED. — **Finland**. Uusimaa: Artjärvi, Hiitelä, Pulikankallio, forest, on fallen *Pinus*, 2004 *Haikonen* 23835 (H). Etelä-Häme: Tammela, Mustiala, on *Pinus*, Nov. 1881 *Karsten* (H). Etelä-Savo: Mikkeli, Vuolinko, on log of *Betula*, 28 Oct. 1962 *Tiensuu* (H). Etelä-Pohjanmaa: Seinäjoki, Hautala, spruce-dominated forest, on *Pinus* with *Stereum sanguinolentum*, 2005 *Pippola 456* (OULU F068691). Pohjois-Karjala: Ilomantsi, Ahvensalo, forest, on twigs of *Pinus*, 1987 *Jäppinen* (OULU F044329). Oulun Pohjanmaa: Oulu, Kaijonharju, Metsänheimo, on *Picea*, partially on basidiomata of *S. sanguinolentum*, 1984 *Metsänheimo* (OULU F044338). Kittilän Lappi: Kittilä, Tuuliharju, Moluskoski, on *Pinus*, 1977 *Ohenoja* (OULU F044344).

Tremella foliacea Pers. : Fr. *s. lato* (Plate 1c, Figs. 4–5)

Observ. mycol. 2: 98. 1799. — *Tremella foliacea* Pers. : Fr., Syst. mycol. 2 (Lundae): 212. 1822. — *Gyraria foliacea* (Pers.) Gray, Nat. Arr. Brit. Pl. 1: 594. 1821. — *Ulocolla foliacea* (Pers.) Bref., Unters. Gesamtgeb. Mykol. 7: 98. 1888. — *Exidia foliacea* (Pers.) P. Karst., Bidr. Känn. Finl. Nat. Folk 48: 449. 1889.

Gyraria ferruginea Gray, Nat. Arr. Brit. Pl. 1: 593. 1821.

Phaeotremella pseudofoliacea Rea, Trans. Br. Mycol.

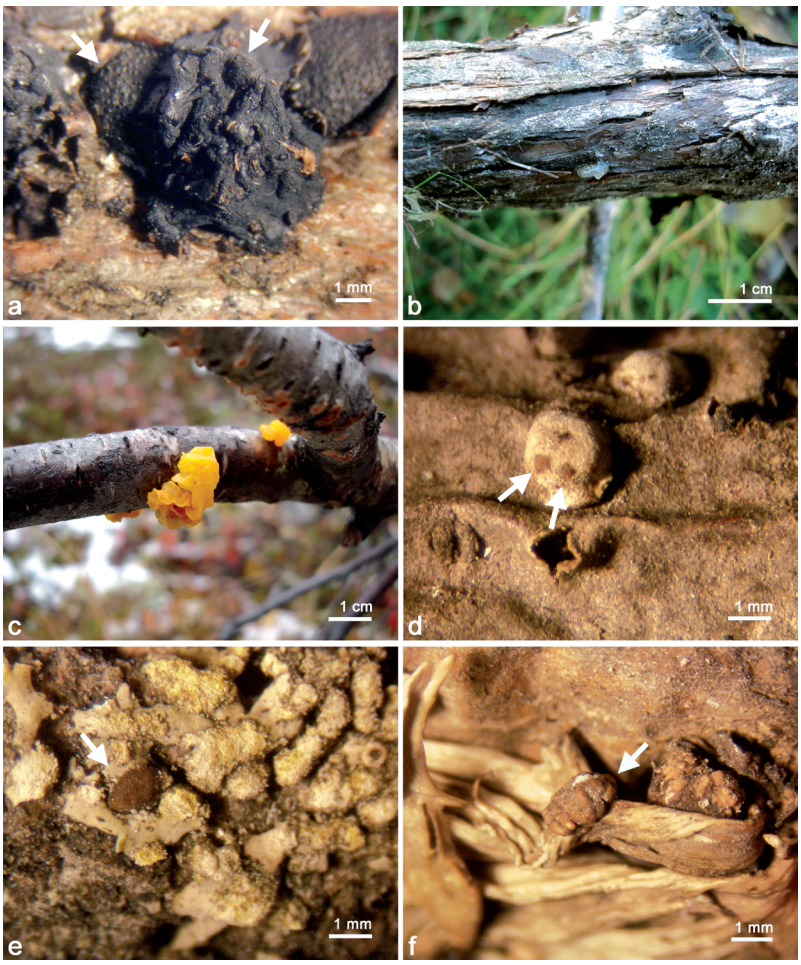

Plate 2. — **a**: *Tremella indecorata* (right arrow), specimen *Pippola 80* on *Diatrype bullata* (left arrow), photographed dry. — **b**: *Tremella karstenii*, specimen Inarin Lappi: Utsjoki, Paistunturit, on *Juniperus communis*, 2005 *Pippola 398* (OULU F069353), photographed fresh. — **c**: *Tremella mesenterica*, specimen Inarin Lappi: Utsjoki, Paistunturit, on *Betula*, 2005 *Knuuttila* (OULU F069526), photographed fresh. — **d**: *Tremella mycetophiloides* (arrows), specimen *Kotiranta 11860*, photographed dry. — **e**: *Tremella phaeophysciae* (arrow), specimen *Hausen* 1927 (OULU F073618), photographed dry. — **f**: *Tremella ramalinae* (arrow), specimen *Haakana* 1964, photographed dry.

Soc. 3: 377. (1911)1912. — *Tremella foliacea* var. *pseudofoliacea* (Rea) Kobayasi, Sci. Rep. Tokyo Bunrika Daigaku B 4: 23. 1939. — Type (Roberts 1999): UK. England, Somerset, Staple Park, 20 Sep. 1911 *C. Rea* (lectotype K(M) 56574). — Synonymized by Donk (1966) and Roberts (1999).

Tremella fimbriata Pers. : Fr., Observ. mycol. 2: 97. 1799. — *Tremella fimbriata* Pers. : Fr., Syst. mycol. 2 (Lundae): 212. 1822. — *Tremella foliacea* var. *fimbriata* (Pers.) S. Lundell, Fungi Exs. Suecici Praes. Upsal. 19-20: 16 (no. 940). 1941.

Tremella nigrescens Fr., Summa veg. Scand.: 341. 1849. — *Exidia nigrescens* (Fr.) P. Karst., Bidr. Känn. Finl. Nat. Folk 48: 449. 1889. — Synonymized by Roberts (1999).

Tremella succinea Pers., Mycol. Eur. 1: 101. 1822. — *Tremella foliacea* var. *succinea* (Pers.) Neuhoff, Z. Pilzk. 10: 73. 1931.

Tremella crispa Lloyd, Mycol. Writ. 7: 1152. 1922. — Type: Australia. Tasmania, Hobart, undated *L. Rodway* (herb. Lloyd 4004) (holotype BPI). — Synonymized by Bandoni (1958).

? *Tremella frondosa* Fr., Syst. mycol. 2 (Lundae): 212. 1822. — Proposals for synonymy made e.g. by Coker (1920) and Looney (1933), but *T. frondosa* is also suggested to be synonymous with *T. aurantia* Schwein. : Fr. (Roberts 1995).

Basidiomata gelatinous, pale brown to almost black, becoming foliate or lobate in maturity, from one to over 10 cm in diam.

Spores hyaline to pale brown, globose to ellipsoid, (6–)6.5–10(–11.4) × (4.5–)5.9–9.4(–9.8) μm, L = 8.2 μm, W = 7.3 μm, Q = 0.9–1.5, Q^* = 1.1 (n = 210/7), apiculus distinctive, oil drops common, some forming secondary spores or germinating by germ tubes.

Basidia four- or occasionally two-celled, longitudinally of obliquely septate, basally clamped, hyaline to pale brown, globose to subglobose or ovoid, (9.4–)11–19.2(–20.2) × (9.4–)10–15.9(–19.8) μm, L = 14.1 μm, W = 13.4 μm, Q = 0.7–1.9, Q^* = 1.1 (n = 132/7), oil drops common, infrequently new basidia originating

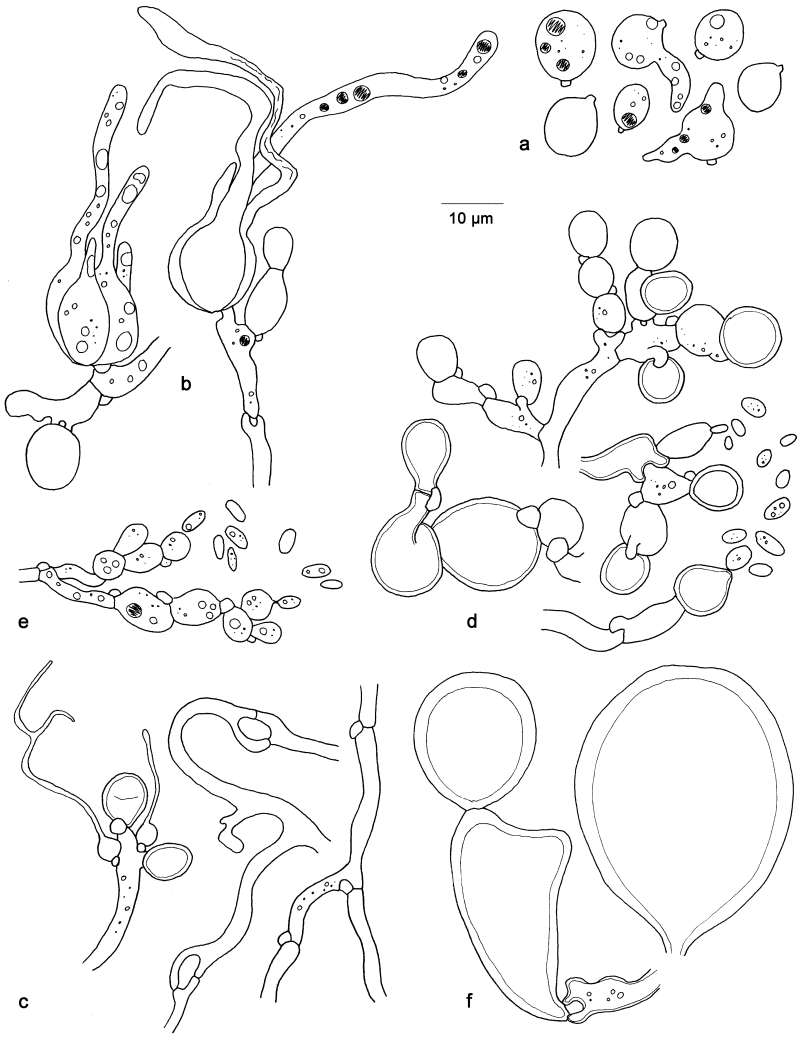

Fig. 4. *Tremella foliacea* (**a**–**d** from *Malmström 39*, **e** from *Pippola 376*, **f** from *Koskela* 1970). — **a**: Spores, of which two germinate by germ tubes. — **b**: Basidia. — **c**: Hyphae with haustoria and a few swollen cells. — **d**, **e** and **f**: Various swollen cells, of which some produce conidia.

from existing basidia, sterigmata up to ca. 75 μm long, (1.6–)1.8–3.8(–3.9) μm in diam., often apically swollen up to 5.8 μm in diam.

Conidia commonly, but not always, observed close to the substrate and occasionally elsewhere, originating from swollen or conidiogenous cells. Conidia hyaline, smooth, thin-walled, globose, ellipsoid or oblong, (1.9–)2.4–5.4(–5.9) × (1.1–)1.6–3.8(–4.2) μm, L = 3.9 μm, W = 2.3 μm, Q = 1.0–3.1, Q^* = 1.8 (n = 120/4).

Terminal and subterminal swollen cells observed especially close to the substrate. Swollen cells smooth, hyaline, pale brown or brown, variable in size and form, globose, ellipsoid, oblong or cylindrical, (5.1–)6.5–39.1(–53.3) × (2.3–)5.7–31(–51.1) μm, L = 14.7 μm, W = 11.1 μm, Q = 0.9–2.6, Q^* = 1.4 (n = 147/7), thin- to very thick-walled (up to 1.6 μm), occasionally extremely thick-walled (up to ca. 4 μm).

Hyphae clamped, smooth or gelatinous, hyaline to pale brown, (1.5–)1.9–6.3(–11.8) μm in diam. (n = 117/7), thin- to very thick-walled (up to 1.8 μm).

Haustoria few or abundant, occurring especially close to the substrate, originating from hyphae or swollen cells. Haustorial mother cells basally clamped, hyaline or pale brown, subglobose, ellipsoid or oblong, (3.4–)3.8–6.1(–6.9) × (2.1–)2.4–4.1(–5.5) μm, L = 4.6 μm, W = 3.4 μm, Q = 1.4–2.9, Q^* = 1.4 (n = 93/7), each bearing one or a few haustorial filaments, 0.5–1.5 μm in diam., up to ca. 60 μm long, branched or unbranched.

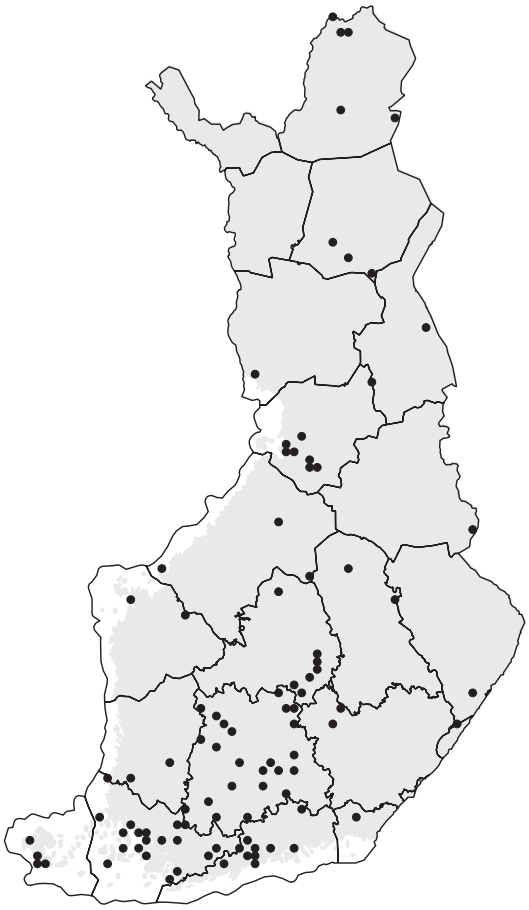

Fig. 5. Distribution of *Tremella foliacea* (●) in Finland. The lines show the boundaries of the biogeographical provinces.

Vesicles and hyphidia absent.

Ecology. *Tremella foliacea* is presumably a parasite of *Stereum* species (Roberts 1999, Torkelsen 2005). In Finland it is noted together with *Stereum hirsutum* (2 specimens studied), *Stereum rugosum* (4 specimens studied) and *Stereum subtomentosum* (1 specimen studied). *Tremella foliacea* is clearly more common on deciduous wood, but occurs occasionally on conifers (Table 2). Its basidiomata exist all year round. Most commonly they are found from August to October, and they are edible (Boa 2004). *Tremella foliacea* seems to prefer herb-rich forests, but it occurs frequently also in pastures, gardens, coniferous forests, as well as in peatlands and virgin forests.

Distribution and abundance. *Tremella foliacea* is a common species found almost throughout Finland (Fig. 5). Worldwide it is known from North (Coker 1920, Martin 1952), Central (Lowy 1971) and South America (Roberts 1999), Australia (Roberts 1999), Asia (Kobayasi 1939, Teng 1996, Chen 1998), Africa (Wojewoda 1981) and Europe (e.g. Wojewoda 1981, Jülich 1984, Torkelsen 1997, Roberts 1999).

Notes. Brown to almost black, foliose basidiomata are specific to *T. foliacea*. However, it is a very variable species in many respects such as substrate, colour, presence of conidia and spore size. For instance, depending on author the conidia are either absent (e.g. Neuhoff 1931, Martin 1952, Chen 1998) or present (e.g. Kobayasi 1939, Lowy 1971, Wojewoda 1981, Roberts 1999). Because of the huge variability, *T. foliacea* has been described several times with numerous variations. Now most of them are regarded as synonyms, but some might be good taxa. For instance, it is not sure if *T. foliacea* and *T. frondosa* are conspecific. If they are distinct, *T. frondosa* is distinguished from *T. foliacea* by its yellow to pale brown colour and presence of conidia (Chen 1998), or it may be synonymous with *T. aurantia* (Roberts 1995). Alternatively, the paler colour may be a result of exposure to liquid or rain (Kobayasi 1939).

Since the concept of the species is not well established, we prefer to use *T. foliacea s. lato*. As noted by Chen (1998), a good specimen should be selected as a neotype for *T. foliacea* from Europe where it was originally described. Such a neotypification could help the study of this complex.

Selected specimens examined. — **Finland**. Åland: Lemland, Marsö, on fallen *Quercus robur*, 1948 *Stenlid 668* (UPS). Uusimaa: Siuntio, centre, on *Alnus incana*, 23.X.1966 *Oittinen* (H). Etelä-Savo: Kangasniemi, Luusniemi, Sikosalo, on *Betula*, 1990 *Malmström 39* (H). Pohjois-Karjala: Kitee, Kiteenjärvi, Potoskanlahti, on stump of *Betula*, 1966 *Kankainen* (TUR 28148). Keski-Pohjanmaa: Haapavesi, birch forest, on *Picea*, 1970 *Koskela* (OULU F044347). Koillismaa: Taivalkoski, Kylmälä, Moskavaara, on fallen *Picea*, 1972 *Ohenoja & Ohenoja* (OULU F044355). Inarin Lappi: Utsjoki, Kistuskaidi, mountain birch forest, on fallen *Salix*, 2005 *Pippola 376* (OULU F069358).

Tremella giraffa Chee J. Chen (Figs. 6–7)

Bibl. Mycol. 174: 173. 1998. — Type: Germany. Tübingen,

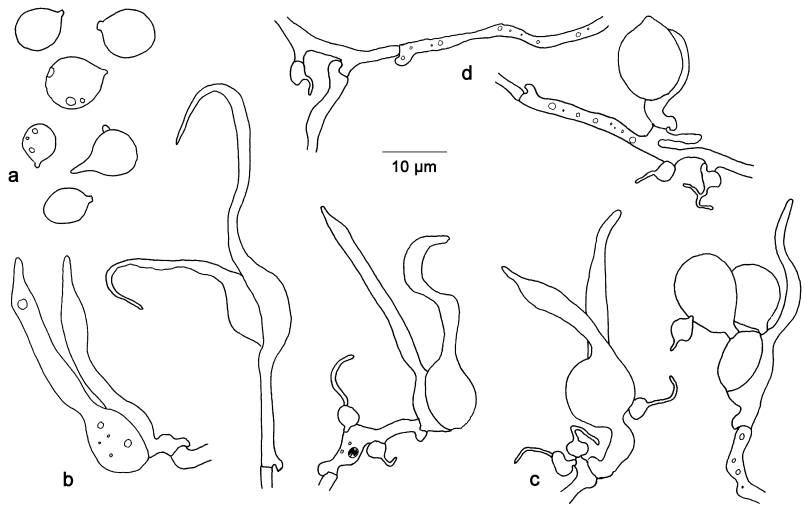

Fig. 6. *Tremella giraffa* (**a**–**d** from *Alanko 132586*). — **a**: Spores, of which one is germinating by a germ tube. — **b**: Basidia. — **c**: Haustoria and new basidia originating from basidia. — **d**: Pseudoclamped hyphae with haustoria and a probasidium.

Schönbuch, in basidiocarps of *Dacrymyces stillatus* growing on branches of *Larix decidua*, 29.VII.1997 *R. Kirschner* (holotype TUB; isotype TAI).

Basidiomata not macroscopically visible, in the host hymenium.

Spores smooth, hyaline, thin-walled, globose to ellipsoid, (5.7–)6.3–8.8(–9.9) × (5–)5.9–8(–9.8) μm, L = 7.6 μm, W = 6.9 μm, Q = 0.9–1.4, Q^* = 1.1 (n = 61/2), apiculus distinctive, oil drops common, some germinating by germ tubes or forming secondary spores.

Basidia usually stalked, (2–)2.1–17(–18) × (1.1–)1.8–3.8 μm (n = 31/2), two-celled, smooth, hyaline, thin-walled, longitudinally or occasionally obliquely or transversely septate, globose to ellipsoid, (9.4–)9.8–14.9(–15.1) × (8.4–)8.8–13.1(–14) μm, L = 12.5 μm, W = 11.3 μm, Q = 0.9–1.4, Q^* = 1.1 (n = 33/2), sterigmata up to ca. 50 μm long, (2.1–)2.2–4(–4.8) μm in diam., often apically swollen up to 5.9 μm in diam.

Hyphae smooth, hyaline, (1.7–)1.8–4.2(–4.3) μm in diam. (n = 32/2), thin-walled (under 0.2 μm), oil drops common. Clamp-like structures, so-called pseudoclamps, near the septa observed instead of real clamps.

Haustoria abundant, originating from hyphae, basidia or stalks of basidia. Haustorial mother cells smooth, hyaline, thin-walled, globose to ellipsoid, (2.3–)2.9–4(–4.2) × 2.1–3.2 μm, L = 3.4 μm, W = 2.7 μm, Q = 1.0–1.9, Q^* = 1.3 (n = 30/2), each mother cell bearing one to three haustorial filaments 0.5–1 μm in diam., up to 21 μm long.

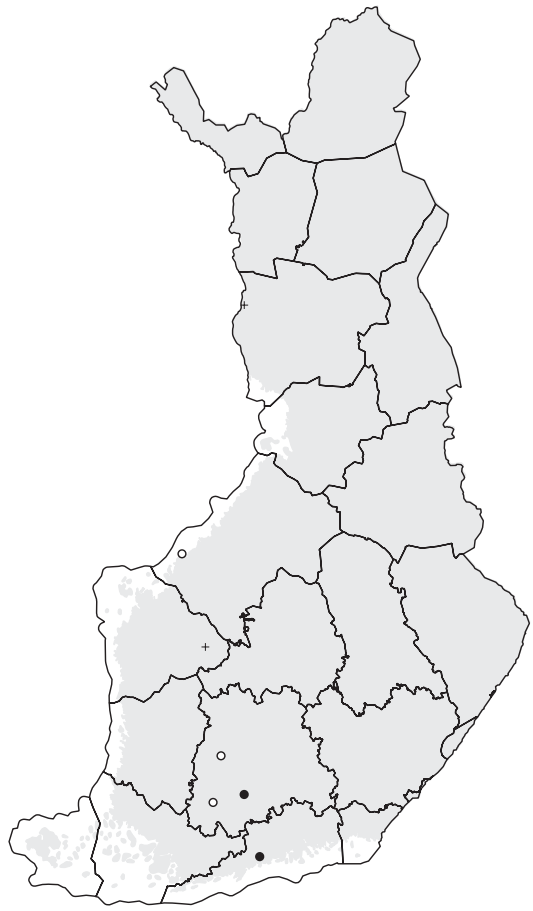

Fig. 7. Distribution of *Tremella giraffa* (●), *T. globispora* (○) and *T. hypocenomycis* (+) in Finland. The lines show the boundaries of the biogeographical provinces.

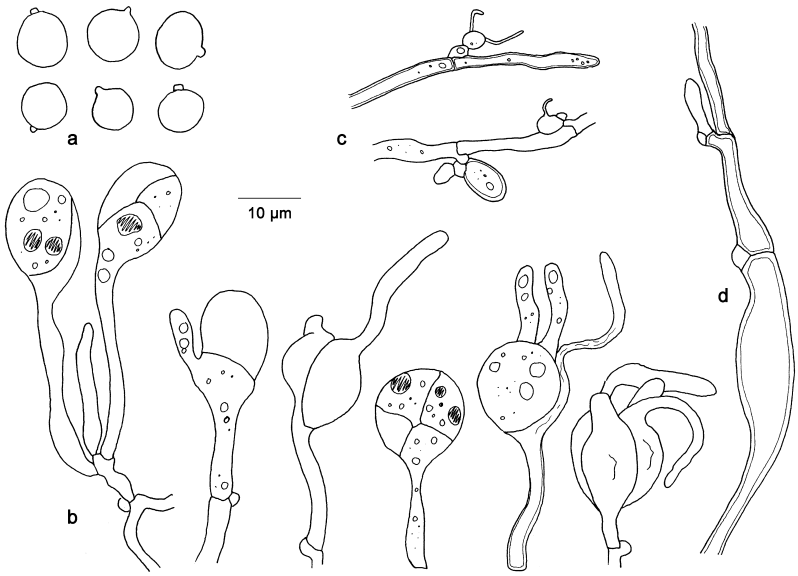

Fig. 8. *Tremella globispora* (**a**–**c** from *Söderholm 2752*, **d** from *Karsten* 1862). — **a**: Spores. — **b**: Basidia at different stages of development. — **c**: Hyphae with a swollen cell and haustoria. — **d**: Wide and thick-walled hyphae close to the substrate.

Conidial stage, swollen cells, vesicles and hyphidia absent.

Ecology. *Tremella giraffa* is parasitic in the hymenium of *Dacrymyces* species. In Finland it is found in the hymenium of *Dacrymyces minor*. It is also known to parasitize *D. stillatus* (Chen 1998) and *D. capitatus* (Van de Put 2000).

Distribution and abundance. This is the first record of *T. giraffa* from Finland. So far, it is known only from two localities (Fig. 7). Even though *Dacrymyces* species are deficiently known in Finland, they seem to be common and widespread. *Tremella giraffa* may be common and widespread as well. However, further studies are needed to understand its distribution and evaluate if it is a threatened, rare or abundant species. In addition to the type locality in Germany (Chen 1998), *T. giraffa* is found only in England, Hungary, Italy (Roberts 2007) and Belgium (Van de Put 2000), and it is deficiently known worldwide.

Notes. In addition to *T. giraffa*, there are three other *Tremella* species parasitizing *Dacrymyces* species: *T. obscura*, *T. occultifuroidea* and *T. penetrans*. *Tremella giraffa* is distinguished from the others especially by its pseudoclamps which are reminiscent of real clamps, but are not fully developed. Moreover, most of its basidia are stalked, haustoria as well as new basidia originate occasionally directly from basidia, and conidia are typically, but not necessarily (*see* Van de Put 2000), absent.

Specimens examined. — **Finland**. Uusimaa: Helsinki, Pitäjänmäki, Marttila, in *Dacrymyces minor* on *Sorbus aucuparia*, 2007 *Alanko 132586* (H). Etelä-Häme: Hämeenlinna, railway station NW, in *D. minor* on *Salix caprea*, 2007 *Alanko 132671* (H).

Tremella globispora D.A. Reid (Plate 1d, Figs. 7–8)

Trans. Br. Mycol. Soc. 55: 414. 1970, as '*globospora*'. — Type: UK. W. Sussex, West Dean Wood, West Dean, on *Rubus fruticosus* agg., in association with *Diaporthe eres*, 21.XII.1968 *D. A. Reid* (holotype K).

Tremella candida var. *globispora* (D.A. Reid) Krieglst., Beitr. Kenntn. Pilze Mitteleur. 12: 39. 1999.

Tremella tubercularia Berk. sensu Bourdot and Galzin (1927), Neuhoff (1931), etc.

Basidiomata cushion-like and usually somewhat cerebriform, 1–3 mm in diam., larger only via coalescence, black when dry, greyish to blackish brown and slightly hyaline when soaked

Spores hyaline to brown, thin-walled, globose to subglobose, often wider than long, (5.4–)5.9–9.6(–10.2) × (5.4–)5.9–10.2(–12) μm, L = 7.6 μm, W = 8.1 μm, Q = 0.8–1.2, Q^* = 1.0 (n = 90/3), apiculus distinctive.

Basidia usually stalked, (2.4–)3.7–24.7(–27.8) × (1.9–)2–4.5(–5.4) μm (n = 50/3), basally clamped, two- or four-celled, longitudinally, obliquely or occasionally transversely septate, hyaline, pale brown or brown, sometimes thick- or very thick-walled (up to 2 μm), subglobose to ellipsoid, (12.3–)13.7–21.3(–22) × (11.4–)12–20(–20.8) μm. L = 17 μm, W = 15.3 μm, Q = 0.8–1.7, Q^* = 1.1 (n = 51/3), sterigmata up to 63 μm long, (1.4–)1.8–4(–4.5) μm in diam., often collapsed.

A few swollen cells observed in subhymenium close to the substrate, pale brown to brown, globose, ovoid or ellipsoid, (5.5–)5.8–10(–11.4) × (4–)4.3–7.9(–8.4) μm, L = 7.8 μm, W = 6.2 μm, Q = 0.9–1.9, Q^* = 1.3 (n = 45/3), thin- to slightly thick-walled (up to 0.4 μm).

Hyphae clamped, smooth, hyaline, pale brown or brown, (1.4–)1.7–6.1(–8.1) μm in diam. (n = 65/3), thin- to very thick-walled (up to 2 μm). Wide and thick-walled hyphae common especially close to the substrate.

Haustorial mother cells hyaline to pale brown, globose to ellipsoid or oblong, (1.9–)2.2–5.7(–6.1) × (1.8–)2–3.3(–3.5) μm, L = 3.5 μm, W = 2.3 μm, Q = 0.8–2.6, Q^* = 1.5 (n = 45/3), each mother cell bearing one or a few haustorial filaments up to 1 μm in diam. and 18 μm long.

Conidia, vesicles and hyphidia absent.

Ecology. *Tremella globispora* occurs in association with pyrenomycetes (Ascomycota). All Finnish collections come from *Salix* spp., and one of them was found on *Allantoporthe tessella*. (syn. *Diaporthe tessella*). According to the original description (Reid 1970), *T. globispora* is constantly associated with the perithecia of *Diaporthe* spp. though perithecia may be indistinct. In addition to *Diaporthe* species, possible host species are known in the genera *Valsa* (Brough 1974) and *Eutypella* (Wojewoda 1981). As the hosts infest various deciduous trees, *T. globispora* may be found not on only *Salix* spp. but also on other deciduous trees.

Finnish specimens were collected either in January or in October. Thus, basidiomata of *T. globispora* may be visible all year round. At least this is the case in British Columbia (Brough 1974).

Distribution and abundance. So far, findings are too few (Fig. 7) to reveal the actual distribution and abundance of *T. globispora* in Finland and assist in evaluating if the species is threatened. In general *T. globispora* seems to be fairly rare, but widespread. It is found in most parts of Europe (e.g. Bourdot & Galzin 1927, Neuhoff 1931, Reid 1970, Wojewoda 1981, Jülich 1984, Torkelsen 1997), North America (Brough 1974), Colombia (Lowy 1971) and China (Zhuang 2005). This is the first Finnish record.

Notes. The small basidiomata, only a few millimetres across, which are associated with perithecia of pyrenomycetous fungi, characterize *T. globispora*. It is distinguished microscopically from *T. indecorata*, another Finnish *Tremella* species associated with pyrenomycetes, by its typically stalked basidia. However, the difference is not necessarily well established (Legon *et al*. 2005, P. Roberts personal comm.).

Conidia are absent in Finnish *T. globispora* specimens, but according to Chen (1998) they do exist.

Sebacina globospora Whelden is not a synonym of *T. globispora* as e.g. Reid (1970) suspected. Both are associated with pyrenomycetous *Diaporthe* spp., but *S. globospora* lacks clamp-connections (Whelden 1935). *Sebacina globospora* is currently known as *Tremella diaporthicola* Ginns & M.N.L. Lefebvre (Ginns & Lefebvre 1993).

Specimens examined. — **Finland**. Etelä-Häme: Lempäälä, Hulikankulma, on old *Allantoporthe tessella* on dead *Salix* twigs, 1998 *Söderholm 2752* (TUR 122476). Tammela, Mustiala, on twigs of *Salix phylicifolia*, 7.X.1867 *Karsten* (H). Keski-Pohjanmaa: Pietarsaari, on twigs of *Salix*, 24.X.1862 *Karsten* (H, S F44064).

Tremella hypocenomycis Diederich (Plate 1e, Figs. 7 and 9)

Bibl. Lichenol. 61: 87. 1996. — Type: Finland. Perä-Pohjanmaa, Pello, Turtola, on *Hypocenomyce scalaris*, 1867 *J.P. Norrlin* (holotype H!; isotype herb. Diederich).

Basidiomata gelatinous, somewhat irregular, grainy or cerebriform, 0.2–2 mm in diam., blackish brown to black when dry, pale brown to blackish brown when soaked.

Spores smooth, thin-walled, hyaline to slightly pale brown, globose or subglobose, (4.6–)5.4–7.6(–7.8) × (4–)5.3–7.6(–8.1) μm, L = 6.4 μm,

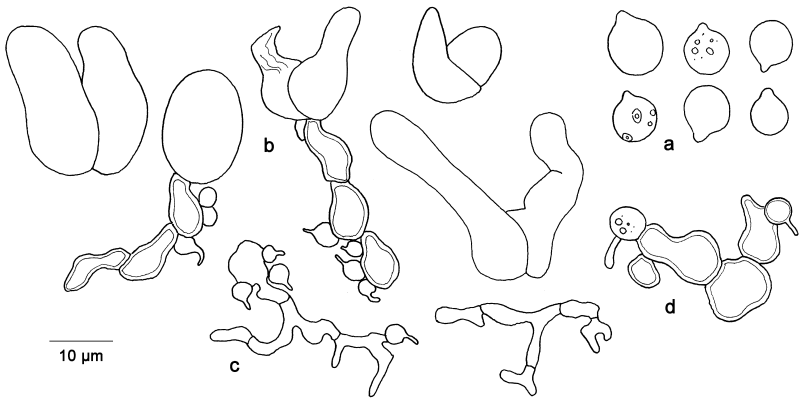

Fig. 9. *Tremella hypocenomycis* (**a**–**d** from *Norrlin* 1867). — **a**: Spores. — **b**: Basidia at different stages of development. — **c**: Context hyphae with haustoria. — **d**: Fertile hyphae with haustoria.

W = 6.2 µm, Q = 0.9–1.2, Q^* = 1.0 (n = 20/2), apiculus remarkably broad.

Basidia two-celled, cells elongated and very variable in size, smooth, hyaline to pale brown, longitudinally or exceptionally obliquely septate, at the septum (7.4–)8.4–17.6(–18.5) × (9.6–)9.8–21.1(–23.7) µm, L = 12.4 µm, W = 13.7 µm, Q = 0.5–1.5, Q^* = 0.9 (n = 33/2), above the septum individual cells 2.4–7.4(–10.2) µm in diam., up to 25.5 µm long, sterigmata absent, possibly degenerated.

All hyphae simple-septate. Two kinds of hyphae observed: so-called context hyphae hyaline to pale brown, smooth, 1.1–2.7 µm in diam. (n = 34/2), thin-walled, so-called fertile hyphae usually pale brown to brown, smooth, (2.3–)2.7–8.3(–8.6) µm in diam. (n = 50/2), thick-walled (up to 1.4 µm), individual cells short, sometimes almost globose.

Haustoria extremely abundant, originating mostly from fertile hyphae. Haustorial mother cells hyaline to brown, globose or subglobose, (1.8–)2–4.4(–5.3) × (2–)2.1–5.1(–5.6) µm, L = 3.1 µm, W = 3.3 µm, Q = 0.6–1.6, Q^* = 1.0 (n = 36/2), sometimes with walls slightly thickened (up to 0.4 µm), each mother cell bearing one or occasionally a few haustorial filaments up to 1 µm in diam. and 10.5 µm long, sometimes slightly branched.

Conidial stage, swollen cells, vesicles and hyphidia absent.

Ecology. *Tremella hypocenomycis* occurs on the thallus of *Hypocenomyce scalaris*.

Distribution and abundance. Until now, *T. hypocenomycis* was only known from the type locality. The specimen from Alavus (western Finland) is thus only the second record in the world (Fig. 7). Both specimens are old, and one might suggest the species is extinct. However, in the light of the distribution and abundance of its host (Vitikainen *et al*. 1997), this possibility seems to be unlikely. New specimens of *T. hypocenomycis* should be found to better understand its actual distribution, abundance and potential threats. At the moment the Red List status of *T. hypocenomycis* is impossible to evaluate.

Notes. The unusual basidia with elongated cells at maturity characterize *T. hypocenomycis*. Another lichenicolous *Tremella* species with similar basidia, *T. christiansenii* Diederich, has larger spores, *viz*. 9–12 × 8.5–10.5 µm (Diederich 1996).

Specimens examined. — **Finland**. Etelä-Pohjanmaa: Alavus, Niinimaa, Uusi-Erkkilä, on *Hypocenomyce scalaris* on charred trunk, 1947 *Leppälä* (OULU F073619). Perä-Pohjanmaa: Pello, Turtola, on *H. scalaris*, 1867 *Norrlin* (holotype H).

Tremella hypogymniae Diederich & M.S. Christ. (Plate 1f, Figs. 10–11)

in Diederich, Bibl. Lichenol. 61: 90. 1996. — Type: France. Pyrénées-Atlantiques, au sud de Arette, un peu en aval du Chalet d'Oumarre, on *Hypogymnia physodes*, 29.VII.1990 *P. Diederich 9145* (holotype LG; isotype herb. Diederich).

Inducing galls or basidiomata on the host thallus. Galls frequent, pale yellow, pinkish, rose or brownish orange, many at least partially blackened, somewhat spherical, 0.1–2.5 mm in diam., with a thin, gelatinous layer on the surface and a white interior consisting of lichen thal-

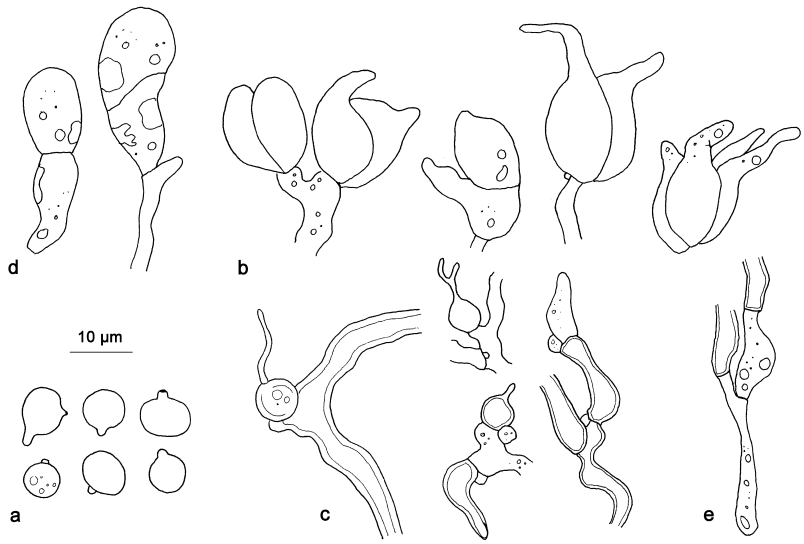

Fig. 10. *Tremella hypogymniae* (**a**–**c** from *Linkola* 1930, **d**–**e** from *Takala 73*). — **a**: Spores, of which one is germinating by a germ tube. — **b** and **d**: Basidia at different stages of development. — **c**: Clamped hyphae with haustoria. — **e**: Simple-septate hyphae.

lus. Basidiomata occasional, orange or brownish orange, slightly cerebriform, gelatinous.

Spores smooth, hyaline, thin- to relatively thin-walled, globose to subglobose, mostly wider than long, (4.1–)5.1–7.9(–8.3) × (4.9–)5.9–9.3(–10) μm, L = 6.4 μm, W = 7.4 μm, Q = 0.6–1.3, Q^* = 0.9 (n = 179/7), distinct apiculus frequently refractive, spores germinating by germ tubes.

Basidia extremely rarely short-stalked, 3.6–4.3 × 3.6–3.7 μm (n = 2/2), two- or exceptionally four-celled, cells sometimes variable in size, hyaline, longitudinally, obliquely or occasionally transversely septate, globose, irregularly ellipsoid, oblong or ovoid, (9.8–)11.6–19.6(–23.5) × (7.9–)9.8–14.1(–15.9) μm, L = 14.8 μm, W = 12.1 μm, Q = 0.7–2.3, Q^* = 1.2 (n = 107/7), oil drops common, sterigmata up to 34 μm long, (1.8–)2–5.4(–5.7) μm in diam.

In some specimens hyphae clamped, in others mostly or completely simple-septate. Hyphae hyaline, smooth, (1.8–)2–5.8(–7.8) μm in diam. (n = 114/7), thin- to very thick-walled (up to 2 μm), mostly with slightly thickened walls (0.2–0.6 μm), sometimes with oil drops. Hyphae, especially in the inner parts of the galls, intermixed with hyphae and other structures of the host lichen.

Haustoria normally few, occasionally either absent or abundant. Haustorial mother cells hyaline, globose to ellipsoid, (3.7–)3.8–6.1(–7.4) ×

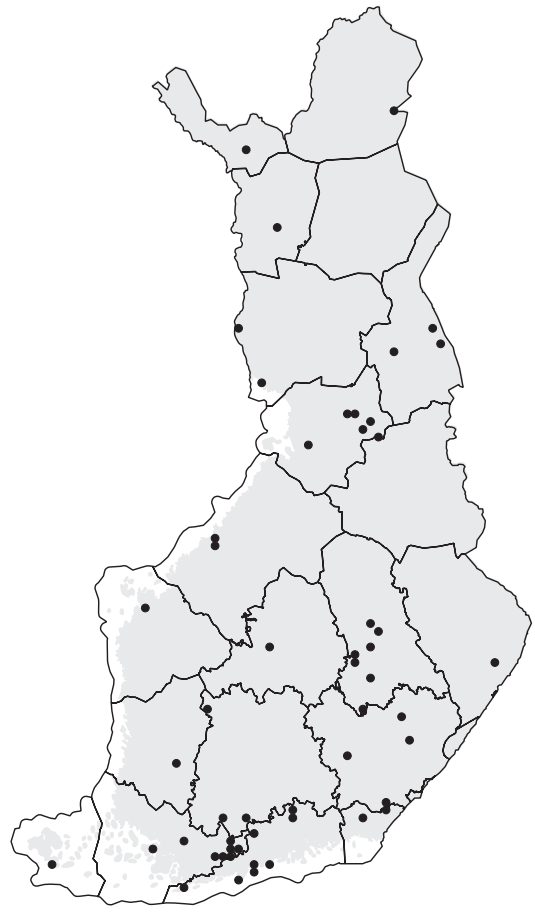

Fig. 11. Distribution of *Tremella hypogymniae* (●) in Finland. The lines show the boundaries of the biogeographical provinces.

(2.9–)3.5–4.5(–5.9) μm, L = 5 μm, W = 4 μm, Q = 1.0–1.9, Q^* = 1.3 (n = 51/6), each mother cell bearing one haustorial filament 0.5–2 μm in diam., up to 23 μm long, rarely slightly branched.

Conidial stage, swollen cells, vesicles and hyphidia absent.

Ecology. Galls and basidiomata of *T. hypogymniae* are only found on the thallus of *Hypogymnia physodes*, an extremely common lichen species occuring on various substrates, especially on trunks and twigs, but also on iron scrap, stones, etc. Basidiomata of *T. hypogymniae* are found in Finland almost all year round, most frequently from June to August.

Distribution and abundance. *Tremella hypogymniae* is common in the whole country (Fig. 11), and it is widespread in Europe (Diederich 1996). It is also reported from Canada (Diederich 1996, 2003) and the U.S.A. (Diederich 2003) including Alaska (Geiser *et al*. 1998), but seems to be rare in North America (Diederich 2003).

Notes. Pale rose to brownish galls on the host thallus characterize *T. hypogymniae*. The predominantly two-celled basidia of *T. hypogymniae* are smaller than those of *Tremella lobariacearum* Diederich & M.S. Christ., *Tremella phaeographidis* Diederich, Coppins & Bandoni and other lichenicolous *Tremella* species which are microscopically similar (Diederich 1996).

In spite of the variability in hyphal septa, all the Finnish specimens clearly belong to a single species. Spore sizes as well as other microscopical structures are identical to each other. Basidiomata of various ages possibly differ in their septa. Simple-septate hyphae were commonly observed especially in young basidiomata with plenty of probasidia and only a few mature basidia and spores.

Selected specimens examined. — **Finland**. Varsinais-Suomi: Salo, Uskela, Pahkavuori, on *Hypogymnia physodes* on *Picea*, 26.VI.1919 *Häyrén* (H). Uusimaa: Orimattila, on *H. physodes* on *Salix caprea*, 1965 *Takala 73* (H). Etelä-Karjala: Ylämaa, Kavenoja, on *H. physodes* on *Betula*, 1965 *Takala 82* (H). Pohjois-Savo: Pieksämäki, Jäppilä, on *H. physodes* on *Betula*, 1964 *Takala 3* (H). Perä-Pohjanmaa: Ylitornio, Aavasaksa, on *H. physodes* on *Pinus*, 21.VII.1936 *Räsänen* (H). Koillismaa: Kuusamo, Oulankajoki, Kiutaköngäs, on *H. physodes* on *Picea*, 11.VIII.1930 *Linkola* (H). Enontekiön Lappi: Enontekiö, Hetta, Jyppyrävaara, on *H. physodes* on *Betula*, 1965 *Takala 103* (H).

Tremella indecorata Sommerf. (Plate 2a, Figs. 12–13)

Suppl. fl. lapp.: 306. 1826. — *Exidia indecorata* (Sommerf.) P. Karst., Rev. Mycol. (Toulouse) 12: 126. 1890. — Type: Norway. Nordland, Saltdal, on dead branches of *Salix phylicifolia*, III.1824 *S. C. Sommerfelt* (holotype O 72784!).

Basidiomata translucent pale brown to brown, cerebriform or cushion-like, 3–10 mm in diam., occasionally up to 20 mm via coalescence, upon drying turning to thin, dark brown or black films.

Spores smooth, hyaline, pale brown or brown, thin-walled, globose to subglobose, often wider than long, (4.9–)5.9–9.4(–9.9) × (5.7–)5.9–9.8(–11.2) μm, L = 7.4 μm, W = 7.7 μm, Q = 0.8–1.3, Q^* = 1.0 (n = 150/5), distinct apiculus often refractive, germinating by germ tubes or forming globose to ellipsoid secondary spores.

Basidia rarely stalked, 2–12 × 2.2–4 μm (n = 13/4), two- or four-celled, longitudinally or obliquely septate, basally clamped, smooth, hyaline to brown, globose, ellipsoid or citriform, sometimes wider than long, (11.8–)12.2–19.6(–27.1) × (11.9–)13.1–20(–22) μm, L = 16.1 μm, W = 16.2 μm, Q = 0.8–1.7, Q^* = 1.0 (n = 89/5), sterigmata up to ca. 100 μm long, (1.5–)1.7–4(–5.7) μm in diam., often collapsed, apical protuberances and thick walls (up to 1.8 μm) observed especially in probasidia, oil drops common.

Conidial stage absent in most specimens. Conidia hyaline, oblong or cylindrical, (2.4–)2.6–4.2 × 0.8–1.6 μm, L = 3.2 μm, W = 1 μm, Q = 1.7–5.3, Q^* = 3.5 (n = 30/1). Conidia originating from conidiogenous cells which are hyaline to brown, subglobose, ellipsoid or oblong, (1.9–)2.4–4.4(–5.9) × (1.7–)1.8–3.4 μm, L = 3.6 μm, W = 2.7 μm, Q = 1.1–2.0, Q^* = 1.3 (n = 30/1), thin-walled, small oil drops common.

Terminal and subterminal swollen cells observed in hymenium and subhymenium. Swollen cells hyaline to brown, smooth, usually thick-walled (up to 2 μm), globose, ellipsoid, ovoid, oblong or citriform, (5.9–)6.5–15.9(–17.8) × (4.3–)5–9.7(–9.9) μm, L = 10.5 μm, W = 7.1 μm, Q = 1.0–2.8, Q^* = 1.5 (n = 77/5). Hyphae or basidia originate occasionally from swollen cells which may be mistaken for probasidia.

Hyphae clamped, smooth or gelatinous, hyaline to brown, (1.4–)1.6–5.9(–7.6) μm in diam.

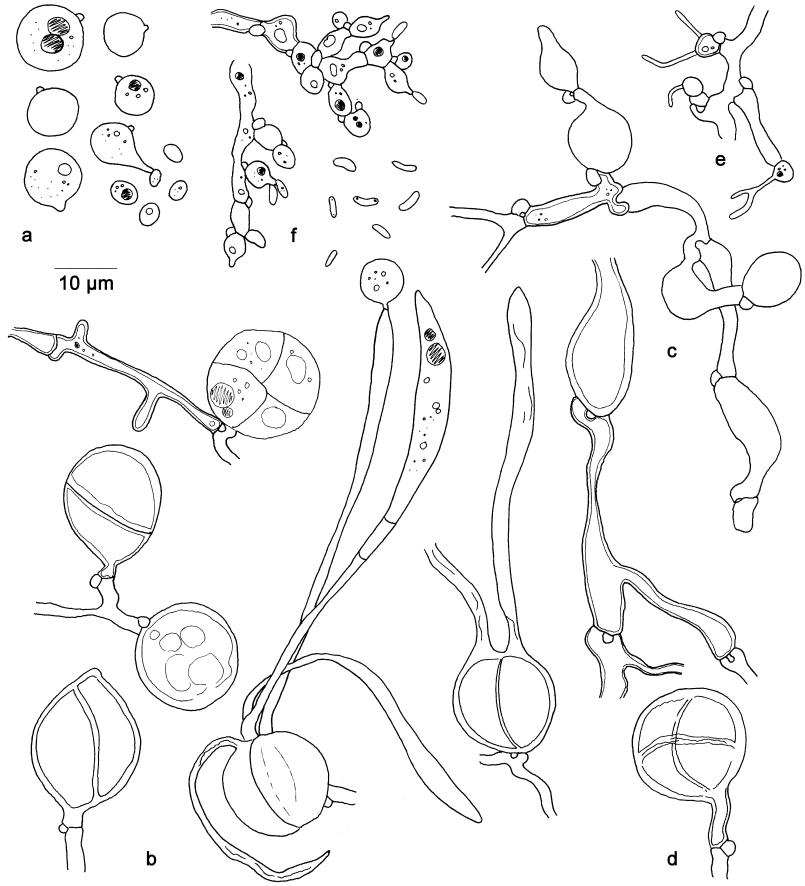

Fig. 12. *Tremella indecorata* (**a**–**c** from *Pippola 80*, **d**–**e** from *Söderholm 2686*, **f** from *Haikonen 1866*). — **a**: Spores and secondary spores. — **b** and **d**: Basidia at different stages of development. — **c**: Hyphae with a few swollen cells. — **e**: Hyphae with haustoria. — **f**: Conidia originating from conidiogenous cells.

(n = 103/5), thin- to very thick-walled (up to 2 μm).

Haustoria few or absent. Haustorial mother cells hyaline to pale brown, globose to ellipsoid, 2.5–5.7 × 2.2–4.3 μm, L = 4 μm, W = 3 μm, Q = 0.9–1.7, Q^* = 1.3 (n = 19/2), each mother cell bearing one haustorial filament, mostly under 1 μm in diam., up to 12 μm long, rarely branched.

Vesicles and hyphidia absent.

Ecology. In Finland *T. indecorata* is found on deciduous wood, often on *Diatrype bullata*. A connection with at least remnants of a pyrenomycete (dead perithecia or traces of mycelium) should always be present (Torkelsen 1968). In addition to *Diatrype* species, possible host species are known in the genus *Eutypa* (Torkelsen 1997). All Finnish specimens were collected either in October or November.

Distribution and abundance. Even though there are only five collections from two biogeographical provinces (Fig. 13), the host species are so common and widespread in Finland (Dissing 2000) that we cannot presume *T. indecorata* to be an especially rare species. Worldwide *T. indecorata* seems to be restricted in Europe where it is reported e.g. from the Nordic countries (Torkelsen 1997), Estonia (Jülich 1984), Poland (Wojewoda 1981) and Spain (Dueñas 1997).

Notes. *Tremella indecorata* is one of the two Finnish *Tremella* species occurring together with pyrenomycetes and forming comparatively small basidiomata. Unlike *T. globispora*, *T. indecorata* mostly has stalkless basidia. In addition, the basidiomata of *T. indecorata* seem to be slightly larger than those of *T. globispora*.

There are also other tiny *Tremella* species associated with pyrenomycetous fungi, such as *T. moriformis* Berk. and *T. subanomala* Coker, which resemble *T. indecorata*. On the basis

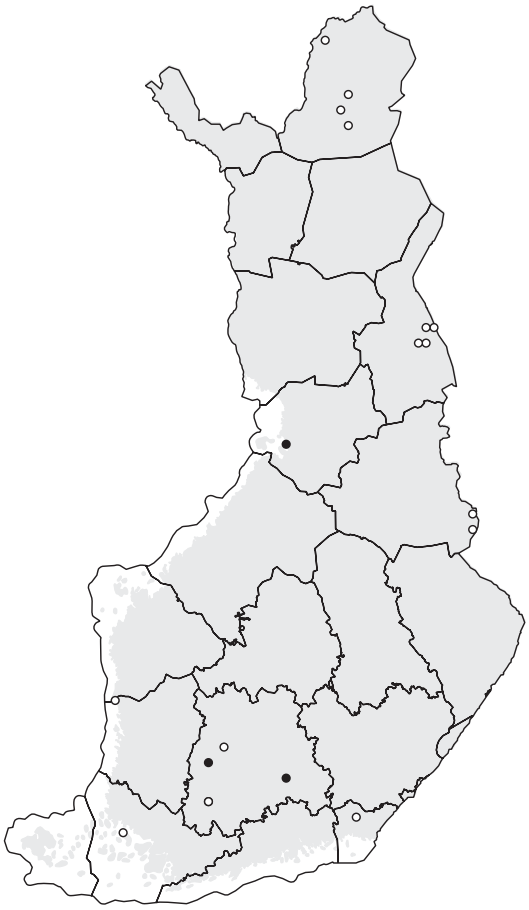

Fig. 13. Distribution of *Tremella indecorata* (●) and *T. karstenii* (○) in Finland. The lines show the boundaries of the biogeographical provinces.

of morphological and molecular studies and a literature survey Chen (1998) placed all these species in the Indecorata group. Many of their characters are very much alike, and one might think that the species are conspecific. There is, however, some molecular evidence supporting differences. Scorzetti *et al*. (2002) studied systematics of basidiomycetous yeasts based on D1/D2 and ITS regions of ribosomal DNA, and according to their results *T. indecorata* and *T. globispora* are clearly distinct from each other as well as from *T. moriformis*. The position of the members of the Indecorata group is distinct on each tree (Scorzetti *et al*. 2002) and differs from the trees of Chen (1998) and Fell *et al*. (2000). Further studies, including DNA techniques, are needed to reveal the actual relationships and the systematic position of the species in the Indecorata group.

Specimens examined. — **Finland**. Etelä-Häme: Asikkala, Kolunkulma, herb-rich forest, on *Corylus avellana*, 1981 *Haikonen 1866* (H). Lempäälä, Sarvikaslahti, on old *Diatrype bullata* on twigs of *Salix*, 1996 *Söderholm 2686* (OULU F034569). Tammela, Mustiala, on a twig of *Betula*, 2.XI.1865 *Karsten* (H). Oulun Pohjanmaa: Oulu, Hietasaari, Johteensalmi, willow thicket, on *Diatrype bullata* on dead twig of *Salix caprea*, 2004 *Pippola 80* (OULU F074015). Oulu, Hietasaari, Johteensalmi, herb-rich forest, on living *S. caprea*, 2004 *Pippola 115* (OULU F074016).

Tremella karstenii Hauerslev (Plate 2b, Figs. 13–14)

Mycotaxon 72: 480. 1999. — *Tremella juniperina* P. Karst., Fungi Fenn. exs. 812. 1869, *nomen illeg*. (*non Tremella juniperina* L.). — *Exidia juniperina* P. Karst., Bidr. Känn. Finl. Nat. Folk 48: 452. 1889. — Type: Finland. Etelä-Häme, Tammela, Mustiala, på en [on *Juniperus communis*], 8.IV.1869 *P. A. Karsten* (lectotype H!; isolectotypes H!).

Basidiomata hyaline to yellowish, smooth or slightly papillose, gelatinous, cushion-like or spherical, sometimes partially resupinate, 1–5 mm in diam., drying to thin, tough, almost invisible films.

Spores hyaline, smooth, thin-walled, globose, often wider than long, (2.5–)3.4–6(–7.6) × (3–)3.5–6.2(–7.5) μm, L = 4.5 μm, W = 4.9 μm, Q = 0.7–1.4, Q^* = 0.9 (n = 210/7), apiculus distinctive, occasionally refractive, oil drops common, some forming subglobose to ellipsoid secondary spores.

Basidia mostly four-celled, rarely two-celled, longitudinally or occasionally obliquely or transversely septate, basally clamped, hyaline, smooth, globose to ellipsoid, sometimes wider than long, (7.8–)8.4–12.5(–15.7) × (7.7–)7.9–13.3(–15.3) μm, L = 10.5 μm, W = 10.4 μm, Q = 0.8–1.6, Q^* = 1.0 (n = 110/7), sterigmata up to ca. 110 μm long, (0.7–)1–2.3(–3.7) μm in diam.

Conidial stage common, but not always present. Conidia difficult to distinguish from secondary spores, and thus not measured, both of them hyaline, smooth, thin-walled, subglobose to ellipsoid. Conidiogenous cells hyaline, smooth, thin-walled, globose to ellipsoid, (2.4–)3.2–

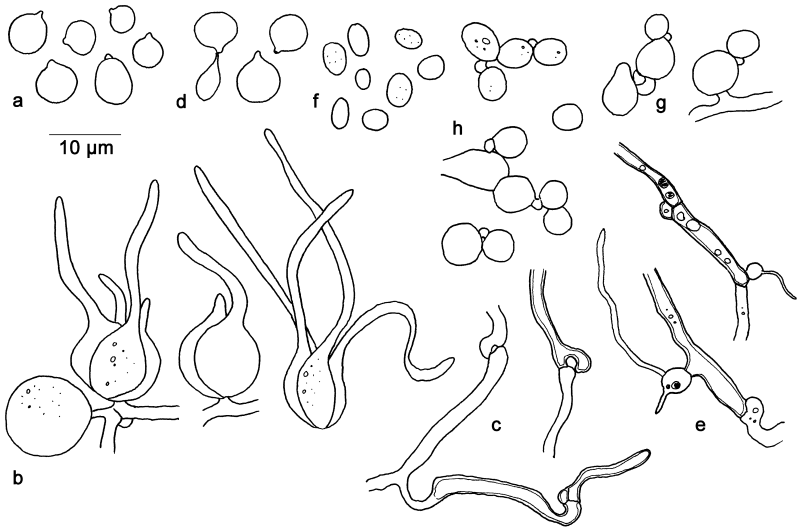

Fig. 14. *Tremella karstenii* (**a**–**c** from *Karsten* 1869, **d**–**g** from *Pippola 231*, **h** from *Pippola 449*). — **a** and **d**: Spores, of which one is forming a secondary spore. — **b**: Basidia. — **c**: Hyphae. — **e**: Hyphae with haustoria. — **f**: Conidia or secondary spores. — **g** and **h**: Conidiogenous cells.

6.5(–7.9) × (1.8–)2.4–6(–6.7) µm, L = 4.7 µm, W = 4.2 µm, Q = 0.9–2.4, Q^* = 1.2 (n = 174/6).

Hyphae clamped, hyaline, smooth, (0.3–)0.9–4(–5.9) µm in diam. (n = 104/7), thin- to slightly thick-walled (up to 0.5 µm), oil drops common.

Haustoria originate from hyphae or conidiogenous cells, mostly scattered and rare, sometimes abundant or totally absent. Haustorial mother cells hyaline, smooth, globose to ellipsoid, (1.6–)1.8–3.5(–3.9) × (1.6–)1.7–3.2(–3.4) µm, L = 2.5 µm, W = 2.2 µm, Q = 0.9–1.4, Q^* = 1.1 (n = 39/4), each mother cell bearing one or two haustorial filaments 0.5–1 µm in diam., up to 29 µm long, rarely branched.

Very few swollen cells observed. Vesicles and hyphidia absent.

Ecology. *Tremella karstenii* grows only on *Juniperus communis*, and according to Torkelsen (1978), it is always found in connection with *Colpoma juniperi*. At least 16 of the 23 Finnish collections are found on or with ascomata of *C. juniperi*. The habitats of *T. karstenii* are mostly coniferous forests, and it seems to prefer moist lake- and riversides. In Finland *T. karstenii* is found from April to October.

Distribution and abundance. Collections of *T. karstenii* are relatively scattered, but they come from both southern and northern Finland (Fig. 13). We therefore presume that *T. karstenii* is common and widely distributed all over the country. *Tremella karstenii* has a predominantly northern alpine distribution. It is known from Norway, Sweden (Torkelsen 1978, 1997), Iceland, Germany, France, Austria, Switzerland, Slovakia, Greenland, the U.S.A. (Krieglsteiner 2000), UK (Legon *et al*. 2005) and Russia (Torkelsen 1978). Records from central Europe are from the Alps or Carpathian Mountains (Krieglsteiner 2000).

Notes. Before this study there were only 10 collections of *T. karstenii* from Finland. The low number is probably due to the difficulty of finding basidiomata. They are easily overlooked because they are small and hyaline, and shrink to thin, almost invisible films when dry. The easiest way to find them is to search broken twigs of *Juniperus communis* that lie partly buried in mosses etc. and are thus somewhat moist.

Selected specimens examined. — **Finland**. Varsinais-Suomi: Merimasku, on *Colpoma juniperi* on *Juniperus communis*, *Karsten* (S F44061). Etelä-Karjala: Hamina, Vehkalahti, Pyhältö, Ämmänmäki, on *J. communis*, 4.VII.1976 *Fagerström* (H). Satakunta: Merikarvia, S of Riispyy, meadow, on *C. juniperi* on *J. communis*, 27.VIII.1969 *Holm & Holm* (UPS). Etelä-Häme: Tammela, Mustiala, on *C. juniperi* on *J. communis*, 8.IV.1869 *Karsten* (lectotype H). Kainuu: Kuhmo, Ulvinsalo, Ulvinvaara, spruce-dominated old-growth forest, on *J. communis*, 2005 *Pippola 449* (OULU F069356). Koillismaa: Kuusamo, Oulanka National Park, Ampumavaara, spruce forest, on *C. juniperi* on *J. communis*, 1978 *Torkelsen 106/78* (O 160931). Inarin Lappi: Inari, Kirakkapäät, Ronkajoki, pine-dominated forest, on *J. communis* with *C. juniperi*, 2005 *Pippola 231* (OULU F069351).

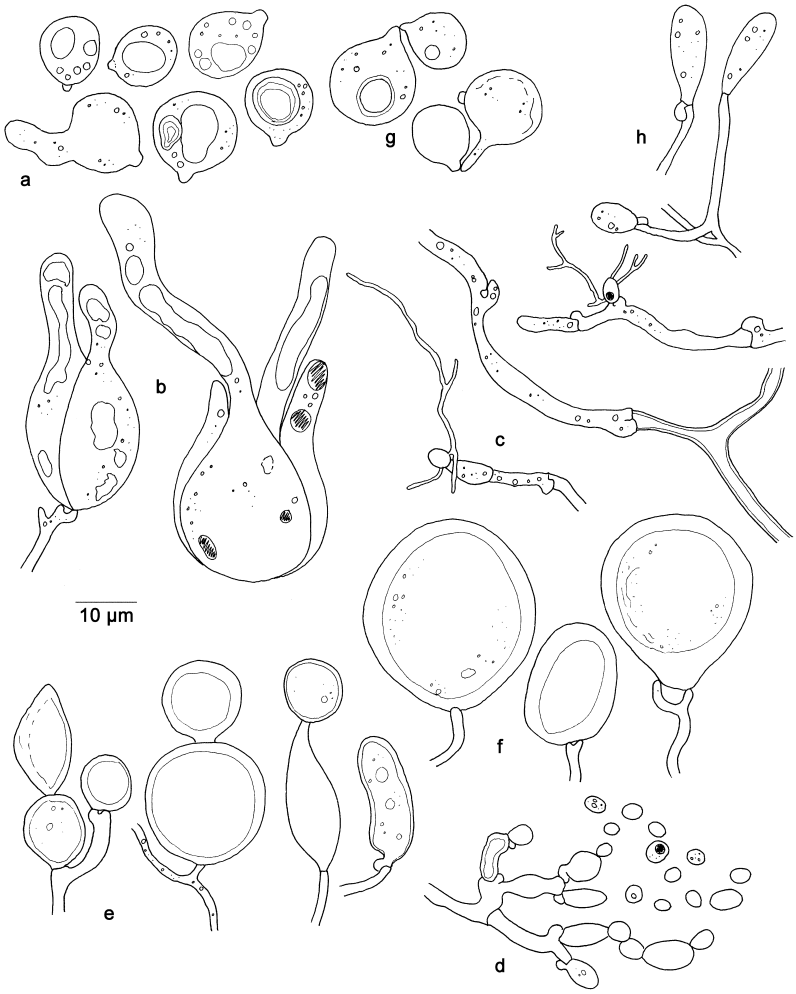

Fig. 15. *Tremella mesenterica* (**a–f** from *Pippola 282*, **g** from *Ulvinen* 1986, **h** from *Korhonen 6307*). — **a** and **g**: Spores, of which one germinates by a germ tube and two form secondary spores. — **b**: Basidia. — **c**: Hyphae with haustoria. — **d**: Conidia originating from conidiogenous cells. — **e**: Various swollen cells. — **f**: Vesicles. — **h**: Hyphidia.

Tremella mesenterica Retz. : Fr. (Plate 2c, Figs. 15–16)

Kongl. Vet. Akad. Handl. 30: 249. 1769. — *Tremella mesenterica* Retz. : Fr., Syst. mycol. 2 (Lundae): 214. 1822. — TYPE (Wong *et al*. 1985): Sweden. Medelpad, Borgsjö, W of Lillberg, on dead trunk of *Salix* sp., 17.VIII.1982. *Strid* (neotype S).

Tremella lutescens Pers., Icon. descr. fung. 2: 33. 1798; Syn. Meth. Fung. 2: 622. 1801. — *Tremella mesenterica* β *lutescens* (Pers.) Pers., Mycol. Eur. 1: 100. 1822. — *Tremella lutescens* Pers. : Fr., Syst. mycol. 2 (Lundae): 213. 1822.

Hormomyces aurantiacus Bonord., Handb. allgem. Mykol.: 150. 1851, *nom. anam*.

Exidia candida Lloyd *sensu auct*.

Tremella albida Huds. : Fr. *sensu auct*.

Tremella candida Pers. *sensu auct*.

Basidiomata cream, yellow or orange-yellow, young basidiomata cushion-like or cerebriform, becoming folded, lobate or foliose in maturity, some parts may be resupinate, up to 5 cm or more in diam.

Spores hyaline to yellowish, smooth, thin-walled, globose to subglobose, (8–)9.8–14.9(–17.4) × (7.4–)7.9–13.5(–15.6) μm, L = 12.2 μm, W = 10.5 μm, Q = 0.9–1.6, Q^* = 1.2 (n = 210/7), apiculus distinctive, mostly with oil drops, spores germinate by germ tubes or form secondary spores.

Hymenium composed only of basidia, of both basidia and conidia or only of conidia. Basidia two- to four-celled, longitudinally or occasionally obliquely septate, basally clamped, hyaline to yellowish, smooth, mostly with oil drops, thin-walled, globose to subglobose, sometimes wider than long, (14.1–)17.4–24.9(–25.9) × (14.1–)15.6–25.4(–26.1) μm, L = 20.8 μm, W

= 20.2 μm, Q = 0.8–1.6, Q^* = 1.0 (n = 110/7), sterigmata up to 96 μm long, (1.9–)2–4.1(–4.4) μm in diam., occasionally apically swollen up to 6.4 μm in diam., rarely branched.

Conidia hyaline to pale yellow, smooth, thin-walled, subglobose to ellipsoid, (1.8–)2.2–4.5(–5.9) × (1.6–)1.8–3.8(–4.2) μm, L = 3.3 μm, W = 2.6 μm, Q = 0.8–2.5, Q^* = 1.3 (n = 210/7), originating from conidiogenous cells.

Subterminal and terminal swollen cells abundant close to the substrate, seldom elsewhere, hyaline, smooth, globose, ellipsoid, citriform or oblong, (4.5–)7.3–26.2(–41.4) × (4–)5.5–21.6(–29.4) μm, L = 16.2 μm, W = 11.3 μm, Q = 0.9–4.4, Q^* = 1.5 (n = 127/7), thin- to thick-walled (up to 1.5 μm), occasionally short-stalked (up to 6.4 μm in length). Swollen cells often difficult to distinguish from vesicles and probasidia.

Vesicles rare or common close to the substrate, hyaline, globose, ellipsoid, ovoid, citriform or oblong, (9.6–)10.4–31.6(–37.2) × (6.5–)9.4–27.2(–37.6) μm, L = 20.5 μm, W = 17.1 μm, Q = 0.7–3.7, Q^* = 1.3 (n = 96/7), extremely thick walled (1.3–4.2 μm), contents frequently oily and yellowish. Often difficult to distinguish from swollen cells.

Hyphae clamped, hyaline to yellowish, smooth, (0.6–)1.4–3.8(–5.6) μm in diam. (n = 119/7), mostly thin- or slightly thick-walled (up to 0.4 μm), occasionally very thick-walled (up to 1.6 μm), oil drops common.

Hyphidia rare and scattered, usually unclear, not measured.

Haustoria abundant close to the substrate, originating from hyphae and sometimes from swollen cells or vesicles. Haustorial mother cells hyaline to yellowish, smooth, thin-walled, globose, ellipsoid or oblong, (2–)2.3–5.9(–6.4) × (1.8–)2–3.9(–4.9) μm, L = 3.7 μm, W = 2.7 μm, Q = 0.8–3.0, Q^* = 1.5 (n = 106/7), each mother cell usually bearing many, frequently branched haustorial filaments about 0.5 μm in diam., up to 30 μm long.

Ecology. According to the literature (Zugmaier *et al*. 1994, Roberts 1995, Torkelsen 2005) *T. mesenterica* is a parasite of *Peniophora* species and possibly some other closely related genera (Zugmaier & Oberwinkler 1995, Torkelsen 2005). In Finland *T. mesenterica* is noted together with the following *Peniophora* species: *P. incarnata* (4 specimens studied), *P. limitata* (4 specimens studied), *P. violaceolivida* (1 specimen studied) and *Peniophora* sp. (1 specimen studied).

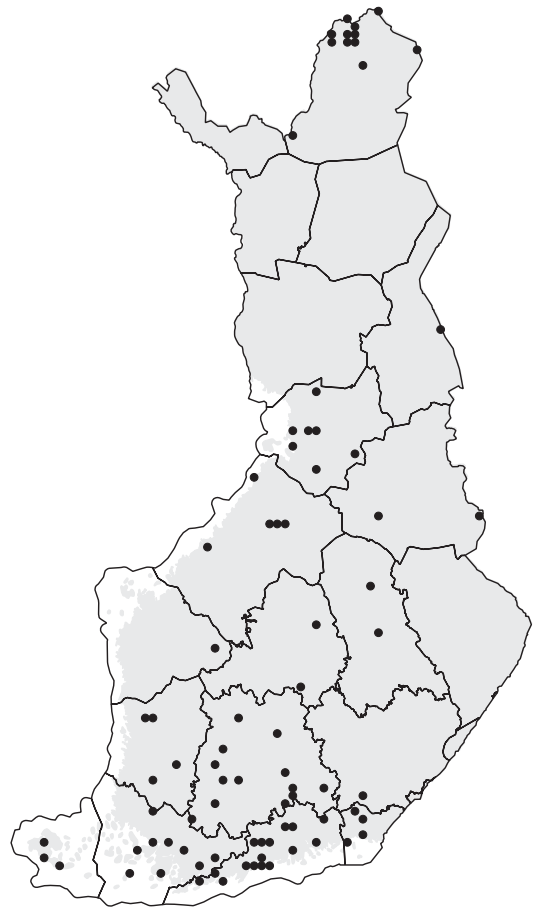

Fig. 16. Distribution of *Tremella mesenterica* (●) in Finland. The lines show the boundaries of the biogeographical provinces.

Tremella mesenterica occurs in all kind of habitats: deciduous, coniferous and herb-rich forests, thickets, wooded pastures, gardens and other cultural environments. In Lapland it is common in mountain birch forests. Basidiomata of *T. mesenterica* are found on deciduous wood (Table 2) all year round, most frequently from August to November. It is one of the edible species in the genus (e.g. Gorter & Eicker 1988, Adhikari & Durrieu 1996, Boa 2004).

Distribution and abundance. *Tremella mesenterica* seems to be the most common Finn-

ish *Tremella* species, followed by *T. foliacea*. The bright colour may cause some misinterpretation because amateurs often bring the conspicuous and attractive basidiomata to the herbaria. *Tremella mesenterica* is found almost throughout Finland (Fig. 16). *Tremella mesenterica* is a cosmopolitan species, known from North America (e.g. Coker 1920, Olive 1946b) as well as from Central and South America (Lowy 1971), Australia (Wojewoda 1981, Roberts 1995, Krieglsteiner 2000), New Zealand (McNabb 1966), Africa (Wojewoda 1981, Gorter & Eicker 1988, Roberts 1995, Krieglsteiner 2000), Asia (Kobayasi 1939, Roberts 1995, Adhikari & Durrieu 1996, Teng 1996, Chen 1998, Krieglsteiner 2000) and Europe (e.g. Jülich 1984, Torkelsen 1997, Krieglsteiner 2000).

NOTES. The yellow, folded to foliose and comparatively large basidiomata of *T. mesenterica* are usually easily identified. Because of the variation in colour and the presence of conidia, *T. mesenterica* is commonly considered to include two or more separate species. However, the variability is attributed to normal developmental changes and responses to different light conditions (Wong *et al*. 1985).

Tremella aurantia is another large and yellow *Tremella* species known from Europe. According to Roberts (1995), it is easily distinguished from *T. mesenterica* by its substantially smaller spores (5.5–9 × 4.5–7 μm), smaller basidia (ca. 9–13 μm wide), and by the presence of host hyphae in subhymenium and context. Moreover, the host species separate these two taxa: *T. aurantia* parasitizes *Stereum hirsutum* whilst *T. mesenterica* parasitizes *Peniophora* species (Roberts 1995). So far, *T. aurantia* has not been found either in Norway (Torkelsen 2005) or in Finland, and it seems that the distribution of *T. aurantia* does not reach the Nordic countries.

SELECTED SPECIMENS EXAMINED. — **Finland**. Åland: Lemland, Flaka, Björkö, herb-rich forest, on fallen *Fraxinus excelsior* with *Peniophora limitata*, 2005 *Pippola 282* (OULU F069340). Uusimaa: Espoo, Espoonkartano, on twig of deciduous tree, 1984 *Korhonen 6307* (H). Etelä-Häme: Jaala, Kimola Canal, herb-rich forest, on cut log of *Populus tremula*, 1981 *Haikonen 1942* (H). Keski-Pohjanmaa: Raahe, Pikku-Kraaseli, birch forest, on *Salix*, 1993 *Särkkä 169* (OULU F025690). Oulun Pohjanmaa: Haukipudas, Niemeläntörmä, on *Alnus*, 1986 *Ulvinen* (OULU F068541). Kainuu: Kuhmo, Elimyssalo, Riihipuro, peaty brookside, on living *Alnus incana*, 2005 *Pippola 439* (OULU F069529). Inarin Lappi: Utsjoki, Rassijoki, on twig of *Betula*, 1960 *Kallio* (TUR 28172).

Tremella mycetophiloides Kobayasi (Plate 2d, Figs. 17–18)

Sci. Rep. Tokyo Bunrika Daigaku B 4: 13. 1939. — TYPE: Japan. Prov. Kôzuke, Konsei Pass, singly or gregariously on hymenium of living *Aleurodiscus* sp., on decaying trunks of *Abies veitchii* Lindley, 13.VII.1938 *Y. Kobayasi* (type TI, probably destroyed). — NEOTYPE (Bandoni & Ginns 1993): Japan. Gunma Prefecture, Konsei Tooge, mainly on the west side of the highway leading through the pass, on *Aleurodiscus grantii* on dead attached lower branches of *Abies veitchii*, 2.V.1986 *R. J. Bandoni 7548* (DAOM).

Tremella mycophaga G.W. Martin, Mycologia 32: 686. 1940. — TYPE: Canada. Ontario, Algonquin Park, on *Aleurodiscus amorphus* on *Abies balsamea*, 18 Sep. 1938 *University of Toronto 13421* (holotype TRTC). — Synonymized by Bandoni and Ginns (1993).

Basidiomata resupinate, cushion-like or spherical, up to 2 mm in diam., brownish orange when dry, translucent yellowish to pale rose when soaked.

No spores seen, and only one mature, two-celled, longitudinally stalked, globose basidia observed, 10.2 × 11.8 μm, single sterigma 16.1 μm long, 1.9 μm in diam. Probasidia hyaline to yellowish, smooth, thin-walled, basally clamped, subglobose, 10.2–14.3 × 7.6–10.2 μm, L = 12.2 μm, W = 9.1 μm, Q = 1.1–1.8, Q^* = 1.3 (n = 15/1).

Many basidiomata consist mainly of conidiogenous cells and dikaryotic and monokaryotic conidia. Conidiogenous cells hyaline to yellowish, smooth, thin-walled, globose to ellipsoid, (6–)6.1–9.1(–9.2) × (5.8–)5.9–8.4(–8.5) μm, L = 7.7 μm, W = 7.1 μm, Q = 0.9–1.5, Q^* = 1.1 (n = 26/1). Dikaryotic conidia smooth, hyaline to yellowish, thin-walled, globose, ellipsoid or oblong, (4.4–)4.5–6.8(–7.6) × (3.3–)3.4–4.4 μm, L = 5.8 μm, W = 3.9 μm, Q = 1.0–2.2, Q^* = 1.5 (n = 30/1). Conidiogenous cells and dikaryotic conidia form monokaryotic conidia via budding. Monokaryotic conidia smooth, hyaline, thin-walled, subglobose to ellipsoid, (1.9–)2–2.5(–2.6) × 1.6–2.3(–2.5) μm, L = 2.2 μm, W = 1.9 μm, Q = 1.0–1.4, Q^* = 1.2 (n = 30/1).

Hyphae clamped, smooth, hyaline to yellowish, irregular, (1.1–)1.6–6.4(–6.6) μm in diam.

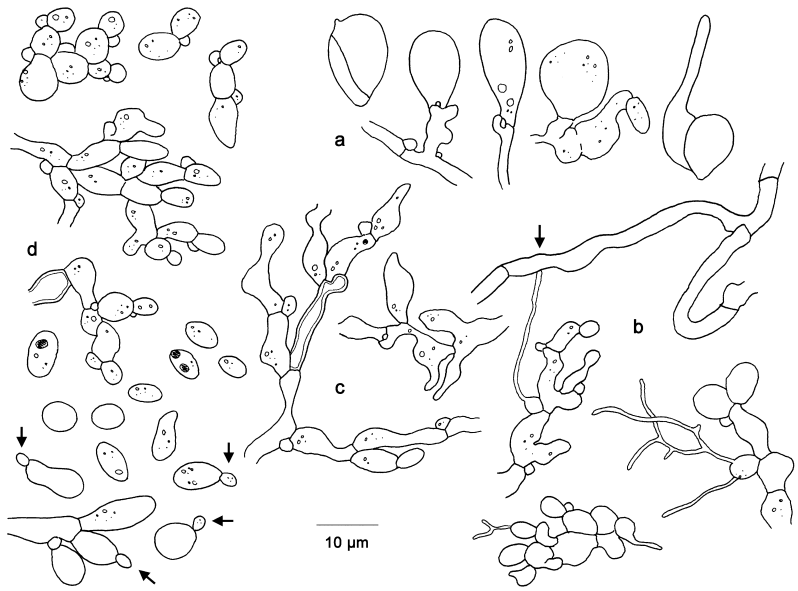

Fig. 17. *Tremella mycetophiloides* (from *Kotiranta 11860*). — **a**: Probasidia and the single mature basidium (right). — **b**: Hyphae with haustoria, of which one is attached to the host hyphae (arrow). — **c**: Hyphae. — **d**: Conidiogenous cells, dikaryotic conidia and formation of monokaryotic conidia (arrows).

(n = 24/1), thin- to slightly thick-walled (up to 0.4 μm).

Haustoria abundant. Haustorial mother cells smooth, hyaline to yellowish, thin-walled, subglobose to ellipsoid 2.4–5.5 × 2–3.7 μm, L = 3.8 μm, W = 2.6 μm, Q = 1.1–2.0, Q^* = 1.6 (n = 17/1), each mother cell bearing one or a few haustorial filaments up to 1.5 μm in diam. and 56 μm long, sometimes branched.

Swollen cells, vesicles and hyphidia absent.

Ecology. In Finland *T. mycetophiloides* is found on *Aleurodiscus amorphus*. In addition, it is reported on *Aleurodiscus grantii* (Bandoni & Ginns 1993) and *Phanerochaete tamariciphila* (Dueñas 1996). *Aleurodiscus amorphus* and *A. grantii* occur typically on dead branches of *Abies* spp. and occasionally on species of *Picea*, *Pinus*, *Pseudotsuga* and *Tsuga* (Ginns 1982); *P. tamariciphila* occurs on *Tamarix* spp. (Boidin *et al.* 1993). In Finland *A. amorphus* is found on *Abies sibirica*, cultivated *Abies* sp., *Picea abies* and *Picea* sp. (Kotiranta & Saarenoksa 2000). The single Finnish collection of *T. mycetophiloides* is from October.

Distribution and abundance. Findings of the host *A. amorphus* are fairly recent and few (Kotiranta & Saarenoksa 2000), and it is not surprising that *T. mycetophiloides* is also rare. Further studies are needed to reveal the distribution and abundance of *T. mycetophiloides*. At present it

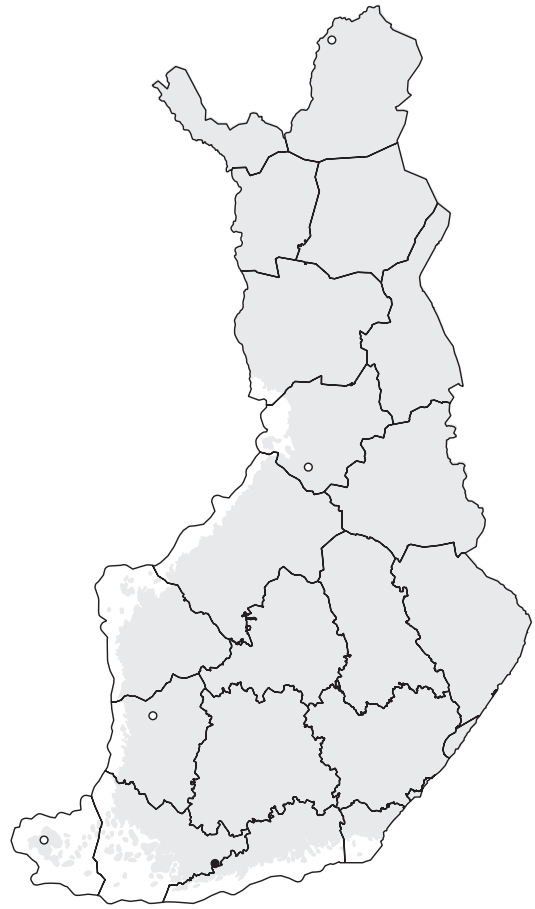

Fig. 18. Distribution of *Tremella mycetophiloides* (●) and *T. obscura* (O) in Finland. The lines show the boundaries of the biogeographical provinces.

is impossible to evaluate whether the species is threatened or not. Worldwide *T. mycetophiloides* seems to be restricted to the Northern Hemisphere, as are its hosts (Ginns 1982, Boidin *et al.* 1993). In Europe it is reported e.g. from Norway (Torkelsen 1968), Denmark (Christiansen 1954), Germany (Bandoni & Ginns 1993), Spain (Dueñas 1996), Sweden, Austria, Czech Republic, Italy, Macedonia (Pilát 1953) and Poland (Wojewoda 1981), in Asia from Japan (Kobayasi 1939, Bandoni & Ginns 1993), Korea and Taiwan (Bandoni & Ginns 1993), and in North America both from Canada (Martin 1940, Bandoni & Ginns 1993) and the U.S.A. (Bandoni & Ginns 1993).

NOTES. Small, pale basidiomata found on *Aleurodiscus* spp. characterize *T. mycetophiloides*. In addition, swellings in the hyphae, which make the hyphae look irregular, and the commonness of the conidial stage are typical. Conidia are intermixed with basidia or alone in the hymenium, and occurrence of the monokaryotic conidia, first observed by Chen (1998), seems to be characteristic.

The same specimen was studied by Kotiranta and Saarenoksa (2000). They managed to see one broadly ellipsoid spore, 6 × 5.5 μm, and obtained slightly larger measures of probasidia, 15–17 × (9–)11.5–13 μm. Other measurements of *T. mycetophiloides* are given for instance in the exhaustive paper by Bandoni and Ginns (1993).

Tremella simplex H.S. Jacks. & G.W. Martin is similar to *T. mycetophiloides*, but lacks clamps and has consistently two-celled mature basidia (Martin 1940).

SPECIMEN EXAMINED. — **Finland**. Varsinais-Suomi: Karjaa, Mustio manor house park, on *Aleurodiscus amorphus* on dead branches of living cultivated *Abies sibirica*, 1994 *Kotiranta 11860* (H, H.K.).

Tremella obscura (L.S. Olive) M.P. Christ. (Figs. 18–19)

Friesia 5: 62.1954. — *Tremella mycophaga* G.W. Martin var. *obscura* L.S. Olive, Mycologia 38: 540. 1946. — TYPES: U.S.A. Georgia, Athens, deciduous woods on the University of Georgia Campus, in the hymenium of *Dacrymyces minor* on decorticated frondose wood, 25.X.1945 *Lindsay S. Olive* (syntypes ISC, K(M) 36761) and in the hymenium of *D. deliquescens* on cedar, 23.X.1945, *Lindsay S. Olive* (syntype not located).

Basidiomata not macroscopically visible, in the host hymenium.

Spores smooth, hyaline, thin-walled, globose to ellipsoid, (4.3–)4.9–9(–10.4) × (3.9–)3.9–8.2(–9.8) μm, L = 7.2 μm, W = 6.3 μm, Q = 0.9–1.7, Q^* = 1.2 (n = 95/4), apiculus usually distinctive, oil drops common, spores germinate by germ tubes. Conidia often resemble spores.

Basidia very rarely stalked, 3.5–8.4 × 2.4–4.4 μm (n = 3/1), basally clamped, two-celled, longitudinally or occasionally obliquely or transversely septate, smooth, hyaline to yellowish, globose to ellipsoid, (8.4–)9.6–15.3(–16.3) × (8–)9.6–14(–15.3) μm, L = 12.3 μm, W = 11.6 μm, Q = 0.8–1.7, Q^* = 1.1 (n = 65/4), sterigmata up to 65 μm long, (1.9–)2–4.3(–6.1) μm in diam., occasionally branched, small oil drops common.

Conidial stage usually abundant. Conidia and conidiogenous cells (not measured separately) smooth, hyaline, globose, ellipsoid or oblong, (3.3–)4.1–7.8(–8.4) × (2.2–)2.5–5.7(–6) μm, L = 5.8 μm, W = 3.8 μm, Q = 1.0–2.6, Q^* = 1.5 (n = 101/4), thin- to fairly thin-walled (up to 0.4 μm), oil droplets common.

Hyphae clamped, smooth, hyaline, 1.6–3.7(–4.3) μm in diam. (n = 58/4), thin- to relatively thin-walled (up to 0.4 μm), small oil drops common.

Haustoria abundant. Haustorial mother cells smooth, hyaline, thin-walled, globose, subglobose or ellipsoid, often wider than long, 1.8–3.8(–4) × (1.8–)1.9–3.9(–4.2) μm, L = 2.8 μm, W = 2.7 μm, Q = 0.5–1.9, Q^* = 1.1 (n = 51/4), each mother cell bearing one haustorial filament, less than 1 μm in diam., up to ca. 42 μm long, rarely branched.

Swollen cells, vesicles and hyphidia absent.

ECOLOGY. *Tremella obscura* grows in the hymenium of *Dacrymyces* species. It was originally described as parasitic on *D. minor* and *D. deliquescens*. Finnish records are from *D. lacrymalis* and *D. stillatus*. *Tremella obscura* can be found whenever basidiomata of *Dacrymyces* species are produced. Since Finnish specimens were collected in February, May, July and August, they can probably be found all year round.

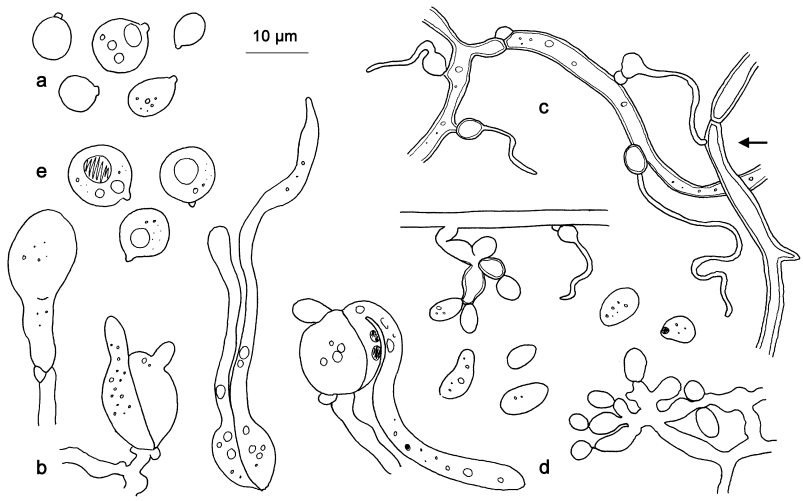

Fig. 19. *Tremella obscura* (**a**–**d** from *Ulvinen* 1972, **e** from *Pippola 394*). — **a** and **e**: Spores. — **b**: Basidia at different stages of development. — **c**: Hyphae with haustoria, of which one is attached to the host hyphae (arrow). — **d**: Conidia and conidiogenous cells.

DISTRIBUTION AND ABUNDANCE. So far, there are only four collections from Finland (Fig. 18). Because they are from different parts of the country and possible hosts are common, we presume *T. obscura* to be a common species in the whole Finland. Worldwide distribution is known to extend to the U.S.A. (Olive 1946b, 1946a), Denmark (Christiansen 1954) and UK (Roberts 2007). In addition, possible records are known e.g. from Norway (Torkelsen 1968), Spain, Portugal (Dueñas 2001) and Germany (Krieglsteiner 2000).

NOTES. *Tremella obscura* is the first described species among the four known *Tremella* species parasitizing *Dacrymyces* species. It has clamped hyphae, mainly stalkless basidia, comparatively short sterigmata, and thin-walled conidia which do not arise from clamp connections. *Tremella obscura* is known to have two- to four-celled basidia (Olive 1946b, Christiansen 1954), but in Finnish collections only two-celled basidia were observed.

Compared with *T. penetrans*, *T. obscura* has smaller spores and basidia and substantially shorter sterigmata. It is not clearly distinct from *Tremella occultifuroidea* Chee J. Chen & Oberw. reported from Taiwan, but according to the original description (Chen *et al*. 1999), *T. occultifuroidea* has thick-walled, dikaryotic conidia, somewhat larger spores and remarkably long sterigmata. *T. giraffa* differs from *T. obscura* in its typical characters discussed earlier, but the characters may sometimes overlap.

In addition to these other *Tremella* species occurring in the hymenium of *Dacrymyces* species, *T. obscura* is often confused with *Tremella caloceraticola* Hauerslev which parasitizes *Calocera* spp. as well as with the conidial stage of *Occultifur internus*, an auricularioid parasite of *Dacrymyces* spp. As noted by Oberwinkler (1990), the description of *T. obscura* by Christiansen is based on material representing two different taxa: one with conidiophores of *O. internus* and another with tremellaceous basidia of *T. obscura*, whereas the original description and illustration by Olive (1946b) only have characters typical of *T. obscura*. Because Christiansen's description is misleading, it is not surprising that many of the reports of *T. obscura* are actually reports of the conidial stage of *O. internus*, or a mixture of these two species.

SPECIMENS EXAMINED. — **Finland**. Åland: Finnström, Husö, deciduous forest, in *Dacrymyces stillatus* on cut top of *Alnus glutinosa* with *Stereum hirsutum*, 2005 *Pippola 292* (OULU F069349). Satakunta: Kankaanpää, Venesjärvi, Metsäkulma, in *Dacrymyces lacrymalis* on *Alnus*, 26.II.1936 *Laurila* (H). Oulun Pohjanmaa: Tyrnävä, Keeterinkangas, deciduous forest, in *D. lacrymalis* on twig of *Salix*, 1972 *Ulvinen* (OULU F044298). Inarin Lappi: Utsjoki, Paistunturit, tributary of Mavvna-avosi, mountain birch forest, in *D. lacrymalis* on twig of *Salix caprea*, 2005 *Pippola 394* (OULU F069347).

Tremella phaeophysciae Diederich & M.S. Christ. (Plate 2e, Figs. 20–21)

in Diederich, Bibl. Lichenol. 61: 142. 1996. — TYPE: Den-

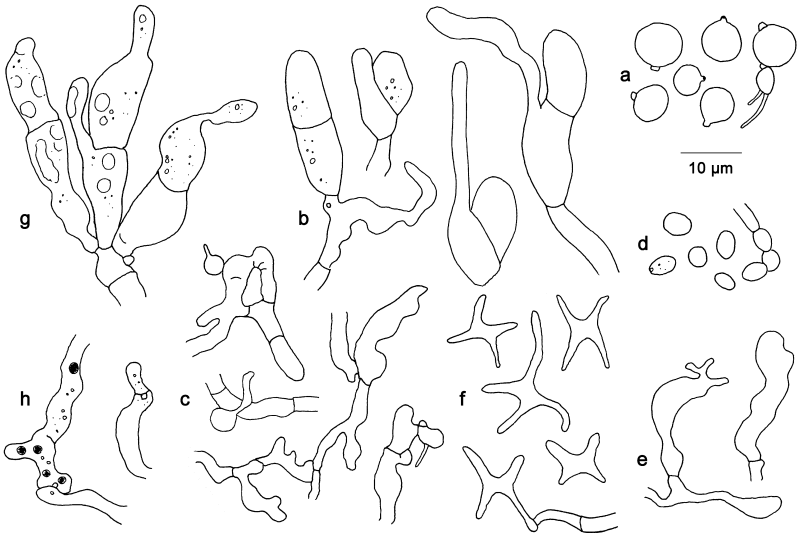

Fig. 20. *Tremella phaeophysciae* (**a**–**f** from *Hausen* 1927 (OULU F073618), **g**–**h** from *Hinneri* 1970). — **a**: Spores, of which one bears a haustorium. — **b** and **g**: Basidia at different stages of development. — **c**: Hyphae with haustoria. — **d**: Conidia. — **e**: Conidiogenous cells. — **f**: Asteroconidia. — **h**: Clamped hyphae.

mark. Zealand, Jungshoved, on *Phaeophyscia orbicularis*, 12.VIII.1966 *M. S. Christiansen 2351* (holotype C; isotype herb. Diederich).

Inducing olive brown, reddish brown, brown or blackish brown, resupinate or somewhat spherical or elliptical galls on the host thallus, 0.1–1.5 mm in diam., surface gelatinous, smooth or slightly wrinkled, interior consisting of the host hyphae.

Spores smooth, hyaline to pale brown, thin- to fairly thin-walled (under 0.2 μm), globose, mostly wider than long, (4.2–)5–7.8(–9.1) × (4.5–)5.7–8.1(–9.4) μm, L = 6.3 μm, W = 7 μm, Q = 0.7–1.1, Q^* = 0.9 (n = 210/9), distinct apiculus occasionally refractive.

Basidia two-celled, rarely basally clamped, smooth, hyaline to pale brown, typically transversely, rarely obliquely or almost longitudinally septate, ellipsoid or irregularly oblong, (11.1–)15–27.7(–31) × (4.3–)5.9–9.5(–11.1) μm, L = 21 μm, W = 7.7 μm, Q = 1.2–5.7, Q^* = 2.8 (n = 134/9), sterigmata up to 27 μm long, (1.2–)1.9–4.9(–6.2) μm in diam.

Conidial stage, especially asteroconidia, common, but not always present. Conidia smooth, hyaline to pale brown, thin- to fairly thin-walled, globose to ellipsoid, (2.2–)2.5–5.1(–5.4) × (1.8–)2.1–4(–4.2) μm, L = 3.9 μm, W = 3.1 μm, Q = 1.0–2.0, Q^* = 1.3 (n = 42/4). Conidiogenous cells very unclear in some specimens and clear and abundant in others, smooth, hyaline, thin- to relatively thin-walled, irregularly oblong, (11.8–)12.2–25.2(–30.2) × (2.1–)2.5–5.3(–5.7) μm, L = 18.4 μm, W = 3.9 μm, Q = 2.9–9.3, Q^* = 5.0 (n = 40/6), usually with small tubes in apices (measures incl. tubes). Four-armed asteroconidia absent in some basidiomata, usually abundant when present. Asteroconidia smooth, hyaline to pale brown, thin-walled, (4.1–)7.8–16(–21) μm in diam., individual arms (0.8–)2.1–8.4(–11) μm long (n = 168/6).

Hyphae mostly simple-septate, infrequently clamped, (1.1–)1.8–5(–7) μm in diam. (n = 139/9), thin- to thick-walled (up to 1 μm).

Haustoria few or abundant, originating from hyphae or spores. Haustorial mother cells basally clamped, smooth, hyaline to pale brown, thin-walled, globose, ellipsoid or oblong, (2.1–)3.1–5.3(–6.2) × (1.8–)2–4.1(–4.3) μm, L = 4.2 μm, W = 3 μm, Q = 0.8–2.9, Q^* = 1.5 (n = 131/9), each mother cell bearing one or two haustorial filaments under 1 μm in diam. and 18 μm long, rarely slightly branched.

Swollen cells, vesicles and hyphidia absent.

Ecology. In Finland *T. phaeophysciae* is commonly found on *Phaeophyscia orbicularis* (53 specimens studied) and rarely on *P. endophoenicea* (2 specimens studied) and *P. nigricans* (1 specimen studied). As far as we know, this is the first record of host species other than *P. orbicularis*. Habitats of *Phaeophyscia* species are mostly parks, yards, etc.

DISTRIBUTION AND ABUNDANCE. Collections are concentrated in southern Finland and the northernmost collections originate from Lapua in western Finland (Fig. 21). Because *P. orbicularis* and *P. nigricans* occur almost throughout the country (Vitikainen *et al*. 1997), the distribution of *T. phaeophysciae* may be much wider than currently known. It is a common and widespread species in Europe (Diederich 1996), but known only from a few localities in North America (Diederich 2003). This is the first record from Finland.

NOTES. Two-celled basidia with a transverse septum are characteristic of *T. phaeophysciae*. When the conidial stage is dominant, typically abundant asteroconidia are found, and both the spores and the basidia are rare. We were able to find only olivaceous, reddish or blackish brown galls induced by *T. phaeophysciae*. According to Diederich (1996) galls will later develop into convex, gelatinous and usually wrinkled basidiomata.

It is noteworthy that KOH occasionally tinges the microstructures purple, especially those of the host, but to some extent also those of *T. phaeophysciae*.

Tremella cladoniae is microscopically very similar to *T. phaeophysciae*, but they are distinguished by the different hosts, *T. cladoniae* occurring on *Cladonia* spp. (*see* Diederich 1996). They may also differ in colour. According to Diederich (1996) basidiomata of *T. cladoniae* are more pinkish brown.

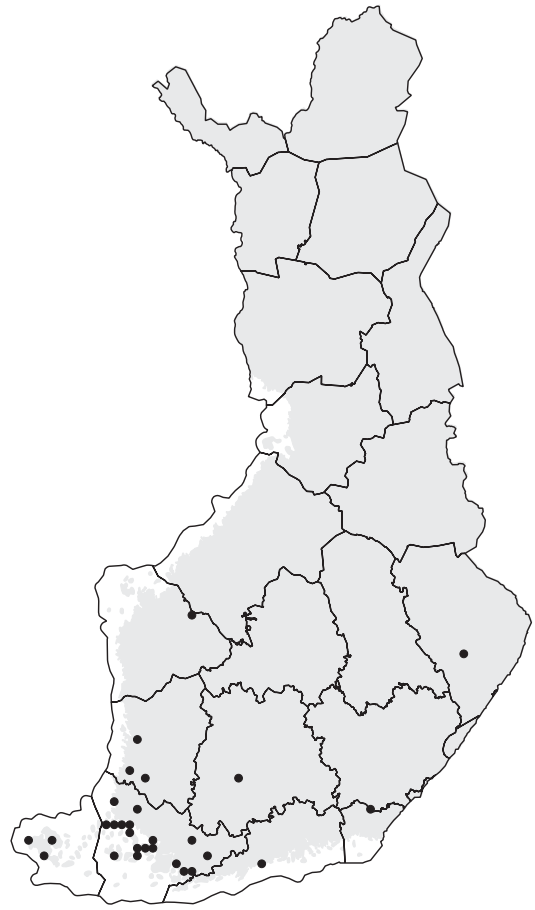

Fig. 21. Distribution of *Tremella phaeophysciae* (●) in Finland. The lines show the boundaries of the biogeographical provinces.

SELECTED SPECIMENS EXAMINED. — **Finland**. Varsinais-Suomi: Kisko, Kärkelän ruukki, on *Phaeophyscia orbicularis* on *Fraxinus excelsior*, 1989 *Laine* (TUR 178741). Uusikaupunki, N of Kasarminlahti, park, on *P. orbicularis* on *Acer platanoides*, 1970 *Hinneri* (OULU F073616). Satakunta: Pori, old graveyard, on *P. endophoenicea* on *Acer*, 1925 *Hausen* (TUR-V 08367). Pori, on *P. orbicularis* on *Acer*, 1927 *Hausen* (OULU F073618). Pori, on *P. orbicularis* on *Acer*, 1927 *Hausen* (OULU F073615). Etelä-Häme: Hattula, Lepaa, on *P. orbicularis* on *Sorbus aucuparia*, 1935 *Räsänen* (TUR 178747). Etelä-Pohjanmaa: Lapua, on *P. orbicularis* on *S. aucuparia*, 1918 *Räsänen* (TUR 178725). Lapua, churchyard, on *P. nigricans* on *Populus tremula*, 1920 *Räsänen* (TUR-V 08471). Pohjois-Karjala: Joensuu, Rantakatu, on *P. orbicularis* on *S. aucuparia*, 1948 *Leppälä* (TUR 178735).

Tremella polyporina D.A. Reid (Figs. 22–23)

Trans. Br. Mycol. Soc. 55: 416. 1970. — TYPE: UK. Scotland, Glasgow, Cadzow Park, in the tubes of *Tyromyces lacteus* which was growing either on *Ulmus* or on *Fraxinus*, 14.IX.1959, *D. A. Reid* (holotype K(M) 32740).

Sebacina polyporophaga Hauerslev, Friesia 11: 106. (1976)1977. — TYPE: Denmark. Sealand, Tokkekøb Hegn, on *Tyromyces caesius*, 28.IX.1969, *K. Hauerslev 3454* (holotype C). — Synonymized by Wojewoda (1981).

Basidiomata not macroscopically visible, in the host hymenium.

Spores smooth, hyaline, thin-walled, globose to subglobose, (3.9–)4–6.2(–7.1) × (3.3–)3.8–6.1(–7) μm, L = 5.3 μm, W = 5 μm, Q = 0.8–1.3, Q^* = 1.1 (n = 120/4), apiculus distinctive, oil drops common.

Basidia two- or four-celled, smooth, thin-walled, longitudinally septate, basally clamped, globose, subglobose or ellipsoid, (6.2–)7.1–

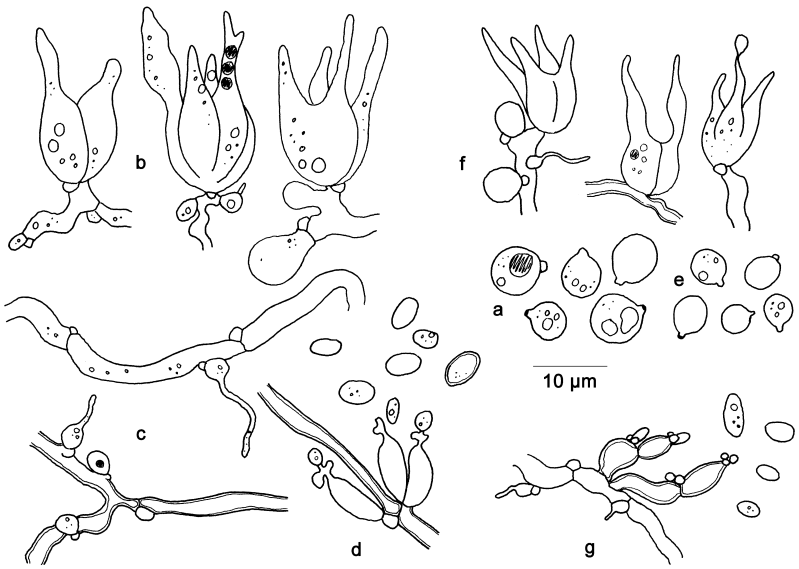

Fig. 22. *Tremella polyporina* (**a**–**d** from *Kytömäki 3/05*, **e**–**g** from *Risunen & Jakobsson 1877*). — **a** and **e**: Spores. — **b** and **f**: Basidia. — **c**: Hyphae with haustoria. — **d** and **g**: Conidia originating from conidiogenous cells.

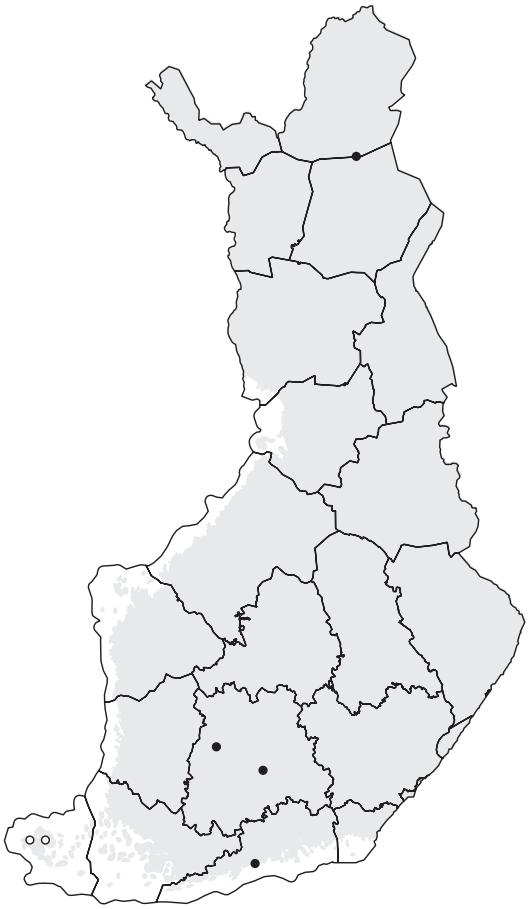

Fig. 23. Distribution of *Tremella polyporina* (●) and *T. ramalinae* (○) in Finland. The lines show the boundaries of the biogeographical provinces.

13.2(–14.1) × (6–)7–13.3(–13.9) µm, L = 10.4 µm, W = 10.1 µm, Q = 0.8–1.4, Q^* = 1.0 (n = 63/4), sterigmata up to 17 µm long, (0.9–)1.1–2.5(–3.5) µm in diam., usually narrowing towards apices, occasionally branched, oil drops common.

Conidial stage common. Conidia smooth, hyaline, globose, ellipsoid or oblong, (2–)2.7–6.2(–7.6) × (1.3–)1.8–3.1(–3.7) µm, L = 4 µm, W = 2.3 µm, Q = 1.0–3.3, Q^* = 1.8 (n = 120/4), thin- to fairly thin-walled (up to 0.3 µm), originating from conidiogenous cells and possibly infrequently from hyphal tips, oil droplets common (seen as black spots).

Hyphae clamped, smooth, (1–)1.8–4(–5) µm (n = 62/4), thin- to thick-walled (up to 0.8 µm), oil drops common.

Haustoria few or abundant. Haustorial mother cells smooth, hyaline, thin-walled, globose to ellipsoid, 2–3.9(–4) × (1.8–)1.9–3.2(–3.3) µm, L = 2.6 µm, W = 2.3 µm, Q = 0.7–1.8, Q^* = 1.1 (n = 55/4), each mother cell bearing one to three haustorial filaments 0.5–1 µm in diam., up to 20 µm long, rarely slightly branched.

Swollen cells, vesicles and hyphidia absent.

Ecology. *Tremella polyporina* is found especially in the hymenium of *Postia* species, but it may not be highly host-specific. It might rather be a generalist occuring on various polypore species. Finnish specimens were collected in August, September or October.

DISTRIBUTION AND ABUNDANCE. Four Finnish collections derive from different parts of the country (Fig. 23). Collections are so widely distributed and the hosts are so common that we can presume *T. polyporina* to be a common species in the whole Finland. After being described from Scotland (Reid 1970), *T. polyporina* has been reported from several European countries, e.g. Sweden (Hansen & Knudsen 1997), Norway (Ryvarden 1998), Germany (Krieglsteiner 2000), Czech Republic, Italy (Pouzar & Vampola 1993), and Spain (Dueñas 1997). It is also known from the U.S.A. (Setliff 1982) and Canada (Koske 1972). This is the first Finnish record.

NOTES. In addition to *T. polyporina*, *Tremella telleriae* M. Dueñas occurs in the hymenium of *Postia* species (Dueñas 2001). If it is distinct from *T. polyporina* (Roberts 2007), it differs in having larger basidia (Dueñas 2001) and probably also longer sterigmata and more irregular hyphae. Spores are similar (Dueñas 2001).

A specimen found in the hymenium of *Antrodia sinuosa* has remarkably smaller spores (Table 1) and basidia than other Finnish *T. polyporina* specimens, but does not differ in other respects. Because there is so far only a single collection, it is not considered as a new *Tremella* species. Further collections combined with DNA techniques are needed to understand the taxonomic position of the specimen in *A. sinuosa* as well as the taxonomy of all *Tremella* species occuring in the hymenium of polypores.

SPECIMENS EXAMINED. — **Finland**. Uusimaa: Helsinki, Vanhakaupunki, Pornaistenniemi, herb-rich forest, in *Postia caesia* on *Alnus incana*, 2005 *Kiema 176* (H & H.K.). Etelä-Häme: Lammi, Evo, Iso-Ruuhijärvi, burned, old clear-cut area, in *Postia tephroleuca* on *Betula* with *Pycnoporus cinnabarinus*, *Polyporus brumalis*, *Fomes fomentarius*, *Fomitopsis pinicola*, *Lenzites betulinus*, *Piptoporus betulinus*, *Trametes velutina* and *T. hirsuta*, 2003 *Miettinen 7833,3 & Pippola* (H). Tampere, Soukonvuori, old spruce-dominated forest, in *Postia* sp. on fallen crown of *Picea*, 2005 *Kytömäki 3/05* (H, H.K.). Inarin Lappi: Inari, Kakslauttanen, Kiilopää, in *Antrodia sinuosa* on *Pinus* log, 1996 *Risunen & Jakobsson 1877* (K(M) 137267).

Tremella ramalinae Diederich (Plate 2f, Figs. 23–24)

Bibl. Lichenol. 61: 152. 1996. — TYPE: Mexico. Baja California, near km 45 on road from San Quintin to Parador Punta Prieta, ca. 10 km N of El Rosario, 30°8´N, 115°46´W, on *Ramalina lacera*, 5.I.1989 *H. Sipman 24905* (holotype B; isotype herb. Diederich).

Basidiomata pale rose to pale brown, discoid or cushion-like, 0.2–3 mm in diam., sometimes basally constricted, surface smooth in young basidiomata, wrinkled in old.

Spores smooth, hyaline, thin-walled, globose to subglobose, (4.3–)4.5–7.3(–7.7) × (4–)5.1–7.7(–7.9) μm, L = 5.8 μm, W = 6.2 μm, Q = 0.8–1.3, Q^* = 1.0 (n = 60/2), distinct apiculus often refractive.

Basidia four-celled, smooth, hyaline, thin-walled, oblong or ovoid, (15.3–)19.2–33.3(–33.5) × (8.5–)9.4–13.6(–13.8) μm, L = 24.6 μm, W = 10.8 μm, Q = 1.4–3.4, Q^* = 2.3 (n = 30/2), uppermost septum longitudinal or oblique, two lower septa transverse, sterigmata up to 26 μm long, (1.9–)2–4.2(–4.9) μm in diam., sometimes with oil drops.

Hyphae simple-septate except the basally clamped haustoria. Hyphae smooth, hyaline, (1–)1.2–3.8(–4) μm in diam. (n = 29/2), mostly thin-walled, occasionally thick-walled (up to 0.8 μm).

Haustoria abundant, originating from hyphae. Haustorial mother cells basally clamped, smooth, hyaline, thin-walled, globose to ellipsoid, (3.2–)3.4–4.5(–4.7) × (2.3–)2.4–4.3(–4.4) μm, L = 3.9 μm, W = 3.7 μm, Q = 0.8–1.7, Q^* = 1.1 (n = 30/2), each mother cell bearing one haustorial filament under 1 μm in diam. and 8 μm long, rarely branched.

Conidial stage, swollen cells, vesicles and hyphidia absent.

ECOLOGY. In Finland *T. ramalinae* is found on the basal parts of the thallus of *Ramalina fraxinea*. It is also reported on *Ramalina lacera* (Diederich 1996), but *R. lacera* does not exist in Finland (Vitikainen *et al.* 1997). Both of the Finnish specimens of *T. ramalinae* were collected in July.

DISTRIBUTION AND ABUNDANCE. The host species *R. fraxinea* is mainly found in Southwest Finland (Vitikainen *et al.* 1997). Thus, distribution of *T. ramalinae* could be wider than currently known (Fig. 23), but further studies are needed to reveal its distribution and abundance and evaluate its possible Red List status.

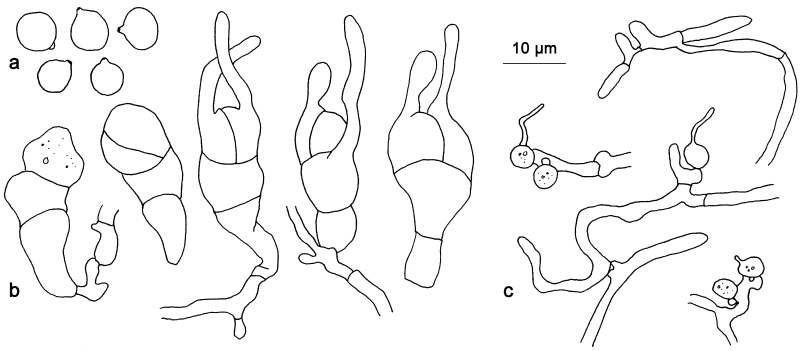

Fig. 24. *Tremella ramalinae* (from *Seppälä* 1914). — **a**: Spores. — **b**: Basidia at different stages of development. — **c**: Hyphae with haustoria.

Tremella ramalinae seems to be a rare species worldwide. So far, only single specimens are known from Sweden, Mexico (Diederich 1996), Spain (Triebel 1997), Estonia (Halonen *et al*. 2000), Lithuania (Motiejūnaitė 2002), Poland (Kowalewska & Kukwa 2003), Iran (Sohrabi & Alstrup 2007) and California (Diederich 2003). This is the first Finnish record.

NOTES. *Tremella ramalinae* is easily distinguished from other lichenicolous *Tremella* species by its four-celled basidia where the two lower septa are transverse and the uppermost septum longitudinal or oblique.

SPECIMENS EXAMINED. — **Finland**. Åland: Hammarland, Kattby, on *Ramalina fraxinea* on *Fraxinus excelsior*, 1964 *Haakana* (OULU F073614). Saltvik, Kvarnbo, on *R. fraxinea* on *F. excelsior*, 1914 *Seppälä* (OULU F073617).

Conclusions

Though knowledge of *Tremella* species and their distribution and abundance in Finland is extended through this study, there is still much to be elucidated. There may well be more than 16 species in Finland, particularly amongst the lichenicolous taxa. Even species new to science could yet be found. The knowledge of distribution, abundance and ecology of some *Tremella* species is still too deficient to evaluate if they are threatened in Finland. Further collections are clearly needed.

During the study we encountered many problems which need to be solved in order to understand taxonomic relationships within the genus *Tremella*. For instance, the taxonomy of species associated with pyrenomycetes and parasitic in the hymenium of polypores or *Dacrymyces* species needs clarification, and a neotype for *T. foliacea* must be selected. Even though all species in the genus *Tremella* have characteristics in common, it is not clear how closely lichenicolous and other *Tremella* species are related.

In addition, other heterobasidioid genera warrant investigation in Finland.

Acknowledgements

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