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MICROSTRUCTURES OF VEGETATIVE MYCELIUM OF MACROMYCETES IN PURE CULTURES

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The book represents original data on microstructures of vegetative mycelia in pure cultures of 100 species of edible and medicinal mushrooms belonging to Basidiomycota and Ascomycota. Investigations of mycelial microstructures in pure cultures (Culture Collection of Mushrooms, Kiev, Ukraine) were made by authors using Scanning Electron Microscopy. The descriptions of the teleomorph stage and cultural characteristics on agar media, and for some species in submerged culture, are presented. Particular attention is paid to microstructures which have taxonomical value and may be used for the identification of taxons and the physiological characteristics of fungal cultures. Many of the microstructures included in the book are described for the first time. Cultures of species represented in the book and belonging to genera *Pleurotus*, *Schizophyllum*, *Ganoderma*, *Auricularia*, *Agaricus*, *Omphalotus*, *Oudemansiella*, *Morchella*, etc., are examined using modern biotechnologies for producing fruit bodies, food additives, pharmaceutical substances, enzymes, etc., and methods used to obtain the micromorphological features under cultivation necessary for obtaining the desired information. The book is useful for students, mycologists, biologist, biotechnologist, and mushroom-growers alike.

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FROM THE EDITORS

Macromycetes represent the group of fungi with a large number of species (approx. 16.000), showing an immense variety not only in morphology but also in physiological and biochemical attributes. The biotechnological importance of macromycetes is of considerable significance, and the potential of their resources are only now starting to be appreciated by biotechnologists. The cultivation of macromycetes under controlled conditions has made a wide variety of biological studies possible of these organisms. Living resources of fungi are the basis for many different studies including taxonomy, cytology, genetics, biochemistry, physiology. Many of the advances in mycology have been made through the use of recognized strains of fungi maintained and distributed by culture collections.

Cultures of fungi are necessary to provide an element of stability and continuity in scientific work. There are limited publications about macromycetes in pure culture. The last book dedicated to some Aphyllophorales in pure culture was published more than 20 years ago.

A topic receiving less attention in the mycological literature is the vegetative mycelium of fungi. Fruit body formation and spore production traditionally receive the focus of attention in the taxonomic literature over the years at the expense of hyphal growth and vegetative cell structure variations.

There are genera, even species, variations in vegetative growth, as noted in the text, which could have economic implications in industrial, food processing, agriculture, and pharmaceutical disciplines.

Such vegetative growth is important taxonomically as well. In growing mycelium of a specific species on a large scale, it is important to constantly monitor the growth to prevent contamination of the original isolate.

SEM, TEM, and some drawings were used in the photomicrography, and many structures included in the text are noted for the first time. All specimens used in this study are stored as pure culture in the culture collections of mushrooms at the M. G. Kholodny Institute of Botany, National Academy of Science of the

Ukraine in Kiev and at the Institute of Evolution, University of Haifa, Israel.

A broad sampling of species held in the collection are described vegetatively in the book. For each described species the reader can find very important illustrations of interesting mycelial cells found in agar culture. The methods selected for these studies could be easily incorporated in studies of microfungi as well as macrofungi for use in other laboratories. More attention should be given to the vegetative growth of the fungi, and this book demonstrates the importance of these investigations.

We are sure that the book that you now possess will be of interest to mycologists, especially taxonomists, biotechnologists, mushroom producers, and biologists and will be used to develop new studies in different fields of mycology and other closely related disciplines of science. The current book is timely and welcomed for scientists and students working in different fields of research.

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INTRODUCTION

Special collections of mushroom cultures today are an important prerequisite for carrying out fundamental studies and biotechnological applications of gourmet and medicinal mushrooms, etc. The book is devoted to the description of morphological characteristics of mushroom cultures, which usually develope vegetative mycelium and anamorphic structures. In pure cultures of some species of mushrooms carpophores (teleomorph stage) are also present. The data on microstructures of mushroom cultures presented in this book was obtained as a result of original investigations. The Culture Collection of Mushrooms of the M.G. Kholodny Institute of Botany, National Academy of Sciences of the Ukraine in Kiev (acronym IBK) and the Culture Collection of mushrooms of Institute of Evolution, University of Haifa (Israel). Provides mushroom species for this study. IBK Culture Collection was established more than 40 years ago. In establishing the IBK Culture Collection special attention was given to species from various taxonomic groups as well as to preserve strain diversity. About 300 species (1.000 strains) of mushrooms, including more than 200 species with known medicinal properties, are maintained in IBK Culture Collection.

The total number of genera of mushrooms which are represented in the IBK Culture Collection is above 100. Genera such as *Agaricus, Pleurotus, Lentinus, Coriolus, Coprinus, Morchella, Ganoderma, Laetiporus, Lycoperdon, Piptoporus, Schizophyllum, Oudemansiella, Flammulina, Hericium, Ganoderma, Suillus*, and others are represented by many species.

Pure cultures of mushrooms, preserved in the IBK Culture Collection, were isolated from natural material (fruiting body tissue, basidiospores, ascospores, colonized substrate, etc.), using ordinary methods of isolation. Methods were modified by authors depending on the size, consistency, age, and contamination of the fruiting body from which the inoculum was taken. Isolation was made on agar media with antibiotics. In some cases, the accumulative culture

on wet filter paper or preliminary cooling of the tissue culture during 1-2 days at + 5 °C was used. Mycological material was collected in the territory of the Ukraine and other states of the former Soviet Union, and also in some Western European countries, Israel, and the United States. Isolated cultures belong to different taxonomic and trophic groups. For the microscopic examination samples of vegetative mycelia from different parts of the colony (margin, center) were taken. For light microscopy, mycelial samples were placed in a mixture of glycerin, 96% ethyl alcohol and water (1:1:1) or in lactic acid with cotton blue. The specimens were also examined using the Jeol JSM-6060 LA Scanning Electron Microscope (Japan) at a magnification of 500 to 20.000.

The correct identification of each shain of isolated culture was one of the most important aspects of the work. The strain investigations were often complicated because necessary information on morphological characteristics of mushroom cultures were absent in literature. It is well known that on or inside carpophores of mushrooms, spores or mycelia of contaminant molds can occur and can be mistakenly isolated instead of the expected mushroom cultures. The incorrect taxonomical identification of cultures which are used in biotechnological processes for obtaining dietary supplements, drugs, and so on, may lead to the production and utilization of toxic substances. Such unfortunate mistakes occur. Because the correct identification of the taxonomic position of cultures is a task of paramount value, the criteria for the identification of mushrooms in pure culture were established. Identification of fungal isolates was made using the complex of morphological, micromorphological, physiological and biochemical characteristics. The teleomorph stage is the most essential criterion for the identification of cultures, but very often mushrooms do not produce carpophores in pure culture. We provide information about vegetative mycelia, teleomorph stage, and data on practical application (edible, cultivated, medicinal) of each species.

ABBREVIATIONS

ChA – Chapek's agar media

MEA – malt extract agar media

OMYA – oatmeal malt yeast enriched agar media

PDA – potato dextrose agar media

SEM – scanning electron microscopy

CHAPTER I. MICROMORPHOLOGICAL CHARACTERISTICS OF MUSHROOM CULTURES

Mushroom cultures are widely applied in biotechnology (production of fruit bodies, cultural mycelium, pharmaceutical substances, enzymes, etc.) and in various aspects of fundamental mycological studies (Buchalo et al., 1983; Buchalo, 1988; Wasser et al., 2000, 2002; Stamets, 2002; Chang and Miles, 2004; Didukh et al., 2004; Dai et al., 2009). Like in most other fungi, the vegetative mycelium of mushroom cultures is a complex of branched hyphae, which differ only within narrow limits of width, length, number of nuclei, thickness of cell walls, and the character of branching. On the basis of statistical evaluation, some authors (Parmeter, 1965) conclude that the vegetative mycelium is similar in different groups of fungi, but its characteristics cannot be used as reliable taxonomic features. However, continuous accumulation of information on an increasing number of fungal species provides new material for study and allows the comparison of morphological characters and for the estimation of their potential use for taxonomic purposes and purity control in biotechnological processes (Stalpers, 1978; Buchalo, 1988; Wasser and Weis, 1998; Buchalo and Didukh, 2005).

Culture collections today store important components of medicinal mushrooms for carrying out fundamental studies and biotechnological application of medicinal as well as culinary mushrooms. A long-term study was carried out using strains from the Culture Collection of Mushrooms (IBK) of the M.G. Kholodny Institute of Botany, National Academy of Sciences of the Ukraine (Kiev), and the Culture Collection of Higher Basidiomycetes of the International Center for Cryptogamic Plants and Fungi, Institute of Evolution, University of Haifa (HAI), Israel. Currently, there are 300 species (1.000 strains) of mushrooms including about 200 species with known medicinal properties maintained at the Culture Collection of Mushrooms of the M.G. Kholodny Institute of Botany National Academy of Sciences of the Ukraine in Kiev (acronym IBK) and the

Culture Collection of Higher Basidiomycetes of the International Center for Cryptogamic Plants and Fungi, Institute of Evolution, University of Haifa (acronym HAI), Israel (Buchalo and Mitropolska, 2002; Wasser et al., 2002; Buchalo et al., 2006).

Good representation of various species in these culture collections include the following genera: *Agaricus*, *Pleurotus*, *Lentinus*, *Coriolus*, *Coprinus*, *Morchella*, *Ganoderma*, *Lycoperdon*, *Piptoporus*, *Oudemansiella*, *Flammulina*, *Hericium,* etc. (Buchalo, and Mitropolska, 2002).

Vegetative mycelial microstructures were studied using a scanning electron microscope (SEM). Mushroom cultures were grown on wort agar or malt-extract agar in Petri dishes. On inoculation of a Petri dish, five-to-seven sterilized square 4×4 mm cover glasses were aseptically placed 1–6 cm away from the inoculum. Petri dishes were incubated at 26 °C. When the cultural mycelium grew over the cover glass surfaces, the cover glasses were removed from the surface of the agar media and transferred to microscope slides. The microscope slides were then placed into a sealed glass vessel to fix the mycelium with osmium tetroxide vapot (1% solution) for 96 h. On fixation, the slides were transferred to an empty Petri dish to dry for 72 h. After drying, samples were covered with gold in a vacuum spray gun JII–4X with rotation. The specimens were examined using a Scanning Electron Microscope JEOL JSM-6060 LA (Jeol, Japan) and studied at a magnification from × 100 to × 18.000 (Buchalo and Didukh, 2005).

Vegetative mycelium of mushroom species investigated in pure culture consisted of thin-walled, septated, and branched hyphae. The diameter of generative hyphae varied between 1.5 to 7.5 μm. In *Agrocybe aegerita* (V. Brig.) Singer (Table 20, Fig. *d*), *Auricularia auricula-judae* (Bull.) Quél, *A. polytricha* (Mont.) Sacc., *Coriolus zonatus* (Nees) Quél., etc., cultures were thin (≤ 1μm wide), with no branching hyphae. In the younger part of *Grifola frondosa* (Dicks.) Gray mycelial colonies that branched, thin (≤ 1μm wide) hyphae (dichohyphidia) were formed (Table 44, Fig. *d*). In the older parts of a mycelial colony, thin (≤ 1μm wide) non-branched hyphae and generative hyphae 3-7 μm wide were

observed. Also, non-branched, aseptate, or secondary septa sceletal and sceletoid hyphae without clamp connections and with thick-walled cells occurred.

In mushroom cultures, a great diversity in hyphal morphlogy was described and some of the forms observed may have taxonomic importance. A few suggestions for classification of hyphae on the basis of their physiological role, type of branching, cell wall thickness, presence of aggregates on the surface or inside the cells, etc., were made. On the mycelia, different types of bristles, spines, swellings, bulbs, hyphal tangles, monilial hyphae, and gloeocystidia formed, some of which may be useful for the morphological characterization of cultures permitting the identification of fungal species. Stalpers (1978) presented a description of 26 types of hyphal modifications, though many of them, in our opinion, are hardly distinguishable.

The presence of dolipore septa was an important criterion for the identification of cultures belonging to the higher Basidiomycetes. Dolipore septa were present between the cells (Table 91, Fig. *c*). For the dikaryotic mycelia, the occurrence of clamp connections was typical (Table 20, Fig. *a*). Clamp connections were absent on primary monokaryotic mycelia that started from single spores or may have disappeared under favorable conditions of cultivation in liquid media (Buchalo, 1988).

Anastomoses formed between hyphae in all investigated species and strains. In some cases, numerous anastomoses were expected (Table 61, Fig. *b*). In old parts of mycelial colonies, anastomoses between hyphae and clamps were typical. In our opinion, anastomoses are of no taxonomical significance.

Hyphal ornamentation from the genus *Lyophyllum,* observed under SEM, may serve as taxonomic characters (Table 60, Figs. *a*-*b*). Warty ornamentations were detected in *Oudemansiella brunneomarginata* Lj. N. Vassiljeva and *O. mucida* (Schrad.) Höhn. on hyphae forming loops (Table 75, 76). Very typical lacunose structured hyphae were described in some species of *Morchella* (Ascomycetes) *M. angusticeps* Peck (Table 67, Figs. *b*, *c*), *M. conica* Pers. (Table

68, Figs. *b-d*), *M. crassipes* (Vent.) Pers. (Table 69, Figs. *a*, *b*), *M. esculenta* (L.) Pers. (Table 70, Fig. *d*), *M. semilibera* DC. (Table 71, Fig. *a*).

In cultures of *Coprinus cinereus* (Schaeff.) Gray (Table 31, Fig. *c*), *Crinipellis shevczenkoi* Buchalo (Table 36, Fig. *b*), *Agaricus gennadii* (Chat. et Boud.) P.D. Orton, *Leucocoprinus bresadolianus*, etc. sclerotia of various shapes, sizes, and structural forms were present.

Strand-like mycelial cords were found in cultures of some species of *Agaricus*, *Macrolepiota*, *Omphalotus olearius*, and some Gasteromycetes species (*Phallus impudicus* L., *Tulostoma brumale* Bertero) (Table 74, Fig. *d*; Table 97, Fig. *b*).

So called hyphae coils were detected in the *Oudemansiella brunneomarginata* (Table 75, Figs. *e*, *f*), *O. mucida* (Table 76, Fig. *b*), and *Tricholoma mongolicum* S. Imai (Table 96, Figs. *d*, *i*) mycelial cultures. The occurrence of coils in the mycelium is a new characteristic that has not yet been described in the literature. It is possible that similar structures will be found in other groups of fungi.

The presence of crystals on hyphae of mushroom cultures was reported in the literature (Stalpers, 1978; Buchalo, 1988; Whitney and Arnott, 1987; Sonnenberg and Fritsche, 1989; Molitoris et al., 1996; Weis et al., 1999; Buchalo et al., 2006; Buchalo and Didukh, 2005). Calcium oxalate crystals were formed on hyphae under cultivation in different nutritional media (agar and liquid media, grain, compost, etc.) and represented a relatively stable characteristic of the cultures. Oxalic acid represents one of the main metabolites of the Krebs cycle in living organisms (Molitors et al., 1996). Crystal formation was observed in all species of *Agaricus* investigated. The density of crystals on the surface of hyphae may vary. Different stages of crystal formation could also be observed. As a rule, crystals cover the hyphae and were rarely found separated from the cells.

The morphology of the crystals was very different. We observed cubic, hexahedral, pyramidal, bipyramidal, prismatic, rod-shaped, and acicular crystals.

Polygonal crystals and crystals of other shapes were observed in *Armillariella mellea* (Vahl) P. Karst. (Table 22, Figs. *a-b*), *Hericium erinaceus* (Bull.) Pers. (Table 45, Figs. *d*, *e*), *Hypsizygus marmoreus* (Peck) H.E. Bigelow (Table 46, Figs. *e-h*), *Kuehneromyces mutabilis* (Schaeff.) Singer & A.H. Sm. (Table 48, Fig. *b*), *Lentinus edodes* (Table 52, Fig. *d*), *Omphalotus olearius* (Table 74, Fig. *c*), *Pholiota adiposa* (Batsch) P. Kumm. (Table 82, Fig. *b*) etc.

On *Agaricus subfloccosus* (Table 17, Figs. *a*, *b*), *Coprinus comatus* (O.F. Müll.) Gray (Table 32, Fig. *c*) and *Montagnea arenaria* (DC.) Zeller (Table 66, Figs. *e*, *f*) hyphae, thin filamentous hair-like crystals were observed.

In *Lentinus edodes* (Table 52, Fig. *d*), crystals formed on the hyphae under cultivation on different nutritional media (agar and liquid media) and presented a relatively stable characteristic of cultures. The morphology of the crystals varied, and could be rhomboid and amorphous. Variously shaped crystals (needle-like, rod-shaped, cubic-like, etc.) formed on hyphae in different, mainly aged, parts of *Omphalotus olearius* (Table 74, Fig. *c*) colonies.

Clamp connections are characteristic features of dikaryotic mycelia of many Basidiomycetes. The presence and dislocation of clamp connections on hyphae are essential taxonomic characteristics for some species. In addition to the presence of clamps in identifying Basidiomycetes cultures, form, size, and frequency of occurrence were also considered. Clamps can be divided into large or small, long or short, gentle or abrupt, and curved or medallion-types based on the ratio of clamp size to hyphal diameter, the angle of a clamp and hyphae, and the presence or absence of a slit between a clamp and a septum (Stalpers, 1978). Some species have clamps of an original form, namely, *Auricularia auricula-judae* (Table 24, Fig. *a*), *Lyophyllum decastes* (Fr.) Singer (Table 60, Figs *a-c*), *Oudemansiella mucida* (Table 76, Figs. *a-c*), *Panus tigrinus* (Bull.) Singer (Table 78, Fig. *a*), *Piptoporus betulinus* (Bull.: Fr.) P. Karst. (Table 83, Figs *a-c*) etc., and were characterized with clamp connections of various forms and sizes. In *L. decastes* and *Piptoporus betulinus*, besides single clamps, whorls of clamps, coupled clamps, and sprouted clamps were observed. Clamps on *P. betulinus* hyphae were

rather variable in shape and size (Table 83, Figs. *a*, *b*). Sprouted, coupled, and single clamps were also found on the mycelium of *Pleurotus ostreatus* (Jacq.) P. Kumm. (Table 91, Figs. *d-f*). In *Panus tigrinus*, the clamps were mostly single or coupled, and only seldom sprouted clamps were present; some clamps were asymmetrical.

In *Coprinus comatus*, a representative of Agaricales, clamps were mostly single, of medallion type and seldom without a slit (Table 32, Figs *a*,*b*). Their form was rather stable and uniform. In *Marasmius oreades* (Bolton) Fr., belonging to the same order, mostly single clamps of a relatively stable form were observed. The medallion type clamps occurred rather frequently (Table 64, Figs *a*,*b*).

Single clamps (except in pairs and whorls) were characteristic for the mycelium of *Cyathus olla* (Batsch) Pers. (Table 37, Figs. *a-d*) and *C. striatus* (Huds.) Willd. (Table 38, Figs *a*, *b*). Some clamps forming anastomozes with adjacent hyphae occurred.

It is widely accepted, however, that clamps are not common in all species of Agaricales. They are constant in cultures of *Pleurotus*, *Coprinus*, *Oudemansiella*, *Panus*, *Lentinus*, and *Pholiota*. Clamp connections were observed in *Agaricus campestris* L., *A. subperonatus* (J.E. Lange) Singer, *A. arvensis* Schaeff., *A. bernardii* Quél., *A. comtulus* Berk. et Broome. The majority of authors noted that clamp connections occurred very rarely in vegetative mycelium of *Agaricus*. Clamps were found in *Agaricus brasiliensis* Wasser, M. Didukh, Amazonas & Stamets (Table 4, Figs *a-c*), *A. campestris* L. (Table 6, Fig. *a*), *A. gennadii* (Table 10, Fig. *a*), *A. nevoi* Wasser (Table 13, Fig. *a*) etc. Clamps seldom occurred, they were mostly of a classical shape, often without a slit.

However, in many species, even the SEM is unable to detect any specific morphological features of a clamp.

Species of macromycetes form different structures of asexual reproduction (anamorphs). Anamorphs, mainly conidial sporulation, may serve as taxonomic criteria for species or sometimes at higher taxonomic levels. Even though the first study on asexual reproduction of mushrooms was provided by Brefeld (1889),

more detailed studies only began relatively recently. For most macromycetes species, anamorphs have not been revealed yet. Taking into account various taxons, the most attention was given to Aphyllophorales, whereas Agaricales, Boletales, Gasteromycetes and Pezizales were not studied in detail. In general, chlamydospores and arthrospores were the most common asexual reproduction structures of Basidiomycetes (Nobles, 1965; Stalpers, 1978; Watling 1977, 1979; Kendrick and Watling, 1979; Reshetnikov, 1982, 1991; Pantidou et al., 1983).

Anamorphs in cultures of macromycetes have been studied mostly using light microscopy. We presented a more detailed description of anamorphic structures using scanning electron microscopy (Buchalo, 1988; Šašek et al., 1986; Buchalo et al. 1996, 1999; Molitoris et al., 1996; Weis et al., 1999; Lomberg et al., 2000; Buchalo and Mitropolskaya, 2002; Buchalo and Didukh, 2005).

Arthroconidia have been found in the mycelial cultures of *Oudmenasiella brunneoincarnata* (Table 75, Fig. *b*). Conidial sporulations (arthroconidial structures) were also found for *Agaricus arvensis* (Table 2, Fig. *a*), *A. cupreobrunneus* **(**Jul. Schäff. & Steer) Pilát (Table 7, Fig. *a*), *A. fisuratus* (F.H. Møller) F.H. Møller (Table 9, Fig. *a*), *A. maskae* Pilát (Table 12, Fig. *a*), *A. silvaticus* (Table 15, Fig. *a*), *Hypsizygus marmoreus* (Table 46, Fig. *b*), *Lepista nuda* (Table 55, Figs. *b-d*), and *Lyophyllum ulmarium* (Bull.) Kühner (Table 61, Figs. *e*, *f*) etc. Arthroconidia were formed by the increase in age of the protoplast.

In *Coprinus comatus* the branched conidiophores bearing conidial structures were described. We studied the fine structure of those 'conidia' and showed that at the tips of conidiophore branches, no real conidial cells were formed (Table 32, Figs. *d-f*). The tips of conidial branches ended with a tuft of fine, radially outgrowing hairs that gave at low magnification the impression of round verrucose conidia. However, the real nature of those structures was revealed at higher magnification. The possible role of the structures has yet to be elucidated.

Two coremia-forming species (*Pleurotus abalonus* Y.H. Han, K.M. Chen & S. Cheng and *P. cystidiosus* O.K. Mill.) were studied using the SEM. The imperfect state of *P. cystidiosus* was classified by Pollack and Miller (1976) as

Anthromycopsis broussonetiae. In our ultrastructural study, we found no difference between the imperfect states of *P. abalones* (Table 84, Figs. *a-e*) and *P. cystidiosus* (Table 87, Figs. *a-j*), which were identical to *Anthromycopsis broussonetiae*. Coremia formation on colony surfaces began as a little tangle of sterile hyphae which turned into a clavarioid form. In the following stages, the growing coremia differentiated into the head and the stipe, and on the head chains of alantoid conidia 12-20 × 4-7 μm formed. No conclusive difference in the process of coremia formation; their size and shape as well as the shape and size of conidia between the two studied organisms were determined (Šašek et al., 1986).

The blastic type of the anamorohic stage was more common in Aphyllophorales than Agaricales. Blastoconidia in *Fistulina hepatica* Schaeff.: Fr. were formed on conidiophores either individually or in a chain; chlamydospores were intercalary, lemon-shaped (Tabl. 40, Figs. *a-e*). *Pholiota adiposa* (Batsch) P. Kumm. anamorphs were similar to the conidia described from *Ph. aurivella* Singer and *Ph. nameko* (T. Ito) S. Ito et S. Imai cultures (Arita, 1979; Watling, 1979; Reshetnikov 1982 a,b). *Ph. adiposa* conidia developed on short branches arising from hyphae (Table 82, Figs. *a-d*). Our observation of conidia formation in *P. adiposa* confirms the opinion that they are arthroconidia (Reshetnikov, 1991).

Asteronphora lycoperdoides is the imperfect stage of *Nyctalis lycoperdoides* which is a parasite on fruit bodies of other species of Higher Basidiomycetes. In culture, in the center of a colony, a mass of dry and ornamented chlamydospores formed. They originated from hyphal cells, cell walls which became thick and covered by outgrowths. Chains of chlamydospores disintegrate at points where the original hyphal cells were connected to the clamps (Table 23, Figs. *a-d*).

Single globose conidia, which are termed by some authors as blastoconidia, pseudoconidia, or excretory conidia (Hilber, 1982, 1997; Reshetnikov, 1991) on simple conidiophores, resembling a sterigmata of the basidium, were laterally formed on hyphae in cultures of *Pleurotus* spp. and *Schizophyllum commune* Fr.: Fr. They were globose, 3-5 μm in diameter (Table 84-92; Table 95, Fig. *c*).

Terminal and intercalary chlamydospores in dicaryotic *Hericium erinaceus* (Table 45, Fig. *c*) cultures, and dichohyphidia and intercalary chlamydospores in the dicaryotic vegetative stage of *Grifola frondosa* (Table 44, Figs. *e*, *f*) were of taxonomic significance (Buchalo et al., 1999; Buchalo and Didukh, 2005).

Conidial sporulations of the oidium type (budding cells) were characteristic of some species belonging to Morchellaceae (Ascomycota) (Table 67, Fig. *a*; Table 68, Fig. *a*, *d*; Table 70, Figs. *a*, *b*; Table 73, Figs. *a*, *b*).

Chlamydospores were also discovered in cultures of *Agaricus arvensis* (Table 2, Fig. *c*), *A. bisporus* (J.E. Lange) Imbach (Table 3, Fig. *d*), *Auricularia auricula-judae* (Table 24, Fig. *b*), *A. polytricha* (Table 25, Figs. *c-e*), *Boletus edulis* Bull. (Table 27, Fig. *a*), *Calvatia excipuliformis* (Scop.) Perdeck (Table 28, Fig. *b*), *Clitocybe gigantea* (Sow.: Fr.) Quél. (Table 30, Fig. *a*), *Coriolus zonatus* (Table 35, Fig. *b*), *Hypsizygus marmoreus* (Table 46, Fig. *b*).

Today, the submerged cultivation of cultures of macromycete fungi is widely used in biotechnological processes as well as for dietary supplements, pharamacological substances, and liquid spawn production. The morphogenesis of mycelial growth under submerged cultivation has been investigated insufficiently. This has led to the erroneous concept that in submerged culture basic changes in mycelial morphology take place, and sporulations identical with those of molds are produced.

Morphogenesis of a wide range of medicinal and gourmet mushrooms under submerged cultivation has been investigated by authors parallel with the development of cultures on agar media. It was found that under submerged cultivation, mushroom cultures produce stable types of vegetative and asexual reproduction similar to those which are observed on agar media. At the same time, it was established that certain specific characteristics which were observed on agar media may have some morphological changes under submerged cultivation. For instance, in *Flammulina velutipes*, *Fistulina hepatica*, *Lepista nuda* (Table 55, Fig. *e*), *Lyophyllum ulmarium*, *Pholiota adiposa* (Table 82, Fig. *d*), etc., conidiophores, under intensive mixing, were comparable to those that form on agar media,

becoming shorter, without branches, and with a single conidia on the top (Table 29, Fig. *a*; Table 30, Fig. *a*; Table 78, Fig. *f*). Chlamydospores were formed in *Panus tigrinus*, *Fistulina hepatica*, *Clitocybe gigantea*, *Calvatia utriformis* (Bull.) Jaap, and *Lepista nuda* under submerged cultivation as well as on agar media. The production of conidia submerged culture was also registered in *Fistulina hepatica* (Buchalo and Didukh, 2005).

CHAPTER II. THE DESCRIPTION OF VEGETATIVE MYCELIUM IN PURE CULTURE AND TELEOMORPH

***1. Agaricus abruptibulbus* Peck** (Agaricaceae, Basidiomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, felty, dense, becoming leathery in some zones of colony; reverse colorless. Crystals on hyphae are present. (Table 1, Fig. *a*).

TELEOMORPH

Pileus 8-12 cm diam., in the center thick-fleshed, thin in the margins, orbicular-campanulate, hemispherical, later convex-applanate, with large umbo or in the center sometimes depressed, white or creamy-white, on handling becoming yellow, silky-floccose; margin thin, involute, later straight, undulating, with remnants of the veil. Gills free, thin, crowded, whitish, grayish-reddish, later dark brown, with pale sterile edge. Stipe 10-12 × 1-2 cm, central cylindrical, erect, sometimes slightly twisted, solid, upper part with reddish tint, on a silky, base often with white flocces. Ring apical, simple, wide, spreading, white, becoming bluish. Flesh white, on exposure staining pinkish, with almond smell. Basidiospores 7-8 × 4-5 μm, thick-walled, brown, ovate or ellipsoid, with 1-2 refractive droplets, apiculus lateral. Basidia 4-sterigmate, 20-30 × 7-8 μm, clavate. Cheilocystidia 8-30 × 7-20 μm, clavate. Cross reaction with Schaeffer's Reagent positive. Fruit bodies are solitary or with groups, in coniferous or mixed forests, parks.

Practical usage: edible, medicinal.

***2. Agaricus arvensis* Schaeff.** (Agaricaceae, Basidiomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, downy; reverse colorless, conidial sporulations (arthroconidia), anastomoses, and crystals are present on hyphae. Conidial

sporulations and chlamydospores are present in submersed culture. (Table 2, Figs. *a-d*).

TELEOMORTH

Pileus 7-15 cm diam., tall-conical, orbicular-campanulate, hemispherical, later convex-applanate, with a small umbo or in the center sometimes depressed, white or creamy-white, on handling becoming yellow, later pale-ochraceous, silky, imbricate-scaly. Margin thin, involute, later straight, undulating, with remnants of the veil. Gills free, thin, crowded, whitish, grayish-incarnate, later dark brown, with pale sterile edge. Gill trama in young carpophores regular, later irregular. Stipe 10-13 × 1-3 cm, central cylindrical, erect, sometimes slightly twisted, solid, later often fistulose in the center, concolorous with the cap, on handling becoming yellow fibrillose, glabrous, toward the base often pruinose. Ring apical, simple, wide, spreading, white, becoming yellow, above smooth, beneath often pruinose. Flesh white, on exposure staining ochraceous, with odour of anise, with sweetish-taste. Basidiaspores 6.3-5 × 4.5-5.5 μm, brown, ovate or ellipsoid, with 1-2 refractive droplets, apiculus lateral. Basidia 4-sterigmate, 27-30 × 7-9 μm, clavate. Sterigmata 3-4 μm long. Cheilocystidia 10-30 × 6-10 μm, abundant, oval, shortly clavate, hyaline. Cross reaction with Schaeffer's Reagent positive. Fruit bodies grow in the grasslands, parks and gardens, on lawns.

Practical usage: edible, medicinal.

***3. Agaricus bisporus* (J.E. Lange) Imbach** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dingy with age, struck with brownish-hues, divergently rhizomorphic, with an overlayer of aerial mycelium developing in age, increase in cottony, forms lacking feather-like outer edges and an overall decline in the speed of growth. Crystals and chlamydospores are present on hyphae. (Table 3, Figs. *a-d*).

TELEOMORPH

Pileus 4-10 cm diam., thick-fleshy, hemispherical, later convex, convex-plane, sometimes flattened in the center, scaly, from whitish to dirty brown with different tints (often grayish-brownish, toward the margin paler), when handled becoming reddish, adpressed-fibrillose-silky or adpressed-floccose-scaly, scales brownish, arranged against a pale background, toward the margin scales often fugacious. Margin fibrillose, thin, involute, later straight, often with remnants of the veil. Gills free, thin, crowded, pinkish-gray, later with reddish-tinge, finally dark brown, with pale sterile edge. Gill trama in young carpophopes regular, later irregular. Stipe 3-6 × 1-3 cm, stipe length is always less than pileus diameter, central, erect, cylindrical, often narrowing toward the base, often with white basal mycelium, solid, later sometimes fistulose, dense, whitish, slightly reddish toward the apex, smooth, fibrillose, below the ring slightly floccose. Ring peronate, thick, sometimes more or less thin, free standing, often with bifurcated edges, whitish, grooved. Flesh white, on exposure becoming pink or slightly red; taste and odour acidulous, fungal. Basidiospores 5.5-7.7 × 4.9-5.5 μm, pale brown, broadly globose-ovate or spherical, with refractive droplets, apiculus lateral. Basidia 2-sterigmate, sometimes 3- and 4-sterigmate, 16-30 × 6-8 μm, clavate. Cheilocystidia 20-45 × 5-13 μm, abundant, broad-clavate, hyaline, sometimes brownish. Spore print dark brown. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are solitary, scattered to gregarious near manure piles, in grass or duff under conifers.

Practical usage: gourmet, commercially cultivated, medicinal.

4. Agaricus brasiliensis **Wasser, M. Didukh, Amazonas & Stamets** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony has longitudinally striate mycelium with radiating rhizomorphs overlaying. Rhizomorphic mycelia in culture produce hyphal aggregates and pseudo-primordia after one month of incubation on MEA, which fail to enlarge to maturity. Becoming loosely aerial in age, mycelia often exude a

yellowish metabolite. Clamp connections, anastomoses, crystals, conidial sporulations and very thin hyphae (above 1 μm) are present. (Table 4, Figs. *a-g*).

TELEOMORPH

Pileus 7.5-12(14) cm, truncate conical, dark brown, with smooth surface and tiny white flakes in the central part in young specimen, later plano-convex aplanate, often cracking, with thin margin, with remnants of veil; surface of pileus disrupts on aging, forming central pallet surrounded by concentric light fulvous, appressed floccose almost triangular squamules on the white background. Lamellae crowded, free, ventricose, first pinkish later reddish brown or chocolate-brown. Stipe 10-13.5 x 1.5-2.8 cm, central, bulbose at base, with narrowly fistulose. Ring 1.5-3.5 cm wide, superior, descending, membranous simple. Context white, turns bright yellow close to cuticle at the base of stipe on scratching, with pleasant mushroom odour and sweetish-taste. Spore print brown. Basidiospores ovoid to elliptic, brown, without germ pore, thick-walled, 5.6-7 × 3.8-4.6 μm. Basidia 4-sterigmate, 16-21(23) × 6.6-7.7(8.8) μm, clavate. Cheilocystidia dispersed, claviform or septated, hyaline, catenulate. Pileipellis trichoderm, consist of 34-76.8 (88) × 6.10(12) μm hyphae, thick-walled or thin-walled, frequently septate, some pale brown, transparent, frequently branching, with few anastomoses. Chains of smaller cells 16.8-24 × 7.2-10 μm and swollen, bulging elements 28.8-43.2 × 12-22.8 μm occur in central part of pileus. Clamp connections present in hymenophoral trama. Schaeffer-reaction positive on surface and flesh of the stipe. Negative on surface and flesh of the pileus, negative on dry fruit bodies. Fruit bodies are dispersed or gregarious in half-open places, on heaps of mown grass.

Practical usage: gourmet, commercially cultivated, medicinal.

***5. Agaricus bresadolianus* Bohus** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dense, downy, branching mycelial cords are usual, golden drops of exudates are present; reverse not changed. Crystals and anastomoses are present on hyphae. (Table 5, Figs. *a-c*).

TELEOMORPH

Pileus 5-10 cm diam., thick-fleshy, at first spherical or hemi- spherical, then convex-plane, white, in the center sometimes umbonate, whitish, later on grayish-yellow, grayish-brown, in the margin darker, silky, silky-fibrillose, dry, sometimes slightly scaly, with thin involute, later straight margin that sometimes bears remnants of veil. Gills free, thin crowded, with even edge, at first whitish, then pinkish, grayish-pink, grayish-violet, and finally dark brown, chocolate-brown or almost black with violet tint, separating easily from the pileal flesh. Spore print purply white. Stipe 3-7 × 0.9-2 cm, central, cylindrical, at the base bulbose, with as a root rhizomorphs, concolorous with pileus, with handling turning slightly yellow. Ring white, thin, soft, often disappearing. Flesh soft, white, when broken becoming reddish with pleasant fungal taste and smell. Basidiospores 6-6.7(7) × 3.9-4.1 μm, dark brown, broadly oval, elipsoid, smooth, with subapical depression. Basidia 4-sterigmate, 24-29 × 5.5-9 μm, clavate. Cheilocystidia absent, pleurocystidia present. Cross reaction with Schaeffer's Reagent negative.

Practical usage: edible, medicinal.

***6. Agaricus campestris* L.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, in age with spots of yellow mycelium and primordia, reverse colorless. Clamp connections are present on hyphae. (Table. 6, Fig. *a*).

TELEOMORPH

Pileus 4-10 cm diam., thick-fleshy, at first spherical or hemi- spherical, with edge strongly involute, then convex-plane, white, whitish, whitish-pinkish, sometimes pale- or yellowish-brown, tawnybrownish, isabelline- or grayish-yellow, silky, silky-fibrillose, dry, sometimes fine-scaly at the center, scaly-cracked, with thin involute, later straight margin that sometimes bears remnants of

veil. Gills free, thin crowded, with even edge, at first whitish, then pinkish, grayish-pink, grayish-violet, and finally dark brown, chocolate-brown or almost black with violet tint, separating easily from the pileal flesh. Gill trama in young carpophores regular, later irregular. Stipe 3-6 × 1-2 cm, central, cylindrical, sometimes at the base either narrowing or widening, white, smooth, fibrillose, sometimes at the apex floccose to finely scaly (under lens), solid, with a simple, whitish, membranous, thin, broad ring attached to the middle of the stipe. Flesh soft, white, pale gray, when broken becoming reddish. Odour and taste pleasant, fungal. Basidiospores 6.-8.5 × 4-5.5 μm, dark brown, tawny-brown, broadly oval, smooth, with lateral apiculus. Basidia 4-sterigmate, 18-36 × 6-9 μm, clavate, thin-walled, hyaline. Spore print umber-brown, black-brown. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are scattered or forming arcs and rings in grassy areas.

Practical usage: gourmet, commercially cultivated, medicinal.

7. Agaricus cupreobrunneus **(Jul. Schäff. & Steer) Pilát** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, grayish, dirty white, aerial mycelium appressed in the center of the colony and in the growing zone. Reverse colorless. Conidial sporulation (arthroconidia) are present on hyphae. Clamp connections rarely occurred. (Table 7, Fig. *a*).

TELEOMORPH

Pileus (2.5)4-6(11) cm in diam., first convex, with flattened center, later expanding, with fringed margin, later exceeding lamellae, young pinkish-brown, soon darker to to reddish-brown, in center smooth, towards margin dark radially fibrillose. Lamellae crowded, free, ventricose, first pinkish later reddish-brown. Stipe 3-5.5(8) × (0.7)0.9-1.8(2.2) cm, with annular zone, cylindrical to attenuated towards base, narrowly fistulose, white, later with brownish tinge, not discoloring on handling. Ring 0.2 cm wide, fibrillose, soon disappearing. Context white,

discoloring weakly pinkish-brownish in apex of the stipe, in pileus faintly reddish when cut, yellowish to orange-brown in base. Smell slightly fungoid-aromatic, taste fungoid. Spore print brown. Basidiospores elliptic, sometimes oblong, with narrow germ pore, 7.0-9.5 × 5.0-6.0 μm. Basidia 4-sterigmate, 20-30 × 5-6.5 μm. Cheilocystidia are few, clavate, 22 × 8.5-10, pleurocystidia absent. Pileipellis slightly irregular 3.0-7.0 mm wide hyphae, with cylindrical elements, with yellowish to brownish parietal pigment.

Cross reaction with Schaeffer's Reagent negative. Fruit bodies are scattered to gregarious in disturbed ground: along paths, in sparse grass.

Practical usage: edible, medicinal.

***8. Agaricus excellens* (F.H. Møller) F.H. Møller** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white, dense, aerial mycelium high, with no expressed concentric zones, growing zones floccose; reverse colorless. Crystals on hyphae are present. (Table 8, Figs. *a-b*).

TELEOMORPH

Pileus 10-15 cm in diam., thick fleshed, first convex, later expanding, gray-yellowish, on handling becoming lemon-yellow, in the beginning only near margin, later on pileus covered with small white flocculose scales. Lamellae crowded, free, ventricose, first white later reddish-brown, with whitish edge. Stipe 10-15 × 3-4 cm, cylindrical narrowly fistulose, in a base wide, white, slightly flocculose. Ring white, slightly flocculose. Context white, discoloring weakly reddish in a base of stipe, with slightly almond smell. Spore print brown. Basidiospores elliptic, sometimes oblong, with narrow germ pore, 7.0-9.5 × 5.0-6.0 μm. Basidia 4-sterigmate, 25-48 × 9-12 μm, clavate. Cheilocystidia abundant, clavate, oval-ovoid, 10-38 × 5-16, pleurocystidia absent. Cross reaction with Schaeffer’s Reagent positive. Fruit bodies are solitary or gregarious in coniferous and deciduous forests.

Practical usage: edible, medicinal.

***9. Agaricus fisuratus* (F.H. Møller) F.H. Møller** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, felty, dense, with abundant aerial mycelia. Conidial sporulations (arthroconidia) are present on hyphae. (Table 9, Fig. *a*).

TELEOMORPH

Pileus 6-15 cm diam., straw-yellow, staining lemon-yellow on rubbing, tall-conical, orbicular-campanulate, hemispherical, later convex-applanate, with a small umbo or in the center sometimes depressed, cuticle soon broken up into fibrils and more or less radially fissured. Gills free, thin, crowded, whitish, grayish-incarnate, later dark brown, with pale sterile edge. Stipe 10-11 × 1-3 cm, central cylindrical, erect, sometimes slightly twisted, solid, later often fistulose in the center, without bulbose base, when young often with small, clearly raised flocci on the upper half, white later ochraceous. Ring pendent, thin, only with soft rounded scales soon becoming ochraceous on the underside. Flesh white, almost unchanging, with almond smell. Basidiaspores 7-9 × 4.5-5.5 μm, brown, ovate or ellipsoid. Basidia 4-sterigmate, 25-35 × 7-8 μm, clavate. Cheilocystidia abundant, oval, shortly clavate, hyaline. Cross reaction with Schaeffer's Reagent positive. Fruit bodies are in coastal areas, generally in grasslands.

Practical usage: edible.

***10. Agaricus gennadii* (Chat. et Boud.) P.D. Orton** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white with concentric zones, not dense, branching mycelial cords and sclerotia are usual; reverse colorless. Clamp connections, anastomoses, and crystals are present on hyphae. (Table 10, Figs. *a*-*e*).

TELEOMORTH

Pileus 3-7 cm in diam., thick-fleshed, at first spherical or hemispherical, then convex plane, sometimes with a central depression, white or whitish, sometimes dirty ochraceous in the center, with adpressed fibrillose scales, margin

frequently with remnants of the veil. Pileal cuticle consisting of hyaline, grayish, thin-walled, cylindrical septate hyphae, without clamps, 3-6 μm in diam. Gills free, thin, crowded, with an even sterile margin, at first pink, later dark brown, chocolate-brown. Gill trama regular. Basidia 4-sterigmate (sometimes l-3-sterigmate), 23-28 × 7-10 μm, clavate. Sterigmate 3-4 μm long. Cheilocystidia 23-33 × 7-10 μm, abundant, clavate, hyaline. Spore print dark brown. Spores 5.7-7.5 × 4-5.5 μm, pale brown, broadly ovoid, with lateral apiculus, with refractive droplets. Stipe 2-6 × 1-1.5 cm, central, cylindrical, narrowing toward the base, solid, whitish, fibrous, with whitish basal volva. Flesh white, unchanging on exposure, or becoming slightly pinkish. Odour fugacious. Taste acidulous. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are in the grasslands, parks, open areas.

Practical usage: edible, medicinal.

***11. Agaricus macrocarpus* (F.H. Møller) F.H. Møller** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, dense, aerial mycelium dense, felty. Conidial sporulations (arthroconidia) and crystals are present on hyphae. (Table 11, Fig. *a*).

TELEOMORTH

Pileus 12-17 cm, thick-fleshed, at first spherical or hemispherical, then convex plane, white, usually yellow on handling, finally yellow, sometimes with brownish spots where touched, fibrillose to silky, with adpressed fibrillose scales, margin frequently with remnants of the veil. Gills free, thin, crowded, with an even sterile margin, at first pink, later dark brown. Stipe 10-20 × 1-2(3) cm, central, cylindrical to subclavate, narrowing, solid, whitish, fibrous, at base 4.5 cm wide, first white later yellowish, brown-orange on handling, sometimes with short rhizomorphs. Ring descending, thick, persistent, cream colored. Flesh white, sometimes reddish-brown or yellowish on base of stipe on cutting, with anise smell, sometimes unpleasant. Basidiospores 7.0-9.0(9.5) × 5.0-6.5 μm, ellipsoid,

without germ pore. Basidia 4-sterigmate, 16-23-28 × 6.5-8.5 μm, clavate. Cheilocystidia usually in short chains of subglobose to cylindrical elements, (5.0)8.5-16(20) × (4.0)6.0-12(15) μm, abundant. Spore print dark brown. Pileipellis cutis of 3.5-8.5 μm wide hyphae with cylindrical to inflated elements. Cross reaction with Schaeffer's Reagent positive. Fruit bodies are solitary or gregarious, saprotrophic in coniferous forests.

Practical usage: edible.

12. Agaricus maskae **Pilát (=** ***Agaricus litoralis*** **(Wakef. & A. Pearson) Pilát)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white to grayish, felty, dense, appressed in the growing zone; reverse colorless or slow dark. Conidial sporulation (arthroconidia) 10-15 × 2.5-3 μm and clamp connections are present on hyphae. (Table 12, Fig. *a*).

TELEOMORTH

Pileus (5)6-12(13.5) cm in diam., at first hemispherical to convex, expanding to irregularly convex or plano-convex, with flattened or sometimes depressed center, with margin young incurved, later largerly appendiculate and exceeding lamellae, whitish, grayish-white or pale brown, occasionally with yellowish or brownish spots, often slightly yellowish with grayish-brown or yellowish appressed fibrillose squames at center. Veil present when young as whitish fringe at margin, later as appendiculate remnants. Lamellae moderately free, acute to adnate. Stipe. Context. Spore print yellowish. Basidiospores elliptic, 5.9-7.5 × 3.4-4.4 μm, Basidia 4-sterigmate and basal clump, cylindric-clavate, 20-25 × 5-6.5 μm. Cystidia not observed. Pileipellis made of parallel, in part branched hyphae 2-7 μm across, occasional hyphal ends exserted, brown-pigmented, septa with clamps. Fruit bodies are grown in grassy meadows and glades.

Practical usage: edible, medicinal.

13. Agaricus nevoi **Wasser** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Vegetative colony white, dense, cottony; reverse colorless. Clamp connections and anastomoses are present on hyphae. (Table 13, Figs. *a-c*).

TELEOMORPH

Pileus 5-7 cm diam., thick-fleshed (up to 2 cm), hemispherical, later convex, convex-expanded, sometimes at the center with a small depression, whitish, pale-grayish, silky, shiny, covered with wide, adpressed scales that are grayish, sometimes pale-brown, thin radially, fibrillose toward the margin, which often bears remnants of the universal veil. The pileal diameter is always larger than the length of the stipe. Pileal cuticle consisting of hyaline, grayish, thin-walled cylindrical, septate hyphae, without clamps, 4-7 μm in diam. Gills free, thin, densely crowded, pink, later dark brown with whitish sterile edge. Gill trama regular, consisting of cylindric, thin-walled hyphae, 5-8 μm in diam. Basidia 4-sterigmate, 24-27 × 7.5-8.5 μm, clavate. Sterigmate 3-4 μm long. Cheilocystidia 26-33 x 6.5-9 μm abundant, clavate, short-clavate. Spore print dark brown. Spores (6) 7-8.5 × 4.5-5.5 μm, light brown, ellipsoid, with or without refractive droplets, with lateral apiculus. Stipe 4-6 × 1.8-2.2 cm, central, erect, narrowing toward the base, solid, white, without ring, with broad basal volva, whitish, whitish-pink, covered with wide, thin adpressed scales. Flesh compact, dense, white, unchanging on exposure, often becoming slightly pink above the gills. Odour and taste pleasant, fungal. Cross reaction with Schaeffer's Reagent negative. Fruit bodies grow in grassy meadows and glades.

Practical usage: edible, medicinal.

***14. Agaricus pequinii* (Boud.) Singer** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, velvety, with drops of excudate in the center of the colony; reverse colorless. Mycelial mat with pellicle spots. Structured hyphae with anastomoses. (Table 14, Figs. *a-f*).

TELEOMORPH

Pileus 6-10 cm in diam., thick-fleshed, hemispherical, later convex-plane, often depressed at the center, whitish, grayish-white, with scattered membranaceous patches from velar material; margin fibrillose, involute, later expanding, undulating often cracked, with remnants of the veil. Pileal cuticle consisting of grayish, grayish-white, thin-walled, cylindrical, septate hyphae, without clamps, 3-6 μm in diam. Gills free, thin, crowded, pink, later chocolate brown, with paler sterile edge. Stipe 4-7 × 1.8-2-(2.5) cm, central, equal, in the center slightly inflated, solid, narrowing toward the base, whitish, below the volva covered with peculiar grayish-purple, adpressed and transversely arranged scales, with basal, membranaceous, whitish, whitish-grayish volva. Flesh white, becoming pink or slightly brown on exposure. Odour and taste faint and agreeable. Spore print dark brown. Basidiospores 5-7 × 4.5-5.5 μm, pale brown, ovoid, rounded with lateral apiculus and refractive droplets. Basidia 4-sterigmate, 23-29 × 7-9 μm clavate. Cheilocystidia 23-32 × 7-9 μm, abundant, clavate-fusiform, hyaline. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are saprotrophic in parks, on lawns.

Practical usage: edible, medicinal.

***15. Agaricus silvaticus* Schaeff.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, aerial mycelium dense, felty. Anastomoses and rectangular crystals are common on hyphae. (Table 17, Fig. *a*).

TELEOMORPH

Pileus 3-10 cm diam., thin-fleshy, in young carpophores ovoid-campanulate, globose truncate, later applanate, with an umbo, umber-brown, purple-brown or reddish-brown, darker at the center glabrous, the rest of the pileus surface with umber-brown, later darkening, adpressed, sometimes diffusely arranged fibrillose scales (with whitish background between scales), margin thin, involute, later straight, often cracked, paler, with remnants of the veil. Stipe 5-12 × 0.7-1.8 cm, central, cylindrical, sometimes curved at the base, with a bulb, solid later fistulose,

above the ring dirty-white, fibrillose, glabrous, below the ring dirty-white, toward the base with ochraceous tint, on handling becoming reddish, with floccose-scaly scurfiness. Ring apical, simple, thin, above whitish, smooth, beneath concolorous with pileus, sometimes ephemeral. Flesh white, on exposure becoming reddish (later brownish). Odour acidulous. Taste sweetish. Gills free, thin, crowded, grayish-brown or brownish with reddish tinge and more or less pale sterile edge. Gill trama in young carpophores regular, later irregular. Basidiospores 4.5-9.5 × 3-4.5 (5.5) μm (rarely spores 5.5-6.8 × 3.5-4.5; 4-5.6 × 2.7- 3.4 μm), pale-brown, ovoid, ovoid-elliptical, with a single refractive droplet, apiculus lateral. Basidia 4-sterigmate, 20-30 × 5-7 μm, clavate. Sterigmate 2-3 μm long. Cheilocystidia 17-32 × 7-13 μm, abundant, clavate, globose, hyaline, sometimes brownish. Spore print dark brown. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are saprotrophic in gardens, parks and grasslands.

Practical usage: edible.

***16. Agaricus silvicola* (Vittad.) Peck** (= ***Psalliota silvicola* (Vittad.) Richon & Rose**) (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first white, then light brown, appressed to agar media, with drops of yellow exudate and mycelial cords. Reverse becomes dark-colored. Conidial sporulations, chlamydospores, anastomoses, and crystals are present on hyphae. (Table 15, Figs. *a-d*).

TELEOMORPH

Pileus 5-11 cm diam., thin-fleshy, ovate, hemispherical, later convex-applanate, without an umbo, sometimes in the center flattened, white, dingy-white or creamy-white, on handling becoming yellow, glabrous, silky-fibrillose. Margin thin, involute, later straight, undulating, sometimes with remnants of the veil. Gills free, thin, crowded, pale, pale-reddish, later dark brown with pale sterile edge. Stipe 6-12 × 1-1.5 μm, central, cylindrical, erect, sometimes slightly twisted, enlarging toward the base, in the center of the stipe fistulose, white, above with

reddish tinge, on handling becoming yellow, glabrous, silky-fibrillose. Ring apical, simple, wide, spreading, later pendulous, above smooth, white, below white, along the edge with yellowish floccose pruina. Flesh white, on exposure, mainly in the stipe, staining reddish-pink, with odour of anisea and taste of acidic. Spores 5-7 × 3-5 μm, pale-brown, ovate, with 1-2 refractive droplets, apiculus lateral. Basidia 4-sterigmate, 20-30 × 5-8 μm, clavate. Cheilocystidia 10-40 × 7-15 μm, abundant, ovate or globose, hyaline. Spore print brown. Cross reaction with Schaeffer's Reagent positive. Fruit bodies are solitary or in small groups in mixed hardwood-conifer forests.

Practical usage: edible, medicinal.

***17. Agaricus subfloccosus* (J.E. Lange) Hlaváček** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dense, with mycelial cords and primordial initials. Hair-line crystals on hyphae are present. (Table 16, Figs. *a-c*).

TELEOMORPH

Pileus 6.5-11(12) cm in diam., first convex, later convex flattened, sometimes with depressed center, with inflaxed, later diflaxed margin, at first grayish to brownish white, later usually at center brownish, towards margin paler brown, with darker brown fibriles concolorous to center, not discoloring or rarly reddish on handling. Surface radially fibrillose to fibrillouse-flocculose, occasionally with large fibrillose appressed innate squames, in center occasionally areolate-rimose; margin exceeding lamellae, with broad adhering veil remnants. Lamellae moderately crowded, free, at first reddish brown later dark brown, with pale brown to white, pruinose edge. Stipe (3)5-6(7) × (1.2)1.5-2.5(3), usually with ring, cylindrical to clavate, stuffed to narrowly fistulose, white to pale brown, sometimes brownish or reddening at base on handling, above ring smooth to scarcely flocculose, below annulus fibrillose, sometimes with short white rhizomorphs. Ring 0.8-1.3 cm wide, sometimes remaining attached at margin of pileus, white to pale brown, very thick, very thick persistance. Context firm,

white, discoloring quickly brownish to reddish, with indistinct smell and fungoid taste, with unpleasant compound. Spore print brown. Basidiospores elliptic to broadly elliptic, 6.0-6.8 × 5.0-5.2 μm, without germ pore. Basidia 4-sterigmate, 23-39 × 7.5-10.5 μm. Cheilocystidia 30-49 × 8.5-15.0(16.5) μm, cylindrical to narrowly clavate. Pileipellis is a cutis of unbrunched irregularly radially arranged (2)3-5.5(7.5) mm wide, with yellowish intercellular pigment. Fruit bodies grow in the grasslands, parks, open areas.

Practical usage: edible.

***18. Agaricus vaporarius* (Pers.) Cappelli (= *Agaricus cappellianus* Hlaváček)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, becomes brownish in the central part of colony, is dense and wrinkled, with good mycelial growth in the agar media. Anastomoses between hyphae often occur. (Table 18, Fig. *a*).

TELEOMORTH

Pileus 7-15 cm diam., thick-fleshy, firm, convex, later plane, with flat center, dark chestnut or chocolate-brown, turning paler toward margin, sometimes becoming black, radially-fibrillose, often with the pileus surface breaking into fibrillose adpressed scales on a more or less pale background; margin incarnate, later straight, sometimes cracked, often with remnants of veil. Gills free, thin, crowded, with even sterile edge, pinkish with reddish tinge, later dark brown. Basidia 4-sterigmate (sometimes 1-, 2-sterigmate), 24-36 × 8-10 μm, clavate. Sterigmata 3-4 μm long. Cheilocystidia 18-28 × 4-10 μm, clavate, hyaline. Spore print dark brown. Spores 6.5-7.5 x 5-5.6 μm, pale brown, globose, with lateral apiculus, smooth, with one or two refractive droplets. Stipe 6-12 × 2.5-5 cm, central, cylindrical or attenuated at base, solid, whitish, brownish toward the base, becoming dark with age, smooth above the ring, sometimes peronate, under the ring fibrillose-sulcate, with thin whitish or brownish scales which, being the remnants of the veil, often form uneven zones on the lower part of the stipe (as in

A. bitorquis). Ring apical, sometimes central, white, whitish, pendulous, relatively thick (up to 1-2 mm), sulcate from above, with brownish scales beneath, often with furcate edge. Flesh firm, whitish, on breaking becoming pink. Odour acidulous, later unpleasant. Taste in young carpophores sweetish, later repulsive. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are saprotrophic, in mixed woods, in grasslands.

Practical usage: edible, medicinal.

***19. Agaricus xanthodermus* Genev.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, becoming light brownish, appressed to agar media, with mycelial cords. Crystals on hyphae are present. (Table 19, Fig. *a*).

TELEOMORPH

Pileus 2-12 cm diam., thick-fleshy, campanulate, hemispherical, later convex or applanate, sometimes with flat center, white, whitish, gray or dark-gray-brown, toward the center darker (without yellow tinge), on handling becoming yellowish or yellowish with orange tinge, glabrous, smooth, silky-fibrillose, slightly scaly, often covered with deep cracks, sometimes radially cracked toward margin. Margin fibrillose, thin, involute, later flat, often cracked, with remnants of the veil. Gills free, thin, crowded, with even sterile edge, whitish, later pinkish-brown, brownish-purple. Gill trama in young carpophores regular, later irregular. Stipe 6-17 × 1-3 cm, the stipe length is almost always equal to pileus diameter, central, erect, cylindrical, sometimes slightly twisted, a small basal bulb (up to 2 cm), often at the base there are white mycelial cords as in *A. romagnesii*, solid later fistulose in the center whitish, concolorous with the pileus, at the base (especially on handling) yellowish, glabrous. Ring apical, wide, simple, infundi-buliform, along the edge, enlarged, sometimes bifurcate, whitish, along the edge sometimes yellowish. Flesh white, on exposure staining yellowish-chrome mainly at the stipe base. With more or less intense odour of ink or carbolic acid. Basidiospores 5.5-7 × 3.3-5 μm,

brownish, globose-ovate, ellipsoid-ovate, with lateral apiculus, smooth, with 1-2 refractive droplets. Basidia 4-sterigmate, 20-28 × 6-7 μm, clavate. Cheilocystidia 10-35 × 8-27 μm, abundant, globose-ovoid to globose. Spore print dark brown. Cross reaction with Schaeffer's Reagent negative. Fruit bodies are scattered, gregarious, or in broad arcs in a variety of habitats: under conifers, hardwoods, in grass and in gardens.

Practical usage: poisonous, medicinal.

***20. Agrocybe aegerita* (V. Brig.) Singer (= *Agrocybe cylindracea* (DC.) Gillet)** (Strophariaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelium in colony is longitudinally linear, becoming cottony, usually not aerial, white at first, soon becoming spotted brown, and eventually tan-brown. Primordia usually form on agar media. Clamp connections, anastomoses, and crystals are present on hyphae. (Table 20, Figs. *a-e*).

TELEOMORPH

Pileus 4-10 cm in diam., hemispherical convex becoming flattened and sometimes cracked at center and often wavy near the margin, pale buff to almost white with rust flush at center when young becoming darker brown with age. Lamellae adnate, or slightly decurrent, cream at first than tobacco brown due to the spores. Stipe 5-10 × 1-1.5 cm, cream at first, darker brown with age, with peresistance ring, which soon becomes dusted brown by spores Context white in the pileus, and stipe, brown in base. Spore print tobacco brown. Basidiospores ovoid-elliptic, 8.5-10.5 × 5-6 μm, oblong, sometimes slightly phaseoliform, with or without apical germ pore, often with 1-2 oil drops. Basidia 4-sterigmate, 20-30 x 6-10.5 μm. Cheilocystidia (15)20-40(45) × 7.0-16(19) μm, intermixed with some lageniform or utriform elements of 25-30 x 10-11 × 4.5-5.5 μm, thin walled, colorless. Pleurocystidia scattered, (15)25-55 × 9.5-19 μm, clavate to fusiform. Pileipellis a thick hymenoderm of clavate to ovoid erect elements 25-35 × 12-20

μm, with pale yellowish intracellular pigment. Clamp connections abundant in stipitipellis and veil. Fruit bodies are growing in clusters on wood.

Practical usage: gourmet, commercially cultivated, medicinal.

***21. Anthurus archeri* (Berk.) E. Fisch. (= *Clathrus archeri* (Berk.) Dring)** (Phallaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony slow growing, not dense, cottony-woolly with silky concentric zones, whitish to brownish; reverse colorless. Clamp connections and anastomoses are present on hyphae. (Table 21, Fig. *b*).

TELEOMORPH

Fruiting body develops underground and pushes up to the surface as small, smooth, white to pale brown, "egg" 25-40 mm tall, with white strands at the base. At maturity the egg ruptures at the top and 4-6 bright red arms, 40-95 mm long, extend upwards, at first remaining fused at the tips but soon spreading outward and drooping. Inner surface pitted. Fertile surface on the pitted upper surface of the arms and down into the stem, dark green, slimy. Smell strong carrion. Spore print greenish. Spores 3.5-5.5(7.0) × 1.5-2.0 μm, oblong to cylindrical, smooth, thin-walled, dark olive in mass. Basidia cylindric, 22-40 × 4-5.5 μm. Cystidia not obsereved. Receptaculum consist of rounded cells, 40-50 μm. Fruit bodies are growing alone, in groups, or clustered in lawns, gardens, under trees, on humus, woody debris, or straw.

Practical usage: unknown.

***22. Armillariella mellea* (Vahl) P. Karst. (=*Armillaria mellea* (Vahl) P. Kumm.)** (Physalaciaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is zonate, with concentric or mosaic segments of different texture (velvety, crustose) and different color (white, cream, brown, and red-brown); reverse colorless with rhizomorphs. Margin of colony is white, often glossy. Some hyphae are encrusted with crystals. (Table 22, Figs. *a-d*).

TELEOMORPH

Pileus 4-10(12) cm. in diam, obtusely conic when young, hemispherical-convex, with an incurved margin and attached partial veil, later planoconvex to somewhat indented, surface dull, dry, olive-yellow to olive-brown when young, later fading from the margin inward to honey-yellow, margin almost whitish, center dark brown to white-brown, when young with sparsely scattered, appressed to slightly erect, yellow squamules which disappear in age, margin even when young, later finely translucent-striate. Lamellae whitish, spotting red-brown, broad, broadly adnate and decurrent, as a low extension, edges undulation to slightly crenate. Stipe 4-10 (17) × 5-15 μm, cylindric often bent, base slightly thinner or somewhat thicker, with a membranous, persistent, whitish ring below apex, stipe whitish-flesh-colored and longitudinally grooved to longitudinally fibrillose below, with yellowish tones toward the base, solid when young, hollow when old, elastic, tough. Ring with a yellow marginal zone on the underside, radially fibrillose and with occasional flocci. Context whitish with a flesh-colored tint, thin, odour somewhat musty, taste mild, irritating to the throat after being chewed for a fairly long time. Spore print whitish. Basidiospores broadly elliptic, smooth, hyaline, with drops, 7.1-8.7 × 5.4-6.4 μm. Basidia 4-sterigmate, slenderly clavate, 30-40 × 6-9 μm. Pileipellis made of parallel, horizontal to ascending hyphae 7-15 μm across, brown-pigmented, septa without clamps. Fruit bodies are typically in large clusters, but sometimes singly on wood or buried wood of both hardwoods and conifers.

Practical usage: gourmet, medicinal.

***23. Asterophora lycoperdoides* (Bull.) Ditmar (**Lyophyllaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first whitish, then becomes brownish in the center, granulated in the margin zone where primordial of teleomorph are forming, differentiated into cap and stem. Chlamydospores connected when clamp connections are present on the cap. (Table 23, Figs. *a-d*).

TELEOMORPH

Pileus 0.5-1.5 cm in diam., subglobose, covered in a clay-buff mealy coating of chlamydospores. Lamellae usually poorly formed and veinlike; attached to the stem; thick; distant; whitish or grayish. Stipe 2-5 cm long; up to 1 cm thick; more or less equal; dry; smooth or velvety; whitish to brownish; basal mycelium whitish to brownish. Context white, unchanging when sliced. Basidiospores (usually only on young gills) white, broadly elliptical, 5.5 × 3.5 µm. Chlamydospores clay-buff, subglobose covered in long blunt processing giving a star-shaped appearance, 13-16 µm in diam. Fruit bodies are grouped to clustered on pileus of the genera *Russula* and *Lactarius*.

Practical usage: unknown.

24. Auricularia auricula-judae* (Bull.) Quél. (=Auricularia auricula*** (Hook.) Underw.)** (Auriculariaceae, Basidiomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is dense, cottony, white thickening with age. White, becoming mottled with brown discolorations in age. Clamp connections, chlamydospores, and anastomoses are present on hyphae. (Table 24, Figs. *a*, *b*).

TELEOMORPH

Fruit body 3–8 cm across, ear-shaped, solitary to clustered, usually imbricate, gelatinous when fresh, hard and horny upon drying; sterile surface tan-brown with minute grayish downy hairs, inner surface gray-brown, smooth, or often wrinkled and ear-like. Spores white, cylindrical to slightly allantoid, hyaline, often with oil drops inside, 16–18 × 6–8 µm. Basidia cylindric, elongated with three transverse septa, with three lateral epibasidia, up to 80 × 7.5 µm. Cystidia absent. Hairs on the upper side hyaline, cylindrical, pointed, 80-200 × 5.5-7.5 µm.

Hyphae gelatinized, branched and some with gnarled outgrowths, 1.5-4 μm across, septa without clamps. Fruit bodies of *Auricularia auricula-judae* prefer warm and moisty habitats, occurs on living or dead deciduous trees and shrubs, commonly found on *Sambucus nigra*.

Practical usage: gourmet, commercially cultivated, medicinal.

***25. Auricularia polytricha* (Mont.) Sacc.** (Auriculariaceae, Basidiomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is felty, first white, becoming brownish with age. Clamp connections, chlamydospores, anastomoses, and crystals are present on hyphae. (Table 25, Figs. *a-e*).

TELEOMORPH

Fruit body ear-shaped, sessile or substipitate, solitary to clustered, usually imbricate, cartilaginous-gelatinous, sterile surface finely hirsute, with hairs longer than those in *A. auricular*, grayish to olive-brown when fresh, somewhat darker upon drying; inner surface, smooth to papilate or wrinkled and ear-like, grayish-brown, dark brown to nearly black in dry specimens; margin thin, undulating. Spores white, cylindrical to slightly allantoid, hyaline, thin-walled 12-19 × 5-7μm. Basidia cylindric, elongated with three transverse septa, up 50-70 × 5-8.5 μm and long tubular sterigmata. Hairs of the sterile surface hyaline, cylindrical, thick-walled, up to 500 × 5-6 μm wide, mostly apically rounded. Hyphae hyaline, septate, thin-walled, 2.5-5 μm diam. Fruit bodies of this species occur on dead hardwoods.

Practical usage: gourmet, commercially cultivated, medicinal.

***26. Boletus aestivalis* (Paul.) Fr. (= *Boletus reticulatus* Schaeff.)** (Boletaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is dense, cottony, white-cream, becoming brownish to light brown in some places with age. Anastomoses on hyphae are present. (Table 26, Fig. *a*).

TELEOMORPH

Pileus 8-30cm in diam., hemispherical when young, later plane and pulvinate, surface smooth, finaly tomentose, suede-like, increasingly, squamose-areolate toward the center, with a tendency for the areolae to become red when dry and in age, light cafe-au-lait-brown to dark tabacco-brown, margin thickly rounded, obtuse. Tube mouths white to gray-white when young, then increasingly green-yellow to olive-green and white reddish tones toward the margin in age, tubes 1-3 cm, long, concolorous with the mouths, notched at the stipe. Stipe 8-20 × 3-8 cm, ventricose to cylindric, light brown, base whitish, entire surface covered with a fine, white net which becomes brownish with age, solid, firm-fleshed. Context whitish to cream-white, light brownish under the cuticle, not discoloring when cut, spongy, thick, odour pleasantly, fungoid, taste mild, faintly nutty. Spore print olive-brown. Basidiospores fusiform, smooth, greenish-yellow, with drops, 13.3-17.1 × 4-5 μm. Basidia (3) 4-sterigmate, clavate, 35-40 × 10-13 μm. Cheilocystidia fusiform, clavate, to capitate or vesicular, 16-45 × 7.5-15 μm. Caulocystidia in the stipe net. Pileipellis is a trichoderm of irregular hyphae, most erect and exserted, some with clavate ends, 4-12 μm across, brown-pigmented, septa without clamps. Fruit bodies are in hardwood forests, planar to submontane, also in subalpine elevations in alpine pastures, prefers mild habitats and calcareous subsoil.

Practical usage: edible, medicinal.

***27. Boletus edulis* Bull.** (Boletaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is cottony or woolly to velvety, cream; reverse is cream. Chlamydospores are present on hyphae. (Table 27, Fig. *a*).

TELEOMORPH

Pileus 6-20(30)cm in diam., hemispherical when young, later plane and pulvinate, surface smooth, finaly tomentose, suede-like, aerolate at most only when dry, slightly lubricous when moist, whitish when young, then increasingly hazel-brown, more rarely also red-brown to dark brown, margin even, incurved for a long time, projecting somewhat beyond the tubes. Tube mouths white to when young, then increasingly yellow to olive-green, bluing not at all or only slightly when bruised, tubes 1-4 cm, long, concolorous with the mouths, notched at the stipe. Stipe 6-15(20) × 2-8 cm, usually ventricose when young, later cylindrical, surface white to light brownish, covered with a white net usually reaching only to about the middle of the stipe but sometimes extending from the apex to the base, solid. Context white and firm when young, brownish under the cuticle, spongy, odour pleasantly, fungoid, taste mild, nutty. Spore print dark olive-brown. Basidiospores fusiform-elliptic, smooth, greenish-yellow, with drops, 12.5-16.6 × 4.2-5.3 μm. Basidia (2)4- sterigmate, clavate, 35-47 × 8.5-10 μm. Cheilo- and pleurocystidia fusiform, 40-70 × 5.5-9 μm. Caulocystidia in the stipe net. Pileipellis made of irregular hyphae, some ascending, with exserted ends 3-6 μm across, brown pigmented, slightly gelatinized, septa without clamps. Fruit bodies are in the soil, in the woods and edges.

Practical usage: edible, medicinal.

***28. Calvatia excipuliformis* (Scop.) Perdeck (= *Lycoperdon excipuliforme* (Scop.) Pers.)** (Lycoperdaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, mycelial mat is wrinkled, felty in the center and appressed at the periphery of the mycelial colony. Gigantic cells and chlamydospores are present on hyphae. (Table 28, Figs. *a-c*).

TELEOMORPH

Fruit body 8–20 cm high, pestle-shaped, head 3-12 cm across, pale buff at first then brownish, outer surface of small spines or warts which soon disappear

exposing the yellowish, papery inner wall of which the upper portion breaks away to expose the spores. Gleba purplish-brown at maturity; sterile base of sponge-like texture, brownish and occupying the entire stem. Spores olive-brown, globose and warted, 3.5-5.5μm, with attached remnant of sterigma, up to ca. 2.5 μm long. Basidia 4-sterigmate, clavate, 12-15 × 6-8 μm, without basal clamp. Threads of capillitum brownish, thick-walled, non-septate, fragile, 3-4 μm across, branched, with short lateral outgrowths and pores. Fruit bodies are on soil in open areas, park grounds or forests.

Practical usage: edible when young, medicinal.

***29. Calvatia utriformis* (Bull.) Jaap (= *Lycoperdon utriforme* Bull.)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is felty, appressed to agar media, powdery in some parts, first white, becoming light brown; reverse light brown or red-brown in the center of the colony. Clamp connections and chlamydospores are present on hypha on agar media and also in submerged culture. (Table 29, Fig. *a*).

TELEOMORPH

Fruiting body 7.0-25.0 cm broad, 9.0-20.0 cm tall, turbinate to compressed-pyriform; apex of fruiting body rounded or dimpled when young, becoming flattened to depressed, tapering gradually or abruptly to a well developed sterile base. Exoperidium approximately 1.0-1.5 mm thick, white to cream-colored, dull brown in age, tomentose to subfloccose, fibrils often forming stellate scales, these in turn aggregated into larger areolate patches, especially on the upper portions of the immature fruiting body. Endoperidium thin, membranous, disintegrating apically, producing a crater-like opening. Gleba cream-colored, soft, soon yellowish-green to olive-brown, powdery in age; subgleba occupying the lower third to one-half of the fruiting body, separated from the gleba by a membranous diaphragm, subglebal tissue composed of cream-colored cells up to 1 mm in diameter. Odour and taste of immature gleba not distinctive. Spores globose to

subglobose, 4.5-5.5 μm in diameter, smooth, moderately thick-walled, often with a single oil droplet, lacking a pedicel; spores olive-brown in mass; capillitial pits common, consisting mostly of sinuous slits. Basidia 1-4 sterigmate, clavate, 9-20 × 5-7 μm, without basal clamp. Capillitum light brown, thick walled, not septate, branches inflated, up to 15 μm across, ends pointed, sometimes surrounded with an amorphous substance. Fruit bodies of this species were commonly reported as inhabiting dry meadows and subalpine sunny pastures, prefers sandy soils.

Practical usage: edible when young, medicinal.

***30. Clitocybe gigantea* (Sowerby) Quél. (= *Leucopaxillus giganteus* (Sowerby) Singer)** (Tricholomataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white to cream, felty, not dense, in some parts becomes granulated or powdery. Reverse not colored. Clamp connections, anastomoses, and chlamydospores are present on hyphae under cultivation on agar media and in submerged culture. (Table 30, Fig. *a*).

TELEOMORPH

Pileus 8-45 cm; at first convex, then flat, eventually developing a central depression and becoming somewhat vase-shaped; dry; smooth; the margin inrolled at first, later wavy and sometimes obscurely lined; fragile in age; whitish at first, but buff to tan by maturity. Lamellae running down the stem; crowded; whitish or buff, becoming nearly tan in age; some forking. Stipe 4-10 cm long; up to 6 cm thick; more or less equal, dry, whitish, with tiny fibers that darken in age; base with copious white mycelium. Context whitish, proportionally thin in age. Spore print white. Basidiospores 6-8 × 3-4.5 μm, elliptical, smooth; weakly amyloid. Cystidia not observed. Clamp connections present. Fruit bodies grow on the ground, can be found in fields, lawns or on roadsides.

Practical usage: edible, medicinal.

***31. Coprinus cinereus* (Schaeff.) Gray** (Coprinaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is dense, woolly, felty, white, becoming grayish when dark-colored sclerotia (30-55 mm) are forming on mycelial mat. Carpophores are easily forming on agar media. Conidial sporulations (sporangium-like anamorphic structure), clamp connections, crystals, and sclerotia are present on hyphae. (Table 31, Figs. *a-e*).

TELEOMORPH

Pileus 2 x1.5 cm when still closed, up to 3 cm when expanding, cylindrical ellipsoid, gray-brown, at center beneath the whitish to silvery gray veil. Lamellae free from the stem; white, becoming pinkish, soon grayish-brown to blackish. Stipe 5-10 × 0.2-0.6 cm; whitish sometimes tapering towards flucculose, more dense at lower part, becoming glabrous with age, base clavate and often rooting. Spore print black. Basidiospores 8.5-12 × 6-8 µm; elliptical or ovoid, dark brown, with germ pore. Basidia 4-sterigmate, 15-36 × 7-11 µm, surrounded by 5-8 pseudoparaphyses. Pleurocystidia absent. Cheilocystidia variously shaped, 50-140 × 20-55µm. Pileipellis made of cylindric elements 20-150 x 3-30 µm. Clamp connections presents. Fruit bodies are solitary or fasciculate on heaps of mixed dung, rotten straw, or vegetable refuse.

Practical usage: gourmet, medicinal.

***32. Coprinus comatus* (O.F. Müll.) Pers.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cottony, often develops “tufts” (hyphal aggregates) with maturity. Asymmetrically shaped mycelial mat often forms along the outer edge of colony. Clamp connections, anastomoses, and hair-like crystals are often present on hyphae. (Table 32, Figs. *a-f*).

TELEOMORPH

Pileus 3-15 cm; oval to rounded-cylindrical when young, expanding to bell-shaped with a lifting margin; in age turning to black "ink"; dry; whitish with a

brownish center; with large, shaggy scales; margin lined at maturity. Lamellae free from the stem; white, becoming pinkish, then black; turning to black "ink"; very crowded. Stipe 5-20 cm long; 1-2 cm thick; frequently tapering to apex; smooth; white; easily separable from cap; hollow, with a string-like strand of fibers hanging inside. Context white throughout, soft. Spore print black. Basidiospores 9-13 × 7-9 µm; elliptical; smooth; with a central to slightly eccentric pore. Basidia 4-sterigmate, 28-43 × 10-13 µm, surrounded by 5-8 pseudoparaphyses. Pleurocystidia absent. Cheilocystidia variously shaped; up to 60 × 40 µm. Pileipellis made of cylindric elements 7-30 µ wide. Only pseudoclamps present. Fruit bodies grow in groups in places which are often unexpected, such as green areas in towns. It occurs widely in grasslands and meadows.

Practical usage: gourmet, commercially cultivated, medicinal

***33. Coriolus hirsutus* (Wulf.) Pat. (= *Trametes hirsuta* (Wulf.) Lloyd)** (Polyporaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony cream or buff-yellow to light antimony-yellow. Aerial hypha 1-10(-12) µm wide. Clamp connections are constant, sometimes sprouting; crystals often present on hyphae. (Table 33, Figs. *a-c*).

TELEOMORPH

Fruit body on vertical substrates semicircular, flabellate, broadly attached on horizontal substrates rosette-like, 3-10 cm across and extending 2-6 cm from the substrate, 0.5-1 cm thick where attached, upper side zoned with concentric undulations, with alternating strongly hispid-hirsute and pilose-tomentose zones, especially pronounced toward the center, whitish, cream colored, ocherish, yellow-brownish, often green from algae, margin sharp, undulating, to crenate, fringed-pilose to glabrous when old, underside fine-pored, whitish to cream colored, later brownish with grayish tone. Pores rounded-angular, 02.-0.4 per cm, tube length 0.1-0.4 cm. Context whitish to cream-colored, 0.2-0.6 cm thick, corky, elastic, tough, odour slightly anise-like, taste somewhat bitter. Basidiospores cylindrical to

somewhat curved, smooth, hyaline, 6.0-7.5 × 1.5-2.5 μm. Basidia 4- sterigmate and basal clump, clavate, 13-20 × 4-5 μm. Cystidia not obsereved. Hyphal system trimitic, generative hyphae thin-walled, 2-4 μm across, septa with clamps; skeletal hyphae thick-walled, 4-7 μm across; binding hyphae strongly branched, thick-walled, 3-5 μm across. Fruit bodies are on dead hardwoods of many genera, more rarely on conifers. Produces a white rot.

Practical usage: medicinal.

***34. Coriolus versicolor* (L.) Quél. (= *Trametes versicolor* (L.) Lloyd)**
(Polyporaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, downy to cottony-woolly or floccose, becoming felty. Advancing zone appressed; hyphae rather distant. Reverse bleached. Chlamydospores typically present, sometimes arthroconidium-like, 4.5-9 × 2.5-6 μm. Clamp connections are often sprouting. (Table 34, Figs. *a-d*).

TELEOMORPH

Pileus up to 10 cm across; only a few mm thick; flexible when fresh; circular, semicircular, bracket-shaped, or kidney-shaped; densely hairy or velvety, often with alternating zones of texture; with concentric zones of white, brown, cinnamon, and reddish-brown (but highly variable in color and sometimes with other shades). Pores whitish to pale grayish; not bruising; pores tiny (4 or more per mm); tubes up to 3 mm deep. Context insubstantial; whitish; tough and leathery. Spore print whitish. Basidiospores 5-6 × 1.5-2 μm, smooth, cylindric. Basidia 2-4 sterigmate, clavate, 15-20 × 5-6.0 μm. Cystidia not observed. Hyphal system trimitic, generative hyphae thin-walled, 1.5-3.5 μm across, septa with clamps; skeletal hyphae thick-walled, 2.5-5 μm across; binding hyphae strongly branched and curved, thick-walled, 2-5 μm across. Fruit bodies grow on a wide variety of dead hardwood, more rarely on conifers. On fallen logs, stumps or stands, on which produces a white rot.

Practical usage: medicinal.

***35. Coriolus zonatus* (Nees) Quél. (= *Trametes ochracea* (Pers.) Gilb. & Ryvarden)** (Polyporaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, downy to farinaceous or cottony-woolly to floccose, becoming felty. Advancing zone appressed to raised; hyphae distant. Reverse bleached. Chlamydospores present, sometimes abundant, 6-14 × 4.5-9 μm. Clamp connections, crystals are present on hyphae. (Table 35, Figs. *a-b*).

TELEOMORPH

Fruit body semicircular, conchate to bracket-like, more rarly forming rosettes, 1.5-5 cm across and extending, 1-4 cm from the substrate, up to 1.5 cm thick where attached, almost triangular in cross section, with orange-brownish line under the tomentum of the pileus, upper side with zones of undulations, umbonate toward the place of attachment, with fine dense tomentum, gray-white to gray-ocher with orange-brownish zones, the glabrous cortex is available in the brownish zones, margin sharp, gray tomentose, later brownish and glabrous, underside fine pored, cream-colored to ocherish. Pores rounded angular, sometimes rather elongated, (0.2) 0.3-0.4 per cm, tube length 0.1-0.4 cm. Context corky, tough, whitish, odor slightly acidic, taste mild. Basidiospores cylindrical some slightly curved, smooth, hyaline, 5.5-7.5 × 2.5-3 μm. Basidia 4-sterigmate and basal clamp, clavate, 15-23 × 4-5 μm. Cystidia not observed. Hyphal system trimitic, generative hyphae thin-walled, 1.5-3.0 μm across, septa with clamps; skeletal hyphae thick-walled, 2.5-6 μm across; binding hyphae strongly branched and curved, thick-walled, 1.5-5 μm across. Fruit bodies are frequently found on dead hardwoods of many genera, more rarely on conifers. Produces a white rot.

Practical usage: medicinal.

***36. Crinipellis shevczenkoi* Buchalo** (Marasmiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony fast growing, overgrowth occurring in Petri dish in 6-7 days white, thick, dense, zonate. Carpophores are developing on agar media (MEA) from sclerotia (0.5-3 cm in diameter) at a temperature over 28 °C. Clamp connections are abundant on hyphae. (Table 36, Figs. *a-d*).

TELEOMORPH

Pileus 0.3-1.7 cm in diameter, first convex, then becoming plane, flat, in the centrums may be depressed, omission to microsquarros, olive-brown. Epithelial hypha pyriform, pigmented, cream to olive-brown, crustose. Basidiospores 8.8-10 × 3.3-4.5 µm, ellipsoidal, colorless. Cheilocystidia 46-48 × 5.7 µm, clavatiformis, colorless. Stipe central, cylindric, hollow 2-5 × 0.1-0.2 cm colored and microsquarrose as pileus, brown to the base. Sclerotia white, hard, 1-3 cm in diameter, connected with the base of the stipe.

Practical usage: the parasitic on the roots of sugar beets in the fields with irrigation.

***37. Cyathus olla* (Batsch) Pers.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first white, becoming brownish to brown, woolly or velvety, dense, white, with concentric zonate in the center. Reverse colorless or light pink. Primordial-line formation appears in the center of aged colony. Clamp connections and anastomoses are present on hyphae. (Table 37, Figs. *a-d*).

TELEOMORPH

Nests typically 1.5 cm high and about 1 cm wide; cup-shaped or goblet-shaped; outer surface brownish to grayish, smooth or minutely hairy to velvety (but not conspicuously hairy); inner surface smooth and shiny, silvery gray to blackish; "lid" typically whitish to pale grayish, soon disappearing; outer edge flared open widely by maturity, frequently broadly wavy. Eggs to 3 or 4 mm wide;

irregular in shape; sheathed; attached to the nest by cords. Spores smooth; egg-shaped to elliptical, hyaline, 10-14 × 6-8 µm. Basidia 2-4 sterigmate and basal clamp, slenderly clavate, 40 × 7µm. Hyphae in the peridioles thin to thick-walled, 1.4-4 µm across, septa with clamps. Hairs of the other surface hyaline to yellowish, smooth, thick-walled, ends clavate to fusiform-clavate and 6-14 µm thick. Fruit bodies are scattered to clustered on soil, often near or on woody debris; fruiting throughout the mushroom season.

Practical usage: not edible, medicinal.

***38. Cyathus striatus* (Huds.) Willd. (= *Peziza striata* Huds.)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white-brownish to light brown, felty, dense in the center of the colony. Clamp connections, crystals, and anastomoses are present on hyphae. (Table 38, Figs. *a*-*e*).

TELEOMORPH

Fruit body 7-15 mm tall, 6-8 mm wide, strongly infundibuliform with narrow, tapering base. Peridium at first entirely covering the gasterocarp then apically fragmenting to reveal the epifragm, outer surface rusty brown to dark fuscous brown, shaggy-tomentose to hairy. Inner surface grayish, vertically ridged or fluted. Peridioles 12-16 in number, 1-2 mm in diam., lenticular, pale grayish, each attached by a fine, thread-like funiculus to the inner peridial surface. Basidiospores 12-21 × 7.0-12 µm, oblong ellipsoid to ellipsoid, hyaline, smooth, thick-walled. Peridiopellis of brown, constricted hyphae, with clamp connections, and fusoid terminal elements, 35-75 × 8-15 µm. Fruit bodies are gregarious on fallen branches, twigs and other debris, often in large numbers, nearly always in woodland, rarely in gardens.

Practical usage: not edible, medicinal.

***39. Disciotis venosa* (Pers.) Arnould** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony not dense, woolly, white, cream; reverse light brown. Microsclerotia and abundant with mycelial cords on PDA and OMYA. Anastomoses and mycelial cords are present. (Table 39, Figs. *a-d*.)

TELEOMORPH

Fruiting body 4-21 cm across; shaped more or less like a cup when young, often with a curled-in edge; in age flattening and becoming irregularly saucer-shaped; upper surface yellowish-brown to brown or reddish-brown, smooth at first but soon becoming wrinkled or veined, especially over the center; under surface whitish to pale tan, often dotted with brown scales, rough or finely hairy; pinched together in the center to form a very short pseudo-stem that is buried in the ground; flesh brittle and pale brownish. Spores 22-25 × 12-15 µm, smooth; elliptical; without oil droplets; contents homogeneous. Asci 230-350 × 16-24 µm; not bluing in Melzer's Reagent or IKI. Fruit bodies are solitary or groups in damp soil or humus under or near trees.

Practical usage: poisonous unless well coocked, medicinal.

***40. Fistulina hepatica* (Schaeff.) With.** (Fistulinaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony at first white to pale pinkish, buff or light buff, becoming ochraceous-buff or ochraceous-tawny, cottony to farinaceous, often somewhat velvety around the inoculum. Reverse finally becomes darker. Typical blastoconidia present, not in chains, ellipsoid. Chlamydospores present on agar media and also in submerged mycelium. Advancing zone appressed to raised; hyphae rather distant. Conidia hyaline to pale yellow, narrowly ellipsoid to ovoid. Conidia single or more typically in dense botryose clusters, attached with a broad base, with thin to thickened walls. Aerial hyphae with brownish crystals or sometimes with aggregation of metabolites. (Table 40, Figs. *a-h*).

TELEOMORPH

Pileus up to 30 cm across; irregular in shape but often fan-shaped or tongue-like; sometimes with multiple caps; surface finely bumpy, velvety, or fairly smooth; the margin lobed; red, reddish-orange, or liver-colored. Pore surface whitish or pale pinkish, becoming reddish-brown in age; bruising reddish-brown; tubes distinctly separated (use a hand lens), to 1.5 cm long. Stipe absent or rudimentary and lateral; colored like the cap, firm. Context whitish, streaked with reddish areas; thick; soft; watery; exuding a reddish juice when squeezed. Spore print pinkish to pinkish-brown. Basidiospores oval, smooth, hyaline, with 1 drop, 3.5-6 × 2.5-4 μm. Basidia 4-sterigmate and basal clamp, clavate, 20-25 × 6-7 μm**.** Cystidia not observed. Hyphal system monomitic, subhymenial hyphae 2-3.5 μm across, septa with clamps; agglutinated hyphae in the tubes parallel, 2-6 μm across, with occasional clampless septa; hyphae in context somewhat inflated, incrusted in dry specimens. Fruit bodies are on living or dead hardwood, especially *Quercus*, fruit bodies often develop on tree bases, also frequent on stumps.

Practical usage: medicinal.

***41. Flammulina velutipes* (Curtis) Singer** (Physalacriaceae, Basidiomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, aerial mycelium longitudinally linear, becoming finely appressed and tinged light brown to spotted with golden yellow-brown zones with age. The surface roughens at the earliest stage of primordial formation. Long-stemmed, small-capped mushrooms commonly form along the inside periphery of the Petri dish on agar media. Conidial sporulation (arthroconidia) is present on hyphae. (Table 41, Figs. *a-d*).

TELEOMORPH

Pileus (1)2-6(10) cm in diam., convex, then expanded and plane and sometimes irregularly undulating, surface smooth, lubricous, viscid, yellow to orange-brown, darker toward the center, margin paler, acute and even or faintly striate, cuticle gelatinous, partly peelable. Lamellae whitish when young, than pale orange-yellow, broad, adnate to slightly notched, sometimes anastomosing, edges

smooth and concolorous. Stipe 1.5-7(10) × 0.2-1(1.5), central, cylindric, at times somewhat widened at the apex, brownish to black, apex yellowish, entirely velutinous, sometimes strigose toward the base, fibrous, solid, soon hollow. Context mild, soft, cream colored, odor pleasant, taste mild, nutty. Spore print whitish. Basidiospores cylindric-elliptic, 8-11 × 3.2-4.5 μm. Basidia 4-sterigmate and basal clump, slenderly clavate, 35-40 × 4-5 μm. Cheilocystidia slendery clavate, 45-65 x 9-13 μm, numerous, dermatocystidia cylindric-clavate, somewhat thick-walled, with yellowish contents, brown in KOH, 60-120 × 6-10 μm. Caulocystidia fusiform, brownish, up to 300 × 20 μm. Pileipellis made of irregular, abundantly and multiply branched hyphae 2-3 μm across, septa with clamps, gelatinized, with dermatocystidia. Fruit bodies are solitary to clustered on hardwood stumps and logs.

Practical usage: gourmet, commercially cultivated, medicinal.

***42. Ganoderma lucidum* (Curtis) P. Karst.** (Ganodermataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dense, with concentric zones, cottony, felty in the center, subfelty with pronounced hyphal tufts near the edge of the Petri dish, interwoven, outline of margin even, mycelium at the margin is raised. Reverse unchanged. Vegetative mycelium in colony center has several types of hyphae (skeletal, generative, binding, and lateral). The number of clamps and staghorn hyphae greatly decreases. In vegetative mycelium of the growth zone the same types of hyphae are observed. Clamp connections and aggregations of exometabolites are present on hyphae. (Table 42, Figs. *a-f*).

TELEOMORPH

Pileus 2-20 cm; at first irregularly knobby or elongated, but by maturity more or less fan-shaped; with a shiny, varnished surface often roughly arranged into lumpy "zones", red to reddish-brown when mature, when young often with zones of bright yellow and white toward the margin. Pore surface white, becoming dingy brownish in age; usually bruising brown; 4-7 tiny (nearly invisible to the

naked eye) circular pores per mm, tubes to 2 cm deep. Stipe sometimes absent, but more commonly present; 3-14 cm long; up to 3 cm thick; twisted; equal or irregular, varnished and colored like the cap, often distinctively angled away from one side of the cap. Context brownish, fairly soft when young, but soon tough. Spore print brown. Basidiospores 7-13 × 5-9 μm, more or less elliptical, sometimes with a truncated end; with the hyaline germination pore, appearing smooth at lower magnifications, finely spiny at high magnification. Basidia 4-sterigmate, ventricose, 17-20 × 10-12 μm. Pileocystidia in regular palisade, clavate, brown, thick-walled, with superficial resinous excretion, amyloid, 60-125 × 7.0-13 μm. Hyphal system trimitic, generative hyphae sparse, hyaline, 2.0-3.0 μm across, septa with clamps; skeletal hyphae thick-walled, brownish 2.0-7.0 μm across, cyanophilic; binding hyphae thick-walled to solid, brownish, 2-3 μm across, strongly branched. Fruit bodies are on stumps or fallen trunks of many hardwood genera, more rarely recorded on conifers. Produces a white rot.

Practical usage: commercially cultivated, medicinal.

***43. Ganoderma tsugae* Murrill** (Ganodermataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, becoming yellow or brown, dense, downy. With concentric zones and dense sectors of mycelium. Mycelium at the margin is raised. Reverse dark brown or bleached. Generative hyphae with abundant clamp connections above almost every septa. Abundant staghorn hyphae are observed in the center of the colony. Aggregations of exometabolites on hyphae are present. (Table 43, Figs. *a-f*).

TELEOMORPH

Pileus 5-30 cm; at first irregularly knobby or elongated, but by maturity more or less fan-shaped; with a shiny, varnished surface often roughly arranged into lumpy "zones"; red to reddish-brown when mature; when young often with zones of bright yellow and white toward the margin; occasionally with bluish tints. Pore surface white, becoming dingy brownish in age; usually bruising brown, 4-6

tiny (nearly invisible to the naked eye) circular pores per mm, tubes to 2 cm deep. Stipe sometimes absent, but more commonly present; 3-14 cm long; up to 3 cm thick, twisted, equal or irregular, varnished and colored like the cap, often distinctively angled away from one side of the cap. Context whitish, fairly soft when young, but soon tough. Spore print brown. Basidiospores 9-11 × 6-8 μ; more or less elliptical, sometimes with a truncated end; usually appearing roughened even at lower magnifications. Basidia 4-sterigmate, with a basal clamp, broadly clavate to ovoid 18-25(30) × (7)10-12 μm. Pileocystidia in regular palisade, clavate to cylindrical, brown thick-walled, with superficial resinous excretions, strongly amyloid, 30-110 × (7)10-12 μm. Hyphal system dichosarcotrimitic to trimitic, generative hyphae clamped, hyaline, forming amyloid palisade in pileus, 2.5-5.0 μm across; skeletal hyphae thick-walled, brownish 2.5-7.0 μm across; binding hyphae thick-walled to solid, 1.0-3.0 μm across, strongly branched. Fruit bodies are on stumps, fallen trunks, and buried wood of dead hardwoods, especially *Tsuga*. Produces a white rot.

Practical usage: commercially cultivated, medicinal.

***44. Grifola frondosa* (Dicks.) Gray** (Meripilaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, later light tawny-brown tones longitudinally linear, eventually thickly, cottony, non-rhizomorphic. The mycelium grows out unevenly. At maturity, the dense mycelial mat can be peeled directly off the agar media. Mycelia have developed strong yellowish to orangish-brown mottled zones, with drops of yellowish metabolite. In the vegetative mycelium numerous medallion clamp connections are present, anastomoses between hyphae and clamps occurred. In the younger part of mycelial colony branched thin (≤ 1 μm width) hyphae (dichohyphidia) are formed. Apical and intercallar chlamydospores form on hyphae, which usually have no clamp connections. (Table 44, Figs. *a*-*g*).

TELEOMORPH

Pileus cluster 15-60 cm broad or more; individual caps 2-10 cm, fan-shaped, gray-brown (often with concentric zones), with wavy margins. Pore surface lavender-gray when young, becoming dirty whitish to yellowish, running down the stem(s). Stipe branches smooth, white, tough, usually lateral. Context firm, white, tough, taste mild. Spore print white. Basidiospores 5-7 × 3.5-5 µm; smooth; broadly elliptical. Basidia 4-sterigmate, clavate, 20-25 × 6-8 µm. Cystidia not observed. Hyphal system monomitic, subhymenial hyphae thin-walled, 2-3.5 µm across, sparsely septate, some with clamps; tramal hyphae thick-walled, often bladder-like and short-celled, 10-40 µm across. Fruit bodies of this species occur on living or dead hardwoods, frequently found at the base of living *Quercus*, as well common on stumps and roots.

Practical usage: gourmet, commercially cultivated, medicinal.

***45. Hericium erinaceus* (Bull.) Pers.** (Hericiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony whitish, forming triangular zones of collected rhizomorphs, radiating from the dense center of colony, numerous clamp connections are present. They are usually located near each cell septum. Intercallar and terminal chlamydospores and anastomoses between hyphae are usual. Abundant crystals of cubic or rectangular shape are sometimes present on hyphae. Highly branched hyphal segments are expected. (Table 45, Figs. *a-i*).

TELEOMORPH

Fruit body annual, compact to lobed, up to 8-40 cm across; consisting of one, unbranched clump of 1-6 cm, soft spines hanging from a tough, hidden "base" that is attached to the tree; white, or in age discoloring brownish to yellowish. Upper surface with short, irregular, sterile spines. Hymenophoral spines on underside 2-5 cm long, regularly crowded. Context homogenous, soft when fresh, tough upon drying, white, not bruising. Spore print white. Basidiospores 4-5.5 × 5-6.5 µm; elliptical or nearly round; amyloid; smooth or minutely rough. Gleocystidia present as elongated undulating organs with refractive contents.

Hyphae hyaline, often swollen up to 20 μm wide, with clamps. Fruit bodies are on living hardwoods or fallen logs. Frequent on wounds of living trees, as well on recently cut ends of fallen trunks.

Practical usage: gourmet, commercially cultivated, medicinal.

***46. Hypsizygus marmoreus* (Peck) H.E. Bigelow** (Lyophyllaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dense, cottony with tufts, edged with mycelial strands. Vegetative mycelium mostly has thin-walled, hyaline, regularly septated hyphae. Clamp connections, anamorphs, and crystals are present on hyphae. Hyphae of vegetative mycelium are incrustated. Conidial sporulations are in chains or solitary. Chlamydospores are terminal and intercalary on hyphae. (Table 46, Figs. *a-j*).

TELEOMORPH

Pileus 2-4 cm; convex, becoming nearly flat at maturity; moist; smooth; buff or pinkish-cream, with water droplets on the top that form a marbling pattern. Lamellae attached to the stem or running down it; nearly distant; cross-veined; buff to pinkish-buff. Stipe 4-22 cm long; smooth except for white hairs at the base, white, with a soft center, usually central, equal or tapering at base, often curved or bent, without a partial veil. Context firm but not tough; soft and cottony at the stem center; white to pinkish-buff. Spore print buff. Basidiospores 4-5 μm, smooth, round or nearly. Fruit bodies are saprophytic on elms, beech, cottonwoods, maple, willow, oaks, and the other hardwoods.

Practical usage: gourmet, commercially cultivated, medicinal.

***47. Inonotus obliquus* (Ach. : Pers.) Pilát** (Hymenochaetaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is downy, zonate, at first white, becoming straw yellow, rarely cinnamon buff or buckthorn brown. Aerial hyphae often incrustated.

Conidial sporulations and aggregation of exometabolites are present. (Table 47, Figs. *a-c*).

TELEOMORPH

Fruit body annual, resupinate, up to 6 mm thick, developing beneath the bark, hard and brittle when dry. Hymenial surface porouse, yellowish-brown becoming dark reddish-brown, pores circular, 6-7(-8) per mm, with thick, entire dissepiments that become thin and lacerate. Tube layer dark reddish-brown, sometimes whitened within, up to 3 mm thick, elongated because of the vertical position of the substratum. Context bright yellowish-brown, slightly zonate, soft, fragile to corky, up to 1-5 mm thick. Basidiospores hyaline to yellowish, broadly ellipsoid to ovoid, 8-10 × 5.5-7.5 μm, smooth, negative in Melzer's Reagent. Basidia broadly clavate, 15-20 × 7-12 μm, with a simple basal septum. Setae frequent to abundant, subulate to ventricose, thick-walled, reddish-brown, 10-30(45) × 5-9 μm. Hyphal system monomitic, generative hyphae yellowish-brown, simple septate, thin to moderately thick-walled, branched, 2-3 μm wide in the trama and up to 7-8 μm wide in the context. Fruit bodies are the imperfect form of the fungus develops on living hardwoods, especially birch (*Betula*), continues to live on dead stands, when the perfect forms of the fruit body develop under the bark. Occasionally may be encountered on other hardwoods. Produces a white rot.

Practical usage: medicinal.

***48. Kuehneromyces mutabilis* (Schaeff.) Singer & A.H. Sm.** (Strophariaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is wooly, first white, becoming cream. Hyphae with clamp connections and anastomoses, often incrustated. (Table 48, Figs. *a-c*).

TELEOMORPH

Pileus 2-16 cm; convex, becoming broadly convex or broadly bell-shaped; sticky or slimy when fresh; tawny to orangish-brown, changing color markedly as it dries out and fading to yellowish (often passing through a two-toned stage); the

margin finely lined when moist; smooth, or with scattered whitish fibrils when young. Lamellae attached to the stem or beginning to run down it; close or crowded; whitish to pale tan when young, becoming cinnamon-brown; at first covered by a whitish to pale tan partial veil. Stipe 4-10 cm long, up to 1.5 cm thick; dry; silky near the apex, with a persistent (occasionally ephemeral) ring whitish becoming brown from the base up, covered with small, whitish to brownish scales. Context whitish, with fragrant odour and somewhat unpleasant taste. Spore print cinnamon-brown. Basidiospores 5.5-7.5 × 4-5 μm; smooth; more or less elliptical; with a well developed apical pore; brownish in KOH. Pleurocystidia absent. Cheilocystidia subcylindric, subfusiform, or subcapitate; scattered; inconspicuous; up to 30 × 7 μm. Pileipellis a gelatinized layer in young, fresh specimens. Clamp connections present. Fruit bodies are on stumps, felled trunks and logs of broad-leaf trees, particularly birch.

Practical usage: gourmet, commercially cultivated, medicinal.

***49. Lacrymaria velutina* (Pers.) Konrad & Maubl. (= *Lacrymaria lacrymabunda* (Bull.) Pat.)** (Psathyrellaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony slow growing, white to cream, with long, radiating hyphal bundles. Clamp connections and anastomoses on hyphae are present. (Table 49, Figs. *a-d*).

TELEOMORPH

Pileus 5-10 cm; convex when young, expanding to broadly convex, flat, or very broadly bell-shaped; dry; densely hairy but sometimes becoming more or less smooth in age; the margin sometimes with hanging partial veil remnants, yellow-brown or darker. Lamellae attached to the stem or free from it; crowded; pale at first, later dark brown and mottled. Stipe 5-15 × 5-1.5 cm, equal, or with a swollen base, hairy, with a fragile ring or a ring zone that is darkened by spores, white above, pale brownish below, hollow. Context thick brownish. Spore print dark brown. Basidiospores 8-12 x 5-8 μm, elliptical, finely warty. Pleurocystidia 48-62

× 9-14 µ, clavate to utriform, often clustered in threes or fours. Cheilocystidia absent. Basidia cylindrical hyaline, 28-40 × 7.5-10 µm. Pileipellis made of erect swollen-vesiculose cells arising from several levels to form a palisadoderm, intermixed and overlain by filamentous tawny, smooth or ornamented hyphae 9-12.5 µm broad. Fruit bodies are in grassland and on verges beside lanes, occasionally also in woodland clearings.

Practical usage: edible.

***50. Laetiporus sulphureus* (Bull.) Murrill** (Fomitopsidaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first appressed to agar medium, with tufts of aerial mycelium, becoming floccose to locally woolly-floccose and farinaceous, pale ochraceous buff to pale orange-yellow or pale ochraceous. Marginal hyphae sometimes with swellings. Conidia subglobose to ellipsoid or ovoid, thin-walled, salmon en masse, (5-)6-10(-11) × 5-8 µm. Chlamydospores ellipsoid to subglobose, becoming thick-walled (up to 1.5 µm), 12-21 × (7.5-)9-16 µm. (Table 50, Figs. *a-h*).

TELEOMORPH

Fruit body 5-60 cm broad, up to 4 cm thick; fan-shaped to obtusely semicircular; smooth to gently wrinkled; suede-like; bright yellow to bright orange when young, frequently fading in maturity and with direct sunlight. Pores tightly packed and nearly invisible when young, sulfur-yellow; sometimes bruising darker. Context thick; soft and watery when young, becoming tough, eventually crumbling away; white to pale yellow. Spore print white. Basidiospores smooth; broadly elliptical to round, usually with drops, 5-7 × 3.5-5 µm. Basidia 4-sterigmate, short-clavate, 10-15 × 6-7 µm. Cystidia not observed. Hyphal system dimitic, generative hyphae of the tube trama thin to thick-walled, 2-4 µm across, septa without clamps; binding hyphae of the pileal trama thin to thick-walled, 8-15 µm across, septa without clamps, with irregular outgrowths. Fruit bodies grow on logs and stumps of hardwoods.

Practical usage: edible, medicinal.

***51. Langermannia gigantea* (Batsch) Rostk.** (= ***Calvatia gigantea* (Batsch) Lloyd)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, not dense, felty, wrinkled, with mycelial cords. Chlamydospores and gigantic cells are present on hyphae. (Table 51, Figs. *a-c*).

TELEOMORPH

Fruiting body ball-shaped, or nearly so; up to 60 cm or more across; white when fresh, becoming yellowish or olive-brown; finely velvety when young, but soon smooth; soft; interior white and fleshy, becoming yellowish or greenish-yellow; the outer surface eventually falling away in pieces; often with a small cord at the point of attachment to the ground. Spores 3-5.5 × 3-5 μm, round or nearly so; minutely spiny or nearly smooth. Capillitial threads 2-9 μm wide, thick-walled, occasionally branched, septate. Fruit bodies are in meadows and pastures, usually on nutrient rich soils.

Practical usage: edible when still white and firm, medicinal.

***52. Lentinus edodes* (Berk.) Singer (= *Lentinula edodes* (Berk.) Pegler)** (Marasmiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, at first, longitudinally linear and cottony-aerial as it ages, in response the mycelium becomes dark brown. Rarely rhizomorphic. Anastomoses are formed between hyphae. Clamp connections are present on dikaryotic mycelia. Clamp connections have the classical form with a slit between the clamps and the septum. Rhomboid and amorphous crystals and lipid droplets are forming on hyphae. (Table 52, Figs. *a-g*).

TELEOMORPH

Pileus 5-10 cm in diam., fleshy convex to applanate, subumbonate, less frequently depressed, dark vinaceous gray, drub or ochraceaous-buff, darker in the center, but very pale at the margin, smooth at first, but soon disrupting to form innate, appressed, triangular, scales or deeply fissured, with age and showing white flesh, margin at first in-curved and bearing thick, cobwed-like, fugacious buff remnants of veil. Lamellae whitish-yellowish, decurrent. Stipe central to excentric 3-7 × 0.8-1.5 cm, cylindrical to slightly fusiform, sometimes slightly swollen towards the base, solid, pale clay-pink or clay-buff or concolorous but paler then cup, fibrillose, smooth with small darker brown squamules below, and sometimes with an evenescent ring-zone. Context white, tough-fleshy, with pleasant taste and smell. Spore print white. Basidiospores ovoid to ovoid-ellipsoid, smooth, hyaline, 5.0-6.5(7) × 3.0-3.5(4.0) μm, Basidia 4-sterigmate, narrowly clavate, hyaline, 15-25 × 4-5 μm. Pleurocystidia 25-30 × 7.5-12.5 μm, inflated clavate, hyaline, thin-walled. Cheilocystidia not observed. Pileipellis poorly developed cutis, made of parallel, radial or slightly interwoven hyphae with pale brown walls, 2.5-7.5 μm broad. Clamp connections present and prominent. Fruit bodies are gregarious on fallen wood of a wide variety of deciduous trees.

Practical usage: gourmet, commercially cultivated, medicinal.

***53. Lepiota erminea* (Fr.) Gillet (= *Lepiota alba* (Bres.) Sacc.)** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony at first white, later pale-gray, transparent, downy, with thin, highly interwoven aerial mycelium, subfelty, with small tufts of aerial mycelium in the growth zone. Outline of the colony even; margin appressed. On aging colony becomes zonate, with radial sectors of different density. Numerous hyphal strands, thick and branching are formed. Hyphae of vegetative mycelium thin-walled, hyaline, regularly septated, frequently branched, with clamp connections and anastomoses. (Table 53, Figs. *a-c*).

TELEOMORPH

Pileus 3-8 cm in diam., slightly thick-fleshy in the center, applanate-convex, later convex, with a wide, low, protruding umbo, white, turning yellowish mostly in the center on aging, smooth, with a squamulose-floccose thin cover, margin thin, involute, later straight margin. Lamellae thin, free, crowded, whitish, later on with yellowish tint. Stipe 4-7 × 0.35-0.9 cm, central, cylindrical, slightly tapering towards the base, fistulous in the center, white, sometimes darker at the base, with a flake-like thin cover below the ring, later naked. Ring thin, with flake-like thin cover at the upper surface of the ring and with striate lower surface. Context white, slightly yellowish in stipe. Spore print white. Basidiospores 9(11)-15(16) × 8-10 μm, colorless, elongated, egg-shaped, ellipsoid, narrowing towards one end, widening and rounded at the other end, with one fluorescent droplet. Basidia 4-sterigmate, 35-50 × 11-13 μm, elongated-clavate. Cheilocystidia 20-29 × 8-10 μm, clavate**.** Pleurocystidia absent. Hymenophoral trama regular. Clamp connections present. Fruit bodies are solitary to gregarious, in small groups, saprotrophic on the soil, in coniferous forests.

Practical usage: not edible, medicinal.

***54. Lepista nebularis* (Fr.) Harmaja (= *Clitocybe nebularis* (Batsch) P. Kumm.)** (Tricholomataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white to light brown, dense with raised growth zone. The surface of colony is not uniform: segments of powdery mycelium are present. Clamp connections and anastomoses are usual on hyphae. (Table 54, Figs. *a*-*e*).

TELEOMORPH

Pileus 7-15(20) cm in diam., convex with an in-rolled margin when young, later plane and somewhat depressed or with a slight, obtuse umbo, surface when young finely tomentose, darkgray-brown, somewhat pruinose, later innately radially fibrillose, dull, light gray-brown to beige-gray, at times somewhat darker in the center (sometimes covered with white, cottony hyphae of a parasitic fungus), somewhat butyraceous when moist, margin regular when young, even, later

irregularly undulating to cleft, cuticle peelable. Lamellae cream-colored to yellowish, broad, easly separable from the pileal flesh, subdecurrent, edges smooth, somewhat uneven. Stipe 5-10(15) × 1.5-5 cm, clavate when young, later cylindric, surface with gray-brown longitudinal fibrils on a whitish background, sometimes also grooved, base strongly attached to the substrate by white mycelium, solid, hollow when old, corticate. Context white to whitish, thick when young, thin when old, soft, odour obtrusively sweetish, unpleasant, taste mild, sourish, somewhat unpleasant. Spore print yellowish. Basidiospores elliptic, smooth, hyaline, 5.9-7.5 × 3.4-4.4 μm. Basidia 4-sterigmate, cylindric-clavate, 20-25 × 5-6.5 μm. Cystidia not observed. Pileipellis made of parallel, in part branched hyphae 2-7 μm across, occasional hyphal ends exserted, brown-pigmented, septa with clamps. Fruit bodies grow in broad-leaf and coniferous woodland and beneath hedgerows.

Practical usage: edible, medicinal.

***55. Lepista nuda* (Bull.) Cooke** (Tricholomataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony velvety, felty, with poorly expressed concentric zones, white to cream, yellowish or light violet. Reverse colorless. Conidial sporulation (arthroconidia), clamp connections and chlamydospores are present on agar medium and also in submerged culture. (Table 55, Figs. *a*-*e*).

TELEOMORPH

Pileus 5-15(20) cm in diam., convex when young, later plane and regularly to irregularly undulating, center slightly umbonate or depressed, surface smooth, dull to lardaceous-shiny, somewhat viscid when moist, violet, violet-blue, lilac, brown-lilac in various transitional colors according to age, habitat, and weather, margin enrolled for long time and even. Lamellae lilac to gray-lilac, sometimes with blue tint, relatively broad. Stipe 5-10 × 1-3 cm, cylindrical to strongly clavate to bulbous, base sometimes also geniculate, surface violet when young, later fading to whitish, longitudinally fibrillose, apex somewhat floccose, base strongly fused

to substrate. Context whitish, thick in the center, thin toward the margin, lilac above the lamellae, odour strongly aromatic, fruity, not unpleasant, taste mild, somewhat mushroomy to nutty. Basidiospores elliptic, finely verrucose, hyaline, 6.5-8.5 × 3.9-4.8 μm. Basidia 4-sterigmate, cylindric to clavate, with basal clamp, 23-36 × 7-10 μm. Cystidia not observed. Pileipellis made of irregular to almost parallel, in part branched hyphae 2-6 μm across, septa with clamps. Fruit bodies prefer to grow in grasslands and dirt areas.

Practical usage: gourmet, commercially cultivated, medicinal.

***56. Leucoagaricus carneifolius* (Gillet) Wasser** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony slowly growing, gray with olive-green spots, at first downy, later zonate, with slightly noticeable concentric zones, with whitish growth zone and even outline; margin zone is raised. Hyphal strands not numerous, thin, not branched, present in the growth zone only. Aerial mycelium thick, not interwoven, short in the growth zone. Reverse darkening and later turns deep dark brown. Clamp connections are not at every septum, abruptly curved, short, small, numerous anastomoses are present on hyphae. (Table 56, Fig. *a*).

TELEOMORPH

Pileus 5-10 cm in diam., fleshy, hemispherical-convex, inflated in the center, light grayish-brownish, paler towards the margin: dark gray, with whitish edge, yellow on bruising, smooth; later on cuticle cracking, covered with small appressed squamules. Lamellae free with small collarium, thin, crowded, whitish; later cream, with white sterile even edge (slightly uneven if studied with under lens), easily separated from the pileus. Lamellules of various sizes present. Stipe 6-7.5 × 1-1.2 cm, central, cylindrical, sometimes curved, slightly widening towards the base, smooth, fistulose, white; turns yellow on bruising and when drying off. Ring apical or situated in the middle of the stipe; simple, white, with fibrose-tomentose border. Context white, does not change on exposure, with pleasant smell. Spore print whitish. Basidiospores 6-10 × 3-7.5 μm, colorless or pinkish,

ellipsoid-amygdaliform, with lateral apiculus, smooth, with small germ pore, thin-walled, with one fluorescent droplet, achromatic, dextrinoid, reddish-brownish with Melzer's Reagent. Basidia 22-30 × 7-8 μm, 4-sterigmate, clavate. Cheilocystidia 24-40(45) × 10-15 μm, clavate, cylindrical, broadly fusiform, lageniform. Pleurocistidia absent. Hymenophoral trama regular. Pileal covering a trichoderm, consisting of 3-5 μm-wide hyphae with tapering thick-walled transparent terminal elements 37.5-74 × 7.5-12.5 μm. Fruit bodies are solitary, in the gardens, parks, grasslands.

Practical usage: not edible, medicinal.

***57. Leucoagaricus leucothites* (Vittad.) Wasser** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony with concentric zones of different colors and radial sectors of different density. Pale gray center of the colony turns deep olive-green towards the margin zone, although the growth zone is white. Reverse becomes darkened with age and turns brown with zones of darker and paler color. Vegetative mycelium thin-walled, much branched, with numerous anastomoses. Clamp connections infrequent, abruptly curved, short, small, spouting clamp connections observed in the center of the colony. (Table 57, Figs. *a*, *b*).

TELEOMORPH

Pileus 4-9 cm in diam., thick-fleshy, hemispherical, later convex-applanate with a small bulb, white dingy-white, sometimes in the center ashy-gray-lilac, on handling not yellowish, on drying sometimes reddish-brown, smooth. Sometimes cuticle scaly-grainy on cracking. Margin involute, later convex, with remnants of the veil. Lamellae free, crowded, with an even edge, white, later pinkish, on drying becoming dark. Stipe 4-8 × 1-1.5 cm, central, cylindrical, sometimes slightly twisted, expanding towards the base, fistulous, white, naked, smooth, stringy. Ring apical, simple, white, often disappearing. Context white, on exposure unchanging. Odour and taste pleasant. Spore print whitish. Basidiospores 7-10 × 5-6 μm, average 7.5-8 × 5-6 μm, ellipsoid-amygdaliform, with rounded apex, with a small

germ pore, colorless, metachromatic, dextrinoid, thin-walled. Basidia 4-sterigmate, 25-40 × 9-10μm, clavate. Cheilocystidia 40-57 × 7.5-15μm, variously shaped, abundant, lecythiform, narrowly lageniform with subcapitate apex, cylindrical, narrowly clavate with subcapitate apex, moniliform, utriform with variously shaped appendix, irregular. Hymenophoral trama irregular. Pileipellis made up of erect to ascending cylindrical hyphae, with terminal elements. Clamp connections not observed. Fruit bodies are solitary or with groups, in parks, grasslands, on roads.

Practical usage: edible, medicinal.

58. Leucoagaricus wichanskyi **(Pilát) Bon & Boiffard** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony slowly growing, light brown, whitish with faint grayish tint, zonate with concentric bands of different density texture, almost felty in the center, downy, plumose with small hyphal tufts in the growth zone. Margin of a mat is even, appressed; aerial mycelium short, thin, slightly interwoven, reverse not changing color. Vegetative mycelium consists of the frequent branching, with septated, thin-walled, generative hyphae without distinguishable pigment. Clamp connections are present on all septa, medallion. Chlamydospores, anastomoses, and mycelial cords are present. (Table 58, Figs. *a-d*).

TELEOMORPH

Pileus 2.5-6 cm in diam., thin-fleshy, hemispherical, later inflated-convex, sometimes with tiny flattened umbo, beige, pink-brown, pale or dark brownish, paler at margin, dry, slightly granular, with thin floccose-scaly, radially cracked surface; flesh in cracks forms white background. Flakes remaining from the universal veil, consisting of the 2.5-13 μm wide thin-walled hyaline septated hyphae, are often present at the center and margin of the pileus. Lamellae free (collarium 0.1-0.25 cm), thin, crowded, white, whitish-cream, unchanged on bruising with concolorous even edge. Stipe 3-8 × 0.3-0.7 cm, central, cylindrical,

straight, sometimes curved, tapering towards the apex, abruptly bulbous, bulb up to 2 cm wide, silky-fibrillose, stuffed, later slightly fistulous, whitish. Ring apical or situated in the middle of the stipe, simple, white, ocher at the edge, coming off, smooth above and below. Context white in pileus and stipe, does not change on exposure (turns yellowish-brownish in the bulb), becomes slightly yellow on drying, without any particular smell or taste. Spore print whitish, with cream tint. Basidiospores 8-10 × 6-7.2 μm (seldom – 10 × 5.5 μm), of various shape, ellipsoid-amygdaliform mainly, with lateral apiculus, smooth, hyaline; germ pore slightly visible, thick-walled, with one or several fluorescent droplets, dextrinoid, endosporium, not metachromatic. Basidia 32.5-35 × 12.5-15 μm, 4-sterigmate, clavate. Cheilocystidia 40-47 × 12.5-15 μm, clavate, narrowly fusiform, narrowly lageniform with subcapitate apex, often with small crystals at the apex, thin-walled. Pleurocystidia absent. Pileal covering consists of thin-walled tapering hyaline hyphae 100-230 × 5-12.5 μm cluster in bunches. Gill trama regular. Fruit bodies are solitary or with small groups, in the parks, grasslands, gardens, sometimes in stony desertic areas in the East.

Practical usage: edibility unknown, medicinal.

***59. Lycoperdon pyriforme* Schaeff.** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony dirty white, felty, not dense, with branched mycelial cords. Clamp connections, anastomoses, and hair-like crystals are present on hyphae. (Table 59, Figs. *a-c*).

TELEOMORPH

Pileus shaped like an inverted pear, or more or less round, 1.5-5 cm wide, 2.5-5 cm high, dry, often covered with tiny white spines when young and fresh, but the spines usually disappearing by maturity, typically with a pinched-off stem base, by maturity developing a central rupture through which spores are liberated by rain drops and wind currents, whitish to yellowish brown, with a white, fleshy interior at first; later with yellowish to olive granular flesh and eventually filled with

brownish spore dust. 7-15(20) cm in diam. Spores 3.5-4.5 μm, round, smooth. Fruit bodies are scattered to clustered on well-rotted stumps and woody debris, also on lignin-rich soils, fruiting from after the fall rains to mid-winter, widely distributed and common.

Practical usage: edible when young, medicinal.

***60. Lyophyllum decastes* (Fr.) Singer** (Lyophyllaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white, cream, dense, woolly, with no distinct radial sectors. Vegetative hyphae are structured, with clamp connections, anastomoses, crystals of various forms and chlamydospores occur infrequently. (Table 60, Figs. *a-e*).

TELEOMORPH

Pileus 6-10(150) cm in diam., hemispherical when young, later convex to plane and sometimes undulating, center usually with an obtuse umbo, pliant but not with a cartilaginous rind, surface smooth, lardaceous-shiny, gray-brown to hazel-brown, paler toward the margin, sometime almost whitish, margin acute. Lamellae whitish, relatively narrow, horizontally adnate, at times some forked toward the stipe, edges smooth. Stipe 4.5-10(20) × 8-15(20) cm, cylindric to clavate, sometimes tapered toward the base, often also twisted or eccentric. Surface whitish to dingy white, longitudinally fibrillose, apex white-pruinose, solid, elastic. Usually clustered, crowded, or in fairy rings, more rarely solitary. Context thick in the center, thin toward the margin, white, elastic, odourless, taste mild, not distinctive. Spore print white. Basidiospores subglobose, smooth, hyaline, 5.6-6.9 × 5.1-6.6 μm. Basidia 4-sterigmate and basal clamp, clavate, 32-47 × 8-10 μm, with siderophilous granules. Cistidia not observed. Pileipellis made of parallel hyphae 4-12 μm across, with brownish pigmentation, septa with clamps. Fruit bodies grow in hardwood and coniferous forests, in grassy places, alongside paths or streets, in parks or gardens, on humusy soils, rarely also in cellars.

Practical usage: edible, medicinal.

***61. Lyophyllum ulmarium* (Bull.) Kühner (= *Hypsizygus ulmarius* (Bull.) Redhead)** (Lyophyllaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white to grayish-white, felty, to 5-7 sm high in the center and appressed in the growing zone. Clamp connections, conidial sporulations and anastomoses are often present on hyphae. (Table 61, Figs. *a-g*).

TELEOMORPH

Pileus 8-12(15) cm in diam., hemispherical when young, later plane to pulvinate, center sometimes slightly umbonate, margin incurved for long time, surface smooth, dull, radially innately fibrillose to radically split, cream-colored to ocher, often with gray tones, with a tendency to turn yellow in age, dry, margin sometimes incurved, acute. Lamellae whitish when young, later cream-yellow, broad, broadly adnate and decurrently as a tooth, edges undulating. Stipe 8-15 × 1-3 cm, slightly clavate, base somewhat tapered, usually eccentric and bent, surface coarsely longitudinally fibrillose to elongate-alveolate, especially toward the base, cream-yellow to ocherish, tough-fleshed, solid. Context white, though-fibrous, thick, odour sourish, taste mild, not distinctive. Spore print whitish. Basidiospores subglobose, smooth, hyaline, with dropes, 5.5-7.2 × 4.5-6.1 μm. Basidia 4-sterigmate, with basal clamp, clavate, 26-30 × 6-7.5 μm, with weakly developed siderophilows granules. Cystidia not observed. Pileipellis made of parallel hyphae 3-9 μm across, the uppermost hyphae gelatinized, septa with clumps. Fruit bodies grow in floodplain forests, parks, along streets, on living or dead trunks of hardwoods.

Practical usage: gourmet, commercially cultivated, medicinal.

***62. Macrolepiota affinis* (Velen.) Bon** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony brownish, not dense, transparent, concentric zonate, with mycelial cords. Hyphal coils are formed. Clamp connections, anastomoses, and crystals are present on hyphae. (Table 62, Figs. *a-d*).

TELEOMORPH

Pileus 5-12 cm in diam., at first convex-hemispherical or campanulate, later on convex, with an acute conical umbo, with a wide base, pileal cuticle is thorough in the center, brownish-reddish, reddish-gray, cracking towards the edge into small reddish or brownish squamules. Lamellae crowded, whitish, later on slightly creamish or creamish-yellowish, free, forming a distinct collarium. Stipe 5-13(20) × 0.5-1(3) cm, attenuate in the upper part and enlarging in the lower part forming a not very pronounced bulb, the surface is densely bested with tiny brown adpressed scales. Ring mobile, simple, whitish, with the margin concolorous with the pileus. Context unchanging, whitish in the pileus, discoloring faintly reddish at the stipe surface. Spore print whitish. Basidiospores 13-16(20) × (7)7.9-9.5(11) μm, ellipsoid, with the protruding germ pore, with metachromatic endosporium. Basidia 30-50(55) × 11-15 μm, calvate, mostly 4-sterigmate. Pleurocistidia absent. Cheilocystidia 20-40(50) × 8-13(15) μm, ventricose, ventricose-fusiform, calvate, seldom septate. Pileipellis is a trichoderm, consisting of cylindrical hyphae 6-12 μm in diam., sometimes septated. Clamp connections present. Fruit bodies grow in forests and glades, in the grass.

Practical usage: edibility unknown, medicinal.

***63. Macrolepiota procera* (Scop.) Singer** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony at first white, turns pale gray, downy, transparent, sparse, with noticeable hyphal strands, later on colony develops distinct concentric zones of different tints (dark-gray and pale-gray) and radial sectors of different density, felty, plumose at margin. Reverse turns dark brown.

Vegetative mycelium of the growth zone consists of hyphae, thin-walled, septated, branching, hyaline. Clamp connections not at every septum, curved, large medallion. Mycelia of the center of the colony is composed of thick-walled, brown, branching septated hypha, with numerous clamps connections. Hyphae with anastomoses and crystals of different sizes are present. (Table 63, Figs. *a*-*e*).

TELEOMORPH

Pileus 10-40 cm in diam., thick-fleshy, at first ovoid, ovoid spherical, campanulate, conical, later subapplanate, applanate, whitish, grayish, grayish-brownish, with a darker center, cuticle cracking into angular, large, brownish-chestnut, with easily separating scales, towards the edge floccose-fibrillose. Lamellae free, forming collarium, crowded, ventricose, with an even edge, easily separating from pileus, snowy-white, white, creamy-white, sometimes with reddish tinge. Stipe 8-40 × 1-4 cm, central, cylindrical, towards the base enlarged into a bulb, with fibrillose scales, arranged in zigzag or concentric circles. Ring apical, wide, movable, upper side white, under side brownish, with a bifurcate edge. Context compact, white, on exposure unchanging. Without a particular odour. Taste pleasant. Spore print whitish. Basidiospores 14-18(19) × 9-12 μm, colorless, metachromatic, ovate, ellipsoid, with a germ pore, apiculus lateral, with fluorescent content, smooth. Basidia 4-sterigmate, 35-45 × 14-16 μm, clavate, thin-walled, hyaline. Sterigmata 4.5-5.5(6) μm long. Cheilocystidia 30-55 × 12-20 μm, polymorphic in shape, clavate, fusiform, almost pear-shaped, catenulate, utriform, cylindrical, etc., thin-walled, hyaline. Spore print whitish-creamy. Hymenophoral trama regular. Hyphae of trama 7-15 μm in diam., consisting of cylindrical thin-walled, hyaline, smooth cells with clamps on septa. Pileipellis a trichoderm with cylindrical hyphae 8-14(16) × 300-400 μm, regularly septate, with attenuate, clavate terminal elements, brownish intracellular pigment is observed. Clamp connections present. Fruit bodies are solitary or mostly in groups, in coniferous or deciduous forests, parks, fields.

Practical usage: edible, medicinal.

***64. Marasmius oreades* (Bolton) Fr.** (Marasmiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cottony, dense with age becoming brown and crustose. Clamp connections and anastomoses are present on hyphae. (Table 64, Figs. *a*, *b*).

TELEOMORPH

Pileus 2-5.5 cm, hemisperical-campanulate to convex, later plane with a broad umbo, surface smooth, hygrophanous, orange-ocher to red-brownish and somewhat lardaceous-shiny when moist, cream colored to pale lather-colored with a darker umbo and dull when dry, margin acute, even to slightly crenate. Lamellae whitish to cream-colored, broad, notched, intervenose, edges smooth. Stipe 3-7(10) × 3-6 cm, cylindric, sometimes widened toward the apex, finely tomentose to scurfy, cream-colored to brownish, white tomentose at the base, often twisted, solid, tough, elastic. Context whitish, thin, soft, odour pleasantly aromatic, taste mild, mushroomy. Spore print whitish. Basidiospores elliptic-shaped, smooth, hyaline, some with dropes, 7.5-10 × 5.0-6.4 μm. Basidia 4-sterigmate and basal clamp, slenderly clavate, 40-50 × 5-8 μm**.** Caulocystidia cylindric to clavate and flexuose, some with knot-like out-growth, thin to thick-walled, 35-50 × 5-8 μm. Pileipellis hymeniderm, made of clavate elements 7-15 × 5-7μm, subcutis of irregular hyphae, septa with clamps. Fruit bodies grow in meadows and pastures, in grassy forests, on forest paths and in gardens.

Practical usage: edible, medicinal.

***65. Marasmius scorodonius* (Fr.) Fr.** (Marasmiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony light brown in the center and white in the zone of growth, downy in the center and velvety at the margin; reverse light pink, teleomorph (carpophores) are formed on agar media. Clamp connections and anastomoses are present on hyphae. (Table 65, Figs. *a-c*).

TELEOMORPH

Pileus 1-3cm across, broadly convex expanding to nearly flat, with an inturned margin that becomes wavy, reddish or yellowish-brown becoming faded, dry, smooth, radially wrinkled. Lamellae adnate or nearly free, crowded, narrow, often forked, yellowish-pink to pallid. Stipe 15-60 × 1-3 mm, round to compressed, yellowish-white toward the top, dark brown below, dry, smooth, shining, brittle. Context whitish, membranous. Odour of onions or garlic. Taste of onions or garlic. Spore print white. Basidiospores ellipsoid-dacryoid, smooth, hyaline, some with drops, 7-10 × 3-5 μm. Basidia 4-sterigmate and basal clamps, slenderly clavate, 31-38 × 5-6.5 μm Cheilocystidia clavate, thick-walled, with digitiform to coralloid outgrowths, 23-30 × 10-18 μm. Pileipellis hymeniform, made of spherical to pyriform, smooth cells 20-40 × 10-23 μm, brownish pigmented. Fruit bodies grow in conifer forests, also in forest meadows, on needle litter, remains of wood, or among grasses, primarily on sand-silicate soils.

Practical usage: gourmet, medicinal.

***66. Montagnea arenaria* (DC.) Zeller** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony not dense, slow growing, whitish, brownish with age. Clamp connections, anastomoses, hair-line crystals, and conidial sporulations are present on hyphae. (Table 66, Figs. *a-d*).

TELEOMORPH

Fruit body 9-12 (20) cm high. Pileus 5-6 cm in diam., convex, depressed in the center, millet yellow to pale brownish-gray. Stipe 9-20 × 0.5-1 cm, white, becoming light millet yellow or pale brownish-gray, cylindrical, the discoid apex continuous with the pileus, covered with some coarse lacerated scales, seated in basal volva. Tramal plates about 5 mm broad, hanging under the pileus, free from the stipe. Spore print black. Basidiospores 10-12 (15) μm, oblong to elliptical, dark brown, smooth. Fruit bodies grow in grassland or in desert.

Practical usage: not edible.

***67. Morchella angusticeps* Peck** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelium colony initially gray, thickens soon and becomes gray-brown, developing numerous brown with orangish to golden, microsclerotia at first white became dark – then divergent, fast running, and non-aerial. With age the mycelial mat resembles a squirrel's fur, typically with microsclerotia that conglomerate. In the zone of sclerotia formation lacunose hyphae are present. Conidial sporulations of *Costantinella terrestris* types are present, also conidial sporulation of *Oidium* type may occur. (Table 67, Figs. *a-c*).

TELEOMORPH

Pileus oblong-conical and subobtuse or narrowly conical and acute, adnate to the stem, one or two inches high, and about half as broad at the base; ribs longitudinal, here and there anastamosing or connected by transverse veins; stem subequal, hollow, whitish, furfuraceous without and within, even or rarely rough with irregular longitudinal furrows; asci cylindrical; spores elliptical, whitish tinged with ochre-yellowish 20-30 ×12-14 μm; paraphyses short, clavate, with one or two septa near the base. Fruit bodies grow in mixed forests, storage places for wood, and waste places. The fruiting bodies can appear after fires.

Practical usage: edible, medicinal.

***68. Morchella conica* Pers. (= *Morchella vulgaris* (Pers.) Boud.)** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is wooly, not dense, white, becoming grayish or light brown; reverse is light brown. Microsclerotia are forming on MEA and ChA agar media. Budding cells, lacunose hypha and mycelial cords are present. Conidial

sporulation of *Costantinella terrestris* type occurs, and also conidial sporulation of *Oidium* type is present on hyphae. (Table 68, Figs. *a-e*).

TELEOMORPH

Fruiting body 5-15 (30) cm tall, cylindrical to sharply conical with parallel, sinuous longitudinal ribs, which are connected by cross-ribs. The surface therefore appears honeycomb-like (alveolate), gray to olive-brownish, ribs turning black with age. Stalk white to ochre, furfuraceous, flecked here and there with rust, sometimes broad toward the base, wrinkled, hollow. Margin of cap is sharply bent inward and attached to stalk. Flesh elastic, taste pleasantly mild. Spores smooth, broadly elliptical, hyaline (18) 20 – 24 (26) × 11-14 (16) μm, sometimes with small droplets on both ends (outside the spore wall). Asci 8-spored, 300-350 (375) × 25-28 μm, paraphyses septate and branched, with clavate thickenings to 16-18 μm at the tips and with brownish contents. Fruit bodies grow in forests on flood plains, spruce forest, wet alder stands, forest edges, storage places for wood, burned areas, commonly in vicinity of ash trees.

Practical usage: edible, medicinal.

***69. Morchella crassipes* (Vent.) Pers.** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, more or less dense, white, becoming grayish or light brown soon; reverse is brown. Microsclerotia are yellow-brown, more abundant on OMYA agar media. Lacunose hyphae are present in the zone of sclerotia formation. (Table 69, Figs. *a*, *b*).

TELEOMORPH

Apothecia large, coarse, 7-15 high, 7-10 cm broad, ovoid to campanulate, sometimes acute, with olivaceous-brown, irregular, angular, deep depressions, 1-1.5 cm broad, ridges broad, dark brownish; stem 10-11 × 5-6 cm, stout, hollow, lower half often much thickenings, wide, deep, longitudinal furrows, cream, often with reddish-brown patches. Spores smooth, broadly elliptical, light yellow, 20-25

× 12-15 µm. Asci 8-spored, elliptical, 200-215 × 22 µm, paraphyses branched with clavate thikenings. In enriched soil in gardens and burnt ground; spring to early summer. Fruit bodies grow on the ground under trees (*Acer, Populus* and *Fraxinus*).

Practical usage: edible, medicinal.

***70. Morchella esculenta* (L.) Pers.** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, dense, white, becoming grayish or brownish quickly; reverse is dark brown. Microsclerotia yellow-brown, more abundant on OMYA agar media. Lacunose and incrustated hyphae and conidial sporulation of *Costantinella terrestris* type are present. (Table 70, Figs. *a-e*).

TELEOMORPH

Fruit bodies very variable in size and shape, up to 20 cm high, the fertile upper part covered by a honeycomb-like arrangement of narrow ridges surrounding angular and often slightly elongated shallow pits, at first grayish, becoming yellowish-brown; stalk white to cream-colored, cylindrical or slightly enlarged at the base, brittle, hollow, the surface even or marked by longitudinal furrows, minutely scurfy. Asci up to 300 × 20 µm; spores broadly elliptical, 16-23 × 11-14 µm, almost colorless under the microscope but deep cream-colored in the mass; paraphyses cylindrical or slightly upwards, multiseptate, 8-17 µm broad. Fruit bodies are solitary under trees (*Acer, Corylus, Fagus, Fraxinus,* and *Ulmus*) in open woods, orchards, roadside banks or in open grassland.

Practical usage: edible, medicinal.

***71. Morchella semilibera* DC. (= *Mitrophora semilibera* (DC.) Lév.)** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, more or less dense, at first white, becoming grayish or brownish quickly; reverse is brown. Microsclerotia are yellow-brown, solitary, more abundant on MEA agar media. Lacunose, anomalouse hyphae, and anastomoses are present. Conidial sporulation of *Costantinella terrestris* type occurs. (Table 71, Figs. *a-c*).

TELEOMORPH

Margin of apothecia free of stem in one-third to one-half the length; apothecia small, campanulate, acute, 2-4 cm high, 1.5-3 cm broad, depressions deep, grayish-brown, vertically elongate, 5-10 × 2-5 mm; vertical ridges dark brown, sharp, in subparallel rows, horizontal ridges low, mostly concolorous with hymenium; stem 2-12 × 1-3 cm, hollow, cream, furfuraceous, all over with short, low depression, at base with deep furrows. Asci cylindrical, 320-350 × 18-19 µm. Spores ellipsoid, smooth 13-24 (27-28.5) × 12-14 µm. Paraphyses cylindrical, slender with clavate thickenings. Fruit bodies grow on rich soil in deciduous forests or in parks and gardens.

Practical usage: edible, medicinal.

***72. Morchella spongiola* Boud.** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, at first white, becomes cream or light brown quickly; reverse is brown. Microsclerotia are yellow-brown on ChA media. Lacunose, anomalouse hyphae, and anastomoses are present. Conidial sporulation of *Costantinella terrestris* type occurs. (Table 72, Figs. *a-d*).

TELEOMORPH

Apothecia 1-3 cm high, 1-2.5 cm broad. Whitish-red spots, ridges concolorous or yellowish-white. Stem 1-2 ×0.5-1 cm depressions 2-5 mm broad, whitish to cream, sometimes with yellowish-brown tinge, thickened below, furrowed. Asci cylindrical, 250-300 × 19-20 µm. Spores ellipsoid, smooth 20-25 ×

12-13 μm. Paraphyses cylindrical, slender with clavate thickenings. Fruit bodies are sandy paths in gardens, places along hedgerows.

Practical usage: edible, medicinal.

***73. Morchella steppicola* Zerova** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, dense, cream or light brown; reverse is brown. Microsclerotia solitary on agar media are usual, more abundant on PDA. Lacunose, anomalouse hyphae, and anastomoses are present. Conidial sporulation of *Costantinella terrestris* type occurs. (Table 73, Figs. *a-d*).

TELEOMORPH

Apothecia (2.5) 5-15 cm high, cap ovoid, spheric-ovoid, sometimes depressed from the top. Grayish-brown, narrow ridges, with irregular shape with warts in a margin. Margin of apothecia not free of stem. Stem white, more or less cylindrical, with wrinkles, withish-gray, 13-14 × 8-10 cm. Asci 8-spored, cylindrical, 200-270 × 15-18 (24) μm. Spores ellipsoid, (17) (25)-30(36) × (10) 13-15 (18) μm. Paraphyses cylindrical, 200-280 × 5-7.5 μm, with clavate thickenings to 8-10 μm at the tips. Fruit bodies grow in field on rich soil.

Practical usage: edible.

***74. Omphalotus olearius* (DC.) Singer** (Marasmiaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white, with age yellow in center, with alternating zones of rather distinct silky, appressed, and raised; dense, cottony aerial mycelium; aged colonies are dense, cottony; the center of the colony becomes granulose. The advancing zone is appressed or raised. Soft-crustose areas are formed at some places. At the margin of the colony, white or yellowish basidiocarp initials (primordia) are formed. Vegetative mycelia consists of thin-walled, branched hyphae (0.1) 1 to 5 (7) μm. Mycelial cords are typical while aged hyphae become

gold-yellow in some places. Clamp connections are usually present at all septa; they have the classic medallion shape. Conidial sporulation (arthroconidia) 2-7 × 0.7-2 μm in chains are usually present on thin hyphae. The formation of variously shaped crystals on hyphae takes place. (Table 74, Figs. *a-e*).

TELEOMORPH

Pileus 5-20 cm; convex but soon flat, eventually vase-shaped, the margin incurved, smooth, bright orange. Lamellae running down the stem, crowded, bright orange. Stipe 5-20 cm long, 1-2 cm thick, more or less equal, but tapering to base, solid, bright orange or darker below, smooth. Context pale orange, odour and taste not distinctive or disagreeable. KOH green on cap surface; ammonia greenish on cap surface. Spore print white to cream or pale yellow. Basidiospores 5.0-6.5 × 5.0-5.5 μm, globose to rarely subglobose, with thick wall, with obtuse base. Basidia 4-sterigmate, 23-36 × 6-9 μm. Cystidia absent. Hymenophoral trama regular. Pileipellis of parallel, 2-6 μm wide hyphae, with intracellular and membranous, rarely minutely incrusting pigment. Clamp connections present in all tissues. Fruit bodies grow in dense groups on stumps or at the base of deciduous trees.

Practical usage: medicinal, poisonous.

***75. Oudemansiella brunneomarginata* Lj. N. Vassiljeva** (Physalacriaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white, later with brown spots cottony, thick. Teleomorph usually forms on agar media. Hyphae are 3-4 μm thick, with clamp connection. On lateral branches conidial sporulation of arthroconidial type are forming. Warty incrustated hyphae and crystals are present. (Table 75, Figs. *a-f*).

TELEOMORPH

Pileus 6-10 cm in diam., hemispherical when young, then expanded, plane, with an obtuse umbo, with a peelable slime layer when moist, silky when dry, pale brown, with the dark yellowish-brown center, margin acute, wrinkled-

striate. Gills white when young, later pale yellow, with pale brown edges, broad, thin. Spore print white. Basidiospores 15-17 × 9-12 μm, elliptic, smooth, hyaline to pale brown. Cheilocystidia sparse, fusiform-ventricose to clavate. Stipe 9-13 × 0.7-1.0 cm, cylndric, bulbous at the base (up to 2 cm), pale brownish, black-brownish squamose-fibrilose. Flesh thick, whitish, almost odourless. Fruit bodies grow solitary on deciduous trees, often on large standing or fallen trunks, also stumps.

Practical usage: edible, medicinal.

***76. Oudemansiella mucida* (Schrad.) Höhn.** (Physalacriaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is first white, with age has brown spots, thick, with mycelial cords. Teleomorph often forms on agar media. Hyphae are 3-4 μm thick, with clamp connections; warty incrustated hyphae are present. (Table 76, Figs. *a-d*).

TELEOMORPH

Pileus 2-5.0(8.0) cm across, hemispherical when young, then convex to plane, surface covered with a peelable slime layer when moist, dull silky when dry, ivory-white with an ocherish center (sometimes also with a darker overtone), margin acute, wrinkled-striate up to ¼ width of the pileus. Lamellae white to pale cream, broad, notched and broadly adnate, edges smooth. Stipe 3-6(10) × 2-5(8) cm, cylindric, base clavate to bulbose, upper third below, stipe longitudnally striate, and dry above the ring, smooth and lubricous below the ring, whitish, increasingly gray-brownish squamose-fibrillose toward thh base, solid, flesh tough, longitudinally fibrous whitish. Context white, thin, odour faintly herbaceous-sourish, taste mild, pleasently herbaceous. Spore print pale cream. Basidiospores globose to subglobose, smooth, hyaline thick-walled with drops, 15-20 × 14.5-19 μm. Basidia 4-sterigmate and basal clamp, 70-90 × 16-22 μm. Pleuro and **c**heilocystidia sparse, fusiform-ventricose to clavate, 70-110(140) × 20-40 μm, slightly thick-walled. Pileipellis palisadiform, composed of erect, clavate to

gnarled, more rarely digitliform hyphal ends, embedded in a gelatinous substance, septa with clamps. Fruit bodies grow on standing or fallen trunks, branches, and stumps. More rarely a weak parasite.

Practical usage: edible, medicinal.

***77. Oudemansiella radicata* (Relhan) Singer** (Physalacriaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony at first white, later with brown spots, thick, cottony. Hyphae are 3-5 μm thick, with clamp connection. Teleomorph often forms on agar media. (Table 77, Figs. *a*, *b*).

TELEOMORPH

Pileus 3-10 cm across, bell-shaped to convex then flattened with a broad umbo, pallid or ochraceous to olive-brown, radially wrinkled, slimy. Lamellae white, adnate with short decurrent tooth, deep and thick, rather distant. Stipe 8-20 × 0.5-1.0 cm, white at the apex, flushed with cap color towards the thickened long-rooting base. Context thin, concolorous. Spore print white. Basidiospores broadly elliptic, nonamyloid, 12-16 × 10-12 μm. Fruit bodies grow under or near deciduous trees, especially beech, attached to roots or buried wood.

Practical usage: gourmet, medicinal.

***78. Panus tigrinus* (Bull.) Singer (= *Lentinus tigrinus* (Bull.) Fr.)** (Polyporaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony fast growing, dense, felty, white with age, with brown-crusted spots on mycelial mat. Teleomorph forms on agar media. Clamp connections, chlamydospores and anastomoses are present on hyphae on agar media and in submerged culture. (Table 78, Figs. *a-f*).

TELEOMORPH

Pileus 4-10 cm across, spherical when young, then expanded and convex, finally infundibuliform, sometimes omphalinoid, surface with brown-black scales

on a cream-whitish to yellowish-whitish background, floccose-squamose in the center, increasingly appressed-fibrillose toward the margin, margin acute, indulating and cleft in age. Lamellae cream to yellowish, broad, decurrent, edges finely serrate. Stipe 3.0-5.0(8.0) × 0.4-0.8 cm, cylindric to compressed, sometimes also conic, rooting, sometimes eccentric, cream-whitish, finely gray-brownish in squamose-punctate toward the base, sometimes with a fugacious ring zone when young, solid, tough. Context whitish, at times somewhat yellowing, thin, tough, odour pleasant and strongly fruity, taste mild, pleasantly mushroomy, irritating-astringent after being chewed for a fairly long time. Spore print white. Basidiospores cylindric to elliptic, smooth, hyaline, with drops, 5.9-7.8 µm. Basidia 4-sterigmate and basal clamp, cylindric-clavate, 25-30 × 5-6 µm. Cystidia not seen, marginal cells 20-25 × 2-3 µm. Pileipellis parallel hyphae 2-6 µm across, slightly gelatinized, septa with clamps, short-celled, dark brown hyphae of the scales overlying it in places. Fruit bodies grow in floodplain forests, along stream and river banks, principally on trunks and dead branches.

Practical usage: edible when young, medicinal.

***79. Peniophora gigantea* (Fr.) Massee** (Phanerochaetaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white at first, appressed to downy, becoming farinaceous to floccose quickly, clamp connection rare. Aerial hyphae 2-6 µm wide, sometimes encrusted. Conidial sporulation (arthroconidia) 2-4.5 µm diam. are abundant on hyphae. (Table 79, Figs. *a-f*).

TELEOMORPH

Furit body resupinate, often found in membranous to crustose patches several centimeters in extent, up to 0.6 mm thick, adnate when fresh, whereas often separable on drying. Hymenial surface grayish-white when fresh, cream-colored when dry, smooth, sometimes minutely velutinous, better observable under hand lens, when dry cracked and sometimes with the margin rolled up from the subiculum. Basidiospores narrowly ellipsoid to broadly cylindrical, 5-7 × 2.5-3.5

μm, smooth, thin-walled, negative in Melzer's Reagent. Basidia slenderly clavate 20-35 × 4-6 μm, hyaline, 4-sterigmate and without basal clamp. Lamprocystidia subulate to cylindrical, hyaline, thick-walled, strongly encrusted, 45-100 × 9-20 μm, projecting up to 40-50 μm above basidia. Hyphal system monomitic, generative hyphae hyaline, simple septate, thin to slenderly thick-walled, strongly agglutinated in the subiculum, 2.5-5.5 μm in diam. Fruit bodies are common throughout the boreal forests of the Northern Hemisphere, this species is associated with a white rot of coniferous wood. On fallen trunks and branches especially of *Pinus*, as well on other types of conifers.

Practical usage: medicinal.

***80. Phallus impudicus* L.** (Phallaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cream, with abundant aerial mycelium and mycelial bundles. Clamp connections, anastomoses, crystals, chlamydospores and excretory cells are present on hyphae. Inside some inflated cells of the vegetative mycelium crystals form. (Table 80, Figs. *a*-*e*).

TELEOMORPH

Immature fruiting body like a whitish to yellowish (or purplish, in *Phallus hadriani*) "egg" up to 6 cm across; usually at least partly submerged in the ground; when sliced revealing the stinkhorn-to-be encased in a gelatinous substance. Mature fruiting body spike-like, to 25 cm high; with a cap 1.5-4 cm wide, which is covered with olive-brown to dark brown slime, often developing a perforation at the tip, the cap surface pitted and ridged beneath the slime, with a whitish, hollow stem, 1.5-3 cm thick, the base enclosed in a white, sack-like volva, which is often at least partly submerged underground. Spores 3.5 × 1.5-2.5 μm elliptical or oblong; smooth, with 2 drops. Basidia 6-8 sterigmate and basal clamp, slenderly clavate, 18-25 × 3.5-4.5 μm. Cystidia not seen. Generative hyphae 1.5-2.5 μm across, septa with clamps; hyphae in the gleba surrounded by amorphous substance, 1-6 μm across, hyphae in the endoperidium strongly gelatinized with

brownish pigmentation, 1.5-3 µm across, septa with clamps. Fruit bodies grow on soil among needle litter in coniferous forests, also in hardwood forests, more rarely in parks on coarse humus.

Practical usage: medicinal.

***81. Phellinus igniarius* (L.) Quél.** (Hymenochaetaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony woolly, cottony, yellow, ochraceous buff or brown. Aerial pigmented mycelium forming crustose layer. Reverse bleached to locally darker. Aerial hypha 1.5–6(-9) µm wide. Conidial sporulations and anastomoses are present on hyphae. (Table 81, Figs. *a-c*).

TELEOMORPH

Fruit body perennial, often solitary more rarely in groups, sessile or rarely effused-reflexed, ungulate to applanate, woody-hard, broadly attached to substrate, 5-25 × 5-20 × 3-15 cm thick. Abhymenial surface glabrous, cruatose, dull, sulcate, gray to blackish, becoming deeply rimose. Margin inflated, obtuse, dull, concolorous to light colored. Hymenial surface porose, pale cinnamon to dark purplish brown, the pores rounded, 4-6 per mm, with thick, entire dissepiments. Context dark brown, zonate, hard and brittle, up to 2 cm thick. Contextual core usually absent, when present rudimentary, 7-12 mm in diam., with intermixed whitish tissue, located next to the substrate. Tube layer indistinctly stratified, individual layers 1-5 mm thick, old tubes tapped with whitish mycelium. Basidiospores subglobose, hyaline, thick-walled, smooth, 5-7 x 4-6 µm, negative in Melzer's Reagent. Basidia clavate, 8-11 x 6-7 µm, 4-sterigmate, without basal clamp. Setae usually numerous in the hymenium and more rare in the core, ventricose to subulate, reddish-brown, thick-walled, 12-20 x 4-9 µm. Hyphal system dimitic. Generative hyphae hyaline, with simple septa, thin-walled, branched, 2-3.5 µm wide. Skeletal hyphae brown, thick-walled, aseptate, sparingly branched, 2-6 µm in diam. Fruit bodies occur as parasite on several genera of

hardwoods, commonly reported on *Salix*, *Populus*, *Sorbus*, *Alnus* and *Malus*. Produces a white rot.

Practical usage: medicinal.

***82. Pholiota adiposa* (Batsch) P. Kumm.** (Strophariaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony yellowish, yellow to yellow-brown, felty, lacunose, granulated or packed in some places; teleomorph develops on agar media. Clamp connections, conidial sporulations, and crystals on hyphae are present on agar media and in submerged culture. (Table 82, Figs. *a-e*).

TELEOMORPH

Pileus 4-10 cm diameter, hemispherical with involute margin when young, expanding to convex, finally flattened with deflexed margin, with or without blunt umbo, not hygrophanous, not transculently striate, yellow-brown, with yellow to sulphur-yellow marginal zone, entirely covered with appressed to uplifted, reddish to blackish-brown, gelatinous squamules, particularly at center, in moist condition usually strongly slimy to glutinous, but slime easily washed off in rainy weather; when young with large velar flocks, especially at margin. Lamellae moderately crowded to crowded, broadly adnate, sometimes emarginate or with decurrent tooth, thin, subventricose, up to 10 mm broad, pale lemon-yellow at first, through ochre-brown to reddish-brown with slight olivaceous tinge, with entire, concolorous edge. Stipe 2-5 cm long × 0.5-1.0 cm diameter, centrally or slightly eccentrically inserted, tapering towards common base, solid then fistullose, when young with well-developed, thick, fibrillose-floccose annulus, above annulus pale yellow, orange to reddish-brown below, glabrous above annulus, squamulose with dark reddish to blackish-brown, gelatinous squamules below, glabrous above annulus. Context whitish-yellowish, with mild taste and indistinct smell. Spore print dark reddish-brown. Basidiospores 5-6.5 × 3-4 µm, smooth, ellipsoid, nonamyloid, amygdaliform. Fruit bodies grow on living and dead stems of tree, especially *Fagus* sp., usually low on the stem or on roots and trunks.

Practical usage: not edible, medicinal.

***83. Piptoporus betulinus* (Bull.) P. Karst.** (Fomitopsidaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is white to cream, dense, cottony. Advancing zone appressed to raised, hyphae distant. Chlamydospores on hyphae are present, (6-12 × 5-8 µm) with slightly thickened walls, some hyphae with short, multibranched lateral hyphae. Clamp connections are usual on hyphae. (Table 83, Figs. *a-c*).

TELEOMORPH

Fruit bodies annual, dimidiate, flabellate, pseudostipitate, attachment point umbonate, up to 5-25 × 5-25 x 2-5 cm thick. Stipe when present up to 7 cm long. Abhymenial surface smooth, not zoned, with a papery thin cuticule usually cracked, cream-white when young later becoming ochraceous-brown. Margin concolorous, thick, inflexed. Hymenial surface porose, white to cream-white, pores roundish 3-5 per mm. Context whitish, homogenous, soft when fresh becoming tough and hard when dry. Tube layer whitish, easily separable from the context, up to 10 mm thick. Basidiospores cylindrical to allantoid, hyaline, smooth, thin-walled, 5-7 × 1.5-2 µm, negative in Melzer's Reagent. Basidia clavate, hyaline with a basal clamp, 12-30 × 4-6 µm. Cystidia or other sterile elements absent. Hyphal system dimitic. Generative hyphae hyaline, clamped, thin-walled, branched, 1.5-3 µm wide. Skeletal hyphae interwoven, thick-walled, sparingly branched, 2-7 µm wide. Fruit bodies occur exclusively on dead wood of birch (*Betula*). Produces a brown cubical rot.

Practical usage: medicinal.

***84. Pleurotus abalonus* Y.H. Han, K.M. Chen & S. Cheng** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first white, then fluffy white, silk. As the mycelium matures conidial sporulation (coremia) occurs, radiating outwards from the center. Coremia

first with white stipe and white head (to 850 μ in diameter), becoming black quickly. Thick mycelial cords and teleomorph (primordial), which are also covered with coremia, form. Coremium formation on the mycelial colony surface starts as a little tangle of sterile hyphae which becomes a clavaroid form. Vegetative mycelium has thin-walled, branched generative hyphae, 2–7 μm in diameter and conidial sporulation (coremia). Growing coremium differentiates into the head and the stipe. Chains of alantoid conidia on the head of coremia for 12–20 × 4–7 μm. (Table 84, Figs. *a*-*e*).

TELEOMORPH

Pileus dark-brown to blackish-brown, margin entire to eroded, incurved, decurved or plane, often distinctly ribbed. Lamellae furcating, sometimes anastomosing, gill-face (dark) cream-colored to ochraceous, margin often dark-brown. Stipe 2-3 x 2-3 (apex) × 0.9-1.0 (base) cm, grayish-brown to dark-brown, apex glandular-dotted, flesh solid, whitish to brownish. Context whitish, with pleasant to aromatic odour, with mild, slightly astringent component. Spore print whitish. Basidiospores (9.5)-12.7-(19) × 3.4-4.8-(6.1) μm. Hymenophoral trama irregular. Cheilocystidia 21-39 × 5.3-6.4 μm, cylindric, tapering from base to apex, hyaline, later yellowish-brown, slightly thick-walled. Pleurocystidia 22.5-40 × 5-10 μm, cylindrical, thin-walled. Pileipellis consist of grayish, brownish-red, thin-walled cylindrical septate hyphae 2.5-5 μm, with clamp connections. Fruit bodies are growing in a moist and warm climate, on dead or living woody plants.

Practical usage: gourmet, commercially cultivated, medicinal.

***85. Pleurotus calyptratus* (Lindb.) Sacc.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dirty white, fibrous, pressed to agar media. Teleomorph forms on agar media. Hyphae 1.5-6.0 μm wide with conidial sporulations, clamp connections, and anastomoses. (Table 85, Figs. *a*-*e*).

TELEOMORPH

Pileus 3-10 x 2-6 cm, dimidiate, plano-convex, white to grayish to pale orange, with radiate, hygrophanous, nut-brown zones. Margin entire, later appendiculate (by the veil), incurved to inrolled, distinctly translucentstriate when moist. Lamellae decurrent, close, narrow, furcate, sometimes fragile, gill face cream, sometimes with a pink hue, turning yellow when dry, margin smooth to eroded, young white, later becoming yellow. Stipe absent or rudimentary, lateral. Context solid, elastic, white to cream, becoming citrine, with farinaceous, fruity to sweet odour, with mild taste. Spore print white to cream, ochraceaous when dry. Basidiospores (8.5)-10.6-12.7-(17.5) × (3.2)-4.2-5.3-(6.4) µm, broad elliptic, sides convex. Pileipellis consist of thin generative hyphae interwoven 4-5µm, thin-walled, hyaline, with frequent clamp connections. Fruit bodies are saprotrophic or weakly parasitic, substrates in nature mainly *Populus* spp.

Practical usage: gourmet, commercially cultivated, medicinal.

***86. Pleurotus citrinopileatus* Singer** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is whitish, sometimes with yellowish tones cottony, often with tufts of dense growth, occasionally run through with underlying rhizomorphic strands. Teleomorph (yellow primordial) are forming on agar media. Conidial spotulations, clamp connections and anastomoses are present on hyphae. (Table 86, Figs. *a-c*).

TELEOMORPH

Fruit body connate, to 80 stipes coming from a bulbous base. Pileus 3-6 (10) cm, plate-shaped to dimidiate, shallowly to deeply depressed, slightly convex, rarely conchate, with lobed to lobulate, decurved or incurved margin, white, citrine to ochraceous. Gills distinctly decurrent to the bulbous base of the stipe, with lamellulae, subdistant to crowded, moderately broad, furcating, anastomosing, cream-colored with pink hue, turning yellow to orange by pressure or in age. Gill trama mono- to dimitic, distinctly irregular. Generative hyphae with frequent

clamp connections. Spore print whitish. Basidiospores 6.5-10 (11) × 3.5-4.5 (5.0) μm, elliptic to subcylindric, hyaline, smooth. Stipe 3-11 × 1-2 cm, solid, central or slightly eccentric, with citrine to ochraceous, rarely white, grooved or reticulate by decurrent gills, subpubescent to subgranulose. Context solid, wooly, thin, white or pale yellow, smell sweet of anise. Fruit bodies are imbricately gregarious, saprophytic and probably also weakly parasitic on deciduous trees, often on large standing or fallen trunks, also stumps.

Practical usage: gourmet, commercially cultivated, medicinal.

***87. Pleurotus cystidiosus* O. K. Mill.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony at first white, silky, then fluffy white. As the mycelium matures coremia (conidial sporulation) form, radiating outwards from the center. Coremia first with white stipe and white head about 850 μ in diameter, becoming black quickly. Thick mycelial cords and primordial, which are also covered with coremia, form. Vegetative mycelium has thin-walled, branched generative hyphae, 2–7 μm in diameter and conidial sporulation (coremia). Coremium formation on the mycelial colony surface starts as a little tangle of sterile hyphae which becomes a clavaroid form. Growing coremium differentiates into the head and the stipe. Chains of conidia form on the head. The conidia are alantoid, 12–20 × 4–7 μm. (Table 87, Figs. *a-m*).

TELEOMORPH

Pileus 2.5-7.5 cm in diam., eccentrically to laterally convex, beige-brown to beige-orange. Lamellae decurrent, along apper third of stipe, narrow with smooth to undulating margin. Stipe 7-8 × 0.6-1 cm, well-developed, eccentric to lateral, tapered from apex to base, flesh turning yellow. Context solid, elastic, whitish, becoming yellowish, with pleasant fungoid smell and taste. Spore print whitish. Basidiospores cylindrical to oblong, smooth, thin walled, 7.5(10)-15(17.5) × 4-5 μm. Basidia 4-sterigmate, 45-50 × 5-7.5 μm, cylindrical, subpyriforme, hyaline.

Cheilocystidia 25-35 × 5-7.5 µm, frequent, clavate, hyaline, thin-walled. Pleurocystidia 22.5-40 × 5-10 µm, cylindrical, thin-walled, abundant. Pileipellis made of grayish, brownish-red, thin-walled, cylindrical septate hyphae 2.5-5 µm wide, with clamp connections. Fruit bodies are gregarious on living trees.

Practical usage: gourmet, commercially cultivated, medicinal.

***88. Pleurotus djamor* (Rumph.: Fr.) Boedijn** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony fast growing, at first white, soon afterwards develop strong pinkish shades, cottony, often with concentric zones and diverging pink rhizomorphs. Aged mycelium produces drops of metabolites. Teleomorph develops on agar media as bright pink primordia and light or dull pink fruit bodies form. Vegetative mycelium consists of thin-walled branched vegetative hyphae 1.5–7.5 µm in diameter. Clamp connections abundant on aerial and substrate mycelium, large, medallion, abruptly curved. Conidial sporulation as globose lateral conidia 1–5 µm in diameter are formed. Anastomoses are usual on hyphae. (Table 88, Figs. *a-c*).

TELEOMORPH

Pileus pinkish in color, pileus usually 2.5 to 6 cm in diameter, grown in cluster attached with one stipe, pink in color, turning somewhat creamy-pinkish with age, fleshy when fresh, becoming stiff on drying. Lamellae crowded, decurrent, distinctly formed, unequal, pink, eccentric. Stipe 4-8 cm long, stipe lateral, often short, embedded in the substrate, sclerified thick-walled and pinkish to light pink. Context pinkish. Spore print whitish to creamish. Basidiospores cylindrical, 6.0–9.0 × 1.5– 3.0 µm. Fruit bodies usually grow on dead trees.

Practical usage: gourmet, commercially cultivated, medicinal.

***89. Pleurotus dryinus* (Pers.) P. Kumm.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, dirty white, later with powdery spots of dark-brown conidial sporulations on hyphae, solitary conidial sporulation (blastoconidia) and conidial sporulation (aleurospores) on branched conidiophores with clamp connections are formed. (Table 89, Figs. *a-c*).

TELEOMORPH

Pileus 4-15(20) cm across, convex to cap-shaped when young, later plane and bracket-like, surface dull, fibrillose-tomentose, splitting somewhat into scales when old or dry, white when young, later cream-colored to light or darker gray, at times also yellowing somewhat, margin incurved and hung with a fleeting veil when young, smooth, acute to somewhat crenate. Lamellae white when young, later cream-colored to yellowish, spotting brownish, broad, some forked, long-decurrent and forming grooves on the stipe, anastamozing, edges slightly undulating. Stipe eccentric, 2-6 × 1-4 cm, slightly conic toward the base, surface whitish to cream-colored, fibrillose-tomentose, sometimes with tomentose-membranous, fleeting annular zone, stipe apex grooved from the decurrent lamellae, sometimes almost reticulate from anastomoses, solid, tough, sometimes deeply rooting. Context whitish, at times somewhat yellowing, tough, thick, almost odour-less to somewhat spicy, taste mild, nutty. Spore print white. Basidiospores cylindric to cylindric-elliptic, smooth, hyaline, with drops, 9.8-13.9 × 3.8-4.2 μm. Aleuriospores subglobose, light yellow to light brown, with drops, 15-25 × 15-20 μm. Basidia 4-sterigmate and basal clamps, slenderly clavate, 35-100 × 6-8 μm. Cystidia not seen. Pileipellis made of parallel hyphae, some ascending, with exserted ends 3-7μm across, septa with clamps. Fruit bodies grow in forests and parks, on living, usually damaged trunks of hard-woods and conifers, parasitic on wounds or in cavities.

Practical usage: gourmet, commercially cultivated, medicinal.

***90. Pleurotus eryngii* (DC.) Quél.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first whitish, then cream, cottony, appressed to the substrate, with colorless droplets of exudates, rhizomorphs often present. Sometimes concentric zones of different texture of mycelia are distinct. On agar media teleomorph (primordial and fruit bodies) are forming. Vegetative mycelium consists of thin-walled and branched hyphae 1.7-7.0 μm wide. Clamp connections, abundant anastomoses, crystals and conidial sporulations are formed on hypha. (Table 90, Figs. *a-i*).

TELEOMORPH

Pileus 4-15(20) cm across, convex to cap shaped when young, later plane and bracket-like, surface dull, fibrillose-tomentose, splitting somewhat into scales when old or dry, white when young, later cream-colored to light or darker gray, at times also yellowing somewhat, margin incurved and hung with a fleeting veil when young, smooth, acute to somewhat crenate. Lamellae white when young, later cream-colored, to yellowish, spotting brownish, broad, some forked, long-decurrent and forming grooves on the stipe, anastamosing, edges slightly undulating. Stipe eccentric, 2-6 × 1-4 cm, slightly conic toward the base, surface whitish to cream-colored, fibrillose-tomentose, sometimes with tomentose-membranous, fleeting annular zone, stipe apex grooved from the decurrent lamellae, sometimes almost reticulate from anastomoses, solid, tough, sometimes deeply rooting. Context whitish, at times somewhat yellowing, tough, thick, almost odourless to somewhat spicy, taste mild, nutty. Spore print white. Basidiospores cylindric to cylindric-elliptic, smooth, hyaline, with drops, 9.8-13.9 × 3.8-4.2 μm. Aleurospore subglobose, light yellow to light brown, with drops, 15-25 × 15-20 μm. Basidia 4-sterigmate and basal clamp**,** slenderly clavate, 35-100 × 6-8 μm. Pileipellis made of parallel hyphae, some ascending, with exserted ends 3-7 μm, septa with clamps. Fruit bodies are in forests and parks, on living, usually damaged trunks of hardwoods and conifers, parasitic on wounds or in cavities**.**

Practical usage: gourmet, commercially cultivated, medicinal.

***91. Pleurotus ostreatus* (Jacq.) P. Kumm.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, with age cream, grayish to ivory, yellow to orange, dense, cottony, longitudinally radial, with concentric bands of different texture. On agar media teleomorph (primordia and carpophores) are formed. Vegetative mycelium consists of thin-walled and branched hyphae (1.5–7.5 μm). Dolipore septa are present between the cells. The occurrence of clamp connections on hyphae is typical. Conidial sporulations single globose conidia 3–5 μm in diameter are present on hyphae. (Table 91, Figs. *a*-*k*).

TELEOMORPH

Pileus 4-15 cm, convex, becoming flat or somewhat depressed, kidney-shaped to fan-shaped, or nearly circular if growing on the tops of logs; somewhat greasy when young and fresh; smooth; pale brown to dark brown, the margin inrolled when young, later wavy, never lined. Lamellae decurrent along the upper third of the stipe, close; whitish or with a gray tinge, sometimes yellowish in age; often filled with black beetles, in current collecting areas. Stipe usually rudimentary and lateral (or absent) when the mushroom is growing from the side of a log or tree, when it grows on the tops of logs or branches, or at an angle, however, it may develop a substantial and thick stem that is dry and slightly hairy near the base. Context thick, white, with fungal or sweetish odour, with mild and pleasant taste. Spore print white-pink when fresh, cream, ochraceous, gray when dry. Basidiospores (5.6)-9.5-(13.7) × 2.7-3.2-(4.2) μm, cylindric, cylindric-elliptic, amygdaliform, ventral side straight, concave (to convex), dorsal side straight or convex. Basidia 4-sterigmate and basal clamp, slenderly clavate 25-35 × 5-7 μm. Hymenophoral trama irregular. Pileipellis irregular, densely intertwinted, flexuous and branched hyphae 2-4 μm across, brown pigmented, walls gelatinized, septa with clamps but difficult to see. Fruit bodies grow in hardwood and mixed conifer-

hardwood forests, as well as in parks and on street trees, on dead hardwoods, rarely on conifers.

Practical usage: gourmet, commercially cultivated, medicinal.

***92. Pleurotus pulmonarius* (Fr.) Quél.** (Pleurotaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelium colony is white, azonate or with concentric bands of different texture when the growth is rhythmic. As the mycelium matures, yellowish droplets of exudates are present. Teleomorphs (primordia and carpophores) form on agar media. Vegetative mycelium consists of branched generative hyphae 2.5–7.0 μm in diameter. Clamp connections medallion, with space between hyphal septum and the clamp; anastomoses are usual. (Table 92, Figs. *a-c*).

TELEOMORPH

Pileus 2-12 cm, convex, becoming flat or somewhat depressed, lung-shaped to semicircular, or nearly circular if growing on the tops of logs, somewhat greasy when young and fresh, fairly smooth, whitish to beige or pale tan, usually without dark brown colorations, the margin inrolled when young, later wavy and very finely lined. Lamellae running down the stem; close or nearly distant, whitish. Stipe sometimes absent or rudimentary, but often present, 1-7 cm long and up to 1.5 cm thick, eccentric or lateral or central. Context thick, white. Spore print whitish, grayish or lilac. Basidiospores 8-14 × 2.5-5 μm, smooth, cylindric to long-elliptical. Basidia 4-sterigmate, slenderly clavate, hyaline, thin-walled, 20-30 × 5-10 μm. Hymenophoral trama irregular. Pileipellis is compact cutis, up to 40 μm thick, made of rather thin hyphae 2-4 μm across. Fruit bodies are growing in shelf-like clusters on dead and living wood of hardwoods, causing a white rot.

Practical usage: gourmet, commercially cultivated, medicinal.

***93. Polyporus squamosus* (Huds.) Fr.** (Polyporaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, becoming yellowish, light brown to brown, felty, cottony in some parts of colony, with age some parts of colony become leathery. Reverse colorless, with mycelial rhizomorphs. Clamp connections are common, conidial sporulations (artroconidia) about 50 x 3-5 μm on agar media and also in submerged culture are present. (Table 93, Figs. *a-c*).

TELEOMORPH

Fruit body annual. Pileus 10-40-(60) cm, when young orbicular, later renifirm or flabelliform, light brown, covered with darker brown, appressed, 1-3 cm broad scales. Context 1-4 cm thick, when fresh whitish, soft, on, dying sordid yellow white. Pore layer strongly recurrent, to 1 cm thick, pores elongate, racially arranged, 2.3-3 mm long, about 2 mm wide. Stipe often lateral, occasionally subcentral, relatively short, 2-6 × 1-5 (6) cm, brown, sometimes black at the base, tomentose. Context hyphal system dimitic, generative hyphae hyaline, thin-walled, with clamps. Skeleto-binding hyphae colorless, atboriform. Basidiospores 10-16 x 4-6 μm, cylindrical, hyaline, smooth. Fruit bodies are growing on deciduous trees, often large standing or fallen trunks, also stumps.

Practical usage: edible when young, medicinal.

***94. Psilocybe cubensis* (Earle) Singer** (Strophariaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cottony at first, soon becoming silky rhyzomorphic, usually radiating outwards with diverging fans from the inoculation. Mycelium frequently, but not always, bruises bluish. Hyphal swellings are common. Conidial sporulations (arthroconidia), anastomoses, and crystals are present on hyphae. (Table 94, Figs. *a-f*).

TELEOMORPH

Pileus 1.5-7.5 cm, conic, campanulate with acute umbo at first but then convex or plano-convex with only an obtuse umbo, viscid, smooth, pallid, cream or buff at first becoming more strongly colored with age in the same shades, or

ochraceous towards umbo, whitish veil fragments at margin, becoming patchily bluish where handled. Lamellae adnate, or adnexed, drab at first then brown vinaceous finaly violaceous-black with prominent white margin, crowded, narrow becoming ventricose in midportion. Stipe 5-10 × 0.5-1.2 cm, occasionally reaching 15 cm, sugequal tapered upwards from a slightly or distinctly swollen base, white throughout, annulate, blueing where injured. Ring membranous thin, collapsing, fragile but persistent. Context thin, with slightly mealy text. Spore print purplish brown. Basidiospores 12-17.5 × 7-9 µm, ovate to broadly elliptic in face-view, sometimes obscurely angled, elliptic in side-view or slightly flattened on one side, thick-walled, smooth. Basidia 4-sterigmate, 28-35 × 10-12.5 µm, hyaline, clavate-cylindric. Cheilocystidia fusiform, ventricose, with abtuse to subcapitate apex, 17.5-32.6 × 6-12µm. Pileipellis made of narrow radially arranged cylindric yellowish to hyaline hyphae 3-5 µm broad. Fruit bodies are on dung, or in rich pastures in subtropical to tropical countries but easily grown in culture under sterile or semi-sterile conditions.

Practical usage: medicinal.

***95. Schizophyllum commune* Fr.: Fr.** (Schizophyllaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony white, cottony, locally woolly, floccose-woolly or plumose, becoming felty. Odour absent or distinct. Advancing zone appressed to raised. Reverse unchanged to bleached. Aerial hyphae (1.5-)2-7(-8) µm wide. Some hyphae densely covered with spinulose projections. Teleomorph (carpophores) are typically formed on agar media. Conidial sporulations (cylindrical arthroconidia) are present on hyphae. Clamp connections and ellipsoid chlamydospores (4-)5.5-15(-20) × 4-8 µm are usual on hyphae. (Table 95, Figs. *a-e*).

TELEOMORPH

Pileus 1-3(5) cm across, conchate to flabellate, with a narrow to pin-like attachment to the substrate, stipeless or with a very short stipe, surface villose to strigose-tomentose, gray-whitish, also greenish from algal growth when old,

concentrically zoned and radially undulating to weakly furrowed, margin crenate, dentate, incurved when young. Lamellae pink flesh-colored, sometimes with a lilac tint, ocher-brownish when old, broad, fanning out radially from the attachment point toward the margin, edges when dry split and turned up, closed again when moist. Stipe absent or only slightly developed. Context ocher, tough, radially fibrous, thin, odour and taste sourish, mild. Spore print orange-ocher. Basidiospores cylindric, some rather curved, smooth, hyaline, with drops, 5.6-7 × 1.8-2.3 μm. Basidia for sterigmate and basal clamp, slenderly clavate, 40-55 × 7-10 μm. Cystidia not seen. Pileipellis made of irregular, thick-walled, and in part erect hyphae 3-6 μm across, interspersed with exserted bundles of hyphae, sparsely septate, some septa with clamps. Fruit bodies are inside and outside forests, commonly in light, sunny, dry places, such as clearcuts, forest edges, street-sides, on dead, fallen or standing wood of broadleaved trees, more rarely on conifers.

Practical usage: edible, commercially cultivated, medicinal.

***96. Tricholoma mongolicum* S. Imai** (Tricholomataceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony whitish, cream, grayish, slow growing, cottony in the center and in and submersed growing in agar media at the periphery. Aerial mycelium forming hyphal net. Mycelial coils with warty ornamentation and anomalous hyphae are present. Clamp connections and anastomoses are usual on hyphae. (Table 96, Figs. *a-h*).

TELEOMORPH

Pileus 5-12 cm, convex when young, finally expandent, plane, sometimes with a small umbo, white, later dingy white to pale cream color, center slightly ochraceous, smooth, glabrous, margin thin at first enrolled. Gills whitish, crowded, ventricose. Spore print white. Basidiospores 6.0-8.0 × 3.0-4.0 μm, ellipsoid, hyaline, smooth. Stipe 3.5-6.0 × 1.5-3.5 cm, thick, solid, slightly bulbous at the base, white, surface with longitudinal fibrils on a white background. Flesh thick,

white, almost odourless. Fruit bodies grow on ground in pastures, forming large rings.

Practical usage: medicinal.

***97. Tulostoma brumale* Bertero** (Agaricaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony whitish, dense, downy, zonate, with mycelial cords. Conidial sporulations, anastomoses on hyphae and mycelial cords are present. (Table 97, Fig. *a*, *b*).

TELEOMORPH

Fruit body epigeous, at maturity stipitate, 1.5-3.5 (4) cm high, binding sand at base. Stipe cylindric, 1.5-2.5 mm in diam., pale yellowish or straw, darker yellow-brown below, surface smooth to fibrous, sometimes splitting to form recurved scales. Exoperidium membranous, soon lost. Endoperidial body 6-10 mm in diam., with a single peristome, subglobose, depressed beneath or not, with an irregular, lacerate, collar-like membrane usually present around the stipe apex. Endoperidium pale yellowish or straw, smooth. Peristome well defined, circular, usually somewhat raised and often darker than the surrounding endoperidium. Gleba pale yellowish. Basidiospores 4.0-5.0 (5.5) μm, globose or subglobose, verrucate, pale yellowish-brown. Capillitial hyphae 3-9 μm in diam., branched, septate, hyaline or pale yellowish-brown, thick-walled, surface smooth or partly encrusted. Fruit bodies are solitary or gregarious, usually on sandy, calcareous soil, among grass and herbs.

Practical usage: medicinal.

***98. Verpa bohemica* (Krombh.) J. Schröt.** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, dense, first white, soon becomes light brown or brown; reverse is brown. Microsclerotia not abundant, on ChA agar media.

Lacunose, anomalouse hyphae, and anastomoses are present. Conidial sporulation in the form of branched chains of budding cells form. (Table 98, Figs. *a-c*).

TELEOMORPH

Fruiting body 40-150 mm tall, cap campanulate to cylindrical, irregularly wrinkled almost like a morel, ribs sinuous, more or less vertical and strongly prominent, light to dark brown, under-surface whitish, 20-50 mm high. Stalk ochre, solid when young, then hollow, free all the way to the tip of the cap, 40-150 ×10-30 mm. Flesh fragile and mild. Growing singly to gregariously. Spores smooth, cylindrical, sometimes slightly curved, hyaline, 55-87 × 17-20 (22) μm. Asci 2-spored, 250-350 × 18-25 μm. Paraphyses cylindrical, slightly sinuous, septate, 5-8 μm thick. Fruit bodies grow in forests on rich soil.

Practical usage: edible.

***99. Verpa conica* (O.F. Müll.) Sw.** (Morchellaceae, Ascomycota)

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony is woolly, not dense, first white, becomes light brown or brown, without microsclerotia; reverse is brown. Lacunose, incrustated, anomalouse hyphae and anastomoses are present. Conidial sporulation of blastoconidia type. (Table 99, Figs. *a-d*).

TELEOMORPH

Fruiting body 30-130 mm tall, cap campanulate to thimble-shaped, irregularly wrinkled, sometimes also with cerebriform to reticulate convolutions, 15-40 mm, honey- to red-brown, undersurface ochre, stalk cylindrical, smooth to slightly sinuous, hollow, free all the way to the top, that is the cap is fused with the stalk only at the apex, white to ochre, weakly banded horizontally with darker scales, 30-130 × 5-15 mm. Flesh fragile and mild. Growing singly to gregariously. Spores broadly elliptical, smooth, hyaline, (17) 20-25 × 11-15 μm, sometimes with droplets on the ends (outside the spore wall). Asci 8-spored, 250-350 × 18-23 μm. Paraphyses septate, with slight clavate thickenings to 12 μm, branched toward

bases. Fruit bodies grow along banks of rivers and streams, hedges, meadows, forest edges.

Practical usage: edible.

***100. Volvariella volvacea* (Bull.) Singer** (Pluteaceae, Basidiomycota).

VEGETATIVE MYCELIUM IN PURE CULTURE

Mycelial colony first white, soon becomes yellowish, brown, grayish, eventually becoming light gray-brown to reddish-brown, often with complex discolored zones, longitudinally linear, quickly becomes aerial and disorganized. Clamp connections, anastomoses, swellings and crystals, conidial sporulations (arthroconidial) are present on hyphae. (Table 100, Figs. *a-g*).

TELEOMORPH

Pileus 4-8(10) cm, broad pale gray, silver-gray with darker fibrils, black-brown to black or rusty-brown, especially in the center which is darker, black-brown, at first conic, bell-shaped, at maturity convex to plane; surface at first velutinous, in age radially fibrillous, dry, sometimes radially cracked, marginnotstriate. Lamellae at first whitish, yellowish, on maturity salmon-pink, crowded, broad, free. Stipe whitish, beige, 4-10(14) × 1-1.5 cm, equal, enlarged downwards, with more or less bulbous base, at first solid, in age hollow. Volva distinct, dirty brownish, membranous, irregularly lobed. Flesh white, delicate, in cap in the center 3-5 mm thick, towards margin thin, in stipe fibrous; without smell or taste. Spore print pink-salmon. Basidiospores broadly-ellipsoid, grayish-pink, smooth, 6-9 × 4-5 μm. Fruit bodies are especially on compost heaps, refuse tips, but also in deciduous and coniferous forests.

Practical usage: gourmet, commercially cultivated, medicinal.

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Fig. *b*, *c*. Lacunose hyphae. SEM *b* (× 2400); *c* (× 2000).

Table 68. ***Morchella conica*** Pers.

Fig. *a*. Conidial sporulation. SEM (× 1000).

Fig. *b*, *c*, *d*. Budding cells on lacunose hyphae. SEM *b* (× 3600);
c (× 2000); *d* (× 1000).

Fig. *e*. Mycelial colony with sclerotia on agar media (ChA).

Table 69. ***Morchella crassipes*** (Vent.) Pers.

Fig. *a*. Lacunose hyphae. SEM (× 2000).

Fig. *b*. Anomalous hyphae. SEM (× 2000).

Table 70. ***Morchella esculenta*** (L.) Pers.

Fig. *a*, *b*. Conidial sporulation. SEM *a* (× 1300); *b* (× 940).

Fig. *c*. Incrustated hyphae. SEM (× 2200).

Fig. *d*. Lacunose hyphae. SEM (× 2000).

Fig. *e*. Mycelial colony with sclerotia on agar media (OMYA).

Table 71. ***Morchella semilibera*** DC.

Fig. *a*. Lacunose hyphae. SEM (× 1100).

Fig. *b*. Anomalous hyphae. SEM (× 3000).

Fig. *c*. Anastomose. SEM (× 3600).

Table 72. ***Morchella spongiola*** Boud.

Fig. *a*. Anomalous hyphae. SEM (× 1600).

Fig. *b*. Vegetative hyphae. SEM (× 6000).

Fig. *c*, *d*. Anastomoses. SEM *c* (× 10 000); *d* (× 1600).

Table 73. ***Morchella steppicola*** Zerova

Fig. *a*, *b*. Conidial sporulation. SEM *a* (× 850); *b* (× 900).

Fig. *c*. Anastomose. SEM (× 3300).

Fig. *d*. Anomalous hypha in the zone of sclerotia formation.
SEM (× 1000).

Table 74. ***Omphalotus olearius*** (DC.) Singer

Fig. *a*, *b*. Clamp connections and anastomoses. SEM *a* (× 4000); *b* (× 3000).

Fig. *c*. Crystals on hyphae. SEM (× 4800).

Fig. *d*. Mycelial cords and anastomoses. SEM (× 1000).

Table 75. ***Oudemansiella brunneomarginata*** Lj. N. Vassiljeva

Fig. *a*. Teleomorph on agar media (MEA).

Fig. *b*, *c*. Conidial sporulation. SEM *b* (× 2000); *c* (× 16 000).

Fig. *d*. Clamp connection and crystals. SEM (× 10 000).

Fig. *e*, *f*. Mycelial coils with warty structures on hyphae.
SEM *e* (× 1500); *f* (× 6000).

Table 76. ***Oudemansiella mucida*** (Schrad.) Höhn.

Fig. *a*, *c*. Clamp connection. SEM (× 10 000).

Fig. *b*. Mycelial coils with warty structures on hyphae. SEM (× 2000).

Fig. *c*. Hyphae of submerged cultivated mycelia.

Fig. *d*. Teleomorph on agar media (MEA).

Table 77. ***Oudemansiella radicata*** (Relhan) Singer

Fig. *a*. Clamp connections. SEM (× 6000).

Fig. *b*. Teleomorph on agar media (MEA).

Table 78. ***Panus tigrinus*** (Bull.) Singer

Fig. *a*, *b*, *c*, *d*. Clamp connections and anastomoses (4).

SEM *a* (× 4800); *b*, *c* (× 4000); *d* (× 2000).

Fig. *e*. Teleomorph on agar media (MEA).

Fig. *f*. Chlamydospores and clamp connection (submerged culture).

Table 79. ***Peniophora gigantea*** (Fr.) Massee

Fig. *a*. Clamp connection. SEM (× 4000).

Fig. *b*, *c*, *d*. Conidial sporulation. SEM *b*, *c* (× 4000); *d* (× 10 000).

Fig. *e*, *f*. Anastomoses. SEM *e*, *f* (× 4000).

Table 80. ***Phallus impudicus*** L.

Fig. *a*. Clamp connection. SEM (× 8600).

Fig. *b*. Excretory cell on hyphae. SEM (× 8600).

Fig. *c*. Vegetative hyphae with crystals.

Fig. *d*. Clamp connections and chlamydospores.

Fig. *e*. Mycelial colony on agar media (MEA).

Table 81. ***Phellinus igniarius*** (L.) Quél.

Fig. *a*, *b*, *c*. Conidial sporulation. SEM *a* (× 6600); *b* (× 2000); *c* (× 2400).

Table 82. ***Pholiota adiposa*** (Batsch) P. Kumm.

Fig. *a*. Clamp connection. SEM (× 6000).

Fig. *b*. Crystals and conidia on hyphae. SEM (× 4000).

Fig. *a*-*c*. Conidial sporulation. SEM *a* (× 6000); *b*, *c* (× 4000).

Fig. *d*. Conidial sporulation and clamp connection in submerged culture.

Fig. *e*. Conidial sporulation on agar media (MEA).

Table 83. ***Piptoporus betulinus*** (Bull.) P. Karst.

Fig. *a*, *b*, *c*. Clamp connections and anastomoses (3). SEM *a*, *b*, *c* (× 4000).

Table 84. ***Pleurotus abalonus*** Y.H. Han, K.M. Chen & S. Cheng

Fig. *a*. Mycelial colony on agar media (MEA).

Fig. *b*. Conidial sporulation (the head of coremia). SEM (× 130).

Fig. *c*. Coremia differentiated into head and stipe. SEM (× 48).

Fig. *d*. Alantoid conidia on the head of coremia. SEM (× 2000).

Fig. *e*. Conidial sporulation. SEM (× 4000).

Table 85. ***Pleurotus calyptratus*** (Lindb.) Sacc.

Fig. *a*. Teleomorph on agar media (MEA).

Fig. *b*, *d*. Clamp connection and anastomoses. SEM *b* (× 4400); *d* (× 3200)

Fig. *c*. Conidial sporulation. SEM (× 10 000).

Table 86. ***Pleurotus citrinopileatus*** Singer

Fig. *a*, *b*. Conidial sporulation. SEM *a* (× 6000); *b* (× 2400).

Fig. *b*. Clamp connections. SEM (× 2400).

Fig. *c*. Anastomoses. SEM (× 2000).

Table 87. ***Pleurotus cystidiosus*** O.K. Mill.

Fig. *a*. Mycelial colony on agar media (MEA).

Fig. *b*. Conidial sporulation (coremia). SEM (× 78).

Fig. *c*, *d*. Conidia on the head of coremia. SEM *c* (× 300); *d* (× 1000).

Fig. *e*, *f*, *g*. Conidial sporulation (the development of coremia).

SEM *e* (× 30); *f*, *g* (× 400).

Fig. *h*, *j*, *k*, *l*. Conidial sporulation (blastic conidia). SEM *h*, *l* (× 10 000); *j*, *k* (× 4000).

Fig. *i*. Clamp connection. SEM (× 10 000).

Table 88. ***Pleurotus djamor*** (Rumph. : Fr.) Boedijn

Fig. *a- d*. Clamp connections. SEM *a*, *c*, *d* (× 4800); *b* (× 7800).

Fig. *a*, *b*. Conidial sporulation. SEM *a* (× 4800); *b* (× 7800).

Fig. *c*, *d*. Anastomoses. SEM (× 4800).

Table 89. ***Pleurotus dryinus*** (Pers.) P. Kumm.

Fig. *a*. Mycelial colony on agar media (MEA).

Fig. *b*. Clamp connections and conidial sporulation on hyphae. SEM (× 4800).

Fig. *c*. Conidial sporulation and conidiophores with clamp connectionss.

Table 90. ***Pleurotus eryngii*** (DC.) Quél.

Fig. *a*, *b*, *c*, *f*, *g*, *h*. Clamp connections. SEM *a* (× 3800); *b* (× 4800); *c*, *g* (× 4400); *f* (× 3600); *h* (× 6000).

Fig. *c*, *f*, *g*, *h*, *i*. Anastomoses. SEM *c*, *g* (× 4400); *f* (× 3600); *h* (× 6000); *i* (× 4800).

Fig. *d*. Chlamydospores. SEM (× 7200).

Fig. *e*, *f*. Crystals on hyphae. SEM *e* (× 4400); *f* (× 3600).

Fig. *g*, *h*, *i*. Conidial sporulation. SEM *g* (× 4400); *h* (× 6000); *i* (× 4800).

Table 91. ***Pleurotus ostreatus*** (Jacq.) P. Kumm.

Fig. *a*. Teleomorph on agar media (MEA).

Fig. *b*. Mycelial colonies on agar media MEA (A); PDA (B); and Norkrans (C).

Fig. *c*. Dolipore septum in vegetative hypha. SEM (× 15 000).

Fig. *d*, *e*, *f*. Clamp connections. SEM *d*, *e* (× 4000); *f* (× 6000).

Fig. *g*. Conidial sporulation. SEM (× 6000).

Fig. *h*. Clamp connections in submerged culture. Obj × 40.

Fig. *i*, *j*, *k*. Mycelial colonies (pellets) in submerged culture.

Table 92. ***Pleurotus pulmonarius*** (Fr.) Quél.

Fig. *a*-*e*. Clamp connections. SEM (× 6000).

Fig. *c*, *d*. Conidial sporulation. SEM (× 6000).

Fig. *a*, *c*. Anastomoses. SEM (× 6000).

Table 93. ***Polyporus squamosus*** (Huds.) Fr.

Fig. *a*, *b*, *c*. Conidial sporulation. SEM *a* (× 1800), *b* (× 5400), *c* (× 6000).

Fig. *b*. Clamp connections. SEM (× 5400).

Table 94. ***Psilocybe cubensis*** (Earle) Singer

Fig. *a*. Clamp connections. SEM (× 12 000).

Fig. *b*. Conidial sporulation. SEM (× 4800).

Fig. *c*. Anastomoses. SEM (× 5400).

Fig. *d*. Crystals and hyphal swelling. SEM (× 4400).

Fig. *e*, *f*. Hyphal swelling. SEM *e*, *f* (× 4800).

Table 95. ***Schizophyllum commune*** Fr.: Fr.

Fig. *a*, *b*. Teleomorph on agar media (MEA).

Fig. *c*. Clamp connections, anastomoses, conidial sporulation. SEM (× 5200).

Fig. *d*, *e*. Secretory cells and anastomoses. SEM *d* (× 4800); *e* (× 4000).

Table 96. ***Tricholoma mongolicum*** S. Imai

Fig. *a*, *b*. Clamp connections. SEM *a* (× 4000); *b* (× 2000).

Fig. *c*. Anastomoses and interlocking hypha. SEM (× 600).

Fig. *d*, *i*. Mycelial coils. SEM *d* (× 4000); *i* (× 1500).

Fig. *e*, *f*, *g*. Anomalous hyphae. SEM *e* (× 4000); *f* (× 4000); *g* (× 2000).

Fig. *h*. Wart incrustation of hyphae dislocated in coils. SEM (× 6000).

Table 97. ***Tulostoma brumale*** Bertero

Fig. *a*. Conidial sporulation. SEM (× 2200).

Fig. *b*. Mycelial cords and anastomoses. SEM (× 4000).

Table 98. ***Verpa bohemica*** (Krombh.) J. Schröt.

Fig. *a*, *b*, *c*. Conidial sporulation. SEM *a* (× 700); *b* (× 500); *c* (× 750).

Table 99. ***Verpa conica*** (O.F. Müll.) Sw.

Fig. *a*. Anomalous hyphae. SEM (× 1800).

Fig. *b*. Lacunose hyphae. SEM (× 2400).

Fig. *c*. Conidial sporulation. SEM (× 7200).

Fig. *d*. Crystals on hyphae. SEM (× 6600).

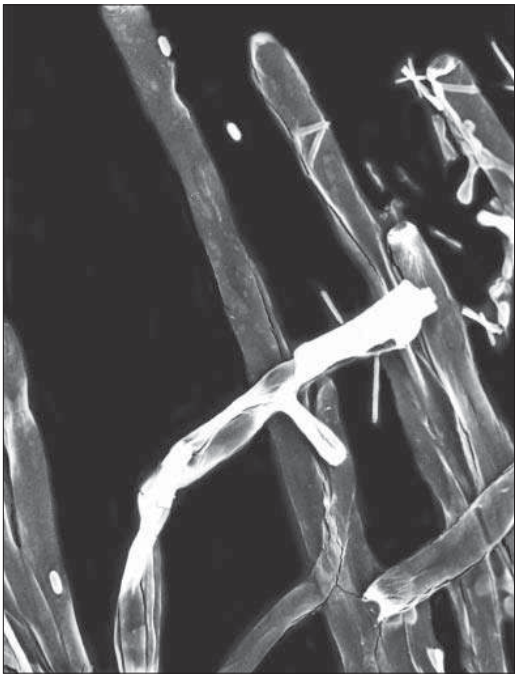
Table 100. ***Volvariella volvacea*** (Bull.) Singer

Fig. *a*, *c*. Clamp connections, anastomoses. SEM *a* (× 7800); *c* (× 2600).

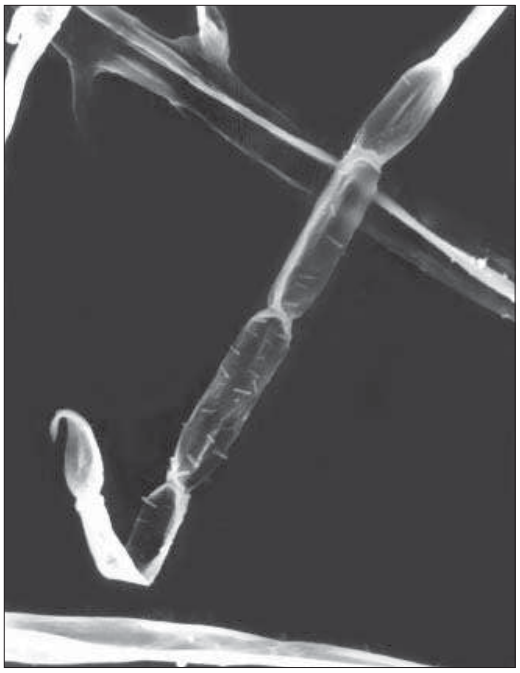
Fig. *b*. Conidial sporulation. SEM (× 1800).

Fig. *d*, *e*, *f*. Crystals on hyphae. SEM *d* (× 6000); *e* (× 4500); *f* (× 5400).

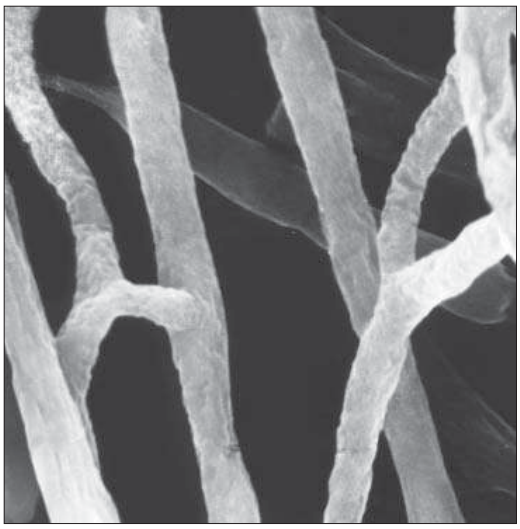
Fig. *g*. Hyphal swelling. SEM (× 5400).



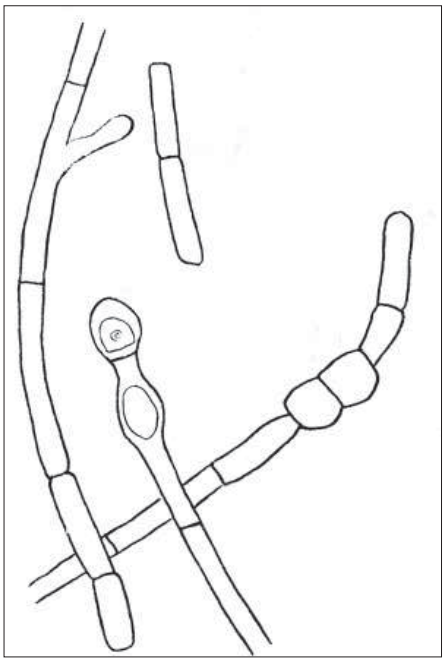
Tabl. 1, Fig. *a*
Agaricus abruptibulbus



Tabl. 2, Fig. *a*
Agaricus arvensis



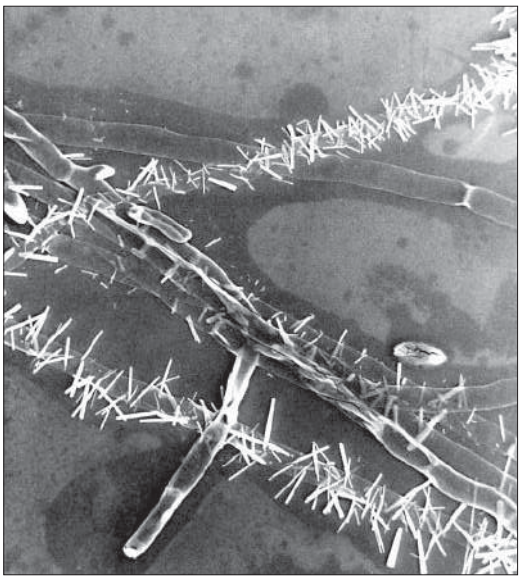
Tabl. 2, Fig. *b*
Agaricus arvensis



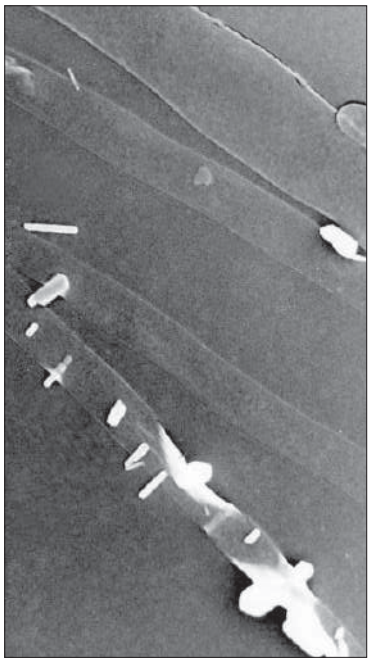
Tabl. 2, Fig. *c*
Agaricus arvensis

Tabl. 2, Fig. *d*
Agaricus arvensis

Tabl. 3, Fig. *a*
Agaricus bisporus



Tabl. 3, Fig. *b*
Agaricus bisporus



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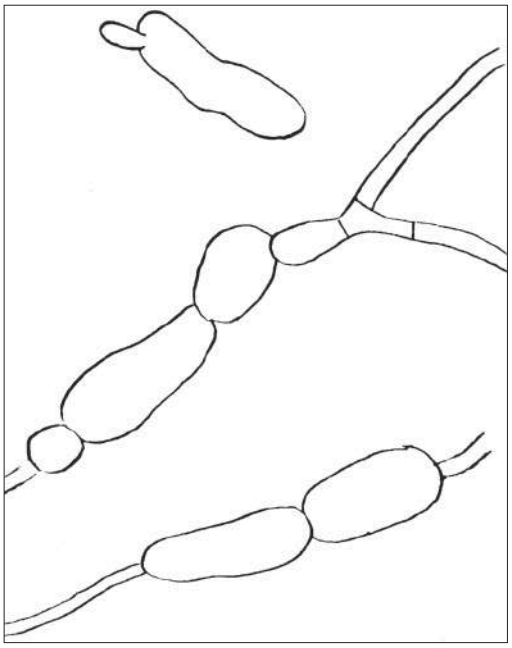
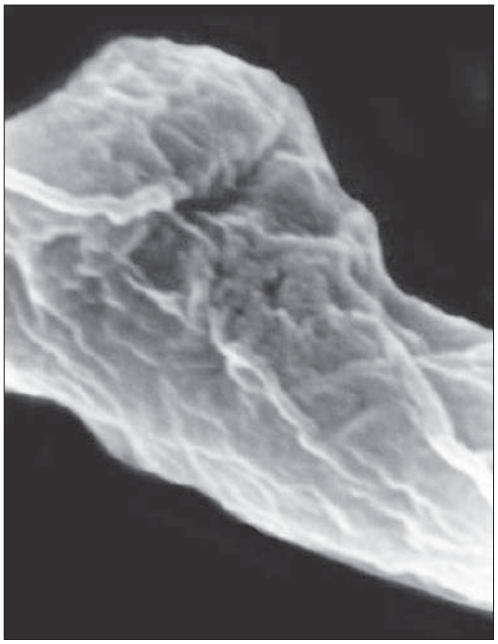
Agaricus bisporus



Tabl. 3, Fig. *d*
Agaricus bisporus

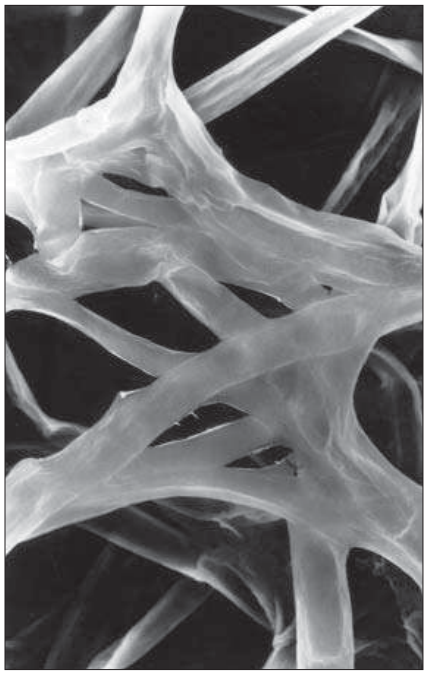


Tabl. 4, Fig. *a*
Agaricus brasiliensis

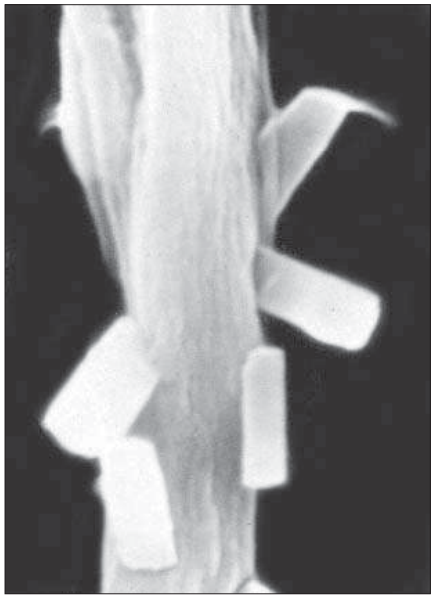
Tabl. 4, Fig. *b*
Agaricus brasiliensis

Tabl. 4, Fig. *c*
Agaricus brasiliensis

Tabl. 4, Fig. *d*
Agaricus brasiliensis



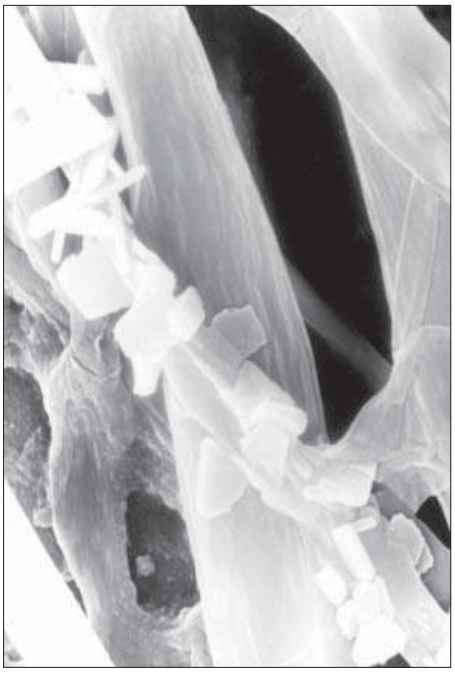
Tabl. 4, Fig. *e*
Agaricus brasiliensis



Tabl. 4, Fig. *f*
Agaricus brasiliensis

Tabl. 4, Fig. *g*
Agaricus brasiliensis

Tabl. 5, Fig. *a*
Agaricus bresadolianus



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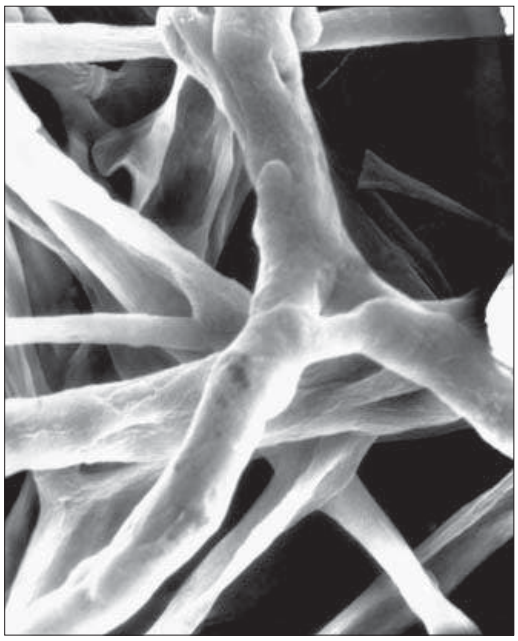
Agaricus bresadolianus



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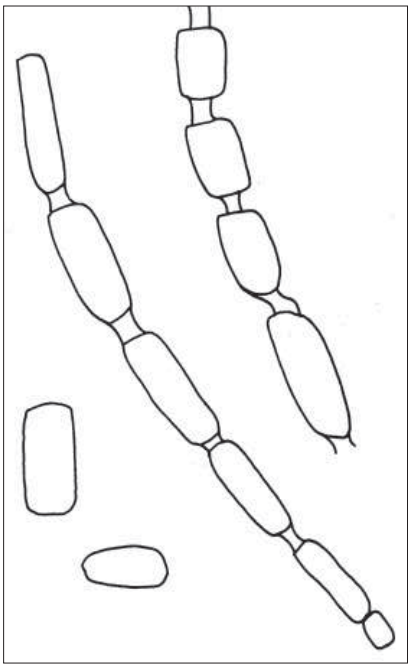
Agaricus bresadolianus

Tabl. 6, Fig. *a*
Agaricus campestris



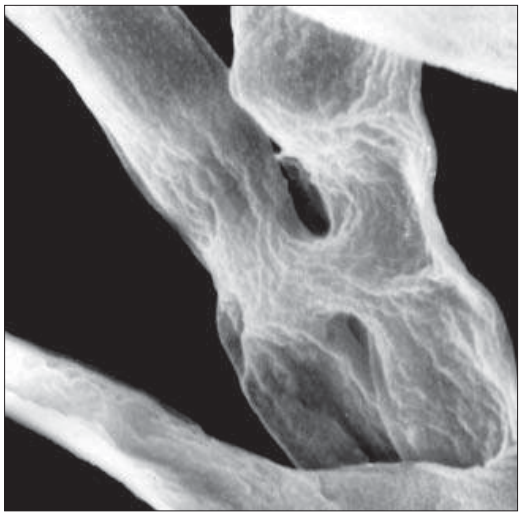
Tabl. 7, Fig. *a*
Agaricus cupreobrunneus

Tabl. 8, Fig. *a*
Agaricus excellens

Tabl. 8, Fig. *b*
Agaricus excellens

Tabl. 9, Fig. *a*
Agaricus fisuratus

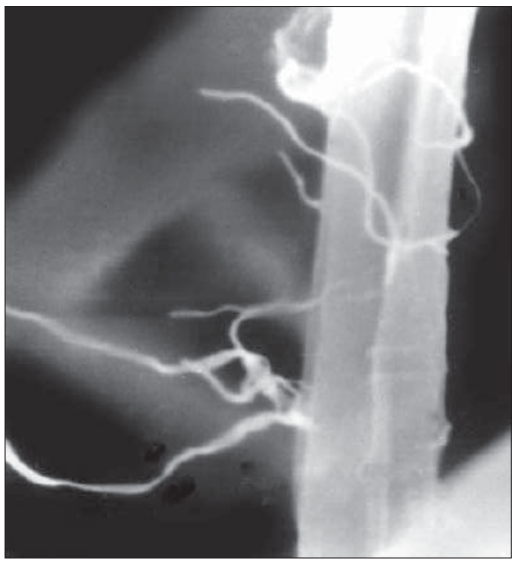
Tabl. 10, Fig. *a*
Agaricus gennadii



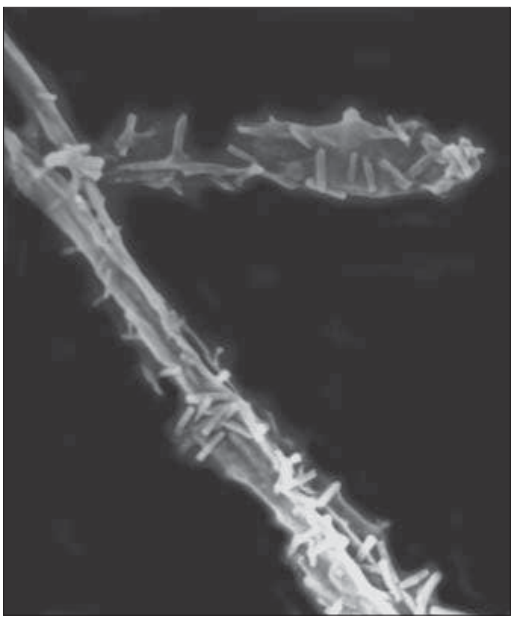
Tabl. 10, Fig. *b*
Agaricus gennadii

Tabl. 10, Fig. *c*
Agaricus gennadii

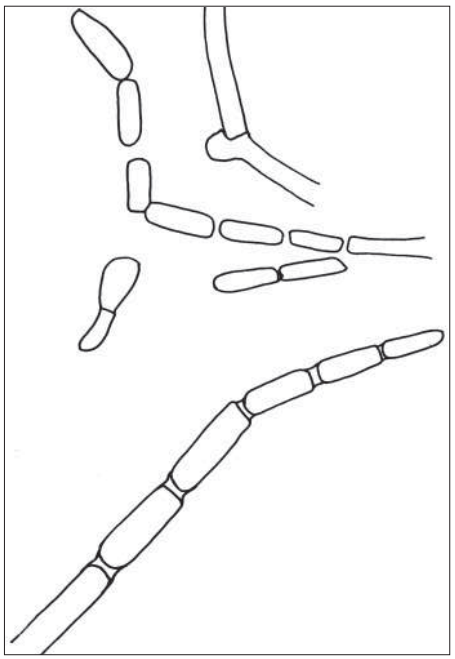
Tabl. 10, Fig. *d*
Agaricus gennadii



Tabl. 10, Fig. *e*
Agaricus gennadii

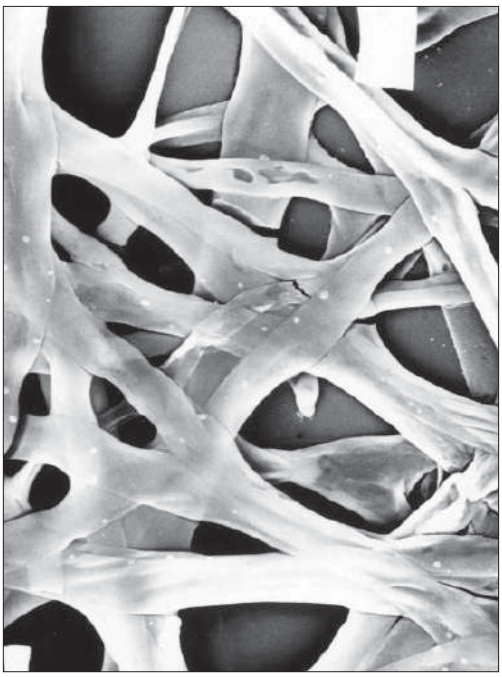


Tabl. 11, Fig. *a*
Agaricus macrocarpus

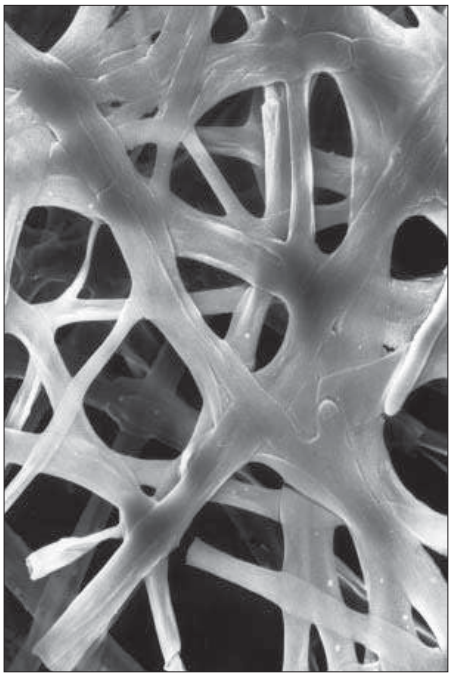


Tabl. 12, Fig. *a*
Agaricus maskae

Tabl. 13, Fig. *a*
Agaricus nevoi



Tabl. 13, Fig. *b*
Agaricus nevoi



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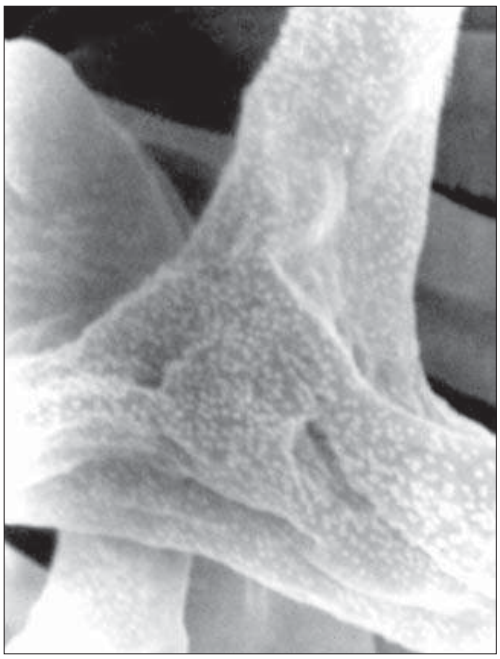
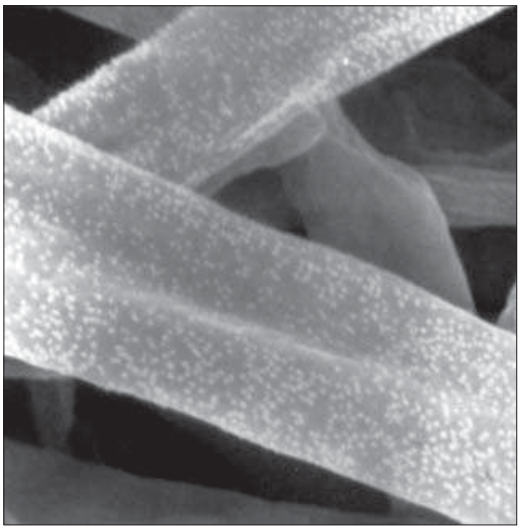
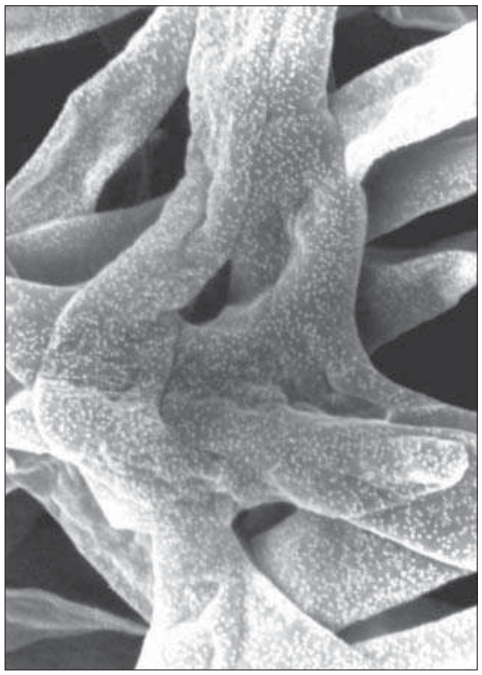
Agaricus nevoi



Tabl. 14, Fig. *a*
Agaricus pequinii



Tabl. 14, Fig. *b*
Agaricus pequinii



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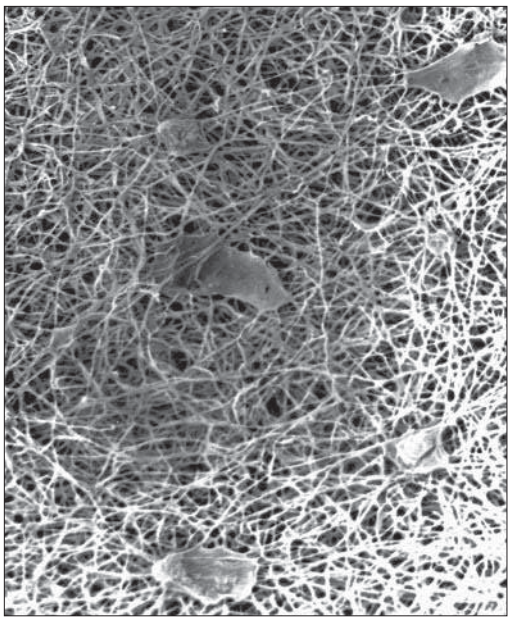
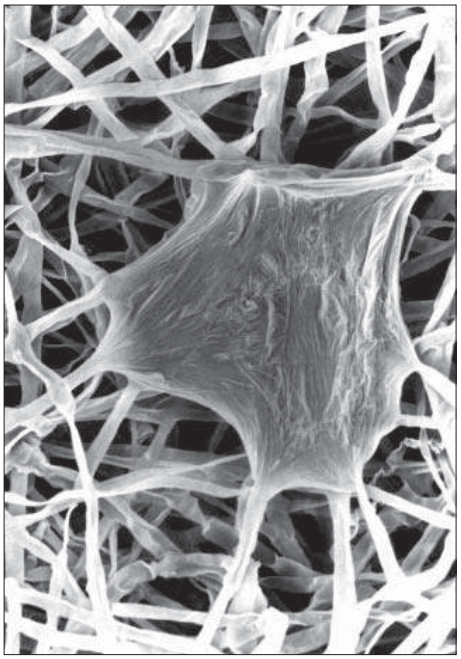
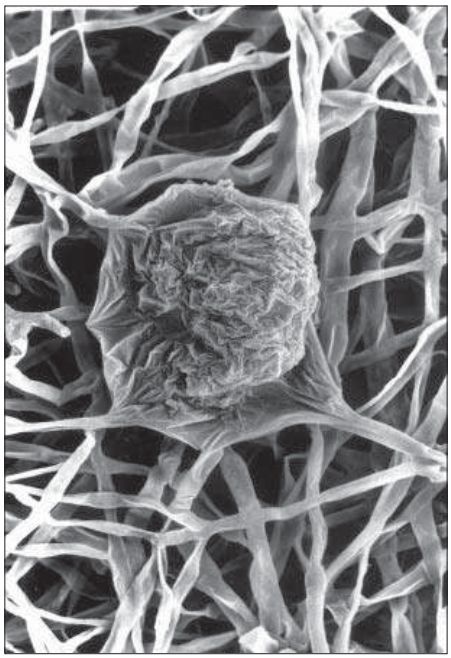
Agaricus pequinii



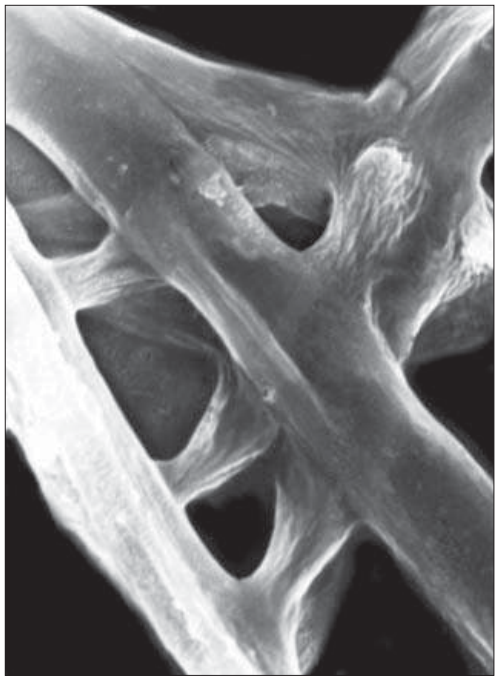
Tabl. 14, Fig. *d*
Agaricus pequinii



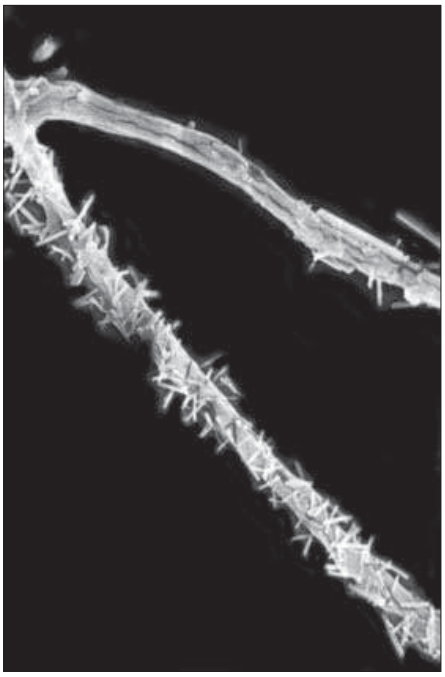
Tabl. 14, Fig. *e*
Agaricus pequinii



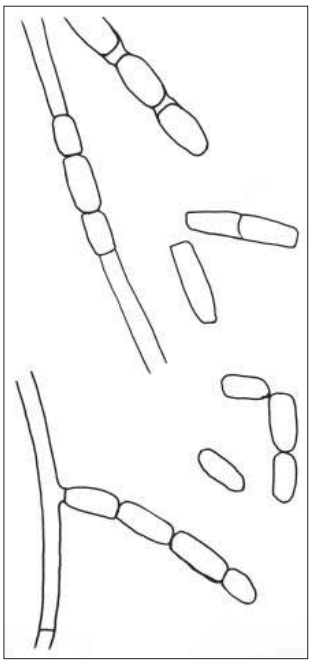
Tabl. 14, Fig. *f*
Agaricus pequinii



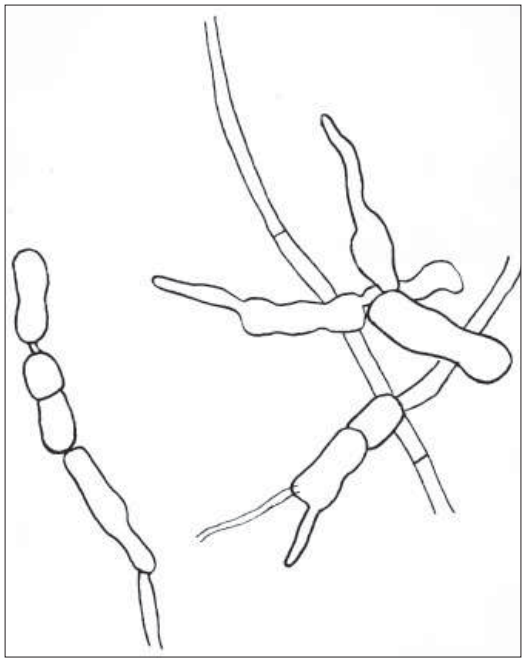
Tabl. 15, Fig. *a*
Agaricus silvaticus



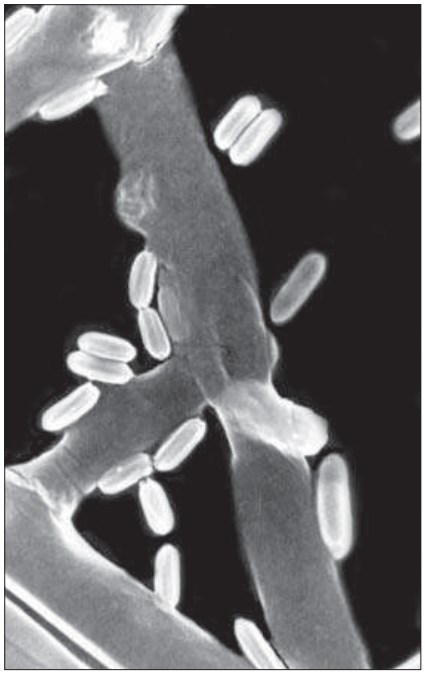
Tabl. 15, Fig. *b*
Agaricus silvaticus



Tabl. 15, Fig. *c*
Agaricus silvaticus

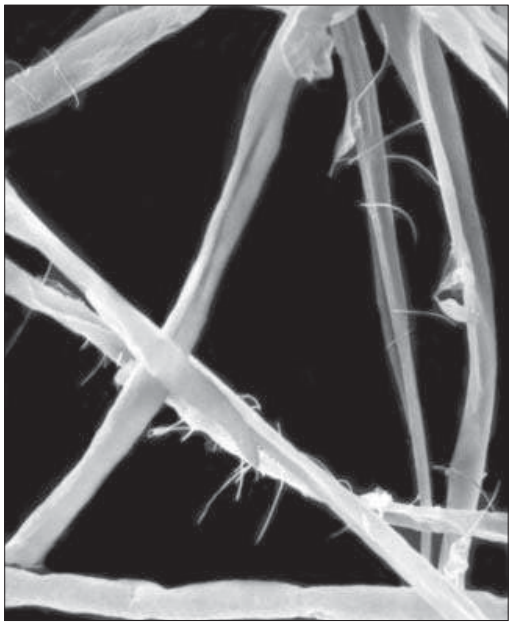


Tabl. 15, Fig. *d*
Agaricus silvaticus



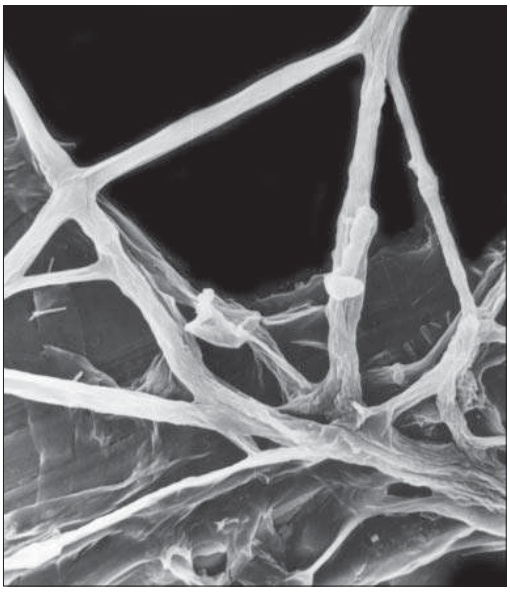
Tabl. 16, Fig. *a*
Agaricus silvicola

Tabl. 17, Fig. *a*
Agaricus subfloccosus

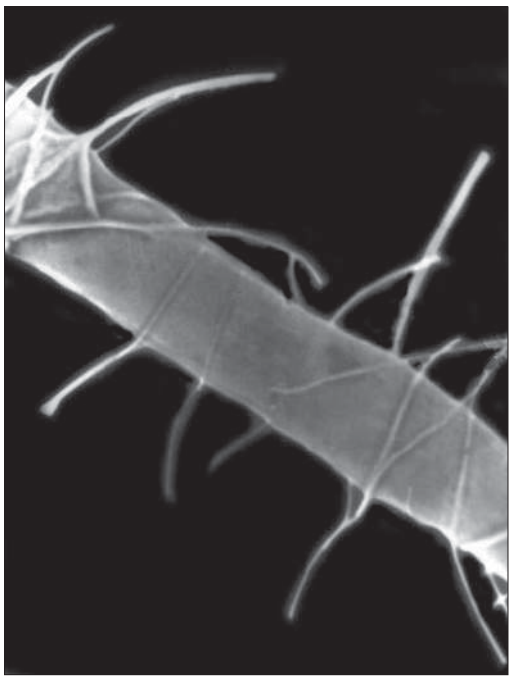


Tabl. 17, Fig. *b*
Agaricus subfloccosus

Tabl. 17, Fig. *c*
Agaricus subfloccosus

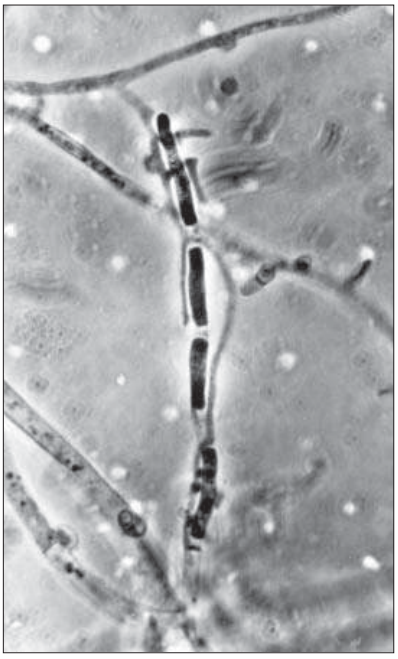


Tabl. 18, Fig. *a*
Agaricus vaporarius

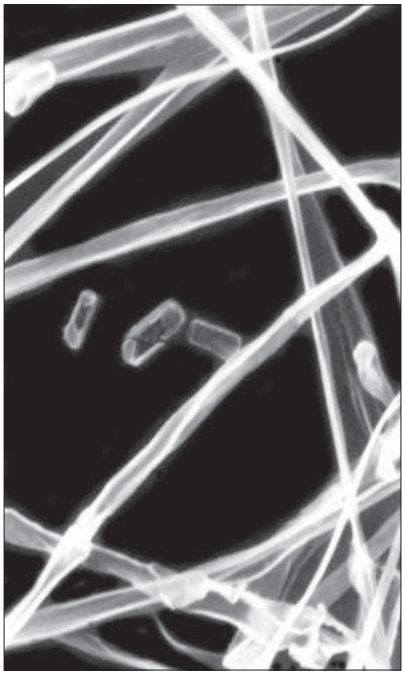


Tabl. 19, Fig. *a*
Agaricus xanthodermus

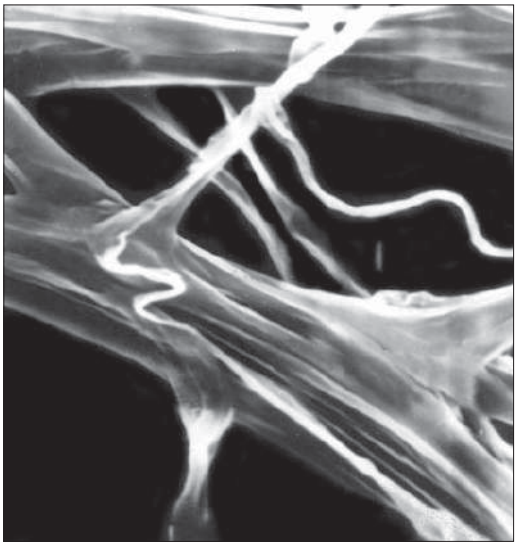
Tabl. 20, Fig. *a*
Agrocybe aegerita



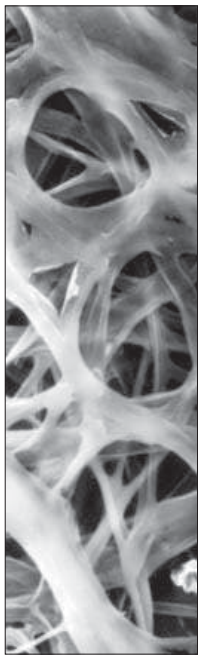
Tabl. 20, Fig. *b*
Agrocybe aegerita



Tabl. 20, Fig. *c*
Agrocybe aegerita

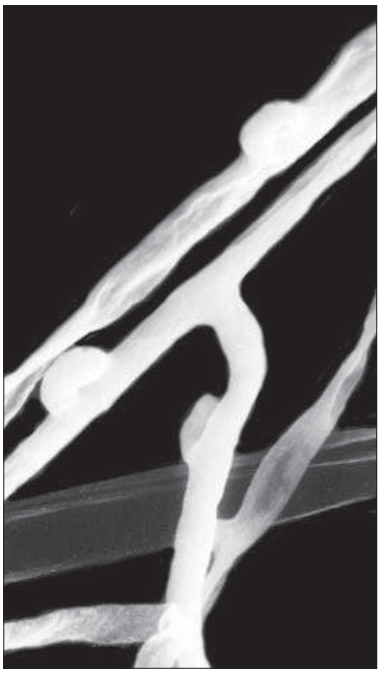


Tabl. 20, Fig. *d*
Agrocybe aegerita

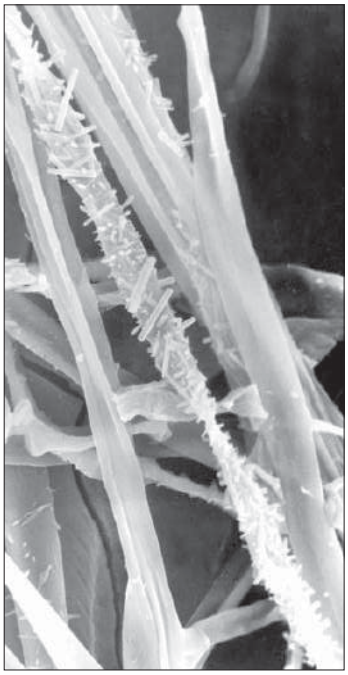


Tabl. 20, Fig. *e*
Agrocybe aegerita

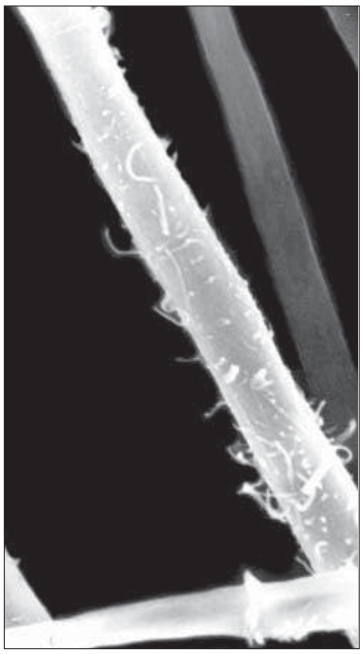
Tabl. 21, Fig. *a*
Anthurus arsheri



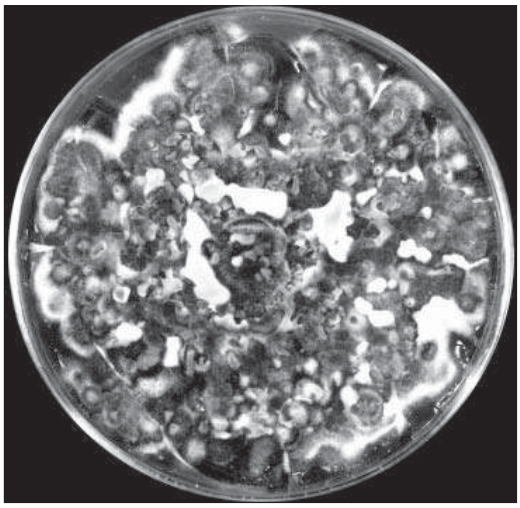
Tabl. 21, Fig. *b*
Anthurus arsheri



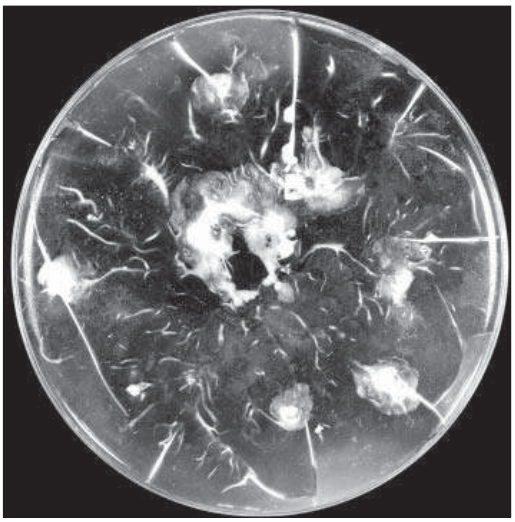
Tabl. 22, Fig. *a*
Armillariella mellea



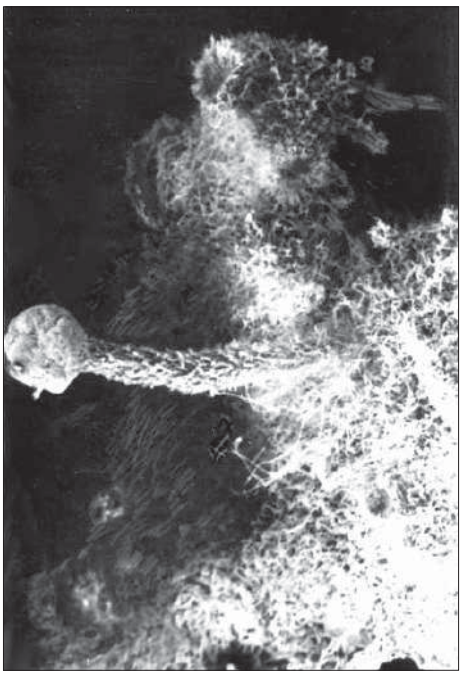
Tabl. 22, Fig. *b*
Armillariella mellea



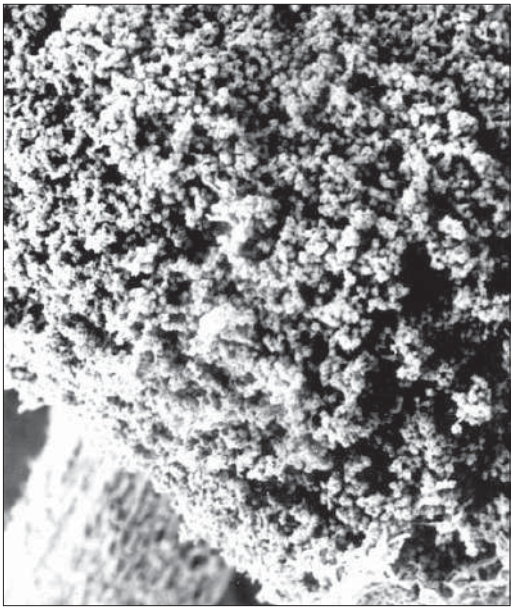
Tabl. 22, Fig. *c*
Armillariella mellea



Tabl. 22, Fig. *d*
Armillariella mellea



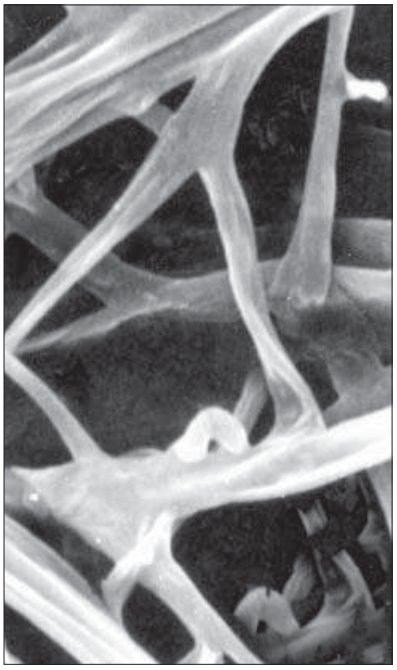
Tabl. 23, Fig. *a*
Asterophora lycoperdoides



Tabl. 23, Fig. *b*
Asterophora lycoperdoides

Tabl. 23, Fig. *c*
Asterophora lycoperdoides

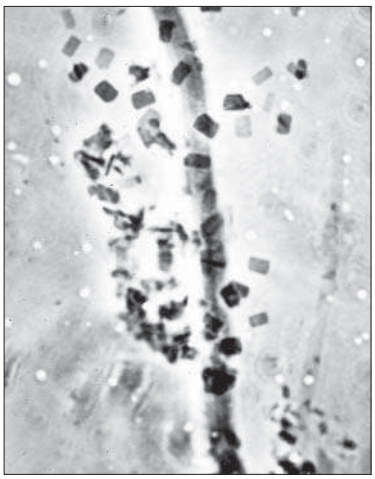
Tabl. 23, Fig. *d*
Asterophora lycoperdoides



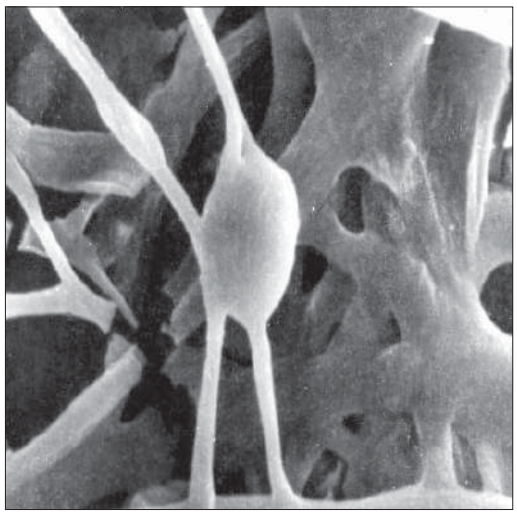
Tabl. 24, Fig. *a*
Auricularia auricula-judae

Tabl. 24, Fig. *b*
Auricularia auricula-judae

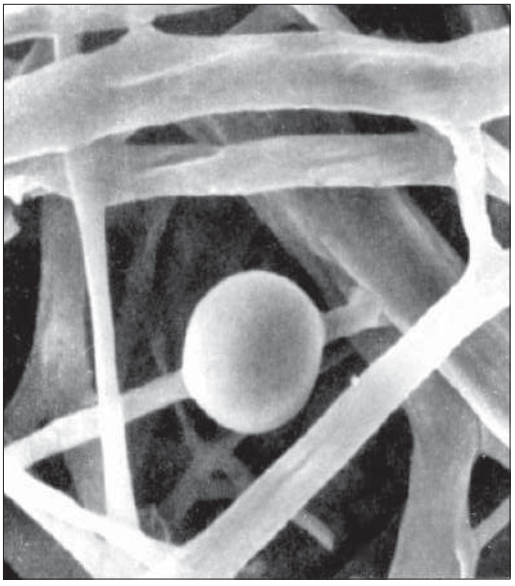
Tabl. 25, Fig. *a*
Auricularia polytricha



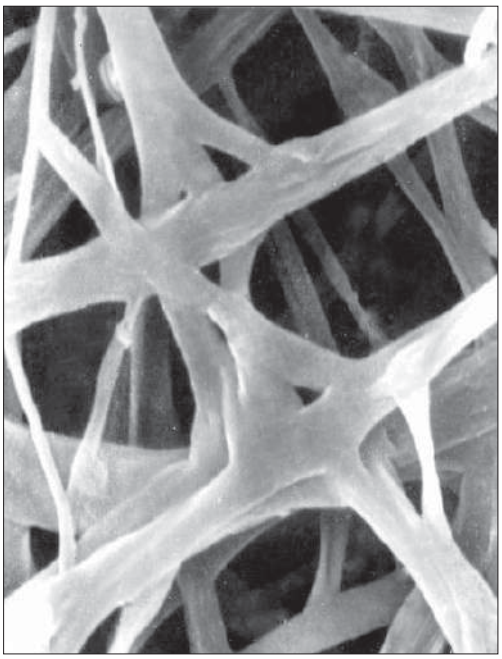
Tabl. 25, Fig. *b*
Auricularia polytricha



Tabl. 25, Fig. *c*
Auricularia polytricha

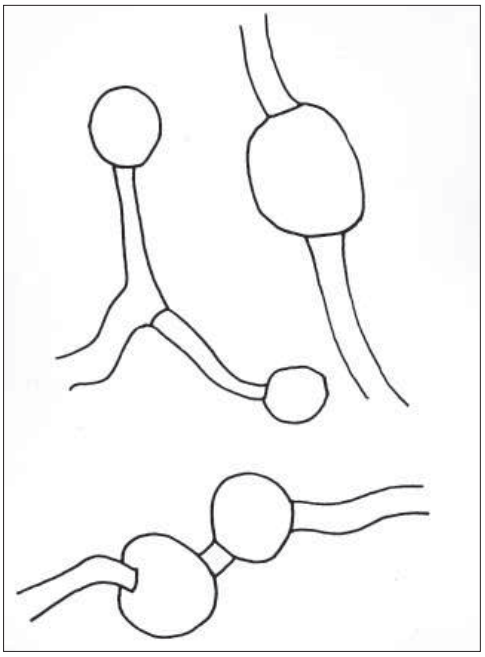


Tabl. 25, Fig. *d*
Auricularia polytricha

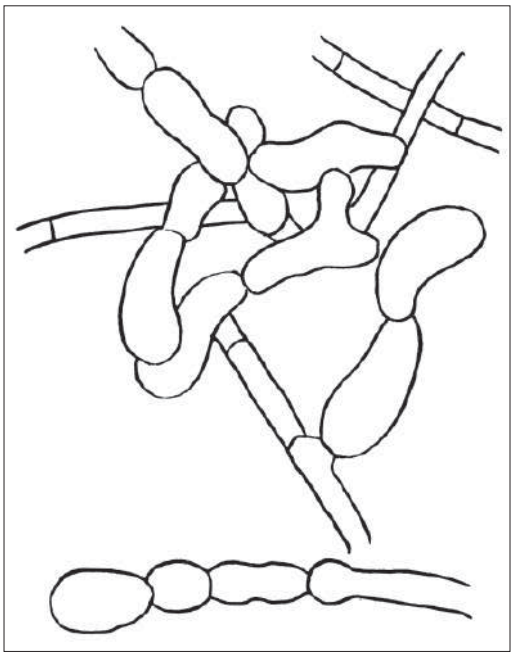


Tabl. 25, Fig. *e*
Auricularia polytricha

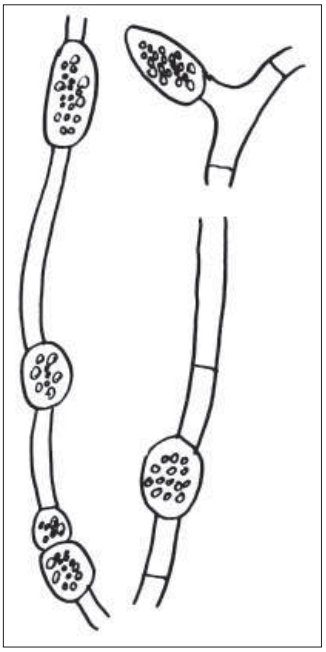
Tabl. 26, Fig. *a*
Boletus aestivalis



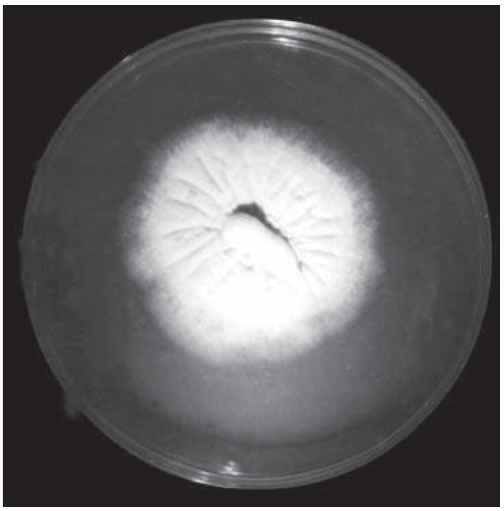
Tabl. 27, Fig. *a*
Boletus edulis



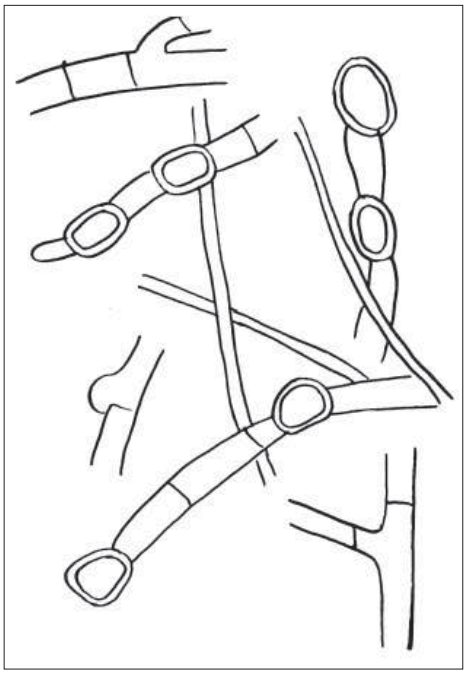
Tabl. 28, Fig. *a*
Calvatia excipuliformis



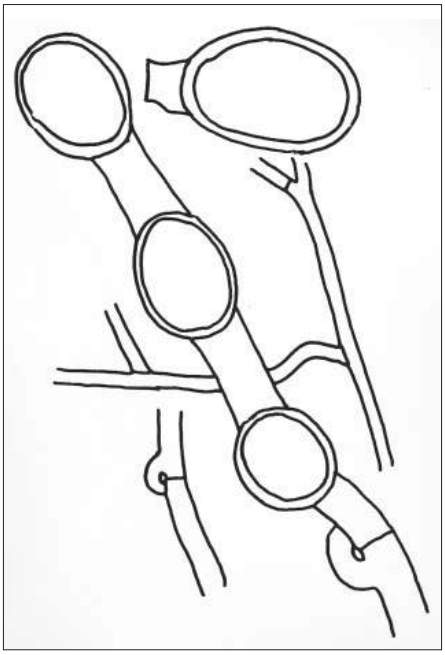
Tabl. 28, Fig. *b*
Calvatia excipuliformis



Tabl. 28, Fig. *c*
Calvatia excipuliformis

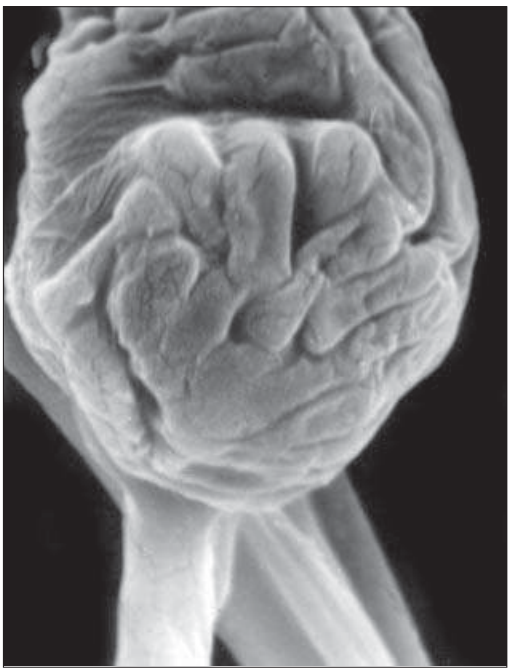


Tabl. 29, Fig. *a*
Calvatia utriformis

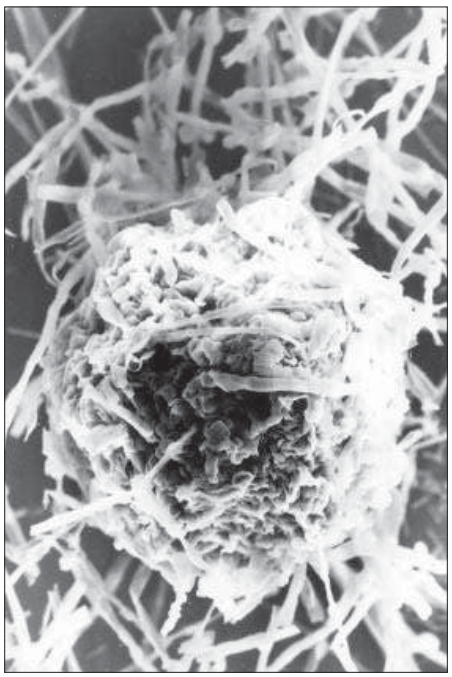


Tabl. 30, Fig. *a*
Clitocybe gigantea

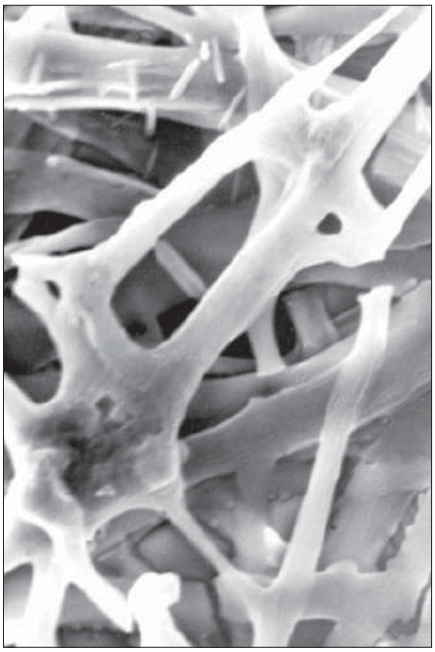
Tabl. 31, Fig. *a*
Coprinus cinereus



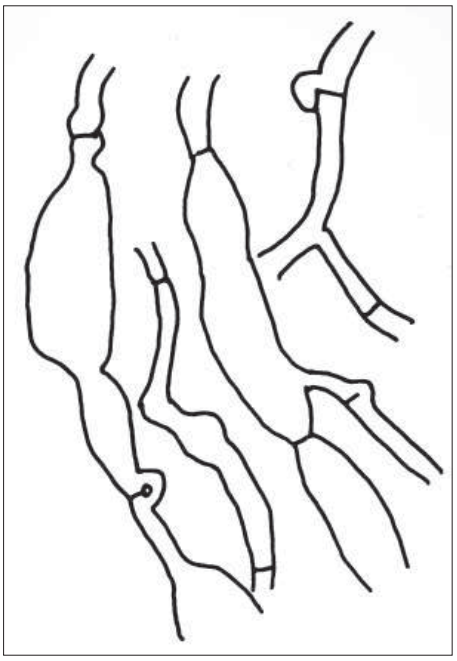
Tabl. 31, Fig. *b*
Coprinus cinereus



Tabl. 31, Fig. *c*
Coprinus cinereus

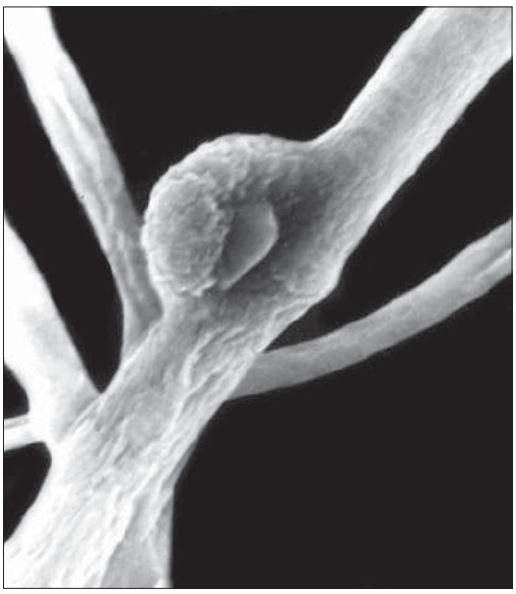


Tabl. 31, Fig. *d*
Coprinus cinereus

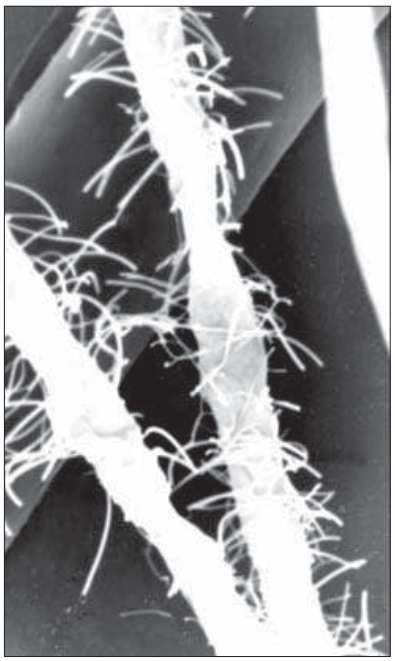


Tabl. 31, Fig. *e*
Coprinus cinereus

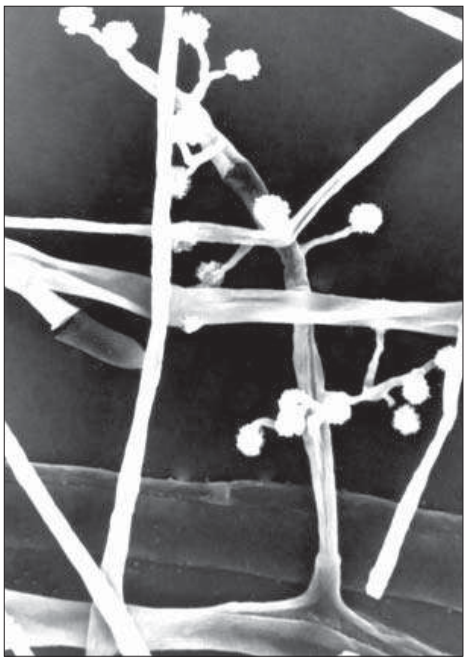
Tabl. 32, Fig. *a*
Coprinus comatus



Tabl. 32, Fig. *b*
Coprinus comatus



Tabl. 32, Fig. *c*
Coprinus comatus

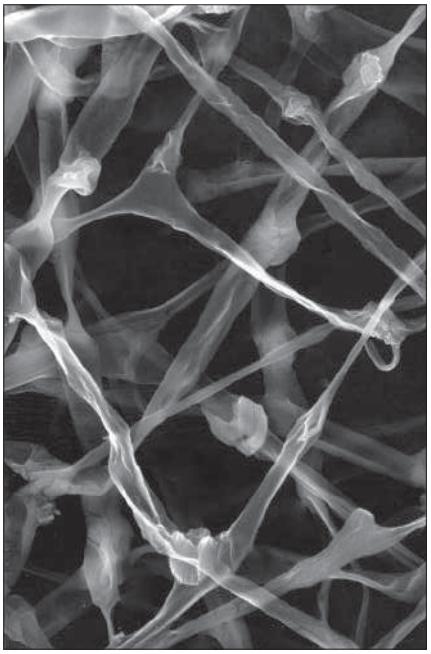


Tabl. 32, Fig. *d*
Coprinus comatus

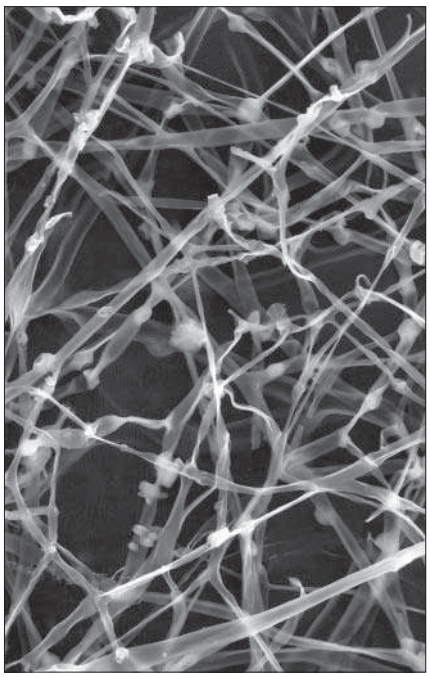
Tabl. 32, Fig. *e*
Coprinus comatus

Tabl. 32, Fig. *f*
Coprinus comatus

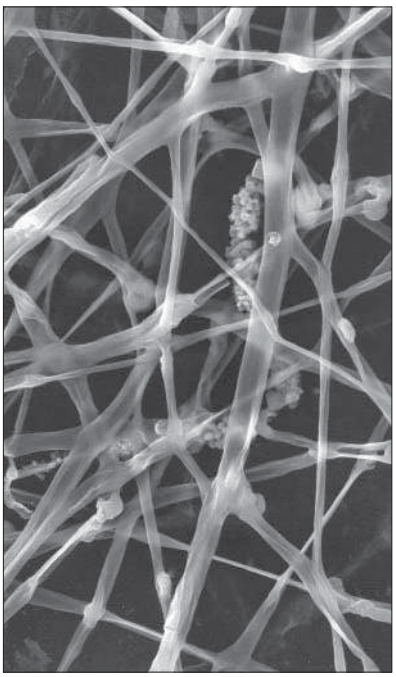
Tabl. 33, Fig. *a*
Coriolus hirsutus



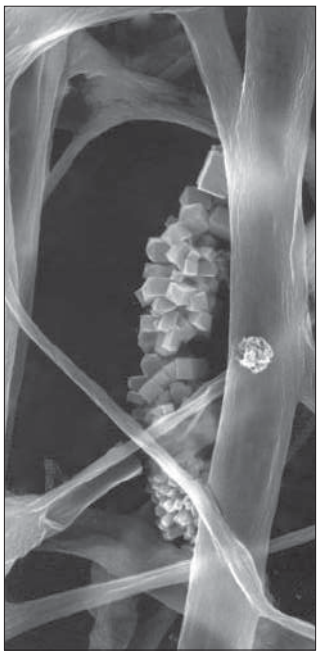
Tabl. 33, Fig. *b*
Coriolus hirsutus



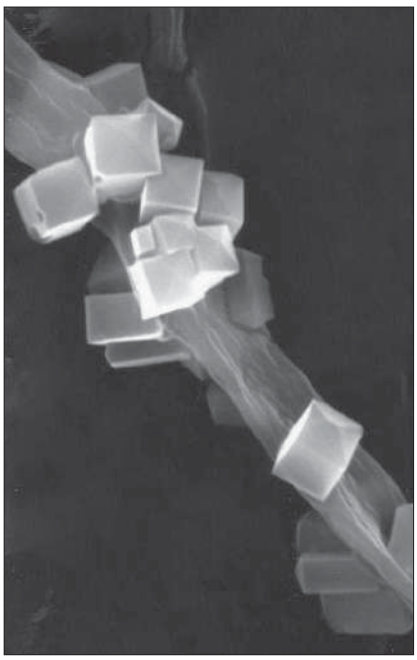
Tabl. 33, Fig. *c*
Coriolus hirsutus



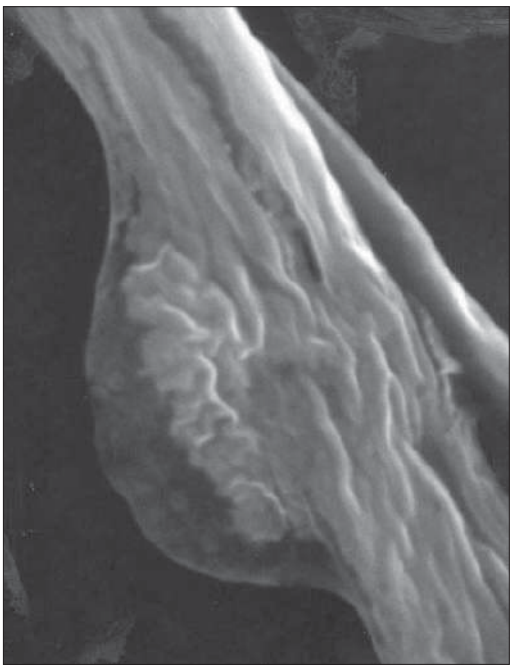
Tabl. 34, Fig. *a*
Coriolus versicolor



Tabl. 34, Fig. *b*
Coriolus versicolor

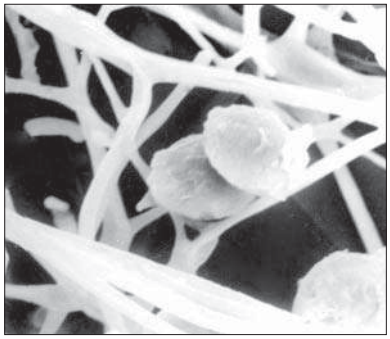


Tabl. 34, Fig. *c*
Coriolus versicolor

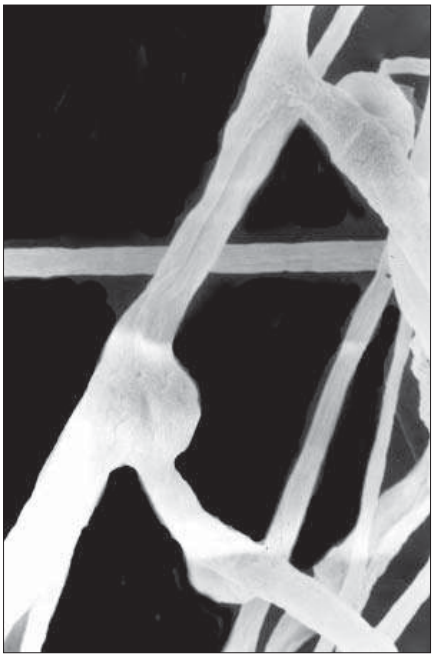


Tabl. 34, Fig. *d*
Coriolus versicolor

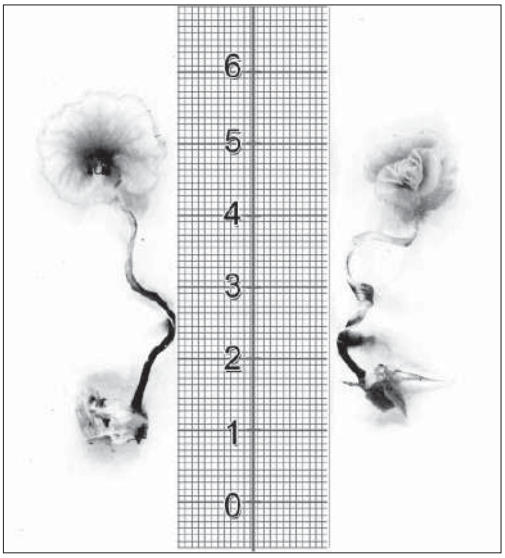
Tabl. 35, Fig. *a*
Coriolus zonatus



Tabl. 35, Fig. *b*
Coriolus zonatus

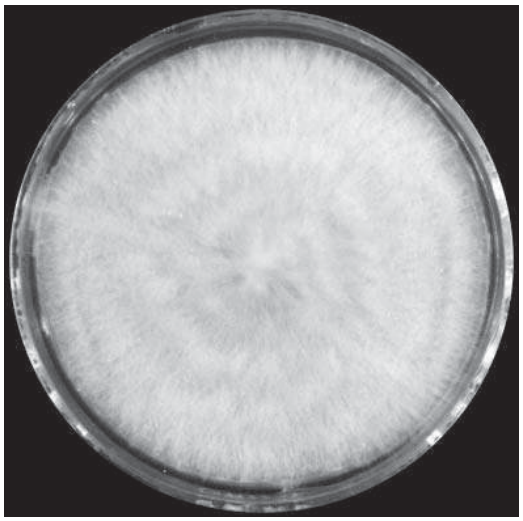


Tabl. 36, Fig. *a*
Crinipellis schevczenkovi

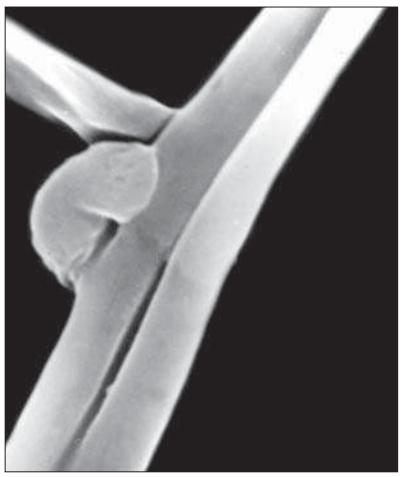


Tabl. 36, Fig. *b*
Crinipellis schevczenkovi

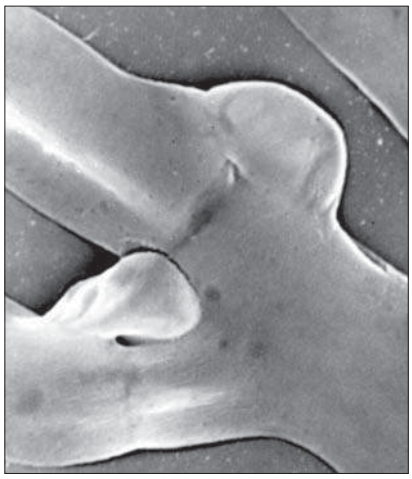
Tabl. 36, Fig. *c*
Crinipellis schevczenkovi



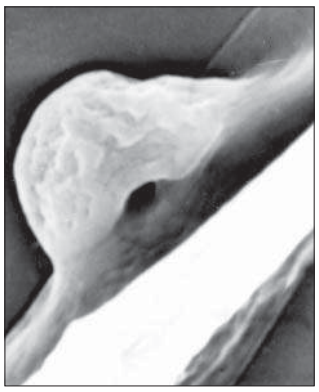
Tabl. 36, Fig. *d*
Crinipellis schevczenkovi



Tabl. 37, Fig. *a*
Cyathus olla

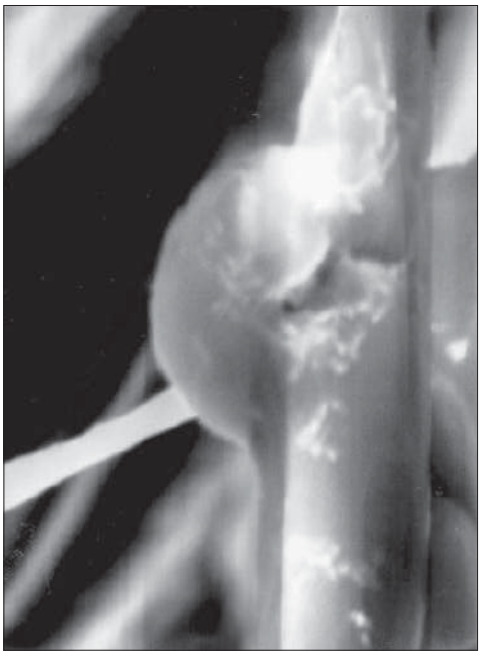


Tabl. 37, Fig. *b*
Cyathus olla

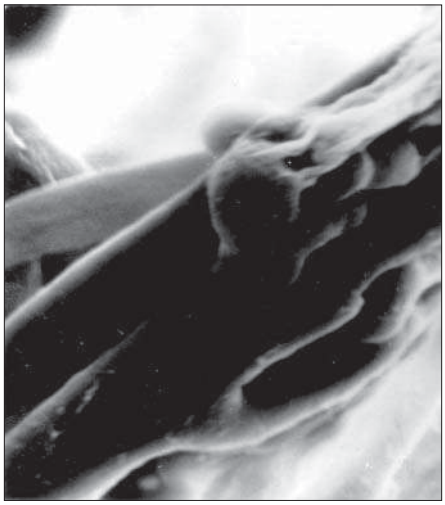


Tabl. 37, Fig. *c*
Cyathus olla

Tabl. 37, Fig. *d*
Cyathus olla

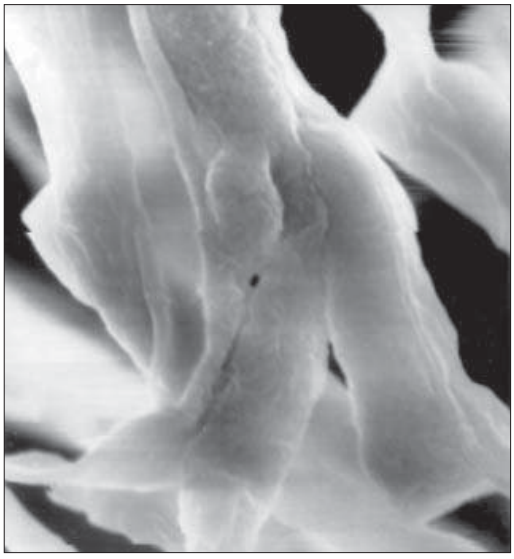


Tabl. 38, Fig. *a*
Cyathus striatus

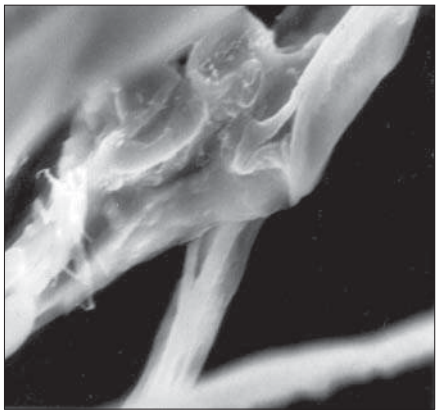


Tabl. 38, Fig. *b*
Cyathus striatus

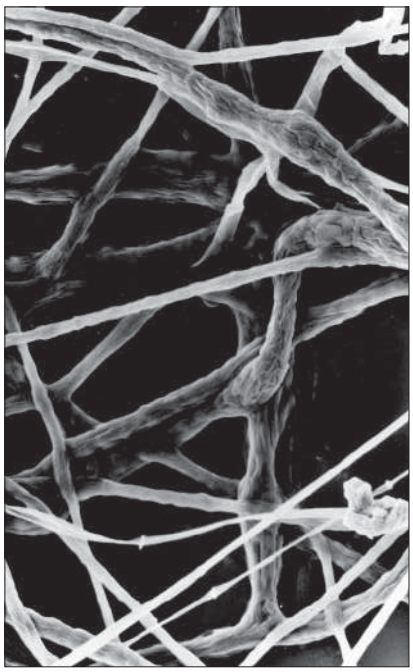
Tabl. 38, Fig. *c*
Cyathus striatus



Tabl. 38, Fig. *d*
Cyathus striatus

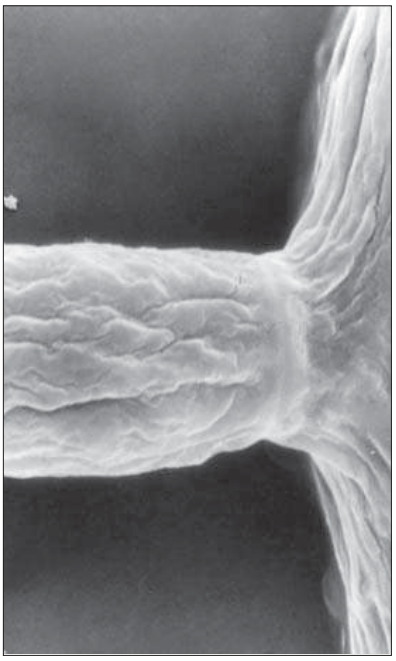


Tabl. 38, Fig. *e*
Cyathus striatus

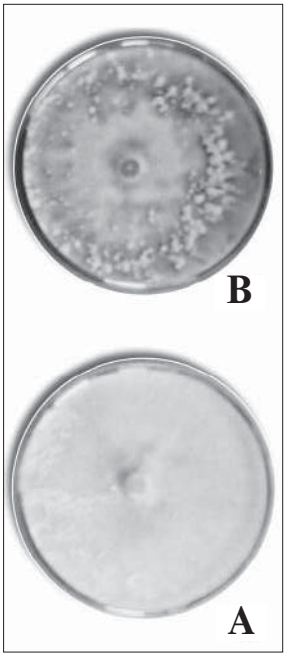


Tabl. 39, Fig. *a*
Disciotis venosa

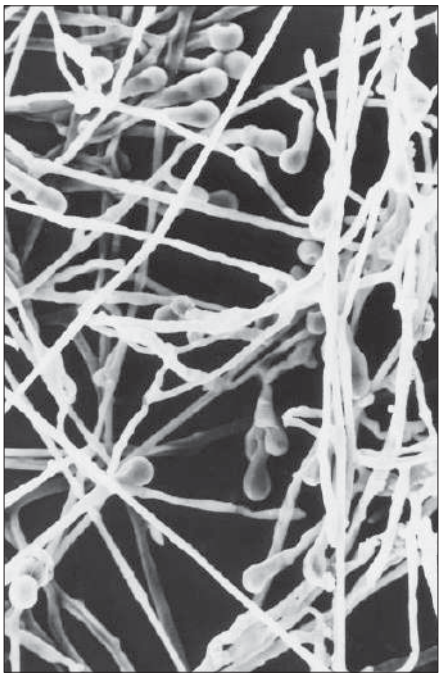
Tabl. 39, Fig. *b*
Disciotis venosa



Tabl. 39, Fig. *c*
Disciotis venosa

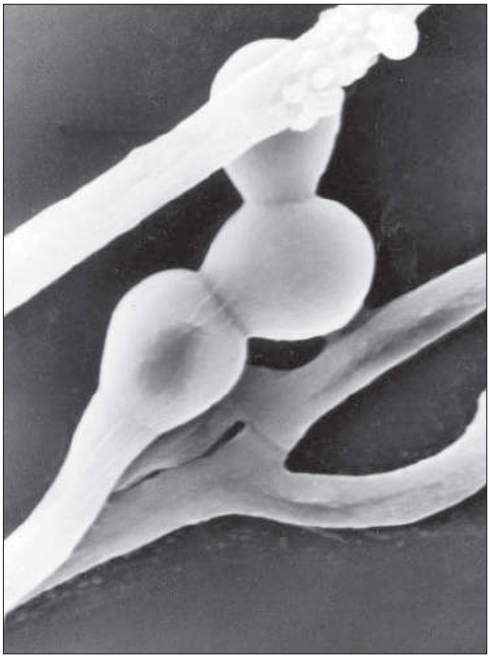


Tabl. 39, Fig. *d*
Disciotis venosa



Tabl. 40, Fig. *a*
Fistulina hepatica

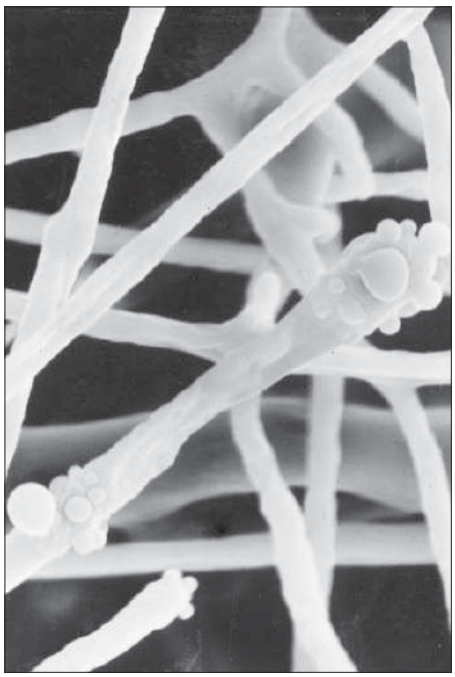
Tabl. 40, Fig. *b*
Fistulina hepatica



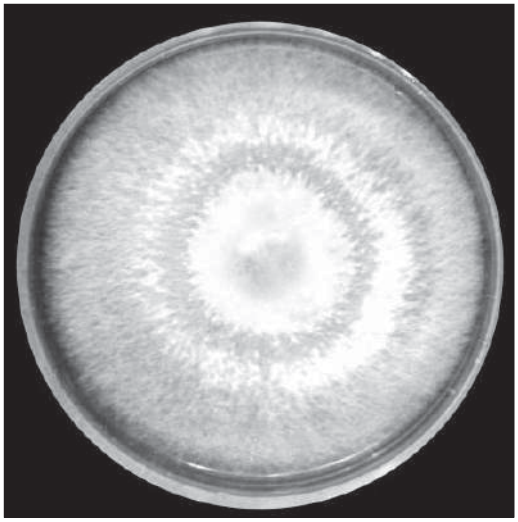
Tabl. 40, Fig. *c*
Fistulina hepatica

Tabl. 40, Fig. *d*
Fistulina hepatica

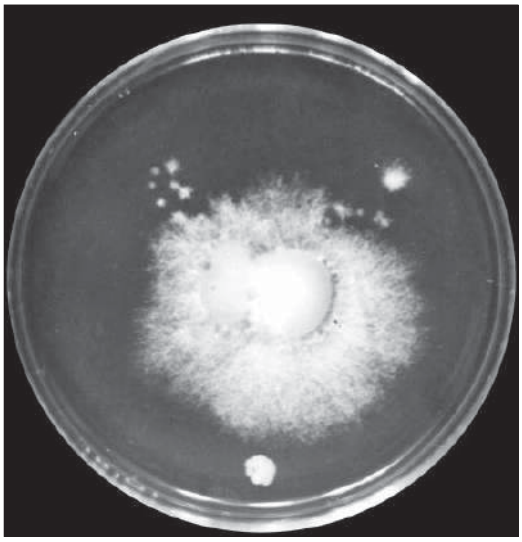
Tabl. 40, Fig. *e*
Fistulina hepatica



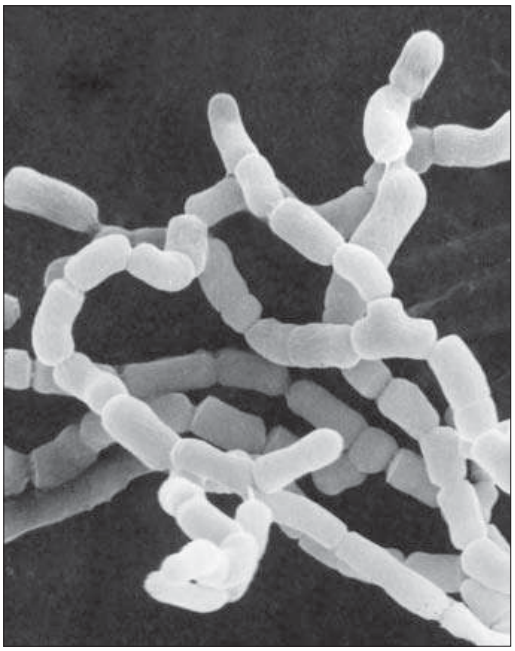
Tabl. 40, Fig. *f*
Fistulina hepatica



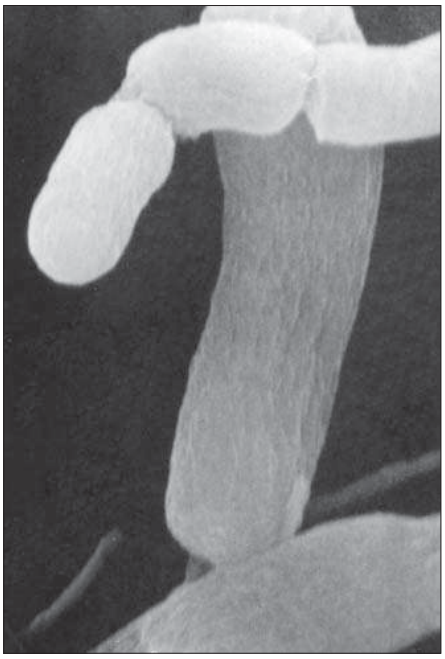
Tabl. 40, Fig. *g*
Fistulina hepatica



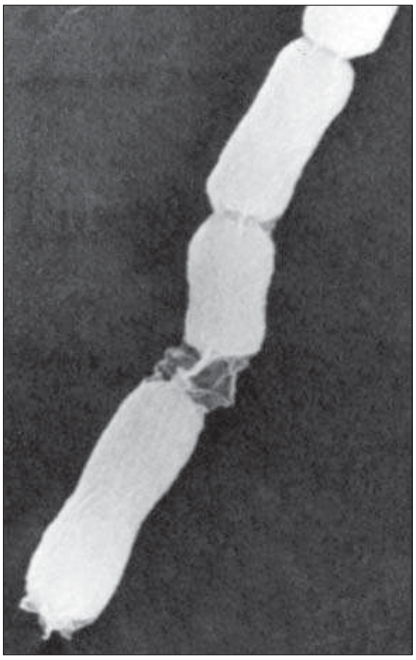
Tabl. 40, Fig. *h*
Fistulina hepatica



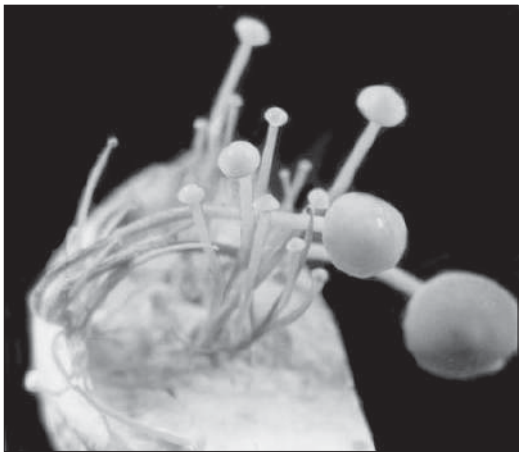
Tabl. 41, Fig. *a*
Flammulina velutipes



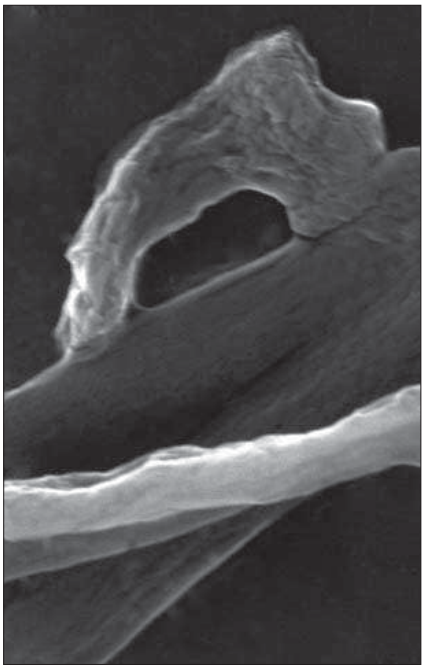
Tabl. 41, Fig. *b*
Flammulina velutipes



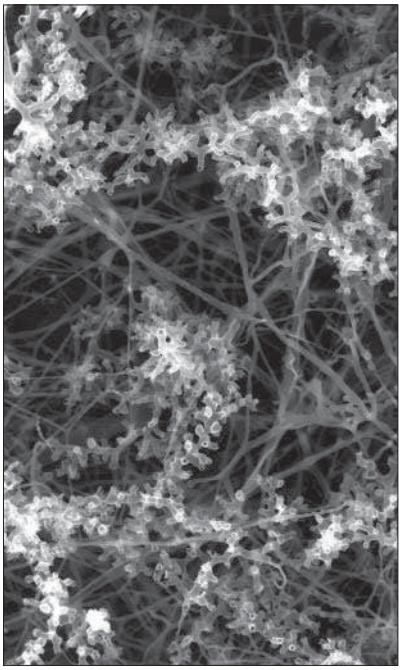
Tabl. 41, Fig. *c*
Flammulina velutipes



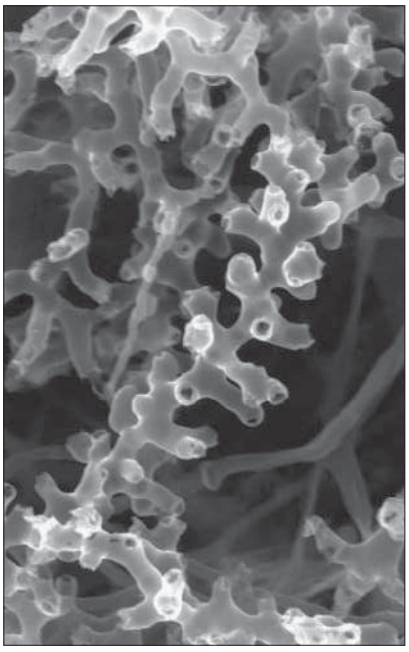
Tabl. 41, Fig. *d*
Flammulina velutipes



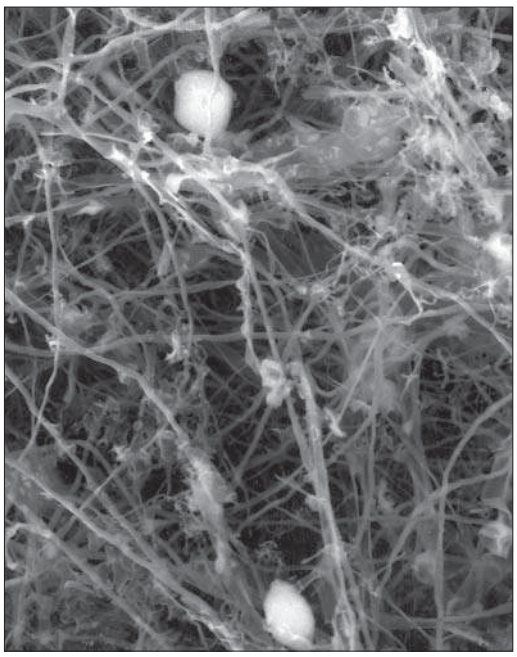
Tabl. 42, Fig. *a*
Ganoderma lucidum



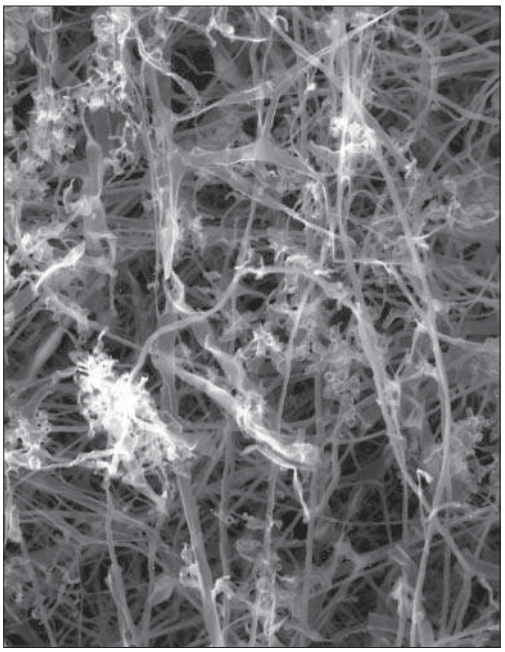
Tabl. 42, Fig. *b*
Ganoderma lucidum



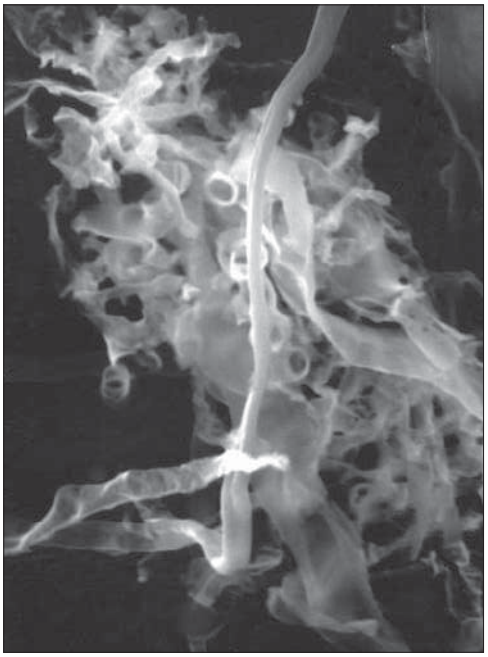
Tabl. 42, Fig. *c*
Ganoderma lucidum



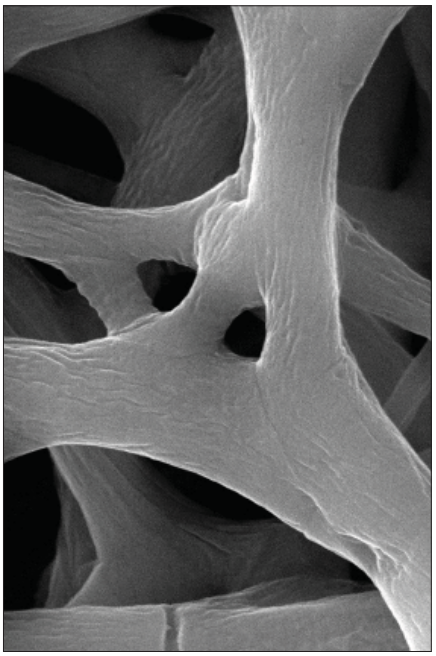
Tabl. 42, Fig. *d*
Ganoderma lucidum



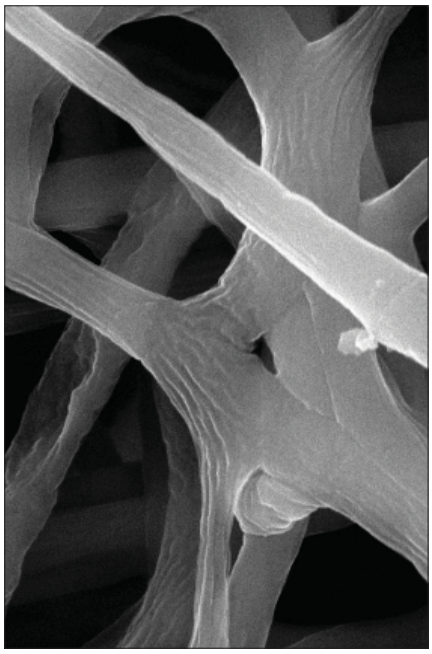
Tabl. 42, Fig. *e*
Ganoderma lucidum



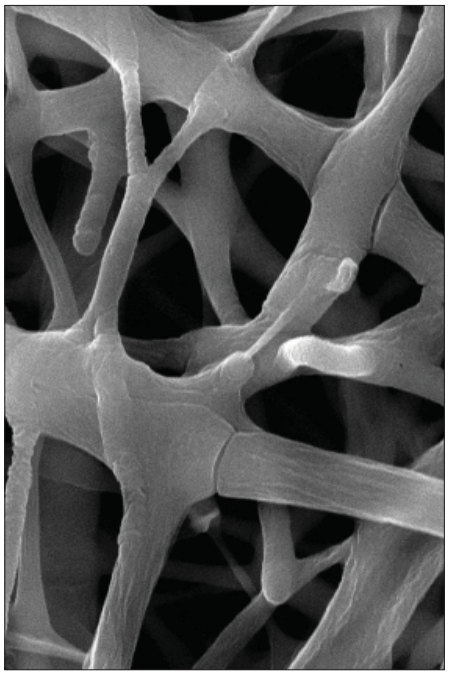
Tabl. 42, Fig. *f*
Ganoderma lucidum



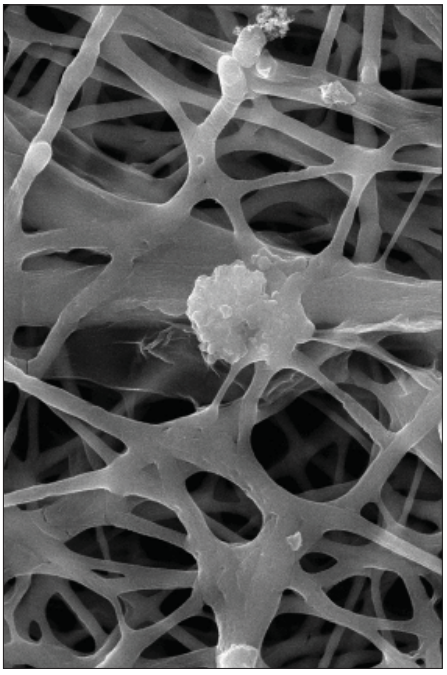
Tabl. 43, Fig. *a*
Ganoderma tsugae



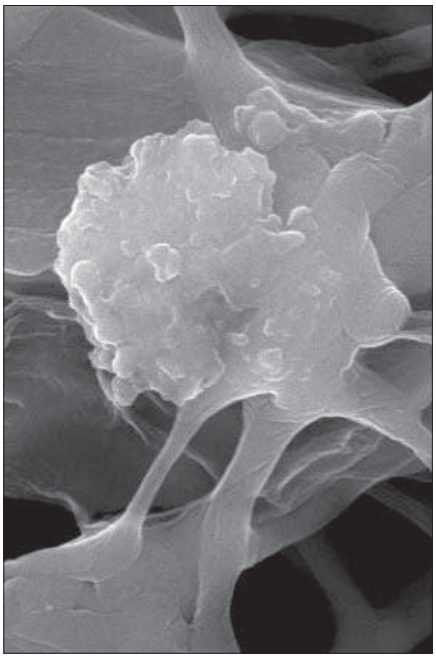
Tabl. 43, Fig. *b*
Ganoderma tsugae



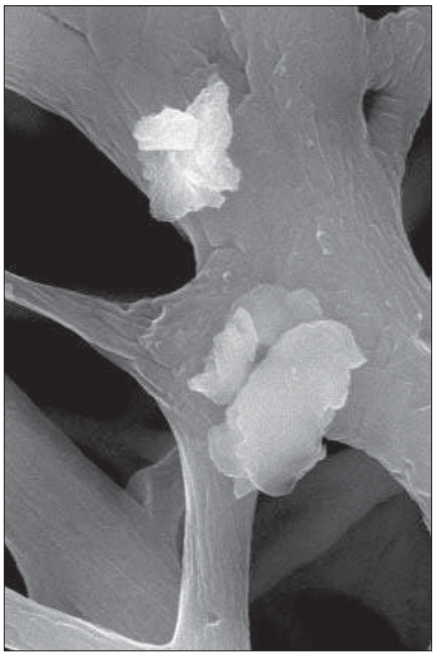
Tabl. 43, Fig. *c*
Ganoderma tsugae



Tabl. 43, Fig. *d*
Ganoderma tsugae

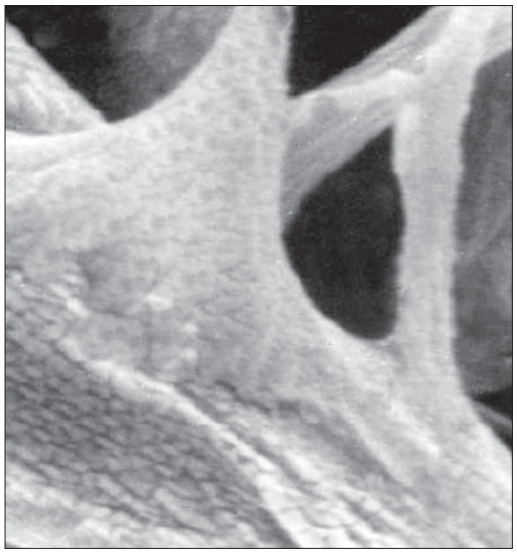


Tabl. 43, Fig. *e*
Ganoderma tsugae

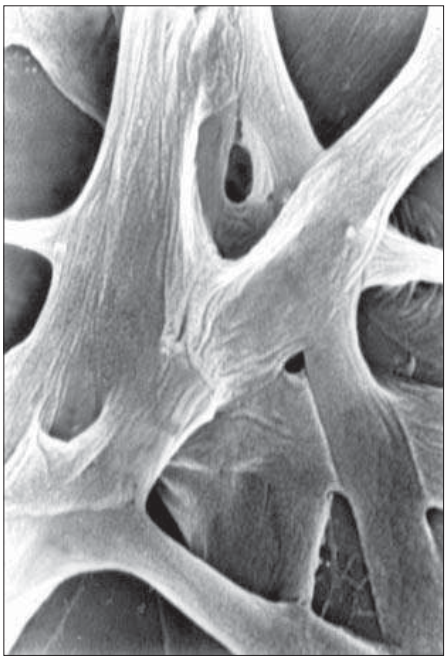


Tabl. 43, Fig. *f*
Ganoderma tsugae

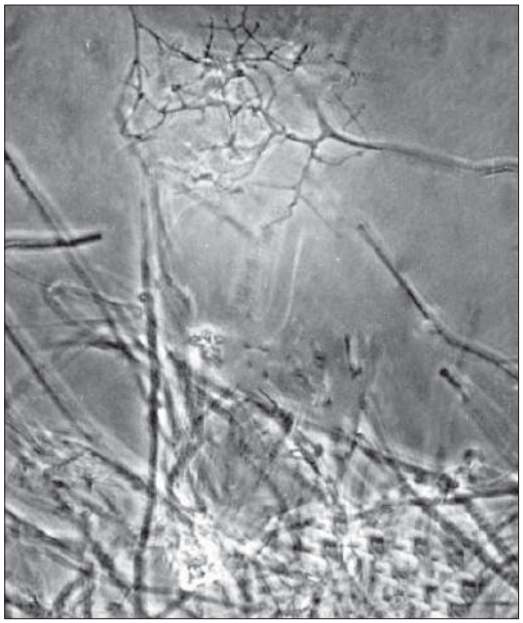
Tabl. 44, Fig. *a*
Grifola frondosa



Tabl. 44, Fig. *b*
Grifola frondosa



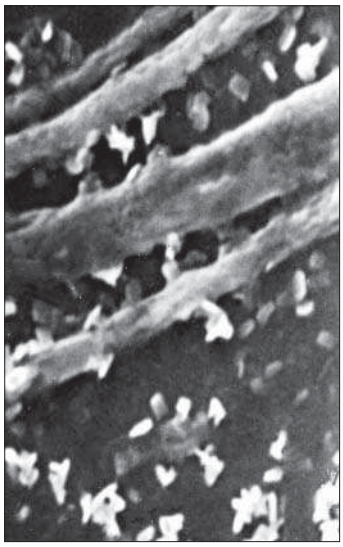
Tabl. 44, Fig. *c*
Grifola frondosa



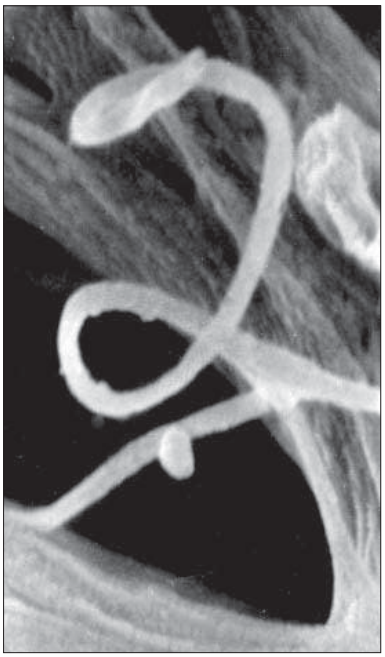
Tabl. 44, Fig. *d*
Grifola frondosa

Tabl. 44, Fig. *e*
Grifola frondosa

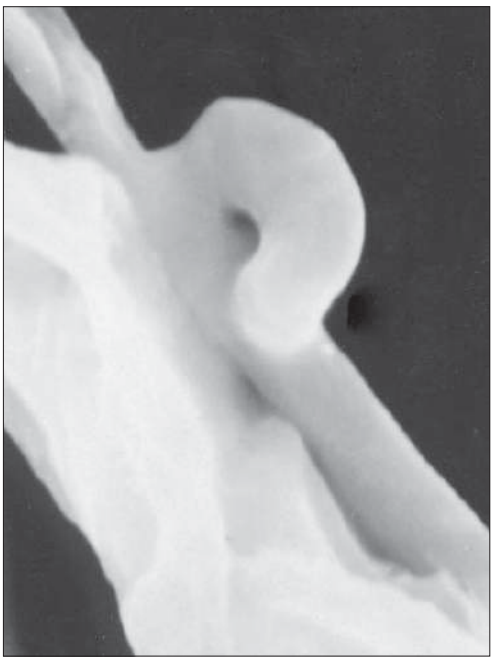
Tabl. 44, Fig. *f*
Grifola frondosa



Tabl. 44, Fig. *g*
Grifola frondosa



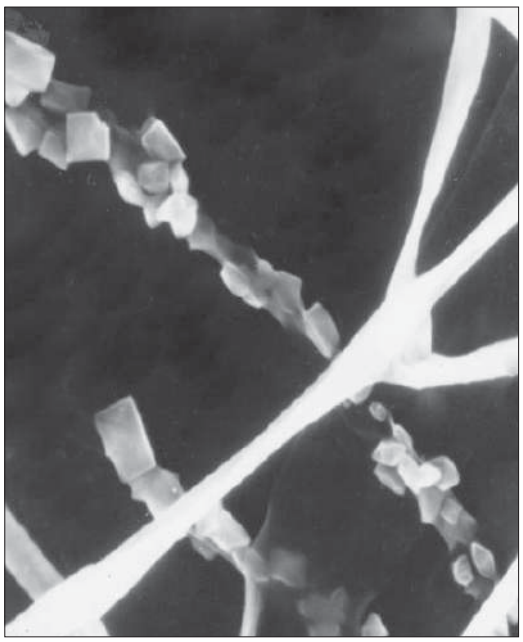
Tabl. 44, Fig. *h*
Grifola frondosa



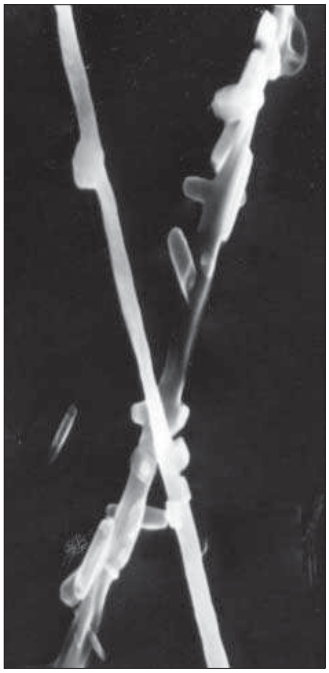
Tabl. 45, Fig. *a*
Hericium erinaceus

Tabl. 45, Fig. *b*
Hericium erinaceus

Tabl. 45, Fig. *c*
Hericium erinaceus



Tabl. 45, Fig. *d*
Hericium erinaceus

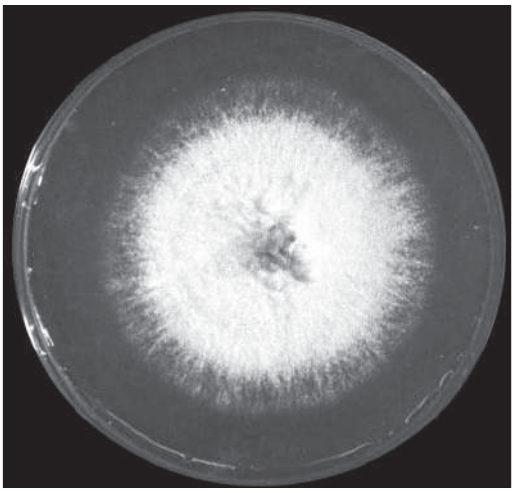


Tabl. 45, Fig. *e*
Hericium erinaceus

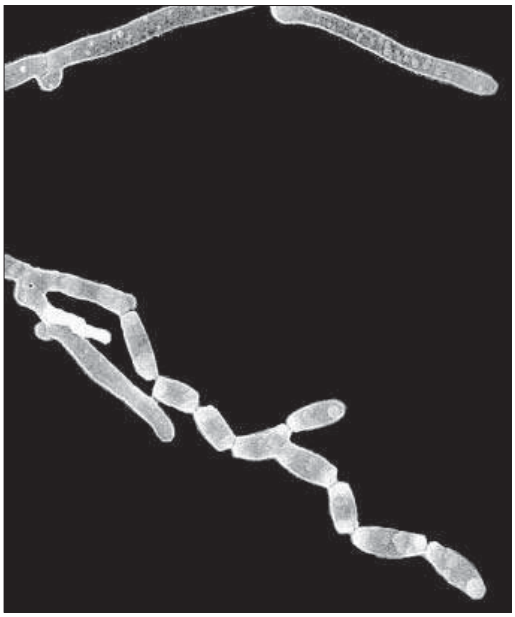
Tabl. 45, Fig. *f*
Hericium erinaceus

Tabl. 45, Fig. *g*
Hericium erinaceus

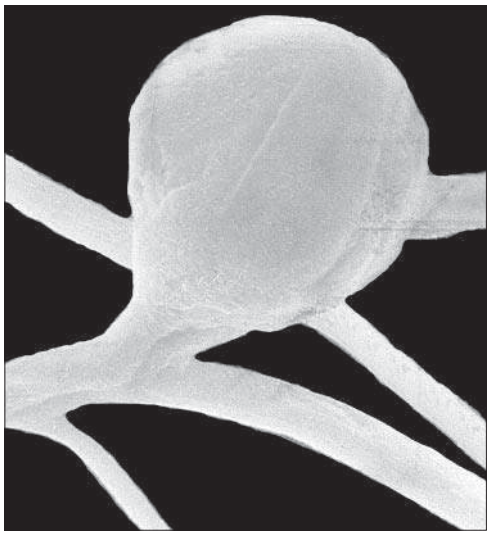
Tabl. 45, Fig. *h*
Hericium erinaceus



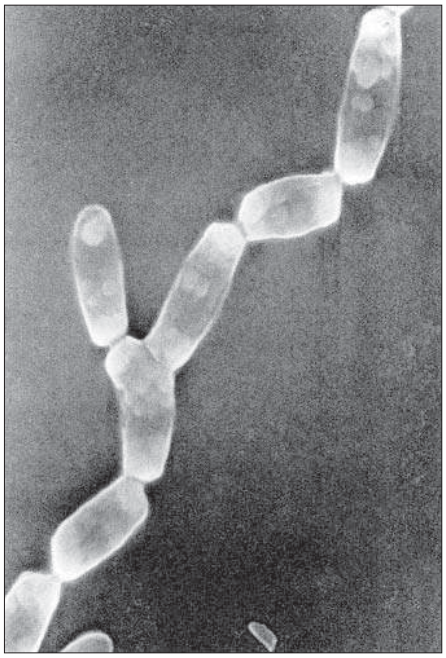
Tabl. 45, Fig. *i*
Hericium erinaceus



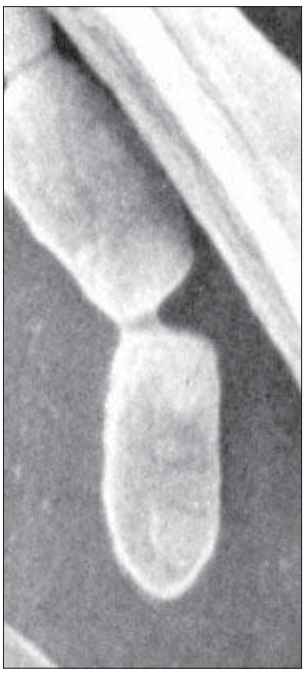
Tabl. 46, Fig. *a*
Hypsizygus marmoreus



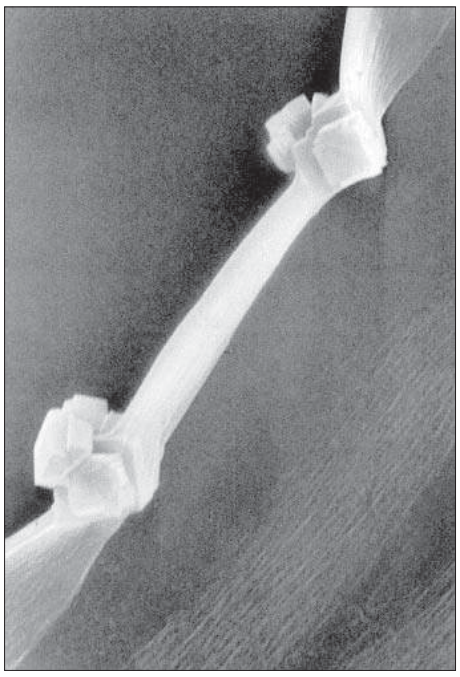
Tabl. 46, Fig. *b*
Hypsizygus marmoreus



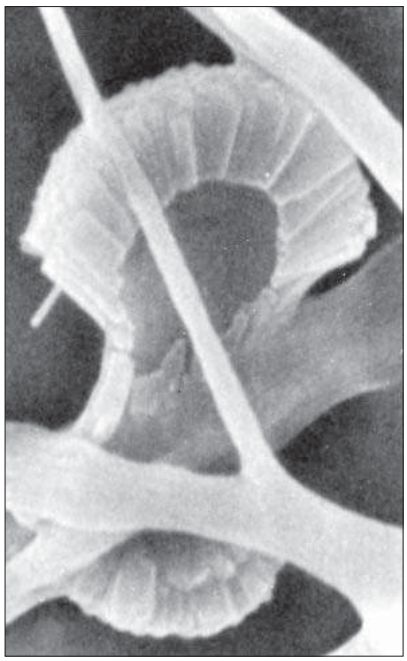
Tabl. 46, Fig. *c*
Hypsizygus marmoreus



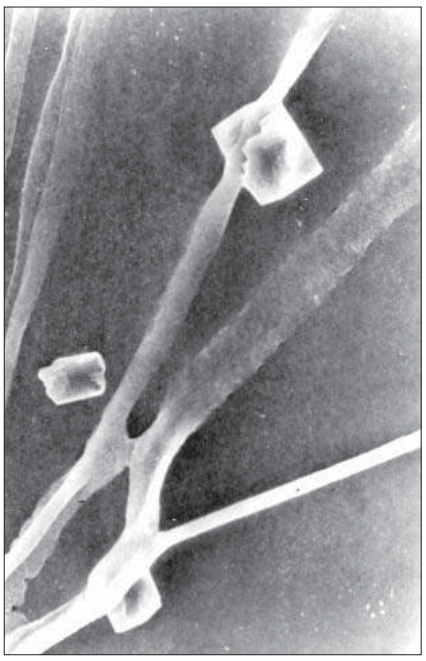
Tabl. 46, Fig. *d*
Hypsizygus marmoreus



Tabl. 46, Fig. *e*
Hypsizygus marmoreus

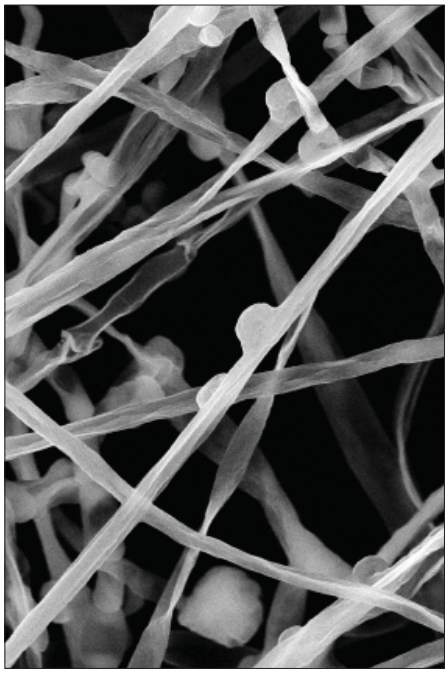


Tabl. 46, Fig. *f*
Hypsizygus marmoreus

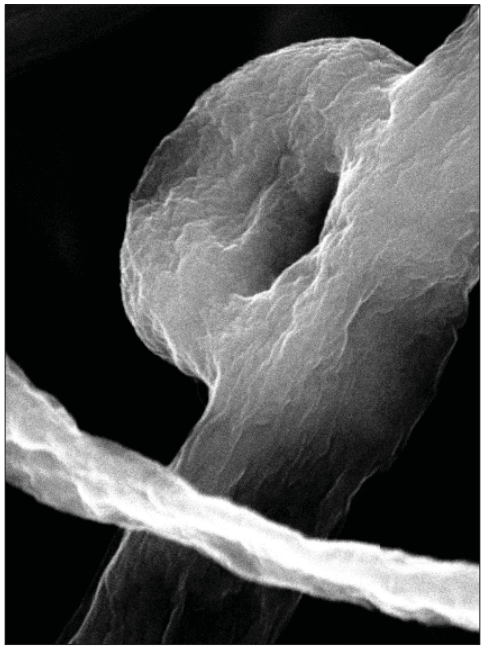


Tabl. 46, Fig. *g*
Hypsizygus marmoreus

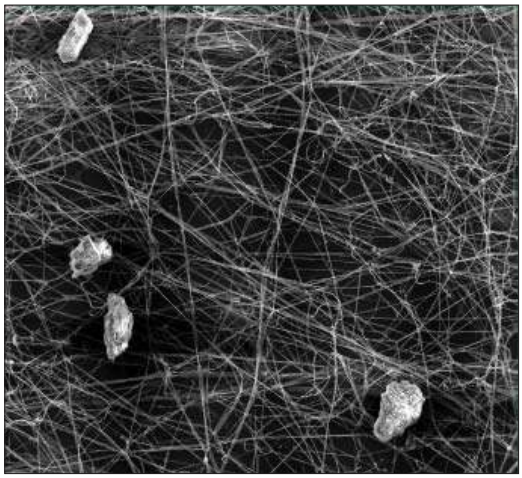
Tabl. 46, Fig. *h*
Hypsizygus marmoreus



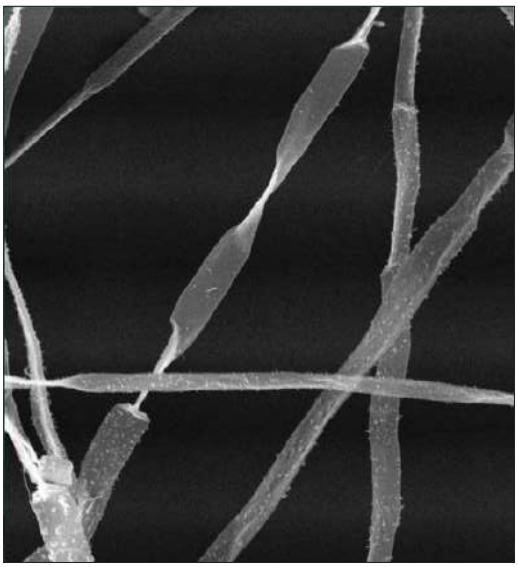
Tabl. 46, Fig. *i*
Hypsizygus marmoreus



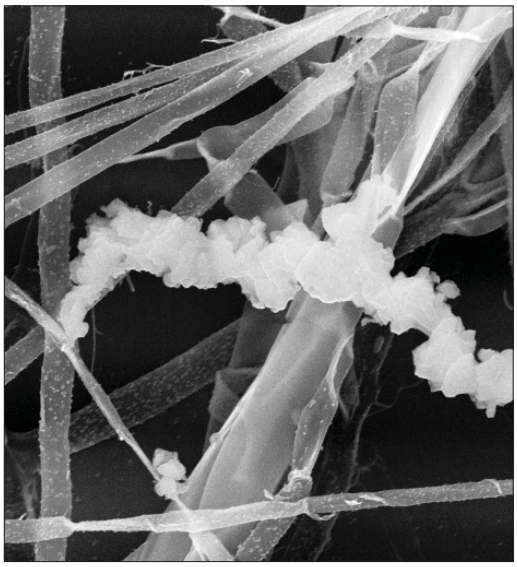
Tabl. 46, Fig. *j*
Hypsizygus marmoreus



Tabl. 47, Fig. *a*
Inonotus obliques



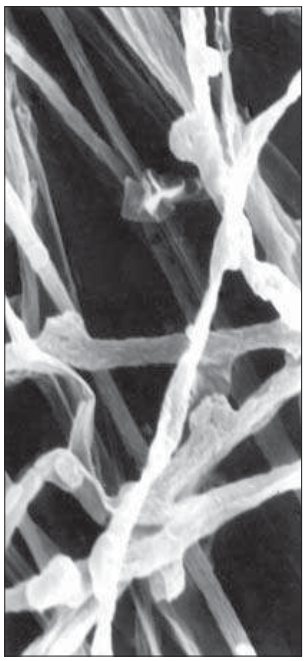
Tabl. 47, Fig. *b*
Inonotus obliquus



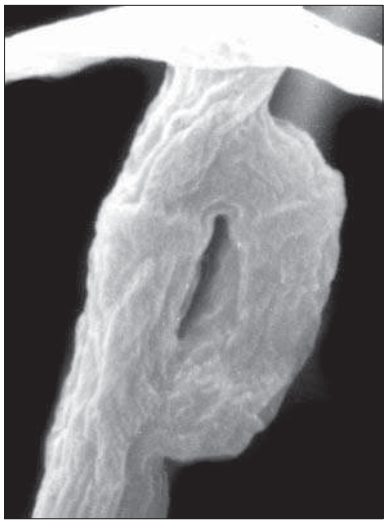
Tabl. 47, Fig. *c*
Inonotus obliquus

Tabl. 48, Fig. *a*
Kuehneromyces mutabilis

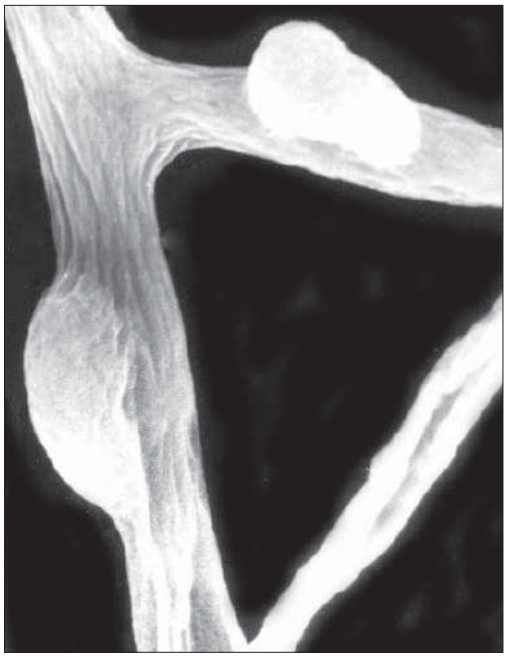
Tabl. 48, Fig. *b*
Kuehneromyces mutabilis



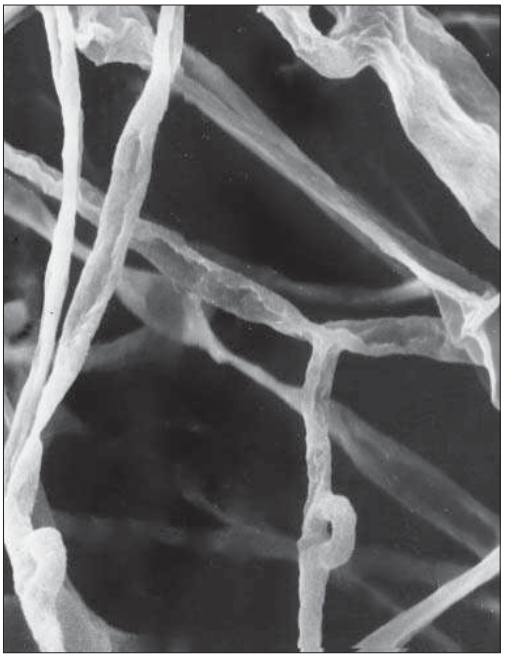
Tabl. 48, Fig. *c*
Kuehneromyces mutabilis



Tabl. 49, Fig. *a*
Lacrymaria velutina



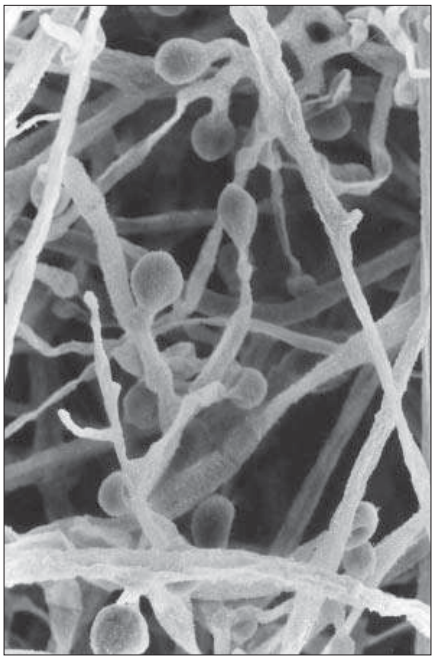
Tabl. 49, Fig. *b*
Lacrymaria velutina



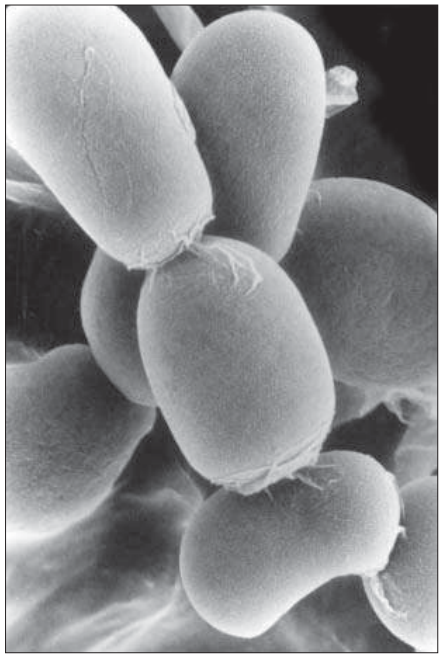
Tabl. 49, Fig. *c*
Lacrymaria velutina

Tabl. 49, Fig. *d*
Lacrymaria velutina

Tabl. 50, Fig. *a*
Laetiporus sulphureus

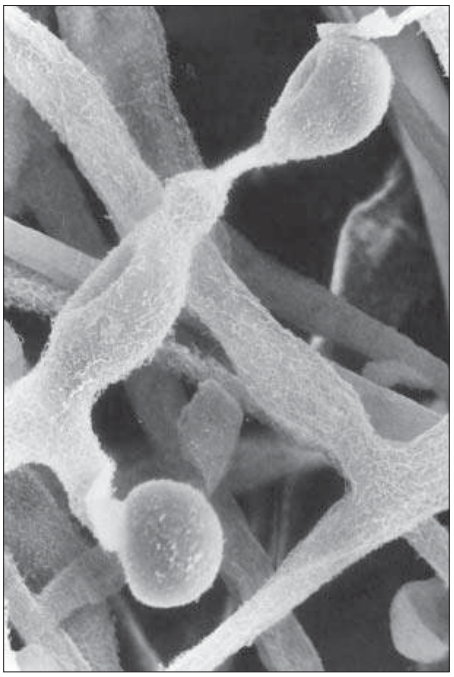


Tabl. 50, Fig. *b*
Laetiporus sulphureus

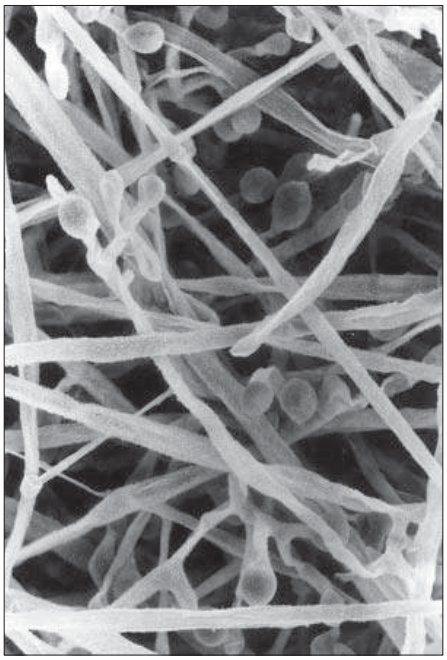


Tabl. 50, Fig. *c*
Laetiporus sulphureus

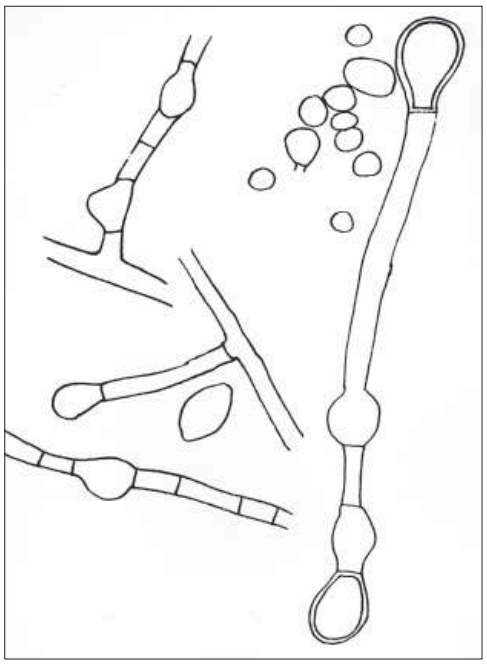
Tabl. 50, Fig. *d*
Laetiporus sulphureus



Tabl. 50, Fig. *e*
Laetiporus sulphureus

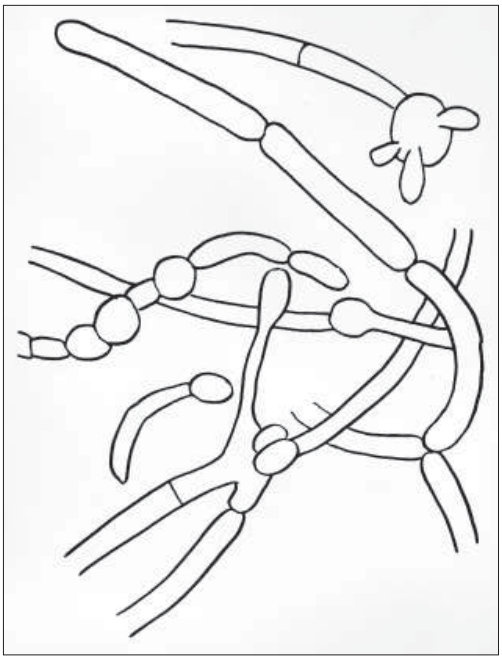


Tabl. 50, Fig. *f*
Laetiporus sulphureus

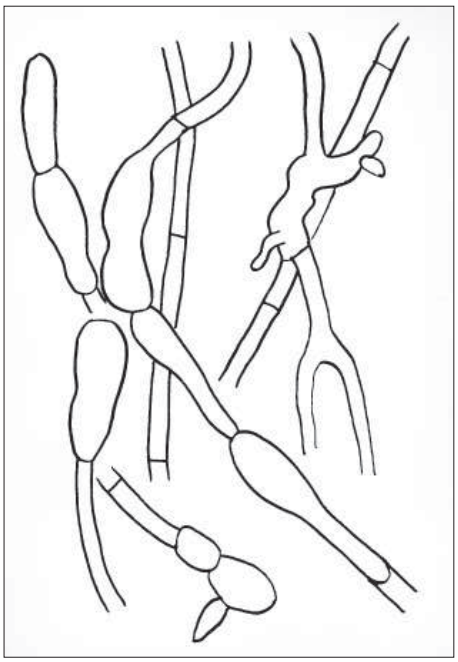


Tabl. 50, Fig. *g*
Laetiporus sulphureus

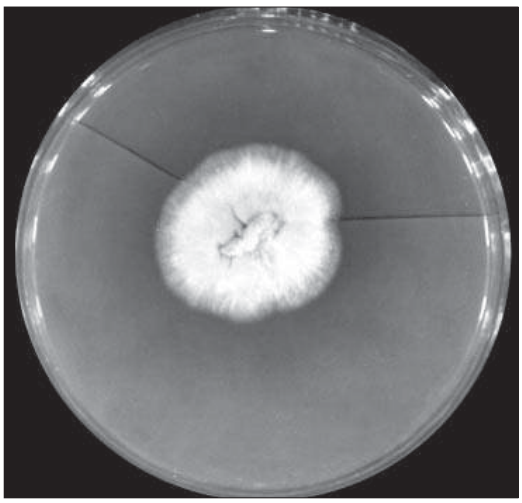
Tabl. 50, Fig. *h*
Laetiporus sulphureus



Tabl. 51, Fig. *a*
Langermannia gigantea

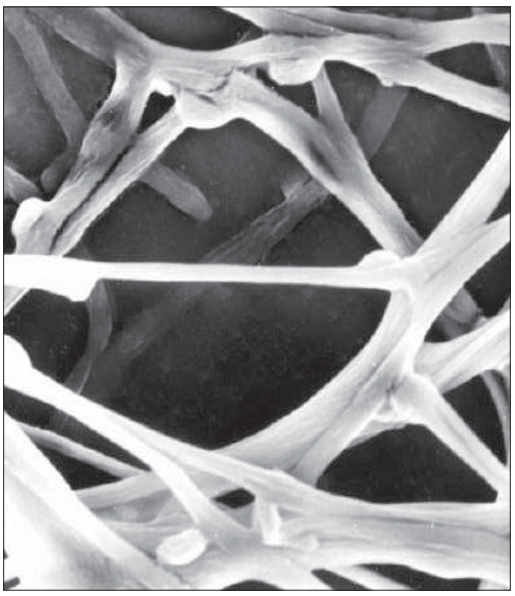


Tabl. 51, Fig. *b*
Langermannia gigantea

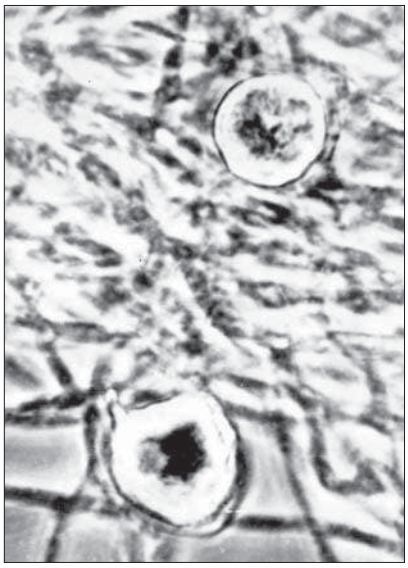


Tabl. 51, Fig. *c*
Langermannia gigantea

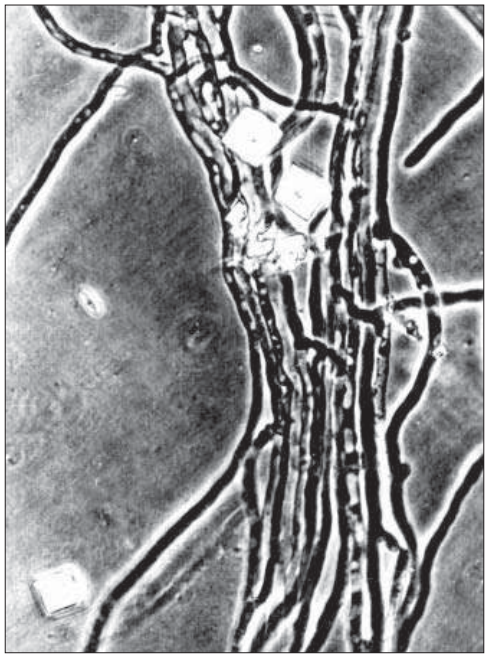
Tabl. 52, Fig. *a*
Lentinus edodes



Tabl. 52, Fig. *b*
Lentinus edodes



Tabl. 52, Fig. *c*
Lentinus edodes



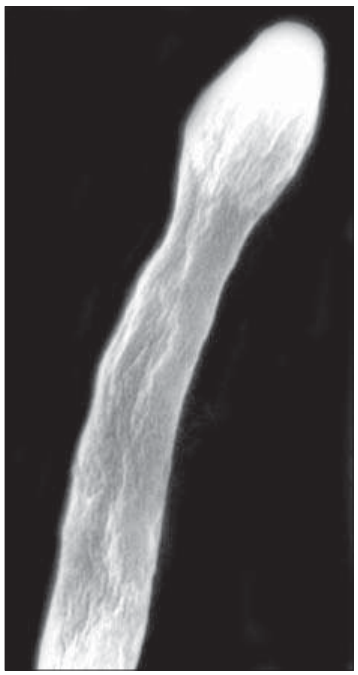
Tabl. 52, Fig. *d*
Lentinus edodes

Tabl. 52, Fig. *e*
Lentinus edodes

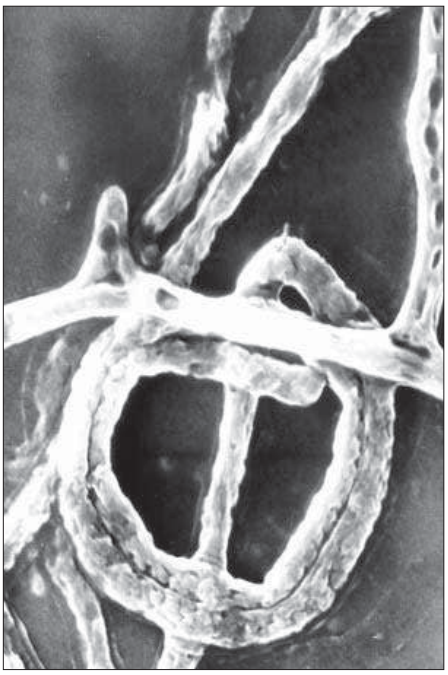
Tabl. 52, Fig. *f*
Lentinus edodes

Tabl. 52, Fig. *g*
Lentinus edodes

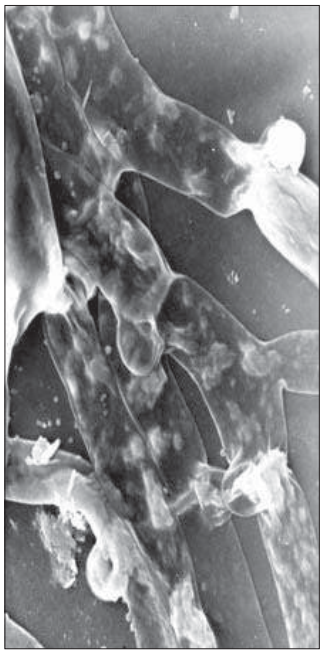
Tabl. 53, Fig. *a*
Lepiota alba



Tabl. 53, Fig. *b*
Lepiota alba

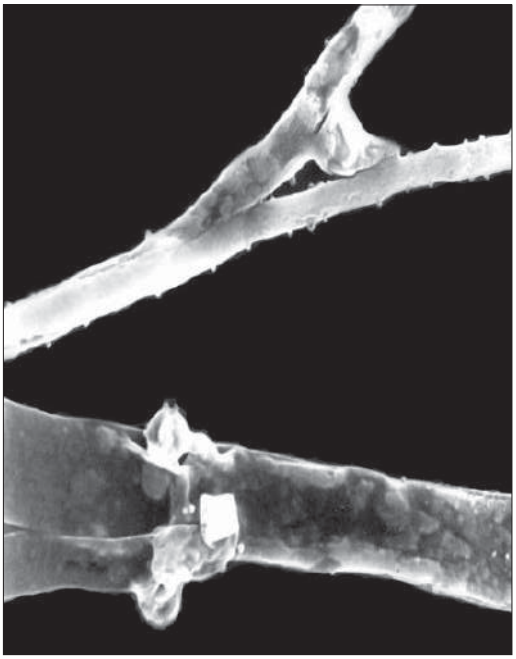


Tabl. 53, Fig. *c*
Lepiota alba



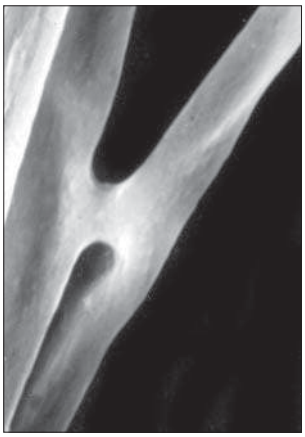
Tabl. 54, Fig. *a*
Lepista nebularis

Tabl. 54, Fig. *b*
Lepista nebularis

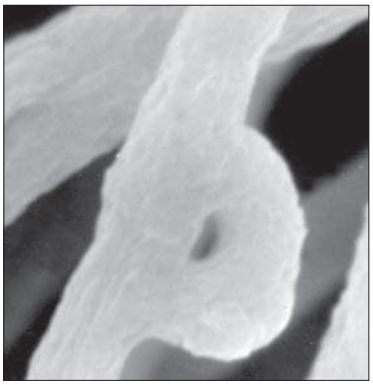


Tabl. 54, Fig. *c*
Lepista nebularis

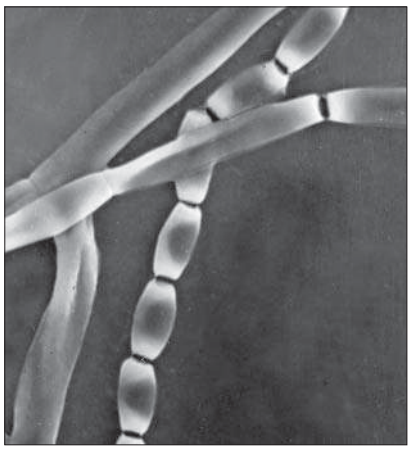
Tabl. 54, Fig. *d*
Lepista nebularis



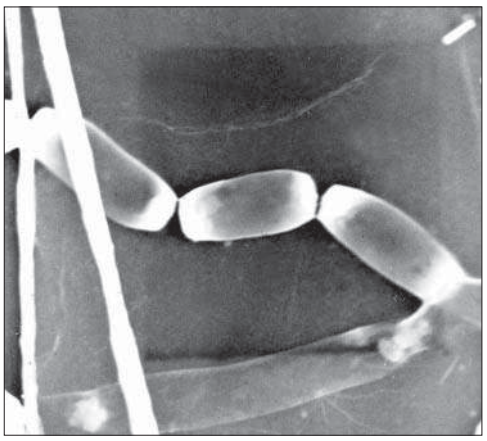
Tabl. 54, Fig. *e*
Lepista nebularis



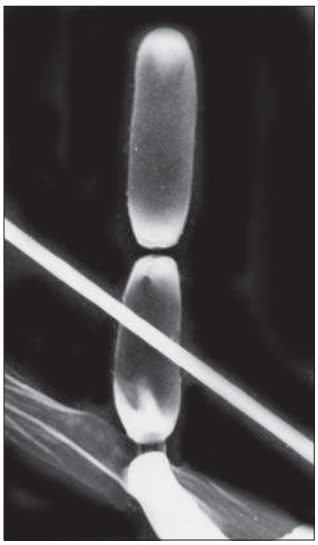
Tabl. 55, Fig. *a*
Lepista nuda



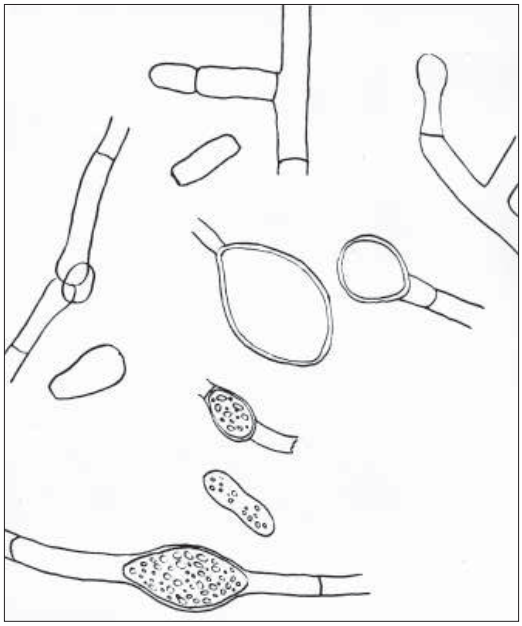
Tabl. 55, Fig. *b*
Lepista nuda



Tabl. 55, Fig. *c*
Lepista nuda

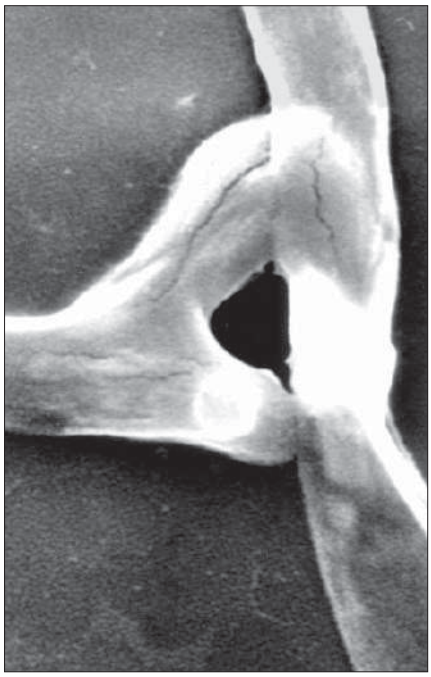


Tabl. 55, Fig. *d*
Lepista nuda



Tabl. 55, Fig. *e*
Lepista nuda

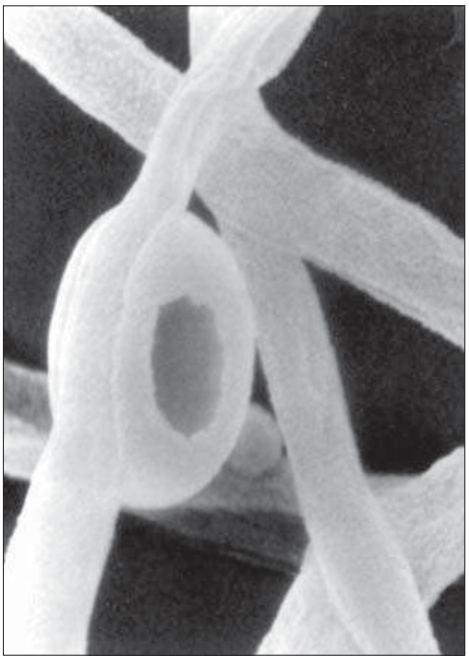
Tabl. 56, Fig. *a*
Leucoagaricus carneifolius



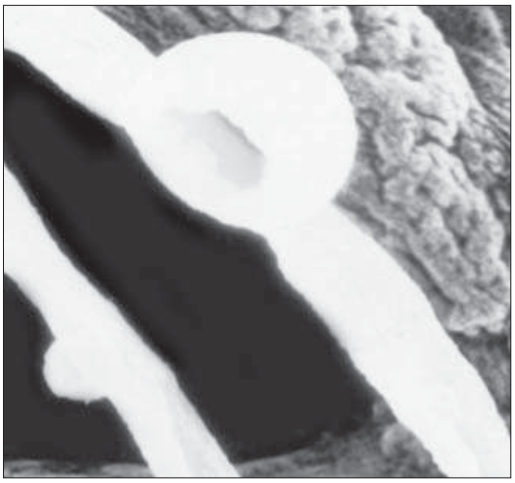
Tabl. 57, Fig. *a*
Leucoagaricus leucothites

Tabl. 57, Fig. *b*
Leucoagaricus leucothites

Tabl. 58, Fig. *a*
Leucoagaricus wichanskyi

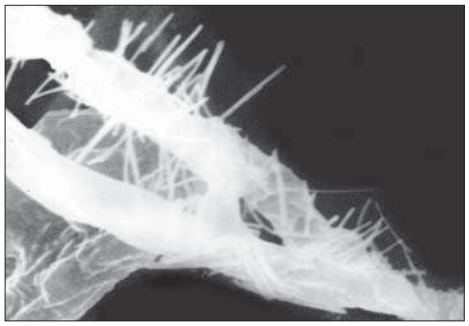


Tabl. 58, Fig. *b*
Leucoagaricus wichanskyi

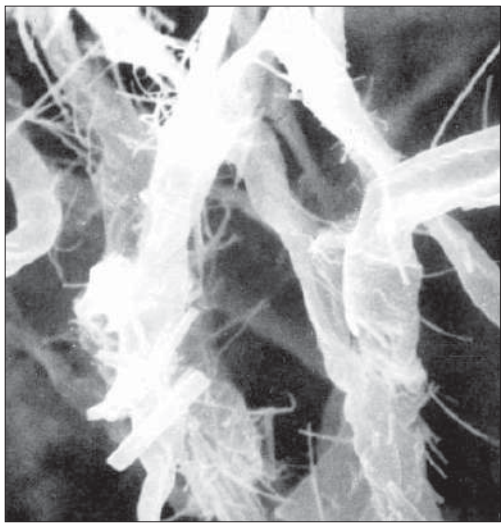


Tabl. 58, Fig. *c*
Leucoagaricus wichanskyi

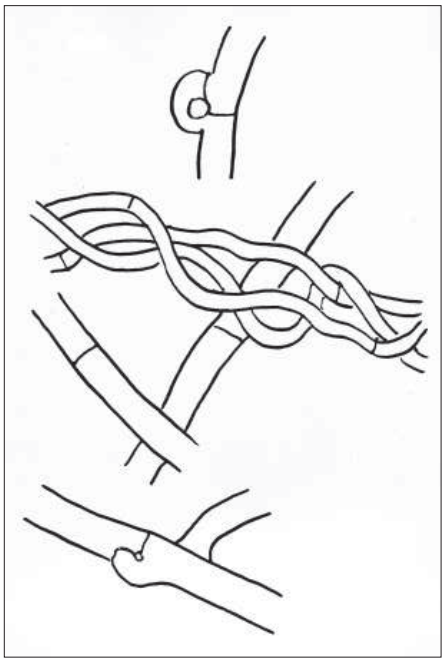
Tabl. 58, Fig. *d*
Leucoagaricus wichanskyi



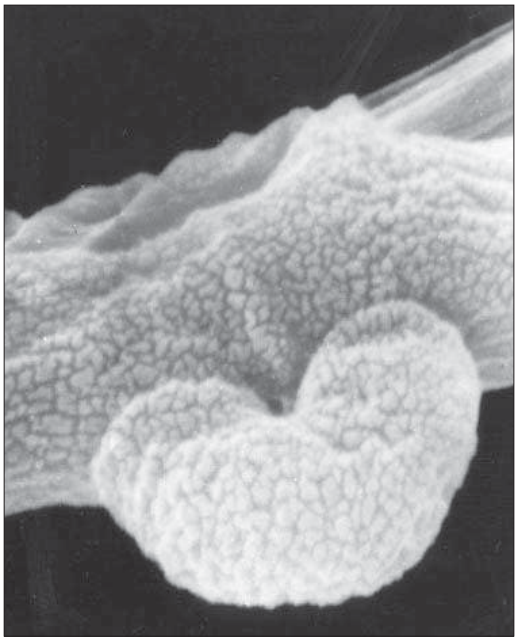
Tabl. 59, Fig. *a*
Lycoperdon pyriforme



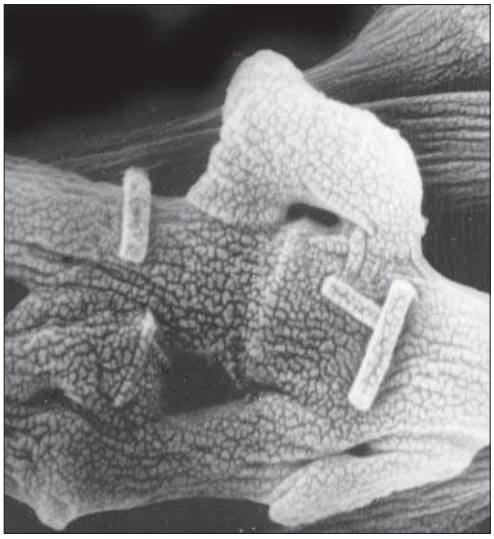
Tabl. 59, Fig. *b*
Lycoperdon pyriforme



Tabl. 59, Fig. *c*
Lycoperdon pyriforme



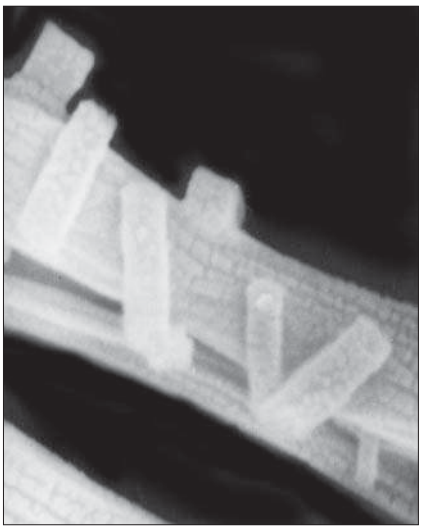
Tabl. 60, Fig. *a*
Lyophyllum decastes



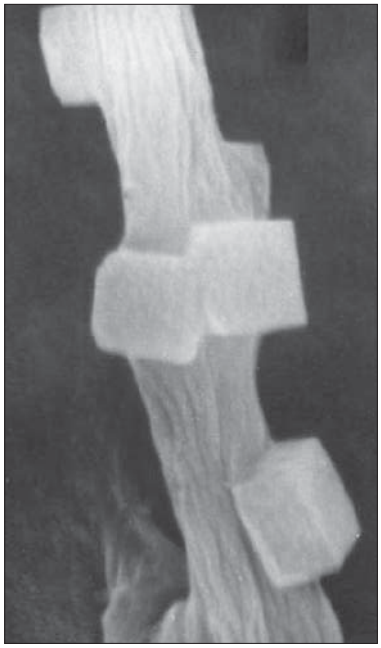
Tabl. 60, Fig. *b*
Lyophyllum decastes

Tabl. 60, Fig. *c*
Lyophyllum decastes

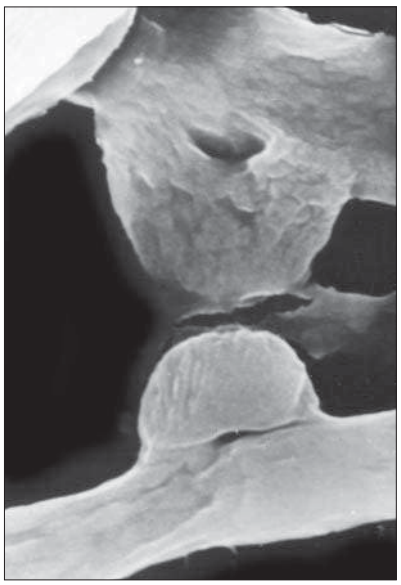
Tabl. 60, Fig. *d*
Lyophyllum decastes



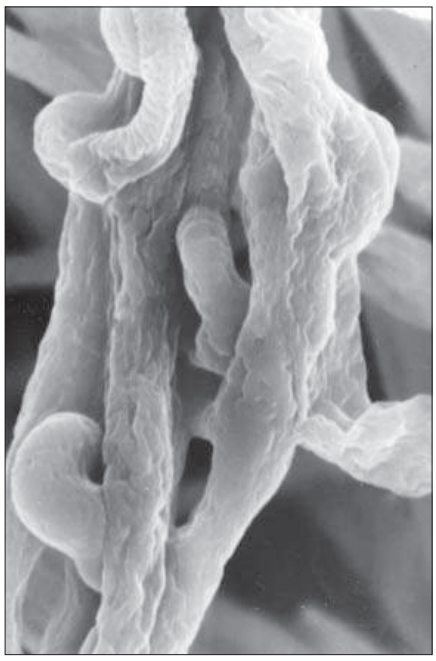
Tabl. 60, Fig. *e*
Lyophyllum decastes



Tabl. 60, Fig. *f*
Lyophyllum decastes



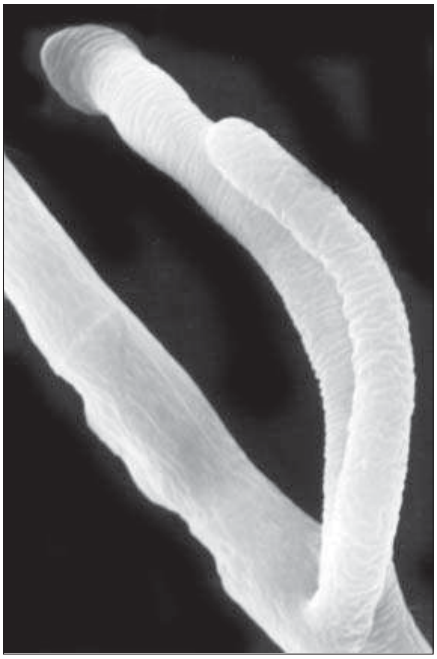
Tabl. 61, Fig. *a*
Lyophyllum ulmarium



Tabl. 61, Fig. *b*
Lyophyllum ulmarium

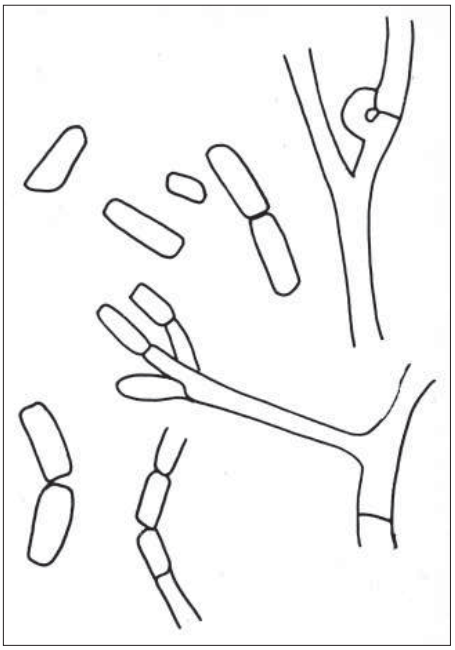
Tabl. 61, Fig. *c*
Lyophyllum ulmarium

Tabl. 61, Fig. *d*
Lyophyllum ulmarium

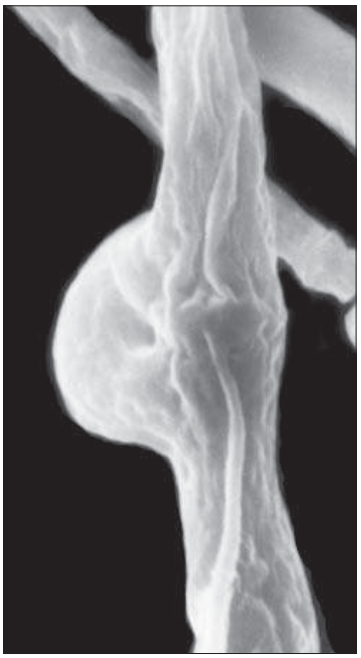


Tabl. 61, Fig. *e*
Lyophyllum ulmarium

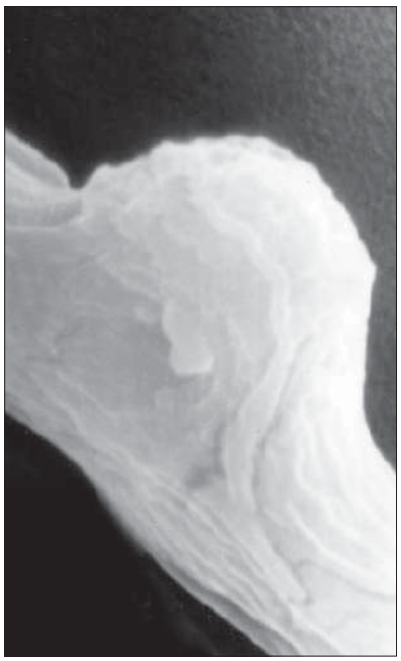
Tabl. 61, Fig. *f*
Lyophyllum ulmarium



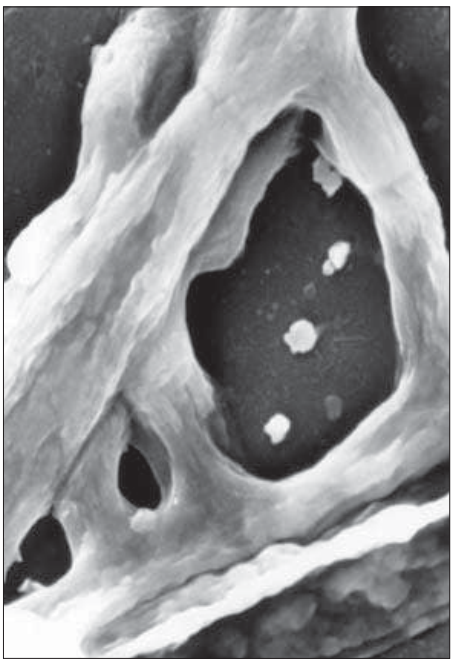
Tabl. 61, Fig. *g*
Lyophyllum ulmarium



Tabl. 62, Fig. *a*
Macrolepiota affinis



Tabl. 62, Fig. *b*
Macrolepiota affinis

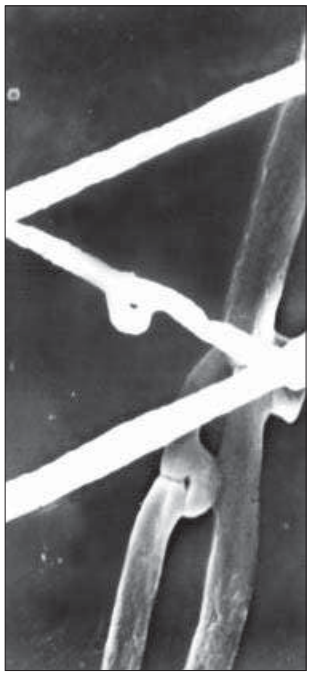


Tabl. 62, Fig. *c*
Macrolepiota affinis

Tabl. 62, Fig. *d*
Macrolepiota affinis

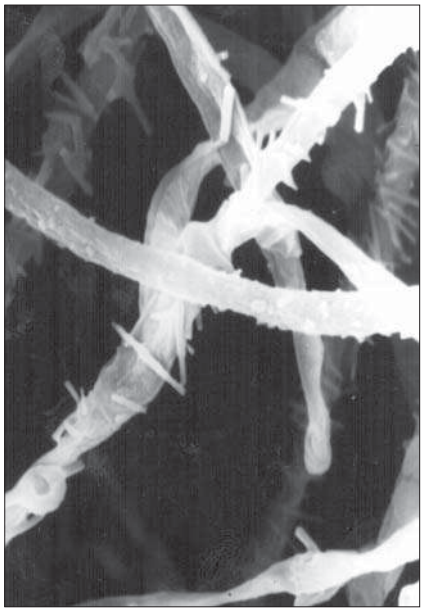
Tabl. 63, Fig. *a*
Macrolepiota procera

Tabl. 63, Fig. *b*
Macrolepiota procera

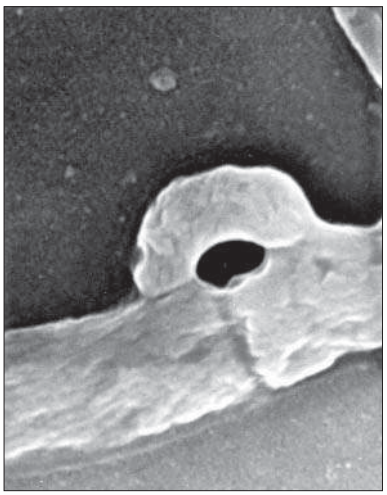


Tabl. 63, Fig. *c*
Macrolepiota procera

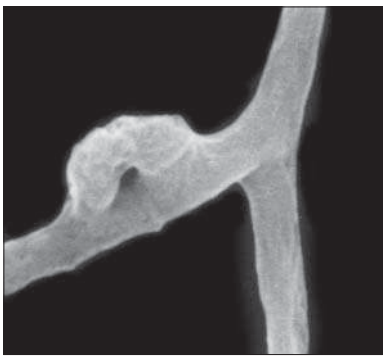
Tabl. 63, Fig. *d*
Macrolepiota procera



Tabl. 63, Fig. *e*
Macrolepiota procera

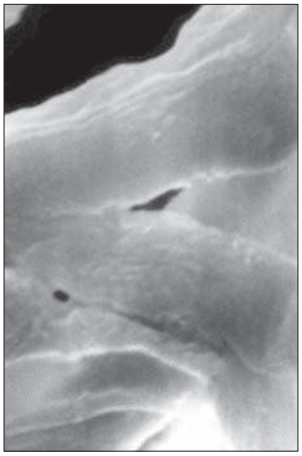


Tabl. 64, Fig. *a*
Marasmius oreades

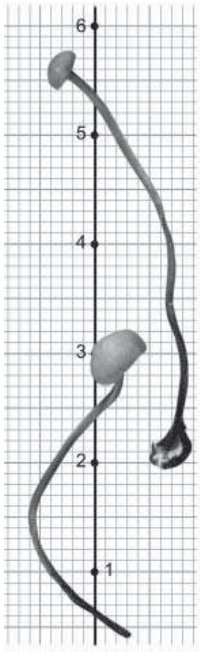


Tabl. 64, Fig. *b*
Marasmius oreades

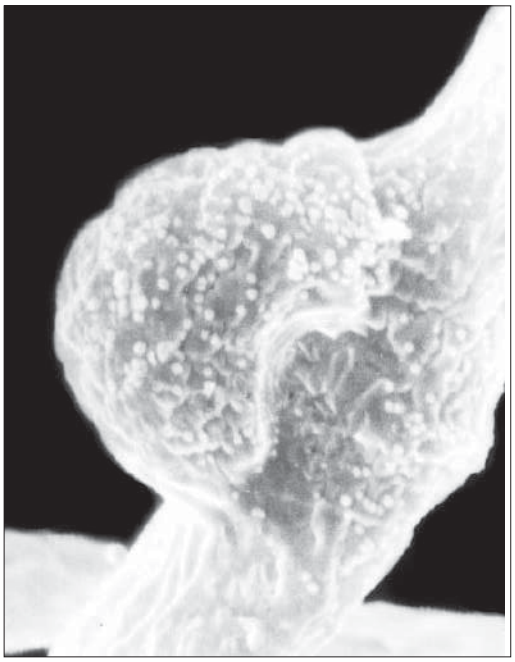
Tabl. 65, Fig. *a*
Marasmius scorodonius



Tabl. 65, Fig. *b*
Marasmius scorodonius

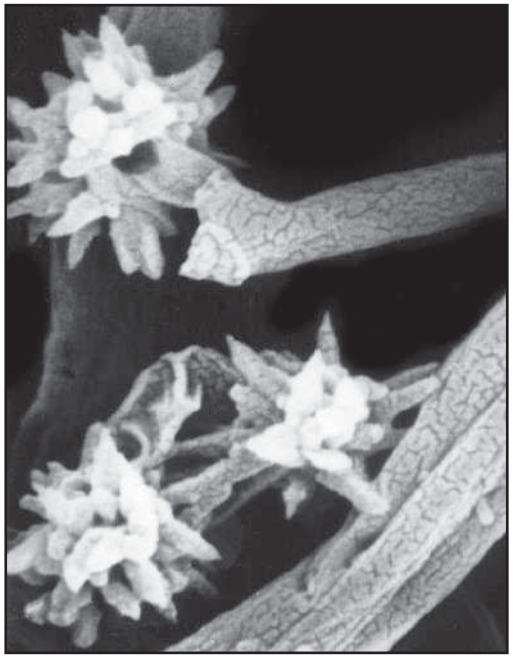


Tabl. 65, Fig. *c*
Marasmius scorodonius

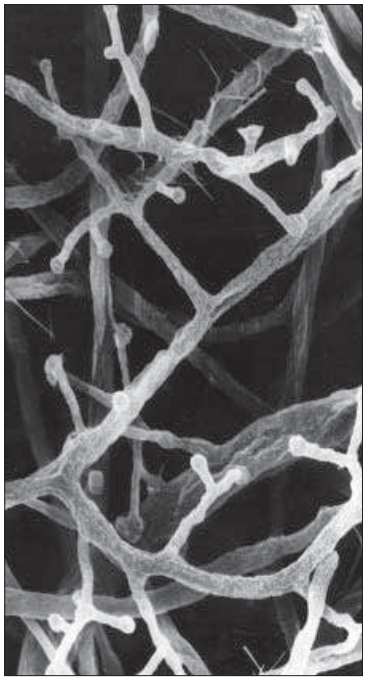


Tabl. 66, Fig. *a*
Montagnea arenaria

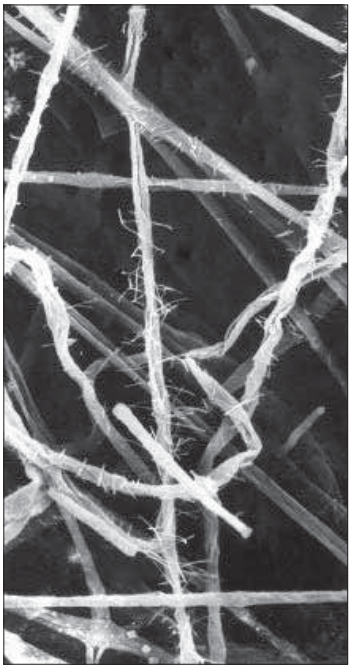
Tabl. 66, Fig. *b*
Montagnea arenaria



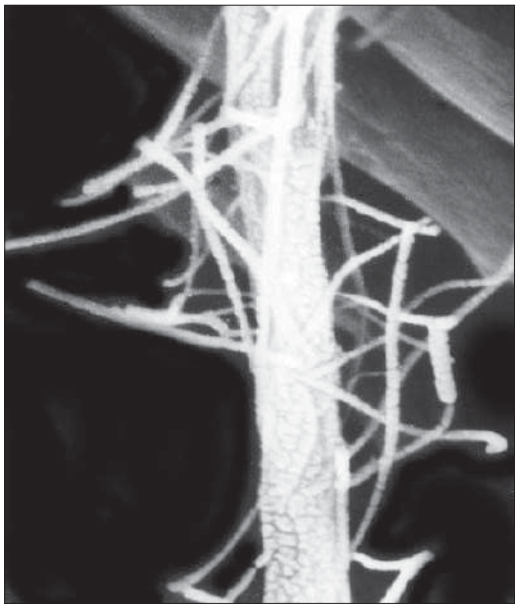
Tabl. 66, Fig. *c*
Montagnea arenaria



Tabl. 66, Fig. *d*
Montagnea arenaria

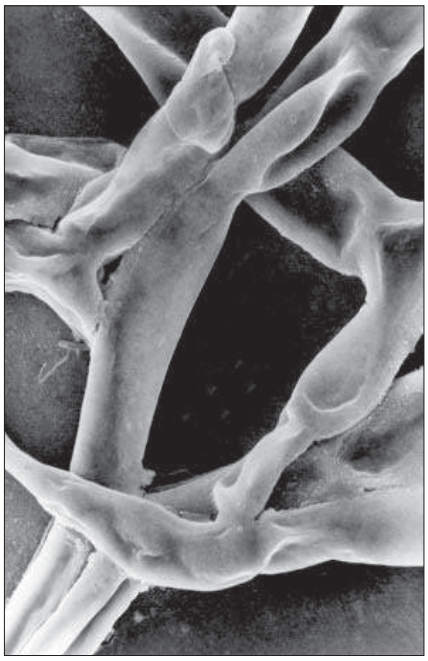


Tabl. 66, Fig. *e*
Montagnea arenaria

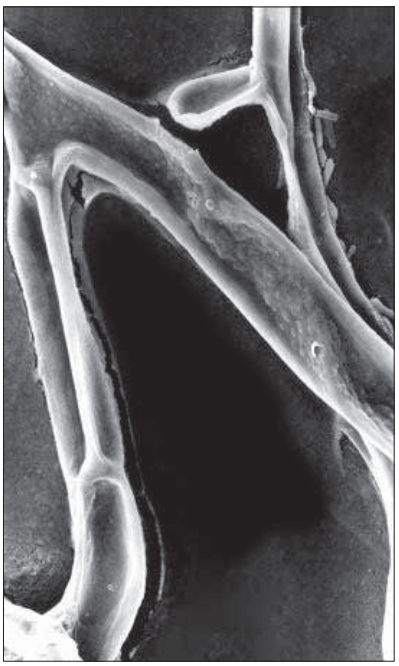


Tabl. 66, Fig. *f*
Montagnea arenaria

Tabl. 67, Fig. *a*
Morchella angusticeps

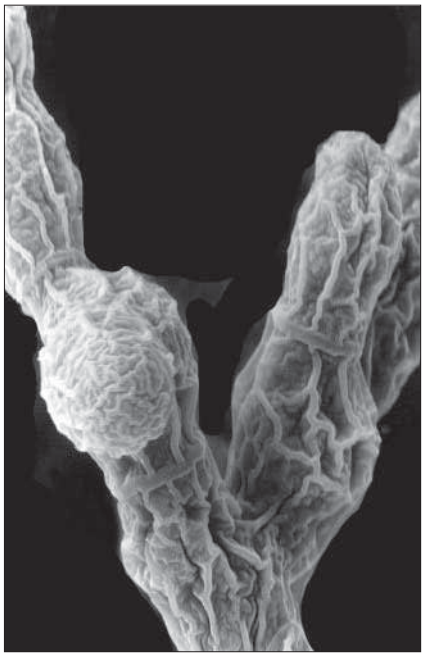


Tabl. 67, Fig. *b*
Morchella angusticeps

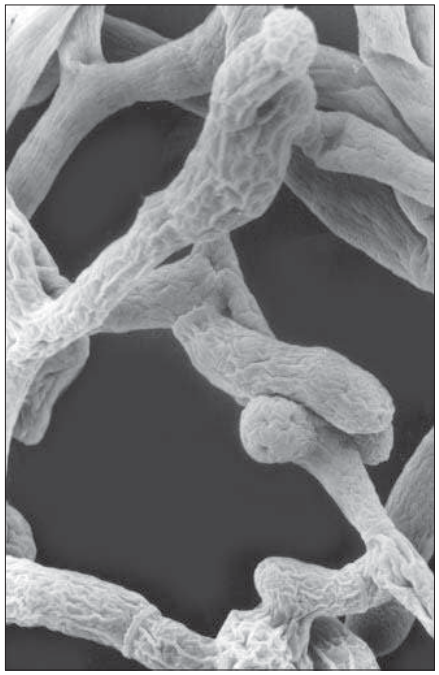


Tabl. 67, Fig. *c*
Morchella angusticeps

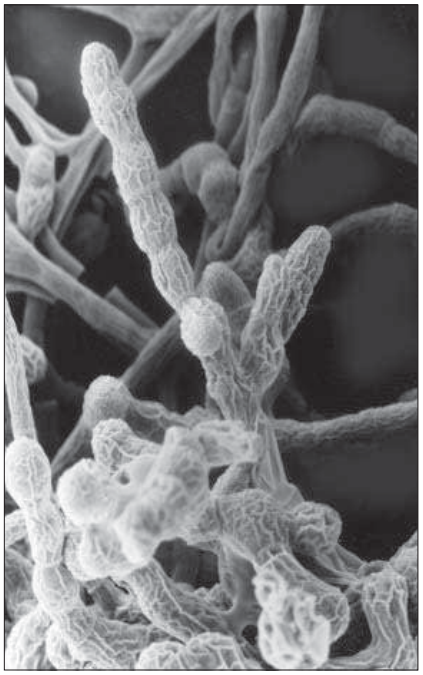
Tabl. 68, Fig. *a*
Morchella conica



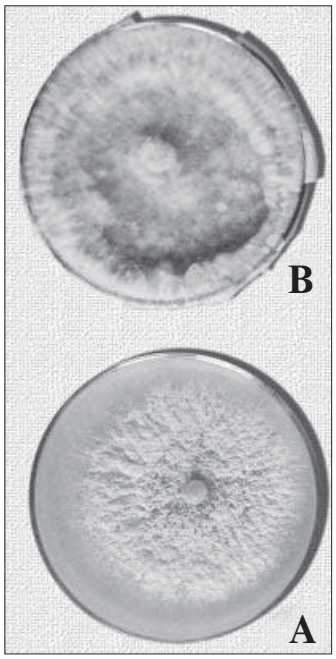
Tabl. 68, Fig. *b*
Morchella conica



Tabl. 68, Fig. *c*
Morchella conica

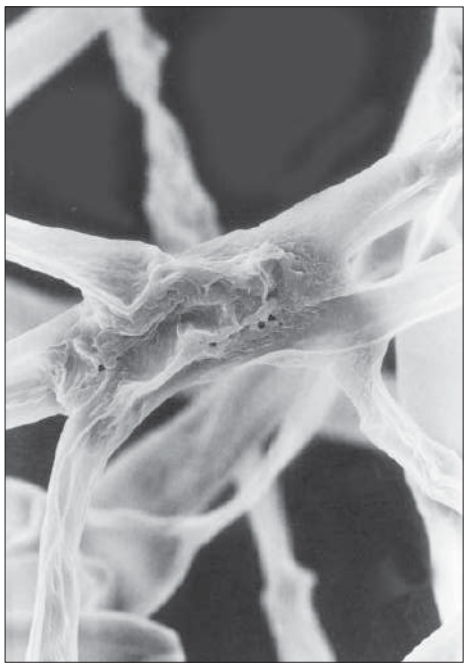


Tabl. 68, Fig. *d*
Morchella conica

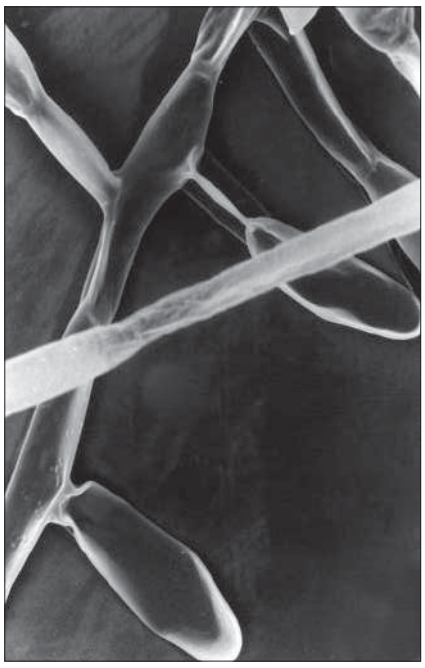


Tabl. 68, Fig. *e*
Morchella conica

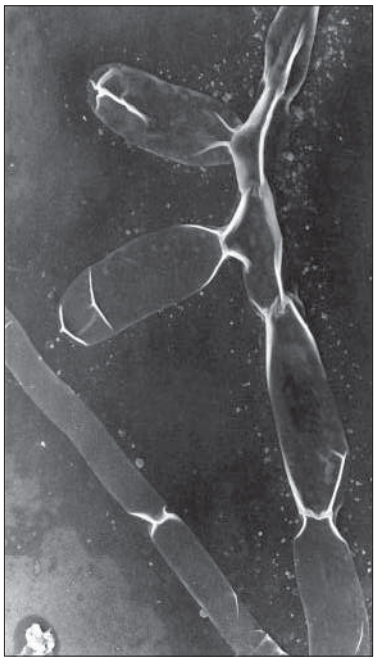
Tabl. 69, Fig. *a*
Morchella crassipes



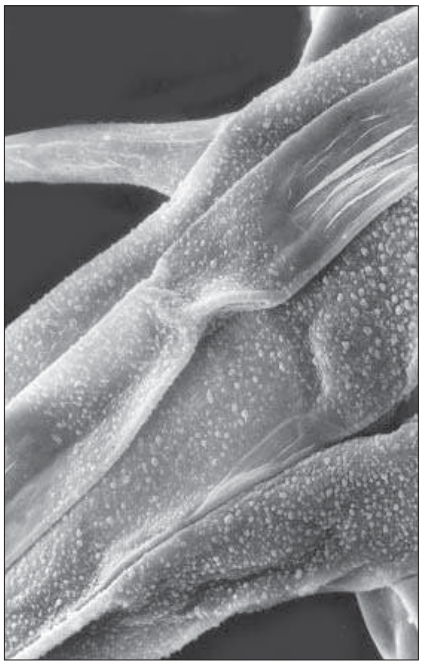
Tabl. 69, Fig. *b*
Morchella crassipes



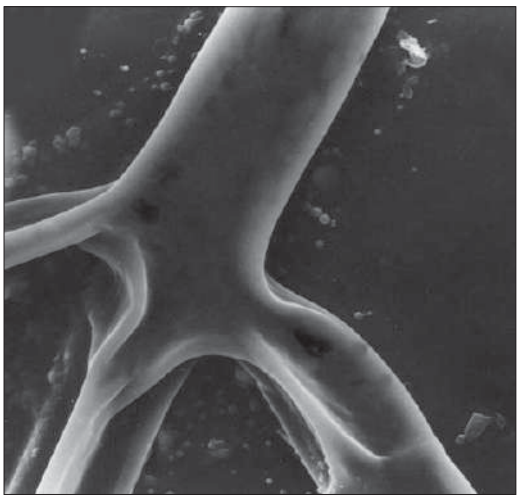
Tabl. 70, Fig. *a*
Morchella esculenta



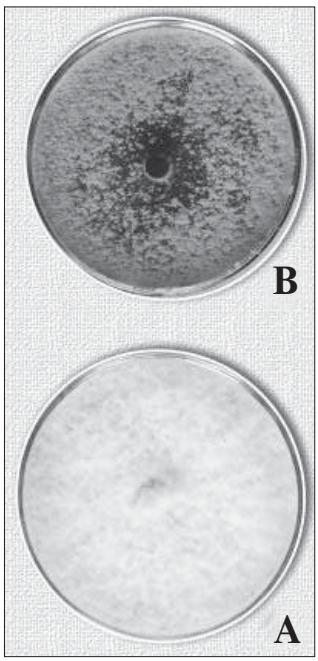
Tabl. 70, Fig. *b*
Morchella esculenta



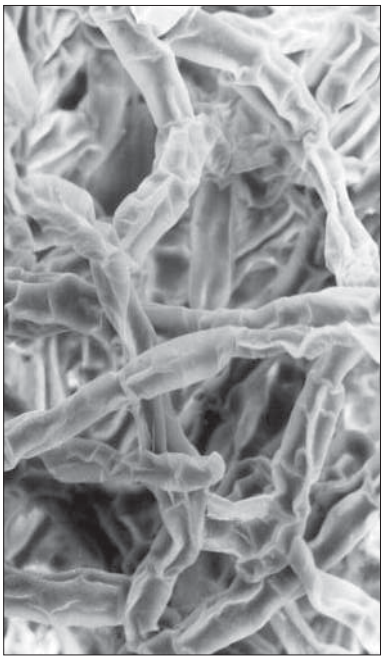
Tabl. 70, Fig. *c*
Morchella esculenta



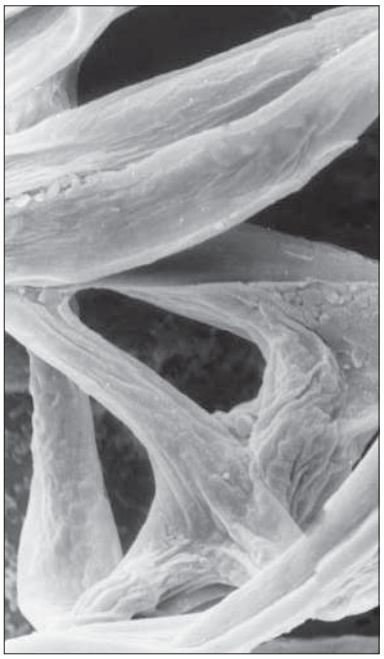
Tabl. 70, Fig. *d*
Morchella esculenta



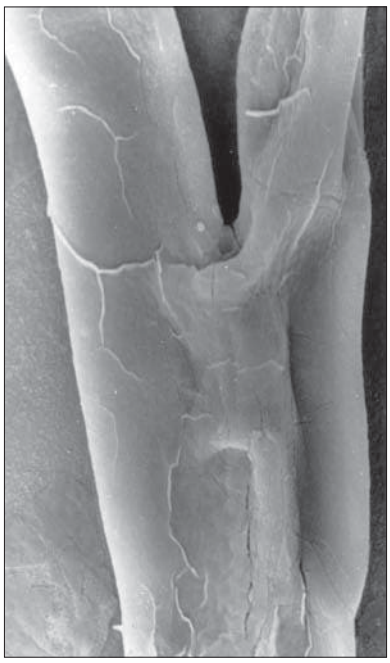
Tabl. 70, Fig. *e*
Morchella esculenta



Tabl. 71, Fig. *a*
Morchella semilibera



Tabl. 71, Fig. *b*
Morchella semilibera

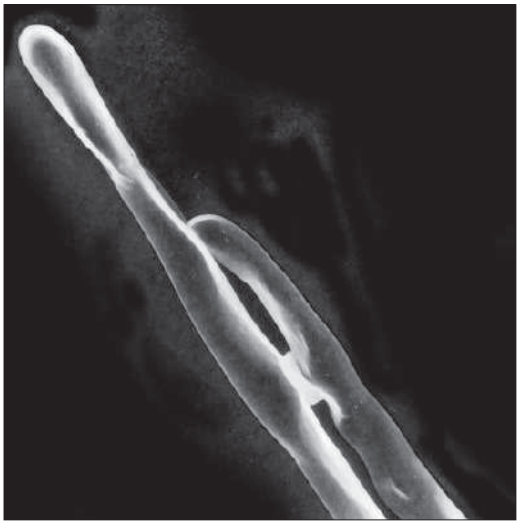


Tabl. 71, Fig. *c*
Morchella semilibera

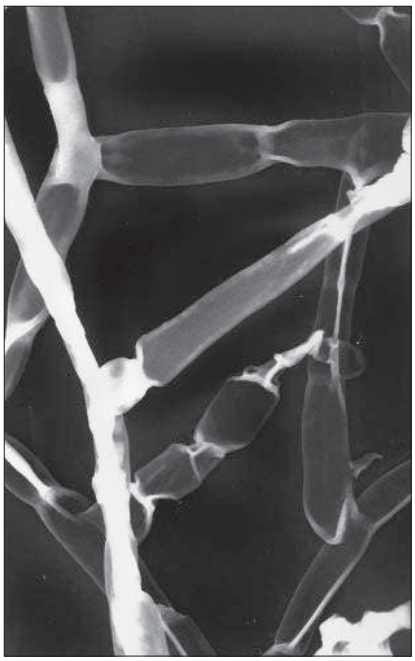
Tabl. 72, Fig. *a*
Morchella spongiola

Tabl. 72, Fig. *b*
Morchella spongiola

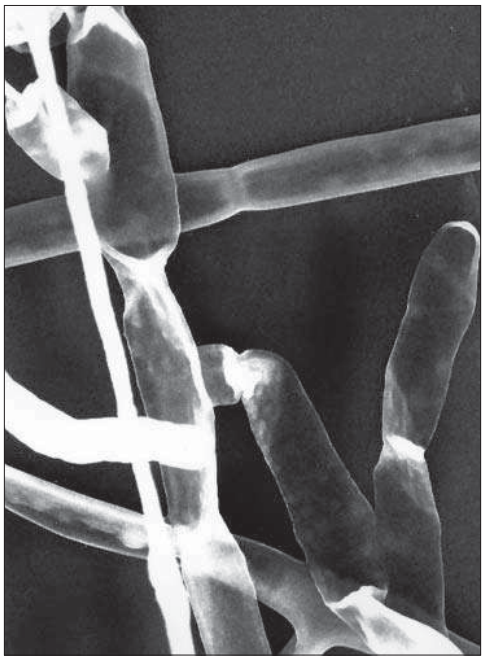
Tabl. 72, Fig. *c*
Morchella spongiola



Tabl. 72, Fig. *d*
Morchella spongiola



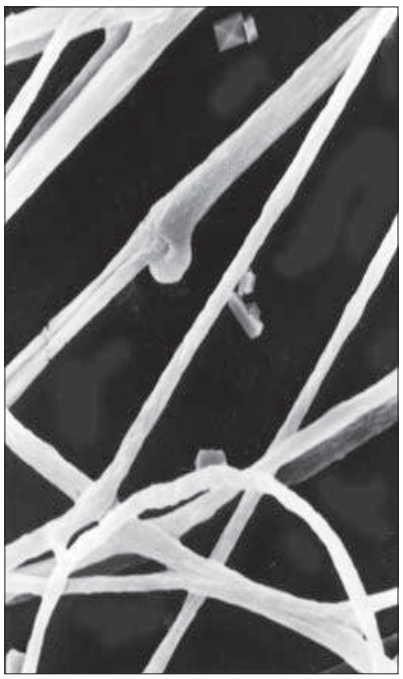
Tabl. 73, Fig. *a*
Morchella steppicola



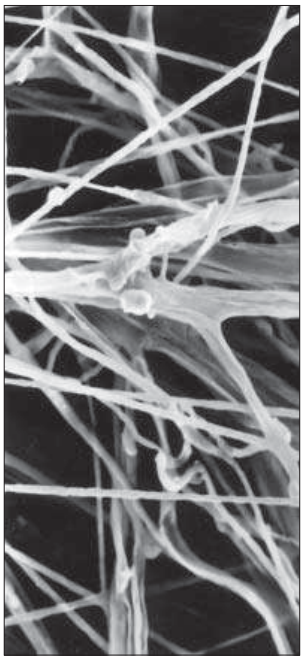
Tabl. 73, Fig. *b*
Morchella steppicola

Tabl. 73, Fig. *c*
Morchella steppicola

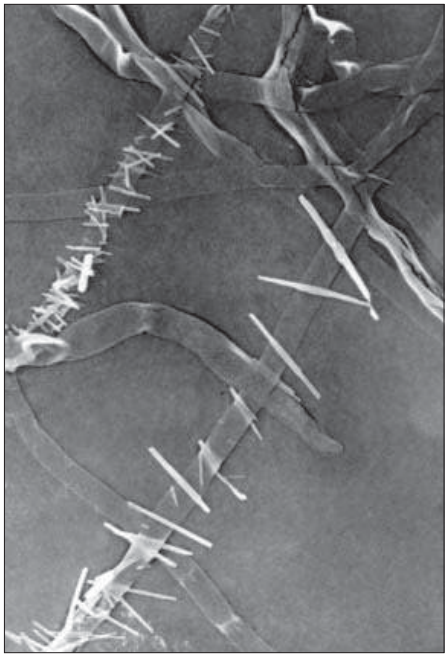
Tabl. 73, Fig. *d*
Morchella steppicola



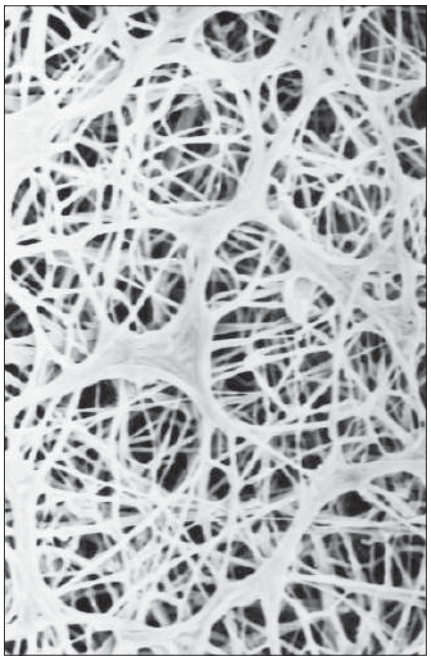
Tabl. 74, Fig. *a*
Omphalotus olearius



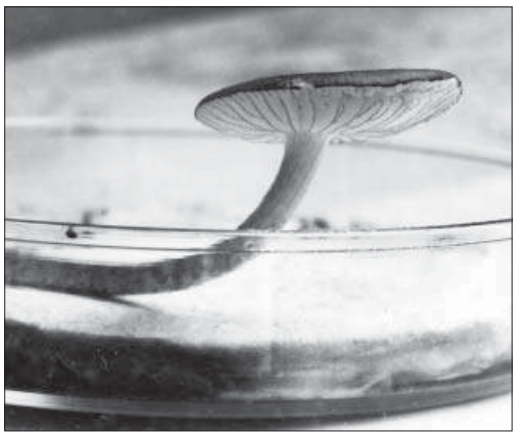
Tabl. 74, Fig. *b*
Omphalotus olearius



Tabl. 74, Fig. *c*
Omphalotus olearius



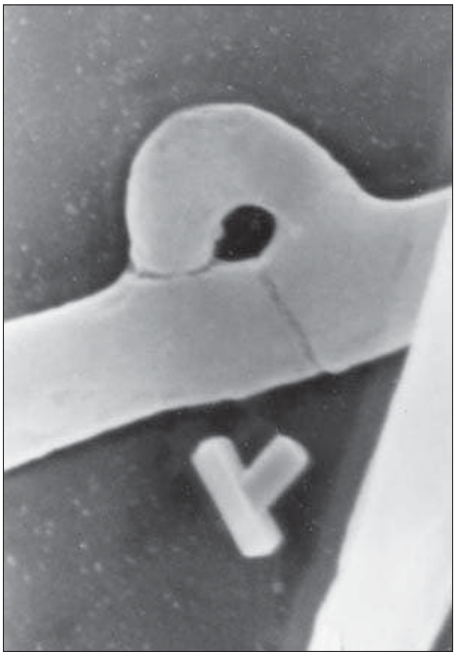
Tabl. 74, Fig. *d*
Omphalotus olearius



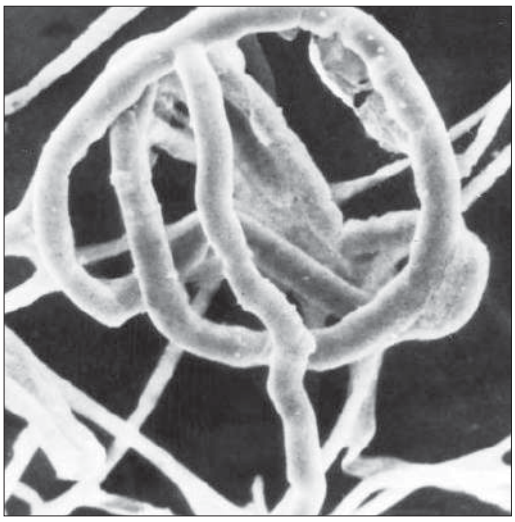
Tabl. 75, Fig. *a*
Oudemansiella brunneomarginata

Tabl. 75, Fig. *b*
Oudemansiella brunneomarginata

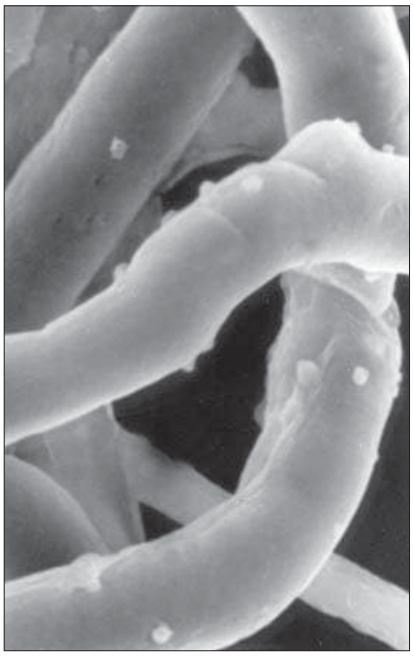
Tabl. 75, Fig. *c*
Oudemansiella brunneomarginata



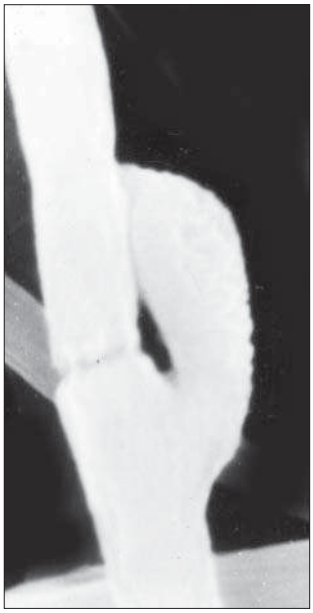
Tabl. 75, Fig. *d*
Oudemansiella brunneomarginata



Tabl. 75, Fig. *e*
Oudemansiella brunneomarginata

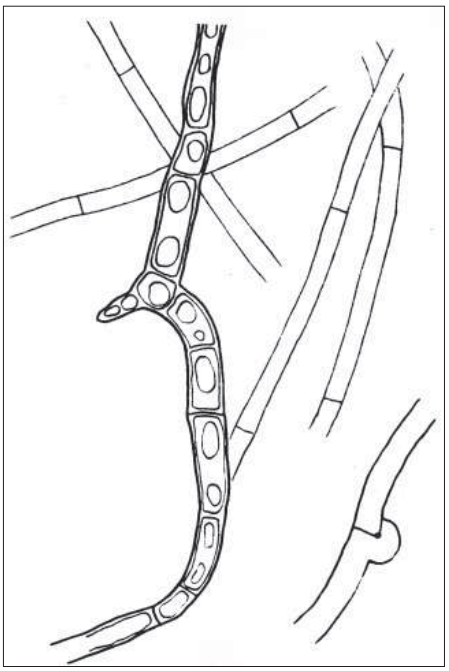


Tabl. 75, Fig. *f*
Oudemansiella brunneomarginata



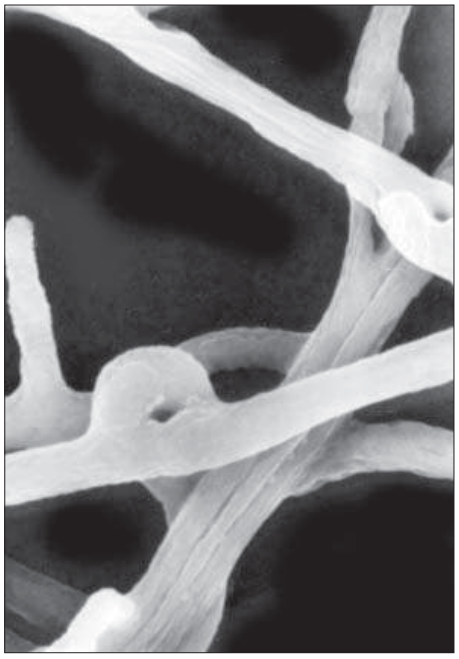
Tabl. 76, Fig. *a*
Oudemansiella mucida

Tabl. 76, Fig. *b*
Oudemansiella mucida



Tabl. 76, Fig. *c*
Oudemansiella mucida

Tabl. 76, Fig. *d*
Oudemansiella mucida



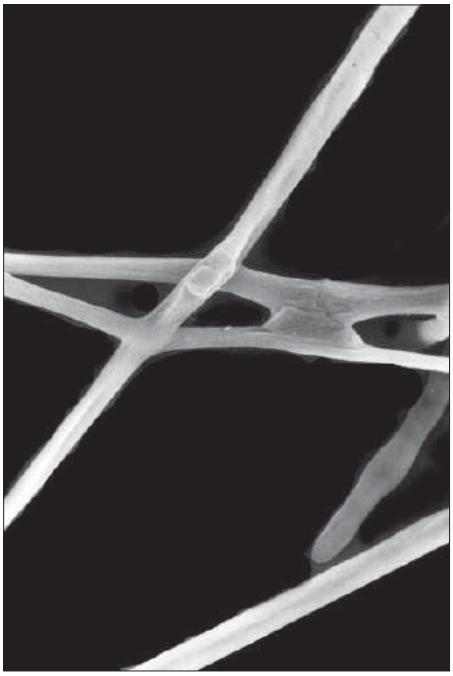
Tabl. 77, Fig. *a*
Oudemansiella radicata

Tabl. 77, Fig. *b*
Oudemansiella radicata

Tabl. 78, Fig. *a*
Panus tigrinus

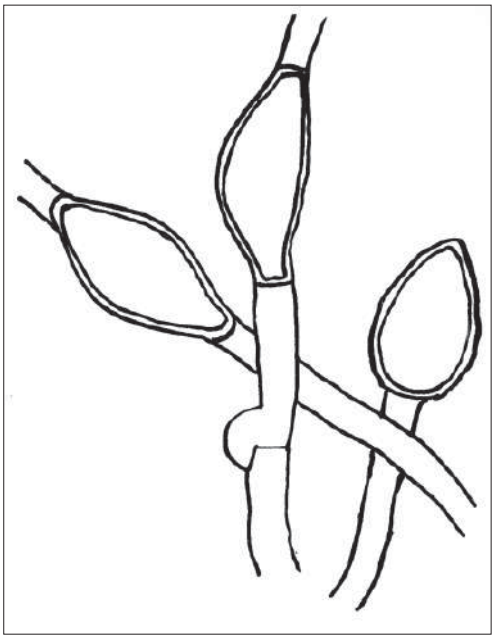
Tabl. 78, Fig. *b*
Panus tigrinus

Tabl. 78, Fig. *c*
Panus tigrinus

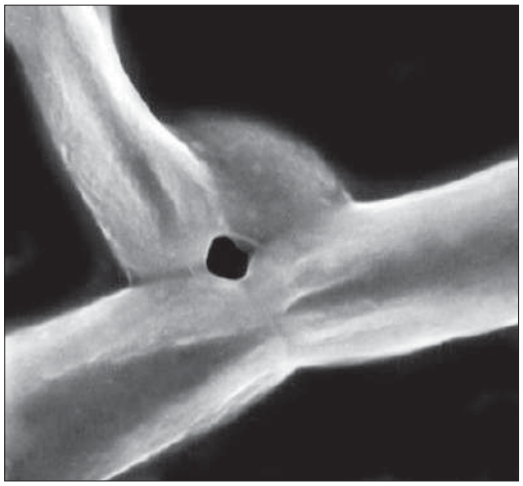


Tabl. 78, Fig. *d*
Panus tigrinus

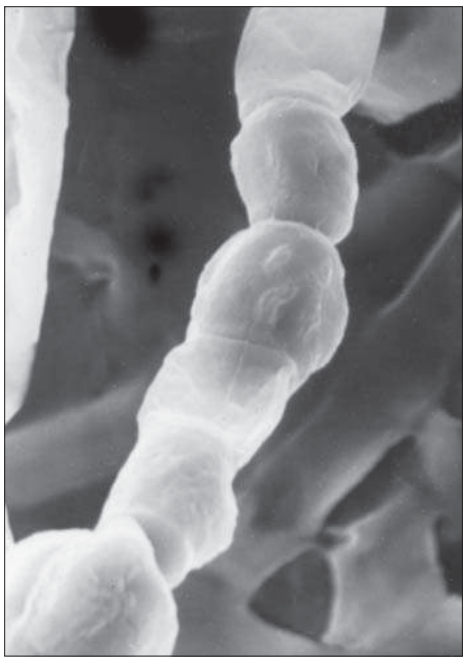
Tabl. 78, Fig. *e*
Panus tigrinus



Tabl. 78, Fig. *f*
Panus tigrinus

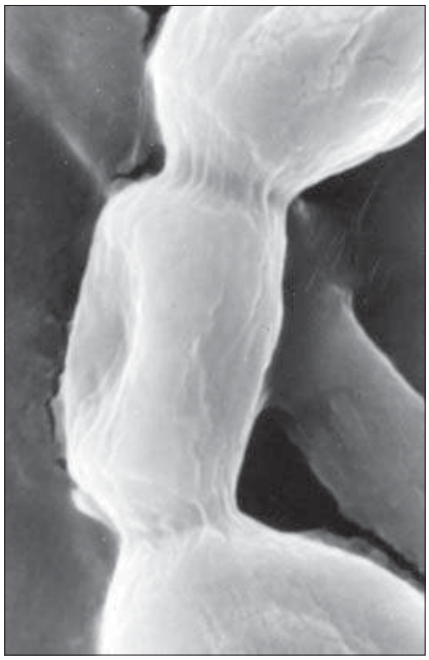


Tabl. 79, Fig. *a*
Peniophora gigantea



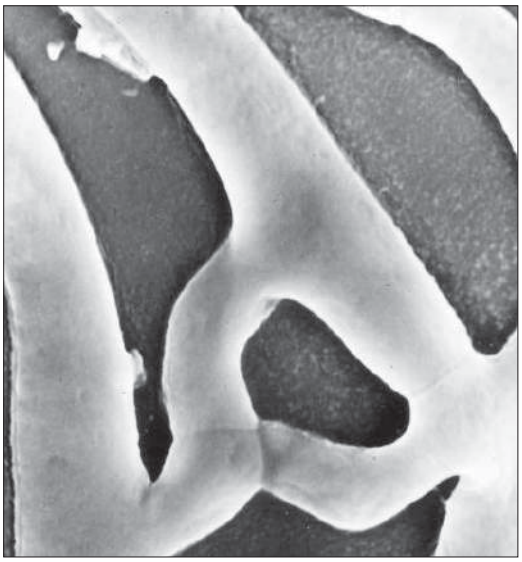
Tabl. 79, Fig. *b*
Peniophora gigantea

Tabl. 79, Fig. *c*
Peniophora gigantea

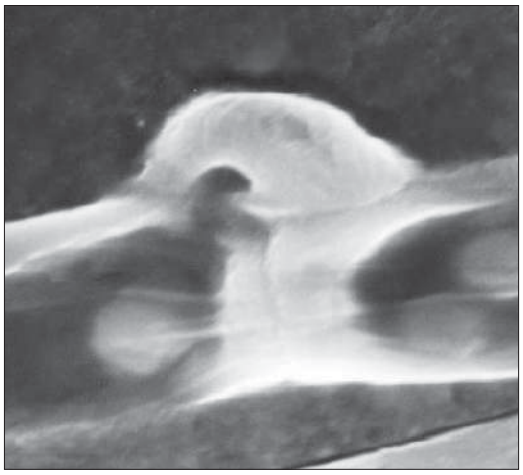


Tabl. 79, Fig. *d*
Peniophora gigantea

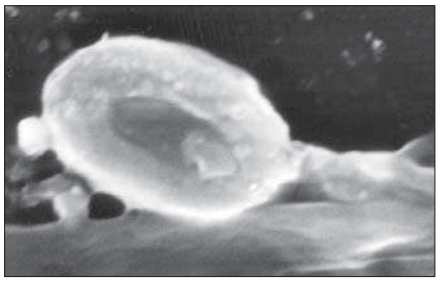
Tabl. 79, Fig. *e*
Peniophora gigantea



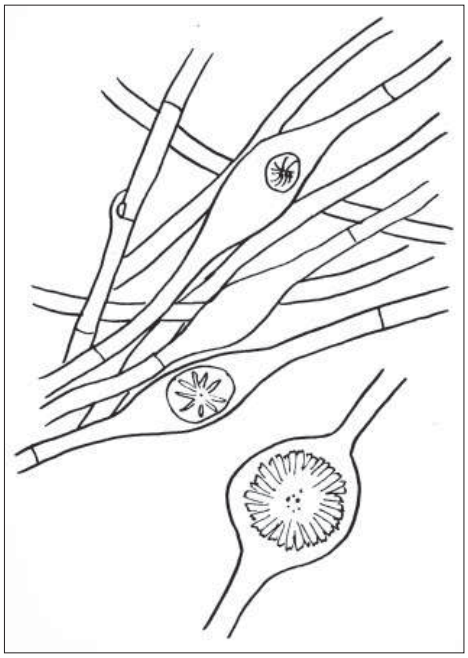
Tabl. 79, Fig. *f*
Peniophora gigantea



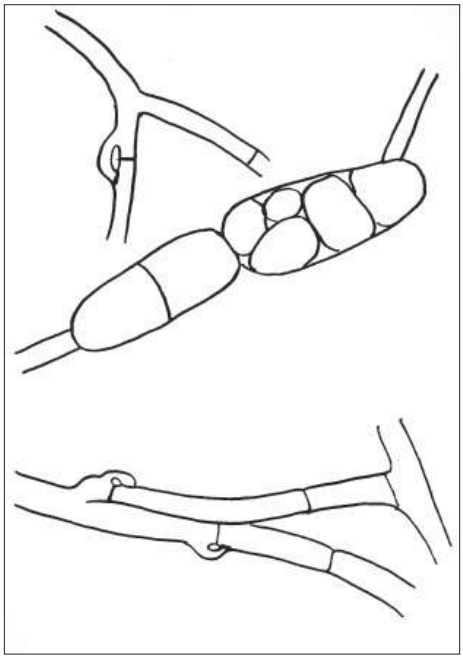
Tabl. 80, Fig. *a*
Phallus impudicus



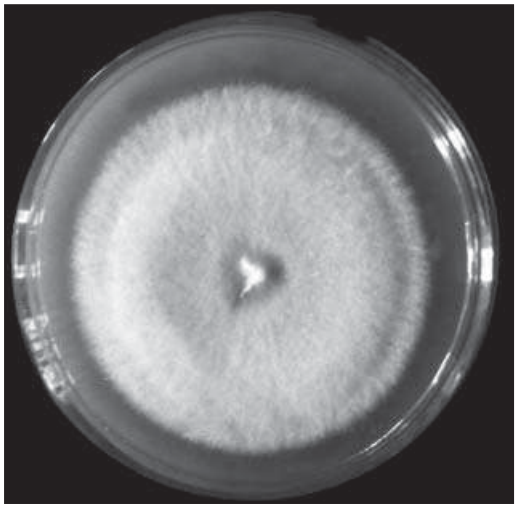
Tabl. 80, Fig. *b*
Phallus impudicus



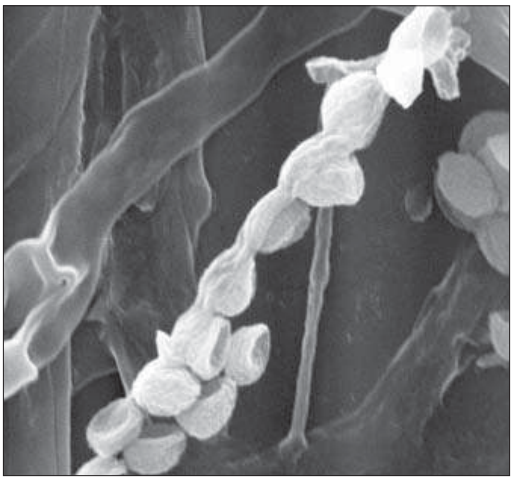
Tabl. 80, Fig. *c*
Phallus impudicus



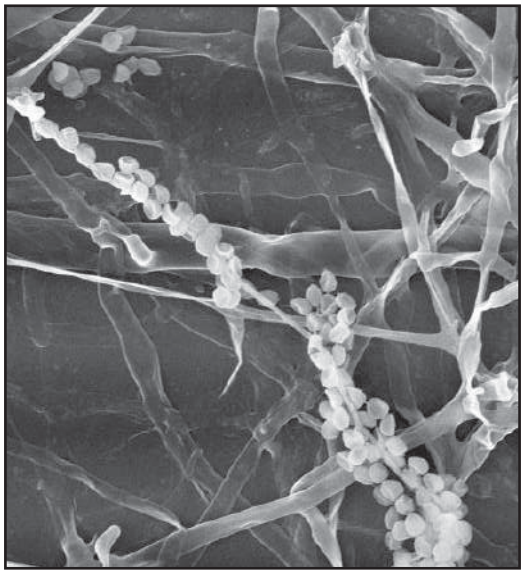
Tabl. 80, Fig. *d*
Phallus impudicus



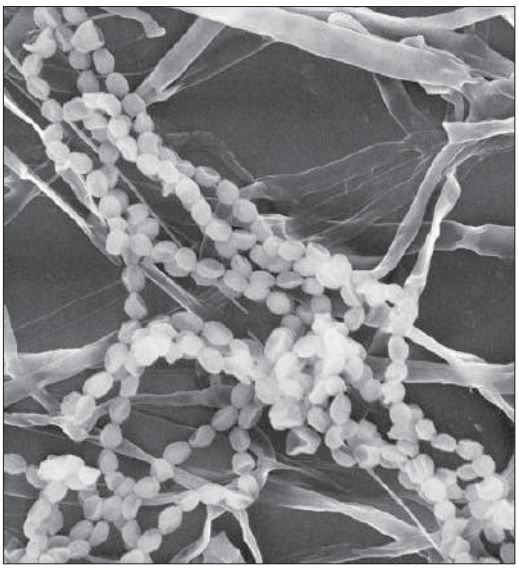
Tabl. 80, Fig. *e*
Phallus impudicus



Tabl. 81, Fig. *a*
Phellinus igniarius

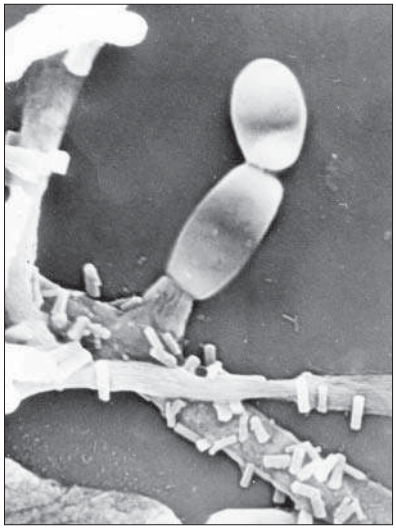


Tabl. 81, Fig. *b*
Phellinus igniarius

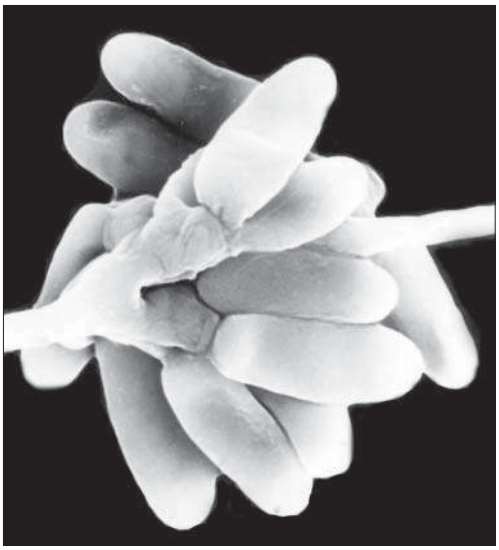


Tabl. 81, Fig. *c*
Phellinus igniarius

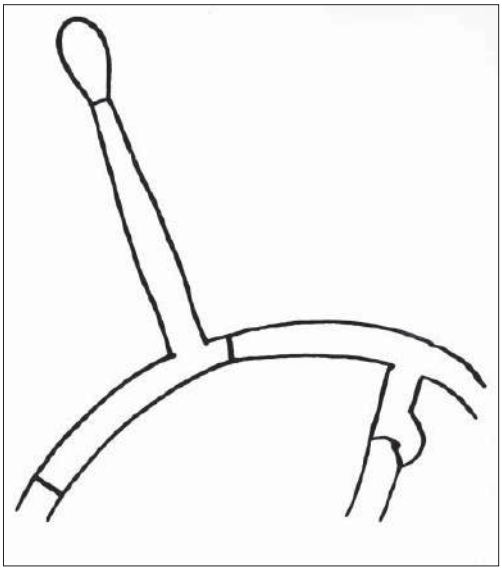
Tabl. 82, Fig. *a*
Pholiota adiposa



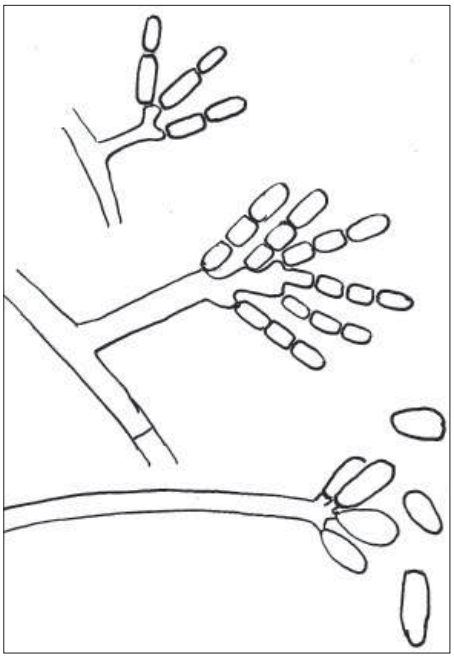
Tabl. 82, Fig. *b*
Pholiota adiposa



Tabl. 82, Fig. *c*
Pholiota adiposa

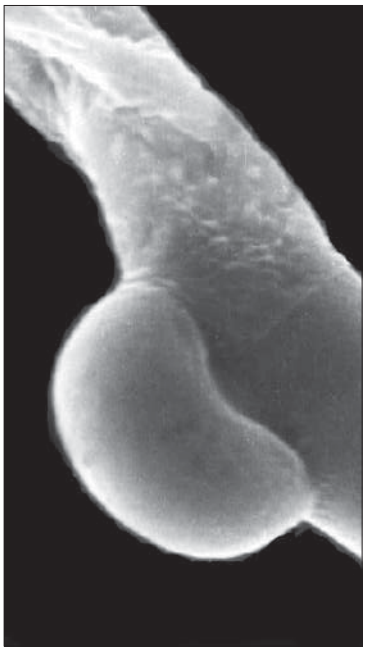


Tabl. 82, Fig. *d*
Pholiota adiposa



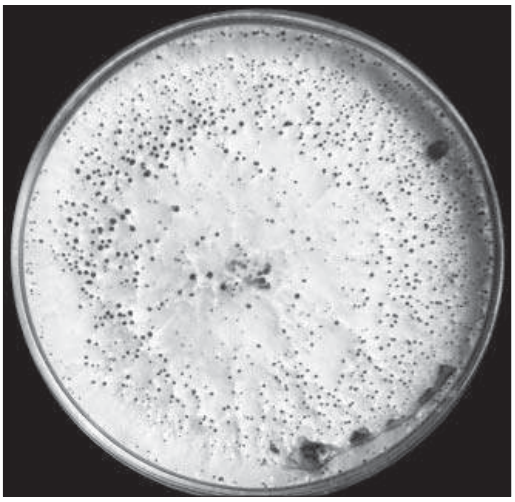
Tabl. 82, Fig. *e*
Pholiota adiposa

Tabl. 83, Fig. *a*
Piptoporus betulinus

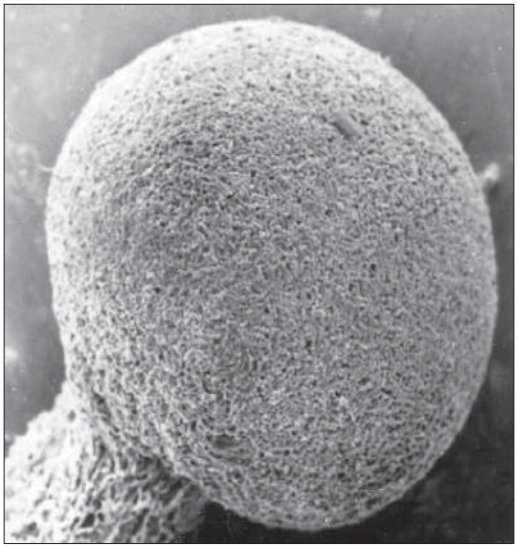


Tabl. 83, Fig. *b*
Piptoporus betulinus

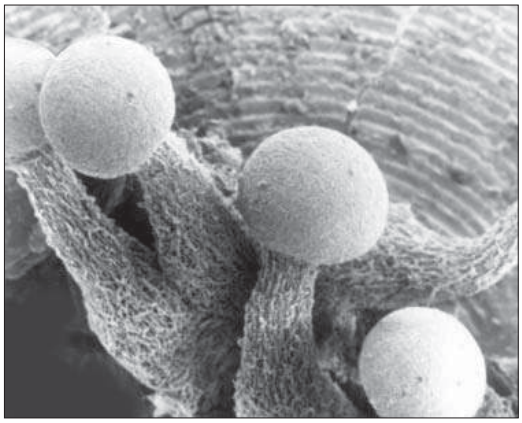
Tabl. 83, Fig. *c*
Piptoporus betulinus



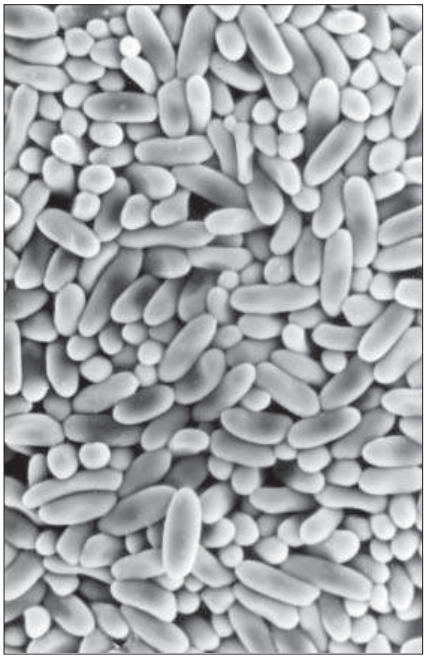
Tabl. 84, Fig. *a*
Pleurotus abalonus



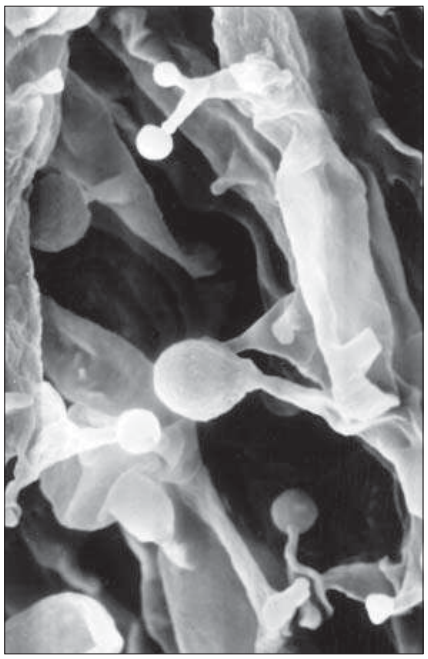
Tabl. 84, Fig. *b*
Pleurotus abalonus



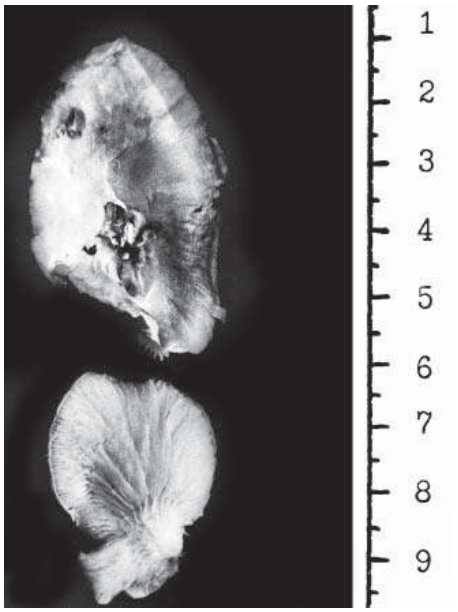
Tabl. 84, Fig. *c*
Pleurotus abalonus



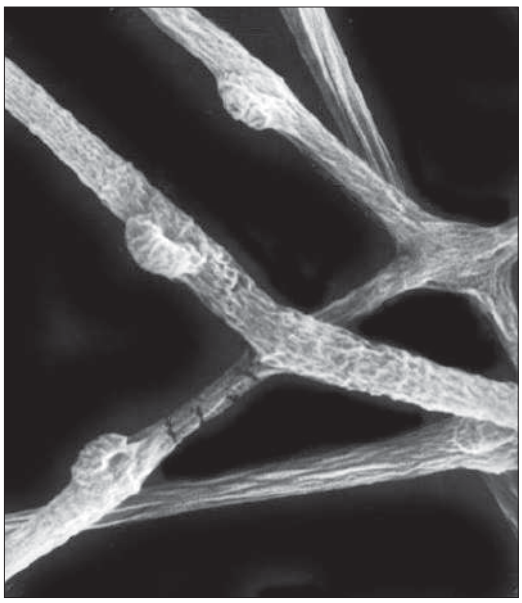
Tabl. 84, Fig. *d*
Pleurotus abalonus



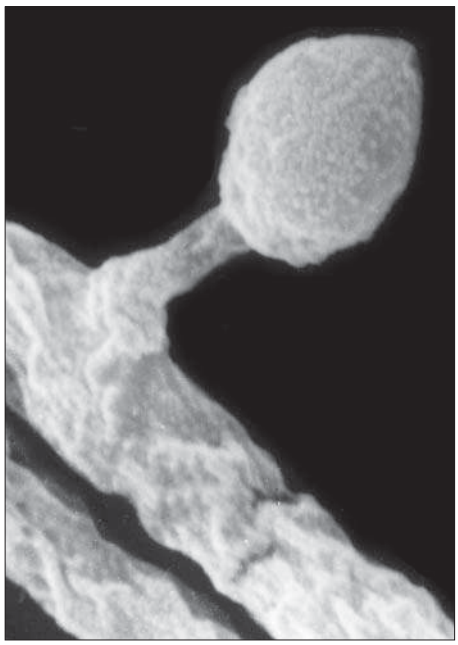
Tabl. 84, Fig. *e*
Pleurotus abalonus



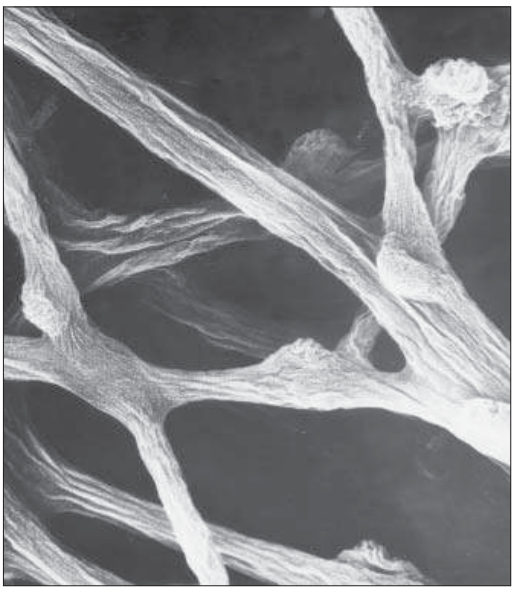
Tabl. 85, Fig. *a*
Pleurotus calyptratus



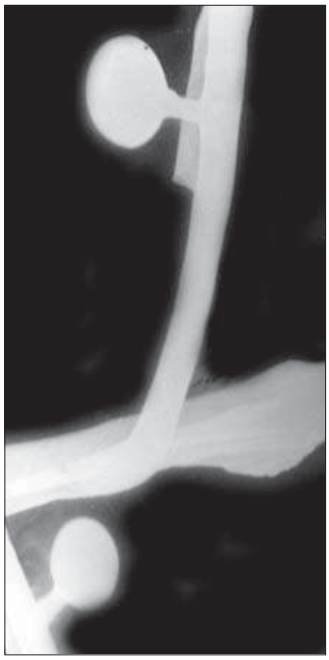
Tabl. 85, Fig. *b*
Pleurotus calyptratus



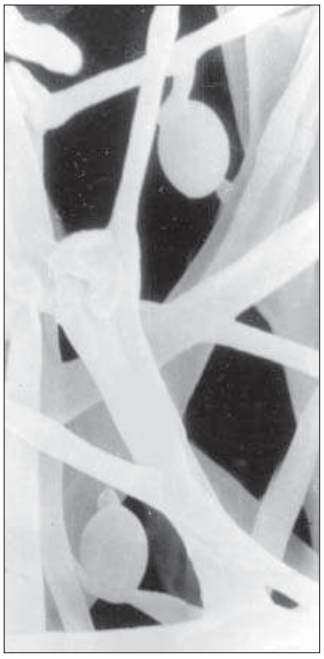
Tabl. 85, Fig. *c*
Pleurotus calyptratus



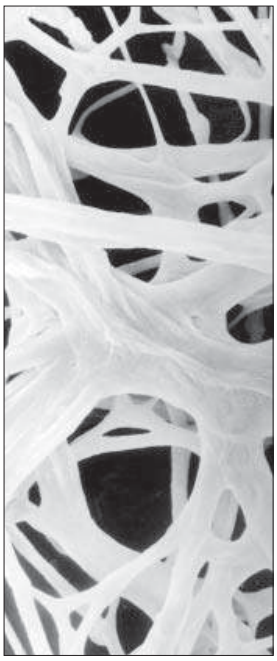
Tabl. 85, Fig. *d*
Pleurotus calyptratus



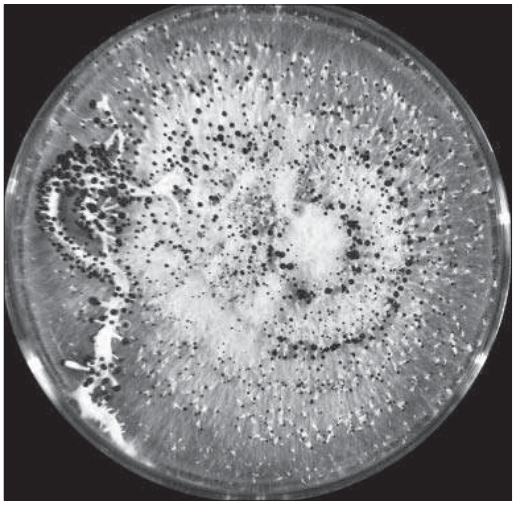
Tabl. 86, Fig. *a*
Pleurotus citrinopileatus



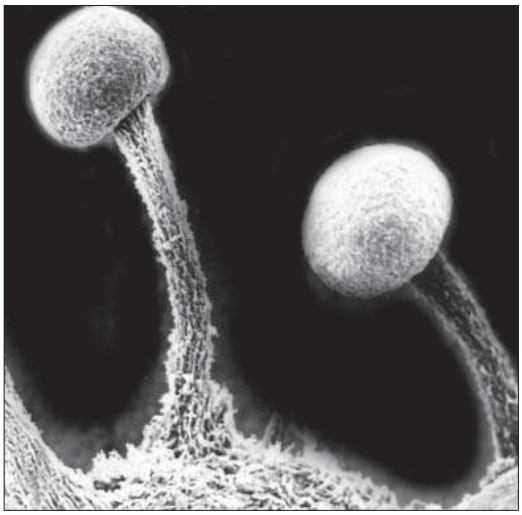
Tabl. 86, Fig. *b*
Pleurotus citrinopileatus



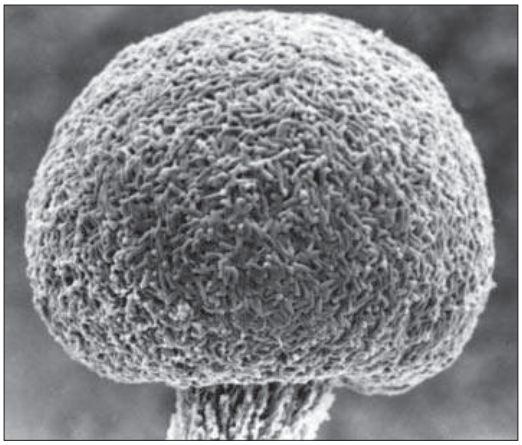
Tabl. 86, Fig. *c*
Pleurotus citrinopileatus



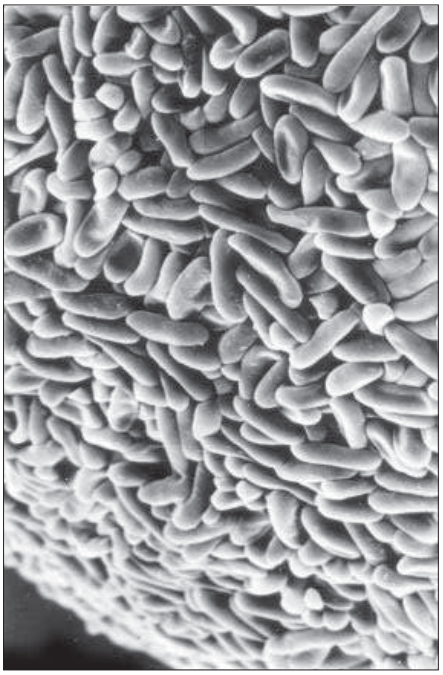
Tabl. 87, Fig. *a*
Pleurotus cystidiosus



Tabl. 87, Fig. *b*
Pleurotus cystidiosus

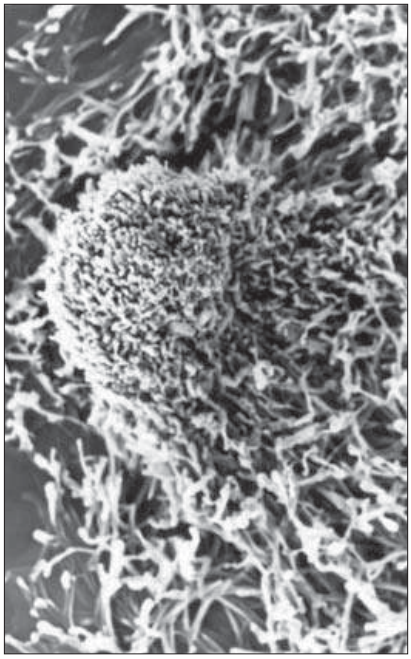


Tabl. 87, Fig. *c*
Pleurotus cystidiosus

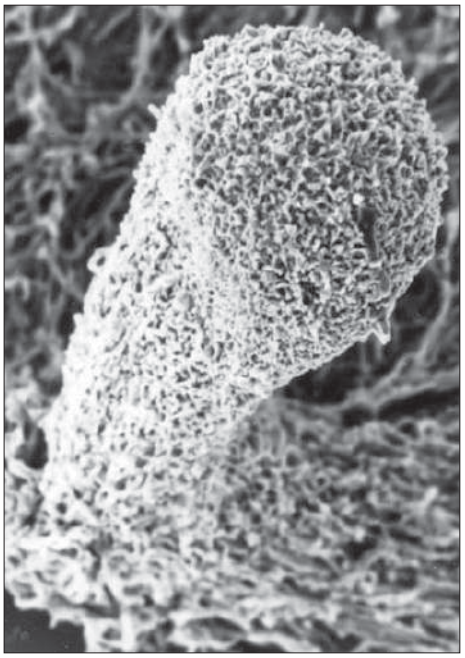


Tabl. 87, Fig. *d*
Pleurotus cystidiosus

Tabl. 87, Fig. *e*
Pleurotus cystidiosus

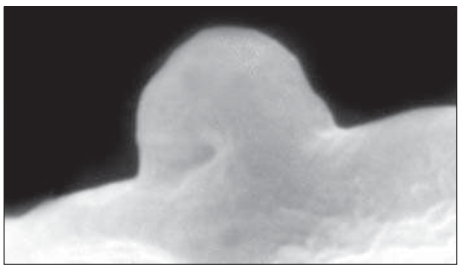


Tabl. 87, Fig. *f*
Pleurotus cystidiosus

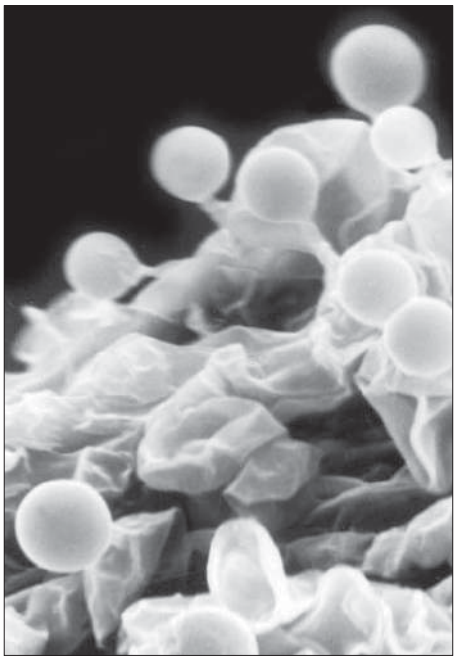


Tabl. 87, Fig. *g*
Pleurotus cystidiosus

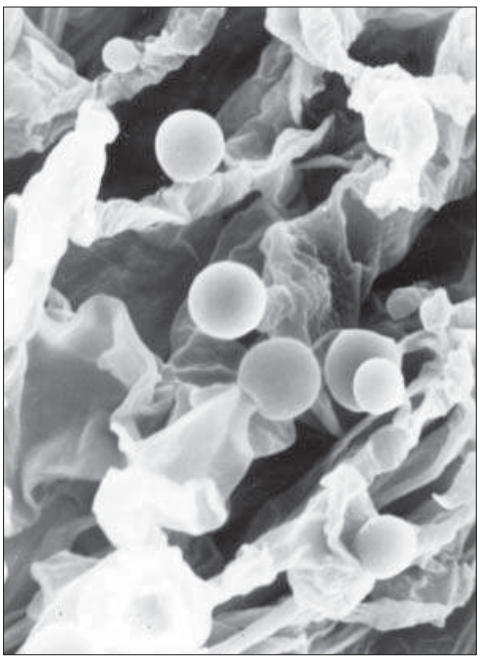
Tabl. 87, Fig. *h*
Pleurotus cystidiosus



Tabl. 87, Fig. *i*
Pleurotus cystidiosus

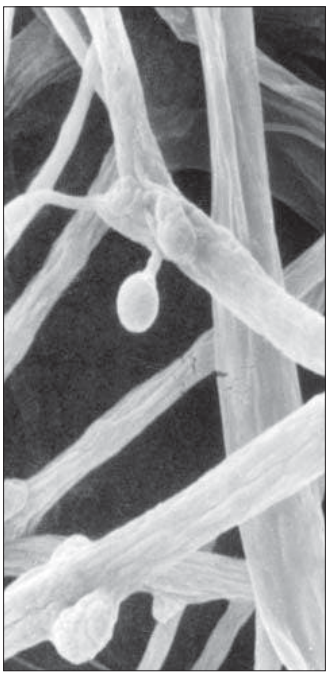


Tabl. 87, Fig. *j*
Pleurotus cystidiosus

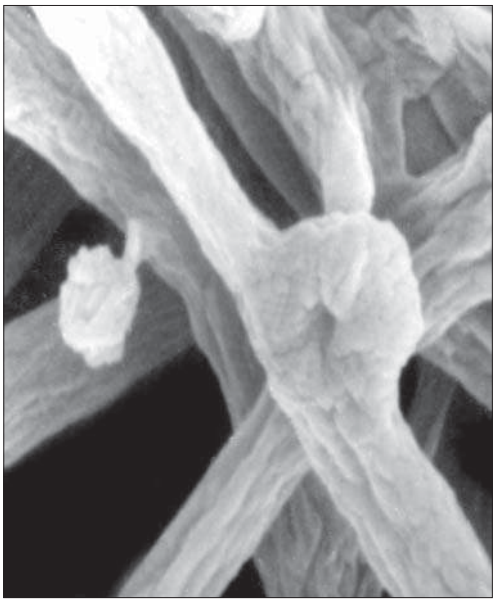


Tabl. 87, Fig. *k*
Pleurotus cystidiosus

Tabl. 87, Fig. *l*
Pleurotus cystidiosus

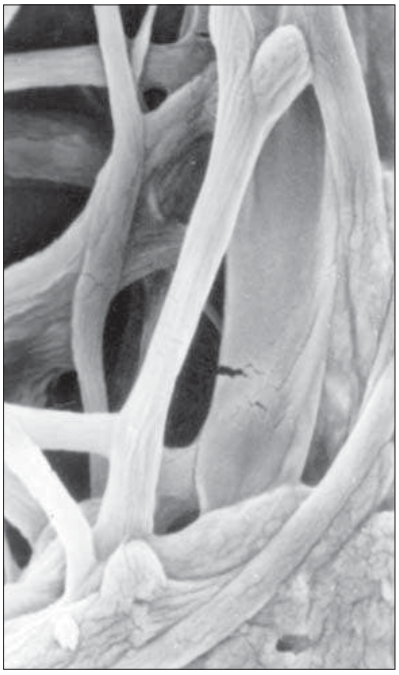


Tabl. 88, Fig. *a*
Pleurotus djamor

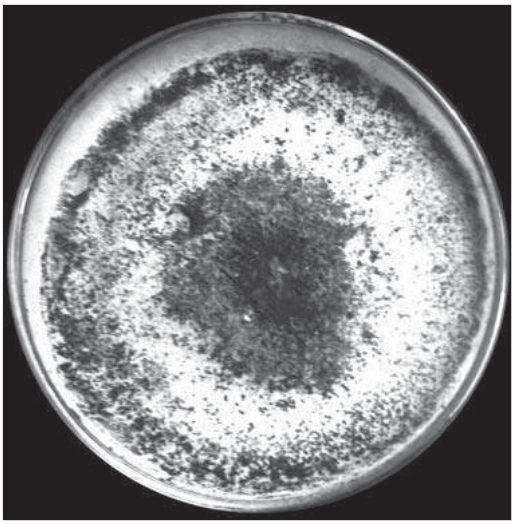


Tabl. 88, Fig. *b*
Pleurotus djamor

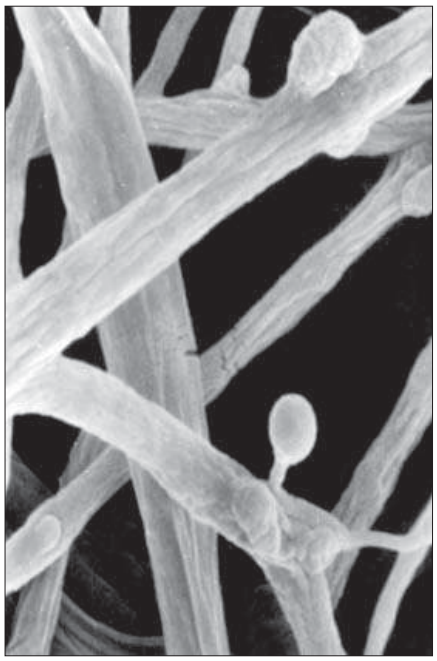
Tabl. 88, Fig. *c*
Pleurotus djamor



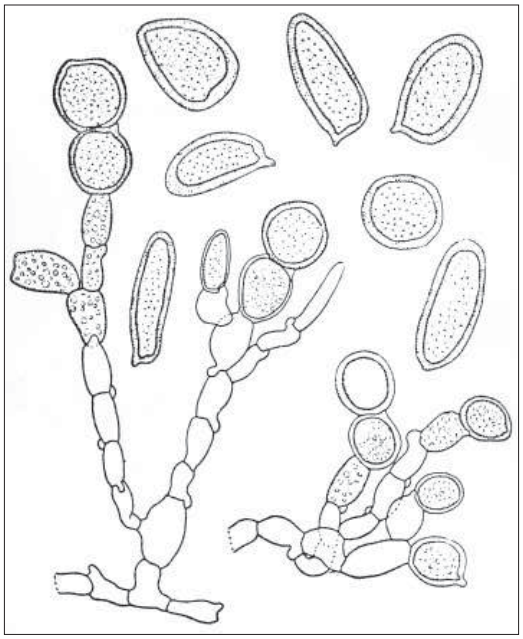
Tabl. 88, Fig. *d*
Pleurotus djamor



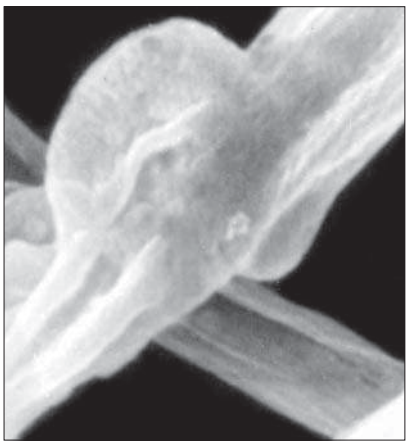
Tabl. 89, Fig. *a*
Pleurotus dryinus



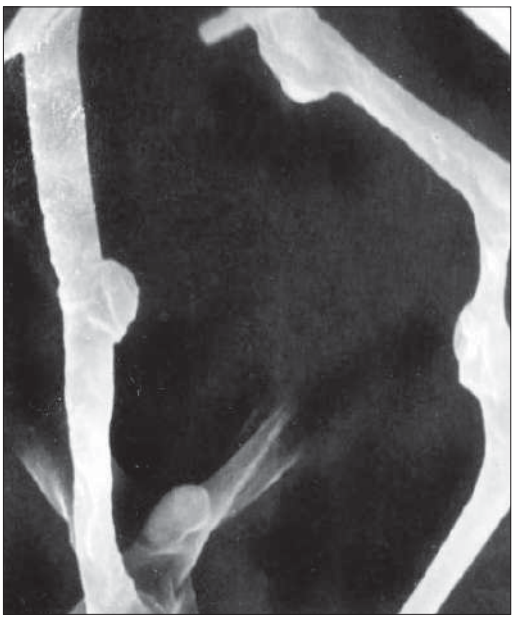
Tabl. 89, Fig. *b*
Pleurotus dryinus



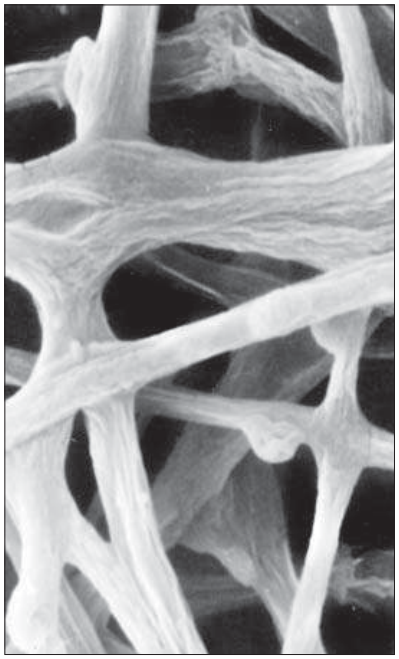
Tabl. 89, Fig. *c*
Pleurotus dryinus



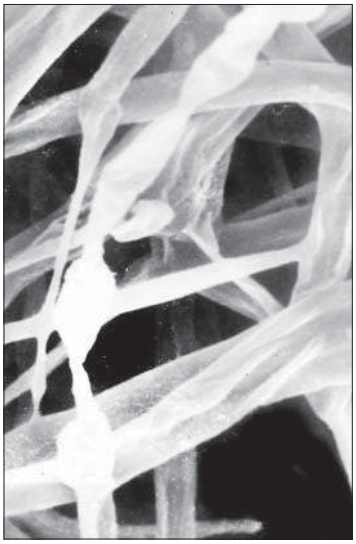
Tabl. 90, Fig. *a*
Pleurotus eryngii



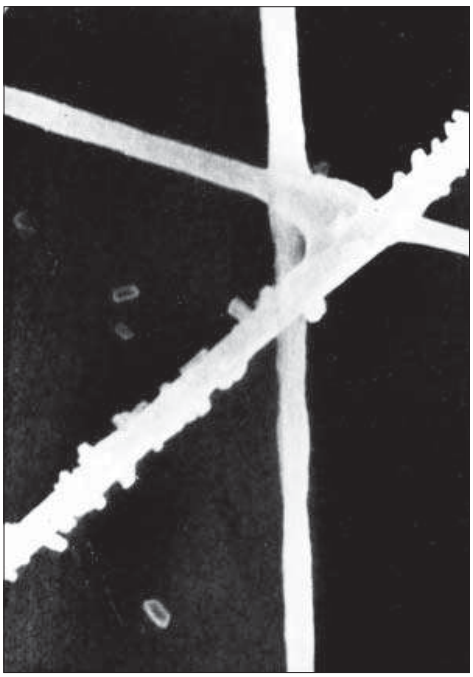
Tabl. 90, Fig. *b*
Pleurotus eryngii



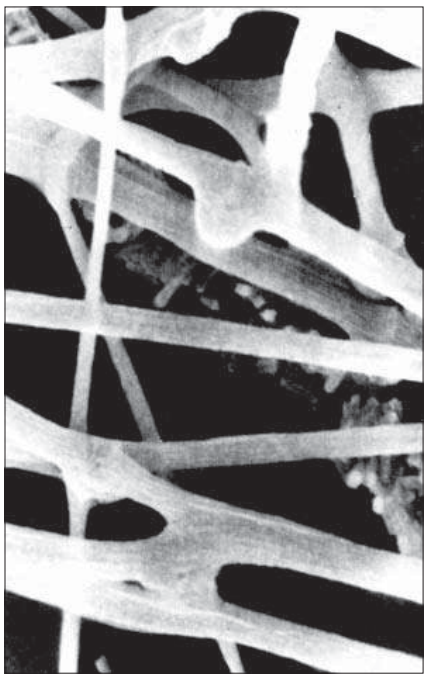
Tabl. 90, Fig. *c*
Pleurotus eryngii



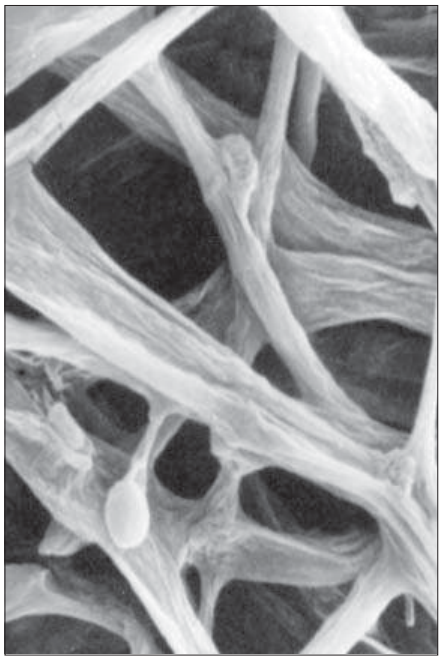
Tabl. 90, Fig. *d*
Pleurotus eryngii



Tabl. 90, Fig. *e*
Pleurotus eryngii

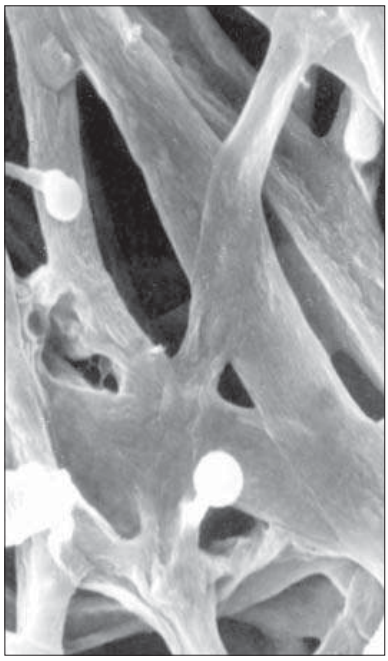


Tabl. 90, Fig. *f*
Pleurotus eryngii



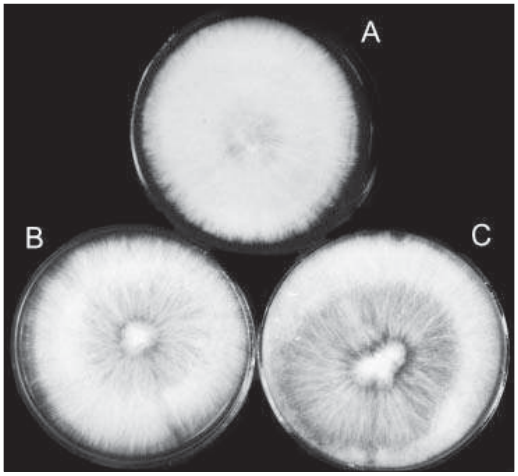
Tabl. 90, Fig. *g*
Pleurotus eryngii

Tabl. 90, Fig. *h*
Pleurotus eryngii

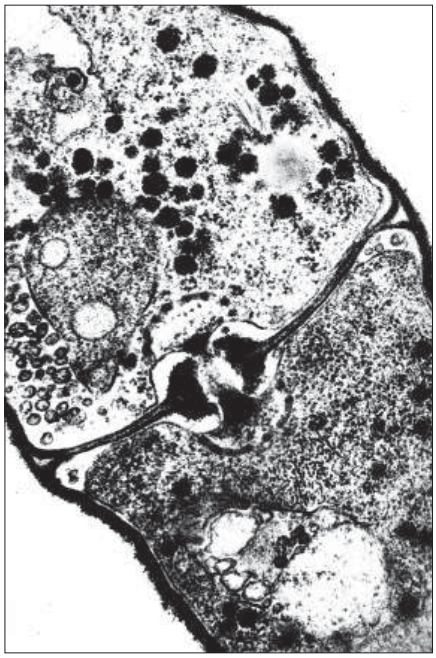


Tabl. 90, Fig. *i*
Pleurotus eryngii

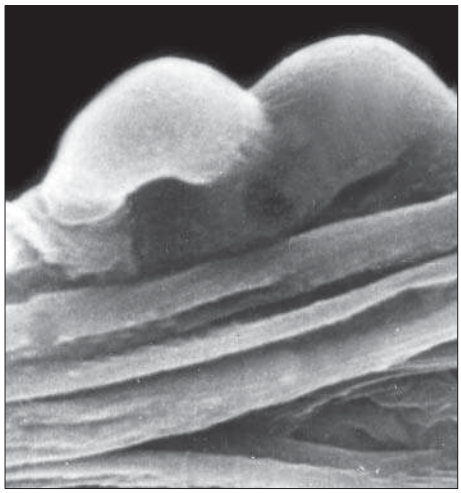
Tabl. 91, Fig. *a*
Pleurotus ostreatus



Tabl. 91, Fig. *b*
Pleurotus ostreatus



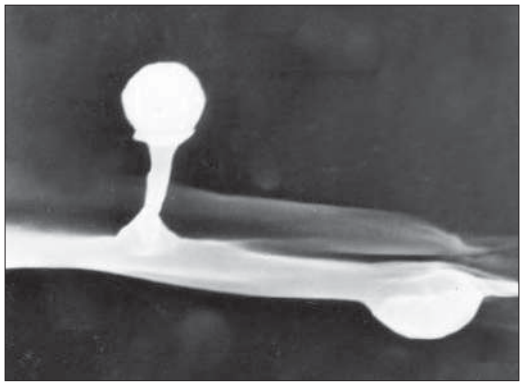
Tabl. 91, Fig. *c*
Pleurotus ostreatus



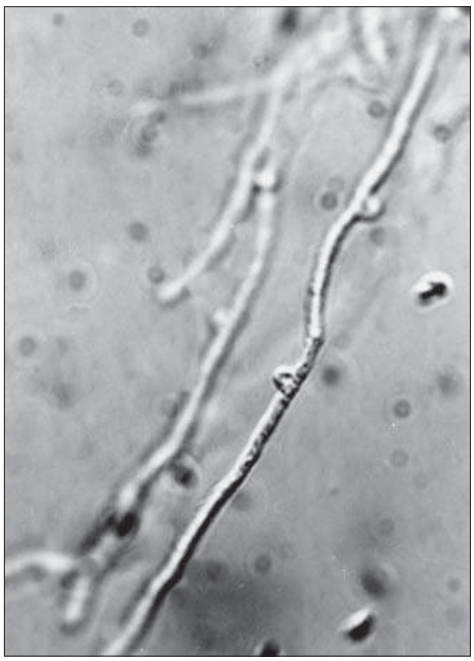
Tabl. 91, Fig. *d*
Pleurotus ostreatus

Tabl. 91, Fig. *e*
Pleurotus ostreatus

Tabl. 91, Fig. *f*
Pleurotus ostreatus

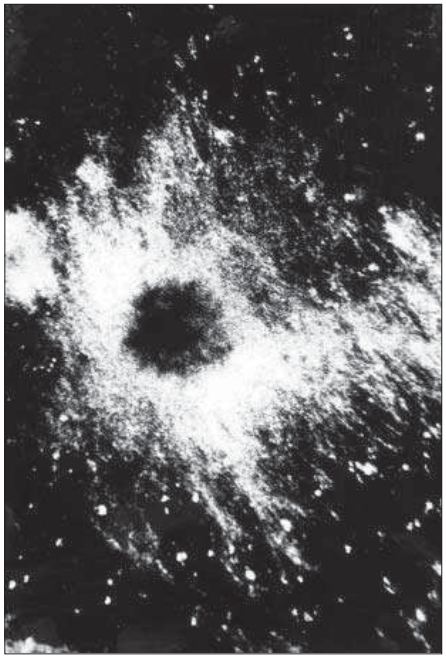


Tabl. 91, Fig. *g*
Pleurotus ostreatus

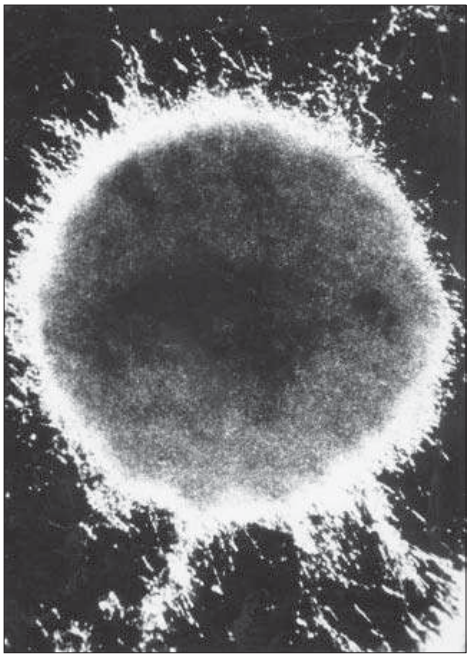


Tabl. 91, Fig. *h*
Pleurotus ostreatus

Tabl. 91, Fig. *i*
Pleurotus ostreatus

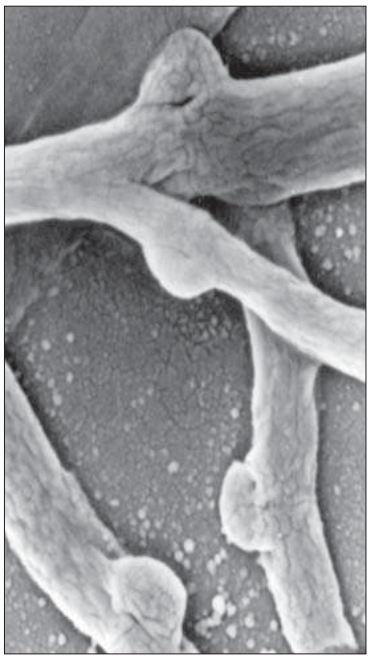


Tabl. 91, Fig. *j*
Pleurotus ostreatus

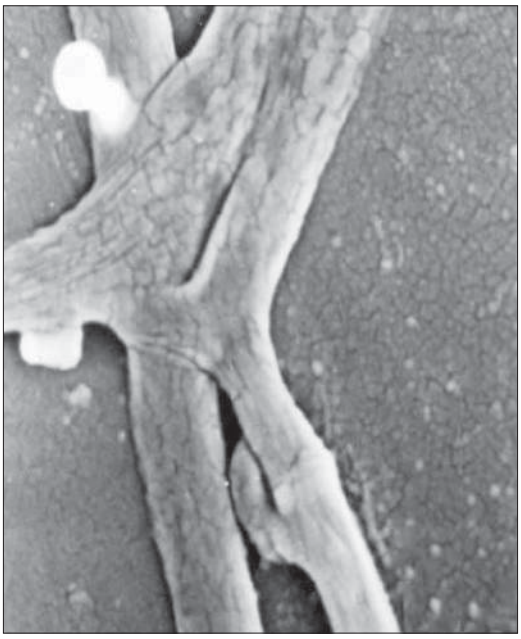


Tabl. 91, Fig. *k*
Pleurotus ostreatus

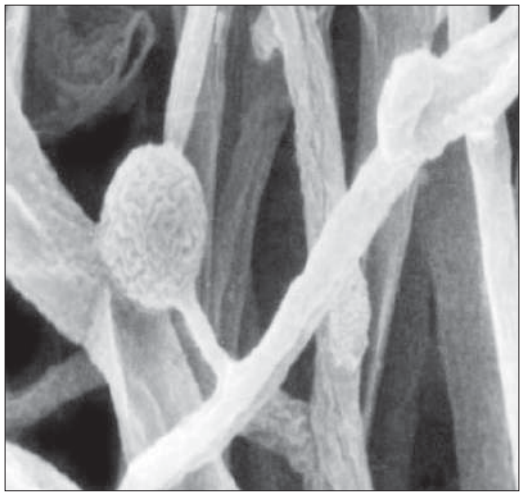
Tabl. 92, Fig. *a*
Pleurotus pulmonarius



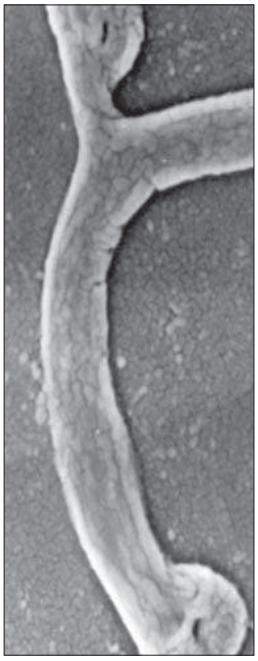
Tabl. 92, Fig. *b*
Pleurotus pulmonarius



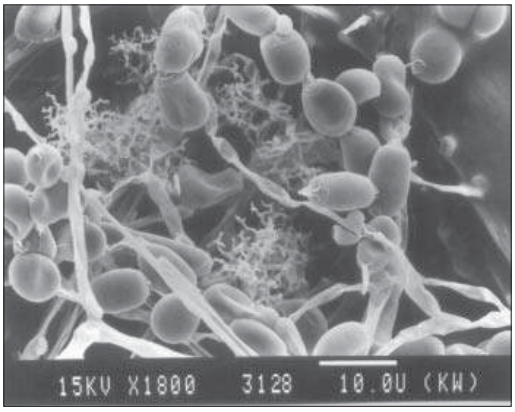
Tabl. 92, Fig. *c*
Pleurotus pulmonarius



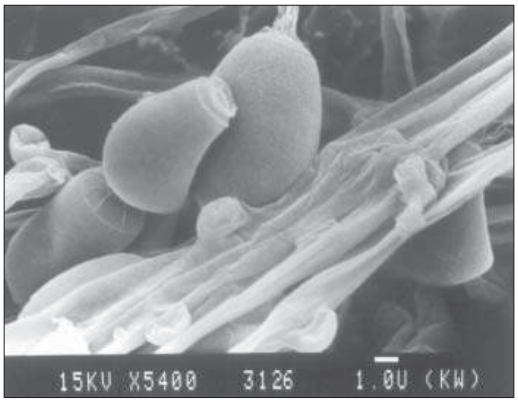
Tabl. 92, Fig. *d*
Pleurotus pulmonarius



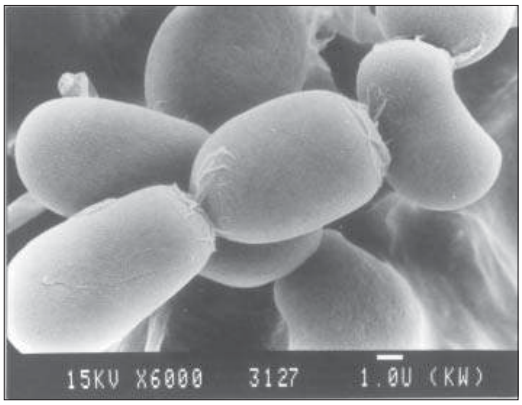
Tabl. 92, Fig. *e*
Pleurotus pulmonarius



Tabl. 93, Fig. *a*
Polyporus squamosus

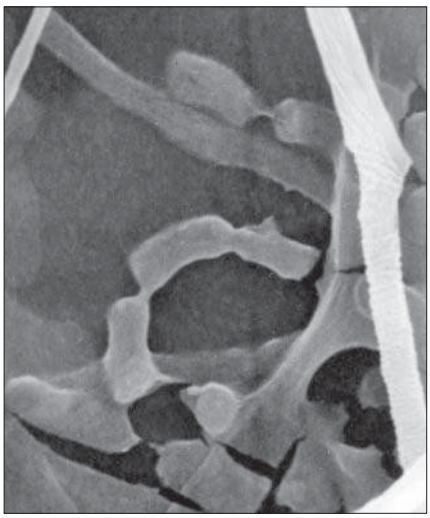


Tabl. 93, Fig. *b*
Polyporus squamosus

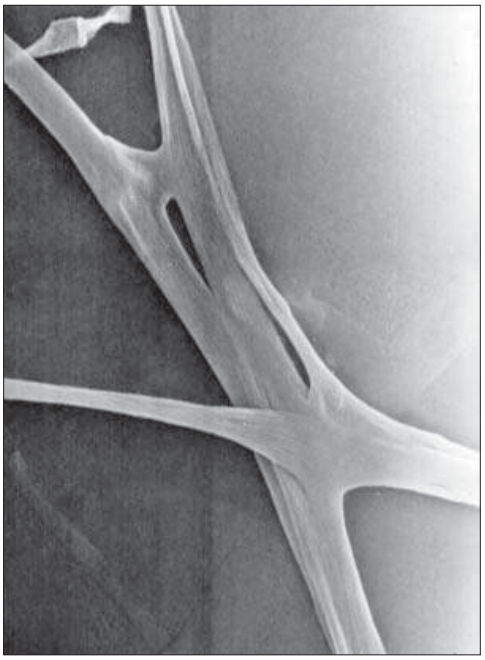


Tabl. 93, Fig. *c*
Polyporus squamosus

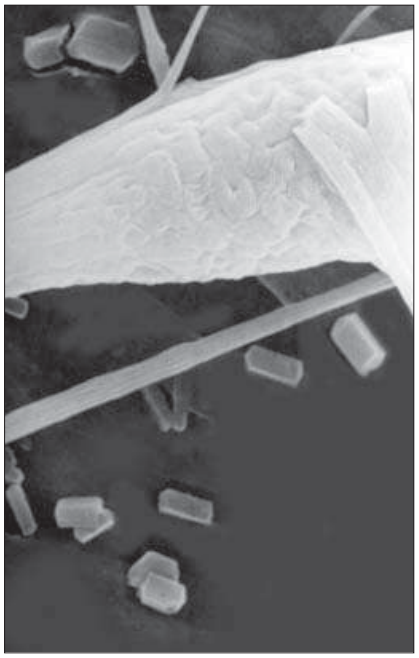
Tabl. 94, Fig. *a*
Psilocybe cubensis



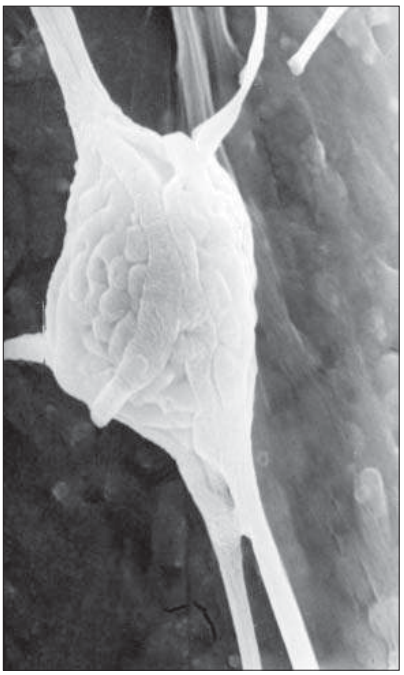
Tabl. 94, Fig. *b*
Psilocybe cubensis



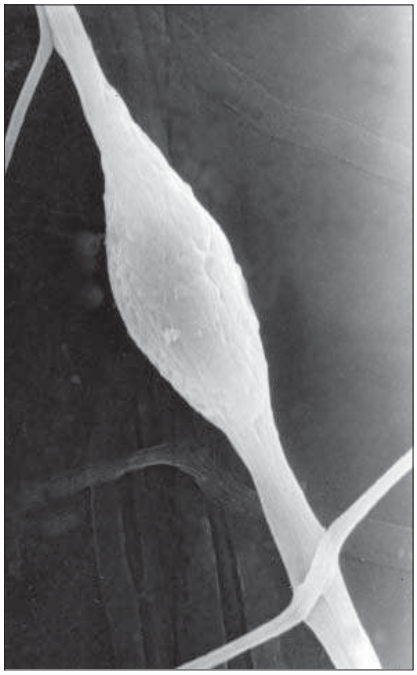
Tabl. 94, Fig. *c*
Psilocybe cubensis



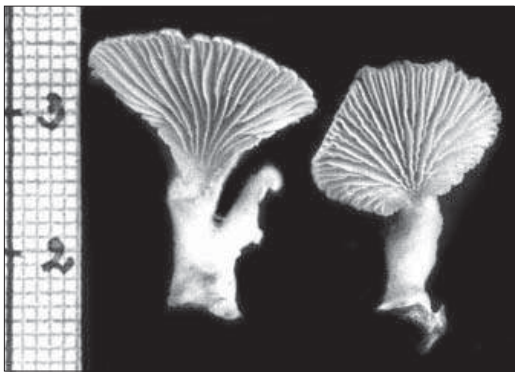
Tabl. 94, Fig. *d*
Psilocybe cubensis



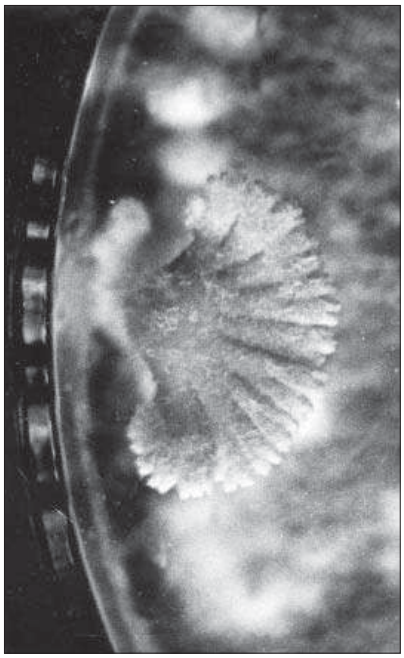
Tabl. 94, Fig. *e*
Psilocybe cubensis



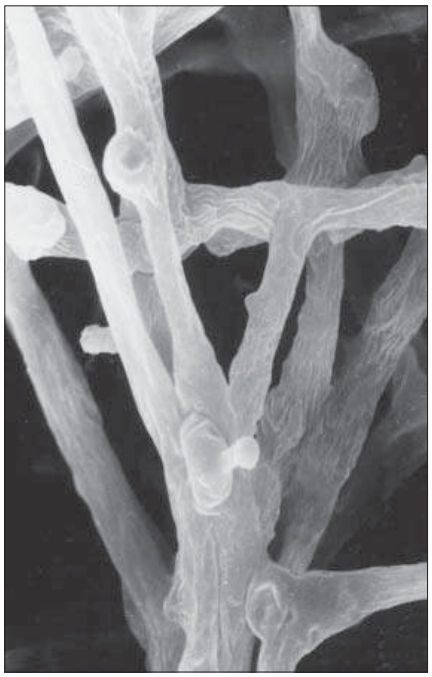
Tabl. 94, Fig. *f*
Psilocybe cubensis



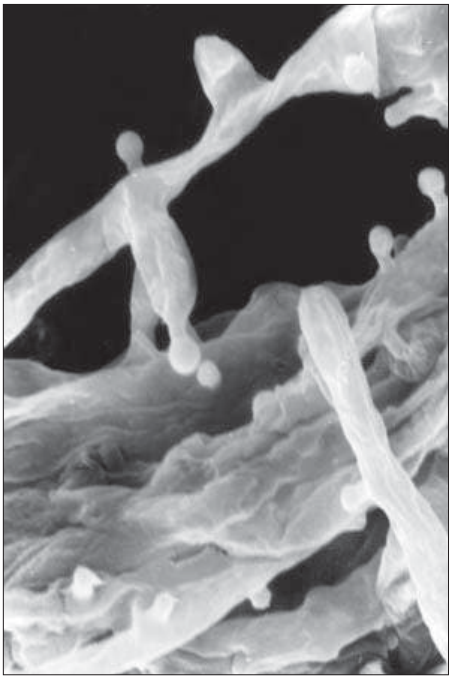
Tabl. 95, Fig. *a*
Schizophyllum commune



Tabl. 95, Fig. *b*
Schizophyllum commune



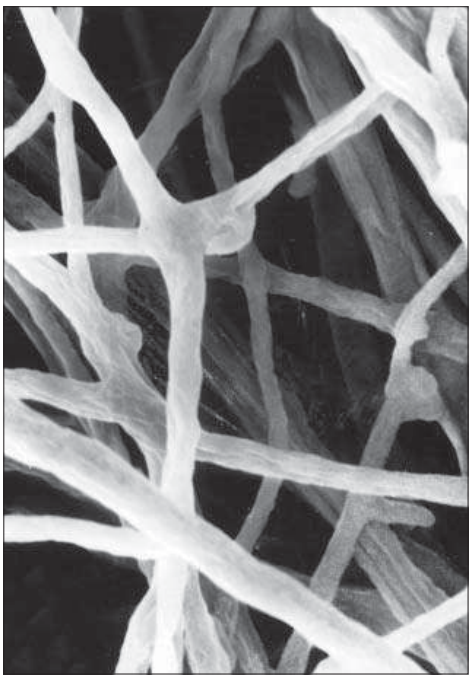
Tabl. 95, Fig. *c*
Schizophyllum commune



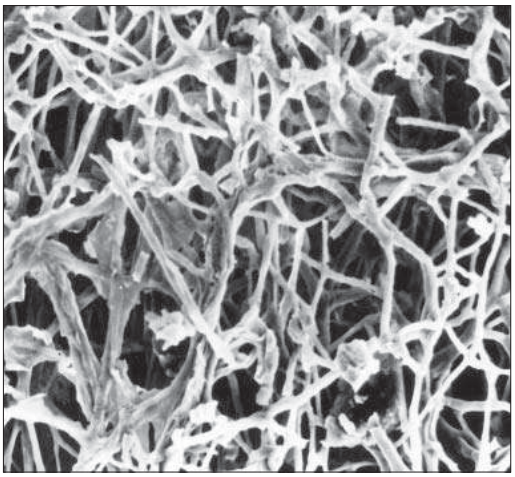
Tabl. 95, Fig. *d*
Schizophyllum commune

Tabl. 95, Fig. *e*
Schizophyllum commune

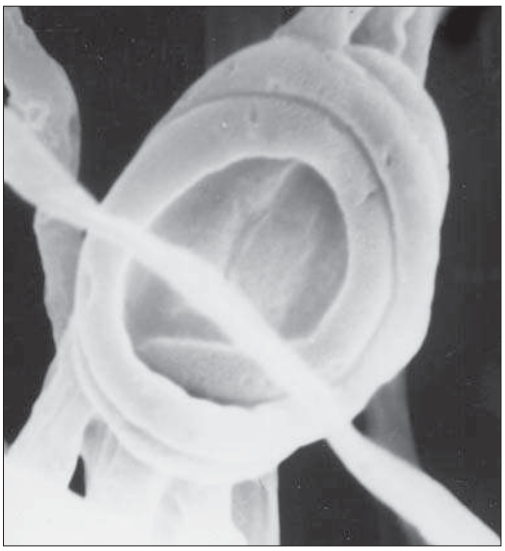
Tabl. 96, Fig. *a*
Tricholoma mongolicum



Tabl. 96, Fig. *b*
Tricholoma mongolicum

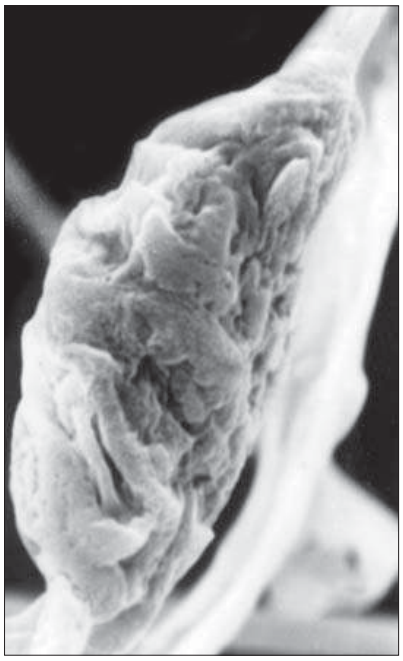


Tabl. 96, Fig. *c*
Tricholoma mongolicum



Tabl. 96, Fig. *d*
Tricholoma mongolicum

Tabl. 96, Fig. *e*
Tricholoma mongolicum



Tabl. 96, Fig. *f*
Tricholoma mongolicum

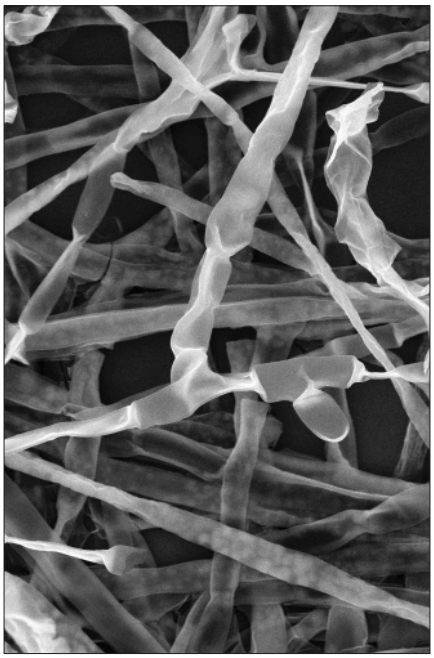
Tabl. 96, Fig. *g*
Tricholoma mongolicum

Tabl. 96, Fig. *h*
Tricholoma mongolicum

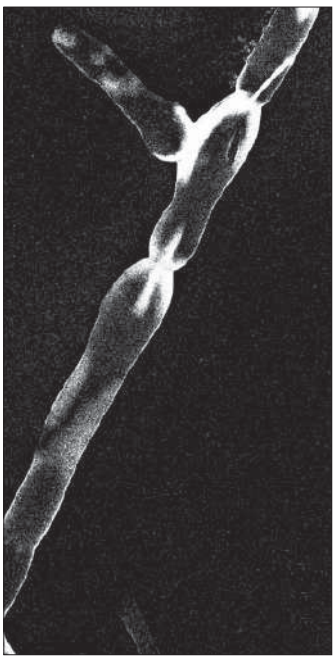
Tabl. 96, Fig. *i*
Tricholoma mongolicum

Tabl. 97, Fig. *a*
Tulostoma betreroanum

Tabl. 97, Fig. *b*
Tulostoma betreroanum

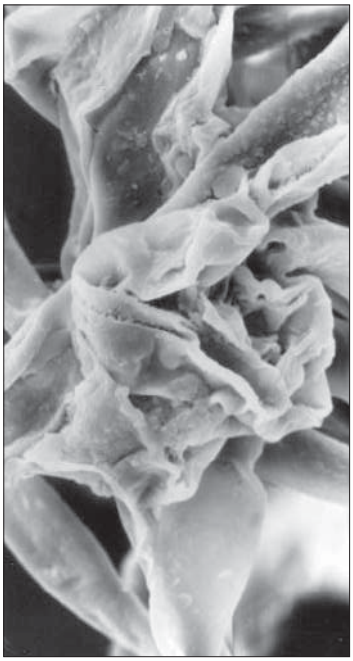


Tabl. 98, Fig. *a*
Verpa bohemica



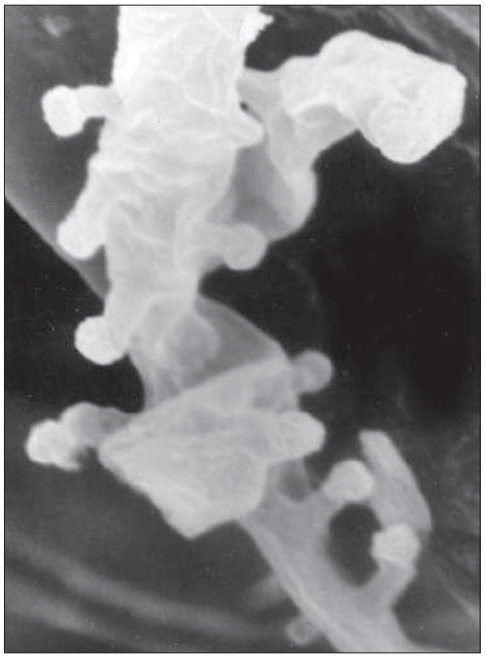
Tabl. 98, Fig. *b*
Verpa bohemica

Tabl. 98, Fig. *c*
Verpa bohemica



Tabl. 99, Fig. *a*
Verpa conica

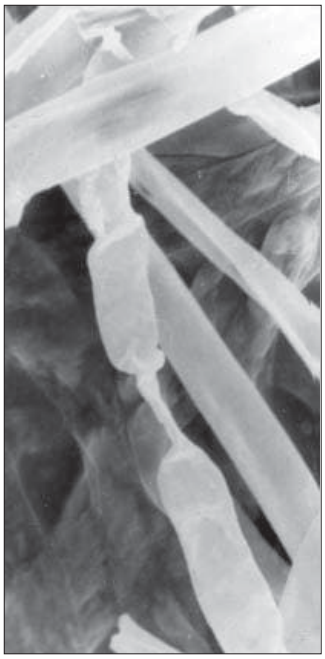
Tabl. 99, Fig. *b*
Verpa conica



Tabl. 99, Fig. *c*
Verpa conica

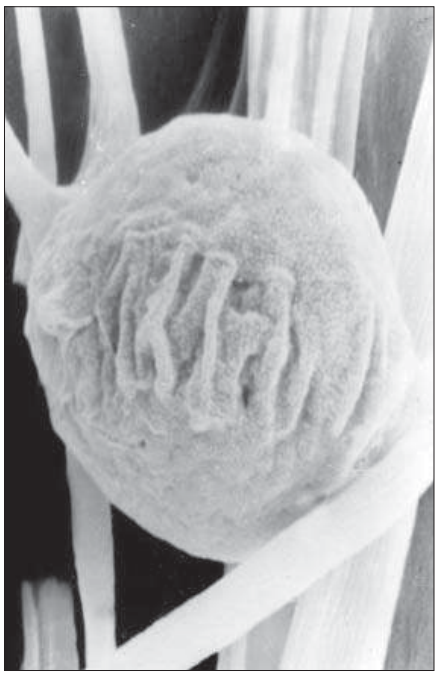
Tabl. 99, Fig. *d*
Verpa conica

Tabl. 100, Fig. *a*
Volvariella volvaceae



Tabl. 99, Fig. *b*
Volvariella volvaceae

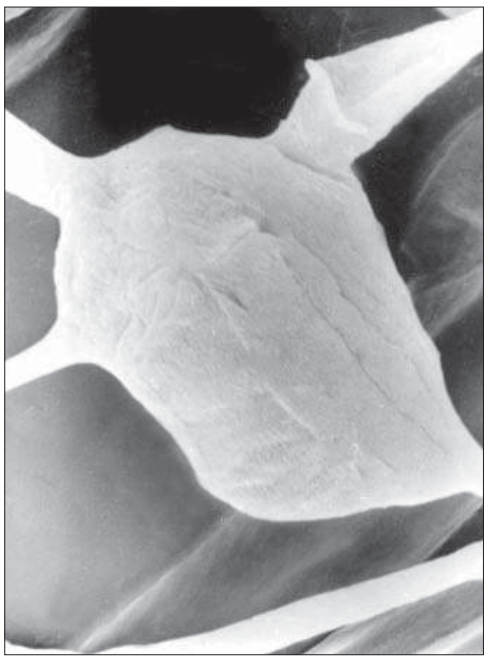
Tabl. 99, Fig. *c*
Volvariella volvaceae



Tabl. 100, Fig. *d*
Volvariella volvaceae

Tabl. 100, Fig. *e*
Volvariella volvaceae

Tabl. 100, Fig. *f*
Volvariella volvaceae



Tabl. 100, Fig. *g*
Volvariella volvaceae