Karstenia 49: 19–31, 2009

Two new Lactarius species, L. flavopalustris and L. flavoaspideus, in Fennoscandia

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KYTÖVUORI, I. 2009: Two new Lactarius species, L. flavopalustris and L. flavoaspideus, in Fennoscandia. – Karstenia 49: 19–31. Helsinki. ISSN 0453-3402.

Two new species with violet staining milk and related to *Lactarius aspideus* (Fr. : Fr.) Fr. are described from Fennoscandia: *L. flavopalustris* Kytöv., spec. nova and *L. flavoaspideus* Kytöv., spec. nova. The distribution of each species is mapped, and their taxonomy, ecology and relationships are discussed.

Key words: *Lactarius, Lactarius aspideus*, *Lactarius flavidus,* Fennoscandia, taxonomy

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Introduction

According to Heilmann-Clausen et al. (1998) *Lactarius* section *Uvidi* (Konr.) Bon, subsection *Aspideini* Singer, consists of seven species in Fennoscandia. One of them: *L. flavidus* s. Korhonen, also presented in Korhonen (1984), has long been known in Finland, but still it has been without a valid name. During the study an additional species appeared to be present in the group.

Material and methods

A total of about 310 collections were studied, and 240 were identified to be the species studied here. Most of the author's collections (about 80 specimens) were gathered in Finland, Sweden and Norway during the years 1979-1989 (deposited in H). The collections of *Lactarius aspideus, L. flavidus, L. salicis-herbaceae* and *L. salicis-reticulatae* held in H, TUR, TUR-A and OULU were also included. The acronyms follow those used by Holmgren et al. (1990).

Macroscopic characteristics were observed from fresh fruitbodies and several collections were used for the descriptions. Some collections were also photographed in fresh condition.

Microscopic characteristics were examined with a light microscope (Leitz Laborlux 12) at magnifications of about × 625 and × 1560. Spores were examined from the surface view of pieces of gills of dried basidiomes and measured with an ocular micrometer. Only mature spores in a perpendicularly lateral position were measured. Young, anomalous, very small or gigantic spores were excluded. Mostly 20 spores per specimen (13–50 in few cases) were measured from one fruitbody (12–16 collections per species). The spore surface ornamentation was excluded in the measurements; length and width were measured from the same spore and the length/width ratios (Q-value) were calculated for individual spores. Cystidia were examined and drawn at the same magnification from the same slides (6 collections per species), and measured with an ocular micrometer and from the drawings.

A few collections (*L. flavopalustris* Kytövuori 07-142; *L. flavoaspideus* Kytövuori 90-1641, 2.VIII.1979 Issakainen, Kytövuori 84446; *L. flavidus* Kytövuori 98-2626; *L. aspideus* Kytövuori 89-1166, Kytövuori 90-2049) were sequenced to determine the ITS sequence of each species (for method see Kytövuori et al. 2005a, where it was very successful with *Cortinarius*). However, the procedure was less successful with these *Lactarius* collections and only a partial ITS sequence of *L. flavopalustris* Kytövuori 07-142 was obtained.

The vegetation zones of Fennoscandia are given according to Ahti et al. (1968) and the biological provinces according to Knudsen and Vesterholt (2008). For a survey of the geology of Fennoscandia, see Hultén (1971: 38).

The illustrations are those of the author.

Key to the Fennoscandian species of subsection *Aspideini*

1. Milk staining the bruised areas violet 2
– Milk not staining the bruised areas violet ..... *Lactarius* spp.
2. Cap whitish brownish to greyish to brown ..... *Lactarius* subsect. *Uvidi*
– Cap whitish yellowish to yellow 3
3 Cap margin bearded, robust species 4
– Cap margin ±glabrous, fairly robust to small species 5
4 Cap deep yellow, cap margin broadly strongly bearded with long hairs, with *Picea* or *Betula* (also *B. nana*), hemiboreal to oroarctic ..... *L. repraesentaneus* (not treated)
– Cap whitish yellowish, cap margin narrowly bearded with short hairs, mostly with *Dryas*, oroarctic ..... *L. dryadophilus* (not treated)
5 Mostly with dwarf *Salix*, mostly in oroarctic habitat 6
– With *Salix*, *Betula* or other deciduous trees, mostly in lowland 7
6 Cap pale citrine yellow, gills distinctly cream-coloured, spores not reticulate ..... *L. salicis-reticulatae* (not treated)
– Cap pale ochraceous yellow, gills more whitish, spores with strong, dark reticulum ..... *L. salicis-herbaceae* (not treated)
7 With *Corylus, Quercus, Carpinus, Fagus* etc., taste acrid, temperate to hemiboreal ..... *L. flavidus* (not treated)
– With *Salix* or *Betula*, taste mild to weakly bitterish, temperate to boreal 8
8 With *Betula*, mostly fairly robust, cap fairly deep citrine, strongly slimy, spores with coarse broad ridges, not reticulate ..... ***L. flavopalustris***
– With *Salix*, smaller, cap paler-coloured, at most thinly slimy, spores reticulate or not 9
9 Mostly with *Salix myrsinifolia*, cap pale citrine, thinly slimy, spores with dense, mostly narrow ridges, not reticulate ..... **2. *L. flavoaspideus***
– Mostly with *Salix caprea*, cap whitish to straw-coloured, viscid, spores incompletely reticulate ..... **3. *L. aspideus***

1. *Lactarius flavopalustris* Kytöv. **spec. nova** – Figs. 1, 4–7
MycoBank no.: MB513252

Lactarius flavidus Boud. in Korhonen (1984) p.p.
Lactarius flavidus s. Korhonen in Heilmann-Clausen et al. (1998): 95.

Pileus 4.5–13 cm latus, margine (sub)glabro, citrinus, interdum margine ochraceo, crassiter glutinosus; stipes 3–11 cm longus, 1–2(–2.5) cm crassus, cavus, citrinus, crassiter glutinosus; latex albus, areis contusis violaceis. Sapor mitis, lente leviter amarus. Sporae 7.7–9.3(–10.2) × 6.1–7.3 µm, ellipsoideae ad subglobosae, ornamento amyloideo non reticulato. Pleuromacrocystidia aliquot abundantia, 66–93 × 9–14.5 µm, anguste fusiformia. Cheilomacrocystidia abundantissima, 35–80 × 6–11 µm, anguste fusiformia. In Fennoscandia calciphilus, in silvis uliginosis, cum Betula. Augustio et Septembri.

Holotypus: **Finland**. **Oulun Pohjanmaa** (OP/Obo): Kiiminki, Keskikylä, Pöksälänkangas, S side of the road, opposite to the relay station, mesic spruce forest with some *Betula, Populus tremula* and *Pinus*, on calcareous ground, UTM grid: MN2, Grid 27˚E: 7227:3335, 16 Aug 2007 *M. Toivonen & I. Kytövuori 07-142* (H-6000373, isotype S, Fig. 1). GenBank no.: FJ899595.

Illustrations: Korhonen (1984): 125. Heilmann-Clausen et al. (1998): 95.

Larger and more robust than the other species treated here. *Pileus* 4.5–13 cm, plano-convex when young, later plano-depressed, pale citrine yellow to bright yellow, evenly coloured or somewhat more ochre and darker at the disc, mostly very weakly zonate with obscure concentric rows of ochre watery spots or zigzag pattern, glabrous at the margin even when young to very weakly, shortly hairy, very slimy. *Lamellae* fairly crowded, 55–85 reaching the stipe, 1–4 lamellulae between each, slightly decurrent, whitish to pale pinkish buff when young, later pale violet

buff, straight, seldom forked. *Stipe* 3–11 cm long, 1–2(–2.5) cm thick, mostly unsymmetrical, often thickest at the middle part and slightly tapering to the base and to the top, yellow (concolorous with the pileus), strongly slimy, evenly coloured or weakly scrobiculate with obscure ochre spots, hollow often with a large cavity when old. *Milk* abundant, white, not changing colour in itself, but slowly staining the bruised areas violet (not dark), mild, mostly with weakly bitter aftertaste (Fig. 1).

Spores 7.7–9.3(–10.2) × 6.1–7.3 µm, $\bar{Q}$ = 1.20–1.44 (333 spores, 17 specimens), $\bar{x}$ = 8.0–9.2 × 6.4–6.8, $\bar{Q}$ = 1.25–1.36, broadly oblong ellipsoid to subglobose, with an amyloid, fairly coarse ornamentation of strong ridges, elongated warts and very small warts up to 1 µm high, not forming a reticulum, pale background fairly largely exposed, plage fairly small, mostly inamyloid, weakly amyloid in some spores (Figs. 5 and 6). *Pleuromacrocystidia* abundant, fusoid, large, 66–93 × 9–14.5 µm (119 cystidia, 6 specimens), with greater part embedded in the hymenium, with the widest point near the top level of the basidioles, projecting up to 40 µm above the basidioles, apex mucronate, sometimes moniliform, mostly less acute than in the two following species, contents mostly fairly strongly granulose and/or with globose oil droplets. *Pseudocystidia* scanty, 3–6 µm thick. *Cheilomacrocystidia* very abundant, large, but smaller, more slender and more acutely pointed than the pleuromacrocystidia, 35–80 × 6–11 µm (107 cystidia, 6 specimens, Fig. 7). *Marginal cells* clavate to cylindrical, 10–25 × 4.5–8.5 µ m. *Basidia* 4-spored, clavate, 40–55 × 9.5–12 µm (59 basidia, 6 specimens). *Pileipellis* an ixocutis with a very thick slime layer. *Exsiccates*: pileus straw yellow to pale yellow ochre, with yellow brown to brown disc, stipe pale yellow ochre, sometimes more brownish at the base, the clear slime layer of the stipitipellis 50–80 µm thick.

Ecology and distribution: *Lactarius flavopalustris* is an exacting species most often growing in eutrophic damp grass-herb mixed forests dominated by *Picea abies*, along margins of eutrophic spruce-hardwood swamps and with trees and bushes in such swamps. It is not dependent on *Salix* species. Maybe the main associate is *Betula* but *Salix* species are often present, too. It is completely missing from man made habitats. The distribution of *Lactarius flavopalustris* is typically boreal, even though the southernmost occurrences are known in the hemiboreal zone and one collection is known from above the tree line in the fjeld (Fig. 4). The optimum is distinctly in the middle and northern boreal zones. The species is rare in most of its distribution area. In some eutrophic and lime-rich areas, e.g. in the Kuusamo, and Tornio – Rovaniemi areas in North Finland, and in Jämtland and parts of Lappland in Sweden, it can be locally more common.

Discussion: Usually *Lactarius flavopalustris* is very easily distinghuished from the other two species treated here, by its larger and brighter yellow basidiomes and different habitat. It can resemble *L. repraesentaneus* and the yellow species of the section *Scrobiculati*. From the former it differs by the smaller size and glabrous cap margin, from the latter by the mild milk, staining the bruised areas violet contrary to the hot and yellow-turning milk of those. Exsiccates are best distinguished by the abundant, large cheilomacrocystidia – in the *Scrobiculati* group cheilomacrocystidia are practically absent. Korhonen (1984) reports the spores of *L. flavidus* s. Korhonen to be distinctly larger, this is because his material is a mixture including *L. flavoaspideus*.

Lactarius flavidus Boud., too, have large fruitbodies but those are paler in colour, less slimy, have an acrid taste and the staining is very strong. That species grows in temperate to hemiboreal deciduous forests on mull soil and is completely lacking in the boreal zone.

Because no name has been allocated to the present, conspicuous, northern species, the new name, *Lactarius flavopalustris*, is applied here. The epithet refers to the yellow colour and the most typical habitat of the species.

Specimens examined: **NORWAY. Hedmark**: Tolga-Os, Os, 2.IX.1986 *Kytövuori* (H). **Sogn og Fjordane**: Luster, Fortun, 8.IX.2000 *Niskanen & Kytövuori* (H). **Møre og Romsdal**: Stordal, Storlihornet, 20.VIII.2005 *Larsen 63-05 & al.* (TUR-A). **Troms**: Nordreisa, Javroaive, 2.IX.1954 *Stordal 9753* (O). Storfjord, Skibotndalen, 19.VIII.2004 *Vauras 21739* (TUR). – **SWEDEN. Dalsland**: Tisselskog, Råvarpen, 14.IX.1990 *Vesterholt* (H). **Uppland**: Gustavsberg, Aug. 1889 *Kugelberg* (S). Österåker, Hjällmsättra, 13.IX.1984 *Kytövuori 84492* (H). **Dalarna**: Boda, Kärvsåsen, 18.IX.1983 *Kytövuori* (H); Styggforsen, 22.VIII.1979 *Kytövuori 79551 (*H). **Härjedalen**, Storsjö, Ljungdalen, 17.VIII.2006 *Toivonen & Kytövuori 06-147* (H). **Ångermanland**: Häggdånger, 26.VIII. 1997 *Broström* (H). **Jämtland**: Bodsjö, Stuguberget, 4.IX.1997 *Kytövuori* (H). Frostviken, Gädd-

Fig. 1. *Lactarius flavopalustris* (Finland, Etelä-Pohjanmaa, Laihia, *Kytövuori 85650,* H). Photo I. Kytövuori.

ede, 18.VIII.1981 *Kytövuori 81609* (H); Björkvattnet, 24.VIII.1980 *P. & I. Kytövuori 80467* (H). Undersåker, Getryggen, 21.VIII.2006 *Toivonen & Kytövuori 06-385* (H). **Åsele Lappmark**: Dorotea, Harrsjöhöjden, 9.VIII.1985 *Kytövuori 85189* (H). **Lycksele Lappmark**: Stensele, Umnäs, 21.VIII.1980 *P. & I. Kytövuori 80362* (H). **Lule Lappmark**: Jokkmokk, Kvikkjokk, 2. 17.VIII.1980 *P. & I. Kytövuori 80249* (H). – **FINLAND. Ahvenanmaa**: Eckerö, Skag, 17.IX.1978 *Ulvinen* (OULU). Lemland, Nåtö, 18.VIII.1974 *Hæggström* (H). **Varsinais-Suomi**: Karkkila, Haavisto, 7.VIII.2002 *Vauras 19062* (TUR). Västanfjärd, Illo, 13.IX.1981 *P. & I. Kytövuori 811382* (H). **Uusimaa**: Hyvinkää, Kalkkivuori, 8.IX.1979 *Kytövuori 79717* (H). **Satakunta**: Kullaa, Järventausta, 27.VIII.2007 *Kosonen* (TUR). **Etelä-Häme**: Heinola, Mataraniemi, 19.VIII.1991 *Kytövuori* (H), 22.VIII.1993 *Kytövuori 93-395* (H). Hämeenkoski, Laaviosuo, 31.VIII.1972 *Tuomikoski* (H). Lammi, Biological station, 8.IX.1977 *Korhonen 2017* (H), 23.VIII.1977 *Harmaja* (H), 25.VIII.1977 *Harmaja* (H). Somero, Palikainen, 27.VIII.2000 *Heinonen* (TUR). **Etelä-Pohjanmaa**: Laihia, Vanha-Kaija, 2.IX.1985 *Kytövuori 85650* (H). **Pohjois-Savo**: Vehmersalmi, Puutosmäki. 19.IX.1991 *Hakala* (H). **Pohjois-Karjala**: Juankoski, Ala-Siikajärvi, 28.VIII.1985 *Kytövuori 85486* (H). Kaavi, Niinivaara, 29.VIII.1985 *Kytövuori 85521* (H). Nilsiä, Loutteinen, 1997 *Ruotsalainen 4070* (H). **Keski-Pohjanmaa**: Alajärvi, Ukonmäki, 4.IX.1990 *Kytövuori 90-1185* (H). Haapajärvi, Uusimaa, 14.IX.1992 *Kytövuori 92-2319* (H). **Kainuu**: Kajaani, Hatulanmäki, 23.VIII.1970 *Harmaja* (H). Paltamo, Mieslahti, 1.IX.1980 *Kytövuori 80608* (H); Tololanmäki, 8.IX.1987 *Leinonen* (OULU), 25.VIII.1988 *Kytövuori 88-822* (H); Oikarila, 10.IX.1983 *Kytövuori 83300* (H). Sotkamo, Jormaskylä, 9.IX.2001 *Ohenoja* (OULU); Kontinjoki, 31.VIII.1980 *Kytövuori 80570* (H), 30.VIII.1981 *Kytövuori 81915* (H), 9.IX.1985 Kytövuori *85985* (H), 25.VIII.1988 Kytövuori *88-804* (H), 25.VIII.2000 *Ohenoja* (OULU). **Oulun Pohjanmaa**: Kiiminki, Isohalmeenmaa, 12.IX.1970 Ohenoja (OULU), 12.IX.1971 *Ulvinen* (OULU); Hannus, 5.IX.1996 *Rahko* (OULU), Jolosmäki, 12.IX.1970 *Ulvinen* (OULU); Jolosjoki, 2.IX.1974 Ulvinen (OULU); Juuvanjärvi, 17.VIII.2007 *Toivonen & Kytövuori 07-203* (H); Juuvankangas, 21.VIII.1990 *M. Ohenoja* (OULU); Pyssyvaara, 24.VIII.1976 *M. Ohenoja* (OULU); Pöksälänkangas, 16.VIII.2007 *Toivonen & Kytövuori 07-142* (H). Pudasjärvi, Korpinen, 23.VIII.1984 *Ulvinen* (OULU); Kouva, 16.VIII.1972 *Ulvinen* (OULU). **Perä-Pohjanmaa**: Keminmaa, Tornivaara, 20.VIII.2007 *Kytövuori 07-380* (H). Rovaniemi, Taipale, 2.IX.1981 *Kytövuori 811007* (H), 7.IX.1988 *Kytövuori 88-1480* (H); Jaatila, 15.VIII.1974 *Kytövuori 4899* (H), 11.VIII.1999 *Vauras 15081* (TUR-A), *15085F* (TUR-A). Tervola, Kirvesmaa, 24.VIII.2007 *Kytövuori 07-702* (H); Pahtaoja, 16.IX.1986 *Ohenoja & Vuorinen* (OULU); Pukinselkä, 21.VIII.2007 *Kytövuori 07-548* (H). Tornio, Kalkkimaa, 1.IX.1981 *Kytövuori 81978* (H). Ylitornio, Kaitajärvi, 9.IX.1997 *Kytövuori 97-1020* (H), 9.IX.1997 *Kytövuori* (H). **Koillismaa**: Kuusamo, Juuma, 31.VIII.2005 *Ruotsalainen & Vauras 23334* (TUR-A), 22.VIII.1997 *Ruotsalainen 4422* (H);

Fig. 2. *Lactarius flavoaspideus* (holotype, H). Photo I. Kytövuori.

Fig. 3. *Lactarius aspideus* (Finland, Uusimaa, Kirkkonummi, *Kytövuori 84484,* H). Photo I. Kytövuori.

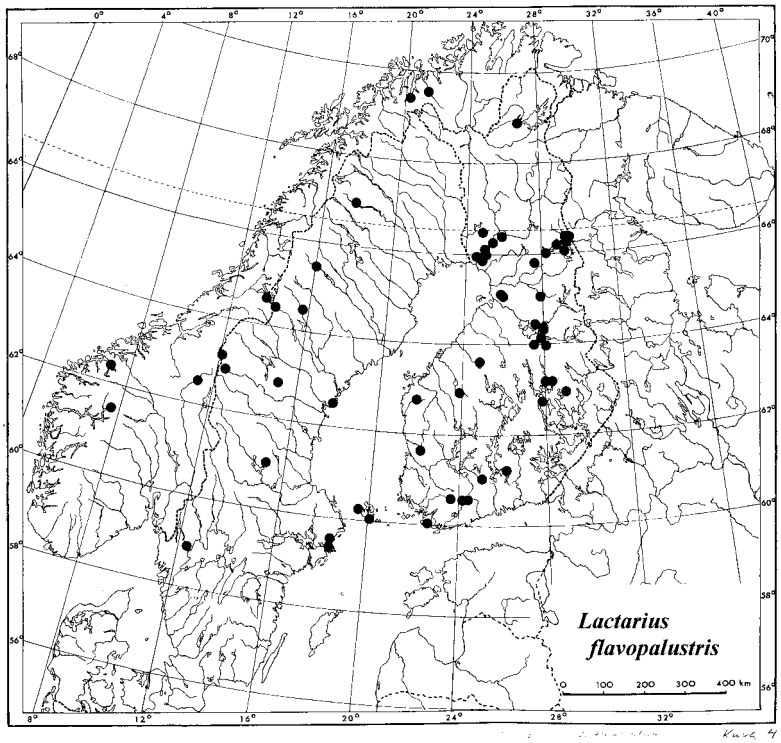

Fig. 4. Distribution of *Lactarius flavopalustris* in Fennoscandia according to the material examined.

Nissinjärvi, 17.VIII.1973 *Kytövuori* (H); Kouvervaara, 23.VIII.1997 *Ruotsalainen 4433* (H); Hautala, 4.IX.1981 *Kytövuori 811168* (H); Oulanka National Park, Ampumavaara, 24.VIII.1974 *Ulvinen* (OULU), 22.VIII.1978 *Pohjola & Alanko* (OULU), 3.IX.1981 *Kytövuori 811104* (H), 11.IX.1981 *Ulvinen* (OULU), 30.VIII.2007 *Campo & Vauras 25085F* (TUR-A); Liikasenvaara, 23.VIII.1971 *Harmaja* (H), 4.IX.1981 *Kytövuori 811152* (H); Korvasvaara, 25.8.1979 *Alanko* (OULU), 8.VIII.1978 Issakainen (H), 29.VIII.1981 *Korhonen 4098* (H), 10.IX.1981 *Ulvinen* (OULU), 19.VIII.1983 *Seppänen & al. 65* (H), 12.VIII.1985 *Ruotsalainen & Vauras 1940F* (KUO), 29.VIII.2007 *Kytövuori 97-1003* (H). Posio, Livojärvi, 5.VIII.1979 *Ulvinen* (OULU). **Inarin Lappi**: Inari, Otsamo, 3.IX.1988 *Kytövuori 88-1292* (H).

2. *Lactarius flavoaspideus* Kytöv. **spec. nova** – Figs. 2, 5–7, 8
MycoBank no.: MB513253.

Pileus 2–5(–7.5) cm latus, margine subglabro, pallide citrinus, margine non fuscato, leviter glutinosus; stipes 1.5–5 cm longus, 0.4–1.1 cm crassus, pallide citrinus, leviter glutinosus; latex albus, areis contusis violaceis. Sapor mitis, lente leviter amarus. Sporae 8.4–10.2 × 6.3–7.9 µm, late ellipsoideae, ornamento amyloideo non reticulato. Pleuromacrocystidia aliquot abundantia, 45–90 × 7.5–11(–12.5) µm, anguste fusiformia. Cheilomacrocystidia abundantissima, 30–73 × 7–10 µm, anguste fusiformia. In Fennoscandia infrequens, in dumetis uliginosis, cum apprime Salice myrsinifolia. Augustio et Septembri.

Holotypus: **Finland**. **Etelä-Häme**: Luopioinen, Kuohijoki, SW of Kipparinlahti, between the small road to Niittylä and Kytöniitty, a thicket of *Alnus incana* and *Salix myrsinifolia* (no *S. caprea*), on soil. UTM grid: LJ2. Grid 27˚E: 6801:3381. 9.IX.1984 I. *Kytövuori 84446* (H, Fig 2).

Pileus 2–5(–7.5) cm, convex-depressed when young, soon plano-depressed, pale citrine, paler than in *L. flavopalustris* but distinctly brighter yellow than in *L. aspideus*, not darker at the disk, very weakly zonate with obscure watery zones, margin very weakly densely hairy when very young, soon glabrous; thinly slimy. *Lamellae* moderately close, 30–50 reaching the stipe, 2–7 lamellulae between each, adnate to weakly decurrent, white to very pale pinkish buff, straight, mostly not forked. *Stipe* 1.5–5 cm long, 0.4–1.1 cm thick, of even thickness or weakly clavate,

mostly unsymmetrical, pale citrine as the pileus, not spotted, more whitish at the top, thinly slimy. Milk white, not itself changing colour, but slowly staining the bruised areas violet (not dark), mild with a slightly bitterish aftertaste or not (Fig. 2). *Spores* 8.4–10.2 × 6.3–7.9 µm, $\overline{Q}$ = 1.21–1.40 (363 spores, 16 specimens), $\overline{x}$ = 8.8–9.7 × 6.8–7.4 µm, $\overline{Q}$= 1.25–1.35, broadly oblong ellipsoid, fairly strongly ornamented by strongly amyloid, broken, curved, nodulose ridges, elongated to very small warts and very thin line bits, not forming a reticulum (ornamentation denser than in *L. flavopalustris*), up to 1 µm high, plage fairly small, inamyloid or sometimes weakly amyloid (Figs. 5 and 6). *Pleuromacrocystidia* large, narrowly fusoid, slightly narrower than in *L. flavopalustris*, 45–90 × 7.5–11(–12.5) µm (229 cystidia, 12 specimens), with greater part embedded in the hymenium, with the widest point near the top level of the basidioles, projecting up to 35 µm, with contents weakly, obscurely granulose and/or with globose oil droplets. *Pseudocystidia* 3–6 µm thick, fairly scanty. *Cheilomacrocystidia* very abundant, large, but somewhat smaller than the pleuromacrocystidia, 30–73(–82) × 7–10 µm (217 cystidia, 12 specimens), very acutely pointed with long, narrow, often moniliform apex (Fig. 7). *Marginal cells* clavate to cylindrical, 10–25 × 5–7 µm. *Basidia* 4-spored, clavate, 42–60 × 9–12 µm (52 basidia, 10 specimens). *Pileipellis* an ixocutis. *Exsiccates*: pileus yellow ochre, the disc not darker or brown, stipe paler than the pileus or brownish at the base, the clear slime layer of the stipitipellis mostly 20 – 50 µm thick.

Ecology and distribution: The species grows in mixed hardwood thickets associated with different *Salix* species. Mostly the habitats are somewhat damp and half of the known collections are from alluvial thickets along rivers or lakes. One collection is from the foot of a low hummock under a small *Salix phylicifolia* in a fairly open, oroboreal valley bottom. Some collections are from southern *Salix* thickets mixed with *Alnus incana* and *Betula*. Except the oroboreal habitat, the dominating *Salix* species has been *S. myrsinifolia*. Altogether the species seems to grow in more natural habitats than *L. aspideus*. As to the nutrient conditions *L. flavoaspideus* seems to be somewhat, but not strongly exacting. The range of *Lactarius flavoaspideus* reaches from the northern part of the hemiboreal zone to the upper oroboreal zone (Fig. 8). The species seems to be fairly rare at least in the southern part of its range. Maybe it can be commoner in the north and in the upper levels when considered that the fungus collections from there are scanty on the whole.

Discussion: Systematically *Lactarius flavoaspideus* is situated between the species *L. aspideus* and *L. flavopalustris*. It resembles the former in the size and external appearance, but differs by its brighter yellowish colour, more slimy fruitbodies, larger and more elongated spores and different spore ornamentation. Differences were best revealed when analysing mixed collections from Lohja in South Finland (H. Harmaja during three years) and Juankoski in Central Finland (Kytövuori during two years). Also the ecology is mostly somewhat different. From *L. flavopalustris* it differs by its smaller size, mostly paler colour, somewhat larger and differently ornamented spores and different ecology. The basidiomes are smaller than in both the other two.

In the north and in fjeld areas *Lactarius flavoaspideus* can be confused with the arctic alpine yellow species *L. salicis-reticulatae* and *L. salicis-herbaceae*. Especially the former may be similar with its citrine colour, but the gills are cream and more distant and the spores larger. The latter has more brownish yellow colours and larger, reticulate spores.

In North America the stirps *Aspideus* is small, only three species are presented by Hesler and A.H. Smith (1979). Two of them are very different from *Lactarius flavospideus*, but the third, *L. aspideoides* Burlingham, is more like that. However, the gills “pale yellow (about concolorous with the pileus in age)” (Hesler & Smith 1979) points to a very pale cap colour or very deeply coloured gills, both in distinct contradiction with my material. Also the spores seem to be smaller and fruitbodies larger than in my material (type not seen).Thus a new name, *L. flavoaspideus* is selected for the species described here. The epithet refers to the yellow colour and similarity to the well-known species *L. aspideus*.

Specimens examined: **NORVAY. Nordland**: Rana, NE of Mo i Rana, alluvial *Salix myrsinifolia* thicket, 13.VIII.1985 *Kytövuori 85302* (H). **Troms**: Lyngen, Furuflaten, mesic–rass-herb *Betula*, *Alnus incana*, *Salix* forest, gently pastured by sheep, 18.VIII.1990 *Kytövuori 90-400* (H). Kåfjord, Kåfjorddalen, 18.VIII.1992 *Printz* (H). Storfjord, Lulleslettan, *Alnus incana*-dominated

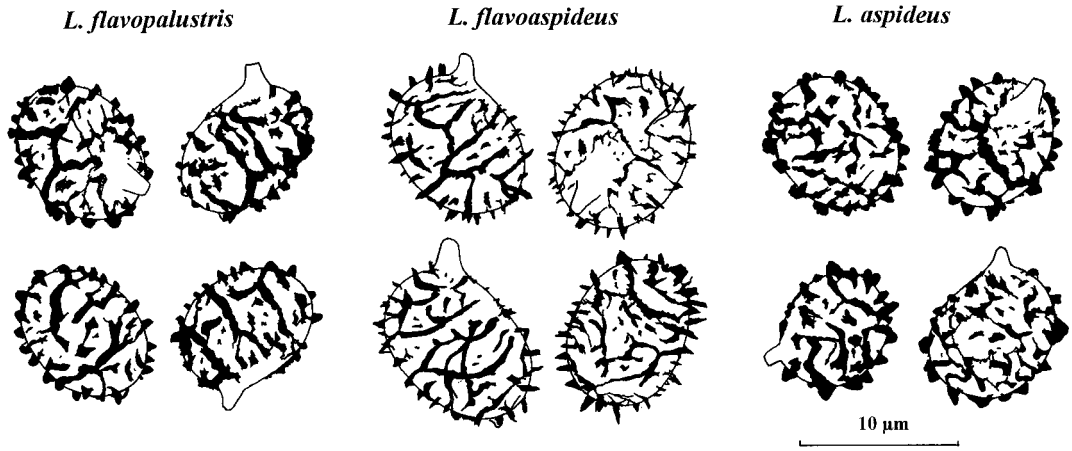

Fig. 5. Spores of *Lactarius flavopalustris* (holotype, H), *L. flavoaspideus* (holotype, H) and *L. aspideus* (Finland, Uusimaa, Porvoo, *Kytövuori 89-1166*, H). Scale × 2000.

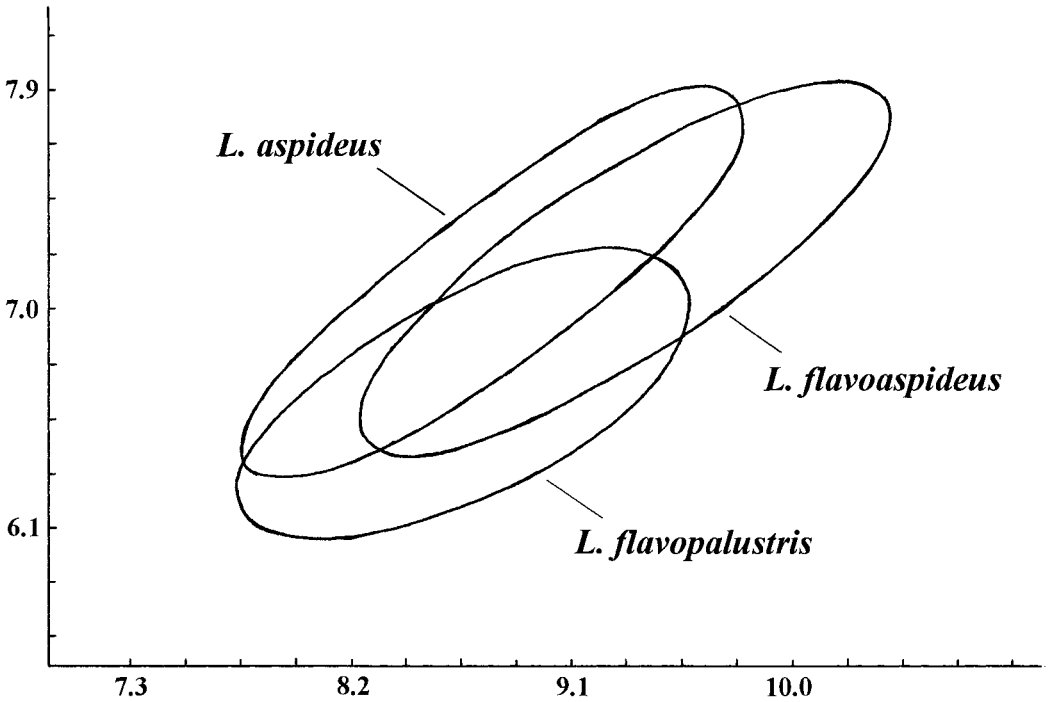

Fig. 6. Diagram showing the spore size of *Lactarius flavopalustris*, *L. flavoaspideus* and *L. aspideus*. The lines are drawn on the basis of scatter diagrams, and represent 95% of the spores measured for each species. X axis: length of spores. Y axis: width of spores.

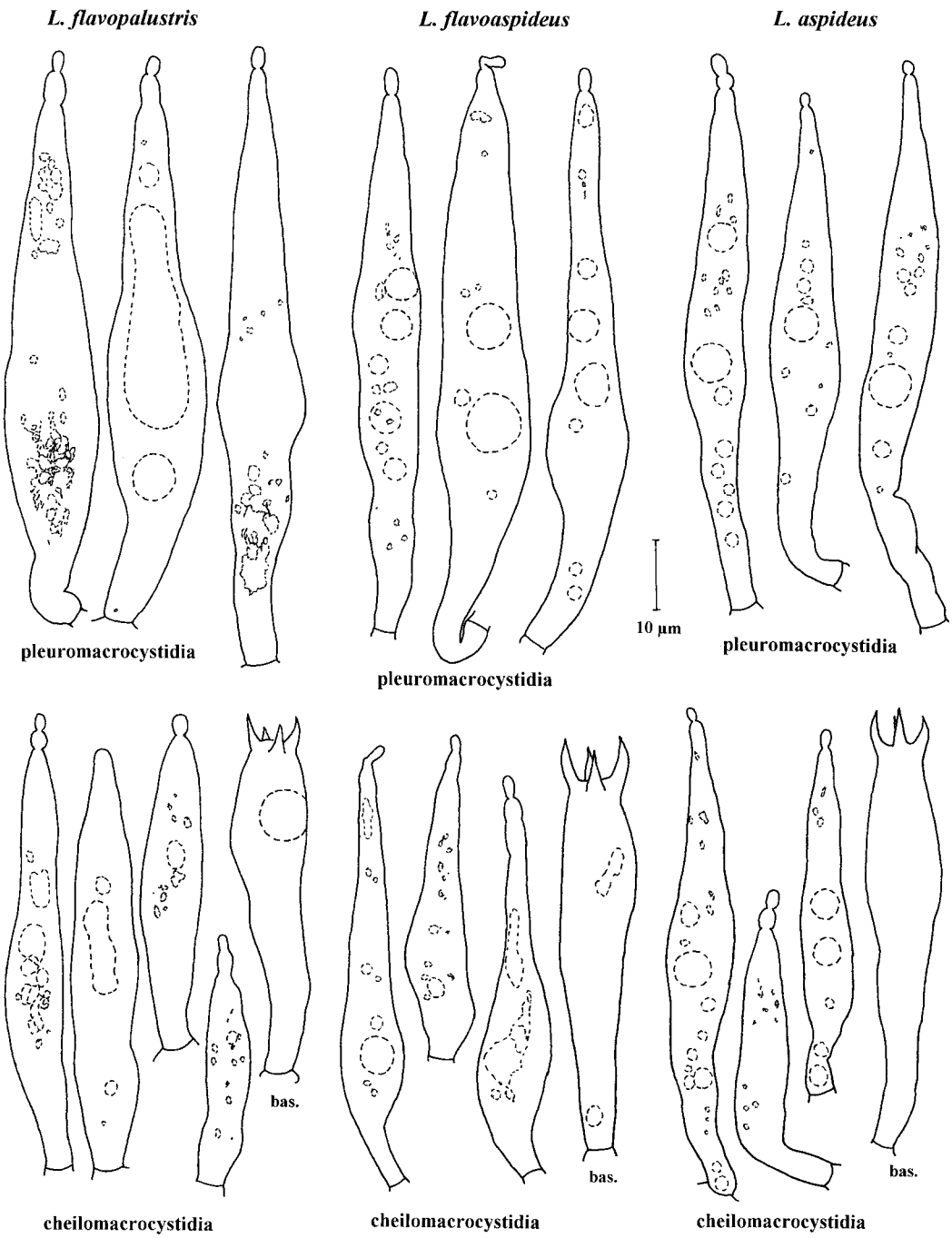

Fig. 7. Pleuromacrocystidia, cheilomacrocystidia and basidia of *Lactarius flavopalustris* (holotype), *L. flavoaspideus* (holotype) and *L. aspideus* (Finland, Uusimaa, Porvoo, *Kytövuori 89-1166*, H). Scale × 1000.

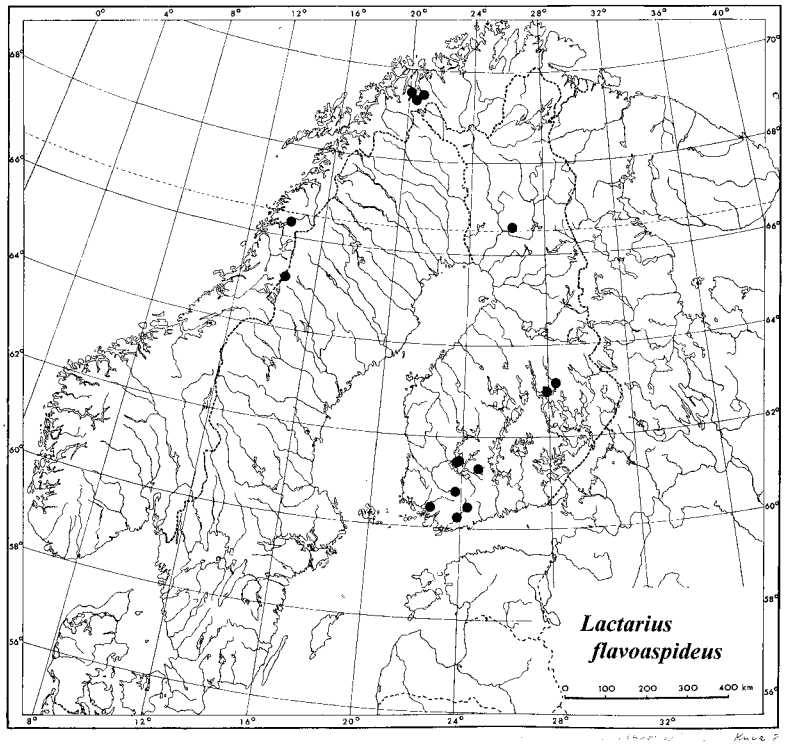

Fig. 8. Distribution of *Lactarius flavoaspideus* in Fennoscandia according to the material examined.

mixed forest, under *Salix caprea*, 19.VIII.1992 *Kaukonen* (H, OULU), *Sivertsen* (H, TRH). – **SWEDEN. Åsele Lappmark**: Vilhelmina, Stekenjåkk, near the birch line, open, partly paludified *Salix* thicket, 725 m, 11.VIII.1985 *Kytövuori 85218* (H). – **FINLAND. Varsinais-Suomi**: Karjaa, Lövkullaudden, alluvial lakeside thicket dominated by *Salix myrsinifolia* and *Alnus glutinosa*, 25.IX.1990 *Kytövuori 90-2037* (H). Lohja, Jalassaari, lakeside thicket, *Salix caprea*, *S. myrsinifolia*, 14.IX.1963 *Toppari* (H), 16.VIII.1965 *Harmaja* (H), 3.IX.1965 *Harmaja* (H), 10.IX.1967 *Harmaja* (H), 5.X.1967 Harmaja (H), 20.VIII.1987 H. & T. Harmaja (H). Paimio, Juntola, 18.IX.1962 *Kukkonen* (TUR). Vihti, Katinhäntä, 2.VIII.1979 *Issakainen* (H). **Etelä-Häme**: Luopioinen, Kuohijoki, a thicket of *Alnus incana* and *Salix myrsinifolia* (no *S. caprea*), on soil, 9.IX.1984 *Kytövuori 84446* (H). Tammela, Mustiala, sub Salice, 8.IX.1874 *Karsten* (H). Tampere, Messukylä, *Salix* thicket, 3.IX.1977 *Söderholm 277* (H); Peltolammi, lakeside thicket, *Salix, Alnus glutinosa, Betula*, 20.VIII.1984 *Söderholm 1109* (OULU). **Pohjois-Savo**: Siilinjärvi, Juurusvesi, 14.VIII.2002 *Vauras 19165* (TUR-A). **Pohjois-Karjala**: Juankoski, Ala-Siikajärvi, *Salix myrsinifolia* thicket with some *S. caprea*, with *Lactarius aspideus*, 28.VIII.1985 *Kytövuori* (H), 30.VIII.1987 *Kytövuori 87-866* (H). **Perä-Pohjanmaa**: Rovaniemi, Vikajärvi, 24.VIII.2007 *Vauras 24977* (TUR-A).

3. *Lactarius aspideus* (Fr. : Fr.) Fr. – Figs. 3, 5–7, 9

Lactarius aspideus (Fr. : Fr.) Fr., Epicr. Syst. Mycol.: 336. 1838. – *Agaricus aspideus* Fr. : Fr., Syst. Mycol. I: 63. 1821. – Type: not typified.
Illustrations: Korhonen (1984): 124, Ryman & Holmåsen (1984, 1987): 559, Heilmann-Clausen et al. (1998): 97, Salo et al. (2006): 35.

Pileus 2–8(–10) cm, convex-depressed when young, later plano-depressed, at the margin weakly velutinate when very young, soon glabrous; whitish alutaceous to pale brownish yellowish, mostly evenly coloured, sometimes a bit more brownish at the disc and/or weakly watery zonate at the margin, viscid (to thinly slimy), fairly soon almost dry. *Lamellae* somewhat distant, 35–46 reaching the stipe, 1–6 lamellulae between each, straight, usually not forked, 3–7 mm high, adnate to weakly decurrent, whitish to pale buff. Stipe 2–7 cm long, 0.6–1.3(–1.8) cm thick, of even thickness to weakly clavate, mostly unsymmetrical, solid to hollow with a

narrow cavity, pale yellowish buff, evenly coloured or brownish at the base, viscid, soon almost dry. *Milk* white or very pale yellowish, not itself changing colour, but staining the bruised areas (dark) violet, mild with a slightly bitterish aftertaste or not (Fig. 3). *Spores* 7.9–9.5 × 6.3–7.9 µm, $\overline{Q}$ = 1.17 – 1.30 (300 spores, 15 specimens), $\overline{x}$ = 8.2–9.1 × 6.6–7.3 µm, $\overline{Q}$ = 1.20–1.25, (broadly ellipsoid to) subglobose, strongly ornamented by heavily amyloid, nodulose, curved ridges, elongated warts and very thin connections, forming an incomplete reticulum, up to 1 µm high, plage small, inamyloid or sometimes weakly amyloid (Figs. 5 and 6). *Pleuromacrocystidia* fairly scanty, large, narrowly fusoid, slightly narrower than in *L. flavopalustris*, 54–90 × 8–11(–12) µm (90 cystidia, 6 specimens), with the greater part embedded in the hymenium, with the widest point near the top level of the basidioles, projecting up to 35 µm, with contents clear to very weakly, obscurely granulose and/or with globose oil droplets. *Pseudocystidia* fairly abundant, 3–5.5 µm thick. *Cheilomacrocystidia* abundant, large, but somewhat smaller than the pleuromacrocystidia, 33–73 × 7–10 µm (92 cystidia, 6 specimens), very acutely pointed with long, narrow, often moniliform apex (Fig. 7). *Marginal cells* clavate to cylindrical, 12–25 × 4.5–6.5 µm. *Basidia* 4-spored, clavate, 45–63 × 10–12 µm (79 basidia, 6 specimens). *Pileipellis* an ixocutis. *Exsiccata*: pileus alutaceous to pale brownish, sometimes more brown at the disc, yellowish shades mostly disappeared, stipe of the pileus colour or more brown, the clear slime layer of the stipitipellis at most 20 µm thick.

Ecology and distribution: *Lactarius aspideus* is typically a species of man-made hardwood thickets round fields and gardens and along roads and in parks and abandoned house sites, mostly on bare mull soil. The main mycorrhiza partner is *Salix caprea*, but it can grow with some other *Salix* species, too, e.g. *S. myrsinifolia* or *S. cinerea*. Sometimes it grows among grasses (*Poaceae*) and at least two collections are from an uncut hayfield several metres from a *Salix caprea* bush. It is fairly common in South Finland, but towards the north it is distinctly rarer (Fig. 9). It is also reported from Ahvenanmaa, Etelä-Karjala

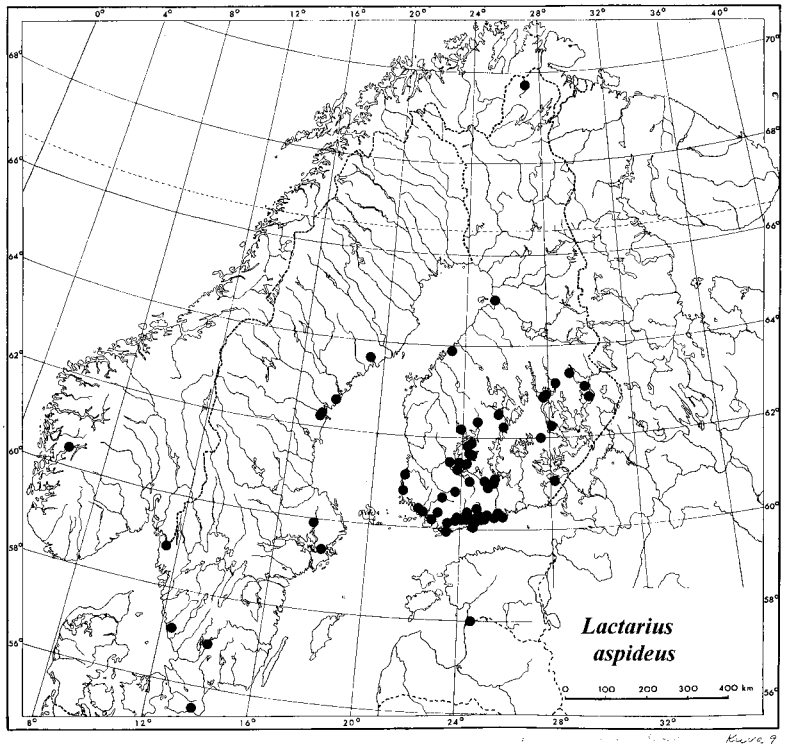

Fig. 9. Distribution of *Lactarius aspideus* in Fennoscandia according to the material examined.

and Koillismaa, in the latter at least five collections, in Kytövuori et al. (2005b), but any correctly determinated *L. aspideus* specimens have not been found. The season of *Lactarius aspideus* is exceptionally long, in South Finland it reaches from the early June to early November.

Discussion: When the two first species above are separated from *Lactarius aspideus*, the rest seems to be still somewhat heterogeneous. The size of fruitbodies and the size of spores are very variable. Also the colour of the fruitbody varies from very pale to brownish, especially in dried fruitbodies. I have been compelled to exclude some specimens from the present concept of the species.

Specimens examined: **GREAT BRITAIN**. **Scotland**: Tays region, Stormont Loch, 12.IX.1991 *P. & I. Kytövuori* (H). – **NORWAY**. **Hordaland**: Kvam, Ytre Ålvik, 27.VIII.1977 *Kytövuori 8153* (H). – **SWEDEN**. **Skåne**: Högestad, Lyckås, 20.IX.1984 Kytövuori 84687 (H). **Småland**: Dörarp, 17.IX.1985 *Kytövuori 851165* (H). **Halland**: Rolfstorp, Stenaljung, 18.IX.1988 *Kytövuori 88-1777* (H). **Bohuslän**: Naverstad, Tingvall, 17.IX.1988 Kytövuori 88-1737 (H). **Uppland**: Lövö, Drottningholm, 14.IX.1924 *Romell* (S). Uppsala, Stadskogen, 6.IX.1994 *Kytövuori 94-151* (H). **Medelpad**: Attmar, Sörfors, 5.X.1982 *Tedebrand* (Muskos 1239). Tuna, Målta, 22.IX.1982 *Muskos 1122*. **Ångermanland**: Härnösand, Gerestastigen, 29.VIII.1997 *Kyvövuori 97-381* (H). Nordmaling, Djupsjönäs, 28.8.1986 *Kytövuori* (H). – **FINLAND**. **Varsinais-Suomi**: Halikko, Vuorentaka, 11.IX.1988 *Kytövuori 88-1621* (H), 10.X.2006 *Vauras 24534* (TUR-A). Kaarina, Ala-Lemu, 28.IX.1982 *Liponkoski* (TUR); Kuusisto, 4.X.1989 *Huhtinen 89/80* (TUR), *Vauras 4181* (TUR-A). Karjaa, Lövkullaudden, 25.IX.1990 *Kytövuori 90-1972* (H), *90-2048* (H), *90-2049* (H); Mustio, 27.IX.1987 *P. & I. Kytövuori 871731* (H). Kemiö, church village, 10.IX.1966 *Siltanen* (TUR). Koski Tl, Vähä-Sorvasto, 14.VII.1990 *Heinonen 36-90* (TUR), 5.VIII.1992 *Vauras 6724F* (TUR-A), 29.IX.1996 *M.-L. & P. Heinonen 449-96F* (TUR). Lohja, Jalassaari, 14.IX.1963 *Toppari* (H), 2.IX.1965 *Harmaja* (H), 3.IX.1965 *Harmaja* (H), 10.IX.1967 *Harmaja* (H); Torhola, 29.VIII.1993 *Kytövuori 93-592* (H). Parainen, Kirjala, 10.9.2000 *M.-L. & P. Heinonen 449-96F* (TUR). Pohja, Pohjankuru, 30.VIII.1990 *Kytövuori 90-903* (H). Uusikaupunki, Sundholma, 14.IX.1957 *Laine & Kallio* (TUR). Tammisaari, Forstinstitut, 11.IX.1975 *Issakainen* (TUR). Turku, Ruissalo, 12.IX.1956 *Kallio* (TUR), Suominen (H). 28.VIII.1957 *Kallio* (TUR), 3.VIII.1957 *Kallio* (TUR), 19.IX.1962 *Kallio* (TUR), 23.IX.1964 *Kankainen* (TUR), 17.VIII.2000 *Vauras 16604F* (TUR-A). Vihti, Salmenkartano, 12.X.1989 *Kytövuori 89-1484* (H). **Uusimaa**: Espoo, Kasberg, 22.IX.1948 *Tuomikoski* (H), 25.IX.1948 *Tuomikoski* (H); Pirttimäki, 25.VIII.1990 *Kytövuori 90-625* (H); Tapiola, Louhentie, 11.X.1963 *Toppari* (H). Grankulla, 30.IX.1938 *Nyberg* (H). Helsinki, Annala, 22.VIII.1981 *Saarenoksa* 41381 (H), 29.IX.1985 *Saarenoksa 49985* (H); Kulosaari, 13.7.1981 *Saarenoksa 16181* (H); Kumpula, 2.X.1979 *Korhonen 3005 & Saarenoksa 68179* (H), 13.VI.1983 *Korhonen 5206* (H); Kumpula–Toukola, 10.VII.1977 *Korhonen 1682 & Saarenoksa 04277* (H), 12.VIII.1977 *Korhonen 1774* (H), 6.VII.1979 *Saarenoksa* (OULU), 17.VIII.1981 *Korhonen 4034 & Saarenoksa 40081* (H), 6.VI.1983 *Saarenoksa 05983* (H); Maunula, 26.VIII.2000 *Kytövuori* (H); Myllypuro–Puotinharju, 23.VIII.1977 *Saarenoksa 18377* (H); Puotinharju, 5.IX.1985 *Saarenoksa* (H); Toukola, 8.IX.1992 *Saarenoksa 24092* (TUR-A); Vuosaari, 24.VIII.1985 *Kytövuori 85411* (H), 31.VIII.1979 *Kytövuori 79691* (H), 11.IX.1966 *Ahti* (H); Västersundom, 3.IX.1953 *Tuomikoski* (H); Wiik, 19.IX.1985 *Saarenoksa 44885* (H), 20.VIII.1986, *Saarenoksa 18486, 40786* (H), 17.IX.1987 *Saarenoksa 29787* (TUR), 17.IX.1989 *Saarenoksa 23489* (H). Kirkkonummi, Evitskog, 17.IX.1981 *Korhonen 4243* (H), 25.VIII.1979 *Saarenoksa 42079* (H); Jorvas, Danskarby, 4.X.1979 *Kytövuori 791007* (H), 11.IX.1985 *Kytövuori 851017* (H), 5.X.1979 *Kytövuori 791012* (H), 10.IX.1984 *Kytövuori 84484* (H); Vols, Kytövuori *90-2351* (H); Väransby, 27.IX.1976 *P. Kytövuori & S.-L. Louhe (*H), 26.IX.1993 *Kytövuori 93-1522* (H). Nurmijärvi, 11.IX.1978 *Askola 707* (H), 26.IX.1979 *Askola 830* (H), 12.IX.1982 *Askola 1102* (H). Porvoo, Bjurböle, 27.VIII.2000 *Nummela-Salo & Salo 7147* (H); Stensböle, 5.VIII.2000 *Kytövuori* (H); Tirmo, 21.IX.1989 *Kytövuori 1166* (H), *18-1324* (H), Sipoo, Hindsby, 5.X.1975 *Saarenoksa 12375* (H), 1.IX.1979 *Saarenoksa 47179* (H), 1.VII.1981 *Korhonen 3814 & Saarenoksa 12381* (H), 12.IX.1981 *Korhonen 4228 & Saarenoksa 55081* (H); Hindsby–Östersundom, 7.IX.1987 *Kytövuori 871221* (H); Löparö, 25.IX.1989 *Kytövuori 89-1301* (H); Myras–Hindsby, 28.VII.1988 *Saarenoksa 04088* (H). Siuntio, Kvarnby, 1.X.1992 *Kytövuori 92-2831* (H). Vantaa, Petikko, 17.IX.2000 *Nummela-Salo & Salo 7332* (H); Silvola, 6.IX.1993 *Kytövuori 93-719* (H), *93-733* (H); Sotunki, 9.IX.2000 *Nummela-Salo & Salo 7240* (H). **Satakunta**: Rauma, Tikkala, 23.IX.1980 *Nikkilä* (TUR); Hanhinen, 10.IX.1993 *Ateva 92* (TUR), 10.X.2004 *Ateva 611* (TUR). **Etelä-Häme**: Hollola, Messilä, 28.IX.1985 *Haikonen 6521* (H); Noitala, 7.IX.1984 *Haikonen 4908* (H). Hämeenlinna, Kankaantausta, 4.IX.1992 *Lahti 14/92* (H). Juupajoki, Hyytiälä, 6.IX.2005 *J. Korhonen* (TUR); Lyly, 19.VII.1984 *Kytövuori 84049* (H). Kangasala, Heponiemi, 2.IX.1990 *Kytövuori 90-947* (H). Kärkölä, Huovilanpuisto, 11.IX.1985 *Haikonen 6330* (H). Lammi, Hauhiala, 10.IX.1986 *Mattila* (H); Jahkola, 4.IX.1990 *Harmaja* (H); Pappilankylä, 8.IX.1982 *Lampinen* (H). Nokia, Haavisto, 18.IX.1976 *Jakowlev & Söderholm* (H). Lempäälä, church village, 10.IX.1988 *Salo 11485* (OULU). Orivesi, church village, 1974 comm. 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tövuori 88-1506 (H), 28.VIII.1985 *Kytövuori 85478* (H), 30.VIII.*1987 Kytövuori 87865* (H). Kangaslampi, Kukkolanmäki, 14.IX.1985 *Haikonen 6347* (H). Kuopio, Ranta-Toivala, 31.VIII.1985 *Kytövuori 85583* (H); Neulaniemi 31. 11.8.1992 *Kytövuori 92-118* (H). **Pohjois-Karjala**: Eno, Kolvananuuro, 19.IX.1992 *Kytövuori 92-2604* (H). Lieksa, Koli, 29.VIII.1956 *Tuomikoski* (H). Nurmes, Salmi, 19.VIII.2002 *Kokkonen & Vauras 19305* (TUR-A). **Keski-Pohjanmaa**: Kälviä, Maunumäki, 16.IX.1982 *Kytövuori 82439* (H). **Oulun Pohjanmaa**: Oulu, Hietasaari, 10.IX.1975 *Niva & M. Ohenoja* (OULU). **Inarin Lappi**: Utsjoki, Kevo, 17.VIII.1995 *Kytövuori 95-560* (H); Raessijoki, 11.VIII.1962 *Kallio* (TUR). – **ESTONIA**. **Pärnu**: Nigula, 27.VIII.1989 *Kytövuori 89-337* (H).

Acknowledgements: I thank Tuula Niskanen, Ph.D., for assistance during the work, Harri Harmaja, Ph.D., for providing me with his specimens and field notes, Kare Liimatainen, MSc., for the sequencening work, Ernest Emmett for help with the English, and Heino Vänskä, Ph.Lic., for revision of the Latin descriptions.

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