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A Floristic and Taxonomic Study of the Wood-rotting Aphyllophorales of the Spruce-fir Forest of the Great Smoky Mountains National Park

Hack Sung Jung
University of Tennessee - Knoxville

To the Graduate Council:

I am submitting herewith a dissertation written by Hack Sung Jung entitled "A Floristic and Taxonomic Study of the Wood-rotting Aphyllophorales of the Spruce-fir Forest of the Great Smoky Mountains National Park." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Botany.

Ronald H. Petersen, Major Professor

We have read this dissertation and recommend its acceptance:

David K. Smith, E. E. C. Clebsch, Ernest Bernard

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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A FLORISTIC AND TAXONOMIC STUDY OF THE WOOD-ROTTING APHYLLOPHORALES OF THE SPRUCE-FIR FOREST OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK

A Dissertation

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Hack Sung Jung

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ABSTRACT

An ecological survey of the wood-rotting Aphyllophorales from the spruce-fir forest of the Great Smoky Mountains National Park was accomplished with emphasis on resupinate taxa. A total of 105 species are described within 51 genera of 6 families and discussed in terms of habitats, substrates, wood rot, host trees, elevation, and distribution. Sixteen species were successfully cultured. Analytical keys for genera and species are provided, and microscopic characters are illustrated in an appendix.

Fungi usually occur in naturally disturbed areas with windbreaks and windthrows. Fomitopsis, Ganoderma, Phellinus, and Perenniporia are the most common decay fungi. Hirschioporus and stereoid fungi play important roles in decomposition of recently dead trees, and when they give way, corticioid fungi follow to colonize leftover substrates. Red spruce and Fraser fir are the most important hosts, and two thirds of the fungi collected occur on these trees. Red spruce is affected at mature and old stages, and Fraser fir at younger stages. Elevational distribution of these fungi agrees with that of their host trees. The fungal flora of the spruce-fir forest is different from those of the cove hardwoods forest of Cades Cove and the pine-hardwoods forest of John Knox Camp.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

FIGURE PAGE

FIGURE PAGE

FIGURE PAGE

CHAPTER I

INTRODUCTION

While some non-resupinate wood-rotting fungi are included in this dissertation, especially in the families. Polyporaceae, Hymenochaetaceae, and Stereaceae, strong emphasis has been placed on resupinate fungi. The non-resupinate fungi have been covered just as an aid to the user of this work, because some of them produce resupinate fruiting forms in addition to their pileate structures.

The resupinate basidiomycetous fungi constitute a cosmopolitan group fruiting mostly on dead wood or wood products throughout the world. Resupinate forms sometimes represent ontogenetic stages of more highly differentiated fungi fruiting over the substratum under certain conditions. In fact, in the Aphyllophorales, a number of fungi favor effuse fruiting, at least in their early development. For this reason, studies of these fungi will eventually touch many natural groups of the Aphyllophorales.

The term resupinate was originally used for appressed agaric fruitbodies (cf. Donk, 1964), as opposed to pileate forms. In this sense, "resupinate" does not represent any particular taxa. The resupinate Aphyllophorales, therefore, is not a taxonomic group but a growth form, a life form, or a grade form which shares in common certain characters of gross morphology. Fruitbodies are formed appressed and attached to the surface of the substratum often with deep-seated mycelial growth hidden beneath the surface.

The fruitbody margin may be rather variable in some cases,

becoming free, raised, or reflexed, forming small shelves or pilei. In general, the entire exposed surface is fertile. Smooth hymenophores are most common, but verrucose, ridged, echinulate, porose and plicate hymenophores are also frequently met. The context of these fruitbodies is pellicular, felty, arachnoid, ceraceous, membranaceous, coriaceous, gelatinous, or even corky to woody (Christiansen, 1971).

Many resupinate fruitbodies are quite visible and often conspicuous, but others are very small, thin, and sometimes form an almost invisible film over the substratum. Identification requires careful and close observations with the aid of a hand lens. Likewise, they usually fruit on the underside of fallen trees, logs, twigs, and leaves and thus remain unnoticed by casual collectors. This is one reason why the study of these fungi has been rather neglected as compared to the larger pileate forms (Rattan, 1977).

Species of similar or identical habit may prove very different under the microscope. Species of inconspicuous or invisible appearance often may possess very conspicuous and outstanding characters under the microscope. This is the other reason for the conflict occurring between present-day knowledge and older classifications (Eriksson and Hjortstam, 1983). To the old masters, like Persoon and Fries, several macroscopically simple characters were enough to determine species. Subsequent experience, however, has continuously inspired taxonomists to search for new characters to improve the study of the resupinate Aphyllophorales.

All forms of modified hyphae occur, for example, and these

structures are so unique that they are not readily found in other groups of the kingdom of fungi. Structures and functions of these microscopic elements have been interpreted in many ways and thus serve as a topic of increasing taxonomic interest, another reason why modern taxonomy of the resupinate fungi has no solid classification system yet.

Biologically, the resupinate Aphyllophorales live on wood substance by digestion of cell walls. They cause tree diseases and decompose slash. Some members are so aggressive and destructive that trees of healthy appearance soon become moribund inside and liable to windthrow. Wood decay of living trees by fungi is known to account for more loss in saw timber than fire, insects, weather, or any other agents (Manion, 1981). A great majority of the species, however, are saprophytes and prefer dead trees and wood products. Deterioration of merchantable wood by decay fungi is apparently considered troublesome, but when the same fungi dispose of forest slash and litter, enriching the soil, their roles are immensely beneficial. Recently, these fungi have been widely studied in forest pathology as well as mycology because of their economic importance (Manion, 1981).

In the Great Smoky Mountains, intermingling of various floras in response to great diversity of topography and high annual rainfall provide rich environmental conditions and sufficient substrate for fungal growth and fruiting. In the Park area of the Great Smoky Mountains, students have worked, in most cases, on groups of fleshy fungi. For the resupinate fungi, little information is available except for occasional checklists or papers by early mycologists.

The first report published on the fungi of this area was by Kauffman (1917). During a stay of three weeks at Elkmont, in September, 1916, where the Park´s largest campground is now developed, he collected and reported on 264 species of fungi from the western slopes of the Smoky Mountains. Under three old families, Thelephoraceae, Hydnaceae, and Polyporaceae of the Basidiomycetes, he listed 55 putative resupinate species. Coker (1921) reported a number of resupinate species from North Carolina but did not travel to the Park area. Burt´s "Thelephoraceae of North America" (1918-1926) revealed that his quotations of Tennessee fungal flora were actually based on Kauffman´s report.

A great deal of collecting in the Park was done by L. R. Hesler, the expert on southern Appalachian fungi. His "A Preliminary List of the Fungi of the Great Smoky Mountains National Park" (1937) enumerated 752 species and varieties. With some alterations, several more resupinate species were added to the previous report, but the majority of other additions were fleshy gilled fungi. Linder (1941) reported on the 1939 Summer Foray of the Mycological Society of America, which was held in the Park, listing 510 species and varieties, among which almost identical resupinate species as reported before were repeated again. Burdsall (1971, 1975, 1976) provided the first descriptions, illustrations, and discussions of some resupinate Aphyllophorales of the southern Appalachians and the southeastern United States. The Park area was a transient stop during his collecting trips, and several species were illustrated in great detail.

With occasional visits of foreign mycologists to the Park, many specimens from the Park are assumed to reside in European herbaria, but no known reports are available. Recently, a much improved list was prepared by Petersen (1979). The list of specific groups was updated, and many identifications were confirmed by experts. In sections on thelephoroid, corticioid, hydnoid, and polyporoid fungi, three and half times the previous enumeration of resupinate species were listed under about 70 modern genera. Lowe and Gilbertson (1961) cited 50 to 60 resupinate polypores, mostly *Poria* spp., in their "Synopsis of the Polyporaceae of the Southeastern United States," tagged with state localities, among which "TENN" was believed to stand for the Park area.

However, collections from the coniferous forest at high elevations of the Park seem to be very rare. Informations on the occurrence of resupinate fungi in relation to their hosts in the spruce-fir forest of the Park have been wanting. Most people may have preferred to work in hardwood forests at low elevations of the Park, perhaps because of many inconveniences in reaching the high-elevation forest.

At the same time, this forest area has become the focus of investigation as one of the southernmost spruce-fir forests of eastern North America. This forest, however, is undergoing significant change due to a number of destructive factors. The infestation of balsam woolly aphid (*Adelges piceae* Ratz.) has reduced fir on a large scale, and some poorly understood stresses have decreased the annual growth of spruce at a significant rate (White, 1984).

This being the case, a floral study of the resupinate fungi in this area has been an increasing need. To meet this need, it is imperative to profile the species which fruit on spruce and fir before the situation goes too far.

CHAPTER II

CLASSIFICATION HISTORY

What Linnaeus and Jussieu did for the flowering plants in the mid-eighteenth century Persoon and Fries did for fungi some fifty years later (Ainsworth. 1976). A fundamental taxonomic framework was constructed by their two works, the "Synopsis Methodica Fungorum" by Persoon (1801) and the "Systema Mycologicum" by Fries (1821-1832). Fries has been held more responsible for their system because of his fame and influence.

In his "Synopsis," Persoon (1801) placed the Basidiomycetes (except the Gasteromycetes) in the order Hymenothecii and divided it into six subdivisions (the last one included some Ascomycetes) according to characters of hymenial configuration. Adopting Persoon´s system, in his "Hymenomyctes europaei," Fries (1874) divided the present-day Hymenomycetes into five families (his "ordo") and assigned the group of smooth hymenophore to the Thelephorei. The other families were Agaricini, Polyporei, Hydnei, and Clavariei, respectively with lamellate, tubulate, toothed, and erect amphigenous hymenophore. Some other artificial families, based on old genera of the Friesian system, were separated later from the Thelephoraceae (Donk, 1971); these were Corticiaceae, Cyphellaceae, and Stereaceae, with the first serving as a reservoir for most resupinate Aphyllophorales.

Subsequent study of resupinate fungi was retarded for many years, partly because old mycologists paid them little attention and

partly because the Friesian system was so practical and satisfactory at the generic level that few efforts were made to improve it. In the Friesian era, comprehensive names were used for many taxa with similar appearance, or contrarily several names for same species on different occasions. Only a few generic names like *Thelephora*, *Corticium*, *Odontia*, *Poria*, and *Merulius* were enough to accommodate all resupinate taxa.

As the use of the microscope for diagnosis increased, the number of described species rapidly escalated. Enormous numbers of species often were brought together and stuffed under a limited number of old generic names, making these genera bulky and heterogeneous. With time, there developed a tendency to help the situation by splitting genera. Some authors like Karsten, Quélet, and Murrill resorted to raising generic subdivisions to generic rank and, therefore, refined many generic characters (cf. Donk, 1971).

Around the turn of the 20th century, revision of the Friesian system was initiated by Patouillard (1900). Not only was he an important critic of the dominant Friesian system, but also a reformative systematist who saw the taxonomic importance of microscopic structures. In his "Essai taxonomique," Patouillard introduced microscopic characters to delimit taxa of higher fungi for the first time and divided the Basidiomyctes into the "Hétérobasidiés" with secondary spores and the "Homobasidiés" without secondary spores.

His "Aphyllophoracés" was divided into two "tribus"; the "Clavariés" with an erect simple or branched basidiocarp and an amphigenous hymenium, and the "Porohydnés" with a resupinate or

pileate basidiocarp and a hymenium underneath the cap. The "Porohydnés" was subdivided into four "sous-tribus," based on the form of the hymenophore, cupulate in the "Cyphellés," even to warted in the "Odontiés," poroid in the "Porés" and toothed in the "Hydnés" (Stalpers, 1978). His "Sous-tribu Cyphellés" and "Série des Corticies" came to serve as the basis of the modern Corticiaceae. His "Série des Igniaires" and "Série des Phylactéries" comprised genera with diverse hymenial configuration, and a number of these genera produced resupinate fruitbodies. They formed the bases of the modern families Hymenochaetaceae and the emended Thelephoraceae (Donk, 1971).

The Patouillardian system was largely extended and applied by Bourdot and Galzin (1928) in "Hyménomycètes de France." They made some rearrangements for Patouillard´s "sous-tribus" but almost inherited his classification and proved its advantage and superiority as an approach to a better systematic goal. In their voluminous work, the large majority of resupinate species were referred to the catch-all genera Corticium, Gloeocystidium, and Peniophora in "Sous-tribu Corticiés" at the same rank as the present Corticiaceae. They divided Corticium into 16 sections and Gloeocystidium and Peniophora into 7 sections each, but many of these superficially smooth resupinate fungi later proved to be only distantly related.

Bourdot and Galzin were apparently convinced that taxa of similar characters were often retained in several different genera, but they did not want to deviate from Patouillard´s original scheme. Because their treatment of genera proved unsatisfactory, subsequent students split off those groups that appeared natural and provided

them with proper generic names, leaving other, not yet classifiable species in the old residual genera.

Donk (1956-1958) initiated a revision of this troublesome taxonomy through a series of notes on resupinate Hymenomycetes and proposed a number of new or emended taxa. Rogers, Jackson, Eriksson, and others developed further revision and added new genera. Eriksson's (1958) study on resupinate Aphyllophorales of the Muddus National Park in Sweden greatly altered generic delimitation within the Corticiaceae.

Influenced by Bourdot and Galzin, Donk (1931, 1933) also adopted the Patouillardian system in his early years, but later, in pursuit of modern concepts, he employed 21 families (two more families were added later) in his "Conspectus of the Families of Aphyllophorales" (Donk, 1964). Carefully delimited, emended, and updated, his families represented a new trend which reserved room for forthcoming taxa. Resupinate members were included in 10 families but still remained as artificial groupings in many cases (Table 1). Many workers to this day are trying to solve the difficult problem which they meet in the resupinate fungi through continuous efforts to correctly place the residual taxa by emending old genera and creating new ones.

Domanski (1972, 1973) devised descriptive keys to the cosmopolitan species of the Polyporaceae sensu lato and Lowe (1957, 1966, 1975) monographed American species of _Fomes_ s.l., _Poria_ s.l., and _Tyromyces_ s.l. Publications on _Aleurodiscus_ by Lemke (1964), the Athelioideae by Jülich (1972), _Tomentella_ by Larsen (1968), the

Table 1. Distribution of fruitbody and hymenial configuration over the families of Aphyllophorales.[a]

Modern Families	Fruitbody					Hymenial Configuration				
	Resupinate		Pileate		Clavarioid & Cantharelloid					
	Effused	Reflexed	Sessile	Stalked		Smooth	Folded	Toothed	Tubulate	Lamellate
Auriscalpiaceae		(X)	X	X				X		X
Bankeraceae				X				X		
Bondarzewiaceae				X	X	X			X	
Canthrellaceae					X	X	X			
Clavariaceae					X	X				
Clavulinaceae					X	X				
Coniophoraceae	X	X	X	X		X	X	X		
Corticiaceae	X					X	X	X	X	
Echinodontiaceae		(X)	X					X		
Fistulinaceae				X					X	
Ganodermataceae		(X)	X	X					X	
Gomphaceae	X			X	X	X	X	X		
Hericiaceae	X	X		X	X	X		X		
Hydnaceae				X				X		
Hymenochaetaceae	X	X	X	X		X		X	X	X
Lachnocladiaceae	X				X	X				
Podoscyphaceae				X		X				
Polyporaceae	X	X	X	X					X	X
Punctulariaceae	X	X				X				
Schizophyllaceae		(X)	X			X	X			X
Sparassidaceae				X		X				
Stereaceae	X	X	X	X		X	X	(X)		
Thelephoraceae	X	X	X	X		X	X	X	X	(X)

[a] The table was adopted from Donk (1971).

X A common feature.

(X) A rare or unusual case.

systematic survey of the Corticiaceae by Parmasto (1968), and the floristic work of Eriksson and Ryvarden (1973-present) on the Corticiaceae of North Europe all have been important advances for the knowledge of the resupinate fungi.

Gilbertson (1963-1965) revised the resupinate hydnaceous fungi from North America through his sequential type studies. He enumerated 90 species within 23 genera. Ginns (1968-1971, 1982) dealt the meruloid fungi by redescribing type materials, with six genera of the Coniophoraceae known to be wholly or partly resupinate. Donk (1960, 1967) reviewed resupinate poroid fungi in his notes on Poria. These groups, known as some of the most intricate subjects in the systematics of the polypores, included about 26 genera, many of which remained in Donk´s concept of the Polyporaceae. Besides workable taxa, there are still some leftovers excluded from the emended families. Placement may not be accomplished until complete studies are performed at the species level for all the resupinate taxa.

Workers of this century, like Bresadola (1881 to 1935), von Höhnel (1906 to 1908), Burt (1914 to 1926), Litschauer (1924 to 1944), Rogers (1935 to 1943), Jackson (1948 to 1951), Donk (1954 to 1962), and several others deserve to be named as contributors to the study of resupinate fungi. Today, systematic studies on resupinate fungi are going on throughout the world, e.g. by Eriksson, Hjortstam, and Strid in Sweden, Ryvarden in Norway, Parmasto in U.S.S.R., Hauerslev in Denmark, Domanski in Poland, Jülich in Holland, Oberwinkler in Germany, Boidin in France, Pouzar and Kotlaba in Czechoslovakia, Rattan in India, and Gilbertson, Burdsall, Larsen, Liberta, Ginns, and

others in North America.

Modern species concepts have outgrown the conventional taxonomic categories. As a comprehensive approach to the naturalness of genera, cultural characters, mating systems, sexuality, habitat, and woodrot type are usually added to morphological and anatomical evidences. In addition to descriptions, discussions of some length are generally appended in order to reach a better recognition of species. Recently, several fundamental but professional questions about geographic distribution, evolutionary mechanism, phylogenetic trend, and ecology of resupinate fungi are being raised in published symposia (Petersen, 1971; Clémençon, 1977; Wells and Wells, 1982).

CHAPTER III

MATERIALS AND METHODS

1. FIELD WORK

Fresh collections were obtained regularly during fruiting seasons from 1981 to 1984 from the spruce-fir forest of the Great Smoky Mountains National Park. Two extralimital sites, Cades Cove in the Park and John Knox Camp in Meigs Co., also were often visited for comparison of resupinate fungal flora. Three herbaria and their directors provided preserved specimens for study: Botanical Museum, University of Göteborg, Sweden (GB); Herbarium, State School of Forestry, Syracuse (SYRF); and Herbarium, University of Tennessee, Knoxville (TENN).

During 32 field trips, careful field records and photographs were made. Hiking time was measured and trail signs were noted to calculate hiking distances and to locate collecting sites and altitudes on 7.5-minute series maps (USGS-TVA Quadrangles, 1964). Field notes were taken with regard to fresh samples, forest site types, habitats, hosts, substrates, type and depth of woodrot, and dbh (diameter at breast height) of host trees. Photographs (Ektachrome 200) were taken in the field for fruitbodies, habitats, and surroundings. Each collection was put in a Ziploc bag to avoid bumping damage and to secure a discrete compartment inside the field pack.

The "Methuen Handbook of Color" (Kornerup and Wanscher, 1978) was carried in the field to identify fresh colors before they changed

on drying or bruising. This handbook is a standard reference in many disciplines and industries but is not so useful in describing colors of biological sciences because it often lacks subtle color variations and intensities.

Some 1.25% Difco malt agar plates (Nobles, 1948) sealed with Parafilm (The Fisher Scientific Company) and closed in Ziploc bags (The Dow Chemical Company) were also carried in the field. Pieces of specimens 3-4 mm^2 were cut from fresh fungi with a clean scalpel and were placed on the agar surface of the plates for lab culture work. This method for lab culture proved ineffective because it was hard to isolate axenic mycelium from a resupinate fruitbody collected on natural substrates. Likewise, wood debris, dust, and tiny litter were usually involved and served as contamination sources. Bacteria and hyphomycetes proved to be constant contaminants. The isolate frequently required subculturing to select out a pure colony.

In descriptions of the text, color names are always followed by coordinates contained in parentheses. For habitat and distribution of fungi, host, location on the host, substrate, and frequency of occurrence were put in order. Authorities for host trees were adopted from the "Manual of the Vascular Flora of the Carolinas" (Radford, Ahles, and Bell, 1964).

2. LABORATORY WORK

After field work, collected materials were brought to the lab as soon as possible, and each piece was put upside down on a clean glass slide for 2 or 3 days to make a spore print. Pieces were then

turned over and dried for 2 or 3 more days. Size and color of fruitbodies were usually preserved well through desiccation at room temperature. After desiccation, big pieces were cut and trimmed to fit herbarium specimen boxes. On specimen labels, the collection number was given on the right upper corner, with the serial number in red and the TENN number in black on the left upper corner. Specimens sterile or not identifiable were put aside, and all the completed specimens were deposited in TENN.

The morphology of fruitbodies, especially of corticioid fungi, was observed with a Wild M5 stereomicroscope (magnification up to 50X). Microscopic examinations were made using a Wild M20 compound research microscope with 15X oculars giving a magnification up to 1500X. Microscopic elements of taxonomic importance were drawn using a Treffenburg-type drawing tube (1.25X) attached to the microscope, and descriptive terminology for taxonomic characters was taken from Snell and Dick (1971).

For fruitbodies of compact texture, a minute piece was taken under the stereomicroscope and free-hand sectioned using razor blades. Sections were mounted in alcoholic potash (1:1 3% KOH and 95% EtOH) and heated over a mild flame to rehydrate tissue and remove crystalline mass from the hymenium for better viewing. Sections were stained with 1% phloxine in glycerine water (1:1 glycerine and water) in order to store the preparations for longer time. For fragile materials, a minute piece of about 1 mm^3 was put in alcoholic potash under the stereomicroscope, thoroughly teased apart using sharp-pointed needles, and then processed the same way. Before examination

under the microscope, each mount was gently pressed down to flatten and immobilize microscopic structures.

Normally, there is no striking difference in microscopic morphology between fresh and revived materials. But the KOH solution must be used with care because it always causes the hyphal elements of brown fungi to darken and the encrustation of certain types of cystidial elements to dissolve. In reviving some materials, water is substituted for the KOH solution to avoid modification of structural details. Reagents were prepared according to Largent et al (1977). Iodine reactions are determined in Melzer´s reagent, cyanophilic reactions in cotton blue, and sulfobenzaldehyde was used to observe gloeocystidia. Fresh mounts were found to be best for study, but old mounts were also good enough to reuse and helpful in saving time.

For each specimen examined, more than 10 measurements were usually made on each microscopic character. In the descriptions below, sizes of basidiospores and their ornamentation are given separately. Basidiospore measurements were taken from hymenial squashes, but spore prints were sometimes used when the basidiospores were hard to find on hymenia. Basidia were measured from the basal septum to the base of the sterigmata, which were measured separately. When subhymenial hyphae grew densely or indistinctly, it was quite difficult to observe the basal septum. Length measurements of other elements like cystidia or hyphidia were also troublesome when their starting points were deep-rooted in the subiculum. In such cases, approximate measurements were sometimes made, or various parts of a fruitbody were examined again.

Width measurements were taken at the widest points. Wall thickness and projected parts were also measured when diagnostic. Four categories were used to describe the wall thickness: thin-walled (0.6 µm or less), somewhat thick-walled (0.8 µm), moderately thick-walled (1.0 µm), and thick-walled (1.2 µm or more). Encrusted or capitulate tips were measured separately when necessary. In the descriptions below, for basidia and basidiospores, the number of measurements is included in brackets. Within the brackets, the first figure represents the number of basidia or spores measured and the second figure the number of collections examined. The ratio L/W (= E; Corner, 1947) expresses the shape or elongation of basidia and spores. When L/W = 1, the shape is globose and, when the ratio increases, the shape elongates. In all cases, the abbreviation X refers to the mean value for the measurements.

3. CULTURE WORK

Culture studies were based on the works of Nobles (1948, 1965), and several drop-tests on growing mycelium were performed according to Stalpers (1978). In order to standardize the cultures, 9 cm disposable Petri plates (The Fisher Scientific Company) containing about 20 ml of malt extract agar (Nobles, 1948) were inoculated with isolated tissues from fresh fungi in the field and carried to the lab to keep in the dark at room temperature for one or two weeks.

Field isolates were then subcultured or discarded according to the degree of contamination. For each successful isolate culture, inocula of 5 mm cubes were transferred to the edge of culture plates

and to slants of culture tubes containing about 5 ml of the same media. Three plates were inoculated, one for descriptive study, one for identification, and one for drop-tests. One culture tube was again inoculated to serve as a refrigerated stock. These duplicates were incubated in the dark at room temperature (20-25 C) for 6 weeks and brought into the light at 2 week intervals for description and examination.

Diagnostic characters were taken from Stalpers (1978) and are listed in Table 2. These include chemical tests (Code 1-4), growth rate (Code 5-10), mat characters (Code 12-38), hyphal characters (Code 39-83), propagative structures (Code 84-88), and substrate (Code 89-91). Studies of growth rate on cherry decoction agar (Code 11) and mating system and nuclear behavior (Code 92-100) were postponed to reduce the amount of culture work.

Color reactions by drop-tests were performed on the advancing zone and read after one day. A purplish color change occurs when laccase reacts with 0.1 M a-naphthol. The color becomes orange brown by 0.1 M p-cresol when tyrosinase is present. And 1:1 1% pyrogallol and 0.4% hydrogen peroxide give a yellowish brown color reaction in the presence of peroxidase. Several tests were done in the same plate because the reagents did not interfere with each other. The reactions were sensitive and usually gave good results on fresh mycelium for the presence and intensity of enzymes.

The growth rate used in the keys is denoted by the colony radius after two weeks and was expressed in several terms like very fast (Code 5-6), fast (Code 7), moderate (Code 8), slow (Code 9), and

Table 2. Stalpers´ species code list.

1. Laccase	51. Width of hyphae $\leq$1.5 µm
2. Tyrosinase	52. Width of hyphae 1.5-3 µm
3. Peroxidase	53. Width of hyphae 3-5 µm
4. KOH	54. Width of hyphae 5-7.5 µm
5. Growth rate >70 mm in 7 days	55. Width of hyphae $\geq$7.5 µm
6. Growth rate >70 mm in 14 days	56. Hyphae with encrusted tips
7. Growth rate 40-70 mm in 14 days	57. Encrusted hyphae
8. Growth rate 25-40 mm in 14 days	58. Hyphae with resinous material
9. Growth rate 10-25 mm in 14 days	59. Hyphae with minute projections
10. Growth rate <10 mm in 14 days	60. Aerial hyphae with resinous material
11. Growth rate ratio MEA : ChA <0.8	61. Much-branched thin-walled hyphae
12. Marginal hyphae raised	62.
13. Marginal hyphae appressed	63. Cuticular cells
14. Marginal hyphal tips distant	64. Interlocking hyphae
15. Outline of colony fringed	65. Hyphal knots or bulbils
16. Aerial mycelium absent	66. Sclerotia
17. Aerial mycelium downy	67. Hyphae pigmented
18. Aerial mycelium farinaceous	68. Asterosetae
19. Aerial mycelium floccose	69. Setal hyphae
20. Aerial mycelium silky	70. Setae
21. Aerial mycelium cottony	71. Acanthohyphidia
22. Aerial mycelium woolly	72. Cystidia
23. Aerial mycelium plumose	73. Gloeocystidia
24. Aerial mycelium pellicular	74.
25. Aerial mycelium felty	75. Terminal swellings (allocysts)
26. Aerial mycelium velvety	76.
27. Aerial mycelium lacunose	77. Stephanocysts
28. Aerial mycelium crustose	78. Ampullate or constricted septa
29. Aerial mycelium zonate	79. Monilioid hyphae
30. Colony white	80. Other remarkable swellings
31. Colony cream	81. Rhizomorphs or hyphal strands
32. Colony orange or reddish	82. Crystals in the aerial mycelium
33. Colony pink, lilac, or blue	83. Crystals in the agar
34. Colony brown	84. Arthroconidia
35. Colony yellow or ochraceous	85. Chlamydospores
36. Odour distinct	86. Blastoconidia
37. Reverse bleached	87. Conidiophores
38. Reverse darkened	88. Basidia formed within 6 weeks
39. Clamps	89. Substrate : angiosperms
40. Clamps, absent in the margin	90. Substrate : gymnosperms
41. Clamps in whorls	91. Other substrate
42. Sprouting clamps	92. Homothallic
43.	93. Heterothallic bipolar
44. Ratio diam hypha:diam clamp >1	94. Heterothallic tetrapolar
45. Ratio diam hypha:diam clamp =1	95. Secondary mycelium binucleate
46. Skeletal hyphae not branched	96. Secondary mycelium multinucleate
47. Skeletal hyphae much-branched	97. One nucleus per basidiospores
48. Thick-walled generative hyphae	98. Two or more nuclei per basidiospores
49. Hyphae with meandering lumen	99. Number of nuclei of primary mycelium
50. Inequivalent branching	100. Number of nuclei of 2ndary mycelium

delayed (Code 10). Microscopic characters were observed by staining marginal or aerial hyphae in 1% phloxine. Descriptive terminology was taken from Stalpers (1978), and the species codes were followed by cultural descriptions. The number indicates regular presence of the character attributed to the number in all cultures. The number in parenthese means variable presence of its character, and no number implies absence of its character.

CHAPTER IV

TAXONOMIC SURVEY

1. FRUITBODY

The fruitbody of resupinate fungi essentially consists of two layers, subiculum attached to its substratum and hymenophore seated on the subiculum. The simplicity of the fruitbody structure limits the number of characters available for taxonomic use and makes the extensive application of the microscope indispensable in the identification of these fungi (Lowe, 1946). The subiculum covers the substratum and varies in thickness. Most resupinate fungal fruitbodies are extremely to comparatively thin, but some may reach considerable thickness. They are composed of loose to densely interwoven hyphae whose "miticity" (see below) is now much valued for species identification.

The fruitbody may be spread over the substratum and firmly attached by its abhymenial side (appressed) or may be loosely attached to the substratum throughout its extension (effused) (Donk, 1964). The fruitbody will be easily separated from its substratum when it is truly effused. Sometimes it will be partially appressed and partially released from the substratum at its margin (reflexed). This reflexed portion may form a narrow or distinct pileus. The term pileate is usually used to oppose the term resupinate, but it is often difficult to distinguish consistently between the resupinate and the pileate fungi. According to growing conditions, a fungus may develop several grade forms as it transforms from an appressed to a reflexed type of

the fruitbody (cf. Table 1).

The subiculum merges into the hymenophore which supports the hymenium. The hymenophore lies adjacent to the hymenium and is responsible for various hymenial configurations (Donk, 1964). Its hyphae are generally more compactly interwoven, more frequent in ramification and septation, and less conspicuous than subicular hyphae. Its tissue usually grades into the subiculum but may rarely differ from it.

It was the hymenophore that Fries used as his first character to subdivide the Hymenomycetes. This character still has an influential role in the modern classification of resupinate fungi, but its significance is now subordinate (Donk, 1964). Smooth, toothed, tubulate, and lamellate types are mainly recognized. A verrucose or ridged hymenophore with folds is believed to be a modification of the smooth hymenophore. This smooth type is potentially fertile all over the exposed surface, but its extreme margin may be left as a sterile zone. The other types are usually fertile over the configurations, but even the surface between teeth, tubes, or lamellae may come to be fertile in some cases.

In many species, the hymenial surface cracks upon drying, with age, or with thickness, sometimes exhibiting unique patterns. Fruitbody margins also are often characteristic. They are indistinct, pruinose to furfuraceous, arachnoid to fibrillose, fimbriate to byssoid, or even rhizomorphic. Mycelial textures are also useful in interpretation of the fruitbody. Simply organized or poorly developed tissue usually has a pellicular, felty, arachnoid, ceraceous, to

membranaceous texture. On the other hand, highly organized or intricately developed tissue may build a coriaceous, corky, or woody texture. The texture of actively growing fruitbodies is normally uniform for a species but is also subject to modifications with age.

Fruitbody colors are usually diagnostic. In many species, fresh colors fade or vary gradually upon drying, so they may differ more or less from those of herbarium specimens. Young or living fungi are commonly lighter in color than old or dead fungi, or the density of the spore deposit (e.g. Coniophora spp.) or the setae (e.g. Hymenochaete spp.) on the hymenial surface may change the fruitbody coloration. The hymenium color often may be contrasted with that of the margin.

Fruitbody size is not so consistent. Resupinate fungi seem to be capable of indefinite growth over their substratum under favorable conditions. After sporulation, fruitbodies may dry up and die or may start again to organize a new hymenium on old ones. When they change their form into a reflexed fruitbody, however, their two-dimensional growth may be controlled to build up more elaborated three-dimensional structures.

2. HYPHAE

Hyphal characters are an integral part of the keys for the primary divisions of resupinate fungi. It was Corner (1932) who first recognized different types of hyphal construction in the polypores. His classical study has since become a useful tool to describe the fruitbody structure of the Aphyllophorales, and is now essential to an

understanding of the taxonomy of resupinate fungi. Types of hyphal systems are fairly consistent through the resupinate fungi and are applied on a wide scale to characterize genera and even higher rank (e.g. the monomitic Corticiaceae) in the name of naturalness. Care should be taken in utilizing hyphal systems, however, because they may not always conform to discrete categories during hyphal differentiation.

Many resupinate fruitbodies are simply built and composed of monomitic generative hyphae. These hyphae are thin-walled, septate, branched, less differentiated, and always identical in their manner of growth, but they often undergo modifications or grade into other types of hyphae (Corner, 1953). In some groups, considerably thick-walled hyphae with sparse ramifications (e.g. Phanerochaete spp.; Figures 289, 294, Appendix C) are often found in the subiculum and closely simulate skeletal hyphae. Again, thick-walled generative hyphae (e.g. Tyromyces spp.; Figures 389, 397, 412, 416, Appendix C) may exist together with thin-walled generative hyphae and look like a dimitic hyphal system. In the species of Stereum or Gloeocystidiellum, pseudocystidial (Figures 359, 364, 369, Appendix C) or gloeocystidial hyphae are present throughout the context and the hymenium. These oleiferous hyphae are thin- to thick-walled, aseptate, usually very long without branching, and morphologically very close to skeletal hyphae. They do not readily fall into Corner's hyphal types and are now regarded as a type of their own (Donk, 1964).

In some fungi (e.g. Irpex spp., Columnocystis spp.), the generative hyphae or skeletal hyphae may merge into intermediate

forms. In common brown fungi (e.g. Hymenochaete spp., Phellinus spp.), generative hyphae seem to be rapidly replaced by thick-walled hyphae of tough texture, and only traces of original generative hyphae are usually found in the hymenial region. In Ganoderma spp., the skeletal hyphae (Figures 99, 104, Appendix C) taper and merge into delicately branched ends functioning as binding hyphae. Finally, in some poroid genera, generative hyphae or their laterals may become aseptate, straight or branched in growth, and thick-walled, appearing as transformations (e.g. Perenniporia medulla-panis) from one miticity to another. Generally, there seems to be no true trimitic state in resupinate fungi except in a few poroid genera, but it becomes rather common in polyporoid genera with complicated hyphal construction.

3. SPORES

As a typical reproductive unit, spores are an important key in the diagnosis of resupinate taxa of various ranks. There is no established system yet for a classification based on spore characters, comparable to the one on hyphal types, even though it is tempting. The number and significance of spore characters seem to be rather limited. Characters like shape, ornamentation, size, color, and wall structure are employed in descriptions.

Spore shape varies to some extent in resupinate fungi. Globose, ovate, and ellipsoid forms are most common. This holds true especially in corticioid genera. In poroid, irpicoid, and stereoid genera, oblong to allantoid spores are repeatedly found. Navicular forms (Figures 27, 29, 31, 37, Appendix C) are uniquely observed in

Botryobasidium spp., and citriform spores (Figure 122, Appendix C) in Aleurodiscus mirabilis and an imperfect fungus Haplotrichum aureum. Spores of Perenniporia medulla-panis (Figure 262, Appendix C) appear truncate and assume somewhat angular forms.

Smooth spores are predominant in resupinate fungi, but ornamented spores are sometimes observed. Most Trechispora spp. have echinulate spores (Figures 374, 377, 380, 383, Appendix C), and this character seems appropriate at a specific level.

Spore size is very variable. Minute spores of 3 μm or so in diameter are very rare, but small spores of 4 to 6 μm in length are common. There are also medium-sized spores of 9 μm or so in length (e.g. Hyphoderma spp.) and larger spores (e.g. Aleurodiscus spp., Jaapia ochroleuca). A genus may consist of species with fairly constant size of spores (e.g. Phanerochaete spp.), but it is not uncommon that the spore size may vary considerably even in a single genus.

Spore color is actually located in the spore wall and seems to depend on the maturity of spores. Spores of Coniophora arida are yellow-brown when mature. The structure of the spore wall is sometimes layered, as in the species of Coniophora, Hypochnicium, or Ganoderma, where spores are distinctly double-walled, and this is useful in diagnoses. In Coniophora arida (e.g. Figure 60, Appendix C), the inner wall has a germ pore which is typical of many agarics but lacking in the Aphyllophorales. In Ganoderma (e.g. Figures 96, 101, Appendix C) spp., the outer layer develops a conical swelling which later collapses, while the inner layer bears a verrucose

ornamentation which penetrates into the outer layer. Sometimes inner and outer layers show different affinity for certain chemicals, indicating their different composition. This kind of chemical reaction of the spore wall has become fundamental in establishing the modern taxonomy of resupinate fungi.

In *Hydrabasidium subviolaceum*, spores germinate by repetition and produce secondary spores. Such a phenomenon has been considered an indication of a heterobasidiomycetous nature (Donk, 1964), but there are now several genera crossing this borderline into resupinate Hymenomycetes. In some species, spores have oil drops or particles refracting under the microscope, but this character is not so reliable because those contents wax and wane with the aging of spores.

Good spore prints are usually made from fresh moist materials, but they are not always as readily obtained as in gill fungi. There are heavy spore-producers like the species of *Hyphodontia*, *Hyphoderma*, *Phanerochaete*, *Coniophora*, *Perenniporia*, and some species of *Phellinus*, but others deposit almost nothing or invisible films of spores. The color of spore prints, which is carefully noted in gill fungi, is rarely mentioned in resupinate fungi. Sometimes the size of spores taken from spore prints may differ to a certain degree from that of spores measured from hymenial tissue, so care should be taken to measure spores from spore prints. In some collections, usually of certain poroid fungi and brown fungi, spores are very rare or none probably because of periodicity in spore production. A patient search is necessary to locate only a few spores, or spore prints must be examined.

4. BASIDIA

Basidia perform important functions in the life cycle of the Basidiomycetes, and their properties often have been adopted as major characters in classification. A palisade of basidia, mixed with sterile elements, forms a hymenium, or fruiting surface. Old hymenial elements are steadily replaced by new ones with age, thus the hymenium gradually increases in thickness. Typical thickening hymenia can be found in *Peniophora* spp. and many other genera. In *Hymenochaete* spp., the hymenium is distinctly layered where revived growth has occurred.

The basidia of thickening hymenia are typically clavate and produce mostly 4 (rarely 2) sterigmata. The size of basidia may be small to medium and rather constant according to the species. When the clavate basidium is much shortened, it becomes obovoid to subglobose like those of *Phellinus* spp. When the basidium becomes much elongated with age, it looks rather cylindrical, but such a variation seems to be common even in a single species.

There is another distinct type of basidium. Starting with a swollen primordium, an urniform basidium develops a rather short cylinder on top of which more than 4 sterigmata are often produced. Even though it may deviate from the above definition a little, a suburniform constriction in the middle of the basidium is common and diagnostic in the species of *Hyphoderma* (e.g. Figures 193, 197, Appendix C) and *Hyphodontia* (e.g. Figures 201, 205, 215, 219, Appendix C). An occasional constriction is also common in *Botryobasidium* (e.g. Figures 28, 32, 35, 38, Appendix C) spp., and a sinuous constriction (when the basidium is constricted more than once) in *Hypochnicium* and

Jaapia spp., but it is not certain if these basidial variations are consistent or an adaptation to the hymenial structure.

In Trechispora spp., basally forked basidia (Figures 375, 378, 381, 384, Appendix C) of a peculiar shape are found. Developing as an appendage of a repent hypha, they are broad at the base and are not separated from the parent hypha by a cross wall (Donk, 1956). They are borne terminally and found scattered rather than in a discrete hymenium. On ascending hyphae from the subhymenium, clavate basidia are normally formed in the same hymenium, so both types are observed together. Considered from this perspective, occurrence of these basidia would better be interpreted as a tendency in certain taxa.

On the other hand, in Aleurodiscus mirabilis (e.g. Figure 4, Appendix C) or Coniophora arida (e.g. Figure 61, Appendix C), basidial development occurs at different times and various levels, amongst sterile elements called hyphidia. The basidia, therefore, have to emerge between the hyphidia to reach the hymenial surface (Lemke, 1964). The mature basidia grow to be utriform as they squeeze out and are rather variable within a single hymenium. When clavate basidia become very elongate and flexuous, they assume the appearance of utriform basidia and become hardly distinguishable from each other in certain cases.

In Hydrabasidium subviolaceum (e.g. Figure 152, Appendix C; based on the only collection, TENN 46159), basidia bear septate sterigmata. The sterigmata are septate at the base and again in the middle when mature, and their upper parts often become deciduous or evanescent. No such septation has been described yet in this genus,

so this new character deserves some consideration.

In general, basidial morphology should not be overemphasized, and basidial function (including nuclear behavior) should be weighed as heavily. A basidium is only one hymenial element and competes with other basidia and sterile elements for spacing in the hymenium. Morphological adaptation is inevitable and causes a variation within certain limits. There is also a gradual change of morphology according to the development stage of basidia.

5. STERILE ELEMENTS

A wide occurrence of various modified hyphae in the hymenium is characteristic in resupinate fungi. These sterile hyphal elements consist of hyphidia (also called paraphysoid hyphae or paraphyses), cystidia, and setae. They are constantly associated with particular taxa and lend themselves to taxonomic use. Their classification is based on shape, structure, contents, encrustation, sometimes ontogeny, and some other criteria. Terminology of sterile elements is still mixed up with that used for agarics or ascomycetes and needs to be standardized (Price, 1973).

Most hyphidia belong to the generative hyphal system and are produced in advance of basidia (Donk, 1964). They form a superficial layer which gradually becomes converted into a catahymenium. A remarkable type of a bottle-brush form, called acanthohyphidia (or acanthophyses; Figure 6, Appendix C), is found in *Aleurodiscus mirabilis*. Some hyphidia (Figure 61, Appendix C) are hardly modified, thus retaining their hyphal nature as in *Coniophora arida*.

Cystidial morphology is extremely variable and, accordingly, has been divided into many categories. According to the location of cystidia, they are called hymenial or tramal. Hymenial cystidia arise at a basidial level, while tramal cystidia have a deeper origin. But hymenial cystidia in a thickening hymenium become embedded far below the basidial level by the increasing hymenial tissue, so these terms are misleading and believed to be of little practical use (Price,1973).

In species with a dimitic hyphal system, skeletal hyphae bend toward the surface and terminate in the hymenium with more or less modified ends called skeletocystidia. They are thick-walled, usually very long with their bases deep in the trama, and may become adventitiously septate with age. Their apices may taper to rounded and/or encrusted ends as in Amylostereum chailletii (e.g. Figure 9, Appendix C) or Irpex lacteus (e.g. Figure 241, Appendix C). They remain in the subhymenium or grow beyond the hymenium, but old ones eventually become embedded in the thickening hymenium.

In species with a monomitic hyphal system, leptocystidia are most common. They are typically thin-walled to slightly thick-walled and usually little differentiated from hymenial hyphal ends. They develop along with and are homologous to basidia (Price, 1973). In Hyphodontia (e.g. Figures 211, 216, 220, 229, Appendix C) spp. they usually project beyond the hymenium and are cylindrical with occasional constrictions, and are commonly encrusted near the apex. In Hyphoderma (e.g. Figure 198, Appendix C) and Hypochnicium (e.g. Figure 233, Appendix C) spp., they are larger and somewhat thick-

walled but without encrustation. In some species of Hyphodontia, there is also a peculiar type called lagenocystidia (Figures 207, 212, Appendix C) ending in a needle-like part provided with characteristic encrustation.

A long type of cystidium, which originates from deep generative hyphae and retains its hyphal character with indeterminate growth, protrudes beyond the hymenium in Hyphodontia (e.g. Figures 206, 225, Appendix C) spp. and Hyphoderma setigerum (e.g. Figure 194, Appendix C). They are called septocystidia (Cunningham, 1953; hyphocystidia in Donk, 1964) after their septate and even clamped hyphal structure. In Hyphodontia spp., they are same as leptocystidia except in length and septation, but in Hyphoderma setigerum, they are huge, thick-walled, robust, and reminiscent of skeletocystidia. Strikingly similar structures to those of Hyphoderma setigerum, along with some other microscopic features, are found in a clavarioid genus Clavulina, suggesting a possible relationship between corticioid and clavarioid genera (Petersen, 1986).

Gloeocystidia (Figures 108, 111, Appendix C) are another characteristic type of cystidium with distinctly oily contents coupled with the positive sulfobenzaldehyde reaction (e.g. Gloeocystidiellum spp., Peniophora spp.). They are thin-walled, generally narrow and flexuous, and usually embedded in the trama. There are sometimes vesicular forms which often lack oily contents as in Gloeocystidiellum citrinum (e.g. Figure 108, Appendix C). When gloeocystidia enter the hymenium in a differentiated (thick-walled in some cases) form, they are named pseudocystidia (Singer, 1975; Figures 357, 362, 367, 372,

Appendix C). These cystidia are always present in Stereum spp. By some authors (Price, 1973), they are called merely skeletocystidia because of a morphological similarity, but the use of one name for two different organs should be avoided. As oleiferous hyphae are different from typical skeletal hyphae by definition, their hymenial extension deserves a separate name.

In Stereum spp., there are different sterile elements, called cystidioles, in the hymenium. They appear as either acutocystidia (Figures 356, 361, 366, Appendix C) with a pointed apex or as acanthocystidia (Figure 371, Appendix C) with protuberances near the apex (Eriksson et al., 1984). The latter resemble acanthohyphidia in shape but arise from the same hymenial level as the basidia and thus differ in origin.

A heavily encrusted type of cystidium called a metuloid is found in Peniophora spp. and Hyphoderma puberum (e.g. Figure 190, Appendix C). Developed from the same level as basidia and projecting well beyond the surface of the hymenium, they give the fruitbody a velvety appearance under a lens. They are large, broadly fusiform, apically obtuse, peculiarly thick-walled, covered with rough crystals and become embedded in the subhymenial region with age. When skeletocystidia are modified to some extent and encrusted all over the projecting surface, they closely resemble metuloids but differ from true metuloids in their point of origin.

Setae (Figures 148, 157, 162, 166, 170, 177, 181, 237, 301, 305, 309, 312, 315, Appendix C) are typical of the Hymenochaetaceae and diagnose the family. Differing from most cystidia by their thick,

smooth, brown wall of xanthochroic chemistry, they are stiff, simple, subulate, ventricose, or fusiform. They are exposed on the hymenial surface but gradually become embedded in the thickening hymenium. They are produced so densely in Phellinus and Hymenochaete spp. that the hymenium becomes scant and hard to recognize with ease in many cases.

6. CHEMICAL TESTS

Taxonomic and chemical evidences have been increasingly correlated in the systematics of the Hymenomycetes. This holds quite true for the characterization of certain types of organs and groups of resupinate fungi. Melzer´s reagent has been a standard solution to test the amyloidity of the spore wall. Prompt color reactions are developed in the spores of the species of Amylostereum, Stereum, and some other genera. The amyloid reaction is almost black, but the dextrinoid spore wall of Coniophora arida turns brown. This test is used to specify certain genera or species, but its validity is much more limited in other groups.

Cotton blue is a valuable help in the taxonomy of resupinate fungi. The cyanophilous reaction is deep blue, and spores of the Coniophoraceae are exclusively positive (the inner wall when double-walled) to cotton blue and characterize this group. Spores of Hypochnicium geogenium are thick-walled and readily cyanophilous. Spores and even hyphae of some Hyphodontia spp. are conspicuously cyanophilous and diagnosed in this way. This test also has a variable reliability in different groups like the amyloid test (Donk, 1964).

Sulfuric benzaldehyde reacts with the contents of gloeocystidia and turns them blackish. This reaction was considered of general importance for gloeocystidial groups, but its value is now questioned because of the inconsistent results encountered in some tests (Larsen and Burdsall, 1976).

Potassium hydroxide solution is used in both specimens and sections to test the xanthochroic reaction. Its positive reaction permanently darkens the brown hyphae of xanthochroic groups (the Hymenochaetaceae). A similar color reaction often occurs in certain taxa with colored hyphae (e.g. *Amylostereum chailletii*) even outside the xanthochroic groups. Equally, calcium oxalate crystals including cystidial encrustations, walls of certain cystidia (e.g. lyocystidia), and colored contents of hyphae, cystidia, and spores are apt to change their morphology and colors in contact with KOH. Such reactions are helpful in diagnosis but require careful observation.

Phloxine always stains the cytoplasm within the hyphae bright red, so it can be routinely used in microscopic examinations. It does not work well in old tissues depleted of their contents, however, or in gelatinous tissues somewhat dissolved on mounting.

CHAPTER V

SOUTHERN APPALACHIAN SPRUCE-FIR FOREST

1. DISTRIBUTION

Along the high elevations of the southern Appalachians, the spruce-fir forest extends through southwestern Virginia, eastern Tennessee, to western North Carolina. The main body of this montane coniferous forest starts in the northern Appalachians, where it merges imperceptibly into the northern boreal forest of New Englnad. Southward, in the middle of the Appalachian chain, it is almost absent through Pennsylvania, West Virginia, and Virginia. Further south, in the culmination of the Appalachian system, however, it reappears all over the peaks and ridges, reaching its best development in the Great Smoky Mountains (Oosting and Billings, 1951). Extended southernmostly and separated phytogeographically, this southern Appalachian spruce-fir forest has been an interesting subject of floristic and ecological studies.

Because of close similarities as well as distinctive differences, the relationships between the northern boreal and the Appalachian montane coniferous forests and between the northern and the southern Appalachian spruce-fir forests have been a matter of frequent discussions. Both coniferous forests are dominated by spruces and firs. The northern boreal spruces are white spruce (*Picea glauca*) and black spruce (*Picea mariana*), while their Appalachian montane counterpart is red spruce (*Picea rubens*). On the other hand, the northern boreal and northern Appalachian fir is balsam fir (*Abies*

balsamea), but it is gradually replaced by the closely related endemic fir, Fraser fir (*Abies fraseri*), in the southern Appalachians (Vankat, 1979).

A typical relationship between latitude and elevation in the distribution of plants exists for the spruce-fir forest. In the mountains of New England the spruce-fir occurs at 750 m elevation. Southward, the elevation increases at a rate of about 100 m per degree latitude, and the spruce-fir is found above 1100 m elevation in southeastern New York state (White, 1984). Leaving a spacious gap in its central range because of low elevation, the forest appears again as low as 1400 m in elevation, but a pure zone of these conifers usually begins above 1600 m as a high-elevation band in the southern Appalachian Highlands (Whittaker, 1956; White, 1984). The Appalachian coniferous forest has been thus separated into two divisions dictated by latitude and elevation across the central Appalachian Lowlands.

During the cool periods of the Pleistocene, the Appalachian spruce-fir forest was believed to cover the central Appalachians and range across a broad latitudinal belt (Delcourt and Delcourt, 1984). With glacial retreats, the following Holocene warm periods favored northern extensions of boreal tree species (Davis, 1983). The spruce and fir flourished upward over the high elevation mountains which provided sufficient environments for their survival, but in the central Appalachians, they found no refuges and had to give way to deciduous trees of temperate types (Oosting and Billings, 1951).

In the southern Appalachians, the spruce and fir were left

behind from the main stream of the migration front. Replaced at low elevations and surrounded at high elevations by temperate tree species, they were geographically isolated from the northern population centers, which with time resulted in speciation or elimination of certain dependent species within this forest community (Delcourt and Delcourt, 1984). The southern Appalachian spruce-fir forest has evolved as a distinct variant within North American spruce-fir forests and persists as an island-like relic ecosystem (White, 1984).

2. VEGETATION

Two dominant species, red spruce (*Picea rubens*) and Fraser fir (*Abies fraseri*), comprise the southern Appalachian spruce-fir forest. Relatively pure spruce stands occur at elevations between 1500 and 1800 m but often stretch downward into hardwood or hemlock forests along ridgetops (Crandall, 1958). Ranging to higher elevations than the spruce, the fir becomes predominant with higher elevation, and in the Smoky Mountains, pure fir stands occur at elevations over 1900 m (Whittaker, 1956).

Yellow birch (*Betula lutea*), prominent at the northern hardwoods interface, is next in importance, along with American beech (*Fagus grandifolia*), pin cherry (*Prunus pensylvanica*), mountain maple (*Acer spicatum*), or mountain ash (*Sorbus americana*). Cove hardwoods forest species such as American basswood (*Tilia americana*), yellow buckeye (*Aesculus octandra*), serviceberry (*Amelanchier laevis*), or Eastern hemlock (*Tsuga canadensis*) merge into some spruce stands at

lower elevations.

The diversity of herbaceous and shrubby plants is not so rich as in the deciduous forests below, but great variation and endemism are found (White, 1984). The cool damp forest conditions provide ideal habitats for ferns, mosses, and lichens on floors, tree trunks or limbs, and fallen logs. On drier slopes and rocky outcrops, rhododendrons form extensive heath balds. On the other hand, on well-drained sites, grass balds are developed in patches. Among the understory and ground cover genera, Viburnum, Vaccinium, Rhododendron, Oxalis, Senecio, Hylocomium, Lycopodium, and Dryopteris, are most abundant in the Smoky Mountains (Crandall, 1958). Some other mountains are topographically less diverse than the Smoky Mountains but are known to be rather similar floristically (Rheinhardt, 1984).

The native vegetation has recently experienced subtle changes because of a significant loss of Fraser fir caused by balsam woolly aphid (Adelges piceae Ratz.) infestation. Some shrubby plants and understory saplings attain greater importance in disturbed areas (De Selm and Boner, 1984), but other ground cover species, like bryophytes adapted to the forest floor environments, are losing their unique habitat (Smith, 1984). Fungal occurrence is also decreased to the degree of the disturbance of the forest (cf. Chapter 6). A widespread and unpredictable modification is expected to the spruce-fir forest vegetation in the future.

3. PERPETUATION

The spruce-fir forest zone of the southern Appalachians consists of seven spruce-fir forests and one spruce forest, ranging from Mt. Rogers in the north to the Balsam Mountains in the south. Comprising 68.3 km^2, more than half of the area is contained in the Great Smoky Mountains National Park (Saunders, 1984). Most of this forest zone is now protected under federal or state ownership, but the original virgin spruce-fir has been disturbed by various human-caused or natural impacts.

Because of the commercial value of the spruce for lumber and pulp, many areas of the spruce forest were once devastated by extensive logging activities. In the pre-Park era, mechanized logging practices removed spruce trees over wide areas, and following slash burns depleted the forest floor and exposed the surface soil, where hardwood species usually replaced the spruce (Korstian, 1937). The spruce-fir land was thus ravaged until the remaining forest area came under adequate protection, as it is now.

The scenic high mountain areas have been developed for recreational activities. Increased or overcrowded use of roads, trails, and backcountry is bringing about management strategies. Opening the canopy for recreation purposes deprives native plants of their habitat and exerts microenvironmental stresses on them. Evidences for recreation disturbances have been reported; wide occurrence of exotic plants, reduction of vegetation cover and diversity, common windthrows, and increased soil erosion at recreation sites (Saunders, 1984).

The spruce-fir forest floor is usually covered with moss and peat in which the trees have shallow roots, so they are frequently thrown or broken by high winds on exposed or opened sites. Uprooted trunks break up the soil layer and disturb the continuity of the canopy, creating site effects similar to opening the canopy for recreation purpose.

These kinds of local impacts are occurring on a limited scale and might be improved with programs to cope with them. On the other hand, persistent and unyielding human-caused and natural impacts are increasing extensively and jeopardizing the near future of this forest.

Today, it is suggested that the air pollution and its subsequent acid rain may persistently interfere with the normal function of trees and cause their general weakness. The high-elevation forest systems are presumably exposed to the polluted atmosphere and are expected to receive more pollutant depositions, carried in precipitation or clouds, than low-elevation forests (Lovett, 1984). For the spruce forest, the analysis of tree rings suggests that the annual growth of the spruce abruptly decreased since about 20 years ago, and its coincident spruce mortality has steadily increased due to unexplained environmental and natural factors (Roberts, 1984).

Another unique impact, the balsam woolly aphid has posed a severe threat to the Fraser fir. This European insect pest was first introduced into Maine about 1900 and has since spread southward along the eastern fir forests. First discovered in the southern

Appalachians, in the vicinity of Mt. Mitchell, North Carolina, in 1957, its subsequent infestations have been found throughout all Fraser fir stands and are known to have already changed the features of the southern Appalachian spruce-fir forest to a significant extent (Eagar, 1984). There is no way to predict toward what conclusion the ongoing change will proceed, but a substantial system-wide change is expected on the structure, composition, and function of this ecosystem (White, 1984).

4. RESEARCH AREA

In the Great Smoky Mountains National Park, the spruce-fir forest extends from near Cosby Knob on the northeastern corner to near Double Spring Gap on the western slope of Clingmans Dome approximately 54 km long along the state-line ridge (Murlless and Stallings, 1973). The forest occurs in an unbroken evergreen belt except in the vicinity of Charlies Bunion. The most extensive stands develop on the northern slope of Mt. Le Conte on the Tennessee side and on the southern slope between Hughes Ridge and Balsam Mountain on the North Carolina side. Two small stands are isolated on Mt. Sterling and Spruce Mt. and Cataloochee Balsam, both on the North Carolina side.

This forest amounts to 36.7 km^2 (Saunders, 1984) and occurs in Sevier and Cocke counties, Tennessee, and Swain and Haywood counties, North Carolina. The range of the high-elevation country shows the highly variable topography of a long sinuous crest with irregular secondary ridges spreading on each side, with 16 peaks above 1800-meter level (Whittaker, 1956).

The climate of the high-elevation country is characterized by cool temperature and high precipitation, the cool-temperature rain forest climate (Shanks, 1954). Temperature decreases with elevation, and the mountaintops are 4.5 to 7°C cooler than Gatlinburg at the base of the mountains (Shanks, 1954). Temperatures average around -4.5°C for the coldest month (January; 4°C at Gatlinburg) and 15°C for the warmest month (July or August; 23.5°C at Gatlinburg), which means a later spring, a shorter summer, and an earlier fall (Murlless and Stallings, 1973).

Precipitation increases with elevation, and the elevation above 1900 m averages over 229 cm per year, the highest in the United States except in the Pacific Northwest, while Gatlinburg averages only 147 cm per year (Shanks, 1954). Rainfall increases in late winter and early spring because of frontal storms passing over the southeastern region. The highest rainfall occurs in summer usually in the form of thundershowers or fog-drips, and becomes driest in September.

The collecting season for fungi starts in late spring and ends in late fall when the fruiting disappears with freezing temperature. The Appalachian Trail is most commonly used because it passes through the main body of the spruce-fir forest along the state-line and connects numerous side trails which penetrate every corner of the forest.

The western half of the forest, especially the section from Newfound Gap to Clingmans Dome, is easy to access by using the Newfound Gap Road and the Clingmans Dome Road. For the rest of the forest, many inconveniences exist in collecting fungi. To approach

the remote interior of the forest, hiking starts from the very base of the mountain. Dusty country roads wind their way and extend only a short way up the mountain where the trailhead appears. Many trails are quite passable at first but become progressively rough or overgrown. Well-prepared backpacking and camping are required in the backcountry sites of the mountain ridge during collecting trips (cf. Figure 1).

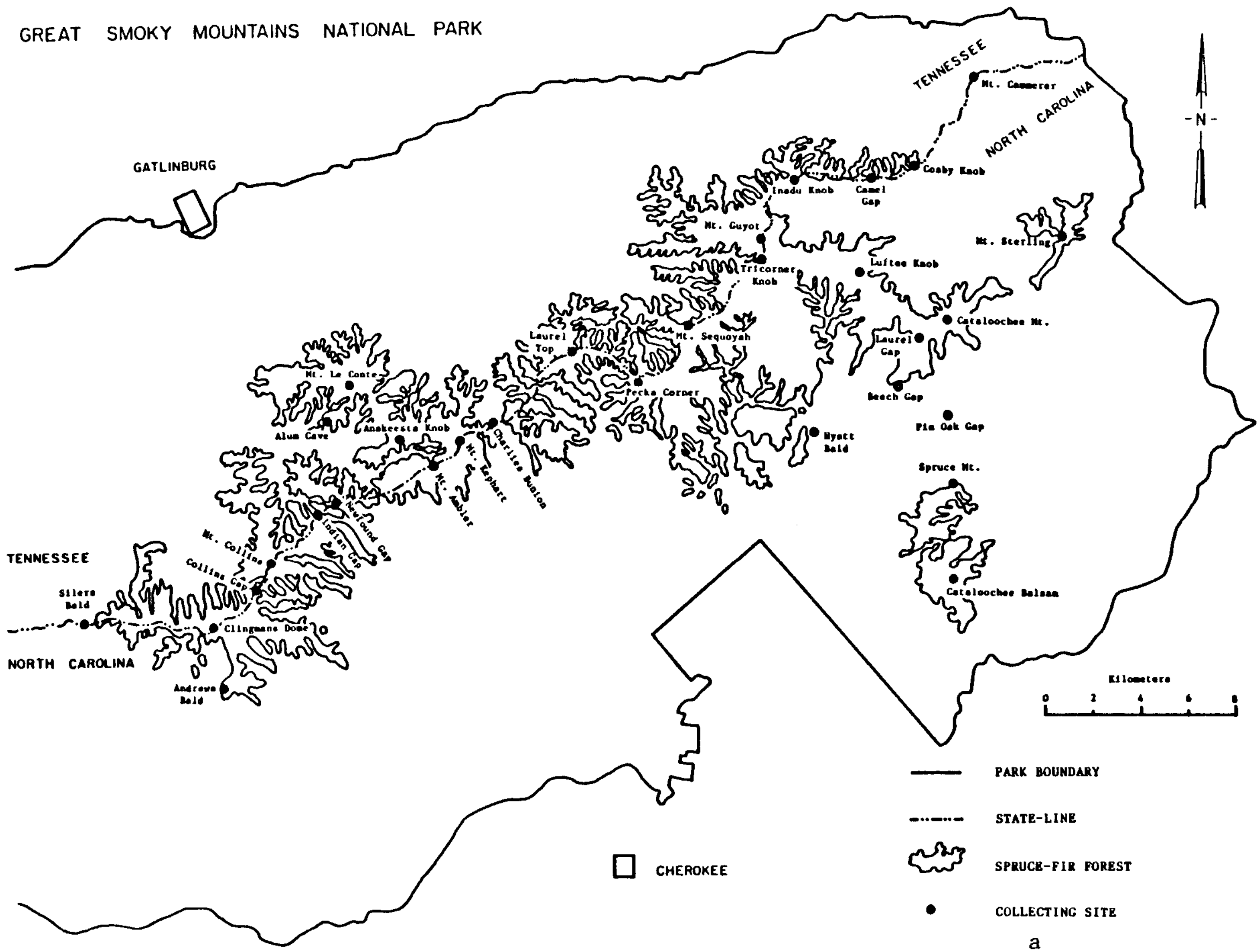

Figure 1. Research area of the Great Smoky Mountains National Park.[a]

[a] The map was taken from Lambert and Ciesla (1967).

CHAPTER VI

FUNGAL ECOLOGY

1. HABITAT

Due to the symptoms of decline and to insect infestation, the spruce-fir forest of the southern Appalachian Mountains is rich in dead trees and provides adequate environments for fungal growth. When trees are alive, one cannot expect to find fungi on them because fungi seldom fruit on the surface until their host trees die (Eriksson, 1958). Fungi usually occur when the forest site is disturbed to some extent. When trees are broken or damaged, tree decays are exposed and the fungi fruit (Eriksson, 1958; Manion, 1981). According to the degree of disturbance, several forest site types are recognized in terms of fungal occurrence in the spruce-fir forest of the Park.

Virgin or second-growth forest sites consist of healthy mature or young trees (Type I, Table 3, Appendix A). Except for one incidental example (*Hydrabasidium subviolaceum*), no fungi were found on living trees.

Forest sites of naturally disturbed or slash-dumped areas by the trail consist of dead trees in all stages of decomposition (Type II, Table 3, Appendix A) and play an important role in fungal ecology. Windbreaks occur where trees are weakened by decay fungi. Windthrows occur when the trees are shallow-rooted on exposed sites. Many of the fallen trees are somewhat decomposed already by pioneer decay fungi and are subsequently attacked by rot fungi. When fallen trees block the trail, they are cut to clear the way, and fruitbodies of decay or

rot fungi are commonly found on those breaks or cuts. The most favorable condition is obtained when fallen trees and slash are dumped or stacked together on the forest floor.

Fungi require very moist conditions for germination and further growth. Their occurrence in the forest seems to be dependent on moisture (Eriksson, 1958). When fir trees die and defoliate, the overstory canopy is extensively opened (Type III, Table 3, Appendix A). Increased penetration of direct sunlight down to the forest floor depletes the moisture of the forest. Substrates for fungi are abundant all over, but fungal growth is quite limited. In such a forest site, fungal fruiting becomes dramatically decreased except when the forest floor remains wet during rainy days. Some polypores and stereoid fungi resistant to desiccation are usually found here.

The heath bald (Type IV, Table 3, Appendix A) which is contiguous to the spruce-fir forest seems to be another poor site. The site is usually on exposed slopes or ridges and results in good drainage. Rhododendron seems to be a poor host for fungi, and only two species were found in this site. The heath bald is believed to be almost rot fungus-sterile compared with its surrounding forest.

2. SUBSTRATES

In general, many fungi fruit both on bark and wood, and the presence of bark seems to be advantageous for the fruiting of decay or rot fungi (Eriksson, 1958) with large, annual or perennial, polyporoid or stereoid fruitbodies and a facultative or saprophytic life form. The bark layer serves as a mechanical support for the fruitbody and

protects the somatic mycelial activity of fungi to derive nutrients from the wood. The decay fungi often first decompose the non-living heartwood from the inside of living trees, followed by the sapwood after the death of the tree. Rot fungi decompose the sapwood of dead trees from the outside. Both of them anchor on the bark when they fruit.

When the trees die from the rot, they become slowly decorticated through the effect of freezing and thawing (Boyce, 1961; Petersen, personal communication) and the activity of insects (Eriksson, 1958). Fungi do not readily decompose the suberose bark tissue, but extreme changes in temperature during winter damage it physically and insects deteriorate it effectively. With time, the dead bark eventually becomes released from the wood. The bark-dependent fungi lose their mechanical and nutritional support and do not usually survive well (Manion, 1981). Their limited survival seems to be important in fungal succession on dead trees because it facilitates a new colonization by subsequent fungi using remnant nutrition and new space.

The succession of fungi continues on exposed or bark-covered dead wood. Under favorable conditions, small, annual, corticioid rot fungi with a saprophytic life form usually germinate and colonize the wood and bark remains which the bark-dependent fungi have left. They are quite cryptic when loosely attached bark hides them. Decayed wood has a spongy texture and holds much water for a while after rain, supporting a quick fungal bloom (Eriksson, 1958). Most of these secondary rot fungi are found on the undersides of fallen trunks where

the habitat stays dim and moist for long periods, and fruitbodies often remain unnoticed by collectors.

Broken or cut surfaces of dead trees provide a unique habitat. In this case, the environment of fungal succession is disturbed, and the substrate is exposed. Some bark-dependent polyporoid or stereoid fungi first colonize the substrate (Table 5, Appendix A) by filling fissures around the torn bark and then spreading toward the open space of broken or cut surfaces. Years later, when the bark-dependent fungi subside, wood-dependent corticioid fungi flourish to fruit on the already decomposed substrate.

Moreover, there seems to be a competition for space between fungi and bryophytes (cf. footnotes, Table 5, Appendix A). Many large fungi with great vigor ignore the presence of bryophytes and override their mechanical barriers. The wood-dependent corticioid fungi do not usually fruit well where bryophytes occur in abundance. Bryophytes possibly may exclude these fungi by depleting available space for fungal growth. On fallen trees, fungi and bryophytes thus often share parts of the trunk with bryophytes on the upper side for photosynthesis and corticioid fungi on the underside.

3. WOOD ROT

The degree of wood rot was observed in the field by sticking the trunk of dead trees with a hunting knife and measuring the soft layer of sapwood.

On recently dead trees with fresh and firm sapwood, some polyporoid fungi, *Hirschioporus* spp., *Gloeophyllum sepiarium*, and some

stereoid fungi, especially Amylostereum chailletii, constantly occur (Table 6, Appendix A) and are believed to be the first rot fungi which attack those trees and play an important role in decomposition by the time of decortication (Baxter, 1948; Stillwell, 1959). Fomitopsis and Phellinus spp. which decay the heartwood of their host do not readily decompose its sapwood and occur on fresh to somewhat decomposed sapwood. Perenniporia subacida remains as a rot fungus and decomposes both heartwood and sapwood so thoroughly that the bark stays complete but the inside wood becomes very rotted and quite soft (Boyce, 1961). Species of most corticioid genera are confined to much or completely decomposed substrates (Table 6, Appendix A), but species of Hyphodontia (i.e. H. breviseta, H. alutaria, H. verruculosa) occur on a broad range of rot and play an significant role in decomposition of dead substrates (Eriksson and Ryvarden, 1976).

The type of wood rot was also observed in the field. White rot was predominant among the fungi collected from the research area (Table 7, Appendix A). Only some polyporoid and stereoid fungi develop brown rot, but all the corticioid fungi, except Coniophora arida, are associated with white rot.

4. HOSTS

Spruce and fir are the major species of the spruce-fir forest of the Park, and most collections were made on these trees.

Red spruce (Picea rubens) is one of the two most important hosts in this forest (Table 8, Appendix A). Its thin and scaly bark is susceptible to injury and its shallow root system makes the tree

susceptible to windthrow. Some fungi (e.g. Fomitopsis and Phellinus spp.) may cause significant heart rot and weaken the trunk (Hepting, 1971). Perenniporia spp. may cause extensive root or butt rot and weaken the base (Hepting, 1971), leading to windbreak. Dead fallen trees support a rich rot fungus flora. A small agaric with an orange-brown cap, Xeromphalina campanella (Bat. ex Fr.) Kühner et Maire, often occurs in clusters on a well-decomposed and moss-covered butt or stump.

Fraser fir (Abies fraseri) is the other important host (Table 8, Appendix A). Many trees have been standing dead, broken, or fallen, and a yellow-orange small cup fungus, Dasyscypha agassizii Saccardo, frequently covers the bark. Again Fomitopsis, Phellinus, and Perenniporia spp. are possible decay fungi of Fraser fir (Hepting, 1971; Table 8, Appendix A). Firs present among spruces accommodate a lot of corticioid rot fungi and support a high species diversity, but in fir stands with stripped foliage and increased open canopy, fungus fruiting is discouraged and only some polyporoid or stereoid rot fungi become predominant.

Yellow birch (Betula lutea) and American beech (Fagus grandifolia) are the most common hosts in the northern hardwood forests at lower elevation, but their distribution is very limited within the spruce-fir forest at higher elevation. Yellow birch seems to be very susceptible to various damages. Many trees were found broken, injured, or sometimes windthrown, and a number of fungi were collected on them (Table 8, Appendix A). Phellinus spp. seem to be common decay fungi on this tree and cause both trunk and root rots

(Hepting, 1971). A number of rot fungi also grow on dead trees. American beech is thin-barked and seems to be subject to many fungus diseases. Phellinus and Ganoderma spp. decay this tree, and some rot fungi decompose dead substrates (Hepting, 1971; Table 8, Appendix A).

Hemlock (Tsuga canadensis) occurs on slopes at the lower limit of the spruce-fir forest and is affected by Fomitopsis, Phellinus, and Ganoderma spp.

Some fungi were incidentally found from uncommon trees and shrubs like cherry, maple, ash, oak, buckeye, serviceberry, and rhododendron, but they did not count for much in preparing the inventory of resupinate fungi from the spruce-fir forest of the Park (Table 8, Appendix A).

5. HOST DBH

The spruce-fir forest of the Park includes spruces 300 years old and firs with average maximum age of 150 years (Oosting and Billings, 1951). Trees diseased by fungi frequently die young. In the hope that there would be a relationship between tree mortality and activity of decay fungi, trunk diameter at breast height (dbh) of dead host trees was measured for three major hosts during collections in the field (Table 9, Appendix A).

The dbh itself does not represent the age of a tree but may correlate with age in some cases. Based on the graph of Oosting and Billings (1951), the dbh of spruce and fir shows a rather definite relationship with the number of growth rings (Figure 2).

In red spruce, the dbh range increases as predicted and most

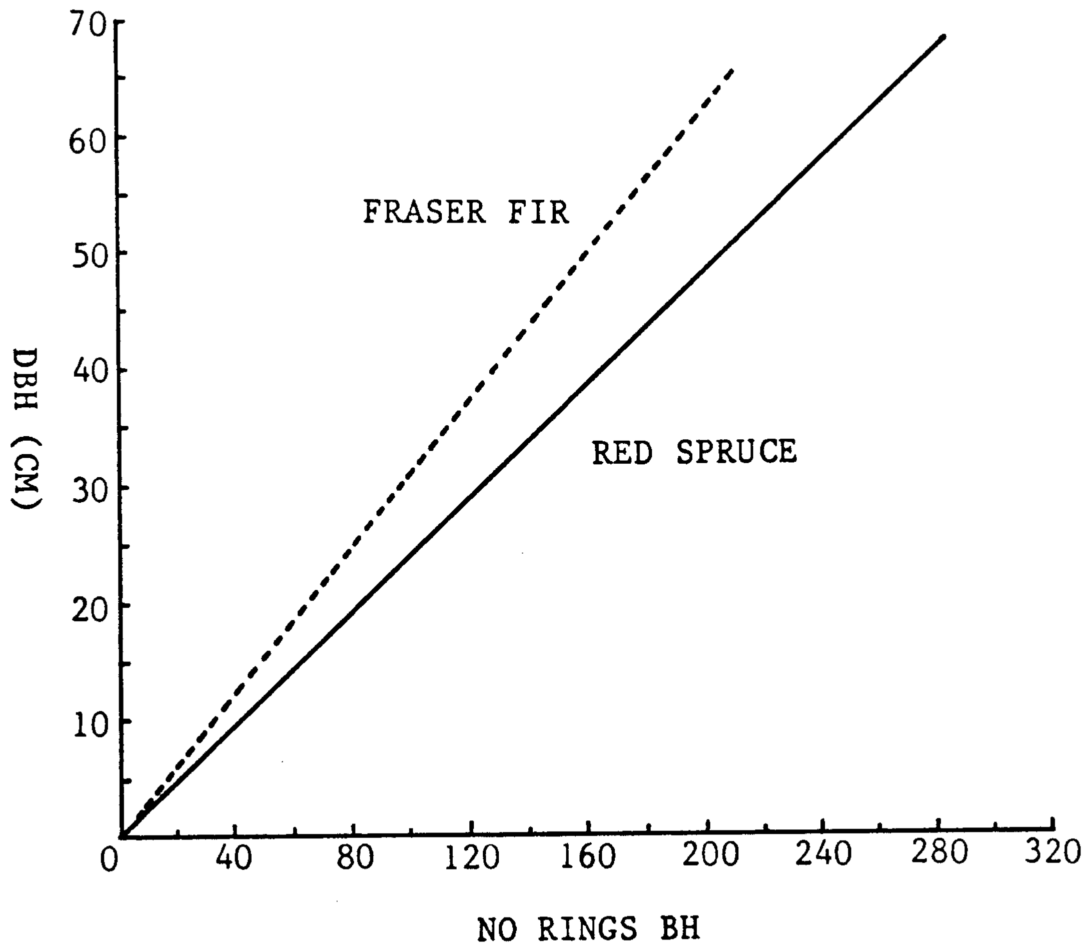

Figure 2. Growth rate of red spruce and Fraser fir, indicated by plotting dbh's against growth rings, of the spruce-fir forest of the Great Smoky Mountains.[a]

[a] The graph was taken from Oosting and Billings (1951).

trees range from 30 to 60 cm in dbh (Table 9, Appendix A). Judging from the growth rate of red spruce (Figure 2), mature to old trees seem most affected. Likewise, the growth rate of affected Fraser fir (Figure 2) was considered. Compared with red spruce, most fir trees seem to be affected at a younger stage with the dbh range from 15 to 35 cm (Table 9, Appendix A). For this fir mortality, the balsam woolly aphid (*Adelges piceae* Ratz.) infestation may be more responsible than the activity of decay fungi.

For some reason, yellow birch is also affected at a very young stage, but the incidence of decay is roughly proportional to dbh (Table 9, Appendix A). Most birch trees range from 5 to 20 cm in dbh. Judging from the report that yellow birch in Nova Scotia contains some decay before reaching 20 cm dbh and 80 years of age (Stillwell, 1955), birch trees of the research area may be also affected before such an age.

6. ELEVATIONAL AND LOCAL VARIATION

Within the research area, there was some elevational variation of fungi in relation to their host. Some fungi occurring below 1350 m elevation at the lower limit of the spruce-fir forest of the Park (Table 10, Appendix A) are believed to belong to the fungal flora of low elevation forests. Common to abundant species usually occupy a broad range of elevation of the research area (Table 10, Appendix A).

Hirschioporus spp. present above 1800-meter level are always associated with dead fir trees. As they are confined to conifers, their distribution agrees with that of spruce and fir. For the same

reason, species of many corticioid genera and most stereoid genera normally occur within the elevation range of spruce and fir (Table 10, Appendix A), but fungi associated with hardwoods usually occur at lower elevations.

For a comparison of the resupinate fungal flora among several different forest types, two more locations, Cades Cove in the Park and John Knox Camp in Meigs Co., were often surveyed.

The elevation of Cades Cove is about 530-590 meters, and the site is characterized by a mixed forest of yellow-poplar, maple, oak, hemlock, and pine. *Hirschioporus pargamenus* occurs on hardwoods rather than conifers. *Stereum complicatum*, rare on yellow birch in the spruce-fir forest, is very common on hardwoods throughout the cove. *Perenniporia subacida* causes an extensive stump or butt rot on pine and hemlock but sometimes occurs even on hardwoods. *Phellinus gilvus*, which was never found in the spruce-fir forest, occurs on hardwoods. *Coriolus versicolor*, rare on Fraser fir at high elevation, was apparently common on hardwoods in Cades Cove.

John Knox Camp is a small point on Watts Bar Lake at 230 meters. Pines are suited to the site, and oak, hickory, and birch are most common throughout the area.

Schizopora paradoxa (= *Poria versipora*) commonly occurs on hardwoods. *Hyphoderma setigerum* is not uncommon on hardwoods in this low-elevation site and seems to have adapted to a broad elevation range. It is notable that two uncommon species of *Phanerochaete*, *P. calotricha* and *P. tuberculata* occur on hardwoods. A species of *Peniophora*, *P. nuda*, was found here on a hardwood for the first time.

This genus must be confined decidedly to hardwood trees.

Fungi seem to depend on tree type (conifer or hardwood) rather than tree species. Possibly because the spruce-fir forest consists largely of conifers, its fungal flora was rather different from those of the above extra-limital sites consisted largely of hardwoods.

CHAPTER VII

CLASSIFICATION OF FUNGI

The fungi collected from the spruce-fir forest of the Park belong to the order Aphyllophorales and are lignicolous species involved in wood decay and rot. Early mycologists classified them based on the traditional Friesian system (Fries, 1821). Even today, many foresters use this system because of its simplicity and convenience in forest situations. Until recently, European mycologists led the movement toward a natural system based on microscopic characters and phylogenetic relationships. As a result of efforts to establish such a new system, the current classification of the Aphyllophorales has become greatly expanded and specialized.

The resupinate fungi treated here have been arranged according to Donk´s (1964) scheme. Among ten families which accommodate them (cf. Table 1), five families have been recognized in this dissertation. A non-resupinate family, Ganodermataceae, is added. The majority belong to two large families, Corticiaceae and Polyporaceae. For the Corticiaceae, the subfamilies and genera have been classified according to the scheme of Parmasto (1968). For the resupinate polypores, Lowe´s (1966, 1975) monographs were consulted and some of Domanski´s (1972, 1973) descriptive keys were used. For the remaining families, mostly of stereoid and xanthochroic groups, other available sources were used to classify them.

Some genera are still unsettled and often hard to fit into currently used systems. The most recent scientific names have been

cited, and the best-known keys have been adopted and modified, if necessary, for the number of available characters. Family descriptions have been avoided because they are usually artificial or ambiguous. Generic descriptions are given because the generic rank is believed to be the basic unit in natural grouping. However, generic descriptions are constructed here only on the basis of specimens from the research area. Specific descriptions have been also based on the collections from the research area and confirmed by referring to loaned or gift specimens or TENN specimens. Some miscellaneous information has been frequently provided in addition to morphology for better understanding of taxa.

For the Polyporaceae, Hymenochaetaceae, and Stereaceae, there are many specimens which were collected from the research area a half century ago and deposited in the TENN Herbarium. Most of these specimens were collected by Hesler and Sharp, and identified by experts such as Overholts, Lowe, and Hesler himself. All of these specimens were utilized in preparing descriptions and compiling the fungal flora of the spruce-fir forest of the Park.

Key to Families of Aphyllophorales

1. Fruitbody brown to dark-colored, permanently darkening in KOH solution; hyphae usually colored; clamp connections absent; setae present or absent..........Hymenochaetaceae (p. 141)

1. Fruitbody white to light- or bright-colored, if brown, not permanently darkening in KOH solution; hyphae hyaline or colored, clamp connections present or absent; setae absent..... 2

2. Basidiospores brown, thick-walled, cyanophilous in cotton blue..........................Coniophoraceae (p. 119)

2. Basidiospores hyaline to light-colored, thin- to thick-walled, usually not cyanophilous in cotton blue...... 3

3. Spores double-walled, truncate, with a verrucose ornamentation penetrating into the outer layer; hymenium without cystidia.........................Ganodermataceae (p. 234)

3. Spores not as above; hymenium often with cystidia............. 4

4. Hymenophore usually tubulate, sometimes irpicoid, dissepiments sterile on edge............Polyporaceae (p. 170)

4. Hymenophore typically smooth, but also tuberculate, toothed, to poroid, hymenial surface fertile all over...... 5

5. Fruitbody resupinate, effused-reflexed, to sessile-pileate, with tomentum and context; hyphal system mono- to dimitic..................................Stereaceae (p. 122)

5. Fruitbody invariably resupinate, without tomentum and context; hyphal system monomitic............Corticiaceae (p. 60)

1. FAMILY CORTICIACEAE

Key to Subfamilies of Corticiaceae

1. Spores exhibiting repetition; basidia bifurcate ....Ceratobasidioideae (p. 84)

1. Spores and basidia not as above.............................. 2

2. Subicular hyphae 8-14 µm diam, branching at right angles..........................Botryobasidioideae (p. 77)

2. Subicular hyphae narrower, usually 2-6 µm diam, not branching at right angles.............................. 3

3. Basidia globose to subglobose or if clavate then hyphae ampullate at septa.......................Sistotremoideae (p. 114)

3. Basidia narrowly to broadly clavate, hyphae not ampullate at septa.. 4

4. Basidia utriform, developing in a catahymenium............ ....Aleurodiscoideae (p. 61)

4. Basidia not utriform, developing in a euhymenium........... 5

5. Gloeocystidia present; basidiospores amyloid.................. ....Gloeocystidielloideae (p. 87)

5. Gloeocystidia present or absent, and if present, basidiospores not amyloid.................................... 6

6. Subicular hyphae gelatinizing, not readily separable...............................Phlebioideae (p. 111)

6. Subicular hyphae not gelatinizing, usually distinct........ 7

7. Hymenial layer pelliculose; basal hyphae loosely parallel to substratum.................................Athelioideae (p. 65)

7. Hymenial layer furfuraceous, tomentose, or ceraceous; basal hyphae rarely parallel to substratum......Hyphodermoideae (p. 91)

Subfamily Aleurodiscoideae

Aleurodiscus Rabenhorst ex Schroeter. 1888. Krypt.-Fl. Schles. 3:429.

Basidiocarp annual or perennial, resupinate, discoid or cyphelloid, initially separate, often confluent, farinose-pulverulent to subcoriaceous; hymenial surface even; margin adnate, free, to

reflexed. Hyphal system typically monomitic. Hyphae hyaline, thin- to thick-walled, septate, with or without clamps. Acanthohyphidia (dendrohyphidia), pseudocystidia, and paraphysoid hyphae often present. Basidia large, with 4 large sterigmata. Spores medium to large, hyaline, varying in shape, smooth or ornamented, thin- to thick-walled, amyloid.

REMARK: Compared with most other genera of Corticiaceae, _Aleurodiscus_ spp. have very large amyloid spores and highly diversified sterile hymenial elements. Among them, pseudocystidia are a form of gloeocystidia which enter the hymenium. Cystidia of some species react with sulfobenzaldehyde and thus provide diagnostic information.

Key to Species of Aleurodiscus

1. Acanthohyphidia present; spores ellipsoid to citriform .... 2. _A. mirabilis_
1. Acanthohyphidia absent; spores subglobose to ellipsoid .... 1. _A. amorphus_

1. _Aleurodiscus amorphus_ (Fr.) Schroeter. 1888. Krypt.-Fl. Schles. 3:429.

≡ _Thelephora amorpha_ Fries. 1828. Elench. Fung. 1:183.

MACROMORPHOLOGY: Basidiocarp discoid, 1-3 mm diam, separate to gregarious, firm, subcoriaceous, up to 1 mm thick; hymenial surface convex, smooth, reddish brown (9D4), grayish red (10D4), to grayish brown (9D3, 10D3); abhymenial surface whitish, hirsute; margin determinate, incurved.

MICROMORPHOLOGY: Hyphae 3.2-5.2(-8) µm diam, somewhat thick-walled, sometimes partially thick-walled (wall up to 2 µm thick), septate, without clamps, irregularly branched. Hymenium crowded with pseudocystidia, paraphysoid hyphae, and basidial elements. Pseudocystidia 144-160 x 7.2-8 µm, moniliform, sulfo-negative, submerged. Paraphysoid hyphae 3.2-4.8 µm diam, simple or branched, submerged. Basidia [4/1] 112-140 x 20-24 µm (X = 122 ± 12.4 x 21.6 ± 2 µm), L/W = 4.8-6.3 (X = 5.7 ± 0.6), large, clavate; sterigmata 4, large, 16-20 µm long. Basidiospores [8/1] 22.4-28 x 16-20 µm (X = 24.3 ± 1.8 x 18.2 ± 1.9 µm), L/W = 1.2-1.5 (X = 1.3 ± 0.1), large, broadly ellipsoid, almost smooth in KOH, asperate with small spines in Melzer's reagent, thick-walled (wall up to 1.4 µm thick), amyloid; spines acicular, dense, up to 2.4 µm long.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*; twig; bark; possibly common.

REMARK: This minute fungus may be common on dead branches of Fraser fir of the Park but has been overlooked. Two herbarium specimens (TENN 12570 and 14280, confirmed by P.A. Lemke) from the research area were examined.

2. *Aleurodiscus mirabilis* (Berk. et Curt.) von Höhnel. 1909. K. Akad. Wiss. Wien, Math.-Nat. Kl. Sitzungsb. 118:818.

 ≡ *Psilopeziza mirabilis* Berkeley et Curtis. 1868. Jour. Linn. Soc. Bot. 10:364.

MACROMORPHOLOGY: Basidiocarp discoid, 2-5 mm diam, separate to gregarious, readily and irregularly confluent, pulverulent to subceraceous, up to 1 mm thick; hymenial surface smooth, glaucous,

sometimes cracked, grayish orange (6B4, 6B5) to brownish orange (6C4, 6C5); abhymenial surface pale, tomentose; margin determinate, reflexed.

MICROMORPHOLOGY: Hyphae 3.2-4.8 µm diam, somewhat to constantly thick-walled (wall up to 1.6 µm thick), with clamps, subregularly branched. Hymenium crowded with acanthohyphidia, pseudocystidia, paraphysoid hyphae, and basidial elements. Acanthohyphidia (Figure 6, Appendix C) 40-76 (or more) x 4.8-9.6 µm, mostly cylindrical, with scattered to dense protuberances usually over the upper half, submerged; protuberances aculeate, 2.4-4 µm long. Pseudocystidia (Figure 5, Appendix C) (60-) 70-116 x (6.4)9-13.6 µm, flexuous-cylindrical, often constricted at the apex, weakly sulfo-positive, submerged. Paraphysoid hyphae 4-4.8 µm diam, simple to branched, flexuous. Basidia (Figure 4, Appendix C) [5/1] 60-120 x 13.6-20.8 µm (X = 79.2 $\pm$ 23.4 x 16.6 $\pm$ 3.3 µm), L/W = 3.8-5.8 (X = 4.7 $\pm$ 0.8), large, clavate; sterigmata 4, large, septate at the base, 18 µm long. Basidiospores (Figure 3, Appendix C) [12/1] (20.8-)22.4-28 x 14.4-16.8(-18.4) µm (X = 25 $\pm$ 1.9 x 15.1 $\pm$ 1 µm), L/W = 1.4-1.8 (X = 1.7 $\pm$ 0.1), large, ellipsoid, citriform, to semilunar, biapiculate, adaxially flattened, almost smooth in KOH, asperate with small spines in Melzer´s reagent, thick-walled (wall up to 1.6 µm thick), amyloid; spines acicular, dense, up to 2.4 µm long.

HABITAT AND DISTRIBUTION: _Betula lutea_; trunk; wood and bark; rare.

REMARK: This species is often confused with _Aleurodiscus penicillatus_ because both have abundant acanthohyphidia in the

hymenium, but the latter has smaller globose spores. There is a discrepancy in the host relationship with the literature, where *Aleurodiscus mirabilis* has been reported to occur on *Rhododendron* (Lemke, 1964; Burdsall, 1976), but TENN 46310 was found on wood and bark of *Betula* from the research area.

Subfamily Athelioideae

Key to Genera of Athelioideae

1. Basidiocarp effused-reflexed, pileate, or cupulate...*Plicaturopsis*
1. Basidiocarp effused, resupinate.............................. 2
    2. Subiculum well-developed, usually of thick-walled hyphae...*Phanerochaete*
    2. Subiculum poorly developed, of thin-walled hyphae.......... 3
3. Basidiocarp pelliculose; hymenium not thickening..........*Athelia*
3. Basidiocarp usually ceraceous; hymenium thickening....*Ceraceomyces*

Athelia Pers. emend. Donk. 1957. Fungus 27:12.

Basidiocarp annual, resupinate, smooth, pelliculose, soft, easily separable. Hyphal system monomitic. Hyphae hyaline, slender, thin-walled, septate, with or without clamps. Basidia small, clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, smooth, not amyloid.

1. *Athelia decipiens* (v. Höhn. et Litsch.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 86.

    ≡ *Corticium decipiens* von Höhnel et Litschauer. 1908. Sitzber. Akad. Wiss. Wien, Math.-Nat. Kl. 117, part 1:1116.

MACROMORPHOLOGY: Basidiocarp effused, grayish white (1B1), arachnoid, pelliculose, smooth, easily separarble in flakes; subiculum loosely webbed, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 18, Appendix C) thin-walled, often encrusted, septate, without clamps, branched in all directions; basal hyphae 2.4-3.8 µm diam; subhymenial hyphae 2-3 µm diam, densely branched into candelabra. Basidia (Figure 17, Appendix C) [24/2] (9.6-)10.4-16.8 x 3.2-5.2 µm ($\bar{X}$ = 12.9 ± 2 x 4.3 ± 0.5 µm), L/W = 2-4 ($\bar{X}$ = 3.1 ± 0.6), rather small, clavate to subclavate, with 4 sterigmata. Basidiospores (Figure 16, Appendix C) [21/2] (3.2-)4-7.2 x 2.4-3.8 µm ($\bar{X}$ = 4.9 ± 0.8 x 2.8 ± 0.4 µm), L/W = 1.4-2.3 ($\bar{X}$ = 1.8 ± 0.2), ellipsoid, often glued in pairs.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*; trunk, stump; wood; uncommon.

Ceraceomyces Jülich. 1972. Willd. Beih. 7:146.

Basidiocarp annual, resupinate, smooth, at first pelliculose, then ceraceous; hyphal strands present. Hyphal system monomitic. Hyphae hyaline, usually thin-walled, with clamps. Cystidia present, hyphoid. Basidia narrowly clavate, with 4 sterigmata. Basidiospores hyaline, subglobose or ovoid, smooth.

REMARK: This genus is close to *Athelia*. The main difference is as follows: in *Athelia* spp., the basidia all form at the same level, but in *Ceraceomyces* spp., the layer of basidia increases in number and the hymenium thickens and develops ceraceous texture with age (Eriksson and Ryvarden, 1973).

1. Ceraceomyces sublaevis (Bres.) Jülich. 1972. Willd. Beih. 7:147.

≡ Corticium sublaeve Bresadola. 1903. Ann. Mycol. 1:95.

MACROMORPHOLOGY: Basidiocarp effused, white, yellowish white (4A2), to pale yellow (4A3), at first thin and pelliculose, then membranous-ceraceous, smooth, adnate, 0.1-0.2 mm thick; margin finely fibrillose, often extended into fine hyphal strands.

MICROMORPHOLOGY: Hyphae (Figure 43, Appendix C) 2.4-4.4 µm diam, usually thin-walled, commonly encrusted all over, with clamps; subicular hyphae mainly straight, frequently branched; subhymenial hyphae repeatedly branched. Cystidia (Figure 42, Appendix C) 42.6-60 x 4-5.6 µm, hyphoid, uncommon, sometimes septate with clamps, moderately thick-walled (wall 0.8-1.2 µm thick), finely encrusted, projecting up to 30 µm. Basidia (Figure 41, Appendix C) [10/1] 14.4-20 x 3.2-4.8 µm (X = 16.7 ± 1.9 x 4.1 ± 0.7 µm), L/W = 3.3-5 (X = 4.1 ± 0.5), narrowly clavate, often slightly constricted, with 4 sterigmata. Basidiospores (Figure 40, Appendix C) small, [17/1] 3.2-4.4 x 2.4-3.2 µm (X = 3.6 ± 0.3 x 2.7 ± 0.2 µm), L/W = 1.1-1.5 (X = 1.4 ± 0.1), subglobose or ovoid, with an oil drop.

HABITAT AND DISTRIBUTION: Picea rubens; trunk; wood; rare.

Phanerochaete Karst. emend. Donk. 1962. Persoonia 2:223.

Basidiocarp annual, resupinate, often conspicuous, ceraceous or membranous, adnate or partly detachable; hymenial surface smooth or somewhat tuberculate; subiculum well-developed, exposed at margin as a fimbriate zone, often developed into rhizomorphs. Hyphal system monomitic. Hyphae hyaline, septate, mostly without clamps; subicular hyphae usually thick-walled, occasionally with single or multiple

clamps, sparsely branched; subhymenial hyphae thin-walled, copiously branched. Cystidia present, usually numerous and conspicuous, somewhat cylindrical, or rarely absent. Basidia narrowly clavate, normally with 4 sterigmata. Basidiospores hyaline, ellipsoid, cylindrical, allantoid, smooth, not amyloid.

REMARK: This genus is easily distinguished by the common bright color of fruitbodies, the hymenium with frequent to numerous and conspicuous cystidia, and the subicular hyphae with thick walls and occasional conspicuous clamps. Some species show great variation especially in color of fruitbodies and in number and encrustation of cystidia.

Key to Species of Phanerochaete

1. Cystidia regularly septate.................. 3. P. septocystidia
1. Cystidia not septate.. 2
   2. Basidiocarp orange-yellow or reddish; substrate stained yellow or red.................................. 3
   2. Basidiocarp white, yellowish, to ochraceous; substrate not stained.. 4
3. Spores <5 μm long............................. 2. P. sanguinea
3. Spores >6 μm long............................. 5. P. viticola
   4. Cystidia scattered, barely encrusted.......... 4. P. sordida
   4. Cystidia numerous, heavily encrusted...... 1. P. filamentosa

1. Phanerochaete filamentosa (Berk. et Curt.) Burdsall in Parker and Roane. 1976. Distrib. Hist. Biota. S. Appalach. 4:278.

≡ Corticium filamentosum Berkeley et Curtis. 1873. Grev. 1:178.

MACROMORPHOLOGY: Basidiocarp effused, extensively confluent over the substrate, pale yellow (4A3), light yellow (4A4), or grayish orange (5B4), soft and pliable when fresh, membranous and brittle when dry, loosely attached and easily separable, 0.1-0.3 mm thick; hymenial surface smooth to somewhat tuberculate, finely pilose from projecting cystidia; subiculum concolorous or paler; margin white to yellowish white (4A2), fibrillose, then fimbriate, often weakly rhizomorphic, 1-2 mm wide; all parts turning orange (6B8) in KOH.

MICROMORPHOLOGY: Hyphae (Figure 281, Appendix C) mostly thin-walled, septate, usually without clamps; subicular hyphae 4-5.6 µm diam, straight and mainly parallel, forming a loose texture, occasionally clamped or multi-clamped at septa, sparsely branched; subhymenial hyphae 2.4-4 µm diam, forming a dense texture, copiously branched, short-celled. Hymenium composed of cystidia, basidia, and often conidiophores. Cystidia (Figure 278, Appendix C) 64-104 x 5.6-6.4 µm, abundant, narrowly conical and tapering to the base, at first thin-walled and almost naked, later thick-walled (wall up to 2.4 µm thick) and heavily encrusted over the apical half or all over, projecting up to 28 µm or sometimes submerged. Conidiophores (Figure 280, Appendix C) 24-48 x 2.4-3.8 µm, common to abundant, aculeate, septate, originating from subhymenial level, with a single conidium at the apex; conidia (Figure 279, Appendix C) 7.2-10.4 x 2.2-3.2 µm, cylindrical. Basidia (Figure 277, Appendix C) [5/1] 22.4-24 x 3.2-4 um ($\bar{X}$ = 23.2 ± 0.8 x 3.8 ± 0.4 µm), L/W = 5.6-7.5 ($\bar{X}$ = 6.2 ± 0.8), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 276, Appendix C) [18/1] 4.4-5.4 x 2.2-2.6 µm ($\bar{X}$ = 4.9 ± 0.3 x 2.4 ± 0.1

μm), L/W = 1.8-2.5 (X = 2 ± 0.2), ellipsoid, adaxially straight.

HABITAT AND DISTRIBUTION: Acer saccharum; log; bark; rare.

REMARK: This species is reported as common on hardwood slash through the eastern mountains of the United States (Burdsall, 1976, 1985). The coexistence of conidiophores implies two things. The conidial state could be a species of Acremonium which is a common parasite on corticioids (Eriksson, personal communication), or it could represent the imperfect state of P. filamentosa.

Compared with reference materials, the specimen (TENN 46497) from the research area has a different color and KOH reaction. Reference materials TENN 41005, 41030, 41053, 46550, 46576, 46603, and Lowe 5099 were grayish yellow (4B4, 4B5), grayish orange (5B4), brownish orange (5C4, 5C5, 6C3, 6C4, 6C5, 6C6), to light brown (6D6) in color, and typically turned purplish, instead of orange, in KOH. Moreover, TENN 41504 was strongly rhizomorphic.

2. Phanerochaete sanguinea (Fr.) Pouzar. 1973. Ceská Mycol. 27:26.

≡ Thelephora sanguinea Fries. 1828. Elench. Fung. 1:203.

MACROMORPHOLOGY: Basidiocarp effused, yellowish white (4A2) to pale yellow (4A3) at first, turning reddish in patches with time, deep red (10C8), brownish red (10D8), to reddish brown (9D6, 9D7, 9D8) when old, staining the wood red, soft when fresh, membranous when dry, loosely adnate or partly detachable, 0.1-0.3 mm thick; hymenial surface smooth, somewhat cracking with age; subiculum generally concolorous; margin fibrillose to fimbriate, readily developed into rhizomorphs.

MICROMORPHOLOGY: Hyphae (Figure 285, Appendix C) 3.2-6.4 μm

diam, septate, usually without clamps; subicular hyphae frequently thick-walled (wall up to 1.6 µm thick), straight, occasionally with conspicuous clamps, sparingly branched; subhymenial hyphae 2.2-3.6 µm diam, thin-walled, copiously branched and densely interwoven, short-celled. Cystidia (Figure 284, Appendix C) 41.6-56 x 4-4.8 µm, common, cylindrical with tapering ends, mostly obtuse at the apex, somewhat thick-walled, usually naked, projecting up to 32 µm. Basidia (Figure 283, Appendix C) [9/1] 22.4-28 x 4-5.4 µm (X = 24.7 ± 1.7 x 4.6 ± 0.4 µm), L/W = 4.2-6.4 (X = 5.5 ± 0.7), narrowly clavate to subcylindrical, with (2-)4 sterigmata. Basidiospores (Figure 282, Appendix C) [20/1] 4-5.2 x 2-2.6 µm (X = 4.5 ± 0.4 x 2.4 ± 0.2 µm), L/W = 1.5-2.2 (X = 1.9 ± 0.2), ellipsoid or narrowly eliipsoid, adaxially straight.

HABITAT AND DISTRIBUTION: Picea rubens; uprooted bottom; root bark and wood; possibly rare.

REMARK: This species is easily recognized by the red color which is developed in the rhizomorphs and as patches in the hymenium. Young specimens may lack this red color, but old specimens become totally red and stain their substrate red.

3. Phanerochaete septocystidia (Burt) Eriksson et Ryvarden in Eriksson, Hjortstam, and Ryvarden. 1978. Cort. N. Europe 5:1021.
   ≡ Peniophora septocystidia Burt. 1929. Ann. Miss. Bot. Gard. 12:260.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, or broadly confluent, at first yellowish white (4A2) to pale yellow (4A3), then orange white (5A2), light orange (6A4), grayish orange (6B4), brownish

orange (6C4), brown (7E4, 7E5), or dark brown (7F4), appearing watery when wet, membranous, adnate, 0.1-0.2 mm thick; hymenial surface smooth, velutinous from the projecting cystidia; subiculum almost concolorous; margin somewhat fibrillose or entire.

MICROMORPHOLOGY: Hyphae densely encrusted, septate, without clamps throughout; subicular hyphae (Figure 289, Appendix C) 4-8.8(-11.2) μm diam, thick-walled (wall 0.8-1.6 μm thick), constricted at septa, branched at wide angles, frequently dichotomously branched; subhymenial hyphae 3-4 μm diam, rather thin-walled, copiously branched and densely intertwined, short-celled. Cystidia (Figure 288, Appendix C) 70-90 (or more) x 7-9.2 μm, uncommon, cylindrical, regularly septate, slightly constricted at septa, obtuse, thick-walled (wall 0.8-1.2 μm thick), covered with granules, somewhat projecting but up to 32 μm. Basidia (Figure 287, Appendix C) [6/1] (12-)15.2-25.6 x 3.2-6 μm (X = 20.5 ± 4.1 x 4.7 ± 1.3 μm), L/W = 3-7 (X = 4.6 ± 1.4), broadly to narrowly clavate, with 4 sterigmata. Basidiospores (Figure 286, Appendix C) [12/1] 4-6.4 x 1.2-2.2(-2.4) μm (X = 5 ± 0.8 x 1.8 ± 0.4 μm), L/W = 2-4 (X = 3 ± 0.7), allantoid.

HABITAT AND DISTRIBUTION: <u>Betula</u> <u>lutea</u>; twig; wood and moss-covered bark; rare.

REMARK: This species is apparently very rare. Burdsall (1976) reported it from the Smokies in a very dry year. His report agrees with the fact that TENN 46462 was collected in the dry year 1983.

This species has some nature of <u>Candelabrochaete</u> in point of broad and simple-septate hyphae, septate cystidia, and small basidia (Eriksson, Hjortstam, and Ryvarden, 1981). For this reason, Burdsall

(1985) recently recombined this species into Candelabrochaete septocystidia, but it is retained here because the author had no chance to compare with other species of Candelabrochaete.

Cystidia vary in number according to the specimen. Reference materials TENN 46551 had abundant cystidia, but TENN 46552 showed rare to uncommon cystidia. University of Toronto specimen No. 21826 (SYRF) had very rare cystidia and comparatively long spores (mostly 5.6-6 µm long).

4. Phanerochaete sordida (Karst.) Eriksson et Ryvarden in Eriksson, Hjortstam, and Ryvarden. 1978. Cort. N. Europe 5:1023.

≡ Corticium sordidum Karsten. 1882. Medd. Soc. F. Fl. Fenn. 9:65.

MACROMORPHOLOGY: Basidiocarp effused, in small patches, then confluent, yellowish white (2A2), pale yellow (2A3), to yellowish gray (2B2), subceraceous, adnate, 0.1-0.2 mm thick; hymenial surface smooth; subiculum pale concolorous; margin indistinct or finely fimbriate.

MICROMORPHOLOGY: Hyphae septate, without clamps throughout; subicular hyphae (Figure 294, Appendix C) 4-9.6 µm diam, distinct, usually straight, branched in all directions at right angles at septa, frequently dichotomously branched, thick-walled (wall up to 1.6 µm thick); subhymenial hyphae (Figure 293, Appendix C) thin-walled, copiously branched into a thickening subhymenium, short-celled, 2.2-3.4 µm diam. Cystidia (Figure 292, Appendix C) 48-88 x 5.6-9.2 µm, scattered to common, fusiform, cylindrical with a tapering apex, or somewhat varying, moderately thick-walled (wall 1-1.2 µm thick), not encrusted, usually projecting up to 28 µm. Basidia (Figure 291,

Appendix C) [6/1] 17.6-20 x 4.4-4.8 µm (X = 19.1 ± 0.9 x 4.6 ± 0.2 µm), L/W = 4-4.6 (X = 4.2 ± 0.2), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 290, Appendix C) [22/1] 4-6.4 x 1.8-3.2 µm (X = 4.9 ± 0.5 x 2.4 ± 0.4 µm), L/W = 1.3-2.6 (X = 2.1 ± 0.3), ellipsoid, adaxially straight.

HABITAT AND DISTRIBUTION: unknown hardwood; twig; wood; rare.

REMARK: Cystidial encrustation is described to vary with age and other factors, so there could be none at all, some around the apex, or dense over the apical half (Eriksson and Ryvarden, 1978). Reference material TENN 46602 had longer spores (5.6-6.4 um in length) and very common cystidia.

5. Phanerochaete viticola (Schw.) Parmasto. 1967. Eesti NSV Tead. Akad. Toim. 16:389.

≡ Thelephora viticola Schweinitz. 1822. Schrift. Leipz. Naturforsch. Ges. 1:107.

MACROMORPHOLOGY: Basidiocarp effused, in small patches, orbicular, or extensively confluent along the substrate, light yellow (4A4, 4A5) to light orange (5A4) around the center, pale red (12A3) to grayish rose (12B3) toward the margin, deep yellow (4A8) to deep orange (6A8) at the margin, staining the wood yellow or red, pellicular, adnate, 0.1-0.3 mm thick; hymenial surface smooth, brittle and easily flaking off when dry; subiculum concolorous with margin, byssoid to fibrous, extending beyond the hymenial surface to form margin; margin fibrillose to byssoid, 1-2.5 mm wide.

MICROMORPHOLOGY: Hyphae (Figure 298, Appendix C) 2.4-4.6 µm diam, distinct, covered by dense yellow granules soluble in KOH,

septate, usually without clamps, frequently branched; subicular hyphae thin-walled or often moderately thick-walled (wall rarely up to 1.2 µm thick), occasionally clamped at septa; subhymenial hyphae thin-walled, septate, without clamps, poorly delimited from the subiculum. Hymenium composed of cystidia, paraphysoid hyphae, and basidia. Cystidia (Figure 297, Appendix C) 64-100 x 5.6-11.2 µm, common, cylindrical, often tapered to the base or narrowed at the base, obtuse, thick-walled (wall up to 1.6 µm thick), projecting up to 48 µm. Paraphysoid hyphae 2.4-3.2 µm diam, common, sometimes branched near the apex, thin-walled. Basidia (Figure 296, Appendix C) [13/1] 25.6-44 x 6-8.8 µm (X = 35 $\pm$ 5.1 x 7.4 $\pm$ 0.8 µm), L/W = 6-8.8 (X = 7.4 $\pm$ 0.8), clavate to clavipedunculate, hyaline or somtimes with oily granules; sterigmata (2-)4, 4-5.6 µm long. Basidiospores (Figure 295, Appendix C) [20/1] 5.6-8.8 x 3.8-5.2 µm (X = 7 $\pm$ 0.9 x 4.3 $\pm$ 0.5 µm), L/W = 1.3-1.9 (X = 1.6 $\pm$ 0.2), ellipsoid to broadly ellipsoid, with a noticeable apiculus.

HABITAT AND DISTRIBUTION: *Betula lutea*; twig; wood and bark covered with moss and lichen; possibly rare.

REMARK: This species is conspicuous by its beautifully combined orange colors. It grew on slash of yellow birch and sometimes expanded several feet long along the twig of slash. It was found on a somewhat decomposed substrate in a dry habitat. Microscopically, it has decidedly smaller spores than those reported in the literature (cf. Burdsall, 1976) and slightly smaller than those (7.2-9.6 x 3.6-4.2 µm) of reference material TENN 27987.

Plicaturopsis Reid. 1964. Persoonia 3:150.

Basidiocarp annual, subresupinate, reflexed-pileate, or pileate, single, gregarious, or imbricate, pliable when fresh, brittle when dry; upper side velutinous; hymenophore plicate with low gill-like ridges; margin involute. Hyphal system monomitic. Hyphae hyaline, mostly thin-walled, with clamps or often medallion clamps; tramal hyphae mainly parallel; subhymenial hyphae dense and intertwined. Basidia subclavate, with 4 sterigmata, forming a hymenial palisade. Basidiospores hyaline, allantoid, smooth, weakly amyloid.

1. Plicaturopsis crispa (Fr.) Reid. 1964. Persoonia 3:150.

≡ Cantharellus crispus Persoon: Fries. 1821. Syst. Mycol. 1:323.

MACROMORPHOLOGY: Basidiocarp reflexed-pileate, pileate, flabelliform or cupulate, sessile or substipitate, subresupinate on undersides, initially in islets or cupules, shortly effused then readily reflexed into pilei, single, crowded, or imbricate, soft and pliable when fresh, firm but brittle when dry; pilei 9 mm wide, protruding 6-7 mm, 1 mm thick, somewhat contracted on drying; upper side subzonate, finely velutinous, brownish orange (5C6) to yellowish brown (5D6); hymenophore radially folded in low dichotomously branched gill-like ridges with crispate edges, glaucous white, greenish gray (1B2); margin involute.

MICROMORPHOLOGY: Hyphae (Figure 325, Appendix C) 2.4-5.2 µm diam, with clamps or often conspicuous medallion clamps; tramal hyphae mainly horizontal, ending into the tomentum of the upper side, slightly thick-walled (wall 0.8-1.2 µm thick); subhymenial hyphae

densely branched. Basidia (Figure 324, Appendix C) [5/1] 14.4-16 x 2.4-4 µm ($\bar{X}$ = 15 ± 0.7 x 3 ± 0.7 µm), L/W =4-6.3 ($\bar{X}$ = 5.2 ± 0.9), subclavate, with 4 sterigmata, forming a dense hymenial palisade. Basidiospores (Figure 323, Appendix C) [10/1] 3.2-5.6 x 0.8-1.6 µm ($\bar{X}$ = 4.4 ± 0.9 x 1 ± 0.3 µm), L/W = 3-6.5 ($\bar{X}$ = 4.5 ± 1.2), allantoid, weakly amyloid.

HABITAT AND DISTRIBUTION: _Betula lutea_; trunk; bark and wood; rare.

REMARK: This species is easily distinguished by the radially folded hymenium. Reid supposed that this species had a relationship with _Merulius_ spp., but it is now thought to have evolved from _Amylocorticium_ spp. (Athelioideae, Corticiaceae) to _Plicaturopsis crispa_ (Eriksson, Hjortstam, and Ryvarden, 1981).

Subfamily Botryobasidioideae

Botryobasidium Donk. 1931. Meded. Nederl. Mycol. Ver. 18-20:116.

Basidiocarp annual, resupinate, loose, reticulate, hypochnoid, inconspicuous. Hyphal system monomitic. Hyphae distinct, broad, branched at right angles, septate, with or without clamps; basal hyphae hyaline to yellowish, long-celled, often thick-walled; subhymenial hyphae hyaline, short-celled, thin-walled. Basidia in clusters, short or elongated, rounded or subcylindrical, often somewhat constricted in the middle, with 6-8 sterigmata. Basidiospores hyaline, fusiform, navicular, or ellipsoid, smooth, not amyloid, cyanophilous.

ANAMORPH: _Haplotrichum_ Link (= _Oidium_ Link ex Fr.)

REMARK: Some species of *Botryobasidium* are found in connection with a conidial state which belongs to the imperfect genus *Haplotrichum*, formerly known as *Oidium*, of the form-family Moniliaceae. The conidial state is morphologically well-differentiated and taxonomically well-known.

Key to Species of Botryobasidium

1. With a basidial state 2
1. With a conidial state 6
    2. Hyphae septate, with clamps 3
    2. Hyphae septate, without clamps 4
3. Clamps present at all septa .... 5. *B. subcoronatum*
3. Clamps present only on subhymenial hyphae .... 3. *B. medium*
    4. Spores ovoid-ellipsoid, apically obtuse... 4. *B. obtusisporum*
    4. Spores navicular, biapiculate 5
5. Spores 6.5-8.5 µm long .... 2. *B. candicans*
5. Spores 8.5-13.5 µm long .... 1. *B. botryosum*
    6. Conidia lemon-shaped, formed in chains.......... 6. *H. aureum*
    6. Conidia ellipsoid, formed singly............ 7. *H. conspersum*

1. *Botryobasidium botryosum* (Bres.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 53.

    ≡ *Corticium botryosum* Bresadola. 1903. Ann. Mycol. 1:99.

MACROMORPHOLOGY: Basidiocarp grayish white (1B1), dull yellow (3B3), grayish yellow (4B3), reticulate, hypochnoid, loosely interwoven, 0.2 mm thick.

MICROMORPHOLOGY: Hyphae septate, without clamps; basal hyphae

8-11.2 µm diam, yellowish, thick-walled (wall up to 2.4 µm thick), commonly branched; subhymenial hyphae 5.6-8 µm diam, hyaline, thin- or slightly thick-walled (wall up to 1 µm thick), densely branched into candelabra. Basidia (Figure 28, Appendix C) [13/1] (13.6-) 16-24.8 x (7.2-)8.8-12.8 µm (X = 20.1 ± 3.3 x 10.6 ± 1.4 µm), L/W = 1.5-2.4 (X = 1.9 ± 0.3), short clavate, subcylindrical, somewhat constricted; sterigmata 6. Basidiospores (Figure 27, Appendix C) [29/1] 8.4-13.6 x 2.8-4.8 µm (X = 10.6 ± 1.4 x 3.6 ± 0.4 µm), L/W = 2.3-4.5 (X = 3 ± 0.5), narrowly navicular.

HABITAT AND DISTRIBUTION: Abies fraseri; stump; wood; rare.

REMARK: This species shows variation in both spore length and width. Reference materials TENN 46558, 46586, 46587, and 46607 have wider spores (mostly 4-4.8 µm wide), and among them, TENN 46558 has subpellicular texture.

2. Botryobasidium candicans John Eriksson. 1958. Svensk. Bot. Tidskr. 52:6.

MACROMORPHOLOGY: Basidiocarp yellowish white (4A2), yellowish gray (4B2), reticulate, hypochnoid, loosely interwoven, 0.1 mm thick.

MICROMORPHOLOGY: Hyphae hyaline, septate, without clamps; basal hyphae 7.2-8.4 µm diam, thin- or slightly thick-walled (wall up to 1 µm thick), commonly branched; subhymenial hyphae 4.8-6.4 µm diam, thin-walled, well-branched. Basidia (Figure 30, Appendix C) [3/1] 12.8-16 x 7.2-8 µm (X = 14.4 ± 1.6 x 7.7 ± 0.5 µm), L/W = 1.8-2 (X = 1.9 ± 0.1), subglobose, obovate, then ellipsoid; sterigmata 6. Basidiospores (Figure 29, Appendix C) [10/1] 6.4-8.8 x 2.8-4 µm (X = 7.4 ± 0.8 x 3.3 ± 0.5 µm), L/W = 1.9-2.5 (X = 2.2 ± 0.2), navicular,

obliquely subfusiform.

HABITAT AND DISTRIBUTION: Picea rubens; trunk; wood; rare.

REMARK: This species is similar to descriptions of B. botryosum but has smaller basidia and spores and narrower hyphae.

3. Botryobasidium medium John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 54.

MACROMORPHOLOGY: Basidiocarp grayish white (1B1), greenish gray (1B2), loosely reticulate, hypochnoid, loosely interwoven, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 33, Appendix C) copiously branched; basal hyphae 6.4-10.6 µm diam, hyaline, yellowish, thick-walled (wall up to 1.2 µm thick), septate, with or without clamps; subhymenial hyphae 4.8-7.2 µm diam, hyaline, thin-walled, with clamps, often dichotomously branched. Basidia (Figure 32, Appendix C) [4/1] 14.4-20.8 x 6.4-10.4 µm ($\bar{X}$ = 18.4 ± 2.9 x 8.7 ± 1.7 µm), L/W = 1.6-3.3 ($\bar{X}$ = 2.2 ± 0.7), subglobose, obovate, then subcylindrical, with conspicuous clamps, somewhat constricted; sterigmata (4-)6. Basidiospores (Figure 31, Appendix C) [24/1] 7.2-12 x (3.2-)3.8-5.6 µm ($\bar{X}$ = 8.6 ± 1.1 x 4.4 ± 0.5 µm), L/W = 1.6 -2.4 ($\bar{X}$ = 2 ± 0.2), navicular.

HABITAT AND DISTRIBUTION: Abies fraseri; trunk; wood; rare.

REMARK: This species is diagnosed by basidia with conspicuous clamps and is distinguished from B. botryosum on this character. Its imperfect state, Haplotrichum medium, was described by Holubová-Jechová (1969) and is known to bear clamps on basal hyphae and produces narrowly ellipsoid conidia on conidiophores.

4. Botryobasidium obtusisporum John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 57.

MACROMORPHOLOGY: Basidiocarp white, grayish white (1B1), pale yellow (4A3), grayish yellow (4B3, 4C3), olive brown (4D3), arachnoid, reticulate, hypochnoid, then confluent, loosely interwoven, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 36, Appendix C) septate, without clamps; basal hyphae 7.2-14.4 µm diam, yellowish, moderately thick-walled (wall up to 1 µm thick), commonly branched; subhymenial hyphae 5.6-8 µm diam, hyaline, thin-walled, densely branched into candelabra. Basidia (Figure 35, Appendix C) [7/2] 16-24 x 7.2-10.4 µm (X = 19.1 ± 3 x 8.3 ± 1.2 µm), L/W = 1.6-3 (X = 2.3 ± 0.5), subglobose, obovate, then subcylindrical, somewhat constricted; sterigmata 6. Basidiospores (Figure 34, Appendix C) [36/3] 6.4-10.4 x 3.2-5.4 µm (X = 8.4 ± 1.2 x 4.1 ± 0.5 µm), L/W = 1.6-3.3 (X = 2.1 ± 0.4), obliquely ovoid, ovoid-ellipsoid, obtusely apiculate.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri; trunk, stump, log; wood, moss-covered wood; occasional.

REMARK: It is the spore shape which characterizes this species. Botryobasidium botryosum resembles this species in every respect but has navicular spores.

5. Botryobasidium subcoronatum (v. Höhn. et Litsch.) Donk. 1931. Meded. Nederl. Mycol. Ver. 18-20:117.

≡ Corticium subcoronatum von Höhnel et Litschauer. 1907. Sber. K. Akad. Wiss. Wien, Math.-Nat. Kl. 116:822.

MACROMORPHOLOGY: Basidiocarp white, yellowish white (3A2),

pale yellow (3A3, 4A3), grayish yellow (4B3, 4B4), arachnoid, hypochnoid, then continuous and subpellicular, loosely interwoven, 0.1-0.2 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 39, Appendix C) hyaline, with clamps, copiously branched; basal hyphae 7.2-9.6 µm diam, thick-walled (wall up to 1.8 µm thick); subhymenial hyphae 5-7.6 µm diam, slightly thick-walled. Basidia (Figure 38, Appendix C) [6/2] 16-24 x 6-7.2 µm (X = 19.7 ± 3.2 x 6.9 ± 0.5 µm), L/W = 2.6-3.3 (X = 2.9 ± 0.3), rounded, obovate, subclavate, then subcylindrical, somewhat constricted; sterigmata 6. Basidiospores (Figure 37, Appendix C) [43/4] (4.6-)5.2-8.4(-9.2) x 2.4-4.8 µm (X = 6.8 ± 0.9 x 3.7 ± 0.9 µm), L/W = 1.2-2.7 (X = 2.0 ± 0.4), navicular.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri; trunk, log; wood, bark; occasional.

REMARK: The inconspicuous fruitbody is quite elusive, but this species seems apparently to be very common on dead firs. This species shows a variation in spore size. Reference materials TENN 46560, 46588, and 46589 have much narrower spores (mostly 2.4-3.2 um wide), but the whole species characters distinguish B. subcoronatum from others of the genus.

6. Haplotrichum aureum (Pers.) Holubová-Jechová. 1976. Ceská Mykol. 30:3.

≡ Acrosporium aureum Persoon. 1822. Mycol. Eur. 1:25.

MACROMORPHOLOGY: Colony effused, light yellow (4A5), reddish yellow (4A7, 4B7), light orange (5A5), grayish orange (5B5), orange (5B8), becoming yellowish white (4A2) at margin, downy, tomentose,

confluent, loosely interwoven, 0.1 mm thick.

MICROMORPHOLOGY: Hyphae 5.6-9.6 µm diam, hyaline, subhyaline, moderately thick-walled (1 µm thick), septate, without clamps, commonly branched. Conidiophores (Figure 123, Appendix C) [7/1] 28-57.6 x 4.8-8 µm (X = 43.1 ± 10.6 x 6.4 ± 1.3 µm), ascending, elongated, branched, very long; sporogenous vesicles fusiform, cylindrical, with one or more sporogenous teeth. Conidia (Figure 122, Appendix C) [29/3] (12.8-)17.6-26.4 x 8.4-12.4 µm (X = 21.8 ± 2.3 x 10.5 ± 1 µm), L/W = 1.7-2.8 (X = 2.1 ± 0.3), hyaline, yellowish, citriform, biapiculate, formed in straight or branched chains.

HABITAT AND DISTRIBUTION: Abies fraseri, Betula lutea, Fagus grandifolia; trunk; wood; possibly occasional.

REMARK: The perfect state of H. aureum is Botryobasidium aureum, which was described and found very rarely from Northern Europe. Reference materials TENN 46557 and 46623 have both perfect and imperfect states on a same fruitbody, where the imperfect conidial state predominates. Reference materials TENN 46556 and 46622 (Botryobasidium aureum) have navicularly ellipsoid spores which measure 6.4-8.8 x 2.6-3.4 um. Botryobasidium aureum has not been reported from the U.S. to this time.

7. Haplotrichum conspersum (Pers.) Holubová-Jechová. 1976. Ceská Mykol. 30:4.

≡ Acladium conspersum Persoon. 1822. Mycol. Eur. 1:28.

MACROMORPHOLOGY: Colony effused, yellowish white (1A2), pale yellow (1A3), pastel yellow (1A4), greenish gray (1B2), becoming white at margin, downy, tomentose, confluent, loosely interwoven, 0.1-0.2 mm

thick.

MICROMORPHOLOGY: Hyphae hyaline, subhyaline, septate, without clamps, commonly branched. Conidiophores (Figure 125, Appendix C) [11/1] 168-376 x 4.8-7.2 (near the apex) to 8.8-9.6 (near the base) µm (X = 238.2 ± 60.8 x 6.2 ± 0.9 to 9.1 ± 0.4 µm), erect, suberect, of uniform thickness, not branched, straight distally, often curved or flexuous at the base, composed of 2-10 cells; sporogenous teeth conspicuous, produced along the conidiophore, fewer toward the base. Conidia (Figure 124, Appendix C) [29/1] 13.6-20 x 11.2-15.6 µm (X = 16.5 ± 1.8 x 12.6 ± 0.9 µm), L/W = 1.1-1.8 (X = 1.3 ± 0.2), hyaline to yellowish, ellipsoid, ovoid, subglobose.

HABITAT AND DISTRIBUTION: *Picea rubens*; trunk; wood; rare.

REMARK: This species is morphologically stable (Linder, 1942) and easily distinguished by the conidiophores bearing conspicuous sporogenous teeth. Its perfect state is *Botryobasidium conspersum*, which is found rather commonly in Northern Europe (Eriksson and Ryvarden, 1973).

Subfamily Ceratobasidioideae

Key to Genera of Ceratobasidioideae

1. Basidia with 2 long sterigmata; spores not exhibiting repetition.. *Cerinomyces*
1. Basidia with 2-4 long sterigmata; spores exhibiting repetition.. *Hydrabasidium*

Cerinomyces Martin. 1949. Mycologia 41:82.

Basidiocarp annual, resupinate, ceraceous, even, somewhat tuberculate. Hyphal system monomitic. Hyphae hyaline, thin-walled, with clamps. Basidia narrowly clavate, with two long sterigmata. Basidiospores hyaline, ellipsoid, allantoid, smooth, not amyloid, not germinating by repetition.

REMARK: Because of its forked basidia, this genus previously has been placed in the Dacrymycetaceae (Martin, 1952) but now is believed to link the Corticiaceae and the Dacrymycetaceae (Eriksson and Ryvarden, 1973). The ceraceous fruitbody, thickening hymenium, and non-septate spores delimit this genus from the Dacrymycetaceae.

1. Cerinomyces pallidus Martin. 1949. Mycologia 41:83.

MACROMORPHOLOGY: Basidiocarp effused, yellowish orange (4B7, 4B8), grayish yellow (4B6, 4C6, 4C7), dark yellow (4C8), pruinose, then ceraceous, smooth, sparsely marked with inconspicuous tubercles, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae 1.8-3.6 µm diam, thin-walled, with clamps, frequently branched. Basidia (Figure 45, Appendix C) [8/1] 8-9.6 x 3.2-4.8 µm (X = 8.7 ± 0.7 x 4.5 ± 0.6 µm), L/W = 1.7-3 (X = 2 ± 0.5), narrowly clavate, with two large sterigmata; sterigmata 6.4-9.6 um long, obtuse or acute. Basidiospores (Figure 44, Appendix C) [12/1] 5.6-8.8 x 2.4-4 µm (X = 6.8 ± 1 x 3.1 ± 0.6 µm), L/W = 1.8-2.7 (X = 2.3 ± 0.3), cylindrical, allantoid.

HABITAT AND DISTRIBUTION: Betula lutea; twig; wood; rare.

REMARK: The specimen (TENN 46460) collected from the research area seems to be very old. Its microscopic structures are obscured by dense yellowish brown granules.

Hydrabasidium Parker-Rhodes: Eriksson et Ryvarden in Eriksson, Hjortstam, and Ryvarden. 1978. Cort. N. Europe 5:896.

Basidiocarp annual, resupinate, even, hypochnoid, becoming submembranous. Hyphal system monomitic. Hyphae hyaline, colored, thin-walled, with clamps. Basidia clavate, with 2-4 sterigmata. Basidiospores hyaline, subhyaline, subglobose, ovoid, smooth, not amyloid, germinating by repetition.

REMARK: As the spores germinate by repetition and produce secondary spores, this genus exhibits some nature which heterobasidiomycetes have, and moreover, adventitious septa occur in the sterigmata. But now both features are often found in the Corticiaceae.

1. Hydrabasidium subviolaceum (Peck) Eriksson et Ryvarden in Eriksson, Hjortstam, and Ryvarden. 1978. Cort. N. Europe 5:897.

≡ Hypochnus subviolaceus Peck. 1894. Ann. Rep. St. Bot. p. 25.

MACROMORPHOLOGY: Basidiocarp effused, pale, then grayish brown (7D3, 7E3, 7F3), hypochnoid, then submembranous, smooth, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 153, Appendix C) 2.4-4 µm diam, hyaline, then fuscous, thin-walled, with clamps, copiously branched from clamps, not differentiated between subhymenium and subiculum. Basidia (Figure 152, Appendix C) [10/1] 14.4-33.6 x 6.4-10.4 µm (X = 22.1 ± 5.8 x 8.4 ± 1.3 µm), clavate, obpyriform, with 2-4 large sterigmata; sterigmata arcuate, septate, 8.8-16.8 µm long. Basidiospores (Figure 151, Appendix C) [18/1] 5-8 x 4.8-7.2 µm (X = 6.5 ± 1 x 5.7 ± 0.9 µm), L/W = 1-1.7 (X = 1.2 ± 0.2), hyaline or

somewhat brownish, subglobose, ovoid.

HABITAT AND DISTRIBUTION: *Picea rubens*; exposed root; root bark; rare.

REMARK: This is the only fungus found on a living host from the research area. It has unique and conspicuous sterigmata. They are at first rather short and obtuse and then become elongated and subulate. They are regularly septate at the base and again in the middle when mature. Their upper part seems to be evanescent and often becomes withered or broken off. Genera with septate sterigmata were once referred to tulasnellaceous fungi, but it is now known that adventitious septation of sterigmata is a common phenomenon in the Aphyllophorales when the sterigmata are large and voluminous enough as in the species of *Hyphoderma*, *Hypochnicium*, and *Tomentella* (Eriksson, Hjortstam, and Ryvarden, 1978).

Subfamily Gloeocystidielloideae

Gloeocystidiellum Donk emend. Donk. 1956. Fungus 26:8.

Basidiocarp annual or perennial, resupinate, soft and ceraceous when fresh, firm, membranous, to corneous when dry, adnate, thin to thick; hymenial surface smooth to tuberculate, often cracked. Hyphal system monomitic. Hyphae distinct or indistinct, hyaline, usually thin-walled, septate, (with or) without clamps, loosely or densely interwoven. Gloeocystidia vesicular or cylindrical, usually submerged, positive or negative to sulfobenzaldehyde. Basidia narrowly clavate, normally with 4 sterigmata. Basidiospores hyaline, varying in size and shape, smooth (or verruculose), amyloid.

REMARK: This genus is characterized by the presence of gloeocystidia and the amyloidity of spores. These two characters alone may not be sufficient to provide a generic basis. Moreover, varying fruitbody features, gloeocystidial characters, hyphal texture, and spore characters render this genus somewhat heterogeneous (Eriksson and Ryvarden, 1975).

The reaction of gloeocystidia to sulfobenzaldehyde is an important criterion in this genus. Between two species from the research area, G. citrinum shows a negative reaction while G. ochraceum a positive reaction.

Key to Species of Gloeocystidiellum

1. Spores globose; gloeocystidia vesicular........... 1. G. citrinum
1. Spores ellipsoid; gloeocystidia cylindrical...... 2. G. ochraceum

1. Gloeocystidiellum citrinum (Pers.) Donk. 1956. Fungus 26:9.

≡ Thelephora citrina Persoon. 1822. Mycol. Europ. 1:136.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, then confluent, bright in color, yellowish white (3A2, 4A2), pale yellow (3A3, 4A3), to light yellow (4A4), soft ceraceous when fresh, somewhat membranous when dry, adnate, 0.1-0.2 mm thick; hymenial surface smooth, sometimes somewhat cracked; margin white, fibrillose, fimbriate, often narrowed into slender hyphal strands, 2 mm wide.

MICROMORPHOLOGY: Hyphae thin-walled, septate, without clamps, with somewhat parallel hyphae of varying width in the subiculum, loosely interwoven when young, densely interwoven and copiously branched especially in the subhymenium when mature, 1.6-3.2 µm diam.

Hymenium crowded with gloeocystidia, basidia, and paraphysoid hyphae. Gloeocystidia (Figure 108, Appendix C) 48-88 x 9.6-15.2 µm, numerous, vesicular, tapering to the apex, thin-walled, with watery contents, sulfo-negative, occurring throughout all tissues, more vesicular in the subiculum, narrower in the subhymenium, prolonged in the hymenium, usually submerged. Paraphysoid hyphae (Figure 107, Appendix C) 2-4 µm diam, numerous, slender, often branched. Basidia (Figure 107, Appendix C) [12/2] 40-54.4 x 5.6-9.2 µm (X = 47.1 ± 4.7 x 7.1 ± 1.2 µm), L/W = 5-9.7 (X = 6.9 ± 1.3), narrowly clavate, sterigmata (2-)4, prominent, 4-5.6 µm long. Basidiospores (Figure 106, Appendix C) [16/1] 4.8-5.8 x 3.8-5.6 µm (X = 5.5 ± 0.3 x 4.5 ± 0.6 µm), L/W = 1-1.4 (X = 1.2 ± 0.1), globose to subglobose, with a distinct oblique or lateral apiculus, smooth, with one or more oil drops, amyloid.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri; trunk, stump; wood, moss-covered wood, moss-covered bark; uncommon.

REMARK: Thanks to the bright color and the fimbriate margin, this species is easily checked. TENN 46412 agreed with G. citrinum but had different spore dimension (6-8 x 4.2-6.4 um), and it is possible that this species may vary in spore size.

Larsen and Burdsall (1976) evaluated sulfuric benzaldehyde in testing gloeocystidia and concluded that it reacted inconsistently with gloeocystidia and gave an unreliable result. But G. citrinum, having no granular contents, constantly gave negative reaction.

2. Gloeocystidiellum ochraceum (Fr.) Donk. 1956. Fungus 26:9.

≡ Thelephora ochracea Fries. 1821. Syst. Mycol. 1:446.

MACROMORPHOLOGY: Basidiocarp effused, broadly confluent, at

first yellowish white (3A2, 4A2), soon pale yellow (4A3) to light yellow (4A4), later light orange (5A4, 5A5) to grayish orange (5B4, 5B5, 5B6), ceraceous when fresh, hard and corneous when dry, closely adnate when young, somewhat released at margin when old, thin to thick, up to 3 mm thick; hymenial surface smooth, then uneven with small tubercles, deeply rimose with age; context layered with numerous, narrow, brown bands; margin pruinose and thinning outward when young, short fibrillose to almost entire with age, much thickened and rounded when old; smell strong, stereoid.

MICROMORPHOLOGY: Hyphae 2.4-3.6 µm diam, thin- to somewhat thick-walled, septate, without clamps or occasionally with clamps (cf. Figure 112, Appendix C) in the margin; main context vertical, parallel, densely agglutinated or united in a pseudoparenchymatous tissue, stratified due to repeated (perennial) growth. Gloeocystidia (Figure 111, Appendix C) 36-64 x 4-5.2 µm, numerous when young, rare when old, cylindrical, often sinuous, somewhat to rather thick-walled (wall 0.8-1.2 µm thick), with granular oily contents, sulfo-positive, submerged or little projecting. Basidia (Figure 110, Appendix C) [8/1] 16.8-21.6 x 3.6-4.8 µm ($\bar{X}$ = 18.7 $\pm$ 1.5 x 4.1 $\pm$ 0.4 µm), L/W = 3.7-5.4 ($\bar{X}$ = 4.6 $\pm$ 0.5), subclavate, best seen where gloeocystidia are sparse; sterigmata 4, 2.4-3.2 µm long. Basidiospores (Figure 109, Appendix C) [26/1] 4.8-6.6 x 2-2.4 µm ($\bar{X}$ = 5.7 $\pm$ 0.5 x 2.2 $\pm$ 0.2 µm), L/W = 2-3 ($\bar{X}$ = 2.6 $\pm$ 0.3), narrowly ellipsoid, smooth, amyloid.

CULTURAL CHARACTERS: Growth rate very fast; advancing zone appressed; marginal hyphae distant, finely fimbriate; aerial mycelium almost absent to inconspicuously farinaceous; colony white.

Generative hyphae 2-7.2 µm diam, thin- to rather thick-walled, septate without clamps or often with clamps commonly whorled, copiously branched, sometimes inequivalently branched.

Code: 1, (2), 3, (5), (6), 13, 14, 16, (18), 30, (39), (40), (41), 45, 48, (50), 52, 53, 54, 83, 89.

HABITAT AND DISTRIBUTION: *Betula lutea*; log; moss-covered cut wood; rare.

REMARK: This species was reportedly restricted to conifers with a few exceptions on *Quercus* and *Castanea* (Freeman, 1978), but TENN 46216 was collected on *Betula* from the research area. It is notable that American specimens have narrower spores than those described by Eriksson and Ryvarden (1975; 4.5-6 x 3-3.5 um). Specimens of *G. sulcatum* from India (TENN; Rattan, 1977) agree with *G. ochraceum* in all respects and are possibly conspecific with *G. ochraceum* (Freeman, 1978).

Subfamily Hyphodermoideae

Key to Genera of Hyphodermoideae

1. Hyphal system dimitic, with skeletal hyphae in the core of odontoid hymenophore.......................... *Fibrodontia*
1. Hyphal system monomitic throughout.............................. 2
    2. Basidiospores <6 µm long.......................... *Hyphodontia*
    2. Basidiospores >6 µm long.................................. 3
3. Basidiospores subglobose to broadly ellipsoid, thick-walled, smooth to asperulate........................ *Hypochnicium*

3. Basidiospores cylindrical to ellipsoid, thin-walled, smooth...*Hyphoderma*

Fibrodontia Parmasto. 1968. Consp. Syst. Cort. p. 174.

Basidiocarp annual, resupinate, subceraceous, fibrous when dry, adnate; hymenial surface odontoid; margin fimbriate, downy, then byssoid. Hyphal system (pseudo-)dimitic. Generative hyphae hyphodontoid, hyaline, thin-walled, with clamps, copiously branched; skeletal hyphae consisiting of the aculeal core, hyaline, rahter thick-walled, aseptate. Basidia subclavate to suburniform, with 4 sterigmata. Basidiospores hyaline, ellipsoid to ovoid, smooth, not amyloid.

REMARK: Compared with other genera, *Fibrodontia* has a close relationship with *Hyphodontia* (Corticiaceae) and *Schizopora* (Polyporaceae). The slight difference is that the species of *Hyphodontia* have a monomitic hyphal system throughout the fruitbody and the species of *Schizopora* a firmer and more or less poroid fruitbody (Eriksson, Hjortstam, and Ryvarden, 1981). Parmasto (1968) placed the genus *Fibrodontia* in his new family Steccherinaceae, but this family seems to be superfluous and overlap the delimitation of the Polyporaceae to some extent. In this dissertation, the genus *Fibrodontia* is retained in the Corticiaceae because of its more hyphodontoid hyphal system and the genus *Schizopora* in the Polyporaceae because of its more polyporoid fruitbody nature.

1. *Fibrodontia gossypina* Parmasto. 1968. Consp. Syst. Cort. p. 207.

MACROMORPHOLOGY: Basidiocarp effused, pale yellow (4A3) to

light yellow (4A4), often with a grayish yellow (4B3) tint, yellowish white (4A2) at the margin, subceraceous when fresh, firmer and fibrous when dry, adnate, 0.1 mm thick; hymenial surface odontoid, with dense and short aculei; aculei up to 1 mm long, crowded, initially conical, then cylindrical, flattened, or often united at the base to form plates, acute, lacerate, or split, apically penicillate due to projecting hyphae; margin often indistinct, determinate with age, pruinose, fimbriate, or downy, later byssoid.

MICROMORPHOLOGY: Hyphae somewhat loosely intertwined. Generative hyphae (Figure 85, Appendix C) 1.6-2.4 µm diam, hyphodontoid, consisting of the hymenium and interweaving between skeletal hyphae, thin-walled, with clamps, copiously branched; skeletal hyphae (Figure 86, Appendix C) 2.2-3.2 µm diam, developed from generative hyphae in the subiculum, consisting of the aculeal core, somewhat to moderately thick-walled, aseptate, not branched, flexuose, somewhat resembling the cystidia of *Hyphodontia abieticola* at the hyphal end. Basidia (Figure 84, Appendix C) [7/1] 14.4-18.4 x 3.6-5.6 µm (X = 16.8 ± 1.5 x 4.7 ± 0.7 µm), L/W = 2.9-4.6 (X = 3.6 ± 0.7), subclavate to suburniform, with 4 sterigmata. Basidiospores (Figure 83, Appendix C) [14/1] 4.2-5.4 x 3.2-4.4 µm (X = 4.9 ± 0.3 x 4 ± 0.4 µm), L/W = 1.1-1.4 (X = 1.2 ± 0.1), broad ellipsoid to ovoid.

HABITAT AND DISTRIBUTION: *Fagus grandifolia*; trunk; wood; rare.

Hyphoderma Wallroth. emend. Donk. 1957. Fungus 27:13.

Basidiocarp annual, resupinate, ceraceous, adnate, thin to thickening; hymenial surface smooth, tuberculate, or odontoid. Hyphal

system monomitic. Hyphae hyaline, mostly thin-walled, with clamps; subicular hyphae usually distinct, frequently branched; subhymenial hyphae crowded, densely branched. Cystidia present in most species, differing in shape and nature, projecting or submerged, often encrusted. Basidia comparatively large, narrowly clavate, constricted or sinuous, with (2-)4 somewhat curved sterigmata. Basidiospores usually large, hyaline, ellipsoid, cylindrical, or allantoid, smooth, with oil drops in the plasm, not amyloid.

REMARK: This genus is admittedly heterogeneous, and its generic delimitation is not clear (Eriksson and Ryvarden, 1975). Many species differ in one way or another from what should be expected for the genus. Nevertheless, it is usually easy to recognize this genus by the help of the size and shape of its cystidia, basidia, and spores.

Key to Species of Hyphoderma

1. Cystidia septate with clamps.................... 3. *H. setigerum*
1. Cystidia not septate.. 2
   2. Cystidia strongly encrusted (metuloid), thick-walled, subulate................................ 2. *H. puberum*
   2. Cystidia normally not encrusted, thin-walled, fusiform..... 3
3. Spores ellipsoid............................... 4. *H. tsugae*
3. Spores cylindrical or allantoid.................. 1. *H. pallidum*

1. *Hyphoderma pallidum* (Bres.) Donk. 1957. Fungus 27:15.

   ≡ *Corticium pallidum* Bresadola. 1898. Fung. Trid. 2:59.

   MACROMORPHOLOGY: Basidiocarp effused, white to orange white

(5A2), pruinose to farinose, dotted with brown excretion (lens 50X), adnate, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 187, Appendix C) 2.6-4 µm diam, somewhat thick-walled, with rather small clamps, copiously branched and closely interwoven. Cystidia (Figure 185, Appendix C) 56-80 x 7.2-10.4 µm, abundant, fusiform, obtuse to acute, sometimes sinuous, thin- to somewhat thick-walled (wall up to 1.2 µm thick), often encrusted at the apex, projecting up to 36 µm; capitate cystidioles (Figure 186, Appendix C) present in the hymenium and the subiculum, 12-15.2 µm wide at the apex, bearing brown resinous excretion. Basidia (Figure 184, Appendix C) [5/1] 22.4-32.8 x 4.8-6.8 µm (X = 28.6 $\pm$ 4.2 x 5.7 $\pm$ 0.9 µm), L/W = 3.3-6.7 (X = 5.2 $\pm$ 1.4), narrowly clavate, with (2-)4 sterigmata. Basidiospores (Figure 183, Appendix C) [20/1] 5.6-8.8 x 3.2-4.2 µm (X = 7.4 $\pm$ 0.8 x 3.8 $\pm$ 0.3 µm), L/W = 1.4-2.5 (X = 2 $\pm$ 0.3), cylindrical or allantoid.

HABITAT AND DISTRIBUTION: Abies fraseri; trunk; wood; rare.

2. Hyphoderma puberum (Fr.) Wallroth. 1833. Fl. Crypt. Germ. P. 576.

≡ Thelephora pubera Fries. 1828. Elench. Fung. 1:215.

MACROMORPHOLOGY: Basidiocarp effused, in small patches, then extensively confluent, at first light yellow (4A3), yellowish gray (4B2), grayish yellow (4B3, 4B4, 4B5), then grayish orange (5B6, 6B6) to brownish orange (5C6, 6C6), rarely grayish magenta (13C3, 13C4, 13C5), smooth, finely velutinous from numerous projecting cystidia, soft when fresh, ceraceous when dry, adnate, 0.1-0.2 mm thick; margin pruinose, finely fibrillose, or almost entire.

MICROMORPHOLOGY: Hyphae (Figure 191, Appendix C) 2.8-4 µm

diam, relatively thin-walled, with clamps, copiously branched, somewhat loose next to the substrate, densely united into an almost pseudoparenchymatic structure in the subhymenium. Hymenium crowded by numerous projecting cystidia. Cystidia (Figure 190, Appendix C) abundant, (48-)60-124 x 10.4-20(-28) µm, tapering to the acute apex, at first thin-walled and naked, soon much thick-walled (wall up to 4 µm thick) and heavily encrusted (metuloid), strongly projecting up to 60 µm but submerged in the subhymenium layer with time. Gloeocystidia rarely present in the hymenium, vesicular, 36-40 x 10-14 µm. Basidia (Figure 189, Appendix C) [5/1] 24-34.4 x 5.2-7 µm (X = 29 ± 4.2 x 6.1 ± 0.7 µm), L/W = 4-6.6 (X = 4.8 ± 1.1), narrowly clavate, often somewhat constricted, with 4 sterigmata. Basidiospores (Figure 188, Appendix C) [30/1] (6-)6.4-11.2(-12) x 2.6-5.6 µm (X = 9.1 ± 1.6 x 3.8 ± 0.5 µm), L/W = 1.3-4 (X = 2.5 ± 0.7), cylindrical or narrowly ellipsoid.

HABITAT AND DISTRIBUTION: *Betula lutea*; trunk; wood; rare.

REMARK: The numerous metuloid cystidia readily distinguish this species from the others of the genus. This species was found partly overgrown by a resupinate jelly fungus. The two fungi were very similar in appearance, and it appeared watery and magenta in color in the field where they grew together.

3. *Hyphoderma setigerum* (Fr.) Donk. 1957. Fungus 27:15.

≡ *Thelephora setigera* Fries. 1828. Elench. Fung. 1:208.

MACROMORPHOLOGY: Basidiocarp effused, orbicular and confluent, white, yellowish white (2A2, 3A2, 4A2), to pale yellow (3A3, 4A3), light yellow (4A4), to grayish yellow (4B3), smooth, finely

tuberculate with semiglobose papillae, to odontoid with short conical aculei, subceraceous to ceraceous, adnate, 0.1-0.2 mm thick; aculei 0.2 mm long, dense, apically pilose from projecting cystidia; margin pruinose, farinose, or fimbriate, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 195, Appendix C) 3-4.6 µm diam, distinct, thin- to somewhat thick-walled (wall up to 1.2 µm thick), with clamps, sparsely branched and loosely interwoven in the subiculum, densely branched and closely matted in the subhymenium. Cystidia (Figure 194, Appendix C) 76-224(-360) x 7.2-12.8 µm, common, conspicuous, cylindrical, regularly septate, usually with clamps, obtuse or papillose, thick-walled (wall up to 1.6 µm thick) except the apical cell, at first naked, then often encrusted with pyramidal crystals, strongly projecting up to 92 µm. Basidia (Figure 193, Appendix C) [11/2] 19.2-28 x 4-7.2 µm (X = 23.4 ± 2.9 x 5 ± 1.3 µm), L/W = 3.8-6.2 (X = 4.9 ± 0.8), clavate to narrowly clavate, with 4 sterigmata. Basidiospores (Figure 192, Appendix C) [45/6] 7.2-12.8 x 3-4.4 µm (X = 9.3 ± 1.5 x 3.6 ± 0.3 µm), L/W = 1.6-3.6 (X = 2.6 ± 0.4), cylindrical to suballantoid.

HABITAT AND DISTRIBUTION: _Abies fraseri_, _Picea rubens_, _Fagus grandifolia_, unknown hardwood; trunk, log, twig; bark, wood, broken wood; common.

REMARK: This species has a great variation in both macro- and micromorphology depending on the age of fruitbodies and the influences of environment, so it is considered as a form complex rather than a species taxon (Eriksson and Ryvarden, 1975). This species is, however, easily recognized thanks to the huge septate cystidia.

4. Hyphoderma tsugae (Burt) Eriksson et Strid. 1975. Cort. N. Europe 3:541.

≡ Corticium tsugae Burt. 1926. Ann. Miss. Bot. Gard. 13:276.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, brownish orange (5C5, 5C6), smooth, marked with dots of brown excretion (lens 50X), ceraceous, adnate, less than 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 199, Appendix C) 2.2-4 µm diam, thin-walled, with relatively small clamps, copiously branched and densely interwoven, often obscured by brown resinous excretion (Figure 199, Appendix C). Cystidia (Figure 198, Appendix C) of two kinds, thin-walled; fusiform cystidia 40-44 x 5.6-7.2 µm, uncommon, mostly acute, projecting up to 28 µm; capitate cystidia 24-32 x 5.6-7.2 µm, common, somewhat submerged, apically surrounded by brown resinous excretion. Basidia (Figure 197, Appendix C) [9/1] 22.4-28 x 4.8-6.8 µm (X = 25.4 ± 2.2 x 5.8 ± 0.6 µm), L/W = 3.8-4.7 (X = 4.4 ± 0.3), clavate, slightly constricted, with (2-)4 sterigmata. Basidiospores (Figure 196, Appendix C) [22/1] 6-9.2 x 3.2-4.6 µm (X = 7.3 ± 0.9 x 4 ± 0.3 µm), L/W = 1.5-2.3 (X = 1.8 ± 0.2), ellipsoid, adaxially straight or convex.

HABITAT AND DISTRIBUTION: Abies fraseri; stump; moss-covered bark; rare.

REMARK: This species was identified and noted not common by Gilbertson (personal communication). Its type was reported on rotten wood of Tsuga canadensis in New Hampshire (Burt, 1926). In Sweden, it was found only once on stump in Pinus silvestris forest (Eriksson and Ryvarden, 1975).

Hyphodontia John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 101.

Basidiocarp annual, resupinate, soft and fibrous when fresh, more tough and friable when dry, adnate, thin; hymenial surface smooth, finely tuberculate, to odontoid; aculei small, conical or cylindrical, apically pilose or penicillate from projecting cystidia; margin usually not differentiated. Hyphal system monomitic. Hyphae distinct, usually hyaline, with clamps, somewhat loosely interwoven, principally branched from clamps or opposite clamps, cyanophilous; subicular hyphae somewhat thick-walled, frequently branched; subhymenial hyphae thinner and denser. Cystidia varying in shape and nature, little differentiated from sterile hyphal ends, hyphoid, differentiated, or conspicuous with thick walls, often of two kinds. Basidia small to medium in size, subclavate to subcylindrical, with a suburniform constriction, with 4 sterigmata. Basidiospores hyaline, varying in shape, frequently subglobose to ellipsoid, smooth, not amyloid.

REMARK: This genus is recognized by the nature of hyphae. Its hyphae are very distinct, somewhat loosely interwoven, moderately thick-walled and cyanophilous, and typically branched from clamps or (just below from) opposite clamps. Differentiation of cystidia varies from almost simple hyphal ends to conspicuous tubular cystidia. When the cystidia are little differentiated form hyphal ends, they can be called rather cystidioles. But there are so many intermediate cystidial forms that it seems to be hard to delimit between cystidia and cystidioles in the genus *Hyphodontia*. Such cystidial forms, as well as true cystidia, are all called merely cystidia in this

dissertation. The fibrous texture of Hyphodontia spp. is due to its thickened hyphal walls and is not ceraceous to the same degree as in other genera.

Key to Species of Hyphodontia

1. With lagenocystidia.. 2
1. Without lagenocystidia... 3
   2. Hymenial surface smooth to somewhat tuberculate
      .... 2. H. alutaria
   2. Hymenial surface odontoid....................... 3. H. arguta
3. Hymenial surface odontoid, compact and visible between the
   aculei.. 4. H. aspera
3. Hymenial surface smooth, tuberculate, to odontoid, loose
   or porous between the aculei.................................. 4
   4. Cystidia thick-walled, tubular.............. 1. H. abieticola
   4. Cystidia comparatively thin-walled, cylindrical........... 5
5. Hymenial surface smooth to somewhat tuberculate.. 6. H. pallidula
5. Hymenial surface odontoid.. 6
   6. Texture soft and farinose................... 5. H. breviseta
   6. Texture dense and ceraceous.............. 7. H. verruculosa

1. Hyphodontia abieticola (Bourd. et Galz.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

≡ Odontia barba-jovis ssp. abieticola Bourdot et Galzin. 1928. Hym. de France p. 426.

MACROMORPHOLOGY: Basidiocarp effused, pale yellow (3A3, 4A3), light yellow (4A4), or grayish yellow (4B3, 4B4), soft and thin,

easily squeezed, adnate, 0.1-0.3 mm thick; hymenial surface porous-floccose to odontoid with small conical aculei, porous-reticulate between the aculei; aculei dense, apically penicillate; margin arachnoid to byssoid, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 203, Appendix C) 2.4-3.4 µm diam, somewhat thick-walled in the subiculum, with clamps, copiously branched. Cystidia (Figure 202, Appendix C) 104-184 x 5.2-8 µm, numerous, conspicuous, tubular, straight, sometimes sinuous, sometimes secondarily simple-septate, constricted once or twice near the apex, obtuse, thick-walled (wall up to 2.4 µm thick) except the apex, projecting one third to one half the length (up to 64 µm). Basidia (Figure 201, Appendix C) [8/1] 17.6-24 x 3.6-5 µm (X = 20 ± 2.4 x 4.7 ± 0.4 µm), L/W = 3.7-5.6 (X = 4.3 ± 0.7), at first clavate, then subclavate, slightly constricted, with 4 somewhat long (up to 4 µm) sterigmata. Basidiospores (Figure 200, Appendix C) [18/1] 4-5.6 x 2.4-3.8 µm (X = 4.9 ± 0.5 x 3.2 ± 0.4 µm), L/W = 1.3-1.9 (X = 1.5 ± 0.2), ellipsoid, adaxially straight.

HABITAT AND DISTRIBUTION: *Picea rubens*; butt; wood; rare.

REMARK: With *H. alienata* and *H. barba-jovis*, which have not yet been found from the research area, this species belongs to the species group of *Hyphodontia* with conspicuous tubular cystidia.

2. *Hyphodontia alutaria* (Burt) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

≡ *Peniophora alutaria* Burt. 1925. Ann. Miss. Bot. Gard. 12:332.

MACROMORPHOLOGY: Basidiocarp effused, broadly or extensively confluent, yellowish white (4A2), pale yellow (3A3, 4A3), light yellow

(4A4, 4A5), or grayish yellow (4B3, 4B4), soft and subceraceous when young, firmer and ceraceous when old, adnate, 0.1 mm thick; hymenial surface smooth to finely tuberculate with semiglobose papillae; margin pruinose, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 208, Appendix C) 2.4-4 µm diam, yellowish in the subiculum, somewhat thick-walled, with clamps, copiously branched. Cystidia of two kinds, both abundant; capitate cystidia (Figure 206, Appendix C) 48-72 x 4-6(-7.2) µm, hyphoid, frequently septate with clamps, with rounded head often encrusted with crystals, with intercalary dilations and constrictions, moderately thick-walled (wall up to 1 µm thick), projecting up to 52 µm; lagenocystidia (Figure 207, Appendix C) 22.4-36.8 x 3-4.4(-5.2) µm, sagittate, ending in a needle-like tip provided with characteristic encrustation, slightly projecting up to 16 µm. Basidia (Figure 205, Appendix C) [12/5] 11.2-18.4 x 3.2-4.8 µm ($\bar{X}$ = 14.4 ± 2.5 x 4.1 ± 0.4 µm), L/W = 2.7-5.1 ($\bar{X}$ = 3.5 ± 0.7), subclavate to subcylindrical, constricted, sometimes sinuous, with 4 sterigmata. Basidiospores (Figure 204, Appendix C) [65/8] 3.8-5.6 x 2.4-4.2 µm ($\bar{X}$ = 4.6 ± 0.5 x 3.2 ± 0.3 µm), L/W = 1.1-1.9 ($\bar{X}$ = 1.4 ± 0.2), broadly ellipsoid, usually with an oil drop.

CULTURAL CHARACTERS: Growth rate delayed to slow; advancing zone appressed; marginal hyphae rather distant; aerial mycelium almost absent; colony translucent, white to cream. Generative hyphae (1-) 1.6-4.8 µm diam, thin- or somewhat thick-walled, septate with clamps, commonly branched, often inequivalently branched, sometimes moniliform.

Code: 1, 3, (9), (10), 13, (14), 16, 30, (31), (36), 39, 45, (50), (51), 52, 53, 79, 90.

HABITAT AND DISTRIBUTION: Abies fraseri, Picea rubens; trunk, log; wood, bark; frequent.

REMARK: This species sometimes grows extensively and covers the whole trunk of decorticated trees (e.g. TENN 46424 and 46526). TENN 46370 overlapped a myxomycete, Ceratiomyxa fruticulosa, and TENN 46498 with Hyphodontia breviseta (TENN 46230).

3. Hyphodontia arguta (Fr.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

≡ Hydnum argutum Fries. 1821. Syst. Mycol. 1:424.

MACROMORPHOLOGY: Basidiocarp effused, broadly confluent, white, grayish yellow (2B3), to dull yellow (3B3), soft and thin, easily squeezed, adnate, 0.1 mm thick; hymenial surface odontoid with small aculei, porose-reticulate between the aculei; aculei up to 0.5 mm long, dense, varying in shape, conical, cylindrical, or irregular, often flattened or raduloid by lateral fusion of aculei on sloping substrate, acute, obtuse, split, or cristate, apically penicillate; margin pruinose, thinning outward, somewhat determinate when mature.

MICROMORPHOLOGY: Hyphae (Figure 213, Appendix C) 2-3.2(-3.6) µm diam, somewhat thick-walled, with clamps, sparsely branched and usually straight in the aculeal trama, frequently branched and intertwined in the subiculum, denser and thinner in the subhymenium. Cystidia of two kinds, both very common; capitate cystidia (Figure 211, Appendix C) 32-52 x 3.8-4.8 µm, similar to sterile hyphal ends, often with intercalary enlargements, sometimes encrusted at the apex,

projecting up to 36 µm; lagenocystidia (Figure 212, Appendix C) 23.2-33.6 x 3.2-4.6 µm, sagittate, ending in a needle-like tip, uniquely encrusted at the tip, slightly projecting up to 20 µm. Basidia (Figure 210, Appendix C) [6/1] 13.6-15.2 x 3.2-4 µm (X = 14.4 ± 0.7 x 3.5 ± 0.3 µm), L/W = 3.4-4.5 (X = 4.1 ± 0.4), clavate, then subcylindrical with a constriction. Basidiospores (Figure 209, Appendix C) [16/1] 4.4-6 x 2.8-3.6 µm (X = 5 ± 0.5 x 3.3 ± 0.2 µm), L/W = 1.4-1.7 (X = 1.5 ± 0.1), broadly ellipsoid or ovoid, with one or two oil drops.

HABITAT AND DISTRIBUTION: _Betula_ _lutea_; log; cut wood; rare.

REMARK: Cystidia of this species agree with those of _H. alutaria_, but morphologically, fruitbodies differ in their odontoid hymenophore.

4. _Hyphodontia_ _aspera_ (Fr.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

≡ _Grandinia_ _aspera_ Fries. 1874. Hym. Eur. p. 627.

MACROMORPHOLOGY: Basidiocarp effused, yellowish white (2A2, 3A2), white at margin, soft, loosely membranous, adnate, 0.1 mm thick; hymenial surface somewhat smooth, then odontoid with small aculei, compact between the aculei; aculei up to 0.8 mm long, sparse, becoming dense, 2/mm to 3-4/mm, conical, subulate, to subcylindrical, often flattened and spathulate, acute, obtuse, or incised, apically pilose; margin pruinose, thinning outward, more determinate with age.

MICROMORPHOLOGY: Hyphae (Figure 217, Appendix C) 2-2.4(-2.8) µm diam, somewhat thick-walled, with clamps, sparsely branched and rather straight in the aculeal trama; copiously branched and

intertwined in the subiculum, denser and thinner and somewhat perpendicular to the surface in the subhymenium, fairly constant in width. Cystidia (Figure 216, Appendix C) 22.4-28 x 2-4 µm, similar to sterile hyphal ends, common, varying in shape, subulate, capitate, or somewhat torulose, sometimes encrusted around the apex, often slightly projecting about 10 um. Basidia (Figure 215, Appendix C) subclavate, then [10/1] 15.2-17.6 x 3.6-4.8 µm (X = 16.2 $\pm$ 0.9 x 4.1 $\pm$ 0.3 µm), L/W = 3.6-4.6 (X = 4 $\pm$ 0.3), subcylindrical with a constriction, with 2-4 sterigmata. Basidiospores (Figure 214, Appendix C) [12/1] 4.4-5.2 x 3-4.4 µm (X = 4.7 $\pm$ 0.3 x 3.6 $\pm$ 0.4 µm), L/W = 1.1-1.5 (X = 1.3 $\pm$ 0.2), broadly ellipsoid or ovoid, usually with an oil drop.

CULTURAL CHARACTERS: Growth rate delayed to slow; advancing zone appressed; marginal hyphae rather distant; aerial mycelium almost absent to downy, or locally farinaceous; colony translucent, white to cream. Generative hyphae (1.2-)1.6-4.8 µm diam, thin- or somewhat thick-walled, with clamps, copiously branched, often with many short branches, often with moniliform inflations; allocysts sometimes present, 5.4-8 µm wide; gloeoplerous hyphae irregularly swollen.

Code: 1, 3, (9), (10), 13, (14), 16, (17), (18), 30, (31), 39, (44), 45, (51), 52, 53, (54), 61, (73), (75), (78), 79, 80, 83, 90.

HABITAT AND DISTRIBUTION: *Abies fraseri*; log; wood; rare.

REMARK: Microscopically, this species is readily recognized by the distinct aculei and the visible compact surface between the aculei. *Hyphodontia aspera* comes very close to *H. breviseta*, but the latter has slightly smaller spores and more differentiated cystidia. Reference materials TENN 46567, 46568, 46612, and 46628 have slightly

larger spores (4.6-5.8 x 3.2-4 um) than those of collections from the research area.

5. Hyphodontia breviseta (Karst.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

≡ Kneiffia breviseta Karsten. 1886. Hedw. 25:232.

MACROMORPHOLOGY: Basidiocarp effused, conspicuously confluent, white, yellowish white (2A2, 3A2, 4A2), pale yellow (2A3, 3A3, 4A3), pastel yellow (3A4), light yellow (4A4, 4A5), yellowish gray (3B2, 4B2), dull yellow (3B3, 3B4), or grayish yellow (4B3, 4B4, 4B5, 4B6), light orange (5A4) to grayish orange (5B4) when infected by a hyphomycete, soft and thin, easily squeezed, adnate, 0.1 mm thick; hymenial surface farinose, porose-floccose, soon odontoid with small aculei, porose-reticulate between the aculei; aculei 0.1-0.4 mm long, dense, conical, papillose, often with several aculei united or accumulated into compound forms, apically pilose or penicillate, margin pruinose, thinning outward.

MACROMORPHOLOGY: Hyphae (Figure 222, Appendix C) 2.4-4.2 µm diam, somewhat thick-walled, frequently encrusted with numerous crystals, with clamps, copiously branched and intertwined. Cystidia of two kinds; capitate cystidia (Figure 220, Appendix C) 32-68 x 3.2-5.6 µm, similar to sterile hyphal ends, very common, often with intercalary enlargements, sometimes encrusted at the apex, projecting up to 28 µm; torulose cystidia (Figure 221, Appendix C) 32-64 x 4-4.8 um, submerged, uncommon. Basidia (Figure 219, Appendix C) [15/6] (11.2-)13.6-19.2 x 3.6-5 µm (X = 15.6 ± 1.5 x 4.2 ± 0.5 µm), L/W = 3.3-4.2 (X = 3.8 ± 0.3), clavate, then subcylindrical with a

constriction, with 4 sterigmata. Basidiospores (Figure 218, Appendix C) [122/12] (3.8-)4-5(-5.6) x 2.8-3.6(-4) µm (X = 4.5 ± 0.5 x 3.3 ± 0.4 µm), L/W = 1-1.7 (X = 1.4 ± 0.2), broadly ellipsoid, with one or two oil drops.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*, *Betula lutea*, *Fagus grandifolia*, *Rhododendron catawbiense*; trunk, stump, butt, twig, log; wood, bark, moss-covered bark; abundant.

REMARK: This species occurs everywhere throughout the research area and grows on wood and bark of conifers and also rarely on hardwoods. It causes a white rot and plays an important role in decomposition of wood remains. *Hyphodontia breviseta* is close to *H. aspera* in appearance. In general, the former has more farinose surface with crowded aculei, while the latter has a smoother surface with separate aculei. When fruitbodies of *H. breviseta* get old (e.g. TENN 46455, 46506, 46507 among the collections from the research area), they sometimes are infected by a hyphomycete state of a bitunicate ascomycete (Eriksson and Ryvarden, 1976) with pale brown fusiform conidia (8.8-12 x 3.8-4.2 um in size).

6. *Hyphodontia pallidula* (Bres.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 104.

  ≡ *Gonatobotrys pallidula* Bresadola. 1903. Ann. Mycol. 1:127.

MACROMORPHOLOGY: Basidiocarp effused, initially inconspicuous, broadly confluent, yellowish white (4A2), pale yellow (4A3), yellowish gray (4B2), to grayish yellow (4B3), finely pruinose, then continuous, adnate, less than 0.1 mm thick; hymenial surface smooth, finely tuberculate with age; margin pruinose, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 226, Appendix C) 1.8-3 µm diam, somewhat yellowish in the subiculum, thick-walled, with clamps, sparsely branched and mainly straight in the subiculum, denser and thinner in the subhymenium. Cystidia (Figure 225, Appendix C) 52-112 x 3.6-4.8 µm, numerous, hyphoid, usually septate with one or several small clamps, capitate or obtuse, straight or often crooked, with intercalary globose enlargements and constrictions, often encrusted at the apex, projecting up to 44 µm. Basidia (Figure 224, Appendix C) [4/1] 9.6-15.2 x 3.2-4 µm (X = 13 $\pm$ 2.4 x 3.5 $\pm$ 0.4 µm), L/W = 3-4.8 (X = 3.7 $\pm$ 0.8), rather small, clavate, then subcylindrical with a constriction, with 4 sterigmata. Basidiospores (Figure 223, Appendix C) [23/1] 3-4 x 2.2-3 µm (X = 3.5 $\pm$ 0.4 x 2.4 $\pm$ 0.2 µm), L/W = 1.2-1.8 (X = 1.5 $\pm$ 0.2), rather small, broadly ellipsoid or ovoid, usually with an oil drop.

HABITAT AND DISTRIBUTION: _Picea rubens_, _Abies fraseri_; trunk, log; wood; uncommon.

REMARK: This species is similar to _H. alutaria_. Compared with _H. alutaria_, _H. pallidula_ has smoother and paler fruitbodies and, microscopically, smaller spores and no (e.g. TENN 46410, 46436) or only a few lagenocystidia.

7. _Hyphodontia verruculosa_ John Eriksson & Hjortstam. 1976. Cort. N. Europe 4:681.

MACROMORPHOLOGY: Basidiocarp effused, white, yellowish white (4A2), pale yellow (4A3), to light yellow (4A4, 4A5), or grayish orange (5B6) to brownish orange (5C6), subceraceous to ceraceous, closely adnate, less than 0.1 mm thick; hymenial surface farinose,

porose-floccose, then odontoid with small aculei, often finely cracked into small polygons; aculei 0.1 mm or sometimes up to 0.4 mm long, densely crowded, conical, papillose, semiglobose, or irregular, often with several aculei accumulated into compound forms, apically fimbriate; margin variable, pruinose, farinose, fibrillose, to tomentose, usually rather determinate.

MICROMORPHOLOGY: Hyphae (Figure 230, Appendix C) 2.4-3.6 µm diam, somewhat thick-walled, with clamps, copiously branched, denser and thinner in the subhymenium. Cystidia (Figure 229, Appendix C) 16-32(-38.4) x 3.6-4.8 µm, similar to sterile hyphal ends, common, capitate, often encrusted at the apex, not projecting. Basidia (Figure 228, Appendix C) [8/1] 14.4-16 x 3.6-4.8 µm (X = 15.5 ± 0.6 x 4.3 ± 0.5 µm), L/W = 3-4.4 (X = 3.7 ± 0.5), subclavate, often constricted, with 4 sterigmata. Basidiospores (Figure 227, Appendix C) [23/1] 4-5.6 x 3-4 µm (X = 4.7 ± 0.5 x 3.4 ± 0.3 µm), L/W = 1.1-1.7 (X = 1.4 ± 0.2), broadly ellipsoid or ovoid, usually with an oil drop.

HABITAT AND DISTRIBUTION: *Betula lutea*; stump, twig; wood, broken wood, moss-covered bark; uncommon.

REMARK: Reference materials TENN 46613 and 46614 have fruitbodies which are finely cracked into small polygons and, as well as TENN 46572, somewhat larger spores which measure 5-6.2(-6.8) x 3-4.4(-4.8) um.

Hypochnicium John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 100.

Basidiocarp annual, resupinate, ceraceous, often membranous when dry, adnate, thin; hymenial surface smooth or finely tuberculate; margin usually not differentiated. Hyphal system monomitic. Hyphae

hyaline, thin- to somewhat thick-walled, with clamps. Cystidia usually present, subcylindrical, projecting or submerged, smooth. Basidia clavate to narrowly clavate, somewhat constricted (or often sinuous), with 4 sterigmata. Basidiospores hyaline, (globose to) ellipsoid, smooth (or verruculose), thick-walled, with oil drops, not amyloid, cyanophilous.

REMARK: Spores of Hypochnicium spp. have conspicuously thickened and cyanophilous walls and are easily recognized from those of Hyphoderma and Hyphodontia spp.

1. Hypochnicium geogenium (Bres.) John Eriksson. 1958. Symb. Bot. Upsal. 16:1, p. 101.

  ≡ Corticium geogenium Bresadola. 1903. Ann. Mycol. 1:98.

MACROMORPHOLOGY: Basidiocarp effused, yellowish white (4A2) to yellowish gray (4B2), ceraceous, adnate, less than 0.1 mm thick; hymenial surface continuous, finely tuberculate when fresh, smooth when dry; margin pruinose, thinning outward or somewhat determinate.

MICROMORPHOLOGY: Hyphae (Figure 234, Appendix C) 3.2-4.2(-5.6) µm diam, thin-walled, basally somewhat thick-walled, with clamps; subicular hyphae frequently and irregularly branched, often irregularly dilated; subhymenial hyphae copiously branched and densely matted. Cystidia (Figure 233, Appendix C) abundant, 64-132 x 7.2-10 µm, subcylindrical, often apically attenuated, sometimes with an occasional simple septum, rather thin-walled, projecting up to 56 µm. Basidia (Figure 232, Appendix C) [6/1] 16.8-24 x 4.8-7 µm (X = 19.2 ± 2.9 x 5.6 ± 1 µm), L/W = 3.1-3.7 (X = 3.5 ± 0.2), clavate, with a median constriction, with 4 sterigmata. Basidiospores (Figure 231,

Appendix C) [28/1] 5.8-8.8(-9.2) x 3.8-5(-6) μm (X = 7.2 ± 0.8 x 4.2 ± 0.3 μm), L/W = 1.2-2.2 (X = 1.7 ± 0.2), ellipsoid, adaxially straight, apiculate, smooth, thick-walled, with one to several oil drops, cyanophilous.

HABITAT AND DISTRIBUTION: *Picea rubens*; exposed bottom; moss-covered wood; rare.

REMARK: The specimen (TENN 46215) from the research area agrees with reference materials TENN 46573 and 46629 quite well, but the latter ones are soft membranous and more tuberculate.

Subfamily Phlebioideae

Resinicium Parmasto. 1968. Consp. Syst. Cort. p. 97.

Basidiocarp annual, resupinate, ceraceous, closely adnate; hymenial surface smooth, granular, or odontoid; margin pruinose. Hyphal system monomitic. Hyphae indistinct, usually agglutinated, hyaline, with clamps. (Halo)cystidia with an apical halo filled with resinous substance. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical, smooth, not amyloid.

REMARK: The presence of unique cystidia, which are easily observed, distinguishes this genus. Two species, *R. bicolor* and *R. furfuraceum*, were found from the research area and agree with reference materials quite well.

Key to Species of Resinicium

1. Hymenial surface odontoid, usually with small and conical teeth.. 1. *R. bicolor*

1. Hymenial surface smooth or finely granular..... 2. *R. furfuraceum*

1. *Resinicium bicolor* (Fr.) Parmasto. 1968. Consp. Syst. Cort. p. 98.

≡ *Hydnum bicolor* Fries. 1821. Syst. Mycol. 1:417.

MACROMORPHOLOGY: Basidiocarp broadly effused, pale yellow (4A3), light yellow (4A4, 4A5), yellowish gray (4B2), grayish yellow (4B3, 4B4, 4B5), light orange (5A5), to brownish orange (5C3, 5C4, 5C5, 5C6, 6C8), often greenish white (29A2), pale green (29A3), to pastel green (29A4) due to overgrown green algae, ceraceous, closely adnate, 0.1 mm thick; hymenial surface odontoid, with small conical aculei; aculei crowded, pilose at the apex, 0.3 mm long; margin pruinose, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 342, Appendix C) 2-3.2 µm diam, agglutinated or united by anastomoses, thin-walled, frequently with clamps, Hymenium dense, composed of cystidia and basidia. Cystidia of two kinds, usually cylindrical; halocystidia (Figure 340, Appendix C) common, capitate with a swollen halo at the apex, halo 12-22.4 µm wide, stalk 12-28 µm long, projecting up to 18 um; asterocystidia (Figure 341, Appendix C) common, pointed with a stellate crystal mass at tip, crystal mass 4.8-10.4 µm wide, stalk 12-27.2 µm long, projecting up to 12 µm. Basidia (Figure 339, Appendix C) [16/3] 11.2-24.8 x 3.2-5.6 µm (X = 14.7 $\pm$ 3.9 x 4.2 $\pm$ 0.7 µm), L/W = 2.5-5 (X = 3.5 $\pm$ 0.9), clavate to narrowly clavate, with 2-4 sterigmata. Basidiospores (Figure 338, Appendix C) [38/2] 4-6.4 x 1.8-3.4 µm (X = 5.3 $\pm$ 0.7 x 2.4 $\pm$ 0.4 µm), L/W = 1.5-3.3 (X = 2.3 $\pm$ 0.4), cylindrical, adaxially straight or slightly concave.

CULTURAL CHARACTERS: Growth rate moderate to somewhat fast;

advancing zone usually appressed; marginal hyphae rather distant, finely fimbriate; mat downy, cottony, to woolly, often with radiating strands which later develop into rhizomorphs; colony often translucent, white. Generative hyphae 1.2-4.8(-7.2) µm diam, thin- to somewhat thick-walled, copiously branched, frequently with rather small clamps; cystidia capitulate, encrusted and 4.8-14.4(-18.4) µm diam at the apex.

Code: 1, (2), 3, (7), (8), (12), (13), (14), 17, (19), 21, 22, 30, 37, 39, 41, (42), (44), (45), 51, 52, 53, (54), 72, (75), (81), 82, 83, (89), (90).

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*; log, trunk; wood, bark; possibly common.

REMARK: This species is reported to cause a significant butt rot in a number of conifers and hardwoods and play an important role in wood decomposition (Nobles, 1953). It is common on conifers and apparently not rare on hardwoods.

The halocystidia are formed as its apical cell wall becomes double and the outer layer inflates to a rounded halo while the inner layer stays behind (Eriksson, Hjortstam, and Ryvarden, 1981). The halo is surrounded by the outer layer and often ruptures shedding its contents.

There is a variation in the number of sterigmata. There are normally 4 sterigmata per basidium, but TENN 46430 had frequent 2-sterigmate basidia.

2. *Resinicium furfuraceum* (Bres.) Parmasto. 1968. Consp. Syst. Cort. p. 98.

≡ Corticium furfuraceum Bresadola. 1925. Mycologia 17:69.

MACROMORPHOLOGY: Basidiocarp broadly effused, white, yellowish white (3A2), yellowish gray (3B2), to dull yellow (3B3, 3B4), ceraceous when fresh, crustaceous when dry, closely adnate, less than 0.1 mm thick; hymenial surface smooth, often somewhat granular in areas, sometimes porulose or finely cracked; margin pruinose, thinning outward.

MICROMORPHOLOGY: Hyphae (Figure 346, Appendix C) 2.4-3.2 µm diam, much agglutinated or anastomosed, mainly vertical at subhymenium, thin-walled, frequently with clamps, copiously branched. Halocystidia (Figure 345, Appendix C) usually abundant, nearly cylindrical or basally widened, capitate with a halo at the apex, halo 6.4-14.4 µm wide, stalk 12.8-24 µm long, projecting up to 12 µm. Basidia (Figure 344, Appendix C) [5/1] 14.4-17.6 x 3.2-5.4 µm (X = 16.2 $\pm$ 1.2 x 4 $\pm$ 0.9 µm), L/W = 3.3-5.3 (X = 4.2 $\pm$ 0.9), clavate or narrowly clavate, with 4 sterigmata. Basidiospores (Figure 343, Appendix C) [13/1] 4-5.6 x 1.6-2.6 µm (X = 4.8 $\pm$ 0.6 x 2.2 $\pm$ 0.3 µm), L/W = 1.8-2.8 (X = 2.2 $\pm$ 0.3), cylindrical, adaxially straight or slightly concave.

HABITAT AND DISTRIBUTION: Abies fraseri; trunk; wood and moss-covered bark; rare.

Subfamily Sistotremoideae

Trechispora Karsten emend. Liberta. 1966. Taxon 15:318

Basidiocarp annual, resupinate, arachnoid, pelliculose, to ceraceous, fragile; hymenial surface even, odontoid, hydnoid, or

reticulate. Hyphal system monomitic. Hyphae with clamps, often ampullate at septa. Basidia short-clavate, with 2-4 sterigmata, infrequently pleurobasidial. Basidiospores small, hyaline, globose, ellipsoid, echinulate, not amyloid.

Key to Species of Trechispora

1. Hymenial surface poroid.......................... 3. *T. mollusca*
1. Hymenial surface not poroid................................. 2
   2. Hymenial surface turning wine-red in KOH, overrun with anastomosing threads............................ 4. *T. vaga*
   2. Hymenial surface not turning wine-red in KOH, without overrunning threads....................................... 3
3. Texture arachnoid to floccose-pelliculose........ 2. *T. farinacea*
3. Texture ceraceous................................ 1. *T. alnicola*

1. *Trechispora alnicola* (Bourd. et Galz.) Liberta. 1966. Taxon 15:318
   ≡ *Grandinia alnicola* Bourdot et Galzin. 1914. Bull. Soc. Mycol. Fr. 30:254.

MACROMORPHOLOGY: Basidiocarp effused, pale yellow (2A3, 3A3), light yellow (4A4, 4A5), ceraceous; margin adnate, pruinose, farinose, thinning outward, yellowish white (2A2) or concolorous; hymenial surface colliculose, reticulate-poroid, odontoid, with conical aculei 0.2 mm long; subiculum white, 0.1 mm thick.

MICROMORPHOLOGY: Subicular hyphae (Figure 376, Appendix C) 2-3 µm diam, hyaline, thin-walled, septate, mostly with clamps, often ampullate at septa up to 6.5 µm broad. Basidia (Figure 375, Appendix C) [14/1] 9.6-16 x 3.6-4.6 µm ($\bar{X}$ = 13.1 ± 2 x 4 ± 0.3 µm), L/W = 2.4-

4.2 (X = 3.3 ± 0.5), clavate, subclavate, subcylindrical, sometimes pleurobasidial; sterigmata (2-)4, 1.5-3 µm long. Basidiospores (Figure 374, Appendix C) [28/1] 2.6-3.6(-4.8) x 2-2.6 µm (X = 3.1 ± 0.3 x 2.3 ± 0.2 µm), L/W = 1.1-1.5 (X = 1.3 ± 0.1), ovoid, ovoid-ellipsoid, subglobose, echinulate; spines 0.2-0.4 um long.

HABITAT AND DISTRIBUTION: Rhododendron catawbiense; twig; bark; rare.

REMARK: This species grows on a common but poor host, rhododendron, which has been dead a long time.

2. Trechispora farinacea (Pers.: Fr.) Liberta. 1966. Taxon 15:318.

≡ Hydnum farinaceum Persoon: Fries. 1821. Syst. Mycol. 1:419.

MACROMORPHOLOGY: Basidiocarp effused, white, soft, arachnoid to floccose-pelliculose; margin adnate, pruinose, fibrillose, thinning outward; hymenial surface farinose, reticulate-ridged, then odontoid, with conical aculei 0.3 mm long; subiculum white, 0.1 mm thick.

MICROMORPHOLOGY: Subicular hyphae (Figure 379, Appendix C) 1.5-3.5 µm diam, hyaline, thin-walled, septate, mostly with clamps, often swollen at septa. Basidia (Figure 378, Appendix C) [4/1] 11.2-12.8 x 3.6-5.2 µm (X = 11.8 ± 0.8 x 4.3 ± 0.7 µm), L/W = 2.2-3.3 (X = 2.8 ± 0.6), clavate, subclavate, occasionally pleurobasidial; sterigmata 4, 3-4 µm long. Basidiospores (Figure 377, Appendix C) [12/1] 3-4.2 x 2.4-3 µm (X = 3.5 ± 0.4 x 2.7 ± 0.2), L/W = 1.1-1.5 (X = 1.3 ± 0.1), ovoid, ovoid-ellipsoid, subglobose, echinulate; spines 0.2-0.4 um long.

HABITAT AND DISTRIBUTION: Betula lutea; twig; wood; rare.

REMARK: Reference material TENN 37744 has well-developed

aculei throughout the surface and abundant spores which mostly measure 3-3.6 x 2-2.4 µm.

3. Trechispora mollusca (Pers.: Fr.) Liberta. 1973. Can. J. Bot. 51:1878.

≡ Polyporus molluscus Persoon: Fries. 1821. Syst. Mycol. 1:384.

MACROMORPHOLOGY: Basidiocarp effused, poroid, white, soft, subceraceous, easily separable; margin adnate, white, arachnoid, to fibrillose, or rhizomorphic; pores angular, rounded, or sinuate, often compound, (2-)3-4(-5)/mm; edges very thin, fimbriate, incised, or split to become odontoid; tubes continuous, up to 1.5 mm long; subiculum white, up to 0.1 mm thick.

MICROMORPHOLOGY: Subicular hyphae (Figure 382, Appendix C) hyaline, thin-walled, often encrusted, septate, mostly with clamps, 1.5-4 µm diam, often ampullate at septa up to 8 µm broad. Basidia (Figure 381, Appendix C) [8/1] 8-13 x 3.2-4.8 µm (X = 11.2 ± 1.7 x 4.2 ± 0.6 µm), L/W = 2.2-3.5 (X = 2.7 ± 0.4), clavate to subcylindrical, often constricted in the middle, rarely podobasidial or pleurobasidial; sterigmata 4, 2-3 µm long. Basidiospores (Figure 380, Appendix C) [22/1] 3.2-4.6 x 2.4-3.4 µm (X = 3.9 ± 0.4 x 2.9 ± 0.3 µm), L/W = 1.1-1.6 (X = 1.3 ± 0.1), ovoid, ovoid-ellipsoid, subglobose, echinulate; spines 0.4-0.6 µm long.

HABITAT AND DISTRIBUTION: Betula lutea; twig; wood; rare.

4. Trechispora vaga (Fr.) Liberta. 1966. Taxon 15:319.

≡ Phlebia vaga Fries. 1821. Syst. Mycol. 1:428.

MACROMORPHOLOGY: Basidiocarp effused, light brown (6D4),

yellowish brown (5D4, 5E4), grayish brown (6D3, 6D4), dark brown (6F5), waxy-membranous, turning wine-red (11D8) in KOH; margin adnate, arachnoid, fibrillose, byssoid, tomentose, fimbriate, plumose, or even rhizomorphic, pale yellow (3A3, 4A3) or concolorous, hymenial surface overrun by branching, anastomosing, fertile strands which produces pruinose, farinose, nodulose, or odontoid hymenium; subiculum 0.1-0.3 mm thick.

MICROMORPHOLOGY: Subicular hyphae 1.5-3 µm diam, mostly fasciculate into strands (cf. Figure 386, Appendix C) of various thickness, subhyaline to yellowish brown, thin-walled, with clamps, often swollen or ampullate up to 6.5 µm broad at septa; old hyphae (Figure 385, Appendix C) much branched, crooked, thick-walled to solid, aseptate, and pigmented. Basidia (Figure 384, Appendix C) [13/2] 11.2-16(-21.6) x 4.4-6.4 µm (X = 13.5 ± 1.6 x 4.9 ± 0.5 µm), L/W = 2.1-3.5 (X = 2.8 ± 0.4), clavate, subclavate, often pedunculate or pleurobasidial; sterigmata 2(-4), 2.5-4 µm long. Basidiospores (Figure 383, Appendix C) [29/2] 3.6-5.2 x 2.4-4 µm (X = 4.4 ± 0.5 x 3.1 ± 0.4 µm), L/W = 1.1-1.8 (X = 1.4 ± 0.2), hyaline, subhyaline, ovoid, ovoid-ellipsoid, often adaxially straight or depressed, asperulate to echinulate; spines 0.2-0.6 µm long.

HABITAT AND DISTRIBUTION: _Picea rubens_, _Abies fraseri_; trunk, log; wood, bark; uncommon.

REMARK: This species shows great variation in color. Fresh material had a golden yellow tint when collected in the field. TENN 46281 had 2-spored basidia and otherwise agreed with the literature quite well. This could be a variety of _T. vaga_, but to prove its own

specificity, further collections are required.

2. FAMILY CONIOPHORACEAE

Key to Genera of Coniophoraceae

1. Basidiocarp corticioid; cystidia absent (or present)....Coniophora
1. Basidiocarp flocculose; cystidia present...................Jaapia

Coniophora DC. ex Mérat. 1821. Nouv. Fl. Environs Paris 1:36.

Basidiocarp annual, resupinate, mostly membranous, thin and arid, adnate (or separable); hymenial surface smooth (to tuberculate), often granulose. Hyphal system monomitic. Hyphae hyaline or yellowish, usually thin-walled, septate, without clamps or rarely with clamps on broad hyphae. Hymenium composed of paraphysoid hyphae and basidia. Cystidia absent (or septate if present). Basidia utriform, with 4 sterigmata. Spores yellowish brown, ovoid to ellipsoid, smooth, thick-walled, with a germ pore, cyanophilous and dextrinoid.

REMARK: The species of this genus are characterized by its brown, smooth, and thick- to double-walled spores which are strongly cyanophilous and dextrinoid. It also has a strongly thickening hymenium and unique utriform basidia.

1. Coniophora arida (Fr.) Karsten. 1882. Bidr. Känn. Finl. Nat. Folk 37:161.

≡ Thelephora arida Fries. 1828. Elench. Fung. 1:197.

MACROMORPHOLOGY: Basidiocarp effused, often extensively confluent, variable in color, light yellow (4A4, 4A5), reddish yellow (4A6, 4A7), deep yellow (4A8), orange yellow (4B8), soon grayish

orange (5B3), brownish orange (5C3, 5C4, 5C5, 5C6), to yellowish brown (5D6, 5E6), later light brown (6D5), brown (6E5, 7E5, 7E4), even dark brown (7F4), arid, membranous, adnate, 0.1-0.2 mm thick; hymenial surface smooth, pruinose to coarsely granulose to the density of spore deposit; context pale concolorous; margin white, yellowish white (3A2, 4A2), to pale yellow (3A3, 4A3), often becoming concolorous with the hymenium, fibrillose to matted, sometimes with hyphal strands, 1-2(-5) mm wide.

MICROMORPHOLOGY: Hyphae 2.6-4.8 µm diam, up to 11.2 µm diam at broad hyphae, hyaline or yellowish next to the substrate, somewhat horizontal and often swollen in the context, thin- to rather thick-walled, especially at broad hyphae (wall up to 1.2 µm thick), septate, without clamps or rarely with clamps at broad hyphae, copiously and irregularly branched. Paraphysoid hyphae (Figure 61, Appendix C) 3.2-4 µm diam, scattered, hyaline, simple or branched, slightly projecting up to 12 µm. Basidia (Figure 61, Appendix C) [10/2] 40-60 x 6.4-10.4 µm (X = 48.1 $\pm$ 7.4 x 7.9 $\pm$ 1.4 µm), L/W = 5.4-6.7 (X = 6.2 $\pm$ 0.4), large, utriform, cylindrical; sterigmata 4, arcuate, up to 6.4 µm long. Basidiospores (Figure 60, Appendix C) [71/6] (8.4-)9-14.4(-15.6) x (4.8-)5.6-8.8 µm, (X = 11.7 $\pm$ 1.4 x 6.9 $\pm$ 0.9 µm), L/W = 1.3-2.3 (X = 1.7 $\pm$ 0.2), large, yellowish brown, ovoid or broadly ellipsoid, thick- to double-walled (wall up to 1.4 um thick), with a germ pore, with oil drops, cyanophilous, dextrinoid.

HABITAT AND DISTRIBUTION: *Abies fraseri*, *Betula lutea*; trunk, log; wood, cut wood, moss-covered bark; common.

Jaapia Bresadola. 1911. Ann. Mycol. 9:428.

Basidiocarp annual, resupinate, arachnoid to flocculose, soft, thin. Hyphal system monomitic. Hyphae distinct, hyaline, somewhat thick-walled, with clamps, copiously branched. Cystidia tubular, tapering to the apex, somewhat sinuous, projecting. Basidia clavate, constricted or sinuous, with 4 sterigmata. Basidiospores hyaline to yellowish, fusiform, smooth, thick-walled, cyanophilous.

REMARK: This genus fits the Corticiaceae well. For example, Jaapia is similar to Hypochnicium. Both genera are characterized mainly by cyanophilous spores, large basidia, and long cystidia. The taxonomic position of Jaapia thus requires a further consideration (Eriksson and Ryvarden, 1976).

1. Jaapia ochroleuca (Bres. apud Brinkm.) Nannfeldt et Eriksson. 1953. Svensk Bot. Tidskr. 47:184.

   ≡ Coniophora ochroleuca Bresadola apud Brinkmann. 1898. Westfäl. Prov.-Ver. Wiss. Kunst 26:130.

MACROMORPHOLOGY: Basidiocarp effused, whitish to yellowish gray (2B2, 3B2), farinose-arachnoid to porose-flocculose, pilose from projecting cystidia, soft, adnate, 0.1 mm thick.

MICROMORPHOLOGY: Hyphae (Figure 247, Appendix C) 4.4-8 µm diam, distinct, somewhat thick-walled, with prominent clamps, copiously branched. Cystidia (Figure 246, Appendix C) 168-240 x 7.2-12.4 µm, abundant, tubular, tapering to the apex, obtuse, often somewhat sinuous, thick-walled (wall up to 1.2 µm thick) except the apex, conspicuously projecting up to 156 µm. Basidia (Figure 245, Appendix C) [8/1] 24-40 x 7.2-8.8 µm ($X = 32.4 \pm 5.7 \times 8.1 \pm 0.7$ µm), L/W = 3.1-5 ($X = 4 \pm 0.8$), clavate, then narrowly clavate, somewhat

constricted or sinuous; sterigmata 4, arcuate, up to 7.2 µm long. Basidiospores (Figure 244, Appendix C) [22/1] 10.4-13.6 x 4.8-6.4 um ($\bar{X}$ = 11.9 ± 0.9 x 5.4 ± 0.4 µm), L/W = 1.9-2.6 ($\bar{X}$ = 2.2 ± 0.2), large, hyaline or yellowish, fusiform, navicular-fusiform, obliquely apiculate, thick-walled (wall 1-1.2 µm thick), with oil drops, cyanophilous.

HABITAT AND DISTRIBUTION: *Abies fraseri*; trunk; wood; rare.

3. FAMILY STEREACEAE

Key to Genera of Stereaceae

1. Spores amyloid 2
1. Spores not amyloid 5
    2. Spores subglobose, asperulate; cystidia metuloid ...... *Laurilia*
    2. Spores ellipsoid to cylindrical, smooth; cystidia not metuloid 3
3. Without cystidioles; hyphae septate, with clamps ...... *Amylostereum*
3. With cystidioles; hyphae septate, without clamps 4
    4. Pseudocystidia abundant; acanthocystidia scarce or absent .... *Stereum*
    4. Pseudocystidia scarce or absent; acanthocystidia abundant .... *Xylobolus*
5. Cystidia present, conspicuous, thick-walled; basidia large, often more than 100 µm long .... *Columnocystidia*
5. Cystidioles present, thin-walled; basidia medium-sized, up to 32 µm long .... *Boreostereum*

Amylostereum Boidin. 1958. Rev. Mycol. 23: 345.

Basidiocarp annual or perennial, resupinate, reflexed, or pileate, coriaceous, hard when dry, thin to thick; upper surface finely tomentose; hymenial surface smooth to tuberculate. Hyphal system dimitic. Hyphae with clamps; generative hyphae hyaline, thin-walled; skeletal hyphae yellowish brown, thick-walled. Cystidia brownish, thick-walled, apically encrusted. Basidia subclavate, with 4 sterigmata. Basidiospores hyaline, narrowly ellipsoid or cylindrical, smooth, amyloid.

1. Amylostereum chailletii (Fr.) Boidin. 1958. Rev. Mycol. 23:345.

≡ Thelephora chailletii Fries. 1828. Elench. Fung. 1:188.

MACROMORPHOLOGY: Basidiocarp effused, effused-reflexed with a narrow pileus, or pileate, orbicular, irregular, or broadly confluent, coriaceous when fresh, hard but brittle when dry, adnate, 0.5-2 mm thick, up to 6 mm thick at the reflexed part; margin finely tomentose to entire, somewhat thickened; pilei 1-3 cm wide or more, protruding 0.5-1 cm, dimidiate, often deflexed, laterally fused, to densely imbricate, irregularly undulate; upper surface brown (6E4), dark brown (6F4), to grayish brown (6D3, 6E3, 6F3), finely tomentose, glabrescent, zonate; hymenial surface grayish orange (5B3, 5B4), brownish orange (5C3, 5C4, 6C3, 6C4), to light brown (6D4), or even brown (6E4) with age, smooth to unevenly tuberculate, often cracked when old; context concolorous with the hymenium, with a narrow black band between the tomentum and the context especially in pileate portions.

MICROMORPHOLOGY: Hyphae somewhat parallel to the substrate in

the context, with clamps; generative hyphae (Figure 10, Appendix C) 1.6-3.2 µm diam, thin-walled or sometimes thick-walled (wall up to 1.2 µm thick or so) in pileate portions, frequently septate, copiously branched, prevalent in the subhymenium; skeletal hyphae (Figure 11, Appendix C) 2.4-4.4(-4.8) µm diam, thick-walled (wall up to 1.4 µm thick to subsolid), rarely septate, sparsely branched, prevalent in the context. Skeletocystidia (Figure 9, Appendix C) variable in size, (28-)36-52(-68) x (3.2-)3.8-5.2(-5.6) µm, numerous, yellowish brown, narrowly conical with a tapering base or narrowly cylindrical, acute to obtuse, clamped at the base, sometimes constricted or twisted, thick-walled (wall up to 1.6 µm thick) and apically encrusted, rarely remaining thin-walled, projecting up to 20 µm, later submerged below the thickening hymenium. Basidia (Figure 8, Appendix C) [15/4] 16-21.6 x 3.2-4.8 µm ($\bar{X}$ = 18 ± 1.8 x 3.5 ± 0.5 µm), L/W = 3.3-6.8 ($\bar{X}$ = 5.2 ± 0.8), subclavate, with 4 sterigmata. Basidiospores (Figure 7, Appendix C) [20/7] 5-7.2 x 1.6-3.2 µm ($\bar{X}$ = 6.3 ± 0.6 x 2.6 ± 0.4 µm), L/W = 2.1-3.5 ($\bar{X}$ = 2.5 ± 0.4), narrowly ellipsoid or cylindrical, amyloid.

HABITAT AND DISTRIBUTION: _Abies fraseri_, _Picea rubens_; trunk, log, uprooted bottom; bark, moss-covered bark, cut wood, moss-covered cut wood; abundant.

REMARK: This fungus is very common throughout the spruce-fir forest of the Park and is restricted to conifers, preferably Fraser fir. It usually grows on fresh substrates of recently cut-down or fallen-down trees, causing yellowish brown discoloration of wood, and plays an important role in decomposition of them.

Boreostereum Parmasto. 1968. Consp. Syst. Cort. p. 186.

Basidiocarp annual, resupinate or effused-reflexed, coriaceous, rigid when dry, thin to thick; upper surface finely tomentose; hymenial surface even to rugulose. Hyphal system dimitic. Generative hyphae hyaline, thin-walled, septate, without clamps; skeletal hyphae yellowish brown, thick-walled. Cystidioles present, thin-walled. Basidia subclavate, with 4 sterigmata. Basidiospores hyaline, cylindrical, smooth, amyloid.

1. Boreostereum radiatum (Peck) Parmasto. 1968. Consp. Syst. Cort. p. 187.

    ≡ Stereum radiatum Peck. 1873. Bull. Buffalo Soc. Nat. Hist. 1:62.

MACROMORPHOLOGY: Basidiocarp effused-reflexed with a small or narrow pileus, orbicular, confluent, coriaceous, rigid when dry, adnate, 0.2-0.5 mm thick, up to 3 mm thick at the reflexed part; margin finely tomentose to entire, somewhat thickened; pilei laterally attached, 1-2.5 cm wide or more, protruding 0.4-0.8 cm, dimidiate, often deflexed, irregularly undulate; upper surface dark violet (16F3, 16F4, 16F5), brown (7E4, 7E5, 7E6) at the margin but dark violet where bruised, finely tomentose, glabrescent, uneven, asperate, concentrically sulcate, zonate; hymenial surface brown (7E4, 7E5, 7E6), becoming dark violet on bruising, smooth, tuberculate, or rugulose; context brownish, blackish where damaged, with a narrow dark band between the tomentum and the context.

MICROMORPHOLOGY: Hyphae densely interwoven, septate without clamps; generative hyphae (Figure 25, Appendix C) predominant, 2-3.2(-

4) µm diam, thin- to somewhat thick-walled, frequently septate, commonly branched, often with a small knob or lateral branch at the septum, often encrusted with brownish granules which green in KOH; skeletal hyphae (Figure 26, Appendix C) 2.4-4 µm diam, thick-walled to subsolid, aseptate, sparsely branched. Cystidioles (Figure 24, Appendix C) 24-40(-52) x 2.4-3.2 µm, numerous, hyaline, filiform, usually acute, thin-walled, often encrusted, projecting or submerged. Basidia (Figure 23, Appendix C) [4/1] 28-32 x 5.2-5.6 µm (X = 29 ± 2 x 5.4 ± 0.2 µm), L/W = 5-5.7 (X = 5.4 ± 0.3), narrowly clavate or subclavate, with 4 sterigmata. Baidiospores (Figure 22, Appendix C) [18/1] 6.4-10.4(-12) x 2-2.4 µm (X = 8.5 ± 1.7 x 2.2 ± 0.2 µm), L/W = 2.9-5.2 (X = 3.9 ± 0.7), cylindrical, pointed at one end.

HABITAT AND DISTRIBUTION: Picea rubens; log; wood; rare.

Columnocystis Pouzar. 1959. Ceská Mykol. 13:17.

Basidiocarp perennial, resupinate to somewhat reflexed, coriaceous, thin to thick; abhymenial surface tomentose; hymenial surface smooth, pubescent. Hyphal system dimitic. Hyphae septate, (with or) without clamps; generative hyphae hyaline, thin-walled; skeletal hyphae brown, thick-walled. Cystidia of two types, large or small, pigmented, somewhat cylindrical, thick-walled, encrusted or smooth, projecting or submerged. Basidia long, narrowly clavate, with 4 sterigmata. Basidiospores hyaline or subhyaline, cylindrical, smooth, not amyloid.

1. Columnocystis ambigua (Pk.) Pouzar. 1959. Ceská Mykol. 13:17.

≡ Stereum ambiguum Peck. 1894. N. Y. St. Mus. Ann. Rep. 47:145.

MACROMORPHOLOGY: Basidiocarp effused or somewhat reflexed, orbicular, then irregularly confluent, coriaceous, somewhat loosely attached by small portions of abhymenial tomentum, 0.5-2 mm thick, up to 4 mm thick at the central part; margin light yellow (4A4, 4A5), light orange (5A4, 5A5), to brown (6D6, 6E6), fibrillose, tomemtose, to entire, somewhat thickened, 1-2 mm wide; abhymenial surface brown (6E4, 6E5, 6E6), tomentose, glabrescent, often zonate; hymenial surface grayish orange (5B3, 5B4), brownish orange (5C3, 5C4), to light brown (5D4, 5D5, 5D6, 6D4, 6D5, 6D6), brown (6E4, 6E5, 6E6, 6E7, 7E4, 7E5) to dark brown (7F4) when old, smooth, pubescent from projecting cystidia; context dark brown, often somewhat layered.

MICROMORPHOLOGY: Hyphae somewhat parallel to the substrate in the context, septate, without clamps; generative hyphae (Figure 55, Appendix C) 2-3 µm diam, hyaline, thin- to somewhat thick-walled, frequently septate, copiously branched especially in the subhymenium; skeletal hyphae 3.2-4.4(-5) µm diam, reddish brown, thick-walled (wall up to 1.6 µm thick), aseptate or rarely septate, rarely branched. Cystidia of two kinds, both very common, sometimes with intermediate forms; large cystidia (Figure 54, Appendix C) (100-)140-180 (or more) x 7.2-9.2 µm, reddish brown, cylindrical with a tapering base, sometimes secondarily septate, thick-walled (wall up to 4 µm thick or sometimes solid), often encrusted, arising deep in the context, usually projecting up to 68 um; small cystidia (Figure 53, Appendix C) 48-84 x 4.8-5.6 µm, brownish orange, narrowly clavate to cylindrical, usually secondarily septate, thick-walled (wall up to 2 µm thick), smooth, arising in the hymenium, embedded. Basidia (Figure 52,

Appendix C) large, [6/2] 64-124 x 4.8-7.2 μm (X = 96.7 ± 21.4 x 6.3 ± 1 μm), L/W = 11.4-22.5 (X = 15.5 ± 4), mostly young, yellowish, then yellowish brown, narrowly clavate, sometimes secondarily septate; sterigmata (2-)4, 3.2-5.6 μm long. Basidiospores (Figure 51, Appendix C) (10.2-)11-15.2(-16.8) x 3.2-4(-5.2) μm (X = 12.9 ± 1.2 x 3.5 ± 0.3 μm), L/W = 3-4.5 (X = 3.8 ± 0.5), large, hyaline to subhyaline, narrowly ellipsoid or cylindrical, adaxially straight, usually with 2 oil drops.

CULTURAL CHARACTERS: Growth rate delayed to slow; advancing zone appressed; marginal hyphae somewhat dense; mat downy, subfelty, to felty, later with woolly overgrowth; colony initially whitish, soon yellowish to ochraceous, later (reddish) brown, darkening in KOH; odour phenolic. Generative hyphae 1.6-3.6 μm diam, hyaline or yellowish, thin- to somewhat thick-walled, septate without clamps, copiously branched, frequently with many short branches; skeletal hyphae 2.4-3.6 μm diam, yellowish brown, rather thick-walled, often with secondary septa, infrequently branched, often encrusted.

Code: (9), (10), 13, (14), 17, (22), 24, 25, 30, 34, 35, 36, 38, (46), 48, 52, 53, (57), (61), 67, 83, 90.

HABITAT AND DISTRIBUTION: _Picea rubens_; log; cut wood, moss-covered cut wood, bark; possibly common.

REMARK: With _Amylostereum chailletii_, this fungus is one of first rot fungi which attack recently dead trees. Its habitat is rather unique because it was found only on cut-down red spruce and more specifically on fresh cut wood except TENN 46337. Reference material Gilbertson No. 456 has a remarkably thick (3-5 mm thick in

general), multilayered, and ligneous context.

Laurilia Pouzar. 1959. Ceská Mykol. 13:14.

Basidiocarp perennial, resupinate, reflexed, or partly pileate, coriaceous to ligneous, thin to thick; abhymenial surface tomentose, concentrically sulcate; hymenial surface tuberculate and sulcate; context two-layered. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal and binding hyphae yellowish, thick-walled, rarely with clamps. Cystidia thick-walled, metuloid. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, globose, echinulate, somewhat thick-walled, amyloid.

REMARK: This genus was once referred to the family Echinodontiaceae with which it has several characters in common like trimitic hyphal system, heavily encrusted cystidia, and stronly amyloid and globose spores (Gross, 1964).

1. Laurilia sulcata (Burt) Pouzar. 1959. Ceská Mykol. 13:14.

≡ Stereum sulcatum Burt in Peck. 1901. N. Y. St. Mus. Ann. Rep. 54:154.

MACROMORPHOLOGY: Basidiocarp effused, reflexed with a narrow pileus, or partly pileate, orbicular, irregularly confluent with time, coriaceous when fresh, hard or ligneous when dry, attached by small portions of abhymenial tomentum, then closely adnate and adapted to the contour of the substrate, 0.5-2 mm thick; margin fibrillose to glabrous, 1-2 mm wide; upper surface light brown (7D8), brown (7E8), to dark brown (7F8), tomentose, glabrescent, somewhat to strongly concentrically sulcate; hymenial surface white, yellowish white (4A2),

or orange white (5A2), finely or unevenly tuberculate and sulcate; context dark brown, two-layered with a narrow black band between the tomentum and the context.

MICROMORPHOLOGY: Context predominately composed of skeletal hyphae with some binding hyphae, subhymenium vertically arranged with skeletal hyphae, binding hyphae, and some generative hyphae; generative hyphae (Figure 256, Appendix C) 1.6-2.6 µm diam, hyaline, thin-walled, with clamps, copiously branched; skeletal hyphae (Figure 257, Appendix C) 2.2-4 µm diam, yellowish, thick-walled (wall up to 1.2 µm thick), aseptate or rarely septate with clamps, not branched; binding hyphae (Figure 258, Appendix C) 1.6-2 µm diam, yellowish, rather thick-walled, aseptate, irregularly and copiously branched. Cystidia (Figure 255, Appendix C) 44-68 x 8-12 µm, numerous, conical with a tapering base, thick-walled (wall up to 4 µm thick), encrusted over the upper half or more, projecting up to 24 µm, later embedded within the thickening hymenium. Basidia (Figure 254, Appendix C) [5/1] 24-26 x 4-4.8 µm ($X = 24.7 \pm 1 \times 4.3 \pm 0.3$ µm), L/W = 5-6.5 ($X = 5.8 \pm 0.7$), clavate, with 4 sterigmata. Basidiospores (Figure 253, Appendix C) [18/1] (4.8-)5-6.2 x 4-5.4 µm ($X = 5.6 \pm 0.4 \times 4.5 \pm 0.5$ µm), L/W = 1.1-1.4 ($X = 1.2 \pm 0.1$), globose to subglobose, echinulate, slightly thick-walled (wall up to 1 µm thick), amyloid.

HABITAT AND DISTRIBUTION: _Picea rubens_, _Tsuga canadensis_; log; broken or cut wood; uncommon.

REMARK: This species seems to be restricted to high elevations and, even though it occurs uncommonly, it is apparently involved in active decomposition of dead conifers as well as other stereoid fungi.

Stereum Persoon. 1794. Neues Mag. Bot. 1:110.

Basidiocarp annual or perennial, resupinate, reflexed, to pileate, gregarious, confluent, to imbricate, coriaceous, tough to hard, thin to thick; upper surface tomentose, zonate; hymenial surface smooth to somewhat tuberculate, bleeding when cut in some species; context thin, dense, usually separated from the tomentum by a narrow brown band (cuticle). Hyphal system monomitic. Hyphae thin- to thick-walled, septate, without clamps, of two kinds; generative hyphae prevalent in the subhymenium; pseudocystidial hyphae prevalent in the context. Cystidia of two kinds, not or barely projecting; pseudocystidia arising deep in the trama, yellowish brown, thick-walled, smooth, with oily contents; cystidioles arising in the subhymenium, thin-walled, acute (acutocystidia) or with apical protuberances (acanthocystidia). Basidia narrowly clavate, with 4 sterigmata. Basidiospores hyaline, narrowly ellipsoid or cylindrical, smooth, thin-walled, amyloid.

REMARK: This genus is time-honored, and most species are cosmopolitan. The genus is well-defined, but its species concept is variable by the lack of stable combinations of characters (Jülich and Stalpers, 1980, Appendix C). Many species are homothallic and probably form microspecies (Eriksson, Hjortstam, and Ryvarden, 1984), and a species-complex concept is commonly used (Welden, 1971; Chamuris, 1985).

Its pseudocystidial hyphae, one of two kinds of hyphae, have oily contents and resemble skeletal hyphae very much but do not readily fit Corner's (1932) system. These hyphae are not taken into

account in defining the hyphal construction (Donk, 1964), so the hyphal system of Stereum spp. is regarded as monomitic.

Key to Species of Stereum

1. Hymenium bleeding when cut.................................... 2
1. Hymenium not bleeding when cut................................ 3
    2. Basidiocarp on hardwood trees; acutocystidia present .... 2. *S. gausapatum*
    2. Basidiocarp on coniferous trees; acanthocystidia present............................... 5. *S. sanguinolentum*
3. Narrow, brown cuticle absent; tomentum whitish...... .... 4. *S. ochraceo-flavum*
3. Narrow, brown cuticle present; tomentum brownish............... 4
    4. Pileus surface tomentose, hirsute; hymenial surface buff to smoky gray........................... 3. *S. hirsutum*
    4. Pileus surface tomentose, shiny; hymenial surface cream-buff............................... 1. *S. complicatum*

1. *Stereum complicatum* (Fr.) Fries. 1838. Epicr. p. 548.

≡ *Thelephora complicata* Fries. 1828. Elench. Fung. 1:179.

MACROMORPHOLOGY: Basidiocarp effused-reflexed to pileate with small pilei, orbicular, gregarious, soon broadly confluent, coriaceous, 0.5 mm thick; margin finely tomentose, soon entire; pilei 0.5-1 cm wide and protruding, dimidiate or flabelliform, laterally fused, to imbricate, radiately complicate; upper surface distinctly zonate with narrow alternating bands of grayish orange (5C6) and brown (7D6, 7E6), tomentose, soon glabrescent and shiny; hymenial surface

grayish orange (6B3, 6B4, fading to 5B3, 5B4) to brownish orange (5C4), smooth, somewhat ridged where coalesced; context pale to whitish, separated from the tomentum by a cuticle.

MICROMORPHOLOGY: Hyphae of two kinds; generative hyphae (Figures 358, 359, Appendix C) 2.4-3.2(-4) µm diam, hyaline, thin- to somewhat thick-walled, septate, without clamps, frequently branched; pseudocystidial hyphae (Figure 359, Appendix C) 4-7.2 µm diam, yellowish (brown), sometimes inflated, thick-walled (wall 1.2-2.4 µm or rarely up to 3.2 µm thick), often secondarily septate, sparsely branched. Cystidia of two kinds, both numerous; pseudocystidia (Figure 357, Appendix C) very long, 4-6.4 µm wide, yellowish (brown), thick-walled (wall up to 2.4 µm thick) except the apex; acutocystidia (Figure 356, Appendix C) 20-25.6 x 3.6-4.4 µm, hyaline, thin-walled. Basidia (Figure 356, Appendix C) [10/1] 24-36 x 3.6-5.4 µm ($X = 29.6 \pm 3.9$ x 4.4 ± 0.6 µm), L/W = 5.4-8 ($X = 6.8 \pm 0.9$), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 355, Appendix C) [9/1] (4.4-)5.4-6.4 x 2-2.6 µm ($X = 5.7 \pm 0.4$ x 2.3 ± 0.2 µm), L/W = 2.2-2.7 ($X = 2.4 \pm 0.2$), narrowly ellipsoid, amyloid.

HABITAT AND DISTRIBUTION: _Betula lutea_; trunk; wood and lichen-covered bark; rare.

REMARK: This species is rare in the spruce-fir forest but becomes very common on hardwoods in Cades Cove at low elevation. _Stereum complicatum_ is microscopically very similar to _S. hirsutum_, so they are distinguished from each other on gross morphology like the tomentum, hymenium, or thickness. It is known that such a separation is often impossible because intermediate specimens exist. For this

reason, it is often suggested that S. complicatum should be maintained as a member of the S. hirsutum-complex (Welden, 1971; Chamuris, 1985).

2. Stereum gausapatum (Fr.) Fries. 1874. Hym. Europ. p. 638.

≡ Thelephora gausapata Fries. 1828. Elench. Fung. p. 171.

MACROMORPHOLOGY: Basidiocarp effused-reflexed to pileate, orbicular, broadly confluent, coriaceous, tough when dry, 0.5-1 mm thick; margin finely tomentose, soon entire; pilei laterally attached to imbricate, 3-6 cm wide or more, protruding 3-4 cm, dimidiate, strongly undulate and complicate; upper surface light brown (6D5, 6D6), often zonate by exposing dark brown (7F4) cuticle in narrow bands near the margin, tomentose, somewhat glabrescent; hymenial surface light brown (6D4, 6D5) with age, bleeding when cut or bruised and dark brown (8F4, 8F5) on drying, smooth, often finely chinked near the base; context pale, separated from the tomentum by a cuticle.

MICROMORPHOLOGY: Hyphae of two kinds; generative hyphae (Figures 363, 364, Appendix C) 2.4-3.2 µm diam in the subhymenium, hyaline, thin- to somewhat thick-walled, septate without clamps, frequently branched and twisted, with transitions to pseudocystidial hyphae; pseudocystidial hyphae (Figure 364, Appendix C) 4-5.2 µm diam, yellowish (brown), thick-walled (wall 0.8-1.6 µm thick), sparsely branched. Cystidia of two kinds, both numerous; pseudocystidia (Figure 362, Appendix C) often more than 160 µm long, 5.2-7.2 µm wide, yellowish (brown), thick-walled (wall 1-1.6 µm or rarely up to 2 µm thick) except the apex; acutocystidia (Figure 361, Appendix C) 20-28 x 2.8-4 µm, hyaline, thin-walled. Basidia (Figure 361, Appendix C) [6/1] 32-40 x 4.8-5.6 µm ($X = 35.3 \pm 3 \times 5.2 \pm 0.4$ µm), L/W = 5.7-7.7

(X = 6.8 ± 0.7), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 360, Appendix C) [16/1] 4.8-6.4(-7.2) x 2.2-2.8 µm (X = 5.6 ± 0.6 x 2.5 ± 0.2 µm), L/W = 1.9-2.7 (X = 2.3 ± 0.3), narrowly ellipsoid, amyloid.

HABITAT AND DISTRIBUTION: *Fagus grandifolia*; log; bark; rare.

REMARK: This is known as a bleeding species of *Stereum* and easily recognized by its bleeding reaction on bruising in the field. It usually occurs on *Quercus* but also rarely on other hardwoods (Lentz, 1955).

3. *Stereum hirsutum* (Willd.: Fr.) S. F. Gray. 1821. Nat. Arr. Br. Pl. p. 653.

≡ *Thelephora hirsuta* Willdenow: Fries. 1821. Syst. Mycol. 1:439.

MACROMORPHOLOGY: Basidiocarp effused-reflexed to pileate, orbicular, separate to gregarious, then confluent, coriaceous, hard and stiff when dry, 0.5-2 mm thick; margin finely tomentose, soon entire; pilei 0.5-2.5 cm wide, protruding 0.5-1 cm, dimidiate, often deflexed, broadly attached, often laterally fused to imbricate, undulate; upper surface zonate with narrow alternating bands of grayish yellow (4B3, 4C3, rarely 2C3, 2C4) and light brown (6D4, 6D5, 7D4, 7D5) to brown (6E4, 6E5, 7E4, 7E5), tomentose, hirsute, to strigose, glabrescent; hymenial surface pale yellow (4A3), grayish yellow (4B3), brownish orange (5C3, 5C4), light brown (5D4, 6D4), to brown (6E4, 7E4), smooth to somewhat tuberculate, often finely chinked; context pale to whitish, separated from the tomentum by a cuticle.

MICROMORPHOLOGY: Hyphae of two kinds; generative hyphae

(Figures 368, 369, Appendix C) 2.4-3.2 µm diam, hyaline, thin- to somewhat thick-walled, septate, without clamps, frequently branched; pseudocystidial hyphae (Figure 369, Appendix C) 3.4-5.2 µm diam, yellwoish brown, thick-walled (wall 0.8-1.6 µm or rarely up to 2 µm thick), often secondarily septate, sparsely branched. Cystidia of two kinds, both numerous; pseudocystidia (Figure 367, Appendix C) more than 120 µm long, 5.4-7.2 µm wide, yellowish brown, thick-walled (wall up to 1.6 µm thick) except the apex, sometimes with a schizopapilla; acutocystidia (Figure 366, Appendix C) 20-28 x 2.4-3.8 µm, hyaline, thin-walled. Basidia (Figure 366, Appendix C) [10/2] 22.4-32 x 3-4.8 µm ($\bar{X}$ = 26.7 ± 3.5 x 3.9 ± 0.6 µm), L/W = 5.1-8.9 ($\bar{X}$ = 6.9 ± 1.2), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 365, Appendix C) [19/2] 5.2-7.2 x 1.8-2.6 µm ($\bar{X}$ = 6.3 ± 0.6 x 2.2 ± 0.2 µm), L/W = 2.2-3.8 ($\bar{X}$ = 2.9 ± 0.4), cylindrical, amyloid.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*, unknown tree; trunk, stump, log, twig; bark, cut wood; frequent.

REMARK: Microscopically, *S. hirsutum* has more distinct and less thick-walled pseudocystidial hyphae and slightly longer spores compared with *S. complicatum*. This fungus seems to be also one of the rot fungi which first occur on recently fallen- or cut-down trees.

4. *Stereum ochraceo-flavum* (Schw.) Ellis. 1878. N. Am. Fungi p. 17.

≡ *Thelephora ochraceo-flava* Schweinitz. 1832. Am. Phil. Soc. Trans. 4:167.

MACROMORPHOLOGY: Basidiocarp cupulate, separate (to gregarious), coriaceous, 0.5 mm thick; pilei up to 5 mm across and 3 mm deep, attached by an umbo or along one side, sometimes laterally

fused; margin fimbriate; upper surface whitish to yellowish gray (2B2, 3B2), tomentose or hirsute, indistinctly zonate; hymenial surface light orange (5A4) to grayish orange (5B3, 5B4), smooth; context pale to whitish, with a poor or absent cuticle.

MICROMORPHOLOGY: Hyphae of two kinds; generative hyphae 2.4-3.4 µm diam, hyaline, thin- to slightly thick-walled (wall up to 1 µm thick), septate, without clamps, frequently branched; pseudocystidial hyphae 3.8-5.8(-8) µm diam, yellowish (brown), thick-walled (wall 1.2-2.2 µm or rarely up to 3.2 µm thick), often secondarily septate, rarely branched. Cystidia of two kinds, both numerous; pseudocystidia more than 140 µm long, 6.4-9.6 µm wide, yellowish (brown), thick-walled (wall up to 3.2 µm thick) except the apex; acutocystidia 20-24.8 x 3-4 µm, hyaline, thin-walled. Basidia [10/1] 21.6-30 x 3.8-4.2 µm (X = 25.4 ± 2.4 x 4 ± 0.1 µm), L/W = 5.4-7.9 (X = 6.4 ± 0.7), narrowly clavate, with 4 sterigmata. Basidiospores [10/1] 5.2-6 x 1.6-2 µm (X = 5.4 ± 0.3 x 1.8 ± 0.2 µm), L/W = 2.7-3.6 (X = 3.1 ± 0.3), cylindrical, amyloid.

HABITAT AND DISTRIBUTION: unknown tree; exposed root; rare.

REMARK: This species of Stereum is small and unique in shape. Microscopically, it is similar to S. hirsutum but has more conspicuous pseudocystidia and slightly shorter spores. Fruitbodies of reference material TENN 10434 and 16780 were gregarious or laterally confluent into an effused form along slender twigs.

5. Stereum sanguinolentum (Alb. et Schw.: Fr.) Fries. 1838. Epicr. p.549.

≡ Thelephora sanguinolenta Albertini et Schweinitz: Fries. 1821.

Syst. Mycol. 1:440.

MACROMORPHOLOGY: Basidiocarp effused-reflexed to pileate, orbicular, separate to gregarious, then confluent, coriaceous, hard and stiff when dry, somewhat thin, rarely up to 1 mm thick; margin finely tomentose to entire; pilei 0.5-1.5 cm wide, protruding 0.5(-1) cm, narrow or dimidiate, often laterally fused, to imbricate, undulate, often crenate or incised; upper surface yellowish brown (5E4, 5E5), brownish orange (6C8), light brown (6D8, 7D6, 7D7, 7D8), to brown (6E8, 7E6, 7E7, 7E8), or rarely olive brown (4D3, 4E3) due to overgrown algae, tomentose or hirsute, glabrescent, zonate by exposing a brown cuticle in narrow bands; hymenial surface orange gray (5B2), grayish orange (5B3), brownish orange (5C3, 6C3, 6C4), to light brown (6D4), brown (6E5, 6E6, 7E4 7E5) when old, bleeding when cut and dark brown on drying, smooth or finely tuberculate, sometimes finely chinked; context pale to whitish, separated from the tomentum by a cuticle.

MICROMORPHOLOGY: Hyphae of two kinds; generative hyphae (Figure 373, Appendix C) 2.4-4(-5.6) µm diam, hyaline, thin- to slightly thick-walled (wall up to 1 µm thick), septate, without clamps, frequently septate and densely branched in the subhymenium; pseudocystidial hyphae (Figure 373, Appendix C) 3-5.6 µm diam, yellowish brown, thick-walled (wall up to 1.6 µm thick), often secondarily septate, not or rarely branched. Cystidia of two kinds, both numerous; pseudocystidia (Figure 372, Appendix C) 100 µm long or more, (4.8-)5.6-9.6(-10.2) µm wide, yellowish brown, thick-walled (wall 0.8-1.6 µm or rarely up to 2.4 µm thick) except the apex;

acanthocystidia (Figure 371, Appendix C) 24-36(-44) x 2.4-4 µm, hyaline, thin-walled, with protuberances up to 2 µm long. Basidia (Figure 371, Appendix C) [9/3] 24-29.6 x 4.4-5.2 µm ($X = 26.8 \pm 1.9$ x 4.8 ± 0.4 µm), L/W = 4.9-6.4 ($X = 5.6 \pm 0.5$), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 370, Appendix C) [42/4] (5.6-)6-10 x 2.2-4.2 µm ($X = 7.6 \pm 1.2$ x 3 ± 0.6 µm), L/W = 1.6-4.2 ($X = 2.7 \pm 0.6$), narrowly ellipsoid or cylindrical, amyloid.

HABITAT AND DISTRIBUTION: *Abies fraseri*, *Picea rubens*; trunk, log; bark, moss-covered bark, wood, cut wood; common.

REMARK: This is another bleeding species of *Stereum* and causes a red heart rot of conifers and a sap rot on their slash (Boyce, 1961). Its decayed wood is light in weight and light brown in color. In the Park, this fungus is associated with the decomposition of recently dead Fraser firs.

Xylobolus Karsten emend. Boidin. 1958. Rev. Mycol. 23:340.

Basidiocarp perennial, resupinate, effused-reflexed, to pileate, confluent, coriaceous to ligneous, thick; upper surface tomentose, sulcate; hymenial surface smooth or tuberculate; context thick, dense, stratified, separated from the tomentum by a brown band (cuticle). Hyphal system dimitic. Generative hyphae hyaline, thin-walled, usually septate, without clamps; skeletal hyphae yellowish brown, thick-walled, usually aseptate. Cystidia of two kinds; skeletocystidia yellowish brown, thick-walled, encrusted; acanthocystidia hyaline, thin-walled, with protuberances. Basidia narrowly clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid to cylindrical, smooth, thin-walled, amyloid.

1. Xylobolus subpileatus (Berk. et Curt.) Boidin. 1958. Rev. Mycol. 23:341.

≡ Stereum subpileatum Berkeley et Curtis in Hooker. 1849. Jour. Bot. and Kew Gard. Misc. 1:238.

MACROMORPHOLOGY: Basidiocarp effused, effused-reflexed, to completely pileate, orbicular, soon confluent, coriaceous, hard or ligneous when dry, 1-2 mm thick in pileate portions, up to 5 mm thick at the central part; margin entire, somewhat thickened; pilei 2.5-4.5 cm wide, protruding 1.5-5.5 cm, dimidiate or flabelliform, narrowly attached by an umbo or broadly by several umbos and lateral fusion, undulate to complicate; upper surface light brown (7D7, 7D6, 7D5), brown (7E7, 7E6, 7E5), reddish brown (8E5, 8E4), dark brown (8F5, 8F4), or even grayish brown (8E3, 8F3), often with a brown (7E8, 7E7) margin where revived, tomentose, soon densely matted to form a rind, concentrically sulcate and often radiately striate; hymenial surface yellowish (4A2), pale yellow (4A3), to grayish orange (5B3), or light brown (6D5, 6D4) when quite old, smooth or finely tuberculate, often finely to deeply cracked; context brownish, dense, narrowly stratified, separated from the tomentose rind by a cuticle.

MICROMORPHOLOGY: Generative hyphae 1.8-2.2 µm diam, hyaline, thin-walled, septate, without clamps, densely branched in the subhymenium; skeletal hyphae 2.6-4 µm diam, yellowish brown, moderately thick-walled (wall up to 1 µm thick), aseptate or rarely septate without clamps, rarely branched. Cystidia of two kinds, both abundant; skeletocystidia (Figure 420, Appendix C) 34-64 x 4-5.2(-7.2) µm, yellowish brown, narrowly cylindrical and tapering to an acute or

obtuse apex, thick-walled (wall up to 1.4 μm thick), encrusted over the upper half, asperate with minute protuberances when naked, projecting up to 20 μm, submerged below the thickening hymenium with time; acanthocystidia (Figure 419, Appendix C) 24-32 x 2.4-4 μm, hyaline, thin-walled, with protuberances up to 2.4 μm long. Basidia (Figure 418, Appendix C) [5/1] 20-25.6 x 3.2-4.8 μm (X = 22.1 ± 2.6 x 3.8 ± 0.7 μm), L/W = 4.3-8 (X = 5.9 ± 1.4), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 417, Appendix C) [22/1] 4-5.2(-5.6) x 2-3 μm (X = 4.6 ± 0.4 x 2.5 ± 0.3 μm), L/W = 1.4-2.6 (X = 1.9 ± 0.3), ellipsoid or narrowly ellipsoid, amyloid.

HABITAT AND DISTRIBUTION: *Quercus rubra*; trunk; wood and bark; rare.

4. FAMILY HYMENOCHAETACEAE

Key to Genera of Hymenochaetaceae

1. Hymenophore smooth.................................*Hymenochaete*
1. Hymenophore raduloid, irpicoid, hydnoid, to tubular........... 2
    2. Basidiocarp effused-reflexed to stipitate; context fleshy, brittle when dry, thick......................*Phaeolus*
    2. Basidiocarp resupinate to sessile, never stipitate; context fleshy, coriaceous, corky, to woody, firm to hard when dry, thin to thick............................ 3
3. Basidiocarp resupinate; hymenophore raduloid, irpicoid, to hydnoid...*Hydnochaete*
3. Basidiocarp resupinate to pileate; hymenophore tubular......... 4

4. Texture perennial, corky to woody; tubes stratified; setae present..Phellinus

4. Texture annual, fleshy to corky; tubes in one layer; setae present or absent..............................Inonotus

Hydnochaete Bresadola. 1896. Hedwigia 35:287.

Basidiocarp annual, resupinate, gregarious, then confluent, tough-corky, ligneous when dry, usually thin; hymenial surface raduloid, irpicoid, to hydnoid; context darkening in KOH. Hyphal system monomitic. Hyphae of two kinds, hyaline or yellowish brown in KOH, thin- to thick-walled, septate, without clamps. Setae reddish brown, subulate, thick-walled. Basidia subclavate, with 4 sterigmata. Basidiospores hyaline, allantoid, smooth, not amyloid.

1. Hydnochaete olivaceum (Schw.) Banker. 1914. Mycologia 6:234.

≡ Sistotrema olivaceum Schweinitz. 1822. Schr. Nat. Ges. Leipzig 1:101.

= Irpex cinnamomeus Fries. 1838. Epicr. Myc. p. 524.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, gregarious, soon broadly confluent, often inconspicuously revolute with a narrow (0.5-1.5 mm wide) margin, tough-corky when fresh, ligneous when dry, adnate, rather thin, rarely up to 1 mm thick; margin byssoid, tomentose, then entire, somewhat thickened; hymenial surface brownish orange (5C5, 5C6, 6C7, 6C8), brownish yellow (5C7, 5C8), to light brown (6D7, 6D8), initially tuberculate, soon raduloid, irpicoid, or hydnoid, finely cracked between teeth with age, finely setulose (under lens); teeth up to 1.5 mm long, crowded; context brown.

MICROMORPHOLOGY: Hyphae of two kinds; one kind 1.8-2.4(-3) µm diam, hyaline or yellowish, thin-walled (cf. Figure 150, Appendix C) to somewhat thick-walled, septate, without clamps, frequently septate and densely branched in the subhymenium, giving rise to the other kind of hyphae; the other kind 3-4 µm diam, yellowish brown, thick-walled (wall up to 1.6 µm thick; cf. Figure 149, Appendix C), rarely septate, without clamps, infrequently branched, often agglutinated. Hymenium composed of setae, occasionally elongated hyphal ends, and basidia. Setae (Figure 148, Appendix C) 44-80(-100) x 8.8-13.6 µm, common to abundant, reddish brown, subulate, straight or often crooked, occasionally bifurcate at the base, thick-walled (wall up to 4.8 µm thick) or sometimes subsolid, projecting up to 40 µm. Hyphal tips (Figure 147, Appendix C) with long slender apices occasionally present in the hymenium. Basidia (Figure 147, Appendix C) [15/2] 13.6-18.4 x 3.2-4.4 µm (X = 15.5 $\pm$ 1.5 x 3.8 $\pm$ 0.4 µm), L/W = 3.4-5.8 (X = 4.2 $\pm$ 0.5), subclavate, with (2-)4 sterigmata. Basidiospores (Figure 146, Appendix C) [20/2] 4-6.6 x 1-2 µm (X = 5 $\pm$ 0.7 x 1.3 $\pm$ 0.3 µm), L/W = 2.8-5 (X = 3.8 $\pm$ 0.7), allantoid.

HABITAT AND DISTRIBUTION: Acer spicatum, Betula lutea; twig; moss- or lichen-covered bark; uncommon.

REMARK: This fungus is apparently common in hardwood forests at low elevation. It is better known by its synonym, Irpex cinnamomeus, and is extremely variable in its morphology, especially in the shape and length of the teeth (Burdsall, 1971). TENN 46238 and 46243 look quite different from the specimens of the research area because of faded color and irregular shape of teeth. Their teeth are

commonly 3 mm long, united into plates, bundles, or compound forms, and often crested, incised, split, or branched at the apex.

Hymenochaete Léveillé. 1846. Ann. Sci. Nat. Bot. III. 5:150.

Basidiocarp annual or perennial, resupinate, effused-reflexed, to pileate, confluent, papery, coriaceous, to firm, usually thin; hymenial surface even to colliculose; context with or without cuticle, darkening in KOH. Hyphal system monomitic. Hyphae hyaline to yellowish brown in KOH, thin- to thick-walled, often agglutinated, septate, without clamps. Hymenium composed of setae, sometimes cystidia or paraphysoid hyphae, and basidia. Setae reddish brown, subulate to ventricose, thick-walled. Paraphysoid hyphae simple or branched. Basidia clavate or subclavate, with 4 sterigmata. Basidiospores hyaline, mostly ellipsoid to allantoid, smooth, not amyloid.

REMARK: This genus, as well as other genera of the Hymenochaetaceae, is xanthochroic and can be characterized by the presence of simple-septate hyphae whose thickened walls darken permanently in KOH. Even though the thick-walled hyphae look skeletal, its hyphal system is considered monomitic. These hyphae rapidly replace generative hyphae but are not truly skeletal because they regularly branch and become frequently septate. Macroscopically, a few characters like growth form, color, and tissues are diagnostic (Reeves and Welden, 1967). In section, three layers or tissues (abhymenial cuticle, context, and hymenium) are recognized, so the presence of cuticle and the stratification of context are helpful in diagnosis. Microscopically, setae and spores play the most important

role in identification.

Key to Species of Hymenochaete

1. Abhymenial cuticle absent; context stratified.................. 2

1. Abhymenial cuticle present; context stratified or not.......... 3

   2. Hymenial surface much cracked; setae up to 12 µm wide or even more................................ 3. *H. corrugata*

   2. Hymenial surface continuous or less cracked; setae 9.6 µm wide or less......................... 5. *H. fuliginosa*

3. Basidiocarp resupinate; context stratified..................... 4

3. Basidiocarp effused-reflexed to pileate; context not stratified.. 6

   4. Encrusted cystidia present in the hymenium; crystalline masses present in the context.................. 1. *H. cervina*

   4. Encrusted cystidia and crystalline masses not present...... 5

5. Basidiocarp deeply cracked and isolated on drying; setate subulate, <100 µm long.............................. 6. *H. spreta*

5. Basidiocarp not isolated on drying; setae acicular, >100 µm long.................................. 2. *H. cinnamomea*

   6. Pileus sericeous, brown, orange yellow at the margin; hymenium deeply cracked in resupinate portions; setae common...................................... 7. *H. tabacina*

   6. Pileus fibrillose, brown throughout; hymenium continuous, velvety; setae few................. 4. *H. curtisii*

1. *Hymenochaete cervina* Berkeley et Curtis. 1868. Linn. Soc. Bot. Jour. 10:334.

MACROMORPHOLOGY: Basidiocarp resupinate, orbicular, soon confluent, firm but brittle, adnate, 0.1-0.3 mm thick; margin thinning outward or abrupt; hymenial surface dark brown (6F5, 7F4, 7F5, 8F4), even to colliculose, finely cracked, densely setulose; context brown, stratified; cuticle distinct, dark brown.

MICROMORPHOLOGY: Hyphae (Figure 159, Appendix C) 2.4-4 µm diam, hyaline, yellowish, or yellowish brown, somewhat to regularly thick-walled (wall usually 0.6-1.2 µm thick), septate, without clamps, commonly branched. Hymenium composed of setae, cystidia, and basidia. Crystalline masses (Figure 158, Appendix C) present in the context. Setae (Figure 157, Appendix C) abundant, 72-88(-104) x 9.6-14.4(-16) µm, subulate, thick-walled (wall 2.4-4.8 µm or rarely up to 5.6 µm thick), occurring in overlapping strata, projecting up to 52 µm. Cystidia (Figure 156, Appendix C) common, 32-60 x 9.6-16(-20) µm, subhyaline, elongate or orbicular, heavily encrusted, finally embedded and turned into crystalline masses. Basidia (Figure 155, Appendix C) [12/1] 14.4-18.4(-20) x 4-5.6 µm (X = 16.8 ± 1.8 x 4.7 ± 0.5 µm), L/W = 2.8-4.4 (X = 3.7 ± 0.6), clavate or subclavate, with (2-)4 sterigmata. Basidiospores (Figure 154, Appendix C) [12/1] 4.8-7.2(-8) x 3.6-4.8 µm (X = 6.2 ± 1 x 4.1 ± 0.4 µm), L/W = 1.2-1.8 (X = 1.5 ± 0.2), broad ellipsoid to ovoid.

HABITAT AND DISTRIBUTION: Rhododendron maximum; twig; bark; rare.

REMARK: This species is morphologically similar to other resupinate Hymenochaete, but its microscopic structures like large spores and crystalline masses distinguish itself.

2. Hymenochaete cinnamomea (Pers.) Bresadola. 1897. I. R. Acad. Agiati Atti III. 3:110.

≡ Thelephora cinnamomea Persoon. 1822. Myc. Eur. 1:141.

MACROMORPHOLOGY: Basidiocarp broadly resupinate, corky to firm, adnate, rather thin, rarely up to 1 mm thick; margin thinning outward or abrupt; hymenial surface brownish orange (7C3, 7C4), light brown (6D6, 6D7, 6D8), brown (6E7, 6E8, 7E6, 7E7, 7E8), to reddish brown (8E7, 8E8), even, continuous at first, finely to deeply cracked with age, densely setulose; context brown, stratified; cuticle present, dark brown.

MICROMORPHOLOGY: Hyphae (Figure 163, Appendix C) 2.4-4 µm diam, hyaline, yellowish, or yellowish brown, somewhat to regularly thick-walled (wall usually 0.6-1.2 µm thick), frequently septate, without clamps, commonly branched, somewhat loosely interwoven. Hymenium composed of setae, paraphysoid hyphae, and basidia. Setae (Figure 162, Appendix C) (44-)62-104 (-128) x (4.8-)5.6-7.2(-8) µm, abundant, acicular, straight or sometimes curved, thick-walled (wall 1.6-2.4 µm or rarely up to 3.2 um thick), naked or partially ensheathed, occurring in overlapping strata, projecting up to 68 um. Paraphysoid hyphae (Figure 161, Appendix C) 2.8-4 µm diam, common to abundant, hyaline or yellowish, usually branched, frequently projecting up to 24 µm. Basidia (Figure 161, Appendix C) [11/3] 14.4-16.4 x 3.6-5.2 µm (X = 15 ± 0.9 x 4.1 ± 0.6 µm), L/W = 3-4.4 (X = 3.7 ± 0.5), subclavate, with 4 sterigmata. Basidiospores (Figure 160, Appendix C) [18/3] 4.8-6.4 x 2.4-3 µm (X = 5.3 ± 0.4 x 2.6 ± 0.3 µm), L/W = 1.7-2.4 (X = 2.1 ± 0.2), ellipsoid to suballantoid.

HABITAT AND DISTRIBUTION: Fagus grandifolia, Betula lutea; trunk, twig; wood; uncommon.

REMARK: The specimens (TENN 46400, 46401, 46514) from the research area have longer and more slender setae than those (64-92 x 6.4-8 um) of reference material TENN 11928. This species is close to H. tenuis, but the latter has shorter setae and occurs on conifers like Thuja, Tsuga, and Pinus.

3. Hymenochaete corrugata (Fr.) Léveillé. 1846. Ann. Sci. Nat. Bot. III. 5:152.

≡ Thelephora corrugata Fries. 1815. Obs. Myc. 1:154.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, soon broadly confluent, corky to firm, adnate, up to 0.5 mm thick; margin thinning outward or abrupt; hymenial surface brownish orange (7C3), grayish brown (7D3), light brown (7D4, 7D5, 7D6), to brown (7E5, 7E6), or occasionally dark brown (7F5), even, asperate, or colliculose, initially continuous, soon finely to deeply cracked, finely setulose; context brown, stratified, without a cuticle.

MICROMORPHOLOGY: Hyphae 2-3.6 μm diam, hyaline, yellowish, to yellowish brown, somewhat to regularly thick-walled (wall usually 0.6-1.2 μm thick), septate, without clamps, commonly branched. Setae (Figure 166, Appendix C) (36-)44-60(-68) x (6.4-)8-12(-16) μm, numerous, conical to subulate, sometimes distorted or radicate, thick-walled (wall 2.4-4.8 μm or rarely up to 5.6 μm thick), sometimes with an occasional bridge across the lumen, naked, occurring in overlapping strata, projecting up to 40 μm. Basidia (Figure 165, Appendix C) [18/2] 11.2-16 x 2.8-4 μm (X = 14.1 ± 1.5 x 3.3 ± 0.3 μm), L/W = 3.1-5

(X = 4.3 ± 0.5), subclavate, with (2-)4 sterigmata. Basidiospores (Figure 164, Appendix C) [36/2] 4-6 x 1.4-2.2 µm (X = 4.9 ± 0.5 x 1.7 ± 0.3 µm), L/W = 2.3-3.9 (X = 2.9 ± 0.4), suballantoid.

CULTURAL CHARACTERS: Growth rate fast to very fast; advancing zone appressed to raised; marginal hyphae rather distant to dense; mat cottony, woolly, subfelty, or sometimes felty; colony white to cream at first, light orange, ochraceous tawny, to (light) brown with age, darkening in KOH. Generative hyphae 2.4-4.8(-5.6) µm diam at the margin, 1.6-2.4 µm diam at the center, hyaline or yellowish (brown), thin- to somewhat thick-walled, septate without clamps, copiously branched, sometimes inequivalently branched; setae rare, 88-92 x 7 µm, orange brown, subulate, thick-walled.

Code: 1, 3, 4, (6), (7), (12), (13), (14), 21, 22, 24, (25), 30, 31, 34, 35, (36), 38, 48, (50), (51), 52, 53, (54), 67, (70), 83, 89.

HABITAT AND DISTRIBUTION: Betula lutea; trunk, twig; wood, lichen-covered bark; uncommon.

REMARK: The specimen (TENN 46528) from the research area fruited over 3 feet of a fallen dead branch. Its setae agreed with those (mostly 40-56 x 8-12.8 um) of reference materials TENN 12622 and 12623 but had shorter ones than those described by others (cf. Cunningham, 1963; Reeves and Welden, 1967).

4. Hymenochaete curtisii (Berk.) Morgan. 1888. Cincinnati Soc. Nat. Hist. Jour. 10:197.

≡ Stereum curtisii Berkeley. 1873. Grevillea 1:164.

MACROMORPHOLOGY: Basidiocarp effused-reflexed to pileate,

orbicular, gregarious, then widely confluent, coriaceous, papery when dry, 0.2-0.5 mm thick; pilei 2-10 mm wide, protruding 3-6 mm, dimidiate or spathulate, usually deflexed, then laterally attached, complicate; upper surface brownish orange (5C3, 6C3) to light brown (6D4, 6D5, 6D6), zonate with narrow brown to dark brown bands, sericeous, glabrescent, concentrically sulcate; hymenial surface light brown (6D4, 6D5, 6D6) to brown (6E5, 6E6, 6E7), even, colliculose, or rugulose, ridged where coalesced, glabrous; context light brown to brown.

MICROMORPHOLOGY: Hyphae (Figure 171, Appendix C) 2-3.2 µm diam, hyaline, yellowish, or yellowish brown, thin- to moderately thick-walled (wall 0.6-1 µm thick), septate without clamps, commonly branched. Hyphal ends (Figure 169, Appendix C) present in the hymenium, tapered and often hooked at the tip. Setae (Figure 170, Appendix C) rare or lacking, 52-56 x 7.2-9.6 µm, subulate, thick-walled (wall 1.6-2.4 µm thick), projecting up to 30 µm. Basidia (Figure 168, Appendix C) [4/1] 12-16 x 3.6-4.4 µm (X = 13.4 ± 1.9 x 4 ± 0.3 µm), L/W = 2.7-4 (X = 3.4 ± 0.6), clavate, with 4 sterigmata. Basidiospores (Figure 167, Appendix C) [16/1] 4.8-6.4(-7.2) x 1.4-2.2 µm (X = 5.8 ± 0.6 x 1.8 ± 0.3 µm), L/W = 2.5-4 (X = 3.3 ± 0.4), allantoid.

HABITAT AND DISTRIBUTION: unknown hardwood; twig; bark; rare.

5. *Hymenochaete fuliginosa* (Pers.) Bresadola in Burt. 1918. Ann. Miss. Bot. Gard. 5:365.

≡ *Thelephora fuliginosa* Persoon. 1822. Myc. Eur. 1:145.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, soon

confluent, corky to firm, adnate, thin, up to 0.3 mm thick; margin abrupt or entire, somewhat thickened; hymenial surface dark brown (7F5, 8F4, 8F5, 9F5), even or colliculose, continuous or finely cracked, finely setulose; context brown, stratified, without a cuticle.

MICROMORPHOLOGY: Hyphae (Figure 174, Appendix C) 2-4 µm diam, hyaline, yellowish, to yellowish brown, somewhat to regularly thick-walled (wall usually 0.6-1 µm thick), septate, without clamps, commonly branched. Setae (Figure 173, Appendix C) 44-72 x 6.4-8.8 µm, numerous, subulate, uniform, thick-walled (wall 2.4-4 µm thick), naked, occurring in overlapping strata, projecting up to 40 µm. Basidia (Figure 173, Appendix C) [9/1] 14.4-16 x 3.2-4.4 µm ($\bar{X}$ = 15.4 ± 0.8 x 3.8 ± 0.4 µm), L/W = 3.5-5 ($\bar{X}$ = 4.1 ± 0.5), subclavate, with 4 sterigmata. Basidiospores (Figure 172, Appendix C) [11/1] 4-5.6 x 1.8-2.4 µm ($\bar{X}$ = 4.6 ± 0.6 x 2.1 ± 0.2 µm), L/W = 1.8-2.7 ($\bar{X}$ = 2.3 ± 0.3), narrowly ellipsoid to cylindrical.

HABITAT AND DISTRIBUTION: *Abies fraseri*, *Rhododendron* or *Betula*; log, twig; moss-covered wood, bark; possibly uncommon.

REMARK: One specimen (TENN 46297) from the research area had grown over a thin mat of moss and peeled off from the substrate at the margin on drying.

Hymenochaete fuliginosa is very similar to *H. corrugata* but is distinguished, according to Burt (1918), by color and by colliculose surface which does not usually crack. But *H. corrugata* is also colliculose and initially has a continuous surface and can be dark brown when quite old. Microscopically, *H. fuliginosa* has more uniform

and slender setae and somewhat wider spores than H. corrugata.

6. Hymenochaete spreta Peck. 1879. N.Y. St. Mus. Ann. Rep. 30:47.

MACROMORPHOLOGY: Basidiocarp widely resupinate, firm, adnate, 0.5-1 mm thick; margin thinning outward or abrupt; hymenial surface brown (7E5, 7E6), even or somewhat colliculose, deeply cracked to the substratum and isolated in the form of squares, finely setulose; context brown, stratified; cuticle indistinct, brown or dark brown.

MICROMORPHOLOGY: Hyphae (Figure 178, Appendix C) 2.4-4.8 µm diam, hyaline, yellowish, or yellowish brown, rather thick-walled (wall 0.8-1.2 µm thick), septate, without clamps, frequently branched, often agglutinated. Setae (Figure 177, Appendix C) abundant, 80-96 x 6.4-8.8 µm, aculeate, thick-walled (wall 2.4-3.6 µm thick), occurring in overlapping strata, projecting up to 40 µm. Basidia (Figure 176, Appendix C) [4/1] 13.6-17.6 x 4-4.8 µm (X = 15.6 ± 1.7 x 4.2 ± 0.4 µm), L/W = 3.3-4.4 (X = 3.7 ± 0.5), subclavate, with (2-)4 sterigmata. Basidiospores (Figure 175, Appendix C) [18/1] 4.8-5.6(-6) x 2.4-3.2 µm (X = 5.3 ± 0.4 x 2.7 ± 0.3 µm), L/W = 1.5-2.3 (X = 2 ± 0.2), ellipsoid to oblong ellipsoid.

HABITAT AND DISTRIBUTION: unknown conifer; log; wood; rare.

7. Hymenochaete tabacina (Sow.) Léveillé. 1846. Ann. Sci. Nat. Bot. III, 5:152.

≡ Auricularia tabacina Sowerby. 1797. Brit. Fungi, pl. 25.

MACROMORPHOLOGY: Basidiocarp almost resupinate, effused-reflexed, to pileate, orbicular, gregarious, then widely confluent, coricaeous, 0.1-0.3 mm thick; pilei 2-7 mm wide, protruding 2-4 mm,

dimidiate, often constricted at the base, deflexed, then laterally attached to imbricate; upper surface brown (7E4, 7E5, 7E6), finally dark brown (7F4), usually orange yellow to yellowish brown at the margin, sericeous, glabrescent, weakly or distinctly zonate; hymenial surface light brown (6D4), even to colliculose, often deeply rimose with radiating cracks in resupinate portions, finely setulose to almost glabrous; context yellow to yellowish brown.

MICROMORPHOLOGY: Hyphae (Figure 182, Appendix C) 2-4.4(-4.8) µm diam, hyaline, yellowish, or yellowish brown, somewhat to regularly thick-walled (wall usually 0.6-1.2 µm thick), septate, without clamps, commonly branched. Setae (Figure 181, Appendix C) abundant, 56-84 x 8.4-13.6 µm, subulate, thick-walled (wall 2.4-4.4 µm thick), projecting up to 44 µm. Basidia (Figure 180, Appendix C) [5/1] 13.6-17.6 x 3.2-3.6 µm ($\bar{X}$ = 15.4 ± 1.7 x 3.4 ± 0.2 µm), L/W = 4.3-5 ($\bar{X}$ = 4.6 ± 0.4), narrowly clavate to cylindrical, with 4 sterigmata. Basidiospores (Figure 179, Appendix C) [16/1] 4.8-6.4 x 1-1.6 µm ($\bar{X}$ = 5.4 ± 0.6 x 1.3 ± 0.2 µm), L/W = 3.3-5 ($\bar{X}$ = 4.2 ± 0.5), cylindrical, allantoid.

HABITAT AND DISTRIBUTION: *Prunus pensylvanica*, unknown hardwood; twig; bark; possibly uncommon.

REMARK: This species is the commonest one of its genus and is easily recognized by its pileate fruitbody with a bright orange yellow margin and the hymenium cracked into radiating systems in resupinate portions (Burt, 1918).

Inonotus Karsten. 1879. Medd. Soc. Faun. Fl. Fenn. 5:39.

Basidiocarp annual, sessile, effused-reflexed, (or resupinate,)

often imbricate, corky-fleshy, hard but friable when dry; pilei small to medium-sized, dimidiate; upper surface anoderm, pubescent to tomentose; hymenophore tubular, of somewhat medium-sized pores; context brown, darkening in KOH. Hyphal system monomitic, (dimitic, or trimitic). Generative hyphae hyaline, yellowish, or yellowish brown, thin-walled, septate without clamps; skeletal hyphae yellowish brown, thick-walled to subsolid, septate without clamps; binding hyphae few, strongly branched and twisted. Setae mostly present, rather small, reddish brown, thick-walled. Basidia clavate, with 2-4 sterigmata. Basidiospores yellowish, ellipsoid or ovoid, smooth, not amyloid.

1. Inonotus radiatus (Sow.: Fr.) Karsten. 1889. Krit. Finl. Basidsv. p. 331.

≡ Polyporus radiatus Sowerby: Fries. 1821. Syst. Mycol. 1:369.

MACROMORPHOLOGY: Basidiocarp sessile, sometimes effused-reflexed, corky-fleshy, hard when dry; pilei imbricate, in clusters, 2-5 cm wide, protruding 1.5-3 cm, 0.5-2 cm thick at the base, dimidiate, plane or convex, undulate to somewhat lobate, usually acute, becoming involute when dry at the margin; upper surface initially light yellow (4A5) to reddish yellow (4A6), soon brownish orange (5C5, 5C6) to brownish yellow (5C7), later brown (7E5, 7E6) to dark brown (7F4, 7F5, 7F6), frequently light yellow (3A4, 3A5) at the margin, sericeous-pubescent, glabrescent, somewhat weakly zonate; pores 3-4/mm, pale yellow (3A3, 4A3), light yellow (4A4), or grayish yellow (4B4), darkening on bruising, later brown (6E4, 6E5, 6E6, 7E5, 7E6) to dark brown (7F5, 7F6), circular to angular, sometimes rather

irregular; dissepiments becoming thin, initially entire and pruinose at the edge, then fimbriate, dentate, to lacerate; tubes 2-6 mm long, light brown (6D4, 6D5, 6D6) to brown (6E5) within; context 3-9 mm thick, brownish orange (5C5) to light brown (6D5, 6D6), soft-corky, almost woody and friable when dry.

MICROMORPHOLOGY: Hyphal system monomitic. Generative hyphae (Figure 238, Appendix C) 2.4-4(-4.8) µm diam, yellowish or yellowish brown, somewhat or moderately thick-walled (wall 0.8-1 µm or rarely 1.2 µm thick), rarely septate without clamps, rarely branched, mostly parallel and agglutinate. Setae (Figure 237, Appendix C) uncommon, 13.6-26.4 x 6.4-9.6 µm, fusiform-ventricose, curved at the tip, thick-walled (wall 1.6-3.2 µm thick), slightly projecting above the hymenium. Basidia (Figure 236, Appendix C) [8/1] 9.6-12 x 5.6-6.4 µm ($\bar{X}$ = 10.9 ± 1.2 x 6.2 ± 0.4 µm), L/W = 1.5-2.1 ($\bar{X}$ = 1.8 ± 0.2), broadly clavate, with 4 sterigmata. Basidiospores (Figure 235, Appendix C) [20/1] 4.2-5 x 2.8-3.2(-3.6) µm ($\bar{X}$ = 4.7 ± 0.3 x 3.1 ± 0.2 µm), L/W = 1.3-1.7 ($\bar{X}$ = 1.5 ± 0.1), yellowish, ellipsoid.

HABITAT AND DISTRIBUTION: *Betula lutea*, *Fagus grandifolia*, unknown hardwood, *Abies fraseri*; trunk, stump, log; bark, moss-covered bark; possibly common.

REMARK: This fungus occurs on weak or dead hardwood trees and causes rather intensive white rot (Domanski, Orlos, and Skirgiello, 1973). It is notable that TENN 8639 collected from Fraser fir atop Mt. Le Conte is known to be the first record from conifer substratum (cf. Overholts, 1953).

Phaeolus (Pat.) Patouillard. 1900. Ess. tax. Hym. p. 86.

Basidiocarp annual, effused-reflexed, sessile, or stipitate, succulent, firm but brittle when dry; pilei dimidiate, circular, or lobed; upper surface tomentose, sulcate or irregular; hymenophore tubular, of entire to incised dissepiments and large pores; context yellowish to reddish brown, darkening in KOH; stipe central or lateral, short. Hyphal system monomitic. Hyphae hyaline, yellowish brown, to dark brown in KOH, thin- to somewhat thick-walled, simple-septate. Cystidia long, common, subclavate to cylindrical. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, ovoid, (or cylindrical), smooth, not amyloid.

REMARK: This genus used to be placed in the Polyporaceae because of its polyporoid fleshy fruitbody. Even though it does not possess setae, its brown context turning permanently dark in KOH and pigmented clampless hyphae distinguish it.

1. Phaeolus schweinitzii (Fr.) Patouillard. 1900. Ess. tax. Hym. p. 86.

   ≡ Polyporus schweinitzii Fries. 1821. Syst. Myc. 1:351.

MACROMORPHOLOGY: Basidiocarp effused-reflexed, sessile, or stipitate, succulent soft-corky, firm but brittle when dry; pilei (5-)10-20 cm in length or diam, solitary or imbricate, dimidate, circular, or lobed, convex, plane, or depressed, involute at the margin; upper surface light brown (6D5, 6D6, 7D5, 7D6), brown (6E5, 6E6, 7E5, 7E6), reddish brown (8E4, 8E5, 8E6), later dark brown (7F5, 7F6, 8F4, 8F5, 8F6), woolly-tomentose to coarsely hirsute, zonate, concentrically sulcate, or irregularly uneven; pores 1-2(-3)/mm, vivid light yellow (4A5), reddish yellow (4A6), grayish yellow (4B5, 4B6),

brownish orange (5C4, 5C5), light brown (5D4, 5D5), to reddish brown (8E4, 8E5), darkening on bruising, finally becoming dark brown (7F4, 7F5, 8F4, 8F5), angular to irregular; dissepiments thin, entire, lacerate, to incised, often confluent into areoles on drying; tubes up to 8 mm long, decurrent, vivid yellow, then concolorous with pores within; context 0.5-2.5 cm thick, yellowish brown to brown, firm-corky when dry; stipe up to 7 cm long, 1.5-2.5 cm thick, central or lateral, short or slender.

MICROMORPHOLOGY: Hyphae (Figure 275, Appendix C) 4-12(-16) µm diam, hyaline or yellowish brown in the subhymenium, dilated and dark brown in the trama, thin- to slightly thick-walled (wall up to 1 µm thick), simple-septate, sparingly branched in the trama, frequently branched and intertwined in the subhymenium. Cystidia (Figure 274, Appendix C) more than 120 µm long, 7.2-13.6 µm wide or sometimes more, common, hyaline or yellowish brown, subclavate, sphaeropedunculate, often with an elongated apex, or cylindrical, barely projecting or projecting up to 64 µm. Basidia (Figure 273, Appendix C) [10/1] 20-28 x 5-6.4 µm ($X = 22.4 \pm 3.4 \times 5.6 \pm 0.4$ µm), L/W = 3.6-4.8 ($X = 4 \pm 0.5$), clavate, with (2-)4 sterigmata. Basidiospores (Figure 272, Appendix C) [20/1] 5-8 x 3.4-4.6 µm ($X = 6.1 \pm 0.9 \times 4 \pm 0.3$ µm), L/W = 1.3-2 ($X = 1.5 \pm 0.2$), hyaline, broadly ellipsoid to ovoid.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*, unknown conifer, *Betula lutea*; trunk, stump, tree base, log; wood, broken wood, moss-covered bark; occasional.

Phellinus Quélet. 1886. Ench. Fung. p.172.

Basidiocarp perennial, sessile, effused-reflexed, or

resupinate, corky to woody, tough to hard; pilei small to large, dimidiate, typically ungulate; upper surface anoderm, zonate; hymenophore tubular, stratified, of small to medium-sized pores; context brown, darkening in KOH. Hyphal system dimitic. Tramal hyphae usually interwoven, septate, without clamps; generative hyphae hyaline, thin-walled, frequently septate; skeletal hyphae yellowish to reddish brown in KOH, thick-walled, usually aseptate. Setae present in most species, small to large, reddish brown, thick-walled. Basidia clavate to broadly clavate, with 4 sterigmata. Basidiospores hyaline or subhyaline, subglobose, ellipsoid, or cylindrical, smooth, not amyloid.

REMARK: Most species of Phellinus are cosmopolitan and are active decay fungi (Domanski, 1972; Domanski, Orlos, and Skirgiello, 1973; Manion, 1981). Phellinus taxa are thus important factors in the pathology and management of forest trees (Gilbertson, 1979). Some species may show great variation in fruitbody form and host specificity. They may assume two distinct effused and sessile forms (e.g. P. igniarius) or develop strict to broad host relationships. Many varieties and forms are frequently hard to distinguish merely on morphological basis. In this dissertation, the specimens from the research area were treated only at species level.

Key to Species of Phellinus

1. Basidiocarp invariably resupinate.............................. 2
1. Basidiocarp reflexed to sessile................................ 6
    2. Basidiospores cylindrical to suballantoid...... 3. P. ferreus

2. Basidiospores subglobose, ovoid, to broadly ellipsoid...... 3

3. Pores 2-4/mm.................................. 2. *P. contiguus*

3. Pores 4-8/mm.. 4

4. Pores 4-6/mm; spores average >5 µm in length; tramal hyphae interwoven.......................... 4. *P. igniarius*

4. Pores 5-8/mm; spores average <5 µm in length; tramal hyphae parallel or interwoven.......................... 5

5. On hardwood trees and *Abies fraseri*............. 5. *P. laevigatus*

5. On fruit trees like *Prunus*....................... 6. *P. pomaceus*

6. On coniferous trees........................ 1. *P. chrysoloma*

6. On hardwood trees.......................... 4. *P. igniarius*

1. *Phellinus chrysoloma* (Fr.) Donk. 1971. Proc. K. Ned. Akad. Wet. (C) 74:39.

≡ *Polyporus chrysoloma* Fries in Ofvers. 1861. K. Vet. Akad. Förh. 18:30.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, gregarious, soon confluent, reflexed at the upper margin, to sessile, firm- to hard-corky; margin 1-2(-4) mm wide, rounded, tomentose, yellowish orange (4B7, 4B8) to orange (5B7, 5B8), then almost concolorous with pores; pilei imbricate, 1-5.5 cm wide or sometimes more due to lateral fusion, protruding 1-2.5 cm, 1-2.5(-3.5) cm thick, dimidiate, applanate, conchate, to somewhat ungulate, undulate, usually acute at the margin; upper surface tomentose, hirsute, later glabrescent, concentrically sulcate, zonate, brown (6E4, 6E5, 7E4, 7E5), reddish brown (8D4, 8D5, 8D6, 8D7, 8D8, 8E4, 8E5, 8E6, 8E7, 8E8), to dark brown (6F4, 6F5, 7F4, 7F5, 8F4, 8F5, 8F6, 8F7, 8F8), yellowish orange

(4B7, 4B8) to orange (5B7, 5B8) at the new margin; pores (2-)3-4(-5) /mm, grayish orange (5B5, 5B4), brownish orange (5C6, 5C5, 5C4), light brown (5D8, 5D7, 5D6, 6D8, 6D7, 6D6, 6D5), to brown (6E8, 6E7, 6E6, 6E5), glancing, angular, elongate, or somewhat daedaloid; dissepiments thin, entire to lacerate; tubes up to 8 mm long, indistinctly stratified, yellowish to yellowish brown within, often yellow-stuffed when old; context 1-3 mm thick, (reddish) brown, tough-fibrous, separated from the tomentum by a black band.

MICROMORPHOLOGY: Generative hyphae (Figure 302, Appendix C) 1.6-2.4 µm diam, hyaline, thin-walled, septate, without clamps, often branched; skeletal hyphae (Figure 302, Appendix C) 2.4-3.2 µm diam, yellowish brown, moderately thick-walled (wall 0.8-1 µm or rarely 1.2 µm thick), usually aseptate, occasionally branched. Setae (Figure 301, Appendix C) (24-)36-52(-64) x (6.4-) 7.2-11.2(-13.6) µm, common to abundant, subulate, or somewhat ventricose, thick-walled (wall 1.6-4 µm thick or rarely more), projecting up to 28 µm. Hyphal ends with a long slender apex occasionally present in the hymenium. Basidia (Figure 300, Appendix C) [12/3] 9.6-12 x 4-5.6 µm (X = 10.5 $\pm$ 0.9 x 4.6 $\pm$ 0.6 µm), L/W = 2-2.6 (X = 2.3 $\pm$ 0.2), clavate with (2-)4 sterigmata. Basidiospores (Figure 299, Appendix C) [31/4] 4.4-5.8 x 3.4-5.2 µm (X = 5 $\pm$ 0.5 x 4.1 $\pm$ 0.5 µm), L/W = 1-1.5 (X = 1.2 $\pm$ 0.1), hyaline or subhyaline, subglobose to ovoid.

CULTURAL CHARACTERS: Growth rate slow; advancing zone appressed; marginal hyphae rather dense; mat floccose, cottony, to woolly; colony white to cream at the beginning, becoming orange yellow, ochraceous, to orange brown, darkening in KOH. Generative

hyphae (1.2-)2-5.6(-7.4) µm diam, hyaline or yellowish , thin- to somewhat thick-walled, septate, without clamps, copiously branched, sometimes swollen.

Code: 1, 3, 4, 9, 13, (14), 19, (21), 22, 30, (31), (34), 35, 38, (46), 48, (51), 52, 53, 54, 67, 80, 83, 90.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri, Tsuga canadensis; trunk, log; bark, broken or cut wood; frequent.

REMARK: This species has been known as a variety of Phellinus pini and called Fomes pini var. abietis or Phellinus pini var. abietis but is now recognized as a separate species by Domanski (1972), Donk (1974), and others. It is very similar to Phellinus pini but, judging from TENN specimens, the latter apparently has a single and ungulate fruitbody, hard and woody texture, rough and rimose surface, more daedaloid pores, thick dissepiments, vivid light-colored tubes, and lustrous cut surface. Phellinus chrysoloma is very common on dead conifers of the research area and causes a white rot.

2. Phellinus contiguus (Pers.: Fr.) Patouillard. 1900. Ess. tax. p. 97.

≡ Polyporus contiguus Persoon: Fries. 1821. Syst. Myc. 1:378.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, gregarious, soon extensively confluent, uneven or undulate on vertical surface, often thickened up to 1 cm forming small pilei at the upper margin, coriaceous-corky, firm when dry; margin 1-2 mm wide, tomentose or glabrous, brownish orange (5C5, 5C6), then concolorous with pores, finally disappearing; pilei rudimentary, nodular, dark brown (6F4, 7F4) and irregularly sulcate due to deformed tubes at the upper

surface; pores 2-3(-4)/mm, light brown (6D7, 6D8, 7D5, 7D6, 7D7, 7D8) to brown (6E5, 6E6, 6E7, 6E8, 7E4, 7E5, 7E6, 7E7, 7E8), rarely dark brown (7F5, 7F6), circular to angular, elongate, to flexuose; dissepiments thin, entire to lacerate, incised to split when vertical; tubes up to 6 mm long, indistinctly stratified, pale brown within, straight or oblique, usually open at external tubes on vertical surface; context up to 1 mm thick, brown, tough-fibrous.

MICROMORPHOLOGY: Generative hyphae scarce, 1.6-2.8 µm diam, hyaline, thin-walled, septate, without clamps, often branched in the subhymenium; skeletal hyphae (Figure 306, Appendix C) abundant, 2-3.2 µm diam, yellowish brown, later thick-walled (wall up to 1.2 µm thick), aseptate, rarely branched, often agglutinated. Setae (Figure 305, Appendix C) variable in size, 32-104(-120) x 6.4-10.8(-12) µm, common to numerous, subulate, thick-walled (wall up to 4 µm thick), projecting up to 44 µm. Basidia (Figure 304, Appendix C) [13/3] 10.4-16 x 4-5.6 µm ($\bar{X}$ = 12.7 ± 1.9 x 4.9 ± 0.6 µm), L/W = 1.9-3 ($\bar{X}$ = 2.6 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 303, Appendix C) [32/3] (4-)4.6-5.6(-6) x 2.4-4 µm ($\bar{X}$ = 5.1 ± 0.5 x 3.2 ± 0.5 µm), L/W = 1.2-2.2 ($\bar{X}$ = 1.6 ± 0.3), hyaline, ellipsoid, sometimes ovoid.

HABITAT AND DISTRIBUTION: _Betula lutea_, _Sorbus americana_; trunk, twig; lichen-covered bark, wood, litter, fallen leaves; uncommon.

REMARK: This fungus was found growing extensively on fallen-down branches, litter, and fallen leaves of yellow birch slash. Some individuals (TENN 46532) were spreading 2 to 3 m long along dead branches and developing an extensive white rot. TENN 46494 was found

growing from the base to nearly the top of a dead standing yellow birch trunk. This fungus is also known to infect live hardwood and coniferous trees (Domanski, 1972).

3. Phellinus ferreus (Pers.) Bourdot et Galzin. 1925. Soc. Mycol. France Bul. 41:247.

≡ Polyporus ferreus Persoon. 1825. Myc. Europe 2:89.

MACROMORPHOLOGY: Basidiocarp effused, initially small, nodular, then orbicular, broadly confluent, even, rugose and often cracked with age, coriaceous-corky, firm when dry; margin 1-2(-3) mm wide, tomentose or glabrous, grayish orange (5B4, 5B5) to brownish orange (5C5), or concolorous with pores; pores 4-6(-7)/mm, grayish orange (5B4, 5B5), brownish orange (5C4, 5C5, 5C6, 6C3), light brown (6D4, 6D5, 6D6), to brown (6E5, 6E6, 6E7, 6E8), circular to angular; dissepiments usually thin, entire, dentate to sometimes incised when vertical; tubes up to 3 mm long, indistinctly stratified, yellowish brown within, sometimes open at external tubes on vertical surface; context up to 1 mm thick, brown, tough-fibrous.

MICROMORPHOLOGY: Generative hyphae scarce, 1.8-2.4 (-3) µm diam, hyaline, thin-walled, septate, without clamps, often branched in the subhymenium; skeletal hyphae abundant, 2-3.2 µm diam, yellowish brown, moderately thick-walled (wall up to 1 µm thick), aseptate, rarely branched, often agglutinated. Setae (Figure 309, Appendix C) 16-36(-40) x 5.6-7.2(-8) µm, abundant, conical, then subulate, often with a somewhat swollen base, thick-walled (wall up to 2.4 µm or rarely 3.2 µm thick), projecting up to 20 µm. Hyphal ends with long slender apices occasionally present in the hymenium. Basidia (Figure

308, Appendix C) [13/2] 12-12.8 x 4.4-6.4 µm (X = 12.2 ± 0.3 x 5.5 ± 0.8 µm), L/W = 1.9-2.9 (X = 2.3 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 307, Appendix C) [18/2] 5-7.2 x 1.6-2.4 µm (X = 6.2 ± 0.6 x 2 ± 0.3 µm), L/W = 2.3-4.5 (X = 3.2 ± 0.6), hyaline, cylindrical to suballantoid.

CULTURAL CHARACTERS: Growth rate slow; advancing zone appressed to raised; marginal hyphae rather dense; mat downy, woolly, to felty; colony white at the beginning, becoming yellow, ochraceous, to light brown, darkening in KOH. Generative hyphae (1-)1.6-2.8 µm, hyaline or yellowish, thin-walled, septate, without clamps, commonly branched; skeletal hyphae 2.4-4(-7.2) µm, yellowish brown, thick-walled; setae abundant, 42-88 x 4.8-6.4 µm, reddish brown, subulate to cylindrical, thick-walled; setal hyphae present, common, 68-224 x 4-7.2(-10.4) µm, reddish brown, thick-walled.

Code: 1, 3, 4, 9, (12), (13), (14), 17, (21), 22, 25, 30, 34, 35, 38, 46, (48), (50), (51), 52, 53, (54), 67, 69, (80), 83, 89.

HABITAT AND DISTRIBUTION: *Betula lutea*, *Fagus grandifolia*, *Acer spicatum*; trunk, twig; bark, lichen-covered bark, wood; occasional.

REMARK: The description of cultural characters was based on the culture of TENN 46405, but the species code matches almost that of *P. ferruginosus* (cf. Nobles, 1965; Stalpers, 1978). The micromorphology of *P. ferruginosus* is different from *P. ferreus* by the presence of ellipsoid spores and setal hyphae (Lowe, 1966; Gilbertson, 1979), and its occurrence is not yet known from the research area.

4. *Phellinus igniarius* (L.: Fr.) Quélet. 1886. Ench. Fung. p. 172.

≡ Polyporus igniarius L.: Fr. 1821. Syst. Myc. 1:375.

MACROMORPHOLOGY: Basidiocarp sessile, effused-reflexed, or typically effused, hard, woody; margin 1-3 mm wide, rounded, glabrous, light concolorous with pores; pilei single or often several individuals agglomerated, 3-10(-20) cm wide, protruding 1-6 cm, 2-6 cm thick or more when agglomerate, 0.5-2 cm thick when effused, dimidiate, initially nodular, then ungulate, often with several individuals agglomerate; upper surface glabrous, concentrically sulcate, deeply rimose, incrusted, often with mosses overgrown, dark brown (7F4, 8F4), grayish brown (7F3, 8F3), to brownish gray (7F2, 8F2), sometimes with a reddish brown (8E4) tint; pores 4-6/mm, grayish orange (5B3), brownish orange (5C3, 5C4, 5C5, 5C6), light brown (6D5, 6D6, 6D7, 6D8), to brown (6E5, 6E6, 6E7, 6E8, 7E5, 7E6), circular; dissepiments thick, entire, dentate when vertical; tubes indistinctly stratified, each layer up to 5 mm thick, whitish to brownish within, usually white-stuffed; context up to 1 cm thick, (reddish) brown, zonate, woody-fibrous.

MICROMORPHOLOGY: Generative hyphae scarce, 1.6-2.4 µm diam, hyaline, thin-walled, septate, without clamps, often branched in the subhymenium; skeletal hyphae abundant, 2.2-4 µm diam, yellowish brown, thick-walled (wall up to 1.4 µm thick), aseptate, rarely branched, often agglutinated. Setae (Figure 312, Appendix C) 11.2-20 x 4-5.6 µm, common to abundant, subulate, usually with a swollen base, or ventricose, thick-walled (wall up to 2.4 µm thick). Hyphal ends with long slender apices occasionally present in the hymenium. Basidia (Figure 311, Appendix C) [6/2] 8-10.4 x 5-5.6 µm ($X = 9.4 \pm 0.9$ x 5.4

$\pm$ 0.3 µm), L/W = 1.5-2.1 (X = 1.8 $\pm$ 0.2), broadly clavate, with 4 sterigmata. Basidiospores (Figure 310, Appendix C) [27/2] 4.6-6.4 x 3.8-5 µm (X = 5.3 $\pm$ 0.6 x 4.1 $\pm$ 0.4 µm), L/W = 1.2-1.6 (X = 1.3 $\pm$ 0.1), hyaline, ovoid to subglobose, somewhat pointed at one end.

HABITAT AND DISTRIBUTION: Betula lutea, Fagus grandifolia, Picea rubens; trunk, stump, twig; bark, broken wood; common.

REMARK: This species is a dangerous heart rot fungus of many hardwood trees (Boyce, 1961; Manion, 1981). It frequently fruits on live trees and develops further for a certain period after the death of its host and causes an intensive white rot (Boyce, 1961; Domanski, Orlos, and Skirgiello, 1973). This fungus is not known on conifers except Picea (Overholts, 1953). Among specimens from the research area, TENN 46282 and 46452 were found on red spruce and seem to be rare examples.

The Phellinus igniarius complex has been a difficult taxonomic problem and is segregated on the basis of macro- and micromorphology, host specificity, and cultural characters (Gilbertson, 1979). Many forms of this complex have been distinguished but are difficult to identify because of many intermediate characters between them (Domanski, Orlos, and Skirgiell, 1973).

5. Phellinus laevigatus (Fr.) Bourdot et Galzin. 1928. Hym. France p.264.

≡ Polyporus laevigatus Fries. 1874. Hym. Eur. p.571.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, broadly confluent, even or somewhat uneven, sometimes cracked when old, hard, woody; margin 1-2 mm thick, rounded, tomentose or glabrous, brown

(6E7, 6E8, 7E7, 7E8) to dark brown (7F7, 7F8); pores minute, 6-8/mm, brown (6E6, 6E7, 6E8, 7E5, 7E6, 7E7, 7E8) to dark brown (6F7, 6F8, 7F6, 7F7, 7F8), sometimes brownish orange (5C4) to light brown (6D4), rarely olive brown (4D4, 4E4) due to overgrown algae, circular; dissepiments thick, entire, dentate when vertical; tubes indistinctly stratified, each layer 1-2(-3) mm thick, whitish to brownish within, white-stuffed with age; context up to 1.5 mm thick, yellowish brown, then brown, woody-fibrous.

MICROMORPHOLOGY: Tramal hyphae parallel; generative hyphae scarce, 1.6-2.4 µm diam, hyaline, thin-walled, septate, without clamps, frequently branched in the subhymenium; skeletal hyphae abundant, 2.4-4 µm diam, yellowish brown, thick-walled (wall up to 1.2 µm or rarely 1.6 µm thick), usually aseptate, not or rarely branched. Setae (Figure 315, Appendix C) 10.4-22.4(-24) x 4-6.4(-7.2) µm, common to abundant, subulate, usually with a swollen base, or ventricose, thick-walled (wall up to 2.4 µm thick). Basidia (Figure 314, Appendix C) [18/5] 7.2-12.8 x 4-5.2 µm (X = 10.6 $\pm$ 1.6 x 4.4 $\pm$ 0.4 µm), L/W = 1.5-3.2 (X = 2.4 $\pm$ 0.4), clavate to broadly clavate, with 4 sterigmata. Basidiospores (Figure 313, Appendix C) [52/6] 3.8-5 x 2.4-3.6 µm (X = 4.3 $\pm$ 0.4 x 3.1 $\pm$ 0.4 µm), L/W = 1.1-2.1 (X = 1.4 $\pm$ 0.2), hyaline, ovoid or broadly ellipsoid.

CULTURAL CHARACTERS: Growth rate slow to moderate; advancing zone appressed to raised; marginal hyphae rather dense; mat farinaceous, then cottony, woolly, to felty, forming a crustose layer; colony white to cream at the beginning, becoming orange yellow, ochraceous, to brown, darkening in KOH; odour sweet. Generative

hyphae 1.6-4.8 µm diam, hyaline or yellowish, thin- to somewhat thick-walled, septate, without clamps, copiously branched; skeletal hyphae 2.4-4.8(-7.2) um, yellowish brown, rather thick-walled, often with secondary septa; interlocking hyphae sometimes present.

Code: 1, 3, 4, (8), (9), (12), (13), (18), (19), 21, 22, 25, (26), 28, (30), (31), 34, 35, 36, (38), (46), 48, 52, 53, 54, 64, 67, 83, (89), (90).

HABITAT AND DISTRIBUTION: Abies fraseri, Betula lutea, Fagus grandifolia, Tsuga canadensis; trunk, stump, butt, uprooted bottom, twig, log, wood fragment; bark, moss-covered bark, broken wood, cut wood; common.

REMARK: This species has been treated as a resupinate state of P. igniarius by Overholts (1953) and Lowe (1957, 1966), but it has somewhat smaller pores and spores and parallel arrangement of tramal hyphae. Based on TENN and SYR specimens, it is so similar to P. spiculosus that they are to be indistinguishable, but they are reported to be quite distinct in culture (Campbell and Davidson, 1942).

The only difficulty in drawing a conclusive identification on specimens from the research area was a different host specificity. Phellinus laevigatus is known to occur on hardwood trees but, in the spruce-fir forest of the Park, it is commonly found on broken-down Fraser firs. If the identity of specimens on conifers is correct, they could be treated as a separate form of P. laevigatus with a different host specificity.

6. Phellinus pomaceus (Pers.: S.F. Gray) Maire. 1932. Fung. Catalog.

I, p. 37.

≡ Boletus pomaceus Persoon: S.F. Gray. 1821. Nat. Arr. Brit. Pl. 1:642.

MACROMORPHOLOGY: Basidiocarp resupinate, thickened or somewhat reflexed at the margin, orbicular, broadly confluent, even or somewhat uneven, hard, woody; margin up to 10 mm thick, brownish orange (6C7, 6C8), light brown (6D4, 6D5, 6D6, 6D7), to brown (6E5, 6E6, 6E7, 6E8), darkened with age, rounded, initially finely tomentose, soon glabrous, concentrically sulcate by annual growth, deeply rimose; pores 5-6/mm, light brown (6D4, 6D5) to brown (6E5, 6E6, 7E5, 7E6), rarely dark brown (7F7, 7F8), circular; dissepiments usually thick, entire, dentate on verical surface; tubes distinctly stratified, each layer 1-3 mm long, whitish, brownish, to brown within, white-stuffed with age; context 1-8 mm thick, yellowish brown to reddish brown, woody, fibrous.

MICROMORPHOLOGY: Generative hyphae (Figure 318, Appendix C) scarce, 1.6-2.4 µm diam, hyaline, thin-walled, septate, without clamps, frequently branched in the subhymenium; skeletal hyphae (Figure 318, Appendix C) 2-4 µm diam, yellowish brown, thick-walled (wall up to 1.2 µm thick), usually aseptate, not or rarely branched. Setae apparently lacking. Basidia (Figure 317, Appendix C) [6/1] 9.6-11.2 x 5.2-6.4 µm ($\bar{X}$ = 10.3 ± 0.6 x 5.6 ± 0.4 µm), L/W = 1.5-2 ($\bar{X}$ = 1.8 ± 0.2), broadly clavate, with 4 sterigmata. Basidiospores (Figure 316, Appendix C) [12/1] 4-5 x 3.2-4 µm ($\bar{X}$ = 4.6 ± 0.3 x 3.5 ± 0.3 µm), L/W = 1.2-1.5 ($\bar{X}$ = 1.3 ± 0.1), ovoid or broadly ellipsoid.

HABITAT AND DISTRIBUTION: Prunus pensylvanica; trunk; bark;

possibly uncommon.

REMARK: This species was once treated as a variation of *P. igniarius* (Lowe, 1957; Domanski, Orlos, and Skirgiello, 1973), and its resupinate condition strongly reminds one of *P. laevigatus*. *Phellinus pomaceus* is characterized by the variable shape (e.g. resupinate, effused-reflexed, sessile, to ungulate and comparatively small structure) and the darkening color of fruitbody and invariable occurence on fruit trees like *Prunus*. It is known as noxious because it causes intensive white rot on branches of living fruit trees (Domanski, Orlos, and Skirgiello, 1973). TENN specimens (TENN 8391, 8653, 8655) from the research area apparently lack setae even though the literature mentions their rare occurrence.

5. FAMILY POLYPORACEAE

Key to Genera of Polyporaceae

1. Basidiocarp resupinate, effused.................................. 2
1. Basidiocarp effused-reflexed, sessile, dimidiate or ungulate, single or imbricate.................................. 11
    2. Hymenium with cystidia or cystidioles...................... 3
    2. Hymenium devoid of cystidia or cystidioles................. 5
3. Hymenophore regular, tubular...................... see *Tyromyces*
3. Hymenophore irregular, lacerate, to irpicoid.................. 4
    4. Cystidioles present, thin-walled, capitate; generative hyphae distinct, hyphodontoid...........*Schizopora*
    4. Cystidia present, thick-walled, encrusted; generative hyphae not hyphodontoid................ see *Irpex*

5. Tubes stratified.. 6

5. Tubes not stratified.. 7

6. Context white to ochraceous, hard, thin; hyphal system trimitic...................................Perenniporia

6. Context white, yellowish, ochraceous, or pink, corky, thick; hyphal system dimitic, with binding hyphae in the context.................................see Fomitopsis

7. Basidiocarp invariably resupinate........................... 8

7. Basidiocarp becoming reflexed to pileate..................... 10

8. Context duplex, with a gelatinous layer above the tubes; spores cyanophilous......................Parmastomyces

8. Context homogeneous; spores not cyanophilous............... 9

9. Pores darkening with age; basidiocarp separable from the substrate.................................. see Rigidoporus

9. Pores discoloring with age; basidiocarp not separable from the substratum.......................................Poria

10. Texture fleshy; hyphal system monomitic....... see Tyromyces

10. Texture tough or firm; hyphal system dimitic.....see Antrodia

11. Basidiocarp perennial....................................... 12

11. Basidiocarp annual.. 14

12. Context brown, darkening in KOH........................Fomes

12. Context white, yellowish, ochraceous, or pink, not reacting with KOH.. 13

13. Pileal surface covered with a resinous crust; hyphal system dimitic......................................Fomitopsis

13. Pileal surface covered with a gelatinous crust; hyphal system monomitic........................Rigidoporus (= Leucofomes)

14. Context changing color with KOH........................... 15

14. Context not noticeably reacting with KOH.................. 17

15. Context crimson to violet with KOH; hymenophore poroid; hyphal system monomitic..............................Hapalopilus

15. Context darkening with KOH; hymenophore poroid, daedaloid, to lamellate...................................... 16

16. Upper surface glabrous; hymenophore typically daedaloid; cystidia absent in the hymenium........Daedaleopsis

16. Upper surface tomentose; hymenophore typically lamellate; cystidia present in the hymenium.......Gloeophyllum

17. Context colored from the first, red....................Pycnoporus

17. Context white, yellowish, or ochraceous....................... 18

18. Context soft, spongy or fleshy............................ 19

18. Context firm, coriaceous, corky, woody, or cartilaginous... 21

19. Pores sulphureous to avellaneous; hyphal system dimitic, with binding hyphae in the context....................Laetiporus

19. Pores and hyphal system different............................ 20

20. Hyphal system monomitic; basidiocarp effused-reflexed to sessile................................Tyromyces

20. Hyphal system dimitic, with binding hyphae in the context; basidiocarp sessile to substipitate.......Piptoporus

21. Hyphae septate, without clamps; hymenophore irpicoid........Irpex

21. Hyphae septate, with clamps; hymenophore poroid............... 22

22. Cystidia or cystidioles present in the hymenium........... 23

22. Cystidia or cystidioles absent in the hymenium............ 24

23. Hymenophore tubular to irpicoid; context usually homogeneous, coriaceous.............................*Hirschioporus*

23. Hymenophore tubular; context composed of two distinct layers, fibrous..................................*Climacocystis*

24. Context duplex with a thin layer which is visible as a dark line in section; spores ellipsoid................ 25

24. Context not duplex; spores cylindrical..................... 26

25. Hymenophore poroid; hyphal system monomitic............*Bjerkandera*

25. Hymenophore poroid, then irpicoid; hyphal system trimitic...*Cerrena*

26. Basidiocarp thin, coriaceous; upper surface zonate; hymenophore poroid..................................*Coriolus*

26. Basidiocarp comparatively thick, corky; upper surface azonate; hymenophore poroid to irregular.............*Antrodia*

Antrodia Karsten. 1879. Medd. Soc. Fauna Fl. fenn. 5:40.

Basidiocarp annual, resupinate, confluent, effused-reflexed, or sessile, coriaceous to corky, firm to hard; pilei small, thick; upper surface anoderm, usually azonate; hymenophore tubular, sometimes stratified, of medium-sized pores. Hyphal system dimitic. Generative hyphae thin- (to somewhat thick-) walled, with clamps; skeletal hyphae thick-walled, usually aseptate. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical to allantoid, smooth, not amyloid.

1. *Antrodia serialis* (Fr.) Donk. 1966. Persoonia 4:340.

≡ *Polyporus serialis* Fries. 1821. Syst. Mycol. 1:370.

MACROMORPHOLOGY: Basidiocarp effused, orbicular, soon broadly confluent, or reflexed forming irregular or rudimentary pilei at the upper margin, corky, firm to hard, usually separable; pilei imbricate, small, 1-1.5 cm wide or more due to lateral fusion, protruding 0.5-1 cm, convex, thick, obtuse at the margin; upper surface white, pale yellow (4A3), brownish orange (5C5), later light brown (5D5, 6D5, 6D6), finely uneven, glabrous, azonate; pores 2-3/mm, white, yellowish white (4A2), pale yellow (4A3), grayish yellow (4B3), finally brownish orange (5C5), to light brown (5D5), circular, later somewhat angular, elongate or somewhat daedaloid when vertical; dissepiments thick, later thinner, entire, dentate or incised to split when vertical; tubes 1-8 mm long, white within, usually open at external tubes on vertical surface; context 0.5-2 mm thick, up to 3 mm thick at the reflexed part, white, whitish, fibrous-corky, hard and somewhat friable when dry; margin narrow or sometimes broad, usually 0.5-2(-5) mm wide, finally covered with tubes, rounded, finely tomentose or glabrous, almost concolorous with pores.

MICROMORPHOLOGY: Generative hyphae (Figure 14, Appendix C) 1.6-3.2 µm diam, thin-walled or somewhat thick-walled (wall 0.8 µm thick or so), with clamps, often septate without clamps in the context, frequently branched in the subhymenium; skeletal hyphae (Figure 15, Appendix C) prevalent, 1.6-3.2 µm diam, thick-walled (wall up to 1.2 µm thick) or often solid, aseptate, rarely branched, somewhat straight, or much branched and twisted like binding hyphae in the context. Basidia (Figure 13, Appendix C) [10/3] 14.4-18.4 x 4-5.6 µm ($X = 16.4 \pm 1.6 \times 4.5 \pm 0.6$ µm), L/W = 3.3-4.2 ($X = 3.7 \pm 0.3$),

clavate to subclavate, with 4 sterigmata. Basidiospores (Figure 12, Appendix C) [26/2] 5.6-8(-9.6) x 2.2-3 µm (X = 6.5 ± 0.9 x 2.4 ± 0.2 µm), L/W = 2-3.4 (X = 2.7 ± 0.4), cylindrical.

HABITAT AND DISTRIBUTION: *Picea rubens*, unknown conifer, unknown tree; trunk, log; bark, wood, cut wood; abundant.

REMARK: Among specimens from the research area, fruitbodies of TENN 46217 and 46379 were forming on old fruitbodies and producing stratified tubes. The new layer of tubes has a pink to lilac tint on a whitish background and overlaps the old one of last year but does not cover the whole surface. The old layer becomes almost deprived of tubes and forms a white fibrous layer. Fruitbodies have a strong resinous odor which is perceptible even in dried specimens and match *Antrodia serialis* form. *resupinato-stratosus* (Domanski, 1972).

Antrodia serialis is known as an important rotter of structural timbers like weave sheds and cotton mills (Overholts, 1953).

Bjerkandera Karst. emend. Murrill. 1907. North Amer. Fl. 9(1):40.

Basidiocarp annual, (resupinate), effused-reflexed, or sessile, imbricate, coriaceous- to hard-fleshy; pilei small, dimidiate, conchate; upper surface anoderm, tomentose, azonate; hymenophore tubular, of small pores; context duplex, with a dark line at the border of tubes. Hyphal system monomitic. Generative hyphae thin- to somewhat thick-walled, with clamps. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, smooth, not amyloid.

1. *Bjerkandera adusta* (Willd.: Fr.) Karsten. 1879. Medd. Soc. Fauna Fl. fenn. 5:38.

≡ Polyporus adustus Willdenow ex Fries. 1821. Syst. Mycol. 1:363.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, coriaceous and succulent, hard when dry; pilei imbricate, 2-4 cm wide or more due to lateral fusion, protruding 1-3.5 cm, dimidiate, conchate, undulate; upper surface grayish yellow (4B4), grayish orange (5B4), later brownish gray (5C2) or brownish orange (5C3), finely tomentose, glabrescent, azonate; pores (6-)8-10/mm, brownish orange (5C3, 6C3, 6C4), light brownish (6D4), later dark brown (6F4, 6F5, even 9F4 to 9F5), angular, often elongated when vertical; dissepiments thin, entire, dentate or lacerate when vertical; tubes 0.5-1 mm long, yellowish, grayish, then concolorous with pores within, cartilaginous when dry; context 2-3 mm thick, duplex, in the upper layer whitish to grayish, coriaceous-fleshy, corky and friable when dry, in the lower layer thin, of a gray to black line above the tubes.

MICROMORPHOLOGY: Generative hyphae (Figure 21, Appendix C) 2.4-3.2 µm diam, thin- to somewhat thick-walled, with clamps, densely compacted, parallel in arrangement. Basidia (Figure 20, Appendix C) [6/1] 12-16 x 4-5 µm ($X = 13.3 \pm 1.6 \times 4.4 \pm 0.5$ µm), L/W = 2.7-3.2 ($X = 3 \pm 0.2$), clavate to napiform, with 4 sterigmata. Basidiospores (Figure 19, Appendix C) [10/1] 4.8-5.6 x 2.4-3.2 µm ($X = 5 \pm 0.3 \times 2.9 \pm 0.3$ µm), L/W = 1.6-2.2 ($X = 1.8 \pm 0.2$), ellipsoid to cylindrical, adaxially straight.

HABITAT AND DISTRIBUTION: Fagus grandifolia, Picea rubens; trunk; moss-covered bark; possibly rare.

Cerrena S. F. Gray. 1821. Nat. Arr. Brit. Pl. 1:649.

Basidiocarp annual, effused-reflexed or sessile, imbricate,

coriaceous; pilei small, dimidiate, conchate; upper surface anoderm, tomentose, zonate; hymenophore tubular, of medium-sized pores, soon irpicoid; context duplex, with a dark line beneath the tomentum of pileus. Hyphal system trimitic. Generative hyphae thin-walled, with clamps; skeletal hyphae thick-walled to subsolid, aseptate; binding hyphae frequently branched and twisted. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, smooth, not amyloid.

1. Cerrena unicolor (Bull.: Fr.) Murrill. 1903. Jour. Mycol. 9:91.

≡ Daedalea unicolor Bulliard: Fries. 1821. Syst. Mycol. 1:336.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, coriaceous, tough or firm; pilei imbricate, 1.5-5 cm wide or more due to lateral fusion, protruding 1-3.5 cm, dimidiate, often contracted at the base, or flabelliform, conchate, undulate; upper surface zonate with light brown (6D7, 6D8, 6D4 to 6D5 near the base) bands on a light yellow (4A4, 4A5) or brownish orange (5C4, 5C5) background, tomentose to hirsute, concentrically sulcate; pores 2-3/mm, grayish orange (5B3, 5B4) to brownish orange (5C4), pale yellow (4A3) at the margin, circular or elongate, soon flexuose and labyrinthine; dissepiments somewhat thick or thin, dentate, lacerate, incised, finally irpicoid; tubes 1-3 mm long, whitish or creamy within; context thin, up to 1 mm thick, duplex, in the upper layer thin, of a gray to black line beneath the tomentum of pileus, in the lower layer creamy, fibrous, then corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 48, Appendix C) scarce, 2-3 µm diam, thin- or somewhat thick-walled, with clamps; skeletal hyphae (Figure 49, Appendix C)

prevalent, 3.2-4 µm diam, thick-walled or subsolid, aseptate; binding hyphae (Figure 50, Appendix C) common, 1.6-2.4 µm diam, thick-walled to solid, aseptate, frequently branched and twisted. Basidia (Figure 47, Appendix C) [8/1] 12-16 x 4-5.2 µm (X = 13.9 ± 1.7 x 4.5 ± 0.4 µm), L/W = 2.7-4 (X = 3.1 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 46, Appendix C) [15/1] 5.2-7.2 x 2.8-3.6 µm (X = 6 ± 0.7 x 3.2 ± 0.3 µm), L/W = 1.5-2.6 (X = 1.9 ± 0.3), ellipsoid, adaxially straight or somewhat concave.

HABITAT AND DISTRIBUTION: Fagus grandifolia, unknown hardwood; trunk (?), log; bark; possibly uncommon.

Climacocystis Kotlaba et Pouzar. 1958. Ceská Mykol. 12:95.

Basidiocarp annual, sessile or stipitate, imbricate, soft-fleshy, then hard; pilei medium in size, dimidiate to flabelliform, conchate; upper surface anoderm, hirsute, azonate; hymenophore tubular, of somewhat large pores; context pale, duplex, with the upper layer soft and the lower layer tough. Hyphal system monomitic. Generative hyphae thin- to rather thick-walled, with clamps. Cystidia clavate-fusiform, thick-walled. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, smooth, not amyloid.

1. Climacocystis borealis (Fr.) Kotlaba et Pouzar. 1958. Ceská Mykol. 12:96.

   ≡ Polyporus borealis Fries. 1821. Syst. Myc. 1:366.

MACROMORPHOLOGY: Basidiocarp sessile or stipitate, spongy and succulent, hard-cartilaginous when dry; pilei imbricate, 3-9 cm wide, protruding 2.5-6 cm, dimidiate to flabelliform, conchate, convex or

depressed toward the base, sometimes undulate, acute, later involute at the margin, devoid of pores up to 2 mm wide below the margin; upper surface pale yellow (4A3), light yellow (4A4), with a grayish orange (5B5) to brownish orange (5C5) tint, or sometimes light brown (7D5, 7D6), often somewhat uneven, appressed hirsute, azonate or inconspicuously zonate; pores 1-3/mm, yellowish, grayish orange (5B5), brownish orange (5C5), or sometimes light brown (7D5), angular, often elongate when old; dissepiments thin, dentate to lacerate; tubes 2-4 mm long, yellowish to somewhat ochraceous within, cartilaginous when dry; context 2-8 mm thick, almost concolorous with the tubes, of two layers; upper layer thin, soft and cottony; lower layer thick, tough and fibrous, hard when dry; stipe short or cuneately contracted at the base, lateral.

MICROMORPHOLOGY: Generative hyphae (Figure 59, Appendix C) 2-3.2(-4) μm diam, thin- to moderately thick-walled (wall up to 1 μm thick), with clamps, densely intertwined, flexuose, often encrusted. Cystidia (Figure 58, Appendix C) 28-40 x 8-11.2(-12.8) μm, common, clavate-fusiform to ovoid, thick-walled (wall 0.8-1.6 μm thick or usually more at the apex), slightly projecting up to 16 μm. Basidia (Figure 57, Appendix C) [6/1] 18.4-21.6 x 4.8-5.6 μm ($\bar{X}$ = 20 ± 1.1 x 5 ± 0.4 μm), L/W = 3.6-4.5 ($\bar{X}$ = 4 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 56, Appendix C) [24/1] 4-5.6 x 3.2-4 μm ($\bar{X}$ = 5.1 ± 0.5 x 3.6 ± 0.3 μm), L/W = 1.1-1.7 ($\bar{X}$ = 1.4 ± 0.2), broadly ellipsoid or ovoid, adaxially straight.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Tsuga canadensis*, *Betula lutea*; trunk, log; bark; possibly occasional.

REMARK: The cystidia of Climacocystis borealis are analogous with those of Climacodon septentrionalis, of the family Hydnaceae, from which the generic etymology came (Donk, 1960). This species is known to cause an intensive white rot mostly on conifers and disintegrate the wood into fibers and flakes (Domanski, Orlos, and Skirgiello, 1973).

Coriolus Quélet. 1886. Ench. Fung. p. 175.

Basidiocarp annual, effused-reflexed or sessile, imbricate, coriaceous, tough or firm; pilei usually small, dimidiate to flabelliform, conchate; upper surface anoderm, tomentose, zonate; hymenophore tubular, somewhat irpicoid, of small or medium-sized pores; context white, thin. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, septate with clamps; skeletal hyphae hyaline or subhyaline, thick-walled to solid, aseptate; binding hyphae much branched and twisted. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical to suballantoid, smooth, not amyloid.

Key to Species of Coriolus

1. Tubes splitting and becoming irpicoid in appearance; pores large, 1-2/mm.............................. 1. C. cervinus

1. Tubes not splitting and remaining poroid; pores 3-6/mm on the average... 2

    2. Pilei relatively thick, up to 8 mm thick at the base; upper surface tomentose to villose, uniformly colored or zonate................................ 2. C. hirsutus

2. Pilei thin, up to 4 mm thick at the base; upper surface tomentose, zonate with various colors....... 3. C. versicolor

1. Coriolus cervinus (Schw.) Bondarzew. 1953. Polyp. Europ. USSR and Caucasus p. 493.

≡ Boletus cervinus Schweinitz. 1822. Syn. Fung. Carol. p. 70.

MACROMORPHOLOGY: Basidiocarp sessile or effused-reflexed, coriaceous-corky, tough and flexible; pilei imbricate, in clusters, or laterally attached, 1.5-6 cm wide or frequently more due to lateral fusion, protruding 1-3 cm, relatively thick, up to 6 mm thick at the base, dimidiate, applanate or conchate, undulate, often plicate, acute or obtuse at the margin; upper surface pale yellow (4A3) or light yellow (4A4), with a grayish orange (5B4, 5B5) tint, sericeous, tomentose, or floccose, then glabrous, becoming rough and fibrillose-scaly, indistinctly zonate, sometimes concentrically sulcate; pores 1-2/mm, exceptionally 3-4/mm at the margin, grayish orange (5B3, 5B4), brownish orange (5C5, 5C6), to light brown (6D7, 6D8), circular, angular, flexuose, or labyrinthine; dissepiments thin, dentate, lacerate, to split, becoming irpicoid; tubes 1-3 mm long, yellowish to ochraceous within; context 1-3 mm thick, pale ochraceous, fibrous-corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 64, Appendix C) scant, 1.6-2.8 µm diam, thin-walled, with clamps, flexuose; skeletal hyphae (Figure 65, Appendix C) prevalent, 2.8-4.8 µm diam, thick-walled to solid, aseptate, not branched, somewhat flexuose; binding hyphae (Figure 66, Appendix C) not common, 2-2.8 µm diam, thick-walled to solid, aseptate, branched

and twisted. Basidia (Figure 63, Appendix C) [8/1] 12-17.6 x 4-4.8 μm (X = 15.7 ± 1.8 x 4.4 ± 0.4 μm), L/W = 3-4.3 (X = 3.6 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 62, Appendix C) [18/1] 5-7.2(-8) x 1.6-2.4 μm (X = 6.1 ± 1 x 2.2 ± 0.3 um), L/W = 2.1-3.8 (X = 2.9 ± 0.5), cylindrical, slightly curved.

HABITAT AND DISTRIBTUTION: Fagus grandifolia, unknown hardwood; trunk, log; bark, moss-covered bark, wood; possibly uncommon.

REMARK: This fungus has passed by the name of Polyporus biformis Lloyd. It occurs on dead hardwoods and causes rapid white rot (Domanski, Orlos, and Skirgiello, 1973).

2. Coriolus hirsutus (Wulf.: Fr.) Quélet. 1888. Flore Mycol. p. 389.

≡ Boletus hirsutus Wulfen in Jacquin. 1788. Collect. 2:149.

MACROMORPHOLOGY: Basidiocarp sessile, coriaceous, firm with age; pilei single, 4.5-8.5 cm wide, protruding 3-5.5 cm, relatively thick, up to 8 mm thick at the base, dimidiate or somewhat reniform, conchate, plane or depressed toward the base, sometimes undulate, acute or obtuse at the margin, devoid of pores 1 mm wide below the margin; upper surface yellowish brown (5E4, 5E5, 5F5) or zonate with alternating bands of brownish orange (5C4, 5C5) and dark brown (6F8), tomentose to coarsely villose, concentrically sulcate; pores 3-4/mm, grayish orange (5B4) to brownish orange (5C4), circular or subcircular; dissepiments somewhat thin to thick, entire; tubes short, 1-3 mm long, yellowish or creamy within; context 3-5 mm thick or more at the base, concolorous with the tubes, fibrous-gossypine.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative

hyphae (Figure 69, Appendix C) scant, 1.6-2.4 μm diam, mostly thin-walled, with clamps; skeletal hyphae (Figure 70, Appendix C) prevalent, 3.6-4 μm diam, thick-walled or solid, aseptate, not branched; binding hyphae (Figure 71, Appendix C) common, 1.6-2.8 μm diam, subsolid to solid, aseptate, much branched and twisted. Basidia (Figure 68, Appendix C) [10/1] 12-15.2 x 4-5 μm (X = 13.1 $\pm$ 1.1 x 4.6 $\pm$ 0.4 μm), L/W = 2.4-3.4 (X = 2.7 $\pm$ 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 67, Appendix C) [14/1] 5.4-7.6 x 1.6-2.4 μm (X = 6.4 $\pm$ 0.7 x 2 $\pm$ 0.2 μm), L/W = 2.6-4 (X = 3.2 $\pm$ 0.4), cylindrical, slightly curved, pointed at one end.

HABITAT AND DISTRIBUTION: Amelanchier laevis, unknown tree; branch (?); bark; possibly rare.

3. Coriolus versicolor (L.: Fr.) Quélet. 1888. Flore Mycol. p. 390.

≡ Polyporus versicolor Linnaeus: Fries. 1821. Syst. Mycol. 1:368.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, coriaceous, stiff when dry; pilei imbricate, 2-4 cm wide or sometimes more due to lateral fusion, protruding 1-3 cm, thin, up to 4 mm thick at the base, dimidiate or flabelliform, conchate, depressed toward the base, undulate, often involute at the margin, devoid of pores 1 mm wide below the margin; upper surface faded, zonate with alternating bands of grayish brown (6F3) and brownish gray (6C2), often dull yellow (3B3) due to overgrown algae near the base, somewhat glossy, tomentose, later withered; pores 4-6/mm, whitish, grayish yellow (3C3, 4B3, 4C3) to dull yellow (3B3) due to overgrown algae, sometimes light brown (6D5, 6D6), circular or subcircular, elongate to sinuose on oblique surface; dissepiments thin, serrate, lacerate to incised on

oblique surface; tubes short, up to 1.5 mm long, whitish, then ochraceous within; context thin, up to 1.5 mm thick, white, tough-fibrous.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 74, Appendix C) scant, 1.6-2.4 µm diam, thin-walled, with clamps; skeletal hyphae (Figure 75, Appendix C) prevalent, 3.2-4.4 µm diam, thick-walled (wall up to 1.6 µm thick) or solid, aseptate, not branched; binding hyphae (Figure 76, Appendix C) common, 1.6-2.4 µm diam, subsolid to solid, aseptate, much branched and twisted. Basidia (Figure 73, Appendix C) [5/1] 10.4-13.6 x 4-5.2 µm (X = 12.2 $\pm$ 1.2 x 4.7 $\pm$ 0.5 µm), L/W = 2.3-3.2 (X = 2.6 $\pm$ 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 72, Appendix C) [18/1] 4.8-6 x 1.6-2.2 µm (X = 5.3 $\pm$ 0.4 x 1.8 $\pm$ 0.2 µm), L/W = 2.4-3.5 (X = 3 $\pm$ 0.3), cylindrical, slightly curved, pointed at one end.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*, *Betula lutea*; twig, stump; bark; uncommon.

REMARK: This species is very common on hardwood trees at low elevation but becomes uncommon in the spruce-fir forest at high elevation. It occurs on hardwood trees but is also known rarely from coniferous trees like *Picea*, *Abies*, or *Tsuga* (Overholts, 1953).

Coriolus versicolor is a variable species with a number of forms which mostly differ from one another by the color of the upper surface of pileus (Domanski, Orlos, and Skirgiello, 1973). The only specimen (TENN 46251) from the research area was an old one and had a faded color. Reference materials TENN 3366 and 46198 have a typically zonate colors with gray blue, red brown, dark brown, and black narrow

bands on a yellowish gray background. TENN 46017 is strongly effused, and the color of the upper surface is weakly zonate and has light yellow (4A5) and grayish orange (5B5) bands. On the other hand, TENN 3367 has a uniform brownish orange (5C5, 5C6) color and seems to be an unusual example.

Daedaleopsis Schroeter. 1888. Pilze Schl. p. 493.

Basidiocarp annual, effused-reflexed or sessile, single or imbricate, corky, tough or firm; pilei medium-sized, dimidiate, applanate; upper surface anoderm, glabrous, zonate; hymenophore tubular, of large and variable pores; context brownish, darkening in KOH. Hyphal system trimitic. Generative hyphae thin-walled, with clamps; skeletal hyphae thick-walled to subsolid, aseptate; binding hyphae frequently branched and twisted. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical, smooth, not amyloid.

1. Daedaleopsis confragosa (Bolt.: Fr.) Schroeter. 1888. Pilze Schl. p. 493.

≡ Daedalea confragosa Bolton: Fries. 1821. Syst. Mycol. 1:336.

MACROMORPHOLOGY: Basidiocarp sessile, corky, firm; pilei single, 9-11 cm wide, protruding 6 cm, 2.5 cm thick, dimidiate, applanate, acute at the margin; upper surface zonate with brown (6E5, 6E6) bands on the grayish orange (5B4) to brownish orange (5C4, 5C5) backgronud, glabrous, slightly sulcate, striate and somewhat wrinkled; pores large, 1-2/mm, light yellow (4A4) with a brownish orange (5C5) tint, or light brown (5D5, 6D5), variable in shape, somewhat circular, radiately elongated, or labyrinthine; dissepiments thin, entire; tubes

0.5-1 cm long, yellowish or creamy within, darker near the edge; context up to 1.5 cm thick at the base, grayish orange (5B4) to brownish orange (5C4), firm-corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 80, Appendix C) scant, 1.6-3.6 µm diam, thin-walled, with clamps; skeletal hyphae (Figure 81, Appendix C) prevalent, 3.2-5.6 µm diam, thick-walled (wall up to 2 µm thick) or subsolid, aseptate; binding hyphae (Figure 82, Appendix C) common, 2-3 µm diam, frequently branched and twisted. Dendrohyphidia (Figure 79, Appendix C) present in the hymenium, 2.4-3.2 µm diam, thin-walled. Basidia (Figure 78, Appendix C) [5/1] 20-24 x 4-5.6 µm ($X = 21.6 \pm 2.2 \times 4.7 \pm 0.6$ µm), L/W = 3.6-6 ($X = 4.7 \pm 0.9$), clavate, with 4 sterigmata. Basidiospores (Figure 77, Appendix C) [14/1] (7.2-)8.8-10.4 x 2-2.6 µm ($X = 9.2 \pm 0.8 \times 2.2 \pm 0.2$ µm), L/W = 3.6-4.8 ($X = 4.2 \pm 0.4$), cylindrical, slightly curved.

HABITAT AND DISTRIBUTION: *Betula lutea*; trunk (?); bark; rare.

REMARK: This fungus seems to be common in hardwood forests, but only one example is known from the research area. It exhibits a variation in morphology. Reference material TENN 3216 has a typically imbricate fruitbody the pilei of which measure up to 17 x 9 cm and an asperate to tuberculate surface. TENN 6362 has an extereme form, with its surface faded and narrowly sulcate, and its hymenophore dichotomously branched or anastomosed to be lamellate.

Fomes (Fr.) Kickx emend. Teixeira. 1958. Arqu. Bot. Est. S. Paulo 3:173.

Basidiocarp perennial, effused-reflexed or sessile, hard,

woody; pilei large, dimidiate, ungulate; upper surface covered with a distinct crust, zonate; hymenophore tubular, stratified, of medium-sized pores; context brown, darkening in KOH, thick. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae yellowish brown in KOH, thick-walled, aseptate; binding hyphae much branched and twisted. Basidia clavate, with 2 or 4 sterigmata. Basidiospores hyaline, cylindrical, smooth, not amyloid.

REMARK: This genus is an old one and used to carry a broad meaning. Almost all polypores with perennial fruitbodies were once included in the genus Fomes s.l. (cf. Overholts, 1953; Lowe, 1957). These days the present genus is much reduced and narrowly interpreted and contains just a few species (Domanski, Orlos, and Skirgiello, 1973).

1. Fomes fomentarius (L.: Fr.) Kickx. 1867. Fl. Crypt. Flandres pp. 237-238.

   ≡ Polyporus fomentarius Linnaeus: Fries. 1821. Syst. Mycol. 1:374.

MACROMORPHOLOGY: Basidiocarp sessile, hard, woody; pilei mostly single, 7-11 cm wide, protruding 3-7 cm, 4-6 cm thick, dimidiate, ungulate, devoid of pores 1-3 mm wide below the margin; upper surface orange gray (5B2), brownish orange (5C3), light brown (5D4, 6D4), brown (6E4), later grayish brown (5D3, 6E3, 6F3), covered with a hard crust, smooth, glabrous, somewhat to strongly sulcate, zonate, never rimose; crust 1-2 mm thick, reddish or dark brown, resinous; pores 2-3/mm, orange gray (5B2), grayish orange (5B3),

brownish orange (5C4), darkening on bruising, circular; dissepiments thick, entire; tubes indistinctly stratified, each layer 2-7 mm long, whitish or yellowish brown within, white-stuffed when old; context up to 1 cm thick, brownish orange (5C5, 5C6) to light brown (6D8), tough-fibrous.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 89, Appendix C) scant, 2.4-3.2(-4) µm diam, hyaline, thin-walled, with clamps; skeletal hyphae (Figure 90, Appendix C) prevalent, 3-6.4 µm diam, yellowish brown, thick-walled (wall up to 2.4 µm thick) or subsolid, aseptate; binding hyphae (Figure 91, Appendix C) common, 2.4-3.2 µm diam, concolorous with skeletal hyphae, thick-walled to solid, aseptate; much branched and twisted. Basidia (Figure 88, Appendix C) [5/1] 24-28 x 6-7.2 µm (X = 25.1 ± 1.8 x 6.6 ± 0.5 µm), L/W = 3.3-4.7 (X = 3.9 ± 0.5), clavate, with 2(-4) sterigmata. Basidiospores (Figure 87, Appendix C) [10/1] 11.2-13.6 x 4-4.8 µm (X = 12.2 ± 0.8 x 4.2 ± 0.3 µm), L/W = 2.5-3.4 (X = 3 ± 0.2), cylindrical.

HABITAT AND DISTRIBUTION: *Betula lutea*, *Fagus grandifolia*; trunk (?), log; bark; possibly rare.

REMARK: This fungus becomes common on hardwood trees like birch and beech at low elevations of the Park. It is known to cause an intensive heart rot of living trees and continue fruiting on dead and fallen trees (Lindsey and Gilbertson, 1978).

Fomitopsis Karsten. 1881. Rev. Mycol. 3(9):18.

Basidiocarp perennial, reflexed, sessile, or sometimes resupinate, hard, woody; pilei large, dimidiate, ungulate; upper

surface covered with a crust; hymenophore tubular, stratified, of rather small pores; context white, yellowish, ochraceous, or pink, thick. Hyphal system dimitic with binding hyphae in the context. Generative hyphae thin-walled, with clamps; skeletal hyphae thick-walled, aseptate. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid or cylindrical, smooth, not amyloid.

1. Fomitopsis pinicola (Sw.: Fr.) Karsten. 1889. Krit. Finl. Basidsv. p. 306.

≡ Polyporus pinicola Swartz: Fries. 1821. Syst. Mycol. 1:372.

MACROMORPHOLOGY: Basidiocarp often resupinate at first, later reflexed, or sessile, hard, woody; pilei single or in groups, 5-19 cm wide, protruding 4-13 cm, 3-8(-12) cm thick, nodular at first dimidiate, convex, then ungulate, somewhat acute or obtuse at the margin, devoid of pores 3-8 mm wide below the margin; upper surface variable in color, yellowish brown (5D4, 5E4), reddish brown (8D4, 8D5, 8E4, 8E5), light brown (5D4, 6D4, 7D4), brown (6E4, 6E5, 7E4, 7E5), dark brown (7F4, 7F5, 8F4, 8F5), to grayish brown (5D3, 6D3, 7D3, 7E3, 7F3, 8E3, 8F3), frequently dull yellow (3B3), grayish yellow (3C3), grayish green (1D3, 1D4), to olive brown (4D3, 4D4) near the base, usually yellowish white (3A2, 4A2), pale yellow (4A3), light yellow (4A4, 4A5), orange white (5A2), pale orange (5A3), light orange (5A4), to grayish orange (5B4) at the margin, later concolorous with the surface, covered with a hard crust, smooth, glabrous, somewhat to strongly sulcate, sometimes uneven, usually azonate, never rimose; crust thin, 0.2-0.3 mm thick, dark brown, resinous, sticky at first, persisting over the new margin, becoming glabrous; pores 5-6/mm,

yellowish white (4A2), pale yellow (4A3), light yellow (4A4), grayish yellow (4B3), yellowish gray (4B2), orange white (5A2), pale orange (5A3), to grayish orange (5B3, 5B4, 6B4), or even grayish red (7B3), becoming brownish orange (6C4) to light brown (6D4, 6D5) when bruised or old, circular; dissepiments somewhat thick, entire; tubes stratified, each layer 3-7 mm long, pale yellow (4A3) within, later yellowish-stuffed; context up to 3.5 cm thick, whitish, pale yellow (4A3), light yellow (4A4), grayish orange (5B4, 6B4), or brownish orange (6C4), corky-woody.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 94, Appendix C) few, 1.6-2.4 µm diam, thin-walled, with clamps; skeletal hyphae (Figure 95, Appendix C) abundant, 2.8-5.6 µm diam, thick-walled (wall up to 2.4 µm thick) or subsolid, aseptate; binding hyphae in the context 2.4-3.6 µm diam, sparse, poorly developed, subsolid to solid, with short branches or processes. Hyphal ends often thin-walled toward the apex, 3.2-4 µm diam. Basidia (Figure 93, Appendix C) [5/2] 14.4-20 x 5-6.4 µm ($\bar{X}$ = 16.3 $\pm$ 2.2 x 5.8 $\pm$ 0.7 µm), L/W = 2.4-4 ($\bar{X}$ = 2.9 $\pm$ 0.7), clavate, with 4 sterigmata. Basidiospores (Figure 92, Appendix C) [10/2] 5.6-7.2 x 3.6-4 µm ($\bar{X}$ = 6.4 $\pm$ 0.6 x 3.8 $\pm$ 0.2 µm), L/W = 1.5-1.8 ($\bar{X}$ = 1.7 $\pm$ 0.1), ellipsoid.

CULTURAL CHARACTERS: Growth rate somewhat slow to moderate; advancing zone appressed to raised; marginal hyphae rather dense; mat pellicular, subfelty, or woolly; colony white, later cream to pale buff. Generative hyphae mostly 1.6-4 µm diam, thin-walled, frequently with clamps, frequently branched; skeletal hyphae (?) 3.2-5.6 µm diam, somewhat thick-walled, often with secondary septa; chlamydospores 4.8-

9.2 μm diam, subglobose, thick-walled.

Code: (8), (9), (12), (13), (14), (20), (21), 22, 24, 30, (31), 39, 42, (44), 45, (46), (48), 52, 53, 54, (83), 85, (89), (90).

HABITAT AND DISTRIBUTION: Abies fraseri, Tsuga canadensis, Picea rubens, Betula lutea, unknown conifer; trunk, stump, log; bark, moss-covered bark, wood; abundant.

REMARK: This fungus is very common throughout the research area and actively decomposes wood. It develops white mycelial mats in cracks of the wood or bark and produces a brown rot. It decomposes wood of dead conifers and hardwoods and less frequently decays living trees (Domanski, Orlos, and Skirgiello, 1973).

Gloeophyllum Karsten emend. Domanski in Domanski, Orlos, and Skirgiello. 1973. Fungi 2:187.

Basidiocarp annual or perennial, effused-reflexed or sessile, single or imbricate, corky, tough or firm; pilei small to medium in size, dimidiate, applanate (to ungulate); upper surface anoderm, tomentose to villose, somewhat zonate; hymenophore lamellate or tubular, of irregular pores; context brown, darkening in KOH. Hyphal system (dimitic or) trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae yellowish brown in KOH, thick-walled to solid, aseptate; binding hyphae poorly developed. Cystidia present or absent. Basidia clavate, with 4 sterigmata. Basidiospores hyaline or somewhat colored, cylindrical, smooth, not amyloid.

1. Gloeophyllum sepiarium (Wulf.: Fr.) Karsten. 1879. Finl. Hattsv. 2:80.

≡ Daedalea sepiaria Wulfen: Fries. 1821. Syst. Mycol. 1:333.

MACROMORPHOLOGY: Basidiocarp sessile, rarely effused-reflexed, tough-corky, firm when dry; pilei single or imbricate, 1.5-4.5 cm wide or sometimes more due to lateral fusion, protruding 1-2.5 cm, 0.5-1 cm thick, dimidiate, applanate, acute at the margin; upper surface brown (7E5), reddish brown (8E5), to dark brown (7F5, 8F5) toward the base, grayish orange (5B4, 5B5), brownish orange (5C4, 5C5), to light brown (6D5, 6D6, 6D7) near the margin, dark brown (6F4, 7F4, 8F4) to grayish brown (6F3, 7F3, 8F3) throughout when old, tomentose at first, coalesced into appressed or erect fascicles, glabrescent when old, weakly to distinctly zonate; lamellae dense, sometimes anastomosed to form flexuose or labyrinthine pores, 15-20 /cm at the margin, 3-5 mm wide, light brown (6D4, 6D5), brown (6E4, 6E5), dark brown (6F6, 6F7, 8F4), to grayish brown (8F3), usually lighter near the margin, covered with a whitish to avellaneous pruina, thin, entire or somewhat dentate at the edge; context rather thin, 1-3 mm thick, yellowish brown, fibrous-corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 116, Appendix C) 2-4 µm diam, hyaline, thin-walled, often somewhat thick-walled near the septa, with clamps; skeletal hyphae (Figure 117, Appendix C) 2.8-4(-5) µm diam, yellowish brown, thick-walled (wall up to 1.6 µm thick) to solid, aseptate, flexuose; binding hyphae (Figure 118, Appendix C) 2-2.8 µm diam, subsolid to solid, aseptate, slightly differentiated from skeletal hyphae, somewhat branched and twisted with short lateral branches. Cystidia (Figure 115, Appendix C) 32-80 x 4-4.8(-6.8) µm, common, hyaline,

later yellowish brown, hyphoid or somewhat fusiform, thin-walled. Basidia (Figure 114, Appendix C) more than 60 μm long, 6-6.4 μm wide, narrowly clavate, with 4 sterigmata. Basidiospores (Figure 113, Appendix C) [12/2] 8.8-11.2 x 2.8-4(-4.8) μm (X = 9.7 ± 0.6 x 3.5 ± 0.6 μm), L/W = 1.8-3.4 (X = 2.9 ± 0.5), hyaline, later yellowish brown, cylindrical, slightly curved.

CULTURAL CHARACTERS: Growth rate slow to moderate; advancing zone usually appressed; marginal hyphae rather distant; mat initially farinaceous, then downy, subfelty, or locally woolly; colony white at first, becoming brownish orange or ochraceous, darkening in KOH. Generative hyphae 1.2-3 um diam, hyaline or yellowish, thin-walled, frequently with clamps except the margin, copiously branched; skeletal hyphae 2-4 um diam, yellowish brown, thick-walled to subsolid, aseptate, rarely branched; cystidia 3-6 um wide, yellowish brown, narrowly fusiform, thick-walled; arthroconidia (?) 4-4.8 x 1.2-2 um, ellipsoid.

Code: 4, (7), (8), (12), (13), (14), (15), (17), 18, 22, 24, (25), 30, 34, 35, (37), (38), (39), 40, 42, (44), (45), 46, 48, 50, 51, 52, 53, 67, 72, 83, (84), 90.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri; stump, log; wood, cut wood, wood crack; common.

REMARK: In the research area, this species occurs on stump or log of conifers where the forest is open and sunny along the trail. It is one of the most important timber-rotting species and destroys railroad ties and structural timbers (Overholts, 1953). It causes intensive brown rot and rapidly decomposes wood of conifers like

Picea, Abies, and Pinus.

Hapalopilus Karsten. 1881. Rev. Mycol. 3(9):18.

Basidiocarp annual, sessile (or effused-reflexed), fleshy, corky when dry; pilei somewhat small, dimidiate, applanate; upper surface anoderm, glabrous, azonate; hymenophore tubular, of medium-sized pores; context ochraceous, crimson to violet in KOH. Hyphal system monomitic. Generative hyphae hyaline, thin- to thick-walled, with clamps, encrusted with yellowish brown grains. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ellipsoid, smooth, not amyloid.

1. Hapalopilus nidulans (Fr.) Karsten. 1881. Rev. Mycol. 3(9):18.

≡ Polyporus nidulans Fries. 1821. Syst. Mycol. 1:362.

MACROMORPHOLOGY: Basidiocarp sessile, soft-fleshy, firm-corky when dry; pilei single or confluent laterally, 3-4 cm wide, protruding 2 cm, dimidiate or reniform, applanate, acute at the margin; upper surface light brown (6D5), darkening at the margin when handled, finely tomentose when young, soon glabrescent, even to somewhat uneven, azonate; pores 3-4/mm, light brown (6D5) to brown (6E5), angular, often elongated; dissepiments thin, entire to finely fimbriate; tubes 2-3 mm long, pale yellow (4A3) within; context 2-3 mm thick, ochraceous or somewhat lighter than the surface, becoming crimson to violet in KOH, succulent, fibrous, corky and friable when dry.

MICROMORPHOLOGY: Generative hyphae (Figure 121, Appendix C) (2.4-)3-4 μm diam, thin- to thick-walled (wall up to 1.2 μm thick),

encrusted with yellowish brown grains which dissolve in KOH, with clamps which are often conspicuous, sparingly branched in the trama, frequently branched in the subhymenium. Basidia (Figure 120, Appendix C) [7/1] 12-13.6 x 4-4.4 µm (X = 12.9 $\pm$ 0.7 x 4.1 $\pm$ 0.2 µm), L/W = 2.7-3.4 (X = 3.2 $\pm$ 0.3), clavate, with 4 sterigmata. Basidiospores (Figure 119, Appendix C) [12/1] (3.2-)4-4.8 x 2-3 µm (X = 4.3 $\pm$ 0.3 x 2.5 $\pm$ 0.3 µm), L/W = 1.5-2.2 (X = 1.7 $\pm$ 0.2), ellipsoid, adaxially flattened.

HABITAT AND DISTRIBUTION: Fagus grandifolia; branch (?); bark: rare.

REMARK: This species is known to occur on dead branches of various hardwood trees and to cause a weak white rot (Domanski, Orlos, and Skirgiello, 1973). Reference material TENN 12416 was collected from a dead ash at low elevation of Mt. Le Conte and measures up to 4.5 x 2.5 x 1.5 cm.

Hirschioporus Donk. 1933. Rev. niederl. Homob.-Aphyll. 2:168.

Basidiocarp annual, sessile, effused-reflexed, or resupinate, commonly imbricate, coriaceous, stiff when dry; pilei small, dimidiate, conchate; upper surface tomentose, hirsute, or villose, concentrically sulcate; hymenophore irpicoid, tubular, or even lamellate, usually with a violet tint when young; context ochraceous to light brown, thin, in two layers or homogeneous. Hyphal system dimitic or trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae subhyaline, thick-walled to solid, aseptate; binding hyphae much twisted, slightly branched. Hymenium consisting of cystidia, basidia, and sterile hyphal ends. Cystidia clavate to

cylindrical, encrusted at the apex. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical, smooth, not amyloid.

REMARK: The species of *Hirschioporus*, except *H. pargamenus*, are most common throughout the spruce-fir forest of the Park. They usually occur on recently dead trees and decay fresh substrates. Together with some stereoid fungi mentioned earlier, they seem to play an important role as pioneer species in decomposition of newly produced wood substrates.

Key to Species of Hirschioporus

1. On hardwood trees; hyphal system trimitic....... 4. *H. pargamenus*
1. On coniferous trees; hyphal system dimitic.................... 2
    2. Context up to 1.2 mm thick; hymenophore lamellate or radiately split into flattened teeth...... 3. *H. laricinus*
    2. Context up to 0.7 mm thick or so; hymenophore radiately irpicoid or poroid............................ 3
3. Pileus dimidiate, conchate; hymenophore incompletely poroid with lacerate to irpicoid dissepiments.... 1. *H. abietinus*
3. Pileus dimidiate, usually constricted at the base; hymenophore radiately irpicoid, frequently poroid around the margin.............................. 2. *H. fusco-violaceus*

1. *Hirschioporus abietinus* (Dicks.: Fr.) Donk. 1933. Med. Bot. Mus. Univ. Utrecht 9:168.

    ≡ *Polyporus abietinus* Dickson: Fries. 1821. Syst. Mycol. 1:370.

MACROMORPHOLOGY: Basidiocarp sessile, effused-reflexed, or sometimes resupinate, coriaceous, hard and stiff when dry; pilei

mostly imbricate or laterally attached, 1-2(-3) cm wide or more due to lateral fusion, protruding 0.5-1 cm, dimidiate, conchate, undulate, thin and acute at the margin; upper surface yellowish white (2A2), pale yellow (2A3), grayish yellow (2B3, 2C3, 3B3, 3C3, 4C3), to yellowish gray (3B2, 3C2, 4B2), often olive (3D4) or olive brown (4D4) due to overgrown algae, hirsute-tomentose, concentrically sulcate; pores 3-5/mm, grayish orange (5B4), brownish orange (5C4, 5C5, 6C3, 7C3), light brown (5D5, 6D4, 6D5, 7D4), brown (6E4, 6E5, 7E4, 7E5, 7E6), dark brown (6F4, 6F5, 7F4, 8F4), or grayish brown (7D3, 8D3, 8E3), sometimes grayish yellow (1B3, 2B3), with a violet tint when young or fresh, circular-angular, often elongate, or flexuose; dissepiments thin, lacerate, incised, or almost irpicoid; tubes incomplete, short, up to 0.8 mm long, straight or oblique; context 0.2-0.6 mm thick, in two layers, the upper one whitish and fibrous, the lower one light brown and firm-ceraceous.

MICROMORPHOLOGY: Hyphal system dimitic; generative hyphae scant, 2-3.2 µm diam, thin-walled, with clamps, much branched in the subhymenium, inconspicuous in the trama; skeletal hyphae (Figure 129, Appendix C) predominant, 2.4-4 µm diam, moderately thick-walled to subsolid, aseptate, not branched; intermediate hyphae present, thick-walled (wall 1.2-1.6 µm thick), with clamps. Cystidia (Figure 128, Appendix C) 10.4-25.6 x 4.4-7.2 µm, common to abundant, clavate, fusiform, or subcylindrical, usually thick-walled (wall 1-1.6 µm thick), capitately encrusted, sometimes smooth or with remains of crystals at the apex, not or slightly projecting. Basidia (Figure 127, Appendix C) [5/1] 14.4-16 x 4-4.8 µm ($\bar{X}$ = 15.2 ± 0.8 x 4.3 ± 0.4

μm), L/W = 3-4 (X = 3.6 ± 0.5), clavate to subclavate, with 4 sterigmata. Basidiospores (Figure 126, Appendix C) [23/2] 5.6-7.4(-8) x 2-3.2 μm (X = 6.4 ± 0.7 x 2.4 ± 0.4 μm), L/W = 1.9-3.3 (X = 2.7 ± 0.4), cylindrical, adaxially straight or somewhat curved.

CULTURAL CHARACTERS: Growth rate rather fast; advancing zone appressed; marginal hyphae distant, finely fimbriate; mat downy, floccose, to woolly; colony translucent, white. Generative hyphae 2-5.6(-7) um diam, thin-walled, frequently with small clamps, copiously branched; cystidia capitulate, encrusted and 6-10 um diam at the apex.

Code: 1, 3, (7), (8), 13, 14, 17, 19, (20), 22, 30, 39, 42, 44, (45), 52, 53, 54, (57), 72, 83, 90.

HABITAT AND DISTRIBUTION: Abies fraseri, Picea rubens; trunk, twig; bark, lichen-covered bark, wood, cut wood; abundant.

2. Hirschioporus fusco-violaceus (Ehrenb.: Fr.) Donk. 1933. Med. Bot. Mus. Univ. Utrecht 9:169.

≡ Hydnum fusco-violaceum Ehrenberg: Fries. 1821. Syst. Myc. 1:421.

MACROMORPHOLOGY: Basidiocarp sessile or effused-reflexed, coriaceous, hard and stiff when dry; pilei commonly singular, weakly imbricate, 1-3.5 cm wide or sometimes more due to lateral fusion, protruding 0.5-1.5 cm, dimidiate, usually constricted at the base, strongly deflexed, often undulate, thin and acute at the margin; upper surface white, yellowish white (1A2, 2A2, 3A2, 4A2), grayish yellow (1B3, 2B3, 2C3, 3C3, 4B3, 4C3), dull yellow (3B3), to yellowish gray (2B2, 2C2, 3B2, 3C2), frequently with a violet tint at the margin when young, often grayish green (1C3, 1C4), olive (2D4, 2E3, 2E4, 3D3, 3D4,

3E4), or olive brown (4D3, 4D4, 4E3, 4E4) toward the base due to overgrown algae, hirsute-tomentose, concentrically and sometimes radiately sulcate; hymenophore grayish orange (5B3, 5B4), brownish orange (5C3, 5C4, 6C3, 6C4), light brown (6D4, 7D4, 7D5, 7D6), brown (6E4, 6E5, 6E6, 7E4, 7E5, 7E6), dark brown (6F5, 6F6, 7F4, 7F5, 8F4, 9F4), reddish brown (8E4, 9E4), violet brown (10E4, 10F4), grayish brown (7E3, 8E3), to dark ruby (12F4, 12F5), with a violet tint when young or fresh, poroid particularly around the margin, radiately elongated to daedaloid, then radiately irpicoid with flattened teeth; teeth straight, 1-4 mm long; context 0.3-0.7(-1) mm thick, in two layers, the upper one whitish and tomentose, the lower one light brown and firm-ceraceous.

MICROMORPHOLOGY: Hyphal system dimitic; generative hyphae (Figure 133, Appendix C) common in the trama; 2.4-3(-4.4) µm diam, thin-walled, with frequent clamps, sparingly branched; skeletal hyphae (Figure 134, Appendix C) 3-4.8 µm diam, somewhat thick-walled to subsolid, aseptate, not branched, straight or undulate. Hymenium consisted of cystidia, basidia, and sterile hyphal ends. Cystidia (Figure 132, Appendix C) 12.8-28(-36) x 4.8-7.2 µm, common to abundant, fusiform to clavate, usually thick-walled (wall 0.8-1.4 µm thick), frequently encrusted or with remains of crystals at the apex, not or slightly projecting. Basidia (Figure 131, Appendix C) [5/1] 14.4-20 x 4-5.2 µm ($\bar{X}$ = 16.6 $\pm$ 2.2 x 4.6 $\pm$ 0.5 µm), L/W = 3-4.6 ($\bar{X}$ = 3.7 $\pm$ 0.6), clavate to subclavate, with 4 sterigmata. Basidiospores (Figure 130, Appendix C) [14/2] 6.2-7.6 x 2.4-3.2 µm ($\bar{X}$ = 7 $\pm$ 0.4 x 2.6 $\pm$ 0.3 µm), L/W = 2.3-3.1 ($\bar{X}$ = 2.7 $\pm$ 0.3), cylindrical, adaxially

straight or somewhat curved.

CULTURAL CHARACTERS: almost same as those of H. abietinus.

HABITAT AND DISTRIBUTION: Abies fraseri, Picea rubens; trunk, stump, fence rail; bark, lichen-covered bark, moss-covered bark, wood, cut wood; abundant.

REMARK: Among the species of Hirschioporus, H. fusco-vilaceus is most abundant and occurs everywhere from somewhat disturbed to completely diseased areas. Some specimens were collected on the fence rail and stripped dead firs around Mt. Le Conte Lodge where nothing else was found. This fungus grows well on dead spruces and firs alike and causes a somehwat intensive white rot.

3. Hirschioporus laricinus (Karst.) Teramoto. 1951. Bull. Tokyo Univ. Forests 39:212.

≡ Lenzites laricina Karsten. 1905. Acta Soc. Fauna Fl. fenn. 27(4):4.

MACROMORPHOLOGY: Basidiocarp sessile or sometimes effused-reflexed, coriaceous, hard and stiff when dry; pilei singular or imbricate, 1-3.5 cm wide or more when laterally fused, protruding 0.5-2.5 cm, dimidiate, usually narrowed at the base, often deflexed, sometimes undulate, acute and thin at the margin; upper surface yellowish white (3A2, 4A2), pale yellow (4A3), or yellowish gray (4B2), usually grayish white (1B1) to greenish gray (1B2, 1C2) toward the base, often olive (2D3, 2D4) due to overgrown algae, woolly-tomentose, concentrically sulcate; hymenophore reddish brown (8D4, 8E4, 9D4, 9E4, 9E5) to grayish brown (8D3), radiately lamellate, with split lamellae, merging into aculeate plates at the base and radiate-

elongate or -labyrinthine pores (2-3/mm) at the margin; lamellae crowded, up to 2 mm wide; context 0.5-1.2 mm thick, in two layers, the upper one whitish and tomentose, the lower one light brown and firm-ceraceous.

MICROMORPHOLOGY: Hyphal system dimitic; generative hyphae (Figure 138, Appendix C) common in the trama, 1.4-2.8 µm diam, thin-walled or somewhat thick-walled, with frequent clamps, much branched especially in the subhymenium; skeletal hyphae (Figure 139, Appendix C) 2.4-4.8 µm diam, thick-walled (wall up to 1.6 µm thick), aseptate, not branched. Cystidia (Figure 137, Appendix C) 17.6-28.8(-37) x 4.4-7.2 µm, numerous, fusiform, clavate, or variable in size and shape, thick-walled (wall up to 2 µm thick), capitately encrusted or with remains of crystals at the apex, not or slightly projecting. Basidia (Figure 136, Appendix C) [7/1] 15.2-22.4 x 4-5.6 µm ($\bar{X}$ = 17 ± 2.5 x 4.5 ± 0.6 µm), L/W = 3.3-4 ($\bar{X}$ = 3.8 ± 0.3), clavate, with 4 sterigmata. Basidiospores (Figure 135, Appendix C) [29/1] 5.6-8.2(-8.8) x 1.8-2.8 µm ($\bar{X}$ = 7 ± 0.8 x 2.3 ± 0.2 µm), L/W = 2.3-4 ($\bar{X}$ = 3.1 ± 0.4), cylindrical, adaxially straight or somewhat curved.

CULTURAL CHARACTERS: Growth rate somewhat slow to moderate; advancing zone appressed; marginal hyphae distant, finely fimbriate; mat downy, woolly, to felty; colony white. Generative hyphae 2-5.6 um diam, thin-walled, frequently with small clamps, copiously branched; cystidia capitulate, encrusted at the apex.

Code: 1, 3, (8), (9), 13, 14, 17, (21), 22, (25), 30, 39, 42, 44, (45), 52, 53, 54, 72, 83, 90.

HABITAT AND DISTRIBUTION: _Abies fraseri_; trunk: bark, wood;

possibly uncommon.

REMARK: As there was no reference material, it was hard to confirm the identification of this species. *Hirschioporus laricinus* is very similar to *H. fusco-violaceus* but has rather lamellate hymenophore and microscopic elements of somewhat varying size and shape. The lamellae of the specimens were not at all entire and were split to form large flattened teeth of radial arrangement. This fungus was once considered as a form, variety, or subspecies of *H. abietinus* or *H. fusco-violaceus* but proved to be a separate species in fertility tests by Macrae (1967). No specimen was collected from *Picea rubens*.

4. *Hirschioporus pargamenus* (Fr.) Bondarzew et Singer. 1941. Ann. Mycol. 39:63.

≡ *Polyporus pargamenus* Fries. 1838. Epicr. p.480.

MACROMORPHOLOGY: Basidiocarp sessile or effused-reflexed, coriaceous, flexible; pilei imbricate, 1-7 cm wide or sometimes more due to lateral fusion, protruding 1-4 cm, dimidiate, flabelliform, or cuneate, entire or lobate, acute and thin at the margin, devoid of pores 1-1.5 mm wide below the margin; upper surface pale yellow (4A3), light yellow (4A4), to grayish yellow (4B3, 4B4), originally zonate with narrow grayish to brownish bands, brownish orange (5C3) to grayish brown (5D3) with age, hirsute-tomentose, sericeous, or subglabrous, somewhat glossy; pores 3-4/mm, pale orange (5A3), grayish orange (5B4), or brownish orange (5C5, 6C5), with a lilac tint when young, light brown (6D5, 6D6) to brown (6E5, 6E6) with age, circular, elongate, or flexuose; dissepiments thin, entire, dentate, incised,

finally irpicoid; tubes initially short, up to 2 mm long, soon incomplete; context 0.5-1 mm thick, homogeneous, whitish, tough-fibrous.

MICROMORPHOLOGY: Hyphal system trimitic; generative hyphae (Figure 143, Appendix C) scant, 2-3.2 μm diam, thin-walled or somewhat thick-walled, with clamps, often merging into skeletal hyphae; skeletal hyphae (Figure 144, Appendix C) predominant, 3.6-5 μm diam, thick-walled to solid, aseptate, not branched; binding hyphae (Figure 145, Appendix C) common, 2-3.2 μm diam, thick-walled to solid, aseptate, much twisted, slightly branched. Cystidia (Figure 142, Appendix C) 18.4-24 x 4-5.6 μm, common, usually thick-walled (wall 1.2 μm thick or so), capitately encrusted, sometimes smooth or with remains of crystals at the apex, not or slightly projecting. Basidia (Figure 141, Appendix C) [5/1] 14.4-17.6 x 4.8-5.6 μm ($X = 15.7 \pm 1.3$ x 5.3 ± 0.3 μm), L/W = 2.6-3.7 ($X = 3 \pm 0.4$), clavate, with 4 sterigmata. Basidiospores (Figure 140, Appendix C) [13/1] 5.2-6.8 x 2-3 μm ($X = 6 \pm 0.5$ x 2.5 ± 0.4 μm), L/W = 2.1-3 ($X = 2.4 \pm 0.3$), cylindrical, adaxially straight or somewhat curved.

HABITAT AND DISTRIBUTION: _Fagus grandifolia_, unknown tree; trunk (?); bark; rare.

REMARK: This fungus is common on hardwood trees at low elevations in Cades Cove but becomes rare in the elevated spruce-fir forest. This species differs from others by its trimitic hyphal system and hardwood host.

Irpex Fries. 1825. Syst. Orb. Veg. p. 81.

Basidiocarp annual, resupinate, effused-reflexed, to sessile,

imbricate, coriaceous; pilei small, narrow; upper surface tomentose, concentrically sulcate; hymenophore poroid to irpicoid; context white, thin. Hyphal system dimitic. Generative hyphae hyaline, usually thin-walled, septate, without clamps; skeletal hyphae hyaline, thick-walled to subsolid, aseptate, not branched, often merging into intermediate hyphae. Skeletocystidia fusiform to elongate-clavate, smooth or encrusted. Basidia subclavate, with 4 sterigmata. Basidiospores hyaline, oblong-ellipsoid, smooth, not amyloid.

1. Irpex lacteus (Fr.: Fr.) Fries. 1828. Elench. Fung. p. 145.

   ≡ Hydnum lacteum Fries: Fries. 1821. Syst. Mycol. 1:412.

MACROMORPHOLOGY: Basidiocarp resupinate, effused-reflexed, to sessile, orbicular, gregarious, soon confluent, coriaceous, flexible, strongly adnate, rather thin, less than 1 mm thick; pilei revolute at the upper margin, laterally fused, often imbricate, narrow, protruding up to 1 cm, inflexed at the pileate margin; upper surface mostly yellowish white (4A2), sometimes pale yellow (4A3) to light yellow (4A4), often with a grayish tint, tomentose, concentrically sulcate; hymenophore pale yellow (4A3), then grayish orange (5B4), poroid, forming a reticulum with circular, angular, irregular, to labyrinthine pores (1-2/mm), then irpicoid with dissepiments splitting into irregular plates, aculei, or denticles up to 1.5 mm long; context thin, hardly visible in the effused part, up to 0.5 mm thick, white, tough-fibrous.

MICROMORPHOLOGY: Tramal hyphae distinct; generative hyphae (Figure 242, Appendix C) 2.4-4 µm diam, thin-walled or somewhat thick-walled, septate, without clamps, frequently branched, usually

flexuose; skeletal hyphae (Figure 243, Appendix C) 3.6-5 µm diam, thick-walled (wall 0.8-1.6 µm thick) to subsolid, aseptate, not branched, often merging into thin-walled intermediate hyphae. Skeletocystidia (Figure 241, Appendix C) 88-176 x 4.8-7.2 µm, numerous, fusiform, cylindrical, or elongate-clavate, often curved, thick-walled (wall 1.2-2.2 µm thick), smooth or encrusted around the apex, projecting up to 52 µm. Basidia (Figure 240, Appendix C) [6/1] 16-24 x 3.2-4.4 µm (X = 18.7 $\pm$ 3 x 3.8 $\pm$ 0.6 µm), L/W = 4-7.5 (X = 5 $\pm$ 1.3), subclavate to somewhat cylindrical, with 4 sterigmata. Basidiospores (Figure 239, Appendix C) [8/1] 4.6-6 x 1.8-2.4 µm (X = 5.3 $\pm$ 0.4 x 2.2 $\pm$ 0.2 µm), L/W = 2.1-2.7 (X = 2.4 $\pm$ 0.2), oblong-ellipsoid, adaxially straight.

CULTURAL CHARACTERS: Growth rate very fast; advancing zone raised; marginal hyphae distant, finely fimbriate; mat downy, cottony, to woolly, sometimes plumose; colony white. Generative hyphae 1.6-7.2(-8) µm, thin- to rather thick-walled, frequently and often inequivalently branched, frequently septate, without clamps; interlocking hyphae sometimes present.

Code: 1, 3, (5), (6), 12, 14, 17, (19), 21, 22, (23), 30, 37, 48, 50, 52, 53, 54, (55), (64), (80), 83, 89.

HABITAT AND DISTRIBUTION: unknown hardwood; twig; bark, wood; rare.

REMARK: The only specimen from the low extreme of the research area, TENN 46533, was vigorously growing 3 m long along the fallen twig of an unknown hardwood. This species becomes common on hardwood trees at low elevation and actually belongs to the taxa of low

elevation forests.

Laetiporus Murrill. 1905. Bull. Torrey Bot. Cl. 31:607.

Basidiocarp annual, (sessile or) substipitate, imbricate, fleshy, caseous; pilei large, dimidiate, applanate; upper surface usually glabrous, uneven, radiate-rugose; hymenophore tubular, of medium-sized pores; context yellowish cream, apricot near the surface, thick. Hyphal system dimitic with binding hyphae in the context. Generative hyphae hyaline, thin-walled, septate, without clamps; skeletal hyphae hyaline, thick-walled, usually aseptate. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ovoid to broadly ellipsoid, smooth, not amyloid.

1. Laetiporus sulphureus (Bull.: Fr.) Bondarzew et Singer. 1941. Ann. Myc. 39:51.

   ≡ Polyporus sulphureus Bulliard: Fries. 1821. Syst. Myc. 1:357.

MACROMORPHOLOGY: Basidiocarp substipitate, soft-fleshy, caseous, firm but fragile when dry; pilei imbricate, in (large) clusters, 5-8 cm wide, protruding 5-6 cm, dimidiate, somewhat undulate, slightly inflexed at the margin; upper surface pale yellow (4A3), light yellow (4A4), light orange (5A4), to grayish orange (5B4), tomentose, soon glabrescent, uneven, radiate-rugose; pores 2-4 /mm, light yellow (1A5, 2A5), then brownish orange (5C5, 6C5) when dry, angular, often elongated on vertical position; dissepiments thin, entire, fimbriate, or lacerate; tubes short, 1-3 mm long; context 0.5-1.5 cm thick, yellowish cream, apricot near the surface, white to pale yellow (4A3) when dry, caseous, light-corky and friable when dry.

MICROMORPHOLOGY: Hyphal system dimitic with binding hyphae in the context; generative hyphae (Figure 250, Appendix C) 3.2-4.8 µm diam, thin-walled or moderately thick-walled, septate, without clamps, occasionally branched; skeletal hyphae (Figure 251, Appendix C) 3.2-5.6 µm diam, usually thick-walled (wall 0.8-1.2 µm thick), aseptate, not branched; binding hyphae (Figure 252, Appendix C) in the context 3.2-13.6 µm diam, usually thick-walled (wall 0.8-1.2 µm thick), copiously branched and interlocking. Basidia (Figure 249, Appendix C) [6/1] 14.4-18.4 x 5.6-7.2 µm ($X = 16.9 \pm 1.5 \times 6.5 \pm 0.5$ µm), L/W = 2.4-2.8 ($X = 2.6 \pm 0.1$), clavate, with 4 sterigmata. Basidiospores (Figure 248, Appendix C) [18/1] 5-8 x 4-4.8 µm ($X = 6.2 \pm 0.8 \times 4.3 \pm 0.4$ µm), L/W = 1.2-1.7 ($X = 1.5 \pm 0.2$), ovoid to broadly ellipsoid.

HABITAT AND DISTRIBUTION: _Abies fraseri_; trunk (?); bark; rare.

REMARK: This species is an uncommon brown rot fungus. Reference material TENN 4357 has unevenly plicate and strongly lobed pilei which are imbricately clustered at the base, whiel TENN 3935 has large pilei measuring up to 15 x 10 cm.

Parmastomyces Kotlaba et Pouzar. 1964. Feddes repertorium 69(2):138.

Basidiocarp annual, resupinate to effused-reflexed, cartilaginous-fleshy, thin to thick; hymenophore tubular, of medium-sized pores; context rather thin, in two layers, the upper one whitish and fleshy, the lower one dark and gelatinous above the tubes. Hyphal system monomitic. Generative hyphae hyaline, thin-walled, with clamps, agglutinate in the lower context. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, usually ellipsoid, smooth, not

amyloid, dextrinoid, cyanophilous.

1. Parmastomyces kravtzevianus (Bond. et Parm.) Kotlaba et Pouzar. 1964. Feddes repertorium 69(2):138.

≡ Tyromyces kravtzevianus Bondarzew et Parmasto in Parmasto. 1957. Mycoth. Eston. 1, No. 25.

MACROMORPHOLOGY: Basidiocarp resupinate to effused-reflexed, orbicular, confluent, soft, cartilaginous-fleshy, separable when fresh, strongly shrunken, firm and friable when dry, adnate, somewhat thick, up to 6 mm thick at the reflexed part; abhymenial surface white to pale yellow (4A3), brownish orange (5C4, 5C5) when touched or dried, byssoid, matted, to membranous, azonate; pores 2-3(-4)/mm, white, turning brownish orange (5C4, 6C4) to light brown (6D4) when dried, circular to angular, elongated on vertical position; dissepiments thin, entire to lacerate, incised on vertical position; tubes initially short, later 2-4 mm long, rather fragile; context 1-2 mm thick, in two layers, the upper one soft, whitish and fleshy, the lower one thinner, above the tubes, dark and gelatinous, hard when dry, seen as a dark line.

MICROMORPHOLOGY: Tramal hyphae densely interwoven and somewhat agglutinate; generative hyphae (Figure 261, Appendix C) 2.4-4.8 µm diam, thin-walled or moderately thick-walled, with frequent clamps, much branched, often flexuose. Basidia (Figure 260, Appendix C) [6/1] 12-16 x 4-4.8 µm (X = 14.4 $\pm$ 1.7 x 4.3 $\pm$ 0.4 µm), L/W = 2.7-4 (X = 3.4 $\pm$ 0.5), clavate, with 4 sterigmata. Basidiospores (Figure 259, Appendix C) [24/1] 4-5.6 x 2-2.8 µm (X = 4.8 $\pm$ 0.5 x 2.5 $\pm$ 0.3 µm), L/W = 1.5-2.3 (X = 2 $\pm$ 0.2), ellipsoid to short cylindrical, not

amyloid, dextrinoid, cyanophilous.

HABITAT AND DISTRIBUTION: Picea rubens, unknown conifer; stump, log; wood; rare.

REMARK: This species is similar to Tyromyces fragilis in its color change on touching or drying, but it differs considerably from the latter by its duplex context and cyanophilous spores.

This species was first described as Poria subcartilagineus by Overholts (1941) without a Latin description. After being renamed as a species of Tyromyces by Parmasto, it was again recombined under the present name by Kotlaba and Pouzar (1964).

Perenniporia Murrill. 1942. Mycologia 34:595.

Basidiocarp perennial, resupinate, coriaceous, corky when dry, thick; hymenophore tubular, stratified, of small pores; context whitish to ochraceous, thin. Hyphal system trimitic. Generative hyphae scant, hyaline, thin-walled, with clamps; skeletal hyphae hyaline, thick-walled, aseptate, flexuose; binding hyphae highly branched and twisted. Cystidioles (if any) thin-walled, inconspicuous. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, broadly ellipsoid, truncate at one end, smooth, not amyloid.

REMARK: The genus Perenniporia was reintroduced by Donk (1967) to segregate a natural group from the artificial genus Poria. The species of Perenniporia are very intensive decomposers of wood substrates in the spruce-fir forest of the Park.

Key to Species of Perenniporia

1. Basidiocarp on hardwoods; basidiospores clearly truncate; binding hyphae predominant; cystidioles absent.......... .... 1. *P. medulla-panis*

1. Basidiocarp on conifers; basidiospores indistinctly truncate; skeletal hyphae predominant; cystidioles present... 2. *P. subacida*

1. *Perenniporia medulla-panis* (Jacq.: Fr.) Donk. 1967. Persoonia 5(1):76.

    ≡ *Polyporus medulla-panis* Jacquin: Fries. 1821. Syst. Mycol. 1:380.

MACROMORPHOLOGY: Basidiocarp effused, small, orbicular, then broadly confluent, following the contour of substrate, coriaceous, hard when dry, adnate, up to 3 mm thick; pores 5-7/mm, white when fresh, yellowish white (4A2), or pale yellow (4A5), regular, circular to angular; dissepiments thin, entire, dentate to lacerate in vertical position; tubes up to 2.5 mm long, indistinctly stratified, white-stuffed when old; context up to 0.5 mm thick, whitish to cream, fibrous- to ceraceous-corky when dry; margin 1 mm wide, entire.

MICROMORPHOLOGY: Tramal hyphae intricately interwoven; generative hyphae (Figure 264, Appendix C) scant, 1.8-2.4 µm diam, thin-walled, infrequently with clamps, uncommonly branched; skeletal hyphae (Figure 264, Appendix C) scant, 1.6-3.2 µm diam, thick-walled to solid, aseptate, not branched; binding hyphae (Figure 265, Appendix C) abundant, 1.2-2.4 µm diam, thick-walled to solid, aseptate, highly branched and twisted. Basidia (Figure 263, Appendix C) [4/1] 12-14.4 x 4.8-5.6 µm ($X = 13.2 \pm 1 \times 5.3 \pm 0.4$ µm), L/W = 2.3-2.7 ($X = 2.5 \pm$

0.2), clavate, with 4 sterigmata. Basidiospores (Figure 262, Appendix C) [15/1] 4-5.6 x 3-4 µm (X = 4.5 ± 0.5 x 3.4 ± 0.3 µm), L/W = 1.2-1.6 (X = 1.3 ± 0.1), broadly ellipsoid to ovoid, truncate at one end, often somewhat angular, thick-walled, dextrinoid.

HABITAT AND DISTRIBUTION: Fagus grandifolia; stump; cut wood, wood crack; rare.

2. Perenniporia subacida (Peck) Donk. 1967. Persoonia 5(1):76.

≡ Polyporus subacidus Peck. 1885. N.Y. St. Mus. Ann. Rep. 38:92.

MACROMORPHOLOGY: Basidiocarp effused, small, orbicular, readily and broadly confluent, following the contour of the substrate, coriaceous, hard when dry, adnate, sometimes separable from smooth substrates, up to 3.5 mm thick; pore 2-4(-5)/mm, white, yellowish white (3A2, 4A2), pale yellow (3A3, 4A3), light yellow (4A4), to reddish yellow (4A6), somewhat darkening on bruising when fresh, light orange (5A4, 5A5), orange (5A6, 5A7, 5A8, 5B8, 6B8), grayish orange (5B3, 5B4, 5B5), brownish yellow (5C8, 6C8), to light brown (6D8) when dry, circular to angular, often elongate or flexuose in vertical position; dissepiments thick and fibrous-corky when young, thin and rigid-membranous with age, entire or dentate, lacerate to incised in vertical position; tubes reticulate and shallow near the margin, up to 2 mm long in the center, sometimes compound, indistinctly stratified; context up to 0.8 mm thick, whitish to cream, ochraceous when exposed, fibrous- to ceraceous-corky when dry, friable; margin narrow to wide, 1-7 mm wide, tomentose, byssoid, or fimbriate, then entire, strongly curled on drying when detached from the substrate.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative

hyphae (Figure 269, Appendix C) 1.6-2.4 µm diam, thin-walled, with clamps, much branched in the subhymenium; skeletal hyphae (Figure 270, Appendix C) predominant, 2.4-4.8 µm diam, thick-walled to solid, aseptate, rarely branched, straight or somewhat flexuose; binding hyphae (Figure 271, Appendix C) inconspicuous, slender, 0.8-1.2 µm diam, thick-walled to solid, much branched and flexuose. Cystidioles (Figure 268, Appendix C) 24-27.2 x 5.6-7.2 µm, uncommon, inconspicuous, clavate to fusiform, mostly embedded. Basidia (Figure 267, Appendix C) [7/1] 9.6-16 x 4.4-5.2 µm ($\bar{X}$ = 12.3 $\pm$ 2.2 x 4.8 $\pm$ 0.3 µm), L/W = 1.9-3.3 ($\bar{X}$ = 2.6 $\pm$ 0.5), clavate, with 4 sterigmata. Basidiospores (Figure 266, Appendix C) [40/2] 4-5.8 x 3-4.4(-4.8) µm ($\bar{X}$ = 4.8 $\pm$ 0.4 x 3.7 $\pm$ 0.5 µm), L/W = 1-1.8 ($\bar{X}$ = 1.3 $\pm$ 0.2), ovoid, ovoid-ellipsoid, or sometimes subglobose, often somewhat truncate at one end, sometimes laterally apiculate, usually with an oil drop.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*, unknown conifer; trunk, stump, butt, log; wood, broken wood, wood crack, moss-covered bark, litter; occasional.

REMARK: TENN 46491-2 and 46524-5 were found to grow vigorously everywhere from the trunk near base onto the surrounding litter on the ground spreading over protrusions and filling cracks. This species causes intensive white rot and disintegrates the wood to single fibers and flakes. It may develop extensive root or butt rot that can weaken the trees from the base and make them subject to windthrow or windbreak (Boyce, 1961; Hepting, 1971).

Piptoporus Karsten. 1881. Med. Soc. Fauna et Flora Fenn. 6:9.

Basidiocarp annual, substipitate or sessile, gossypine, corky

when dry; pilei medium-sized, dimidiate, involute at the margin; upper surface covered with a cuticle becoming rimose and detaching with age; hymenophore tubular, of rather small pores; context white, thick. Hyphal system dimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae hyaline, thick-walled to subsolid, aseptate. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, cylindrical or fusiform-ellipsoid, smooth, not amyloid.

1. Piptoporus betulinus (Bull.: Fr.) Karsten. 1881. Rev. Mycol. 3:17.

≡ Polyporus betulinus Bulliard: Fries. 1821. Syst. Mycol. 1:358.

MACROMORPHOLOGY: Basidiocarp substipitate, gossypine, rigid when dry; pilei singular, often laterally attached, 4-7 cm wide, protruding 3.5-7 cm, dimidiate or oval, pulvinate, thick and strongly involute at the margin; upper surface whitish at first, brownish orange (5C3, 5C4, 5C5), light brown (5D5, 5D6, 6D4, 6D5, 6D6), to brown (6E4, 6E5, 6E6), glabrous, covered with a cuticle; cuticle thin, papery, becoming rimose and detaching in pieces when old; pores 3-4 /mm, whitish at first, light brown (6D4), brown (6E4), dark brown (7F4, 7F5), to grayish brown (7F3), regular, circular to angular; dissepiments thin, entire or dentate; tubes 2-5 mm long, in one layer, easily peeled from the context when fresh, somewhat detaching from the context on drying; context 1-3 cm thick, white, soft-gossypine, rigid-corky when dry.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 321, Appendix C) 2-4 μm diam, thin-walled, with clamps, sparingly branched; skeletal hyphae (Figure 322, Appendix C) predominant, 2.4-5 μm diam, thick-walled to subsolid, aseptate, not

branched, flexuose. Basidia (Figure 320, Appendix C) [8/1] 15.2-19.2 x 4-4.8 µm (X = 16.8 ± 1.4 x 4.3 ± 0.4 µm), L/W = 3.2-4.8 (X = 3.9 ± 0.6), clavate, with 4 sterigmata. Basidiospores (Figure 319, Appendix C) [14/1] 4.4-5.6 x 1.4-2.2 µm (X = 5 ± 0.5 x 1.8 ± 0.3 µm), L/W = 2.4-3.5 (X = 2.8 ± 0.4), cylindrical, slightly curved, somewhat pointed at one end.

HABITAT AND DISTRIBUTION: Betula; trunk (?); bark; rare.

REMARK: Fruitbodies of reference material TENN 35032 were large, measuring 15 x 12 x 4.5 cm. With TENN 14828, their cuticle and tube layer remained whole and did not detach in pieces at all in the dried condition.

Poria Persoon: S.F.Gray. 1821. Nat. Arrang. Brit. Pl. 1:639.

Basidiocarp annual (or perennial), resupinate, of various texture, thin to thick; hymenophore tubular, of various pore, length, and width; context white to colored, thin. Hyphal system monomitic, dimitic, or trimitic. Generative hyphae hyaline, usually thin-walled, septate, with or without clamps; skeletal hyphae hyaline, thick-walled, aseptate. Cystidia or cystidioles present or absent. Basidia clavate, with 4 sterigmata. Basidiospores usually hyaline, varying in size and shape, smooth, not amyloid.

REMARK: This is a traditional genus in which resupinate polypores used to be artificially assembled. This assemblage is known as one of the most intricate subjects in the systematics of polypores (Donk, 1967). Many natural groups have been segregated from this genus, and it has been strongly reduced thereafter. The genus is now retained just for the still unclassified taxa.

Key to Species of Poria

1. Basidiocarp orange when fresh, dull red when dry; hyphal system monomitic; hyphae septate, without clamps; cystidioles absent.................................. 2. *P. spissa*
1. Basidiocarp cream when fresh, ochraceous buff when dry; hypha system dimitic; hyphae septate, with clamps; cystidioles present............................ 1. *P. crustulina*

1. *Poria crustulina* Bresadola. 1925. Mycologia 17:75.

MACROMORPHOLOGY: Basidiocarp effused, small, orbicular, readily and broadly confluent, coriaceous, hard when dry, adnate, 1-3 mm thick; margin narrow, 1 mm or rarely up to 4 mm wide, whitish to cream, matted to finely tomentose, often slightly detaching from the substrate on drying, sometimes disappearing with age; pores 3-4(-5) /mm, pale yellow (4A3), light yellow (4A4), grayish yellow (4B3, 4B4), grayish orange (5B4, 5B5, 5B6), orange (6B7), to brownish orange (5C4, 5C5, 5C6, 6C7, 6C8), somewhat circular, becoming angular, elongate or flexuose on vertical position; dissepiments thin, entire or dentate, lacerate to incised on vertical position; tubes alveolate at the margin, 1-3 mm long in the center, sometimes compound; context up to 0.5 mm thick, whitish, fibrous-corky.

MICROMORPHOLOGY: Hyphal system dimitic; generative hyphae (Figure 328, Appendix C) common, 1.8-3 μm diam, usually thin-walled, with clamps, often branched; skeletal hyphae (Figure 329, Appendix C) 2.4-4.8 μm diam, thick-walled to solid, aseptate, not branched, flexuose. Cystidioles (Figure 327, Appendix C) 18.4-20 x 4.8-6 μm,

fusiform, imbedded. Basidia (Figure 327, Appendix C) [4/1] 11.2-12.8 x 5-5.6 µm (X = 12 ± 0.7 x 5.3 ± 0.3 µm), L/W = 2.2-2.3 (X = 2.3), clavate, with 4 sterigmata. Basidiospores (Figure 326, Appendix C) [20/1] 5.2-6.4(-6.8) x 2.4-3 µm (X = 5.8 ± 0.4 x 2.5 ± 0.2 µm), L/W = 1.9-2.7 (X = 2.3 ± 0.2), broadly allantoid.

HABITAT AND DISTRIBUTION: _Picea rubens_; trunk (?); bark; possibly rare.

REMARK: _Perenniporia subacida_ closely resembles this species. The former differs in the ovoid spores and the trimitic hyphal system.

2. _Poria spissa_ (Schw.) Cooke. 1886. Grevillea 14:110.

≡ _Polyporus spissus_ Schweinitz in Fries. 1828. Elench. Fung. p. 111.

MACROMORPHOLOGY: Basidiocarp effused, small, orbicular, irregularly and widely confluent, caseous, firm but brittle when dry, often finely cracked on drying, adnate, 0.5-1.5 mm thick; margin narrow to wide, 1-15 mm wide, pale orange (5A3), light orange (5A4), grayish orange (5B4, 5B5, 6B4), to brownish orange (6C4), matted to finely tomentose; pores 6-8/mm, bright orange when fresh, turning brown (7E5, 7E6), reddish brown (8E4, 8E5, 8E6), to dark brown (8F4, 8F5, 8F6, 8F7, 8F8) when dry, becoming pale toward the margin, circular to angular, elongate or flexuose on vertical position; dissepiments thin, entire, dentate, or often incised on vertical position; tubes alveolate at the margin, up to 1.5 mm long in the center, sometimes compound; context thin, 0.2 mm thick or so, yellowish to buff, soft-fibrous to ceraceous.

MICROMORPHOLOGY: Hyphal system monomitic; generative hyphae

(Figure 332, Appendix C) 2.4-4.8 µm diam, parallel and compact in the trama, thin-walled to somewhat thick-walled, usually encrusted with yellowish brown granules, septate, without clamps, often branched. Basidia (Figure 331, Appendix C) [8/1] 8-12 x 4-4.8 µm ($\bar{X}$ = 10.5 ± 1.7 x 4.5 ± 0.4 µm), L/W = 1.7-2.7 ($\bar{X}$ = 2.3 ± 0.4), clavate, with 4 sterigmata. Basidiospores (Figure 330, Appendix C) [16/1] 4-5 x 1-1.6 µm ($\bar{X}$ = 4.4 ± 0.4 x 1.3 ± 0.2 µm), L/W = 2.6- 4.8 ($\bar{X}$ = 3.6 ± 0.7), allantoid.

HABITAT AND DISTRIBUTION: unknown hardwood; log (?); wood; rare.

Pycnoporus Karsten. 1881. Rev. Mycol. 3(9): 18.

Basidiocarp annual, sessile, (sometimes effused-reflexed), coriaceous, corky when dry; pilei somewhat small, dimidiate; upper surface pubescent, then glabrous, azonate; hymenophore tubular, of medium-sized to small pores; context red-orange, darkening in KOH. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae hyaline, thick-walled, aseptate, encrusted with yellowish brown granules; binding hyphae strongly branched and twisted. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, short cylindrical, smooth, not amyloid.

1. *Pycnoporus* *cinnabarinus* (Jacq.: Fr.) Karsten. 1889. Krit. Finl. Basidsv. p. 308.

   ≡ *Polyporus* *cinnabarinus* Jacquin: Fries. 1821. Syst. Mycol. 1:371.

   MACROMORPHOLOGY: Basidiocarp sessile, coriaceous, rigid when

dry; pilei singular or laterally attached, 3.5-7 cm wide or more due to lateral fusion, protruding 3-6 cm, dimidiate or sometimes flabelliform, conchate, acute at the margin, devoid of pores 1-2 mm wide below the margin; upper surface cinnabar red at first, light brown (7D5, 7D6) to reddish brown (8D5, 8D6), often decolorized with age, azonate or inconspicuously zonate, initially pubescent, soon glabrous, uneven, smooth or slightly rugose; pores 2-3/mm, brownish red (8C6, 8C7, 8C8) to reddish brown (8D6, 8D7, 8D8, 9D7, 9D8, 9E7, 9E8), brownish orange (6C8, 7C8) at the margin, circular to angular, sometimes elongate; dissepiments thin, entire, sometimes dentate, often finely pubescent at the edge; tubes 1-3 mm long, yellowish or yellowish orange within, cinnabar red at the edge; context 2-10 mm thick, subconcolorous with the surface, distinctly zonate, of rather separable layers, byssoid to fibrous-corky, darkening in KOH.

MICROMORPHOLOGY: Tramal hyphae intricately interwoven; generative hyphae (Figure 335, Appendix C) scant, 1.6-3.2 µm diam, thin-walled, with clamps; skeletal hyphae (Figure 336, Appendix C) predominant, 2.8-4.8 µm diam, thick-walled (wall 1-1.6 µm thick), often covered with yellowish brown granules, aseptate, not or rarely branched, flexuose or geniculately curved, sometimes abruptly tapered; binding hyphae (Figure 337, Appendix C) common, 1.6-3.6 µm diam, thick-walled or solid, aseptate, strongly branched and twisted, with obtuse or acute short lateral branches. Basidia (Figure 334, Appendix C) rather various in size and shape, [10/1] 15.2-21.6 x 4.8-7.2 µm ($\bar{X}$ = 17.6 $\pm$ 2.2 x 6 $\pm$ 0.9 µm), L/W = 2.2-3.8 ($\bar{X}$ = 3 $\pm$ 0.5), generally clavate, with 4 sterigmata. Basidiospores (Figure 333, Appendix C)

[12/1] 4.8-6.4 x 2-2.4 µm (X = 5.6 ± 0.5 x 2.2 ± 0.2 µm), L/W = 2-3 (X = 2.6 ± 0.3), short cylindrical.

HABITAT AND DISTRIBUTION: unknown hardwood; trunk (?); bark: possibly rare.

Rigidoporus Murrill. 1905. Bull. Torrey Bot. Cl. 32:478.

Basidiocarp annual or often perennial, resupinate, fleshy-ceraceous, hard when dry, separable, thick; hymenophore tubular, stratified, of small pores, blackening on bruising or aging; context white or pale, thin. Hyphal system monomitic. Generative hyphae hyaline, thin- to thick-walled, septate, without clamps, conglutinate. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, subglobose, smooth, not amyloid.

1. Rigidoporus nigrescens (Bres.) Donk. 1966. Persoonia 4(1):341.

   ≡ Poria nigrescens Bresadola. 1897. Atti R. Acad. Agiato III, 3:83.

MACROMORPHOLOGY: Basidiocarp effused, small, orbicular, often confluent and becoming large, soft, fleshy-ceraceous, hard but friable when dry, separable, 2 4 mm thick; margin narrow, 0.1-1 mm wide, thin, abrupt, often irregularly curved; pores 5-7/mm, whitish at first, becoming brown and then black on bruising or aging, grayish orange (5B3), brownish orange (5C3, 5C4), to light brown (5D4, 5D5) on drying, circular or sometimes elongate; dissepiments thin, entire or often dentate; tubes frequently reviving several times, partially overlapping old ones and forming stratified hymenophore, 1-3 mm long for the oldest layer, up to 1 mm long for the new layers; context

thin, up to 1 mm thick, whitish, then ochraceous, fibrous to corky.

MICROMORPHOLOGY: Tramal hyphae conglutinate and somewhat parallel, composed of pseudoparenchymatous cells of various shape; generative hyphae (Figure 349, Appendix C) 3.2-8(-9.2) µm diam, somewhat to remarkably thick-walled (wall 0.8-2.8 µm thick), often septate, without clamps, commonly branched at right angles. Basidia (Figure 348, Appendix C) [10/2] 14.4-17.6 x 5.6-7.2 µm (X = 15.5 $\pm$ 1 x 6.4 $\pm$ 0.5 µm), L/W = 2-2.9 (X = 2.4 $\pm$ 0.2), broadly clavate, with 4 sterigmata. Basidiospores (Figure 347, Appendix C) [22/2] 4-5.6 x 3.2-4.2 µm (X = 4.9 $\pm$ 0.5 x 3.5 $\pm$ 0.3 µm), L/W = 1.2-1.7 (X = 1.4 $\pm$ 0.1), subglobose or globose ellipsoid.

HABITAT AND DISTRIBUTION: unknown hardwood; log; wood; rare.

REMARK: On a reference specimen (TENN 1331), abundant cystidia were found. They seem to have been differentiated from hyphal ends and protrude in the hymenium. They measured 20-48(-56) x 5.6-12 um and were mostly fusiform to clavate, but often of various shape, and usually thick-walled as much as generative hyphae.

Schizopora Velenovsky emend. Donk. 1967. Persoonia 5:76.

Basidiocarp annual, resupinate, gregarious, soon confluent, coriaceous, firm when dry, thick; hymenophore tubular to irpicoid, of medium-sized pores; context whitish, thin. Hyphal system dimitic. Generative hyphae distinct, hyaline, thin-walled to somewhat thick-walled, with clamps; skeletal hyphae hyaline, thick-walled, aseptate, cyanophilous. Cystidioles present, thin-walled. Basidia somewhat utriform, with 4 sterigmata. Basidiospores hyaline, ovoid, smooth, not amyloid.

1. Schizopora paradoxa (Schrad.: Fr.) Donk. 1967. Persoonia 5:104.

≡ Hydnum paradoxum Schrader: Fries. 1821. Syst. Mycol. 1:424.

= Poria versipora (Pers.) Romell. 1926. Svensk Bot. Tidskr. 20:15.

Basidiocarp effused, sometimes inconspicuously revolute with a narrow (1-2 mm wide) margin, small, orbicular, gregarious, soon irregularly and widely confluent, coriaceous, firm when dry, friable when old, adnate, 1-3 mm thick; margin narrow but sometimes wide, usually 1 mm but up to 5 mm wide, yellowish white (2A2, 3A2, 4A2), fibrillose, tomentose, or byssoid, later disappearing; hymenophore yellowish white (4A2), pale yellow (4A3), light yellow (4A4), yellowish gray (4B2), or grayish yellow (4B3), even brownish orange (5C5) when old, initially rather poroid forming a reticulum with circular, angular, elongate, to labyrinthine pores (1-3/mm) especially near the margin, soon irpicoid with dissepiments irregularly splitting into lacerate plates, flattened aculei, or denticles up to 2.5 mm long; context thin, up to 0.5 mm thick, whitish, fibrous-corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 353, Appendix C) common, 2-2.8 µm diam, hyphodontoid, thin-walled to somewhat thick-walled, with small clamps, copiously branched at the septum on the opposite or sometimes same side of the clamp, often ending in a vesicle 4-7 µm diam; skelatal hyphae (Figure 354, Appendix C) abundant, 2.8-4 µm diam, thick-walled (wall 1-1.2 µm thick), aseptate, not or rarely branched, straight or somewhat flexuose, cyanophilous. Cystidioles (Figure 352, Appendix C) 15.2-20 x 4-4.8 µm, uncommon, inconspicuous, somewhat fusiform to bottle-shaped, mostly embedded. Basidia (Figure 351, Appendix C) [8/1] 13.6-

20.8 x 4-5.2 µm (X = 16.5 ± 2.9 x 4.3 ± 0.4 µm), L/W = 2.8-5 (X = 3.9 ± 0.7), mostly utriform or subclavate with a constriction in the middle, with 4 sterigmata. Basidiospores (Figure 350, Appendix C) [15/1] 4-5.6 x 3.2-3.6(-4) µm (X = 4.7 ± 0.5 x 3.5 ± 0.3 µm), L/W = 1.2-1.8 (X = 1.3 ± 0.2), ovoid, adaxially often straight, usually with one oil drop.

HABITAT AND DISTRIBUTION: Betula lutea, Fagus grandifolia; branch; bark, lichen-covered bark; uncommon.

REMARK: This species is morphologically very close to the species of Irpex but its microscopic details except skeletal hyphae are almost same as those of Hyphodontia spp. It exhibits a highly variable morphology in regard to the shape and length of tubes. The versatile species which was once known as Poria versipora is synonymized under the present species (Donk, 1967).

Schizopora paradoxa is very common in hardwood forests at low elevations of the Park and develops intensive white rot on fallen branches but becomes much more limited in its distribution at the high elevations of the research area.

Tyromyces Karsten. 1881. Rev. Mycol. 3(9):17.

Basidiocarp annual, resupinate, effused-reflexed, to sessile, soft, fleshy or fleshy-coriaceous, firm to hard when dry, separable; pilei small to medium-sized, dimidiate, flabelliform, reniform, or subcircular, commonly conchate; upper surface glabrous, pubescent, tomentose, villose, or velutinous, even, uneven, verrucose, to rugose; hymenophore tubular, of small to medium-sized pores; context white or whitish, thick. Hyphal system mostly monomitic. Generative hyphae

hyaline, thin- to thick-walled, with clamps. Cystidia or cystidioles present or absent, thin-walled. Basidia clavate, with 2 to 4 sterigmata. Basidiospores hyaline, allantoid, short cylindrical, ellipsoid, to ovoid, smooth, not amyloid.

Key to Species of *Tyromyces*

1. Basidiospores allantoid.. 2
1. Basidiospores not allantoid.................................... 5
    2. Basidiocarp white or whitish when fresh, changing color on bruising.................................... 3
    2. Basidiocarp invariably white or whitish when fresh......... 4
3. Basidiocarp changing color to gray bluish on bruising or aging.................................... 3. *T. caesius*
3. Basidioacrp changing color to rusty brown on bruising or drying.................................... 5. *T. fragilis*
    4. Basidiocarp resupinate or effused-reflexed with a narrow pileus.................................... 8. *T. undosus*
    4. Basidiocarp sessile with a dimidiate or subcircular pileus.................................... 1. *T. albellus*
5. Basidiospores broad ellipsoid to ovoid........... 2. *T. balsameus*
5. Basidiospores short cylindrical to ellipsoid.................. 6
    6. Basidiocarp small, less than 3 cm in length, coriaceous, firm but brittle when dry...... 4. *T. floriformis*
    6. Basidiocarp large, fleshy, hard and stiff when dry......... 7
7. Basidiocarp white to yellowish when fresh, becoming brown on bruising, excreting fluid drops........ 6. *T. guttulatus*

7. Basidiocarp milk-white, not changing color on bruising, without excretion........................ 7. *T. immitis*

1. *Tyromyces albellus* (Peck) Bondarzew et Singer. 1941. Ann. Mycol. 39:52.

≡ *Polyporus albellus* Peck. 1876. N.Y. St. Mus. Ann. Rep. 30:45.

MACROMORPHOLOGY: Basidiocarp sessile, succulent, firm but somewhat friable when dry; pilei singular, 6-9 cm wide, protruding 4-5 cm, dimidiate or subcircular, thin to thick and rather acute at the margin; upper surface pale yellow (3A3), grayish yellow (2B3), to dull yellow (3B3), initially pubescent, covered with a thin pellicle visible after drying, azonate; pores 3-4/mm, pale yellow (4A3), light yellow (4A4), light orange (5A4), to grayish orange (5B4), circular to angular, sometimes elongated; dissepiments becoming thin, entire, dentate, or serrate; tubes 2-4 mm long, whitish, yellowish, to pale ochraceous within; context 5-15 mm thick, whitish, soft, friable-corky when dry.

MICROMORPHOLOGY: Hyphal system dimitic. Tramal hyphae densely interwoven; generative hyphae (Figure 389, Appendix C) 1.6-4 μm diam, thin-walled or thick-walled (wall 1-1.6 μm thick) with a narrow and sinuous lumen, with frequent clamps, but often resembling skeletal hyphae without septation, sparingly branched, commonly flexuose; skeletal hyphae (Figure 390, Appendix C) 2-3.6 μm diam, thick-walled to subsolid, aseptate, not branched, flexuose. Basidia (Figure 388, Appendix C) [8/1] 10.4-15.2 x 4-5.6 μm (X = 12.2 $\pm$ 1.6 x 4.8 $\pm$ 0.7 μm), X = 1.9-3.4 (X = 2.6 $\pm$ 0.6), clavate, with 2 or 4 sterigmata. Basidiospores (Figure 387, Appendix C) [24/1] 4-5.6(-6) x 1-1.6 μm (X

= 5 ± 0.6 x 1.2 ± 0.2 um), L/W = 2.8-5.6 (X = 4.1 ± 0.8), allantoid.

HABITAT AND DISTRIBUTION: Abies fraseri; log; bark; possibly rare.

REMARK: The generative hyphae are indistinctly differentiated into skeletal hyphae, making it difficult to define the hyphal system. When the generative hyphae become thick-walled and sparsely septate, they frequently resemble the skeletal hyphae.

2. Tyromyces balsameus (Peck) Murrill. 1920. Mycologia 12:7.

≡ Polyporus balsameus Peck. 1878. N.Y. St. Mus. Ann. Rep. 30:46.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, fleshy-coriaceous, hard and stiff when dry; pilei singular, laterally attached, or imbricately confluent, 1-3.5 cm wide or more due to lateral fusion, protruding 1-1.5 cm, dimidiate, flabelliform, or irregular, frequently depressed and cuneately constricted at the base, acute and thin or deflexed at the margin; upper surface whitish at first, pale yellow (4A3), light yellow (4A4), grayish orange (5B4), to brownish orange (5C4, 5C5), pubescent, sericeous, or adhering bristles near the base, later glabrous, sometimes remaining covered with brown (7E6, 7E7) fibrillose scales or zones near the base, uneven, radiate-rugose; pores 4-5/mm, pale yellow (4A3), pale orange (5A3), light orange (5A4), to grayish orange (5B4), circular to angular, sometimes elongate to flexuose; dissepiments becoming thin, initially entire, soon dentate, lacerate, to incised; tubes 1-3 mm long, concolorus with the pore surface; context 0.5-3 mm thick, whitish, fleshy, firm-corky when dry.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae

compact and somewhat parallel; generative hyphae (Figure 394, Appendix C) 2-4.8 µm diam, thin-walled to regularly thick-walled (wall 1-1.4 µm thick, refracting), with clamps, irregularly interwoven, sparingly branched, frequently flexuose. Cystidia (Figure 393, Appendix C) 12-38.4(-44) x 4.8-7.6 µm, common to abundant, fusiform, vesicular, narrowly conical, or somewhat cylindrical, often crooked or constricted, often clustered and crowded, occasionally with a septum in the middle, usually thick-walled toward the apex, projecting up to 16 µm. Basidia (Figure 392, Appendix C) [11/2] 8.8-14.4 x 4-5.6 µm (X = 12.2 ± 2.1 x 4.6 ± 0.5 µm), X = 1.8-3.6 (X = 2.7 ± 0.6), clavate, with 4 sterigamata. Basidiospores (Figure 391, Appendix C) [40/2] 3.2-4.8 x 2-2.4(-2.6) µm (X = 4 ± 0.4 x 2.3 ± 0.2 µm), L/W = 1.2-2.4 (X = 1.8 ± 0.2), broad-ellipsoid or somewhat ovoid, usually with an oil drop.

HABITAT AND DISTRIBUTION: *Abies fraseri*, *Fagus grandifolia*; stump, log; bark, moss-covered bark, wood; possibly uncommon.

REMARK: Abundant cystidia and broadly ellipsoid spores distinguish this species from others. TENN 46445 was found to develop intensive brown rot on a stump of Fraser fir and disintegrate the wood into irregular cubes.

3. *Tyromyces caesius* (Schrad.: Fr.) Murrill. 1907. N. Am. Fl. 9(1):34.

≡ *Polyporus caesius* Schrader: Fries. 1821. Syst. Mycol. 1:360.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, soft-fleshy, firm when dry; pilei singular, sometimes confluent, 1-3.5 cm wide, protruding 0.5-2 cm, dimidiate, thin to thick at the margin,

acute, obtuse, or somewhat inflexed at the margin; upper surface whitish at first, often bluish at the margin, turning grayish blue on bruising or aging, later yellowish gray (4B2), orange gray (5B2), to brownish orange (5C3, 5C4, 5C5), villose, becoming glabrous, azonate or inconspicuously zonate; pores (2-)3-4/mm, white, whitish, or bluish, later pale yellow (4A3), pale orange (5A3), to grayish orange (5B3, 5B4), usually circular; dissepiments becoming thin, dentate to irregularly lacerate; tubes 0.5-4 mm long, somewhat concolorous with the pore surface; context 1-6 mm thick, whitish to bluish, later grayish yellow, fleshy, fibrous or firm-corky when dry.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae conglutinate and somewhat parallel; generative hyphae (Figure 397, Appendix C) 2-4.4 µm diam, thin-walled or thick-walled (wall 1-2 µm thick, refracting) with a narrow and sinuous lumen, with frequent clamps, irregularly interwoven, sparingly branched, frequently flexuose. Basidia (Figure 396, Appendix C) [10/1] 12-16 x 3.6-4.6 µm ($\bar{X}$ = 13.1 ± 1.4 x 4 ± 0.3 µm), L/W = 2.6-4 ($\bar{X}$ = 3.3 ± 0.4), clavate, with 2 or 4 sterigmata. Basidiospores (Figure 395, Appendix C) [20/1] 4-5.2 (-5.6) x 1-1.4 µm ($\bar{X}$ = 4.8 ± 0.4 x 1.1 ± 0.1 µm), L/W = 3.1-5.2 ($\bar{X}$ = 4.4 ± 0.6), allantoid.

HABITAT AND DISTRIBUTION: *Abies fraseri*, *Fagus grandifolia*, *Betula lutea* (?); log; bark, wood; possibly uncommon.

REMARK: A typical form is easily recognized by the grayish blue color, but its characteristic color often seems to disappear in herbarium specimens stored for an extended period.

4. *Tyromyces floriformis* (Quél.) Bondarzew et Singer. 1941. Ann.

Mycol. 39:51.

≡ Polyporus floriformis Quélet in Bresadola. 1884. Fungi Trid. 1:61.

MACROMORPHOLOGY: Basidiocarp sessile or effused-reflexed, coriaceous, rigid when dry; pilei imbricate or in clusters, 1-2.5 cm wide, protruding 0.5-1.5 cm, dimidiate or flabelliform, usually depressed and attenuated to a lateral base, thin and acute at the margin; upper surface light yellow (4A4) to light orange (5A4), sericeous, uneven, sometimes inconspicuously zonate, undulate; pores 4-6/mm, pale yellow (4A4), light orange (5A4), to grayish orange (5B4, 5B5), circular to angular, sometimes elongated; dissepiments thin, dentate, serrate, or sometimes lacerate; tubes 0.5-1.5 mm long, somewhat concolorus with the pore surface; context 0.5-1.5 mm thick whitish, fibrous-corky.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae compact and somewhat conglutinate; generative hyphae (Figure 400, Appendix C) 2.4-4 µm diam, thin-walled or thick-walled (wall 1-1.2 µm thick), with frequent clamps, sparingly branched, commonly flexuose. Basidia (Figure 399, Appendix C) [10/1] 12-14.4 x 4-5.6 µm ($X = 13 \pm 1.1 \times 4.7 \pm 0.6$ µm), L/W = 2.1-3.6 ($X = 2.8 \pm 0.5$), clavate, with 2 or 4 sterigmata. Basidiospores (Figure 398, Appendix C) [20/1] 3.2-4.4 x 1.8-2.4 µm ($X = 3.7 \pm 0.4 \times 2 \pm 0.2$ µm), L/W = 1.5-2.2 ($X = 1.9 \pm 0.2$), ellipsoid or short cylindrical, adaxially straight.

HABITAT AND DISTRIBUTION: Abies fraseri (?); log (?); bark, wood; rare.

5. Tyromyces fragilis (Fr.) Donk. 1933. Med. Bot. Mus. Univ. Utrecht

97:148.

≡ Polyporus fragilis Fries. 1828. Elench. Fung. p. 86.

MACROMORPHOLOGY: Basidiocarp effused-reflexed or sessile, soft, succulent, firm but fragile when dry; pilei singular or laterally attached, 2-4.5 cm wide, protruding 0.5-2.5 cm, dimidiate, usually undulate, acute or somewhat involute at the margin when dry; upper surface pure white when fresh, turning brownish orange (6C5), light brown (6D5), brown (7E5), to reddish brown (8E5) on bruising or drying, radiately fibrillose and somewhat rugose, tomentose to fluffy, with hairs tuffed pyramidally, inconspicuously zonate or azonate; pores (2-)3-4/mm, white at first, turning reddish brown on bruising, later brown (6E5, 7E4, 7E5) to dark brown (7F4) on drying, usually circular, often somewhat elongated; dissepiments thin, initially entire, soon dentate, lacerate, to incised; tubes 2-5 mm long, whitish at first, becoming darker than the upper surface on drying; context 2-10 mm thick, slightly zonate, whitish, brunnescent, fibrous-fleshy.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae dense and parallel; generative hyphae (Figure 403, Appendix C) 2.4-4 μm diam, thin-walled or somewhat thick-walled, with frequent clamps, slightly branched, commonly flexuose. Basidia (Figure 402, Appendix C) [6/1] 12-16 x 3.2-3.6 μm (X = 14.3 ± 1.6 x 3.3 ± 0.2 μm), L/W = 3.8-5 (X = 4.3 ± 0.4), narrowly clavate, with 2 or 4 sterigmata. Basidiospores (Figure 401, Appenidx C) [10/1] 4-5.4 x 1.4-1.8 μm (X = 4.7 ± 0.5 x 1.5 ± 0.1 μm), L/W = 2.8-3.7 (X = 3.2 ± 0.3), allantoid.

CULTURAL CHARACTERS: Growth rate delayed to slow; advancing zone appressed; marginal hyphae dense; mat downy, cottony, to woolly,

often pellicular, or locally farinaceous; colony white, cream with age. Generative hyphae (1.2-)1.6-4.8 µm, thin-walled to somewhat thick-walled, frequently branched, with clamps, often with many short branches.

Code: (9), (10), 13, (14), (15), 17, 18, 21, (22), 24, 30, (31), 37, 39, 42, 45, (48), (51), 52, 53, (61), 83, 90.

HABITAT AND DISTRIBUTION: Picea rubens, Abies fraseri, unknown conifer, unknown tree; trunk, log; wood, cut wood; possibly occasional.

REMARK: This fungus is easily identified in the field as its fresh fruitbody is very sensitive to contact and changes to yellowish, then to reddish brown almost immediately. It causes intensive brown rot on wood of dead conifers.

6. Tyromyces guttulatus (Peck) Murrill. 1907. N. Am. Fl. 9:31.

≡ Polyporus guttulatus Peck in Saccardo. 1888. Syll. Fung. 6:106.

MACROMORPHOLOGY: Basidiocarp sessile, firm-fleshy, hard when dry; pilei singular, 12 cm wide, protruding 9 cm, flabelliform, depressed and attenuated to a lateral base, acute or involute at the margin when dry; upper surface originally yellowish, becoming brownish on bruising, grayish yellow (4B5), grayish orange (5B5), brownish orange (5C5, 5C6), light brown (6D6, 7D6), to brown (6E6, 7E6) on drying, glabrous, uneven, radiately rugose, concentrically verrucose, marked with small depressed spots due to drops of exuded fluid; pores 3-5/mm, yellowish, becoming grayish orange (5B5, 5B6), browinsh orange (5C6, 6C6), to light brown (6D6, 7D6) on bruisng, regular, circular to angular; dissepiments becoming thin, entire; tubes 1-6 mm long,

yellowish, then brownish on aging; context 2-6 mm thick, yellowish, fibrous-fleshy.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae densely interwoven; generative hyphae (Figure 407, Appendix C) 2.8-4.8 μm diam, mostly deeply stained, often indistinct as if partially gelatinized, thin- to moderately thick-walled, with some clamps from which short lateral branches often arise, slightly branched, straight or flexuose, sometimes moniliform (cf. Figure 408, Appendix C). Cystidioles (Figure 406, Appendix C) present, 4-4.4 μm in width, hard to discern. Basidia (Figure 405, Appendix C) [6/1] 13.6-20 x 4.4-4.8 μm (X = 15.2 $\pm$ 2.5 x 4.5 $\pm$ 0.2 μm), L/W = 2.8-4.2 (X = 3.4 $\pm$ 0.5), clavate, with 4 sterigmata. Basidiospores (Figure 404, Appendix C) [18/1] 3.2-4.8 x 1.8-2.6 μm (X = 4.1 $\pm$ 0.5 x 2.3 $\pm$ 0.3 μm), L/W = 1.5-2.3 (X = 1.8 $\pm$ 0.3), ellipsoid or short cylindrical.

HABITAT AND DISTRIBUTION: Abies fraseri; trunk (?); bark: rare.

REMARK: Some polypores have a weeping habit as they exude watery drops in certain stages of growth. This habit is well-known in Tyromyces guttulatus in the field (Overholts, 1953). Reference material TENN 12391 has a somewhat large fruitbody of imbricate clusters measuring 15 x 12 cm and occurs on a hemlock log.

7. Tyromyces immitis (Peck) Bondarzew. 1953. Polyp. Europ. USSR and Caucasus. p. 228.

≡ Polyporus immitis Peck. 1884. N.Y. St. Mus. Ann. Rep. 35:135.

MACROMORPHOLOGY: Basidiocarp sessile or effused-reflexed, succulent, tough with age, hard when dry; pilei singular or in

imbricate clusters, 5-13 cm wide, protruding 3-7 cm, dimidiate or reniform, mostly conchate, plane, pulvinate, or depressed to the base; upper surface pale yellow (4A3) to light yellow (4A4), later grayish orange (5B4, 5B5, 5B6), brownish orange (5C5, 5C6, 6C5, 6C6), to light brown (6D5, 6D6, 7D5, 7D6), often dark brown right at the margin, glabrous or sometimes pubescent, uneven, radiately rugose or plicate, coarse or verrucose; pores 4-6/mm when young, (1-)2-4/mm with age, usually pale yellow (4A3) to light yellow (4A4), sometimes grayish brown (5B4, 5B5), light brown (6D4, 6D5), or even brown (6E4, 6E5), circular, angular, or somewhat elongated, later more elongated or flexuose; dissepiments thin, entire, sometimes dentate; tubes 3-7 mm long, whitish, yellowish, to ochraceous within, rigid but somewhat fragile when dry; context 3-10 mm thick, slightly zonate, whitish to yellowish, fibrous-fleshy.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae often conglutinate and somewhat parallel; generative hyphae (Figure 412, Appendix C) 1.6-4 μm diam, thin-walled, uniformly thick-walled, or often irregularly thick-walled (wall 0.8-1.6 μm thick) with a narrow lumen, with some clamps, slightly branched, frequently flexuose. Cystidioles (Figure 411, Appendix C) 12-20 x 3.2-4.8 μm, fusiform, somewhat inconspicuous. Basidia (Figure 410, Appendix C) [6/1] 10.4-14.4 x 4-4.8 μm ($\bar{X}$ = 12.4 ± 1.4 x 4.4 ± 0.4 μm), L/W = 2.2-3.6 ($\bar{X}$ = 2.9 ± 0.5), clavate, with 2 or 4 sterigmata. Basidiospores (Figure 409, Appendix C) [26/1] 4-5.2 x 2.2-2.8 μm ($\bar{X}$ = 4.5 ± 0.4 x 2.5 ± 0.2 μm), L/W = 1.4-2.3 ($\bar{X}$ = 1.8 ± 0.2), broad ellipsoid, ellipsoid, or short cylindrical.

HABITAT AND DISTRIBUTION: Abies fraseri, unknown conifer; trunk, log (?); bark, wood; possibly uncommon.

REMARK: The specimen (TENN 17199) from the research area apparently has larger spores than other examples. The spores of literature measure 4-5.5 x 1.5-2 um (Lowe, 1975), 3.3-4.5(-5) x 1.5-2.2(-2.5) um (Domanski, Orlos, and Skirgiello, 1973), or 3-4 x 1.5-2 um (Overholts, 1953) and seem to show a great variety in dimension. Tyromyces immitis is known as Tyromyces stipticus (Pers.: Fr.) Kotlaba et Pouzar [= Polyporus stipticus Persoon: Fries] in Europe (Lowe, 1975).

8. Tyromyces undosus (Peck) Murrill. 1907. N. Am. Fl. 9:34.

≡ Polyporus undosus Peck. 1881. N.Y. St. Mus. Ann. Rep. 34:42.

MACROMORPHOLOGY: Basidiocarp effused to effused-reflexed with a narrow pileus, orbicular, confluent, subcoriaceous, hard and stiff when dry; pilei imbricately arising, small, 5-10 mm wide, protruding 5 mm, dimidiate, spathulate, or laterally elongated, undulate, thin and acute at the margin; upper surafce yellowish white (4A2), pale yellow (4A3), to orange white (5A2), tomentose, indistinctly zonate or azonate; pores 1-2(-4)/mm, pure white, when fresh, yellowish white (4A2) to orange white (5A2) when dry, angular, often elongate or flexuose; dissepiments thin, fimbriate, lacerate, to incised; tubes 2-5 mm long, whitish within, somewhat brittle when dry; context up to 1 mm thick, white or whitish, fibrous, hard when dry.

MICROMORPHOLOGY: Hyphal system monomitic. Tramal hyphae densely interwoven and often agglutinated into strands; generative hyphae (Figure 416, Appendix C) 1.6-3.6 μm diam and thin-walled in the

subhymenium, 3.2-4.8 µm diam and exclusively thick-walled (wall 1.2-2 µm thick) with a narrow and sinuous lumen in the trama, with frequent clamps, commonly or often strongly branched, flexuose. Hyphal ends (Figure 415, Appendix C) present in the hymenium, common, 2.8-3.2 µm diam, cylindrical. Basidia (Figure 414, Appendix C) [6/1] 16-24 x 3.6-4.4 µm (X = 19.7 ± 3.6 x 4 ± 0.4 µm), L/W = 4.2-5.5 (X = 4.9 ± 0.5), narrowly clavate, with 4 sterigmata. Basidiospores (Figure 413, Appendix C) [16/1] 4.8-6.4(-6.8) x 1.4-1.6 µm (X = 5.7 ± 0.6 x 1.5 ± 0.1 µm), L/W = 3.1-4.6 (X = 3.7 ± 0.5), allantoid.

HABITAT AND DISTRIBUTION: *Picea rubens*, *Abies fraseri*; log; wood, moss-covered cut wood; possibly uncommon.

6. FAMILY GANODERMATACEAE

Ganoderma Karsten emend. Patouillard. 1889. Bull. Soc. Mycol. Fr. 5:67.

Basidiocarp annual or perennial, sessile or laterally stipitate, corky to woody; pilei medium-sized to large, dimidiate or reniform; upper surface covered with a specific and often varnished crust; hymenophore tubular, of small pores; context whitish to brownish with various tints, thick. Hyphal system trimitic. Generative hyphae hyaline, thin-walled, with clamps; skeletal hyphae thick-walled, sometimes much branched, occasionally tapering and ramifying at the tip; binding hyphae few, strongly branched and twisted. Basidia clavate, with 4 sterigmata. Basidiospores hyaline, ovoid, truncate at one end, double-walled, with a verrucose inner layer, cyanophilous.

REMARK: The genus *Ganoderma* is a distinct group characterized by its truncated and double-walled spores. The outer layer of spores develops a conical swelling which later collapses into a truncate appearance, while the inner layer grows to bear a verrucose ornamentation which penetrates into the outer layer. Such a uniqueness of spore morphology enabled a family based on the genus *Ganoderma* to split from the Polyporaceae s.l. (Donk, 1964).

Key to Species of Ganoderma

1. Basidiocarp laterally stipitate; pileal crust very thin, varnished; context whitish, ochraceous directly above the tubes... 2. *G. tsugae*
1. Basidiocarp sessile; pileal crust up to 1 mm thick, hard; context reddish brown, finally white-speckled... 1. *G. applanatum*

1. *Ganoderma applanatum* (Pers.: Wallr.) Patouillard. 1889. Bull. Soc. Mycol. Fr. 5:67.

   ≡ *Polyporus applanatus* Persoon: Wallroth. 1833. Fl. Crypt. Germ. 2:591.

MACROMORPHOLOGY: Basidiocarp sessile, sometimes effused-reflexed, rarely resupinate on horizontal position, hard, woody; pilei single or in groups, 6-22 cm wide, protruding 5-15 cm, 2-7 cm thick at the base, dimidiate, sometimes narrowed at the base, usually acute at the margin, devoid of pores 2-10 mm wide below the margin; upper surface initially whitish, yellowish gray (4B2), or orange gray (5B2), then grayish yellow (4C3), grayish orange (5B3), brownish orange (5C3, 5C4, 5C5), grayish brown (5D3, 5E3, 6D3, 6E3, 6F3), light brown (5D4,

5D5, 6D4, 6D5), brown (6E4, 6E5), or dark brown (6F4, 7F4), covered with a hard crust, often dusted with a layer of spores deposited during sporulation of summer and fall, uneven, rugose, concentrically sulcate, finely and superficially cracked; crust 0.2-1 mm thick, dark brown; pores 5-7/mm, pale yellow (4A3), light yellow (4A4), or grayish yellow (4B3, 4B4), quickly turning tobacco brown when scratched, becoming brownish orange (5C3, 5C4, 6C3), graysih brown (6D3), to light brown (5D4, 5D5, 6D4, 6D5), circular; dissepiments somewhat thick, entire; tubes stratified, each layer 5-15 mm long, light brown (6D4, 6D5, 6D6, 7D4, 7D5, 7D6) to brown (7E5, 7E6) within, white-stuffed with age; context 5-12 mm thick, concolorous with the tubes, white-speckled with age, tough-corky.

MICROMORPHOLOGY: Tramal hyphae densely interwoven; generative hyphae (Figure 98, Appendix C) scant, inconspicuous, observed at the growing fruitbody, hyaline, 1.6-3 μm diam, thin-walled, with clamps, commonly branched; skeletal hyphae (Figure 99, Appendix C) abundant, brown, 2.8-4 μm diam, thick-walled to subsolid, aseptate, much or strongly branched, tapering and merging into delicate tortuous ends; binding hyphae (Figure 100, Appendix C) few, 0.8-1.2 μm diam, usually solid, strongly branched and twisted. Basidia (Figure 97, Appendix C) [5/1] 11.2-16 x 7.2-8 μm ($X = 13.1 \pm 2$ x 7.7 ± 0.4 μm), L/W = 1.5-2 (1.7 ± 0.2), clavate, with 4 sterigmata. Basidiospores (Figure 96, Appendix C) [16/1] 5.6-8 x 4.6-5.6 μm ($X = 6.9 \pm 0.7$ x 4.9 ± 0.3 μm), L/W = 1.2-1.7 ($X = 1.4 \pm 0.1$), ovoid, truncate at one end, double-walled, cyanophilous; the outer layer smooth and hyaline, the inner layer verrucose and light brown.

HABITAT AND DISTRIBUTION: _Fagus grandifolia_, _Aesculus octandra_, _Quercus rubra_, _Tsuga canadensis_, _Abies fraseri_; log, trunk, stump; bark, moss-covered bark, wood; possibly frequent.

REMARK: This fungus is one of most common species in hardwood forests, and a number of trees are susceptible to its attack (Overholts, 1953). In the spruce-fir forest of the Park, it occurs preferably on hardwoods where hardwoods and conifers usually mix or merge together. It causes intensive white mottled rot chiefly on dead trees but also occasionally on living trees (Boyce, 1961). The white rot is usually restricted to the lower parts of trees and is known to be responsible for windthrows (Manion, 1981).

2. _Ganoderma tsugae_ Murrill. 1902. Bull. Torrey Bot. Cl. 29:601.

MACROMORPHOLOGY: Basidiocarp laterally stipitate, soft-corky, rigid-corky when dry; pilei 3-6(-15) cm in length or diam, spathulate when young, reniform, to flabelliform, convex, usually obtuse at the margin, devoid of pores 1-4 mm wide below the margin; upper surface reddish brown (8E5, 8E6, 9E6, 9E7, 9E8) to dark brown (8F4, 8F5, 8F6, 9F5, 9F6), usually light yellow (4A4), grayish orange (5B4, 5B5), to brownish orange (5C5) at the margin when young, covered with a varnished crust, often dusted with a layer of spore deposit, uneven or somewhat rugose, often weakly zonate; crust thin, 0.1 mm thick, red brown; pores 4-6/mm, pale yellow (4A3), light yellow (4A4), grayish orange (5B3), to brownish orange (5C4), circular; dissepiments somewhat thick, entire; tubes 2-6 mm long, in one layer or stratified, buff to ochraceous within; context 0.5-3 cm thick, white or whitish, concolorous with the tubes right above them, indistinctly zonate,

spongiose, firm and light-corky when dry.

MICROMORPHOLOGY: Tramal hyphae densely interwiven; generative hyphae (Figure 103, Appendix C) mostly observed at the growing fruitbody, hyaline, 1.6-3.2 µm diam, thin-walled, with clamps, commonly branched; skeletal hyphae (Figure 104, Appendix C) abundant, 3.2-6.4 µm diam, thick-walled (wall 0.8-1.6 µm thick), aseptate, tapered and branched at the end, undulate; binding hyphae (Figure 105, Appendix C) common, 1.6-3 µm diam, often of varying diam, somewhat thick-walled to solid, strongly branched and twisted. Basidia (Figure 102, Appendix C) [6/1] 13.6-16 x 6.4-7.2 µm (X = 14.7 ± 1 x 6.8 ± 0.4 µm), L/W = 2-2.5 (X = 2.2 ± 0.2), clavate, with 4 sterigmata. Basidiospores (Figure 101, Appendix C) [16/1] 8-12 x 5.6-8 µm (X = 10.1 ± 1.2 x 6.6 ± 0.8 µm), L/W = 1.3-1.9 (X = 1.5 ± 0.2), ovoid, truncate at one end, double-walled, cyanophilous; the outer layer smooth and hyaline, the inner layer distinctly verrucose and light brown.

HABITAT AND DISTRIBUTION: Tsuga canadensis; trunk, log; bark; possibly uncommon.

REMARK: This fungus is usually identified by its coniferous host, the shiny reddish brown crust, the white context, and the distinctly ornamented spores. It is often found in the hemlock forest near the lower limit of the spruce-fir forest. On a collection trip to Mt. Guyot along the Maddron Bald Trail, a group of decaying fruibodies fallen from hemlock trunks during a severe thunder shower were once found scattered on the ground.

CHAPTER VIII

RESULTS

A total of 269 specimens were collected from the research area, the spruce-fir forest of the Great Smoky Mountains National Park. Another 131 TENN herbarium specimens once collected from the research area by earlier mycologists were examined, and 351 extra-limital specimens were analysed and used as reference materials.

A total of 105 species were identified within 51 genera of 6 families of the Aphyllophorales. There were 16 common to abundant species which actively decompose wood substrates and apparently play important roles in the ecology of the spruce-fir forest of the Park. *Hirschioporus fusco-violaceus* constantly occurred where dead firs and spruces were standing or lying. Likewise, *Hyphodontia breviseta*, *Amylostereum chailletii*, *Hirschioporus abietinus*, and *Fomitopsis pinicola* were abundant and dominant throughout the research area. *Stereum hirsutum*, *Antrodia serialis*, *Hyphodontia alutaria*, and *Phellinus chrysoloma* frequently occurred at somewhat disturbed sites of the forest. Besides them, some fungi like *Phellinus igniarius*, *Phellinus laevigatus*, *Coniophora arida*, *Stereum sanguinolentum*, *Perenniporia subacida*, *Ganoderma applanatum*, and *Gloeophyllum sepiarium* were commonly distributed in this research area.

Due to repeated contamination, only 16 species were successfully cultured. Some species of *Hirschioporus*, *Phellinus*, *Hyphodontia*, *Resinicium*, and *Columnocystis* gave a good result.

CHAPTER IX

CONCLUSIONS

In terms of fungal occurrence, the spruce-fir forest of the Park consists of several forest site types (Table 3, Appendix A). Fungi usually occur when the forest site is disturbed to a certain degree. The forest sites of natually disturbed areas (Type II) where frequent windbreaks and windthrows occur provide ideal fungal habitats and supply adequate substrates and moisture for fungal growth. More than three fourths of the fungi counted occurred in this type of forest site. On the other hand, extreme disturbance or impact discourages fungal growth. Where the trees defoliate and the canopy is widely opened (Type III), the forest floor dries up and fungal occurrence becomes quite reduced. Only one fifth of the fungi counted occurred here. Corticioid fungi are mostly restricted to Type II except when they are able to utilize moisture in Type III. *Phellinus* spp. which are widely distributed in Type II do not occur in Type III.

Many polyporoid and stereoid fungi grow both on bark and wood (Table 5, Appendix A) and cause decay or rot. The bark layer supports their fruitbodies and retains moisture for their growth (Eriksson, 1958). When trees die, they become slowly decorticated (Eriksson, 1958). With the shedding of bark, corticioid fungi secondarily colonize the decomposed wood and bark remains causing rot in dead trees. They fruit when moisture is stored in decayed wood and dry up with the desiccation of wood.

Broken or cut wood creates a unique habitat as the substrate is

exposed very abruptly. Some polyporoid or stereoid fungi like Hirschioporus, Gloeophyllum, Amylostereum, Stereum, or Columnocystis spp. first colonize recently broken or cut trees (Baxter, 1948; Stillwell, 1959). About two thirds of the fungi counted occur on bark and one third on wood, while 44 species of the fungi classified occur on bark and 45 species on wood (Table 5, Appendix A). The frequency of fungal occurrence is higher on bark, but species diversity on bark and wood remains almost equal even though fungal succession occurs upon the change of substrates.

With some exceptions, polyporoid and stereoid fungi produce rot up to 3.8 cm thick in red spruce and 2.5 cm thick in other trees, but many corticioid fungi occur on the rot much thicker than that (Table 6, Appendix A). On recently dead conifers with fresh and firm sapwood, Hirschioporus spp. and some stereoid fungi first occur on broken or cut wood (Table 6, Appendix A) and play an important role in the decomposition of those trees by the time of decortication (Baxter, 1948; Stillwell, 1959).

Polyporoid fungi like Fomitopsis and Phellinus spp. occur on fresh to somewhat decomposed sapwood, but Perenniporia subacida exceptionally occurs on much decomposed substrates (Table 6, Appendix A) and functions both as decay and rot fungi (Boyce, 1961). Hyphodontia breviseta, H. alutaria, and H. verruculosa have broad ranges of wood rot and play a significant role in decomposition of wood and bark remains (Eriksson and Ryvarden, 1976). Many corticioid fungi colonize their substrates secondarily and are confined to strongly decomposed substrates. When the fungi are grouped according

to the type of wood rot, more than four fifths of the fungi classified produce white rot (Table 7, Appendix A).

In the spruce-fir forest of the Park, red spruce and Fraser fir are the most important hosts, and two thirds of the fungi counted occur on these trees (Table 8, Appendix A). Some decay fungi like *Fomitopsis*, *Phellinus*, and *Perenniporia* spp. may cause heart rot and butt rot and weaken those trees (Hepting, 1971). Yellow birch and American beech are the most common hardwoods in the research area. *Phellinus* and *Ganoderma* spp. cause trunk rot and butt rot (Hepting, 1971).

Most of the host red spruces fall within the dbh range from 30 to 60 cm (Table 9, Appendix A) and seem to be affected at mature or old stages. But most of the host Fraser firs fall within the dbh range from 15 to 35 cm and seem to be affected at a young stage. Balsam woolly aphid rather than fungi might have caused an early mortality of fir trees. In affected yellow birches, the dbh mostly ranges from 5 to 20 cm. These trees must have been affected at a very young stage for some reason.

Elevational variation of fungi within the research area (Table 10, Appendix A) is related to the distribution of their host trees. Some species of fungi occurring at the lower limit of the research area apparently belong to the taxa of low elevaton forests. Common to abundant species usually occupy a broad range of elevation. Fungal distribution depends on tree type, like conifer or hardwood, rather than individual tree species.

The fungal flora of the spruce-fir forest of the Park was

different from that of the cove hardwoods forest of Cades Cove and the pine-hardwoods forest of John Knox Camp. Cades Cove and John Knox Camp look alike in appearance, but there was still a variation in fungal profile. It is assumed that a given forest creates its own habitats which support its own fungal flora.

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APPENDICES

APPENDIX A

TABLES FOR FUNGAL ECOLOGY

Table 3. Fungal occurrence according to forest site type.[a]

FOREST SITE TYPE — SPECIES

TYPE I [1][b] (1)[c]

Hydrabasidium subviolaceum (1)

TYPE II [71] (211)

Aleurodiscus mirabilis (1)
*Antrodia serialis (7)
Botryobasidium botryosum (1)
Botryobasidium medium (1)
Botryobasidium subcoronatum (5)
Cerinomyces pallidus (1)
*Coniophora arida (6)
Fibrodontia gossypina (1)
*Ganoderma applanatum (1)
Gloeocystidiellum ochraceum (2)
Haplotrichum aureum (3)
*Hirschioporus abietinus (10)
*Hirschioporus laricinus (1)
Hymenochaete cinnamomea (3)
Hymenochaete fuliginosa (1)
Hyphoderma puberum (1)
Hyphoderma tsugae (1)
*Hyphodontia alutaria (9)
*Hyphodontia breviseta (19)
Hyphodontia verruculosa (2)
Irpex lacteus (1)
Laurilia sulcata (1)
Perenniporia subacida (5)
Phanerochaete filamentosa (1)
Phanerochaete septocystidia (1)
Phanerochaete viticola (2)
Phellinus contiguus (3)
Phellinus igniarius (4)
Plicaturopsis crispa (1)
*Resinicium bicolor (2)
Schizopora paradoxa (3)
*Stereum hirsutum (6)
Trechispora farinacea (1)
Trechispora vaga (2)
Tyromyces fragilis (2)
Xylobolus subpileatus (1)
*Amylostereum chailletii (12)
Athelia decipiens (2)
Botryobasidium candicans (1)
Botryobasidium obtusisporum (4)
Ceraceomyces sublaevis (1)
*Columnocystis ambigua (5)
*Coriolus versicolor (1)
*Fomitopsis pinicola (8)
Gloeocystidiellum citrinum (2)
*Gloeophyllum sepiarium (2)
Haplotrichum conspersum (1)
*Hirschioporus fusco-violaceus (13)
Hydnochaete olivaceum (2)
Hymenochaete corrugata (2)
Hyphoderma pallidum (1)
Hyphoderma setigerum (6)
Hyphodontia abieticola (1)
Hyphodontia arguta (1)
Hyphodontia pallidula (2)
Hypochnicium geogenium (1)
Jaapia ochroleuca (1)
Perenniporia medulla-panis (1)
Phaeolus schweinitzii (2)
Phanerochaete sanguinea (3)
Phanerochaete sordida (1)
Phellinus chrysoloma (4)
Phellinus ferreus (3)
Phellinus laevigatus (7)
Poria crustulina (2)
Resinicum furfuraceum (1)
Stereum complicatum (1)
*Stereum sanguinolentum (2)
Trechispora mollusca (1)
Tyromyces balsameus (1)
Tyromyces undosus (1)

TYPE III [18] (55)

Table 3. (Continued)

FOREST SITE TYPE	SPECIES
*Antrodia serialis (3)	*Amylostereum chailletii (6)
Climacocystis borealis (3)	*Columnocystis ambigua (1)
*Coniophora arida (2)	*Coriolus versicolor (1)
*Gloeophyllum sepiarium (3)	*Fomitopsis pinicola (3)
*Ganoderma applanatum (1)	*Hirschioporus abietinus (6)
*Hirschioporus fusco-violaceus (10)	*Hirschioporus laricinus (3)
*Hyphodontia alutaria (1)	Hyphodontia aspera (1)
*Hyphodontia breviseta (2)	*Resinicium bicolor (2)
*Stereum hirsutum (5)	*Stereum sanguinolentum (2)
TYPE IV [2] (2)	
Hyphodontia breviseta (1)	Trechispora alnicola (1)

[a] Classification of fungi according to the forest site types is based on the specimens (among TENN 45983-46533) collected from the research area by the author. Old TENN specimens once collected from the same area are not counted here because their forest site types are not known.

[b] Number of species occurring on the given forest site type.

[c] Number of collections.

[*] Species occurring in both Type II and III.

Table 4. Classification of fungal genera based on fruitbody feature.

FRUITBODY	GENERA		
POLYPOROID[a]	Antrodia	Bjerkandera	Cerrena
	Coriolus	Climacocystis	Daedaleopsis
	Fomes	Fomitopsis	Ganoderma
	Gloeophyllum	Hapalopilus	Hirschioporus
	*Hydnochaete	*Hymenochaete	*Inonotus
	Irpex	Laetiporus	Parmastomyces
	Perenniporia	*Phaeolus	*Phellinus
	Piptoporus	Poria	Pycnoporus
	Rigidoporus	**Schizopora	Tyromyces
STEREOID[b]	Amylostereum	Boreostereum	Columnocystis
	Laurilia	Stereum	Xylobolus
CORTICIOID[c]	Aleurodiscus	Athelia	Botryobasidium
	Ceraceomyces	Cerinomyces	Coniophora
	**Fibrodontia	Gloeocystidiellum	Haplotrichum
	Hydrabasidium	Hyphoderma	Hyphodontia
	Hypochnicium	Jaapia	Phanerochaete
	Plicaturopsis	Resinicium	Trechispora

[a] Having characters of the genus Polyporus s.l. (cf. the Polyporaceae).

[b] Having characters of the genus Stereum s.l. (cf. the Stereaceae).

[c] Having characters of the genus Corticium s.l. (cf. the Corticiaceae).

[*] Xanthochroic taxa.

[**] Taxa closely related to Hyphodontia in part.

Table 5. Fungal occurrence according to substrate.[a]

SUBSTRATE	SPECIES	
BARK AND WOOD [32][b] (151)[c]		
	Aleurodiscus mirabilis (1)	*Amylostereum chailletii (8)
	Antrodia serialis (7)	Botryobasidium subcoronatum (5)
	Columnocystis ambigua (1)	*Coniophora arida (7)
	*Fomitopsis pinicola (11)	*Ganoderma applanatum (2)
	*Gloeocystidiellum citrinum (2)	*Hirschioporus abietinus (14)
	*Hirschioporus fusco-violaceus (20)	*Hirschioporus laricinus (4)
	*Hymenochaete corrugata (2)	*Hymenochaete fuliginosa (1)
	Hyphoderma setigerum (5)	Hyphodontia alutaria (10)
	*Hyphodontia breviseta (22)	*Hyphodontia verruculosa (1)
	Irpex lacteus (1)	**Perenniporia subacida (3)
	*Phanerochaete septocystidia (1)	**Phanerochaete viticola (2)
	*Phellinus chrysoloma (2)	**Phellinus contiguus (3)
	*Phellinus ferreus (3)	Plicaturopsis crispa (1)
	*Resinicium bicolor (4)	*Resinicium furfuraceum (1)
	*Stereum complicatum (1)	*Stereum sanguinolentum (3)
	Trechispora vaga (2)	Xylobolus subpileatus (1)
BARK ONLY [12] (28)		
	Climacocystis borealis (3)	Coriolus versicolor (1)
	*Hydnochaete olivaceum (2)	*Hyphoderma tsugae (1)
	Phanerochaete filamentosa (1)	Phaeolus schweinitzii (1)
	Phellinus igniarius (3)	*Phellinus laevigatus (3)
	Poria crustulina (2)	*Schizopora paradoxa (3)
	*Stereum hirsutum (7)	*Trechispora alnicola (1)
WOOD ONLY [21] (30)		
	Athelia decipiens (2)	Botryobasidium botryosum (1)
	Botryobasidium candicans (1)	Botryobasidium medium (1)
	Botryobasidium obtusisporum (4)	Ceraceomyces sublaevis (1)
	Cerinomyces pallidus (1)	Fibrodontia gossypina (1)
	Haplotrichum aureum (3)	Haplotrichum conspersum (1)
	Hymenochaete cinnamomea (3)	Hyphoderma pallidum (1)
	Hyphoderma puberum (1)	Hyphodontia abieticola (1)
	Hyphodontia aspera (1)	Hyphodontia pallidula (1)
	Jaapia ochroleuca (1)	Phanerochaete sordida (1)
	Trechispora farinacea (1)	Trechispora mollusca (1)
	Tyromyces fragilis (2)	
WOOD BREAK OR CUT [24] (54)		

Table 5. (Continued)

SUBSTRATE	SPECIES
*Amylostereum chailletii (9)	Antrodia serialis (3)
*Columnocystis ambigua (5)	*Coniophora arida (1)
Coriolus versicolor (1)	Gloeophyllum sepiarium (5)
*Gloeocystidiellum ochraceum (2)	Hirschioporus abietinus (2)
Hirschioporus fusco-violaceus (3)	Hyphoderma setigerum (1)
Hyphodontia arguta (1)	Hyphodontia pallidula (1)
Hyphodontia verruculosa (1)	Laurilia sulcata (1)
Perenniporia medulla-panis (1)	Perenniporia subacida (2)
Phaeolus schweinitzii (1)	Phellinus chrysoloma (2)
Phellinus igniarius (1)	Phellinus laevigatus (4)
Stereum hirsutum (4)	Stereum sanguinolentum (1)
Tyromyces balsameus (1)	*Tyromyces undosus (1)
EXPOSED ROOT OR TREE BOTTOM [4] (6)	
Amylostereum chailletii (1)	Hydrabasidium subviolaceum (1)
Hypochnicium geogenium (1)	Phanerochaete sanguinea (3)

[a] Classification of fungi according to the substrates is based on the specimens collected from the research area by the author. Old TENN specimens once collected from the same area are not counted here because it is often hard to tell their correct substrates.

[b] Number of species occurring on the given substrate.

[c] Number of collections.

[*] Species growing with bryophytes.

[**] Species growing vigorously on its surroundings, including bryophytes, slash, and litter.

Table 6. Fungal occurrence according to depth of wood rot.[a]

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HOST        SPECIES                      DEPTH OF WOOD ROT (CM)

                            |----|----|----|----|----|----|----|----|----|----|
                            0        2.5       5.0       7.5      10.0      ≥12.5

RED SPRUCE (Picea rubens) (36)b
                               c
Hirschioporus abietinus (1)  ||
Amylostereum chailletii (2)  |--------|
Laurilia sulcata (1)          ||
Phellinus igniarius (1)       ||
Phellinus chrysoloma (3)         |----|
Columnocystis ambigua (3)        |----|
Hyphodontia breviseta (6)         |-------------------------------------------|
Tyromyces undosus (1)               ||
Hyphodontia alutaria (3)              |--------------|
Hypochnicium geogenum (1)               |-------|
Antrodia serialis (3)                   |----------|
Botryobasidium subcoronatum (1)           ||
Perenniporia subacida (2)                  |---------|
Ceraceomyces sublaevis (1)                        |---------------------------|
Hyphodontia pallidula (1)                         |---------------------------|
Tyromyces fragilis (1)                              ||
Gloeocystidiellum citrinum (1)                       |------------------------|
Botryobasidium obtusisporum (2)                       |-----------------------|
Athelia decipiens (1)                                                        ||
Haplotrichum conspersum (1)                                                  ||

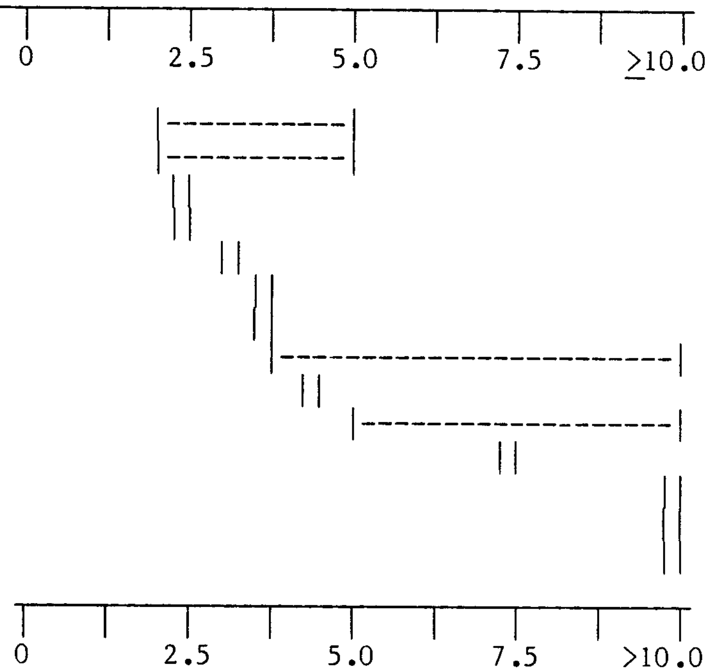
                                     |----|----|----|----|----|----|----|----|
                                     0        2.5       5.0       7.5       ≥10.0

FRASER FIR (Abies fraseri) (61)

Fomitopsis pinicola (1)               ||
Gloeophyllum sepiarium (2)            |-|
Stereum sanguinolentum (2)            |--------|
Coniophora arida (6)                  |-----------|
Hirschioprus abietinus (1)             ||
Hirschioporus fusco-violaceus (2)      ||
Hirschioporus laricinus (3)            |-------|
Botryobasidium subcoronatum (3)         |----------------|
Hyphodontia breviseta (8)               |------------------------|
Hyphoderma setigerum (2)                 ||
Phellinus laevigatus (1)                 ||
Hyphodontia alutaria (6)                   |------------------|
Athelia decipiens (1)                       ||
Tyromyces balsameus (1)                     ||
Hyphodontia aspera (1)                       ||
```

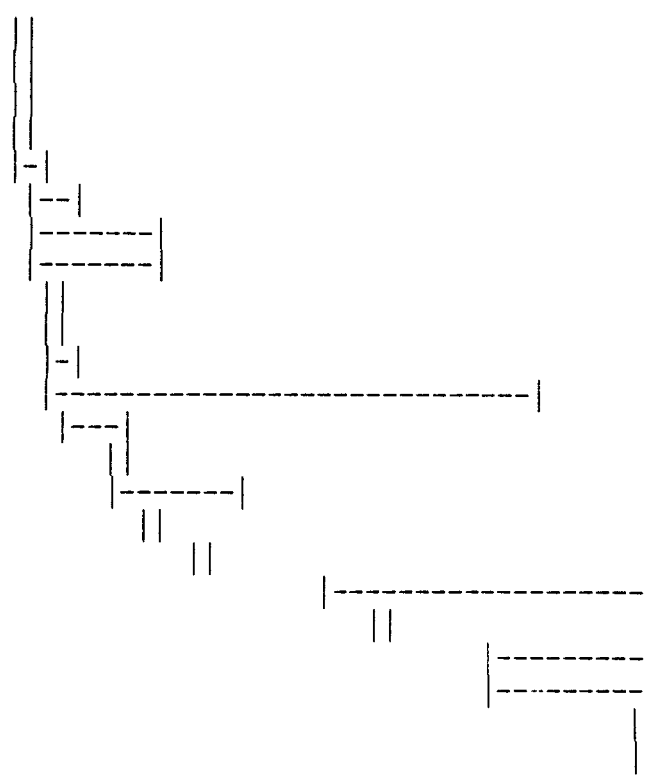
Table 6. (Continued)

HOST SPECIES DEPTH OF WOOD ROT (CM)



Amylostereum chailletii (6)
Resinicium bicolor (3)
Botryobasidium obtusisporum (1)
Gloeocystidiellum citrinum (1)
Hymenochaete fuliginosa (1)
Botryobasidium botryosum (1)
Hyphoderma tsugae (1)
Perenniporia subacida (1)
Resinicium furfuraceum (1)
Hyphoderma pallidum (1)
Botryobasidium medium (1)
Hyphodontia pallidula (1)
Jaapia ochroleuca (1)
Haplotrichum aureum (1)

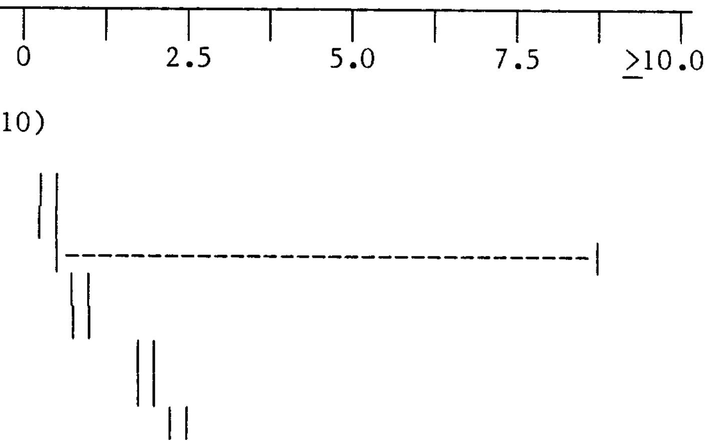
YELLOW BIRCH (*Betula lutea*) (33)



Aleurodiscus mirabilis (1)
Phellinus laevigatus (2)
Plicaturopsis crispa (1)
Stereum complicatum (1)
Schizopora paradoxa (2)
Hydnochaete olivaceum (1)
Hyphodontia breviseta (4)
Phellinus ferreus (2)
Phanerochaete septocystidia (1)
Phanerochaete viticola (1)
Hymenochaete cinnamomea (2)
Hyphodontia verruculosa (2)
Hymenochaete corrugata (2)
Coniophora arida (1)
Phellinus contiguus (2)
Haplotrichum aureum (1)
Trechispora mollusca (1)
Resinicium furfuraceum (1)
Trechispora farinacea (1)
Gloeocystidiellum ochraceum (1)
Hyphodontia arguta (1)
Hyphoderma puberum (1)
Resinicium bicolor (1)

Table 6. (Continued)

HOST	SPECIES	DEPTH OF WOOD ROT (CM)
AMERICAN BEECH (*Fagus grandifolia*) (10)		
	Phellinus laevigatus (2)	
	Schizopora paradoxa (1)	
	Hyphoderma setigerum (2)	
	Fomitopsis pinicola (1)	
	Hymenochaete cinnamomea (1)	
	Hyphodontia breviseta (1)	
	Haplotrichum aureum (1)	
	Perenniporia medulla-panis (1)	



[a] Occurrence of fungi according to the depth of wood rot is based on the specimens collected from the research area and provided with available data by the author. The blade of the hunting knife used was 14 cm long, and the measurement was confined to sapwood rot.

[b] Number of tested collections.

[c] Depth range of wood rot.

Table 7. Classification of fungi according to type of wood rot.[a]

WOOD ROT	SPECIES	
BROWN ROT		
	*Amylostereum chailletii	Antrodia serialis
	Columnocystis ambigua	Coniophora arida
	Fomitopsis pinicola	Gloeophyllum sepiarium
	Phaeolus schweinitzii	*Stereum sanguinolentum
	Tyromyces balsameus	Tyromyces fragilis
	Tyromyces undosus	
WHITE ROT		
	Athelia decipiens	Botryobasidium botryosum
	Botryobasidium candicans	Botryobasidium medium
	Botryobasidium obtusisporum	Botryobasidium subcoronatum
	Climacocystis borealis	Coriolus versicolor
	Ganoderma applanatum	Gloeocystidiellum citrinum
	Haplotrichum aureum	Haplotrichum conspersum
	Hirschioporus abietinus	Hirschioporus fusco-violaceus
	Hirschioporus laricinus	Hydnochaete olivaceum
	Hymenochaete corrugata	Hymenochaete cinnamomea
	Hyphoderma pallidum	Hyphoderma puberum
	Hyphoderma setigerum	Hyphodontia abieticola
	Hyphodontia alutaria	Hyphodontia arguta
	Hyphodontia aspera	Hyphodontia breviseta
	Hyphodontia pallidula	Hyphodontia verruculosa
	Hypochnicium geogenium	Irpex lacteus
	Jaapia cohroleuca	Laurilia sulcata
	Perenniporia medulla-panis	Perenniporia subacida
	Phanerochaete filamentosa	Phanerochaete septocystidia
	Phanerochaete sordida	Phanerochaete viticola
	Phellinus chrysoloma	Phellinus contiguus
	Phellinus ferreus	Phellinus igniarius
	Phellinus laevigatus	Poria crustulina
	Resinicium bicolor	Resinicum furfuraceum
	Schizopora paradoxa	Stereum complicatum
	Stereum hirsutum	Trechispora farinacea
	Trechispora mollusca	Trechispora vaga
	Xylobolus subpileatus	

[a] Classification of fungi according to the type of wood rot is based on observations in the field and on information from the literature.

* Species which possibly belong to brown rot fungi.

Table 8. Fungal occurrence according to host.[a]

HOST	SPECIES
RED SPRUCE (_Picea rubens_) [40][b] (122)[c]	
Aleurodiscus amorphus (1)	_Amylostereum chailletii_ (6)
Antrodia serialis (11)	_Athelia decipiens_ (1)
Bjerkandera adusta (1)	*_Boreostereum radiatum_ (1)
*_Botryobasidium candicans_ (1)	_Botryobasidium obtusisporum_ (3)
Botryobasidium subcoronatum (2)	*_Ceraceomyces sublaevis_ (1)
Climacocystis borealis (6)	*_Columnocystis ambigua_ (7)
Coriolus versicolor (1)	_Fomitopsis pinicola_ (3)
Gloeocystidiellum citrinum (1)	_Gloeophyllum sepiarium_ (3)
*_Haplotrichum conspersum_ (1)	_Hirschioporus abietinus_ (5)
Hirschioporus fusco-violaceus(10)	*_Hydrabasidium subviolaceum_ (1)
Hyphoderma setigerum (1)	*_Hyphodontia abieticola_ (1)
Hyphodontia alutaria (4)	_Hyphodontia breviseta_ (9)
Hyphodontia pallidula (1)	*_Hypochnicium geogenium_ (1)
Laurilia sulcata (2)	_Parmastomyces kravtzevianus_ (1)
Perenniporia subacida (3)	_Phaeolus schweinitzii_ (4)
*_Phanerochaete sanguinea_ (3)	_Phellinus chrysoloma_ (9)
Phellinus igniarius (2)	*_Poria crustulina_ (3)
Resinicium bicolor (1)	_Stereum hirsutum_ (6)
Stereum sanguinolentum (1)	_Trechispora vaga_ (1)
Tyromyces fragilis (2)	_Tyromyces undosus_ (1)
FRASER FIR (_Abies fraseri_) [45] (135)	
Aleurodiscus amorphus (1)	_Amylostereum chailletii_ (16)
Athelia decipiens (1)	*_Botryobasidium botryosum_ (1)
*_Botryobasidium medium_ (1)	_Botryobasidium obtusisporum_ (1)
Botryobasidium subcoronatum (3)	_Coniophora arida_ (7)
Coriolus versicolor (1)	_Fomitopsis pinicola_ (7)
Ganoderma applanatum (1)	_Gloeocystidiellum citrinum_ (1)
Gloeophyllum sepiarium (3)	_Haplotrichum aureum_ (1)
Hirschioporus abietinus (10)	_Hirschioporus fusco-violaceus_ (13)
*_Hirschioporus laricinus_ (4)	_Hymenochaete fuliginosa_ (1)
*_Hyphoderma pallidum_ (1)	_Hyphoderma setigerum_ (3)
*_Hyphoderma tsugae_ (1)	_Hyphodontia alutaria_ (6)
*_Hyphodontia aspera_ (1)	_Hyphodontia breviseta_ (8)
Hyphodontia pallidula (1)	_Inonotus radiatus_ (1)
*_Jaapia ochroleuca_ (1)	*_Laetiporus sulphureus_ (1)
Perenniporia subacida (2)	_Phaeolus schweinitzii_ (1)
Phellinus chrysoloma (3)	_Phellinus laevigatus_ (4)
Resinicium bicolor (3)	*_Resinicium furfuraceum_ (1)
Stereum hirsutum (4)	*_Stereum sanguinolentum_ (7)
Trechispora vaga (1)	*_Tyromyces albellus_ (1)
Tyromyces balsameus (2)	_Tyromyces caesius_ (1)

Table 8. (Continued)

HOST	SPECIES

*Tyromyces floriformis (2 ?)
*Tyromyces guttulatus (1)
Tyromyces undosus (1)
Tyromyces fragilis (2)
Tyromyces immitis (2)

YELLOW BIRCH (Betula lutea) [34] (53)

*Aleurodiscus mirabilis (1)
Coniophora arida (1)
Coriolus versicolor (1)
Fomes fomentarius (1)
*Gloeocystidiellum ochraceum (2)
Hydnochaete olivaceum (1)
Hymenochaete cinnamomea (1)
*Hyphodontia arguta (1)
*Hyphodontia verruculosa (2)
Phaeolus schweinitzii (1)
*Phanerochaete viticola (2)
Phellinus igniarius (7)
Phellinus laevigatus (2)
*Plicaturopsis crispa (1)
*Resinicium furfuraceum (1)
*Stereum complicatum (1)
*Trechispora mollusca (1)
*Cerinomyces pallidus (1)
Climacocystis borealis (1)
*Daedaleopsis confragosa (1)
Fomitopsis pinicola (1)
Haplotrichum aureum (1)
*Hymenochaete corrugata (2)
*Hyphoderma puberum (1)
Hyphodontia breviseta (3)
Inonotus radiatus (4)
*Phanerochaete septocystidia (1)
Phellinus contiguus (2)
Phellinus ferreus (2)
*Piptoporus betulinus (1 ?)
Resinicium bicolor (1)
Schizopora paradoxa (2)
*Trechispora farinacea (1)
Tyromyces caesius (1 ?)

AMERICAN BEECH (Fagus grandifolia) [21] (28)

Bjerkandera adusta (1)
Cerrena unicolor (2)
Fomes fomentarius (1)
*Hapalopilus nidulans (1)
Hirschioporus pargamenus (1)
Hyphoderma setigerum (1)
Inonotus radiatus (2)
Phellinus ferreus (2)
Phellinus laevigatus (2)
*Stereum gausapatum (1)
Tyromyces caesius (1)
Coriolus cervinus (2)
*Fibrodontia gossypina (1)
Ganoderma applanatum (2)
Haplotrichum aureum (1)
Hymenochaete cinnamomea (2)
Hyphodontia breviseta (1)
*Perenniporia medulla-panis (1)
Phellinus igniarius (1)
Schizopora paradoxa (1)
Tyromyces balsameus (1)

EASTERN HEMLOCK (Tsuga canadensis) [7] (13)

Climacocystis borealis (1)
Ganoderma applanatum (3)
Laurilia sulcata (1)
Phellinus laevigatus (1)
Fomitopsis pinicola (3)
*Ganoderma tsugae (1)
Phellinus chrysoloma (3)

Table 8. (Continued)

HOST	SPECIES
PIN CHERRY (Prunus pensylvanica) [2] (4)	
Hymenochaete tabacina (1)	*Phellinus pomaceus (3)
MOUNTAIN MAPLE (Acer spicatum) [2] (2)	
Hydnochaete olivaceum (1)	Phellinus ferreus (1)
MOUNTAIN ASH (Sorbus americana) [1] (1)	
Phellinus contiguus (1)	
CATAWBA RHODODENDRON (Rhododendron catawbiense) [3] (3)	
Hymenochaete fuliginosa (1)	Hyphodontia breviseta (1)
*Trechispora alnicola (1)	
ROSEBAY RHODODENDRON (Rhododendron maximum) [1] (1)	
*Hymenochaete cervina	
NORTHERN RED OAK (Quercus rubra) [2] (2)	
Ganoderma applanatum (1)	*Xylobolus subpileatus (1)
YELLOW BUCKEYE (Aesculus octandra) [1] (1)	
Ganoderma applanatum (1)	
SERVICEBERRY (Amelanchier laevis) [1] (1)	
Coriolus hirsutus (1)	
SUGAR MAPLE (Acer saccharum) [1] (1)	
*Phanerochaete filamentosa (1)	
UNKNOWN CONIFER [10] (12)	
Antrodia serialis (2)	Fomitopsis pinicola (1)
*Hymenochaete spreta (1)	Laurilia sulcata (2)
Parmastomyces kravtzevianus (1)	Perenniporia subacida (1)
Phaeolus schweinitzii (1)	Tyromyces fragilis (1)
Tyromyces immitis (1)	Tyromyces undosus (1)

Table 8. (Continued)

HOST	SPECIES	
UNKNOWN HARDWOOD [11] (12)		
	Cerrena unicolor (1)	*Coriolus cervinus* (1)
	Hymenochaete curtisii (1)	*Hymenochaete tabacina* (1)
	Hyphoderma setigerum (1)	*Inonotus radiatus* (1)
	**Irpex lacteus* (1)	**Phanerochaete sordida* (1)
	**Poria spissa* (1)	**Pycnoporus cinnabarinus* (2)
	Rigidoporus nigrescens (1)	
UNKNOWN TREE [8] (9)		
	Antrodia serialis (2)	*Coniophora arida* (1)
	Coriolus hirsutus (1)	*Ganoderma applanatum* (1)
	Hirschioporus pargamenus (1)	*Stereum hirsutum* (1)
	Stereum ochraceo-flavum (1)	*Tyromyces fragilis* (1)

[a] Classification of fungi according to the hosts is based on the total specimens collected from the research area by the author and earlier mycologists.

[b] Number of species occurring on the given host.

[c] Number of cllections.

* Species occurring only on the listed host within the research area.

Table 9. Fungal occurrence according to host dbh.[a]

```
HOST     SPECIES                              DBH (CM)

                             |    |    |    |    |    |    |    |    |
                             0   10   20   30   40   50   60   70   80
                              b
RED SPRUCE (Picea rubens) (33)
                                        c
Tyromyces fragilis (1)                ||
Hyphodontia alutaria (3)               |-------|
Antrodia serialis (3)                   |-------------------|
Botryobasidium subcoronatum (1)             ||
Perenniporia subacida (2)                   |------|
Botryobasidium obtusisporum (2)              |-----|
Columnocystis ambigua (3)                     |------|
Hyphodontia breviseta (4)                      |--------------------|
Amylostereum chailletii (2)                      |-------|
Phellinus chrysoloma (3)                         |--|
Athelia decipiens (1)                               ||
Hyphodontia pallidula (1)                           ||
Haplotrichum conspersum (1)                         ||
Ceraceomyces sublaevis (1)                            ||
Phellinus igniarius (1)                               ||
Laurilia sulcata (1)                                   ||
Tyromyces undosus (1)                                   ||
Hypochnicium geogenium (1)                               ||
Gloeocystidiellum citrinum (1)                                  ||

                             |    |    |    |    |    |    |    |    |
                             0   10   20   30   40   50   60   70   80

FRASER FIR (Abies fraseri) (59)

Resinicium bicolor (3)           |----------|
Gloeocystidiellum citrinum (1)    ||
Hirschioporus fusco-violaceus (2) ||
Hirschioporus abietinus (1)          ||
Hyphoderma pallidum (1)              ||
Hyphodontia breviseta (6)            |-----|
Botryobasidium subcoronatum (3)      |---------|
Hyphodontia alutaria (6)              |------|
Coniophora arida (6)                  |----------|
Amylostereum chailletii (6)           |-----------|
Botryobasidium botryosum (1)            ||
Jaapia ochroleuca (1)                   ||
Resinicium furfuraceum (1)              ||
Stereum sanguinolentum (2)              |-|
Gloeophyllum sepiarium (2)              |--|
Hirschioporus laricinus (3)             |----|
```

Table 9. (Continued)

HOST SPECIES	DBH (CM)
	0 10 20 30 40 50 60 70 80
Phellinus laevigatus (1)	
Hymenochaete fuliginosa (1)	
Hyphodontia pallidula (1)	
Hyphoderma setigerum (2)	
Botryobasidium medium (1)	
Botryobasidium obtusisporum (1)	
Tyromyces balsameus (1)	
Hyphodontia aspera (1)	
Haplotrichum aureum (1)	
Hyphoderma tsugae (1)	
Perenniporia subacida (1)	
Fomitopsis pinicola (1)	
Athelia decipiens (1)	
	0 10 20 30 40 50 60 70 80
YELLOW BIRCH (*Betula lutea*) (27)	
Hyphodontia breviseta (3)	
Gloeocystidiellum ochraceum (1)	
Hyphodontia arguta (1)	
Phanerochaete septocystidia (1)	
Phellinus contiguus (1)	
Trechispora farinacea (1)	
Hyphodontia verruculosa (2)	
Aleurodiscus mirabilis (1)	
Phanerochaete viticola (1)	
Plicaturopsis crispa (1)	
Hymenochaete corrugata (1)	
Phellinus ferreus (2)	
Coniophora arida (1)	
Hymenochaete cinnamomea (1)	
Haplotrichum aureum (1)	
Hyphoderma puberum (1)	
Resinicium bicolor (1)	
Stereum complicatum (1)	
Schizopora paradoxa (2)	
Phellinus laevigatus (1)	
Resinicium furfuraceum (2)	

Table 9. (Continued)

[a] Occurrence of fungi according to the host dbh is based on the specimens collected from the research area and provided with available data by the author.

A six-foot long tape ruler was used to measure the circumference of host trees. For large trees, the circumference was measured again to add extra length. The dbh was calculated from the data of circumference.

[b] Number of tested collections.

[c] Range of host dbh.

Table 10. Elevational distribution of fungi of the spruce-fir forest of the Great Smoky Mountains National Park.[a]

```
 SPECIES                                 ELEVATION (M)

                      |    |    |    |    |    |    |    |    |    |    |
                   1200      1350      1500      1650      1800      1950
                  b    c
Irpex lacteus (1)    ||
Pycnoporus cinnabarinus (1)||
Phanerochaete filamentosa (1)||
Ganoderma tsugae (1)          ||
Hymenochaete cervina (1)      ||
Fomitopsis pinicola (9)         |-----------------------------------|
Gloeocystidiellum ochraceum (1)  ||
Hyphodontia arguta (1)           ||
Hyphoderma setigerum (6)           |------------------------|
Perenniporia subacida (3)          |--------------------------|
Hyphodontia breviseta (23)         |----------------------------------|
Perenniporia medulla-panis (1)       ||
Hydnochaete olivaceum (2)            |----------|
Phellinus laevigatus (4)             |----------------|
Phellinus chrysoloma (6)             |------------------------|
Resinicium furfuraceum (2)            |---------|
Coniophora arida (7)                  |------------------------|
Phellinus igniarius (5)                |------------------------|
Gloeocystidiellum citrinum (2)          |-------------------|
Haplotrichum conspersum (1)              ||
Phellinus contiguus (2)                  ||
Trechispora alnicola (1)                 ||
Piptoporus betulinus (1)                 ||
Hymenochaete corrugata (2)               |----------|
Amylostereum chailletii (19)             |------------------------------|
Hyphodontia abieticola (1)                 ||
Antrodia serialis (7)                      |----------|
Athelia decipiens (2)                      |----------|
Hirschioporus abietinus (15)               |--------------------------|
Hirschioporus fusco-violaceus (21)         |--------------------------|
Aleurodiscus mirabilis (1)                   ||
Fibrodontia gossypina (1)                    ||
Hydrabasidium subviolaceum (1)               ||
Laurilia sulcata (1)                         ||
Phanerochaete sordida (1)                    ||
Plicaturopsis crispa (1)                     ||
Stereum complicatum (1)                      ||
Trechispora farinacea (1)                    ||
Hymenochaete cinnamomea (3)                  |--|
Phellinus ferreus (3)                        |----|
Schizopora paradoxa (3)                      |----|
Tyromyces fragilis (2)                       |----|
```

Table 10. (Continued)

SPECIES	ELEVATION (M)
Haplotrichum aureum (3)	
Gloeophyllum sepiarium (5)	
Botryobasidium obtusisporum (5)	
Columnocystis ambigua (6)	
Resinicium bicolor (5)	
Hyphodontia alutaria (10)	
Hyphoderma puberum (1)	
Hypochnicium geogenium (1)	
Phanerochaete septocystidia (1)	
Poria crustulina (2)	
Trechispora mollusca (1)	
Tyromyces floriformis (1)	
Stereum sanguinolentum (5)	
Botryobasidium candicans (1)	
Tyromyces balsameus (1)	
Tyromyces immitis (1)	
Trechispora vaga (2)	
Ganoderma applanatum (3)	
Tyromyces undosus (2)	
Cerinomyces pallidus (1)	
Hymenochaete fuliginosa (1)	
Hymenochaete tabacina (1)	
Phanerochaete viticola (1)	
Tyromyces caesius (1)	
Xylobolus subpileatus (1)	
Botryobasidium subcoronatum (3)	
Hyphoderma tsugae (1)	
Jaapia ochroleuca (1)	
Phellinus pomaceus (3)	
Phanerochaete sanguinea (3)	
Stereum hirsutum (9)	
Botryobasidium botryosum (1)	
Hirschioporus laricinus (4)	
Hyphodontia verruculosa (2)	
Botryobasidium medium (1)	
Ceraceomyces sublaevis (1)	
Hyphoderma pallidum (1)	
Hyphodontia pallidula (2)	
Climacocystis borealis (2)	
Hyphodontia aspera (1)	
Coriolus versicolor (2)	

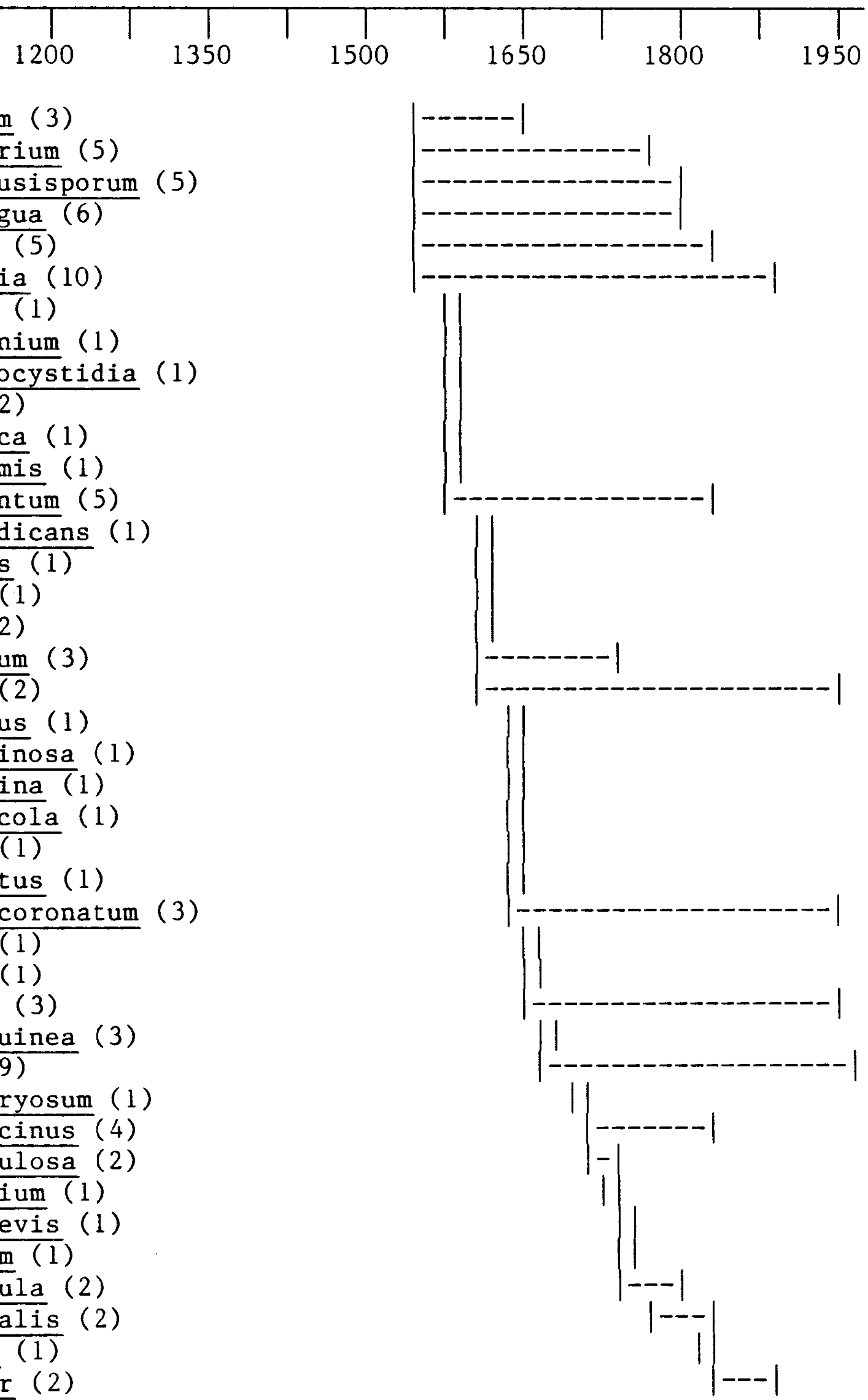


Table 10. (Continued)

[a] Occurrence of fungi according to the elevation is based on the data provided by the author and some fragmentary informations of the old TENN specimens collected by earlier mycologists.

The elevation was determined by measuring hiking time, referring to trail signs, and locating collecting sites on 7.5-minute series maps (USGS-TVA Quadrangles, 1964).

[b] Number of tested collections.

[c] Elevation range within which fungi occur.

APPENDIX B

SPECIMENS EXAMINED

ALEURODISCUS AMORPHUS

Research Area

Clingmans Dome, 19.VIII.1939, No. 12570 (TENN); Indian Gap, 14.VI.1942, No. 14280 (TENN).

Extra-limital

Canada: Ontario, Lake Timagami, Bear Island, 13.VIII.1937, TRTC 11601 (TENN 24794); Ontario, Lake Timagami, Matagama Point, 13.VIII.1938, TRTC 13313 (TENN 14810); Ontario, Dorset, U.T.F., 9.IX. 1962, No. 27443 (TENN). United States: New Hampshire, Grafton Co., Littleton, near Connecticut River, 24.VII.1932, No. 3500 (TENN); Oregon, Clackamas Co., Mt. Hood National Forest, 14.XII.1930, No. 3499 (TENN).

ALEURODISCUS MIRABILIS

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46310 (TENN).

AMYLOSTEREUM CHAILLETII

Research Area

Mt. Le Conte, 20.VII.1934, No. 6573 (TENN); Mt. Kephart, 4.IX.1941, No. 14043 (TENN); Indian Gap, 4.X.1942, No. 10106 (TENN); Indian Gap, 27.V.1944, No. 16756 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, No. 46102 (TENN); Appalachian Trail between Clingmans Dome and Collins Gap, 14.VII.1982, Nos. 46118-46125 (TENN); Appalachian Trail, near Mt. Collins, 24.VII.1982, No. 46273 (TENN); Newfound Gap, 4.VIII.1982, No. 46276 (TENN); Charlies Bunion,

18.VIII.1982, Nos. 46187, 46294 (TENN); Jct. of Appalachian and Boulevard Trails, 18.VIII.1982, No. 46197 (TENN); Boulevard Trail, near Myrtle Point, 9.VII.1983, No. 46220 (TENN); Anakeesta Knob, 9.VII.1983, No. 46438 (TENN); near Jct. of Appalachian and Boulevard Trails, 23.VII.1983, No. 46224 (TENN); Balsam Mt. Trail, between Tricorner and Luftee Knobs, 10.IX.1983, No. 46523 (TENN); Mt. Guyot, 18.VIII.1984, No. 46231 (TENN).

Extra-limital

India: Himachal Pradesh, Mahasu, Narkanda, 3.VIII.1965, Rattan No. 5003 (TENN 39479); same locality, 30.VI.1971, Rattan No. 5533 (TENN 39560); Himachal Pradesh, Mahasu, Bagi, 18.VIII.1965, No. 39498 (TENN); Himachal Pradesh, Simla, Chadwick Falls, 25.IX.1967, Rattan No. 5301 (TENN 39533). Sweden: Pite Lappmark, Arvidsjaur parish, 7.VII.1966, GB 7367 (TENN 46554, 46620); Dalsland, Nössemark parish, 12.IX.1980, Hjortstam No. 11952 (TENN 46605); Dalsland, Skallerud parish, 1.V.1982, GB 30342 (TENN 46621).

ANTRODIA SERIALIS

Research Area

Boulevard Trail, 9.XI.1935, No. 8656 (TENN); same locality, 10.XI.1935, No. 8644 (TENN); Clingmans Dome, 14.VI.1942, N. 15925 (TENN); Newfound Gap, 4.X.1942, No. 15932 (TENN); Indian Gap, 27.V.1944, No. 16661 (TENN); Alum Cave Trail, near Alum Cave, 18.VI.1982, Nos. 46086, 46089, 46247 (TENN); same locality, 26.VI.1982, No. 46106 (TENN); Newfound Gap, 4.VIII.1982, No. 46379 (TENN); Jct. of Maddron Bald and Snake Den Mt. Trails, 10.IX.1982, No.

46306 (TENN); Appalachian Trail, near Indian Gap, 25.VI.1983, No. 46429 (TENN); same locality, 8.VII.1983, No. 46217 (TENN); Boulevard Trail, near Jumpoff, 9.VII.1983, No.46440 (TENN); Balsam Mt. Trail, between Laurel Gap and Luftee Knob, 10.IX.1983, NO. 46421 (TENN).

Extra-limital

United States: Illinois, Rock River, X.1918, F S907 (TENN 15845); Virginia, Great Falls, 19.X.1922, NO. 2305 (TENN). U.S.S.R.: Lisino-forestry, Leningrad Reg., 17.X.1961, No. 40371 (TENN).

ATHELIA DECIPIENS

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46210 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 23.VII.1983, No.46223 (TENN).

Extra-limital

Sweden: Jämtland, Revsund parish, 29.VII.1958, GB 8196 (TENN 46544); Pite Lappmark, Arvidsjaur parish, 7.VII.1966, GB 8130 (TENN 46606); same locality, 1979, GB 8130 (TENN 46555); Angermanland, Junsele parish, 21.IX.1970. United States: Tennessee, Blount Co., GSMNP, Cades Cove, 13.VI.1973, No. 41027 (TENN).

BJERKANDERA ADUSTA

Research Area

Beech Gap, 12.V.1935, No. 7707 (TENN); Indian Gap, 2.VII.1949, No. 20283 (TENN).

Extra-limital

United States: Tennessee, Blount Co., Montvale Springs, 23.VIII.1934, No. 7688 (TENN); Tennessee, Knoxville, Carters School, 10.VII.1934, No. 7683 (TENN).

BOREOSTEREUM RADIATUM

Research Area

Boulevard Trail, 4.IX.1941, No. 14038 (TENN).

Extra-limital

United States: Tennessee, Sevier Co., GSMNP, Chimneys, 9.VII.1943, No. 15790 (TENN); same locality, 7.V.1944, No. 16367 (TENN).

BOTRYOBASIDIUM BOTRYOSUM

Research Area

Mt. Sterling, 2.VII.1983, No. 46433 (TENN).

Extra-limital

Sweden: Västergötland, Alingsas, 12.X.1969, GB 12644 (TENN 46586); Västergötland, Undenäs parish, 3.X.1969, GB 12646 (TENN 46587); Värmland, Gräsmarks sn, 30.X.1976, GB 19424 (TENN 46558, 46607). *United States*: Tennessee, Blount Co., GSMNP, Cades Cove, 8.VIII.1981, No. 46042 (TENN).

BOTRYOBASIDIUM CANDICANS

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, No. 46248 (TENN).

BOTRYOBASIDIUM MEDIUM

Research Area

Forney Ridge Trail, near Andrews Bald, 17.IX.1983, No. 46422 (TENN).

BOTRYOBASIDIUM OBTUSISPORUM

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, No. 46104 (TENN); Alum Cave Trail, near Alum Cave, 18.VI.1983, No. 46426 (TENN); Pecks Corner, 27.VIII.1983, No. 46446 (TENN); Tricorner Knob, 18.VIII.1984, No. 46324 (TENN).

Extra-limital

Sweden: Smaland, Rumskulla parish, 8.X.1966, GB 8496 (TENN 46559, 46624); Vg, Alingsas, 9.IV.1971, GB 19826 (TENN 46608).

BOTRYOBASIDIUM SUBCORONATUM

Research Area

Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46173 (TENN); Charlies Bunion, 18.VIII.1982, Nos. 46186, 46296, 46395 (TENN); Mt. Le Conte, 9.Vii.1983, No. 46334 (TENN).

Extra-limital

Sweden: Västergötland, Undenäs parish, 3.X.1969, GB 16600 (TENN 46560, 46589); Västergötland, Vänga parish, 25.IX.1969, GB 16593 (TENN 46588).

CERACEOMYCES SUBLAEVIS

Research Area

Boulevard Trail, between Myrtle Point and Anakeesta Knob, 9.VII.1983, No. 46221 (TENN)

CERINOMYCES PALLIDUS

Research Area

Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, No.46460 (TENN).

Extra-limital

United States: Tennessee, Anderson Co., Norris Watershed, 15.X.1976, No. 41040 (TENN).

CERRENA UNICOLOR

Research Area

Cataloochee, 28.VII.1935, No.8048 (TENN); Collins Gap, 18.IX.1938, No. 11771 (TENN); Mt. Le Conte, 8.VIII.1941, No.13888 (TENN).

Extra-limital

United States: Pennsylvania, Center Co., Black Bear Run, 4.I.1920, No. 3219 (TENN); Pennsylvania, Huntingdon Co., Charter Oak, 17.III.1934, No. 3218 (TENN); Tennessee, Nashville, Percy Warner Park, 2.IV.1947, No. 18534 (TENN).

CLIMACOCYSTIS BOREALIS

Research Area

Mt. Collins, 6.VIII.1934, No. 6455 (TENN); Road Prong Trail, between Indian Gap to Chimney, 26.VII.1936, No.10050 (TENN); Newfound Gap, 20.VI.1937, No.10445 (TENN); Indian Gap, 21.VI.1942, No.15930 (TENN); same locality, 26.VI.1949, No. 19030 (TENN); Mt. Collins, 24.VII.1982, Nos. 46149, 46269 (TENN); Appalachian Trail, near Mt. Collins, 24.VII.1982, No. 46271 (TENN).

Extra-limital

Canada: Ontario, Lake Timagami, 9.IX.1935, TRTC 7717 (TENN 8062). United States: Tennessee, Blount Co., GSMNP, 26.IX.1935, No. 8357 (TENN).

COLUMNOCYSTIS AMBIGUA

Research Area

Alum Cave Trail to Mt. Le Conte, 21.VIII.1939, No. 12674 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, Nos. 46103, 46105, 46256 (TENN); Appalachian Trail, near Indian Gap, 2.X.1982, No. 46315 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1983, No. 46212 (TENN); Boulevard Trail, near Anakeesta Knob, 9.VII.1983, No. 46337 (TENN).

Extra-limital

United States: New York, Onondaga Co., Jamesville, Clark Reservation, 20.IX.1952, Gilbertson No. 456 (SYRF); Tennessee, Campbell Co., Jellico, 8.III.1936, No. 8647 (TENN).

CONIOPHORA ARIDA

Research Area

Newfound Gap, 18.VIII.1939, No. 14148 (TENN); Jct. of Maddron Bald and Snake Den Mt. Trails, 10.IX.1982, Nos. 46305, 46418, 46420 (TENN); Appalachian Trail, near Indian Gap, 2.X.1982, No. 46402 (TENN); Balsam Mt. Trail, between Tricorner and Luftee Knobs, 10.IX.1983, No. 46501 (TENN); Forney Ridge Trail, near Andrews Bald, 17.IX.1983, Nos. 46451, 46454 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 17.VIII.1984, No. 46475 (TENN).

Extra-limital

Finland: Lapponia, 3.IX.1960, Eriksson No. 1033 (SYRF). India: Jammu and Kashmir, Pehalgam, 30.VIII.1972, Rattan No. 5773 (TENN 38673). United States: New York, Allegany State Park, 12.IX.1964, No. 27105 (TENN); Tennessee, Blount Co., Laurel Lake, 20.VII.1963, No. 26330 (TENN); Tennessee, Blount Co., Friendsville Road, 7.VIII.1963, No. 26328 (TENN).

CORIOLUS CERVINUS

Research Area

Cataloochee, 28.VII.1935, No. 8330 (TENN); Mt. Le Conte, 4.X.1936, No. 9540 (TENN); Indian Gap, 8.X.1955, No. 22152 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, Bowers Creek, 15.VI.1934, No. 6316 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, 8.IX.1956, No. 22401 (TENN).

CORIOLUS HIRSUTUS

Research Area

Clingmans Dome, 1.IV.1934, No. 7069 (TENN); Forney Ridge Trail to Andrews Bald, 22.VIII.1939, No. 12656 (TENN).

Extra-limital

Canada: Cheekeye, British Columbia, 25.VII.1926, Nos. 3352, 3354 (TENN). Denmark: Munke Bjaerby, 23.IX.1970, No. 36541 (TENN). United States: Pennsylvania, Pennsylvania State College, XI.1933, No. 3353 (TENN).

CORIOLUS VERSICOLOR

Research Area

Grassy Patch, 27.VI.1934, No. 3945 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, No. 46101 (TENN); Mt. Le Conte, 26.VI.1982, No. 46251 (TENN).

Extra-limital

United States: Pennsylvania, Luzerne Co., Hazleton, 27.XII.1932, No. 3367 (TENN); Pennsylvania, Pennsylvania State College, 18.I.1933, No. 3368 (TENN); same locality, XI.1933, No. 3366 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Hyatt Lane, 18.VII.1981, No. 46001 (TENN); same locality, 8.VIII.1981, 46017 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Campground, 3.X.1981, Nos. 46501-3 (TENN); Tennessee, Blount Co., GSMNP, Environmental Education Center, Tremont, 3.X.1981, No. 46070 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, Nos. 46200, 46299, 46416 (TENN).

DAEDALEOPSIS CONFRAGOSA

Research Area

Alum Cave, 14.IX.1941, No. 14009 (TENN).

Extra-limital

Canada: Ottawa, C.E.F., Arboretum, 19.X.1932, No. 6220 (TENN). United States: Pennsylvania, Pennsylvania State College, XI.1933, Nos. 3215-3216 (TENN); Pennsylvania, Huntingdon Co., Charter Oak, 17.III.1934, No. 3217 (TENN); Tennessee, Lea Lakes, 8.IV.1934, No. 6362 (TENN).

FIBRODONTIA GOSSYPINA

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46312 (TENN).

FOMES FOMENTARIUS

Research Area

Beech Gap, 19.V.1935, No. 4935 (TENN); Road Prong Trail, between Indian Gap and Chimneys, 26.VII.1936, No. 9072 (TENN).

Extra-limital

Canada: Quebec, Mt. Burnet, 6.IX.1931, no. 6225 (TENN). United States: Pennsylvania, Huntingdon Co., Stone Creek, 7.I.1933, No. 3239 (TENN); Pennsylvania, Bradford Co., Ulster, 6.VI.1934, No. 3238 (TENN).

FOMITOPSIS PINICOLA

Research Area

Clingmans Dome, i.IV.1934, No. 6908 (TENN); Grassy Patch, 27.VI.1934, Nos. 6354, 6356 (TENN); Cataloochee, 28.VII.1935, No. 8156 (TENN); Boulevard Trail, 10.XI.1935, No. 8412 (TENN); Road Prong Trail, between Indian Gap and Chimneys, 26.VII.1936, No. 9073 (TENN); Clingmans Dome Road, near Indian Gap, 3.IV.1982, Nos. 46074, 46391 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, Nos. 46088, 46369 (TENN); Clingmans Dome, 14.VII.1982, No. 46258 (TENN); Appalachain Trail, between Clingmans Dome and Collins Gap, 14.VII.1982, No. 46259 (TENN); Collins Gap, 24.VII.1982, No. 46261 (TENN); Collins Gap, 24.VII.1982, No. 46261 (TENN); Appalachian Trail, near Mt. Collins, 24.VII.1982, No. 46270 (TENN); Mt. Collins, 24.VII.1982, No. 46469 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46470 (TENN); Jct. of Appalachian and Boulevard Trails, 18.VIII.1982, No. 46481 (TENN).

Extra-limital

United States: Colorado, San Isabel National Forest, near Monarch Pass, 19.VI.1935, Solheim No. 364 (TENN 15619); Michigan, Rock River, IX. 1927, No. 11911 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier, Ramsey Prong, 14.III.1936, No. 8914 (TENN).

GANODERMA APPLANATUM

Research Area

Clingmans Dome, 1.IV.1934, No. 7041 (TENN); near Alum Cave, 27.VI.1934, Nos. 6357-8 (TENN); Grassy Patch, summer.1934, No. 4264 (TENN); Mt. Kephart, 10.XI.1935, No. 8414 (TENN); Newfound Gap, 26.VII.1936, No. 8950 (TENN); Appalachain Trail, between Newfound Gap

and Mt. Ambler, 4.VIII.1982, No. 46476 (TENN); Indian Gap, 2.X.1982, No. 46521 (TENN); Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46512 (TENN).

Extra-limital

United States: Idaho, Priest River, 1.X.1968, Petersen No. 4107 (TENN 34236); Indiana, Jefferson Co., near Kent, 17.VIII.1934, No. 7153 (TENN); Tennessee, Blount Co., GSMNP, Whiteoak Sink, 22.VIII.1934, No. 7055 (TENN); Tennessee, Carter Co., Roan Mt., 23.VI.1935, No. 7821 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 10.IX.1982, No. 46399 (TENN); Tennessee, Coffee Co., Tullahoma, 3.VII.1947, No. 18131 (TENN).

GANODERMA TSUGAE

Research Area

Grassy Patch, 27.VI.1934, No. 7231 (TENN)

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, 3.VI.1959, No. 23301 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, No. 46301 (TENN); Tennessee, Sevier Co., Alum Cave Trail, near Arch Rock, 18.VI.1982, No. 46520 (TENN).

GLOEOCYSTIDIELLUM CITRINUM

Research Area

Balsam Mt. Trail, between Tricorner and Luftee Knobs, 10.IX.1983, No. 46412 (TENN); Road Prong Trail, 1/3 mile off Clingmans Dome Road, 24.IX.1983, No. 46456 (TENN).

Extra-limital

Canada: Alberta, Banff National Park, Mosquito Creek, 29.VII.1966, Gilbertson No. 6409 (TENN 40959). United States: Idaho, Bonner Co., Gisbourne Mt., 8.VII.1964, Gilbertson No. 4641 (TENN 40961); New York, Onondaga Co., Syracuse, College of Forestry Experimental Station, 4.XI.1966, Gilbertosn No. 6924 (TENN 40958).

GLOEOCYSTIDIELLUM OCHRACEUM

Research Area

Mt. Sterling Ridge Trail, between Mt. Sterling Gap and the ridge top, 2.VII.1983, Nos. 46216, 46332 (TENN).

Extra-limital

France: Alpes maritimes, Le Boréon, 18.X.1964, LY 4923 (TENN 41098).

GLOEOPHYLLUM SEPIARIUM

Research Area

Collins Gap, 14.VII. 1982, No. 46129 (TENN); Appalachian Trail, near Mt. Collins, 24.VII.1982, No. 46154 (TENN); Newfound Gap, 4.VIII.1982, No. 46161 (TENN); Icewater Spring, 18.VIII.1982, Nos. 46190-1 (TENN); Forney Ridge Trail to Andrews Bald, 22.VIII.1939, No. 12637 (TENN).

Extra-limital

United States: Colorado, Rocky Mt. National Park, Bear Lake, 6.VII.1940, No. 12695 (TENN); Idaho, Elk River, 21.VII.1925, Nos. 3281, 3284 (TENN); Missouri, Shannon Co., Eminence, 18.VIII.1940,

Routien No. 1409 (TENN 13281); Pennsylvania, Huntingdon Co., Charter Oak, 17.III.1934, No. 3283 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Bowers Creek, 15.VI.1934, No. 3767 (TENN); Tennessee, Blount Co., Rich Mt., 24.VI.1934, No. 3766 (TENN); Tennessee, Blount Co., GSMNP, Tremont, 13.IX.1934, No. 7043 (TENN); Tennessee, Carter Co., Roan Mt., 22.VIII.1937, No. 10830 (TENN); Tennessee, Sevier Co., GSMNP, near Cherokee Orchard, I.1934, No. 7087 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier, 7.VI.1934, No. 6322 (TENN).

HAPALOPILUS NIDULANS

Research Area

Indian Gap, 7.IX.1941, No. 14382 (TENN).

Extra-limital

Canada: Ontario, Lake Timagami, Bear Island, 1.IV.1935, TRTC 7741 (TENN 8545). United States: Indiana, Jefferson Co., Dupont, 22.VIII.1934, No. 6807 (TENN); Tennessee, Sevier Co., GSMNP, Mt. Le Conte, 19.VI.1938, No. 12416 (TENN).

HAPLOTRICHUM AUREUM

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46314 (TENN); Laurel Top, 27.VIII.1983, No. 46344 (TENN); Spruce Mt. Trail, 26.X.1983, No. 46464 (TENN).

Extra-limital

Norway: Sor-Trondelag, Orkdal, 25/26.VIII.1982, Hjortstam No. 12806 (TENN 46557, 46623) [with Botryobasidium aureum]. Sweden:

Västmanland, Västeras-Barkarö parish, 22.IX.1981, GB 3959 (TENN 46556). United States: Tennessee, Blount Co., GSMNP, Cades Cove, 18.VII.1981, No. 45994 (TENN); Tennessee, Sevier Co., GSMNP, Trillium Gap, 22.V.1982, N. 46244 (TENN).

HAPLOTRICHUM CONSPERSUM

Research Area

Spruce Mt. Trail, 26.X.1983, No. 46510 (TENN).

HIRSCHIOPORUS ABIETINUS

Research Area

Clingmans Dome Road, near Indian Gap, 3.IV.1982, Nos. 46076, 46240 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, Nos. 46373, 46428 (TENN); same locality 26.VI.1982, No. 46100 (TENN); Mt. Le Conte, 26.VI.1982, Nos. 46254, 46374, 46413 (TENN); Clingmans Dome, 14.VII.1982, Nos. 46113-4, 46257 (TENN); Mt. Collins, 24.VII.1982, Nos. 46143, 46146 (TENN); Newfound Gap, 4.VIII.1982, Nos. 46162, 46278 (TENN); Charlies Bunion, 18.VIII.1982, No. 46184 (TENN).

Extra-limital

United States: Colorado, San Isabel National Forest, near Monarch Pass, 17.VI.1935, Solheim No. 366 (TENN 15621); New Jersey, Gloucester Co., Newfield, XII. 1893, Ellis and Everhart No. 303 (TENN 15307); New York, Onondaga Co., Highland Forest, X.1981, Chamuris No. 1010 (TENN 46692); Tennessee, Meigs Co., John Knox Camp, 24.X.1981, Nos. 46467, 46477 (TENN).

HIRSCHIOPORUS FUSCO-VIOLACEUS

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, No. 46087 (TENN); Alum Cave Trail, near Alum Cave, 18.VI.1982, No. 46372 (TENN); Mt. Le Conte, 26.VI.1982, Nos. 46093, 46098, 46250, 46252-3, 46413 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, No. 46107 (TENN); Clingmans Dome, 14.VII.1982, No. 46112, 46376 (TENN); Collins Gap, 14.VII.1982, Nos. 46127-8, 46260 (TENN); Mt. Collins, 24.VII.1982, Nos. 46142, 46147, 46263, 46265-7 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46283 (TENN); Charlies Bunion, 18.VIII.1982, Nos. 46180-1 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, 2.VII.1934, No. 3931 (TENN).

HIRSCHIOPORUS LARICINUS

Research Area

Mt. Collins, 24.VII.1982, No. 46268 (TENN); Icewater Spring, 18.VIII.1982, Nos. 46192, 46194 (TENN); Jct. of Appalachian and Boulevard Trails, 18.VIII.1982, No. 46196 (TENN).

HIRSCHIOPORUS PARGAMENUS

Research Area

Clingmans Dome, 1.IV.1934, No. 7072 (TENN); Cataloochee, 28.VII.1935, No. 8128 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, 2.VII.1934, No. 3930 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Loop Road, 18.VII.1981, Nos. 45987-8, 46008 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Hyatt Lane, 18.VII.1981, Nos.46000, 46004 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Parson Branch Road, 18.VII.1981, No. 46007 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Hyatt Lane, 8.VIII.1981, Nos. 46018-9 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Campground, 3.X.1981, No. 46357 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, No. 46396 (TENN). U.S.S.R.: Lisino-forestry, Leningrad Reg., 22.IX.1960, No. 40376 (TENN).

HYDNOCHAETE OLIVACEUM

Research Area

Balsam Mt. Trail, between Pin Oak Gap and Laurel Gap, 9.IX.1983, No. 46409 (TENN); Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46515 (TENN).

Extra-limital

United States: New York, Oswego Co., near Parish, Happy Valley Wildlife Area, 26.IX.1983, Chamuris No. 1719 (TENN 46691); Tennessee, Blount Co., GSMNP, Cades Cove, 22.IV.1934, No. 6467 (TENN); Tennessee, Knoxville, U.T. Cherokee Woodlot, 12.V.1982, Nos. 46078, 46243 (TENN); Tennessee, Meigs Co., John Knox Camp, 14.VIII.1982, Nos. 46384, 46386 (TENN); Tennessee, Sevier Co., GSMNP, Cherokee Orchard, 17.VIII.1939, No. 12631 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier Cove,

13.VII.1975, No. 41013 (TENN).

HYDRABASIDIUM SUBVIOLACEUM

Research Area

Newfound Gap, 4.VIII.1982, No. 46159 (TENN).

HYMENOCHAETE CERVINA

Research Area

Grassy Patch, 27.VI.1934, No. 6744 (TENN).

HYMENOCHAETE CINNAMOMEA

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, Nos. 46400-1 (TENN); Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46514 (TENN).

Extra-limital

United States: Michigan, Ann Arbor, 27.X.1929, No. 11928 (TENN).

HYMENOCHAETE CORRUGATA

Research Area

Road Prong Trail, 1/3 mile off Clingmans Dome Road, 24.IX.1983, No. 46457 (TENN); Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, No. 46528 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove,

20.VIII.1939, No. 12622 (TENN); Tennessee, Sevier Co., Greenbrier, GSMNP, 18.IV.1937, No. 12452 (TENN); Tennessee, Sevier Co., GSMNP, Chimneys Parking Area, 21.VIII.1939, No. 12623 (TENN).

HYMENOCHAETE CURTISII

Research Area

Indian Gap, 4.X.1942, No. 14758 (TENN).

Extra-limital

United States: Tennessee, Knox Co., Ball Camp Pike, 16.I.1937, No. 10191 (TENN); Tennesse, Knoxville, Tobler Road, 24.X.1949, No. 19506 (TENN).

HYMENOCHAETE FULIGINOSA

Research Area

Charlies Bunion, 18.VIII.1982, No. 46297 (TENN); Cataloochee, 28.VII.1935, No. 8338 (TENN)

Extra-limital

United States: Pennsylvania, Armstrong Co., Olivet, 2.VII.1932, Overholts No. 14417 (TENN 3271).

HYMENOCHAETE SPRETA

Research Area

Boulevard Trail, 9.IX.1935, No. 8661 (TENN).

Extra-limital

United States: New York, Allegany State Park, 25.V.1964, Olexia No. 1383 (TENN 28251); New York, Allegany State Park, 12.IX.1964, No.

27108 (TENN).

HYMENOCHAETE TABACINA

Research Area

Mt. Kephart, 10.XI.1935. No. 8650 (TENN); Indian Gap, 27.V.1944, No. 16369 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Costello Lake, 29. VIII.1939, TRTC 14202 (TENN 14848). United States: Tennessee, Sevier Co., GSMNP, Elkmont, 15.XI.1936, No. 10088 (TENN); Tennessee, Sevier Co., GSMNP, near Chimneys, 18.VIII.1939, No. 12624 (TENN); West Virginia, Greenbrier Co., White Sulphur Springs, 1.VII.1940, No. 12758 (TENN).

HYPHODERMA PALLIDUM

Research Area

Boulevard Trail, between Myrtle Point and Anakeesta Knob, 9.VII.1983, No. 46222 (TENN).

HYPHODERMA PUBERUM

Research Area

Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46516 (TENN).

Extra-limital

United States: Tennessee, Knoxville, U.T. Woodlot, 21.XI.1976, No. 41067 (TENN).

HYPHODERMA SETIGERUM

Research Area

Collins Gap, 24.VII.1982, No. 46377 (TENN); Appalachian Trail, between Newfound Gap and Mt, Ambler, 4.VIII.1982, No. 46171 (TENN); Indian Gap, 25.VI.1983, No. 46214 (TENN); Boulevard Trail, near Myrtle Point, 9.VII.1983, No. 46219 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 20.VIII.1983, No. 46342 (TENN); Balsam Mt. Trail, between Pin Oak Gap and Laurel Gap, 10.IX.1983, No. 46346 (TENN);

Extra-limital

Sweden: Smaland, Värnamo, 1.XI.1959, GB 4627 (TENN 46545, 46562); Västergötland, Langared parish, 6.VIII.1969, GB 15293 (TENN 46610). United States: Colorado, Larimer Co., Roosevelt National Forest, 4.VIII. 1984, NO. 46349 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Parson Branch Road, 18.VII.1981, No. 46006 (TENN); Tennessee, Knoxville, U.T. Woodlot, 21.VI.1976, No. 41020 (TENN); Tennessee, Meigs Co., John Knox Camp, 24.X.1981, No. 46237 (TENN); same locality, 14.VIII.1982, Nos. 46290, 46383 (TENN).

HYPHODERMA TSUGAE

Research Area

Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, No.46347 (TENN).

HYPHODONTIA ABIETICOLA

Research Area

Newfound Gap, 4.VIII.1982, No. 46279 (TENN).

HYPHODONTIA ALUTARIA

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, No. 46370 (TENN); Boulevard Trail, between Myrtle Point and Anakeesta Knob, 9.VII.1983, Nos. 46335, 46437, 46522 (TENN); Appalachian Trail, near Mt. Ambler, 23.VII.1983, No. 46339 (TENN); Newfound Gap, 23,VII.1983, No.46441 (TENN); Balsam Mt. Trail, between Pin Oak Gap and Laurel Gap, 9.IX.1983, No. 46498 (TENN); Sweat Heifer Creek Trail, 1/3 mile off Appalachian Trail, 24.IX.1983, No. 46526 (TENN); Appalachian Trail, near Mt. Buckley, 15.X.1983, No. 46424 (TENN); Mt. Guyot, 18.VIII.1984, No. 46486 (TENN).

Extra-limital

Sweden: Angermanland, Junsele park, 19.IX.1970, GB 15855 (TENN 46594); same locality, 20.IX.1970, GB 15882 (TENN 46565, 46611).

HYPHODONTIA ARGUTA

Research Area

Mt. Sterling Ridge Trail, between Mt. Sterling Gap and the ridge top, 2.VII.1983, No. 46432 (TENN).

Extra-limital

India: Himachal Pradesh, Simla, Chail, 5.VIII.1971, Rattan No. 4329 (TENN 38921). *Sweden*: Västmanland, Västeras-Barkarö parish, 13.XI.1975, GB 23008 (TENN 46566); same locality, 11-13.X.1975, GB 22999, 23008 (TENN 46591, 46592); same locality, 13.X.1975, GB 22965 (TENN 46627).

HYPHODONTIA ASPERA

Research Area

Jct. of Appalachian and Boulevard Trails, 8.VII.1983, No. 46434 (TENN).

Extra-limital

Sweden: Angermanland, Junsele parish, 20.IX.1970, GB 18614 (TENN 46567, 46628); same locality, 22.IX.1970, GB 18617 (TENN 46568, 46612).

HYPHODONTIA BREVISETA

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, No. 46090 (TENN); Newfound Gap, 4.VIII.1982, Nos. 46158, 46275 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46164 (TENN); Charlies Bunion, 18.VIII.1982, No. 46185, 46295 (TENN); Indian Gap, 2.X.1982, No. 46316 (TENN); Anakeesta Knob, 9.VII.1983, No. 46439 (TENN); Camel Gap, 20.VIII.1983, No. 46227 (TENN); Pecks Corner, 27.VIII.1983, No. 46228 (TENN); Balsam Mt. Trail, near Laurel Gap, 9.IX.1983, No. 46230 (TENN); Forney Ridge Trail, near Andrews Bald, 17.IX.1983, No. 46503 (TENN); Sweat Heifer Creek Trail, 1/3 mile off Appalachian Trail, 24.IX.1983, No. 46455 (TENN); Road Prong Trail, 1/3 mile off Clingmans Dome Road, 24.IX.1983, Nos. 46423, 46458 (TENN); Appalachain Trail, near Mt. Buckley, 15.X.1983, No. 46505 (TENN); Fork Ridge Trail, 1/4 mile off Clingmans Dome Road, 15.X.1983, No. 46506 (TENN); Spruce Mt. Trail, 26.X.1983, Nos. 46321, 46463, 46507 (TENN); Mt. Sterling Ridge Trail,

between Mt. Sterling and Pretty Hollow Gap, 29.X.1983, No. 46513 (TENN); Tricorner Knob, 18.VIII.1984, No. 46325 (TENN).

Extra-limital

Sweden: Smaland, Värnamo, 1.IX.1977, Hjortstam No. 8762 (TENN 46569, 46599). United States: Tennessee, Meigs Co., John Knox Camp, 14.VIII.1982, No. 46287 (TENN).

HYPHODONTIA PALLIDULA

Research Area

Boulevard Trail, between Myrtle Ponit and Anakeesta Knob, 9.VII.1983, No. 46436 (TENN); Tricorner Knob, 10.IX.1983, No. 46410 (TENN).

Extra-limital

Sweden: Lycksele Lappmark, Stensele parish, 20.IX.1966, No. 46571 (TENN); Lycksele Lappmark, Hensele parish, 20.IX.1966, No.46595 (TENN); same locality, 21.IX.1966, No.46581 (TENN).

HYPHODONTIA VERRUCULOSA

Research Area

Jct. of Appalachian and Sweat Heifer Creek Trails, 24.IX.1983, No.46504 (TENN); Fork Ridge Trail, 1/2 mile off Clingmans Dome Road, 15.X.1983, No. 46531 (TENN).

Extra-limital

Sweden: Västergötland, Medelplana parish, 30.IX.1969, GB 18664 (TENN 46614); Bohuslän, Säve parish, 6.XI.1975, GB 9321 (TENN 46613); without locality, 6.XI.1979, GB 9321 (TENN 46572).

HYPOCHNICIUM GEOGENIUM

Research Area

Mt. Sterling, 2.VII.1983, No. 46215 (TENN).

Extra-limital

Sweden: Smaland, Värnamo, 1.XI.1959, Eriksson No. 1971 (TENN 46596); same locality, 2.XI.1959, Eriksson No. 1503 (SYRF); Smaland, Rumskulla parish, 26.X.1966, Nos. 46573, 46629 (TENN).

INONOTUS RADIATUS

Research Area

Mt. Mingus, 14.IX.1935, No.8352 (TENN); Mt. Le Conte, 10.XI.1935, No. 8639 (TENN); Forney Ridge Trail to Andrews Bald, 22.VIII.1939, No. 12657 (TENN); Indian Gap, 7.IX.1941, No. 14027 (TENN); Mt. Kephart, 11.IX.1941, No. 14028 (TENN); Indian Gap, 6.IX.1945, No. 17172 (TENN); same locality, 9.VIII.1953, No. 20958 (TENN); near Collins Gap, 8.X.1955, No. 22146 (TENN).

Extra-limital

United States: Tennessee, Carter Co., Roan Mt., 22.VIII.1937, No. 10833 (TENN).

IRPEX LACTEUS

Research Area

Mt. Sterling Ridge Trail, near Mt. Sterling Gap, 29.X.1983, No. 46533 (TENN).

Extra-limital

United States: Iowa, Iowa City, 6.VIII.1936, No. 10523 (TENN);

Tennessee, Blount Co., GSMNP, Cades Cove, Hyatt Lane, 8.VIII.1981, No. 46029 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Campground, Nos. 46049, 46350, 46356 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, Nos. 46203-5, 46483 (TENN); same locality, 10.IX.1982, No. 46307 (TENN); Tennessee, Sevier Co., GSMNP, Newfound Gap Road, near Chimneys, 20.II.1982, No. 46239 (TENN); Tennessee, Sevier Co., GSMNP, Trillium Gap, 22.V.1982, No. 46367 (TENN).

JAAPIA OCHROLEUCA

Research Area

Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, No. 46459 (TENN).

LAETIPORUS SULPHUREUS

Research Area

atop Mt. Le Conte, 20.VII.1934, No. 5036 (TENN).

Extra-limital

United States: North Carolina, Macon Co., Highlands, Cullasaja Falls, 11.VI.1934, No. 4357 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier, 7.VI.1934, No. 3935 (TENN).

LAURILIA SULCATA

Research Area

Indian Gap, 18.VIII.1939, No. 12677 (TENN); Mt. Le Conte, 4.VIII.1940, No. 13166 (TENN); Newfound Gap, 4.X.1942, No. 10105 (TENN); Indian Gap, 1.IV.1945, NO. 16745 (TENN); Alim Cave Trail,

between Alum Cave and Mt. Le Conte, 18.VI.1983, No. 46213 (TENN).

Extra-limital

United States: Colorado, Boulder Co., Peaceful Valley, VI.1933, Overholts No. 16598 (TENN 3430); Tennessee, Fentress Co., near Allardt, 8.VII.1934, No. 6794 (TENN).

PARMASTOMYCES KRAVTZEVIANUS

Research Area

Indian Gap, 27.VIII.1949, No. 20494 (TENN); same locality, 24.IX.1950, No. 18961 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, 26.VIII.1949, No. 20495 (TENN); Tennessee, Sevier Co., GSMNP, Cherokee Orchard, 24.VIII.1949, No. 20496 (TENN).

PERENNIPORIA MEDULLA-PANIS

Research Area

Cosby Knob, 20.VIII.1983, No. 46495 (TENN).

Extra-limital

United States: Illinois, Shabbona Grove, IX.1918, F S869 (TENN 16504); Tennessee, Sevier Co., GSMNP, Mt. Le Conte, 17.VIII.1939, No. 12409 (TENN).

PERENNIPORIA SUBACIDA

Research Area

Newfound Gap, 4.X.1942, No. 15933 (TENN); Cosby Knob,

20.VIII.1983, Nos. 46491-2 (TENN); Balsam Mt. Trail, between Tricorner and Luftee Knobs, 10.IX.1983, Nos. 46524-5 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 17.VIII.1984, No. 46485 (TENN).

Extra-limital

United States: Mississippi, Harrison Co., Saucier, 7.VIII.1951, Lowe No. 4806 (SYRF); Tennessee, Blount Co., GSMNP, Cades Cove, 11.III.1945, No. 16721 (TENN); same locality, 30.IX.1951, No. 23427 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Parson Branch Road, 3.VII.1978, No. 41187 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Loop Road, 18.VII.1981, Nos. 45985, 45995, 45997 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove Campground, 3.X.1981, No. 46502 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, No. 46482 (TENN); Tennessee, Cocke Co., GSMNP, Cosby, 22.IX.1983, No. 46320 (TENN).

PHAEOLUS SCHWEINITZII

Research Area

Boulevard Trail, 9.XI.1935, No. 8411 (TENN); same locality, 4.IX.1941, No. 14029 (TENN); Indian Gap, 27.VIII.1949, No. 19292 (TENN); same locality, 10.VII.1952, No. 20491 (TENN); same locality, 9.IX.1968, No. 30328 (TENN); Collins Gap, 24.VII.1982, Nos. 46139, 46468 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, 25.VIII.1945, No. 17346 (TENN); same locality, 4.VI.1954, No. 21401 (TENN).

PHANEROCHAETE FILAMENTOSA

Research Area

near Pin Oak Gap, 9.IX.1983, No. 46497 (TENN).

Extra-limital

India: Himachal Pradesh, Mahasu, Bagi, 31.VIII.1971, Rattan No. 5655 (TENN 38937). *Sweden*: Halland, Släp parish, 19.IX.1972, GB 22742 (TENN 46603). *United States*: Arkansas, Ashley Co., Crossett, 21.VIII.1951, Lowe No. 5099 (SYRF); Tennessee, Blount Co., GSMNP, road to Cades Cove, 7.VI.1975, No. 41005 (TENN); same locality, 28.VII.1975, No. 41054 (TENN); Tennessee, Blount Co., GSMNP, Crib Gap, 15.VIII.1975, No. 41030 (TENN); Tennessee, Sevier Co., Rainbow Falls Trail, 24.VII.1975, No. 41053 (TENN).

PHANEROCHAETE SANGUINEA

Research Area

Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, Nos. 46167-9 (TENN).

Extra-limital

United States: Tennessee, Blount Co., GSMNP, Cades Cove, 22.VI.1976, No. 41025 (TENN).

PHANEROCHAETE SEPTOCYSTIDIA

Research Area

Spruce Mt. Trail, 26.X.1983, No. 46462 (TENN).

Extra-limital

Canada: Ontario, Lake Timagami, Bear Island, 28.VII.1945, TRTC

21826 (SYRF). Iran: Asalem, Gilan, 16.VII.1976, GB 23651 (TENN 46551). Sweden: Aust-Agder, Landvik, 22.VIII.1971, GB 21452 (TENN 46552).

PHANEROCHAETE SORDIDA

Research Area

Newfound Gap, 23.VII.1983, No. 46442 (TENN).

Extra-limital

Sweden: Västergötland, Skallsjö parish, 3.VI.1972, Hjortstam No. 5440 (TENN 46577), GB 13184 (TENN 46617); Vg, Alingsas, 5.VII.1968, GB 14945 (TENN 46602). United States: Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 10.IX.1982, No. 46425 (TENN).

PHANEROCHAETE VITICOLA

Research Area

Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, Nos. 46529, 46530 (TENN).

Extra-limital

United States: Tennessee, Putnam Co., North of Crossville, 1.VI.1965, No. 27987 (TENN); Tennessee, Sevier Co., above Elkmont, 13.X.1935, No. 8669 (TENN).

PHELLINUS CHRYSOLOMA

Research Area

Mt. Mingus, 29.IV.1934, No. 6373 (TENN); same locality, 13.VI.1934, No. 4629 (TENN); Mt. Le Conte, 19.VII.1934, No. 6315

(TENN); same locality, 22.IX.1934, No. 6420 (TENN); Mt. Kephart, 9.XI.1935, No. 8407 (TENN); Grassy Patch, 13.XI.1938, No. 12392 (TENN); Alum Cave Trail to Mt. Le Conte, 21.VIII.1939, Nos. 12610-1 (TENN); Boulevard Trail, 4.IX.1941, No. 14033 (TENN); Alum Cave, 14.IX.1941, No. 14012 (TENN); Mt. Le Conte, 8.V.1966, No. 28992 (TENN); Newfound Gap, 4.VIII.1982, No. 46277 (TENN); Balsam Mt. Trail, between Tricorner and Luftee Knobs, 10.IX.1983, No. 46411 (TENN); Pecks Corner, 27.VIII.1983, No. 46447 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 17.VIII.1984, No. 46517 (TENN).

Extra-limital

United States: Wyoming, Carbon Co., Medicine Bow Mountains, 7.VII.1939, Solheim No. 362 (TENN 15617).

PHELLINUS CONTIGUUS

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46484 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 20.VIII.1983, No. 46494 (TENN); Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46532 (TENN).

Extra-limital

India: Jammu and Kashmir, Bhadarwah, 5.X.1966, Rattan No. 6175 (SYRF). United States: Illinois, Glen Ellyn, X.1903, No. 16494 (TENN); West Virginia, Webster Springs, 22.VIII.1924, USDA-FP 60960 (TENN 1324).

PHELLINUS FERREUS

Research Area

Indian Gap, 12.VI.1938, No. 12999 (TENN); Clingmans Dome, 15.X.1939, No. 12987 (TENN); Indian Gap, 2.X.1982, No. 46403 (TENN); Appalachian Trail, near Indian Gap, 25.VI.1983, No. 46405 (TENN); Spruce Mt. Trail, 26.X.1983, No. 46511 (TENN).

Extra-limital

Canada: Ontario, Brant Co., 2 mile east of New Durham, 29.X.1934, TRTC 7056 (TENN 7632). United States: North Carolina, Chapel Hill, 28.III.1921, No. 3165 (TENN); North Carolina, Macon Co., Highlands, 4.VII.1937, No. 12994 (TENN); Tennessee, Sevier Co., GSMNP, Elkmont, XI.1940, No. 12988 (TENN).

PHELLINUS IGNIARIUS

Research Area

Grassy Patch, 29.IV.1934, No. 6902 (TENN); Mt. Le Conte, 20.VII.1934, No. 5020 (TENN); Boulevard Trail, 9.XI.1935, No. 8418 (TENN); Mt. Kephart, 10.XI.1935, No. 8415 (TENN); Road Prong Trail, between Indian Gap and Chimneys, 26.VII.1936, No. 9067 (TENN); Indian Gap, 24.IX.1950, No. 19813 (TENN); Mt. Collins, 24.VII.982, No. 46378 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46282 (TENN); Appalachian Trail, between Cosby Knob and Camel Gap, 20.VIII.1983, No. 46343 (TENN); Fork Ridge Trail, 1/4 mile off Clingmans Dome Road, 15.X.1983, No. 46452 (TENN).

Extra-limital

United States: Tennessee, Sevier Co., Silers Bald, 15.V.1938, No. 11402 (TENN); Wyoming, Grand Teton National Park, near Swan Lake,

5.VII.1956, Solheim No. 1552 (TENN 39133). U.S.S.R.: Lisino-forestry, Leningrad Reg., 23.IX.1960, No. 40397 (TENN).

PHELLINUS LAEVIGATUS

Research Area

Grassy Patch, 29.IV.1934, No. 6355a (TENN); Road Prong Trail, between Indian Gap to Chimneys, 26.VII.1936, No. 10051 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, Nos. 46284, 46381 (TENN); Appalachian Trail, near Indian Gap, 25.VI.1983, No. 46330 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 23.VII.1983, No. 46338 (TENN); Cosby Knob, 20.VIII.1983, No. 46444 (TENN); Appalachian Trail, between Cosby knob and Camel Gap, 20.VIII.1983, No. 46493 (TENN); Noland Divide Trail, 3/4 mile off Clingmans Dome Road, 1.X.1983, No. 46527 (TENN).

Extra-limital

United States: North Carolina, Mt. Mitchell, 23.VIII.1950, Lowe No. 4405 (SYRF); North Carolina, Graham Co., Joyce Kilmer Memorial Forest, V.1956, No. 23420 (TENN); Pennsylvania, Pennsylvania State College, 2.XI.1932, No. 3243 (TENN); Pennsylvania, Bradford Co., Ulster, 6.II.1934, Overholts No. 16429 (TENN 3241); Tennessee, Knoxville, University Farm, 25.IV.1937, No. 10240 (TENN); Tennessee, Sevier Co., near Newfound Gap, 5.III.1963, Lowe No. 3963 (SYRF).

PHELLINUS POMACEUS

Research Area

Atop Mt. Le Conte, 13.IX.1935, No. 8391 (TENN); Boulevard

Trail, 9.XI.1935, No. 8653 (TENN); Mt. Kephart, 9.XI.1935, No. 8655 (TENN).

Extra-limital

United States: Iowa, East Okoboji, 12.VII.1933, No. 2678 (TENN).

PIPTOPORUS BETULINUS

Research Area

Alum Cave, 27.VI.1934, No. 3905 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Island Lake, 15.IX.1939, TRTC 15720 (TENN 14828). Sweden: Fyby Forest, 5.IX.1970, Petersen No. 5052 (TENN 35032).

PLICATUROPSIS CRISPA

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46309 (TENN).

Extra-limital

France: Hte-Saone, 2.XI.1974, Demoulin No. 4925 (TENN 41326). United States: Tennessee, Cocke Co., GSMNP, 1.IX.1982, No. 46302-3 (TENN).

PORIA CRUSTULINA

Research Area

Mt. Kephart, 9.XI.1935, No. 8658 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, Nos. 46371, 46393

(TENN).

Extra-limital

United States: Colorado, White River National Forest, Trappers Lake, 18.VIII.1955, Lowe No. 6149 (TENN 23618).

PORIA SPISSA

Research Area

Mt. Sterling Ridge Trail, 8.VII.1978, No. 41211 (TENN).

Extra-limital

United States: New York, Onondaga Co., Tully, 27.VIII.1944, Lowe No. 2639 (TENN 17748); North Carolina, Transylvania Co., Brevard, Davidson River, 2.IX.1950, Lowe No. 3862 (TENN 23621).

PYCNOPORUS CINNABARINUS

Research Area

Clingmans Dome, 1.IV.1934, No. 7085 (TENN); Grassy Patch, 27.VI.1734, No. 6319 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Lake of Two Rivers, 13.IX.1939, TRTC 15596 (TENN 14788). United States: Tennessee, Roane Co., Kingston, 18.IV.1935, No. 7699 (TENN); Tennessee, Union Co., Big Bridge Park, 24.III.1935, No. 7679 (TENN).

RESINICIUM BICOLOR

Research Area

Newfound Gap, 4.VIII.1982, No. 46163 (TENN); Appalachian Trail,

near Indian Gap, 25.VI.1983, No. 46430 (TENN); Jct. of Appalachian and Boulevard Trails, 8.VII.1983, No. 46333 (TENN); near Jct. of Appalachian and Boulevard Trails, 23.VII.1983, No. 46225 (TENN).

Extra-limital

Canada: Ontario, Holland R. Marsh, 6.V.1936, TRTC 10745 (TENN 11663). *India*: Jammu and Kashmir, Bhadarwah, Basti, 17.VIII.1967, Khara No. 4165 (TENN 38857). *Sweden*: Smaland, Kärda parish, 5.XI.1956, Eriksson No. 2406 (SYRF); without locality, 26.IX.1970, GB 24181 (TENN 46582); Dalsland, Jöftedal, 3.VII.1972, GB 24186 (TENN 45683); Västergötland, Ostad parish, 17.IX.1978, Hjortstam No. 9720 (TENN 46579); Dalsland, Fröskog parish, 18.XI.1980, GB 35018 (TENN 46618). *United States*: North Carolina, Mt. Pisgah, 20.VII.1950, Lowe No. 3807 (SYRF); Tennessee, Blount Co., GSMNP, Cades Cove, 7.VII.1963, No. 26362 (TENN).

RESINICIUM FURFURACEUM

Research Area

Appalachian Trail, between Laurel Top and Porters Gap, 27.VIII.1983, No. 46496 (TENN).

Extra-limital

Sweden: Västergötland, Undenäs parish, 3.X.1969, Hjortstam No. 2883 (TENN 46580), GB 18289 (TENN 46584); Dalsland, Dalskog parish, 23.IX.1972, GB 18366 (TENN 46630).

RIGIDOPORUS NIGRESCENS

Research Area

Indian Gap, 4.X.1942, No. 15934 (TENN).

Extra-limital

United States: New York, Onondaga Co., Jamesville, 29.IX.1934, Lowe No. 1591 (TENN 17745); Tennessee, Sevier Co., GSMNP, Mt. Le Conte, 17.III.1935, No. 7694 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier, 15.IV.1935, No. 7700 (TENN); Tennessee, Sevier Co., GSMNP, Rainbow Falls, 13.IX.1935, No. 8353 (TENN); Virginia, Fairfax Co., near Fairfax, 3.XI.1932, USDA-FP 52041 (TENN 1331).

SCHIZOPORA PARADOXA

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46313 (TENN); Heintooga Picnic Area, 3.IX.1983, No. 46408 (TENN); Spruce Mt. Trail, 26.X.1983, No. 46471 (TENN).

Extra-limital

United States: Illinois, Johnson Co., Goose Pond, 29.VII.1984, No. 46487 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Loop Road, 18.VII.1981, No. 45990 (TENN); Tennessee, Meigs Co., John Knox Camp, 14.VIII.1982, Nos. 46176, 46382. 46478, 46480 (TENN).

STEREUM COMPLICATUM

Research Area

Appalachian Trail, near Indian Gap, 2.X.1982, No. 46311 (TENN).

Extra-limital

United States: Illinois, Johnson Co., Goose Pond, 29.VII.1984, No. 46488 (TENN); Massachusetts, Middlesex Co., Wayland, Great Meadows

National Wildlife Refuge, 16.V.1982, Chamuris No. 1045 (TENN 46689); North Carolina, Nantahala National Forest, Kimsey Creek Campground, I.V.1982, Nos. 46077, 46242 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Loop Road, 18.VII.1981, No. 45996, 45998 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, Parson Branch Road, 18.VII.1981, No. 46005 (TENN); Tennessee, Blount Co., Cades Cove, Hyatt Lane, 8.VIII.1981, Nos. 46011-7 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove Campground, 3.X.1981, No. 46352 (TENN); Tennessee, Blount Co., GSMNP, Tremont, Environmental Education Center, 3.X.1981, Nos. 46065, 46364 (TENN); Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 1.IX.1982, Nos. 46397, 46415 (TENN); Meigs Co., John Knox Camp, 14.VIII.1982, Nos. 46385, 46388-9 (TENN); Tennessee, Union Carbide Recreation Park, 30.IV.1983, No. 46319 (TENN); Tennessee, Sevier Co., GSMNP, Trillium Gap, 22.V.1982, No. 46079 (TENN); Virginia, Shenandoah National Forest, White Oak Canyon Trail, 24.XI.1982, Chamuris No. 1544 (TENN 46688).

STEREUM GAUSAPATUM

Research Area

Indian Gap, 25.VIII.1941, No. 14041 (TENN).

Extra-limital

United States: Ohio, Lorain Co., Cooper's Hollow, 22.XI.1959, No. 27780 (TENN); Tennessee, Blount Co., GSMNP, Spruce Flats, 13.I.1935, No. 7009 (TENN); Tennessee, Anderson Co., Claxton School, 1.I.1943, No. 16759 (TENN); Tennessee, Blount Co., GSMNP, Cades Cove, 22.X.1944, No. 16594 (TENN).

STEREUM HIRSUTUM

Research Area

Mt. Le Conte, 17.III.1935, No. 4981 (TENN); Alum Cave Trail, between Alum Cave and Mt. Le Conte, 26.VI.1982, No. 46255 (TENN); Clingmans Dome, 14.VII.1982, No. 46109 (TENN); Collins Gap, 14.VII.1982, No. 46134 (TENN); Appalachian Trail, near Mt. Collins, 24.VII.1982, Nos. 46150-1, 46153, 46155 (TENN); Mt. Collins, 24.VII.1982, Nos. 46262, 46265 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46170 (TENN).

Extra-limital

United States: Colorado, Rio Grande Co., Papoose Creek Campground, 4.X.1948, Solheim No. 453 (TENN 19086); Illinois, Rock River, VII.1918, F S586 (TENN 15817); Ohio, Lorain Co., Oberlin, 11.XI.1923, OC 1511/B (TENN 27801); Washington, Pierce Co., Sumner, IV.1906, F 1158 (TENN 15818); Wyoming, Carbon Co., Sierra Madre Mountains, 13.VII.1939, Solheim No. 350 (TENN 15605).

STEREUM OCHRACEO-FLAVUM

Research Area

Mt. Le Conte, 11.IX.1935, No. 8670 (TENN).

Extra-limital

Mexico: Puebla, west of Huanchinango, 7.X.1944, Sharp No. 978 (TENN 16780). United States: Florida, Clay Co., Penny Farms, 23.XII.1936, No. 10434 (TENN).

STEREUM SANGUINOLENTUM

Research Area

Mt. Kephart, 10.XI.1935, No. 8662 (TENN); Clingmans Dome, 27.IX.1936, No. 10712 (TENN); same locality, 22.VI.1941, No. 13782 (TENN); Collins Gap, 14.VII.1982, No. 46122 (TENN); Appalachian Trail, Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46172 (TENN); Jct. of Appalachian and Boulevard Trails, 18.VIII.1982, No. 46298 (TENN); Appalachian Trail, between Charlies Bunion and Porters Gap, 27.VIII.1983, No. 46229 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Pinetree Lake, 31.VIII.1940, TRTC 16428 (TENN 14865); Ontario, Lake Timagami, Cattle Island, 7.IX.1933, TRTC 5775 (TENN 7555). India: Himachal Pradesh, Mahasu, Narkanda, 29.VI.1971, Rattan No. 5330 (TENN 39615). United States: Michigan, Neebish, X.1917, F S370 (TENN 15822); New York, Onondaga Co., Syracuse, SUNY Coll. Forestry Experimental Station, 9.VII.1982, Chamuris No. 1146 (TENN 46690); Pennsylvania, Huntingdon Co., Pennsylvania Furnace, 18.II.1933, No. 3427 (TENN).

TRECHISPORA ALNICOLA

Research Area

Spruce Mt. Trail, 26.X.1983, No. 46461 (TENN).

TRECHISPORA FARINACEA

Research Area

Appalachian Trail, near Indian Gap, 25.VI.1983, No. 46331

(TENN).

Extra-limital

United States: Indiana, near Bloomington, John English Farm, 29.X.1970, Dodd No. 849 (TENN 37744).

TRECHISPORA MOLLUSCA

Research Area

Mt. Sterling Ridge Trail, near Pretty Hollow Gap, 29.X.1983, No. 46473 (TENN).

TRECHISPORA VAGA

Research Area

Alum Cave Trail, between Alum Cave and Mt. Le Conte, 18.VI.1982, No. 46519 (TENN); Appalachian Trail, between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46281 (TENN).

TYROMYCES ALBELLUS

Research Area

Clingmans Dome, 4.VI.1942, No. 15931 (TENN); Mt. Le Conte, 9.VII.1954, No. 19427 (TENN).

Extra-limital

United States: New York, Allegany State Park, 12.IX.1964, Olexia No. 683 (TENN 28497); Ohio, Lorain Co., Amherst, North Quarry, 1.X.1960, No. 27817 (TENN).

TYROMYCES BALSAMEUS

Research Area

Cataloochee, 28.VII.1935, No. 8344 (TENN); Indian Gap, with no date, No. 18142 (TENN); Pecks Corner, 27.VIII.1983, No. 46445 (TENN).

Extra-limital

United States: Tennessee, Cocke Co., GSMNP, Indian Camp Creek, 30.VIII.1938, No. 12980 (TENN).

TYROMYCES CAESIUS

Research Area

Boulevard Trail, 10.XI.1935, No. 8659 (TENN); Clingmans Dome, 14.IX.1941, No. 14026 (TENN); same locality, 11.VIII.1953, No. 20986 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Pinetree Lake, 11.IX.1939, TRTC 15751 (TENN 15022). United States: Tennessee, Blount Co., GSMNP, Cades Cove, 17.X.1937, No. 10928 (TENN).

TYROMYCES FLORIFORMIS

Research Area

Newfound Gap, 27.VIII.1949, No. 19606-7 (TENN).

TYROMYCES FRAGILIS

Research Area

Mt. Le Conte, 22.IX.1934, No. 6416 (TENN); near Indian Gap, 8.VIII.1937, No. 10804 (TENN); Clingmans Dome, 14.IX.1941, No. 14022 (TENN); Mt. Mingus, 23.VII.1942, No. 14452 (TENN); Appalachian Trail,

between Newfound Gap and Mt. Ambler, 4.VIII.1982, No. 46165 (TENN); near Jct. of Maddron Bald and Snake Den Mt. Trails, 10.IX.1982, No. 46209 (TENN).

Extra-limital

United States: North Carolina, Macon Co., Highlands, 30.VIII.1944, No. 16458 (TENN); Tennessee, Sevier Co., GSMNP, Mt. Le Conte, 13.VIII.1939, No. 12421 (TENN).

TYROMYCES GUTTULATUS

Research Area

Clingmans Dome, 31.VIII.1949, No. 19325 (TENN).

Extra-limital

United States: North Carolina, Swain Co., Forney Ridge, 6.VII.1935, No. 8337 (TENN); Tennessee, Sevier Co., GSMNP, Roaring Fork, 9.VIII.1934, No. 6452 (TENN); Tennessee, Sevier Co., GSMNP, Greenbrier, 16.VII.1939, No. 12391 (TENN).

TYROMYCES IMMITIS

Research Area

Clingmans Dome, 30.IX.1945, No. 17199 (TENN); Indian Gap, 27.VIII,1949, No. 19608 (TENN); Clingmans Dome, 5.IX.1952, No. 20593 (TENN).

Extra-limital

Canada: Ontario, Algonquin Park, Cache Lake, 1.IX.1939, TRTC 17026 (TENN 14826).

TYROMYCES UNDOSUS

Research Area

Top of Mt. Le Conte, 10.XI.1935, No. 8667 (TENN); Indian Gap, 27.VIII.1949, No. 19303 (TENN); Appalachian Trail, between Charlies Bunion and Porters Gap, 27.VIII.1983, No. 46449 (TENN).

Extra-limital

United States: North Carolina, Ashville, Bent Creek, 12.IX.1959, Lowe No. 10830 (SYRF); North Carolina, Chapel Hill, 20.X.1945, Lowe No. 2983 (SYRF).

XYLOBOLUS SUBPILEATUS

Research Area

Mt. Sterling Ridge Trail, between Mt. Sterling and Pretty Hollow Gap, 29.X.1983, No. 46472 (TENN).

Extra-limital

United States: North Carolina, Durham Co., Duke Forest, 19.IV.1939, No. 12121 (TENN); Tennessee, Blount Co., GSMNP, Spruce Flats, 13.I.1935, No. 7011 (TENN); Tennessee, Knox Co., Carter's Mill, 30.I.1941, No. 14052 (TENN); Tennessee, Sevier Co., Mt. Le Conte, 10.VIII.1934, No. 6773 (TENN).

APPENDIX C

ILLUSTRATIONS OF MICROSCOPIC STRUCTURES

Figure 3. Basidiospores of Aleurodiscus mirabilis.

Figure 4. Basidia of Aleurodiscus mirabilis.

Figure 5. Pseudocystidia of Aleurodiscus mirabilis.

Figure 6. Acanthohyphidium of Aleurodiscus mirabilis.

Figure 7. Basidiospores of Amylostereum chailletii.

Figure 8. Basidia of Amylostereum chailletii.

Figure 9. Skeletocystidia of Amylostereum chailletii.

Figure 10. Generative hyphae of Amylostereum chailletii.

Figure 11. Skeletal hyphae of Amylostereum chailletii.

Figure 12. Basidiospores of Antrodia serialis.

Figure 13. Basidia of Antrodia serialis.

Figure 14. Generative hyphae of Antrodia serialis.

Figure 15. Skeletal hyphae of Antrodia serialis.

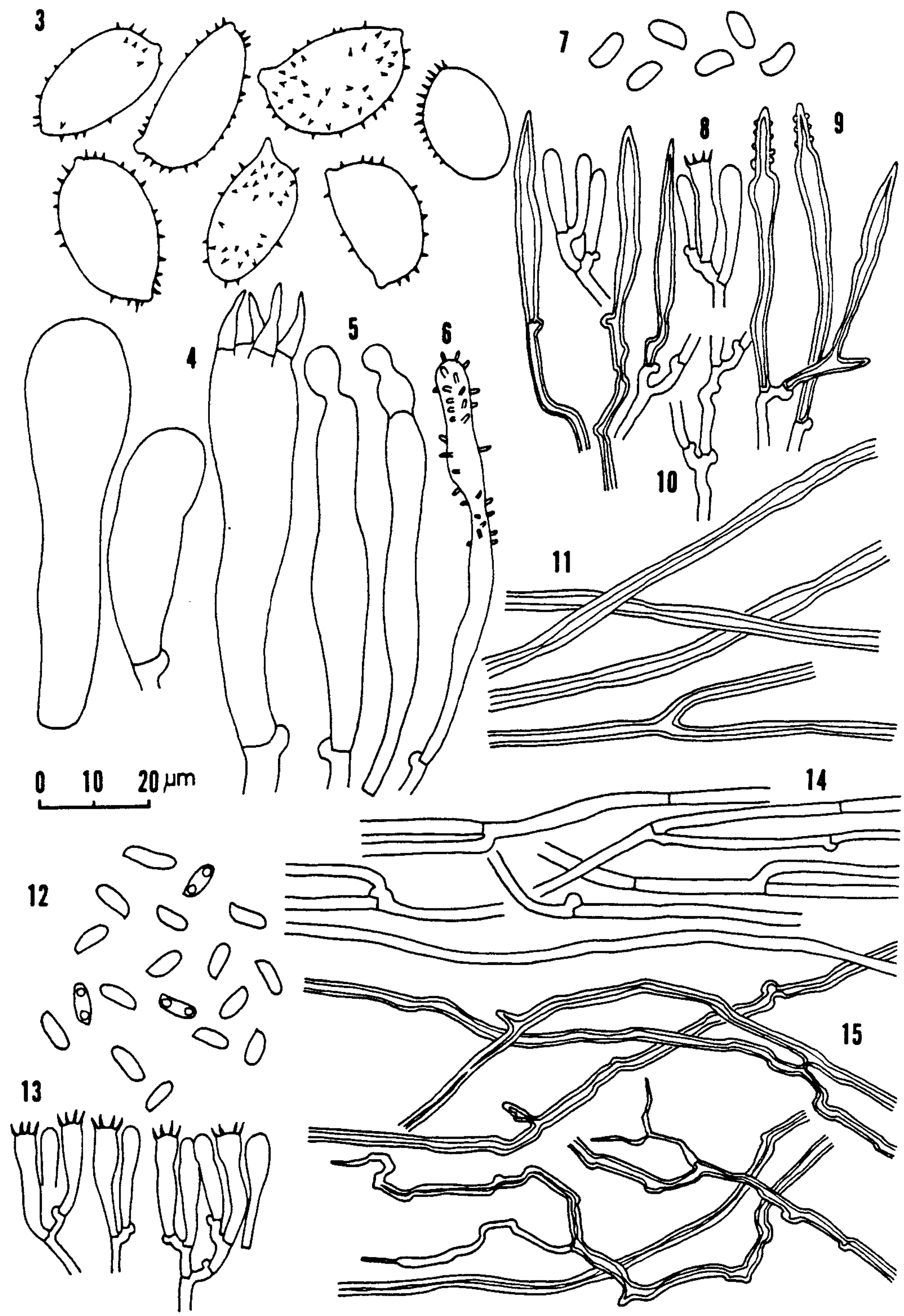

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Figure 16. Basidiospores of *Athelia decipiens*.

Figure 17. Basidia of *Athelia decipiens*.

Figure 18. Hyphae of *Athelia decipiens*.

Figure 19. Basidiospores of *Bjerkandera adusta*.

Figure 20. Basidia of *Bjerkandera adusta*.

Figure 21. Generative hyphae of *Bjerkandera adusta*.

Figure 22. Basidiospores of *Boreostereum radiatum*.

Figure 23. Basidia of *Boreostereum radiatum*.

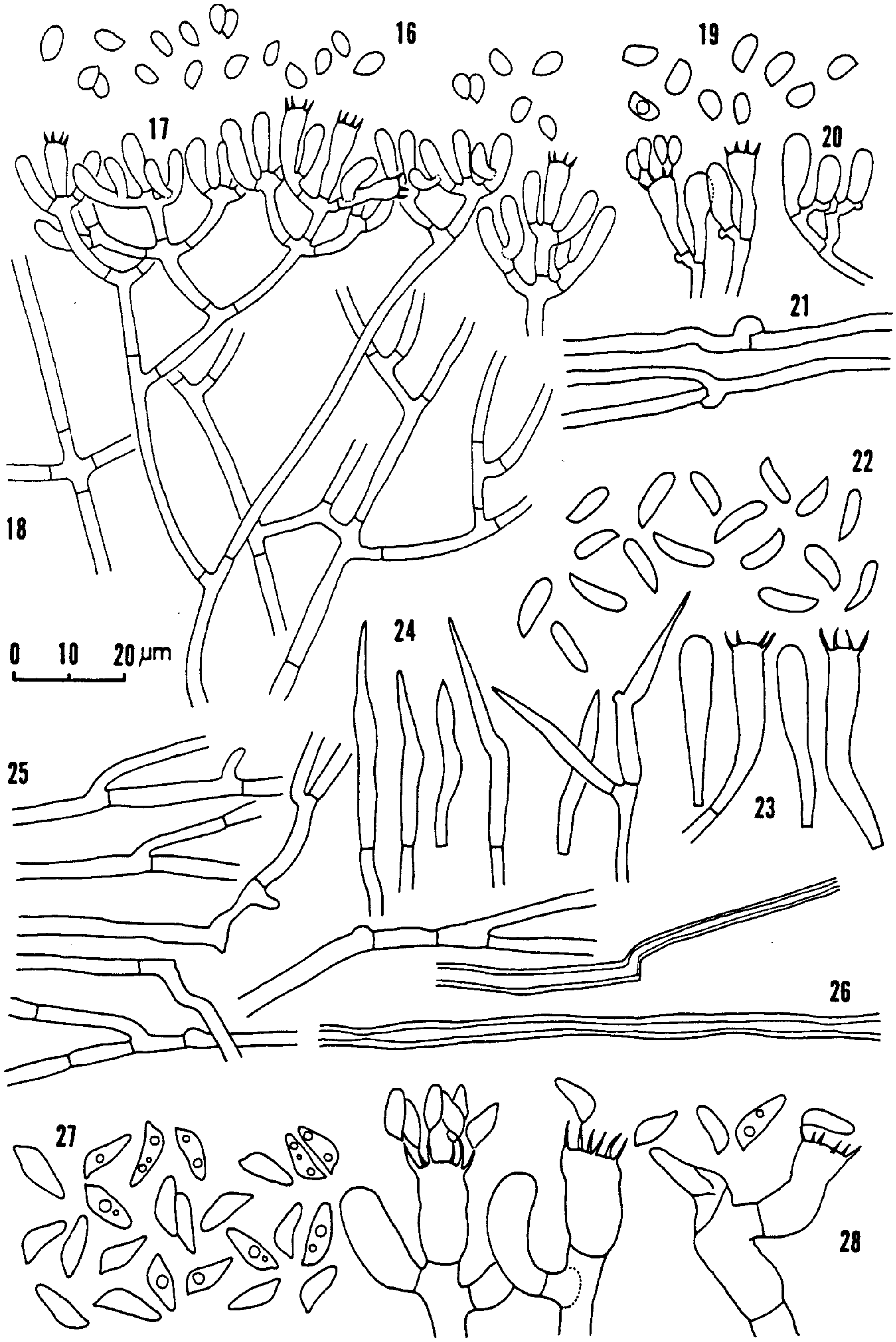
Figure 24. Cystidioles of *Boreostereum radiatum*.

Figure 25. Generative hyphae of *Boreostereum radiatum*.

Figure 26. Skeletal hyphae of *Boreostereum radiatum*.

Figure 27. Basidiospores of *Botryobasidium botryosum*.

Figure 28. Basidia of *Botryobasidium botryosum*.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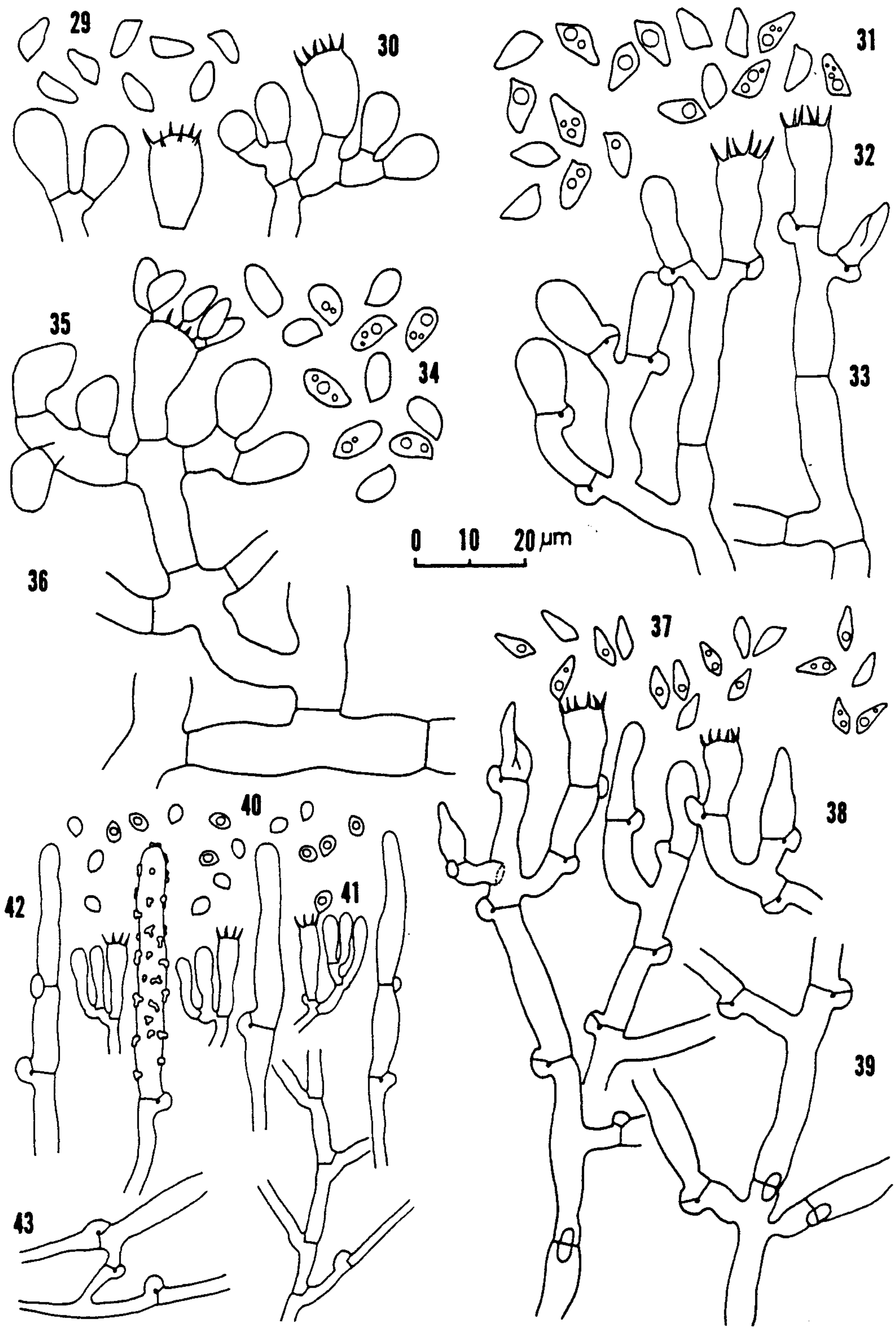
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Figure 44. Basidiospores of Cerinomyces pallidus.

Figure 45. Basidia of Cerinomyces pallidus.

Figure 46. Basidiospores of Cerrena unicolor.

Figure 47. Basidia of Cerrena unicolor.

Figure 48. Generative hyphae of Cerrena unicolor.

Figure 49. Skeletal hyphae of Cerrena unicolor.

Figure 50. Binding hyphae of Cerrena unicolor.

Figure 51. Basidiospores of Columnocystis ambigua.

Figure 52. Basidia of Columnocystis ambigua.

Figure 53. Small cystidia of Columnocystis ambigua.

Figure 54. Large cystidia of Columnocystis ambigua.

Figure 55. Generative hyphae of Columnocystis ambigua.

Figure 56. Basidiospores of Climacocystis borealis.

Figure 57. Basidia of Climacocystis borealis.

Figure 58. Cystidia of Climacocystis borealis.

Figure 59. Generative hyphae of Climacocystis borealis.

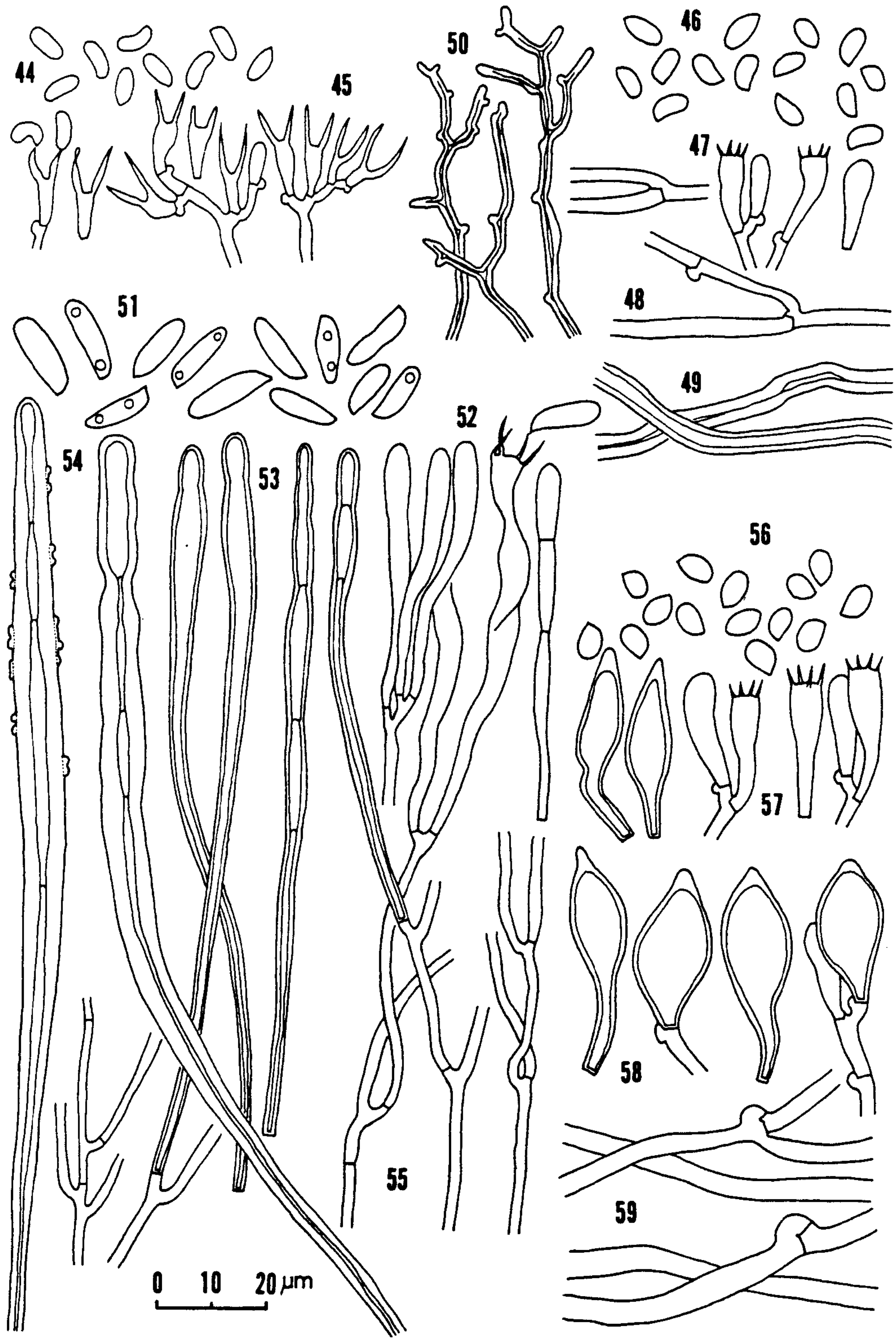
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Figure 60. Basidiospores of *Coniophora arida*.

Figure 61. Basidia and paraphysoid hyphae of *Coniophora arida*.

Figure 62. Basidiospores of *Coriolus cervinus*.

Figure 63. Basidia of *Coriolus cervinus*.

Figure 64. Generative hyphae of *Coriolus cervinus*.

Figure 65. Skeletal hyphae of *Coriolus cervinus*.

Figure 66. Binding hyphae of *Coriolus cervinus*.

Figure 67. Basidiospores of *Coriolus hirsutus*.

Figure 68. Basidia of *Coriolus hirsutus*.

Figure 69. Generative hyphae of *Coriolus hirsutus*.

Figure 70. Skeletal hyphae of *Coriolus hirsutus*.

Figure 71. Binding hyphae of *Coriolus hirsutus*.

Figure 72. Basidiospores of *Coriolus versicolor*.

Figure 73. Basidia of *Coriolus versicolor*.

Figure 74. Generative hyphae of *Coriolus versicolor*.

Figure 75. Skeletal hyphae of *Coriolus versicolor*.

Figure 76. Binding hyphae of *Coriolus versicolor*.

Figure 77. Basidiospores of *Daedaleopsis confragosa*.

Figure 78. Basidia of *Daedaleopsis confragosa*.

Figure 79. Dendrohyphidia of *Daedaleopsis confragosa*.

Figure 80. Generative hyphae of *Daedaleopsis confragosa*.

Figure 81. Skeletal hyphae of *Daedaleopsis confragosa*.

Figure 82. Binding hyphae of *Daedaleopsis confragosa*.

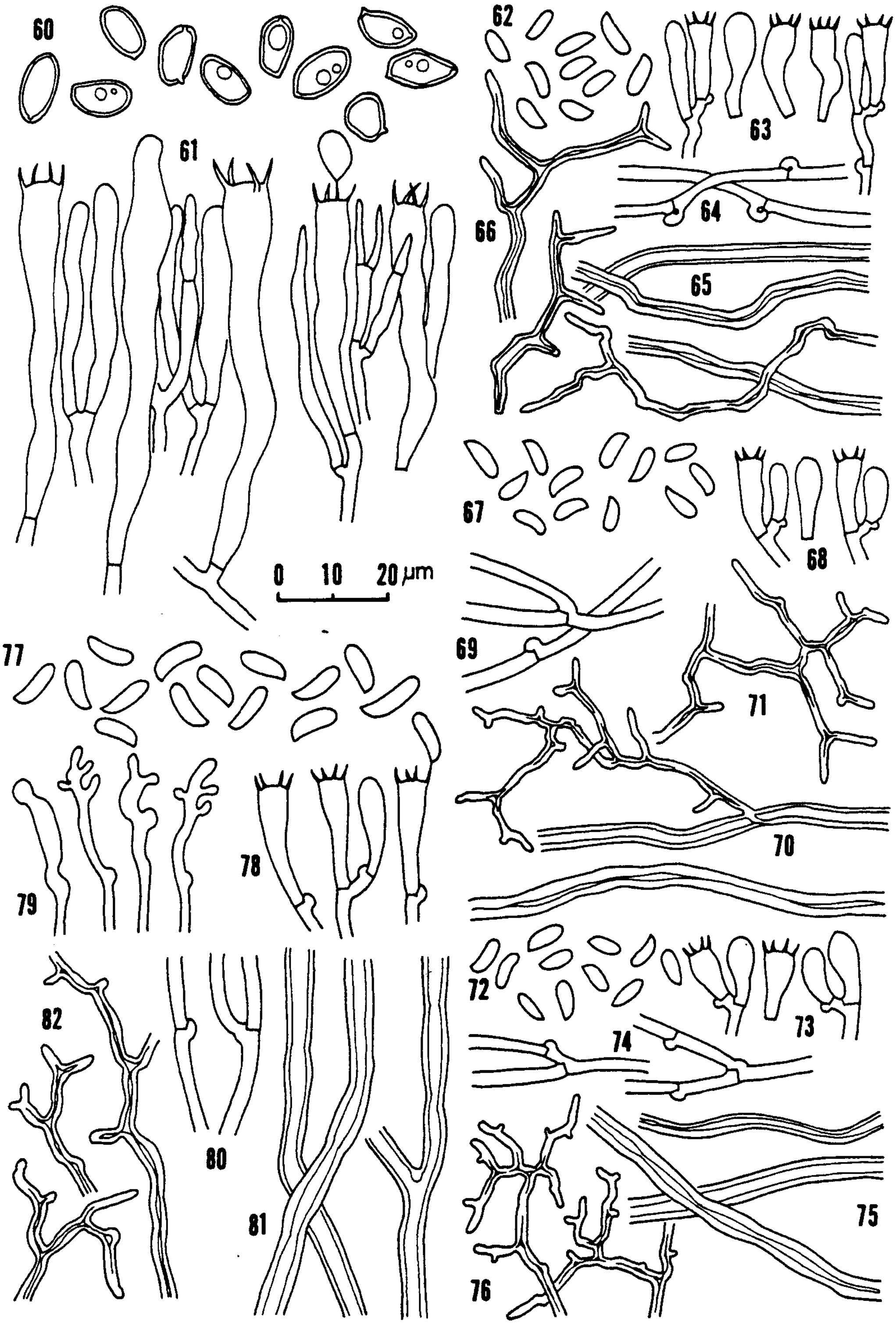
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Figure 83. Basidiospores of Fibrodontia gossypina.

Figure 84. Basidia of Fibrodontia gossypina.

Figure 85. Generative hyphae of Fibrodontia gossypina.

Figure 86. Skeletal hyphae of Fibrodontia gossypina.

Figure 87. Basidiospores of Fomes fomentarius.

Figure 88. Basidia of Fomes fomentarius.

Figure 89. Generative hyphae of Fomes fomentarius.

Figure 90. Skeletal hyphae of Fomes fomentarius.

Figure 91. Binding hyphae of Fomes fomentarius.

Figure 92. Basidiospores of Fomitopsis pinicola.

Figure 93. Basidia of Fomitopsis pinicola.

Figure 94. Generative hyphae of Fomitopsis pinicola.

Figure 95. Skeletal hyphae of Fomitopsis pinicola.

Figure 96. Basidiospores of Ganoderma applanatum.

Figure 97. Basidia of Ganoderma applanatum.

Figure 98. Generative hyphae of Ganoderma applanatum.

Figure 99. Skeletal hyphae of Ganoderma applanatum.

Figure 100. Binding hyphae of Ganoderma applanatum.

Figure 101. Basidiospores of Ganoderma tsugae.

Figure 102. Basidia of Ganoderma tsugae.

Figure 103. Generative hyphae of Ganoderma tsugae.

Figure 104. Skeletal hyphae of Ganoderma tsugae.

Figure 105. Binding hyphae of Ganoderma tsugae.

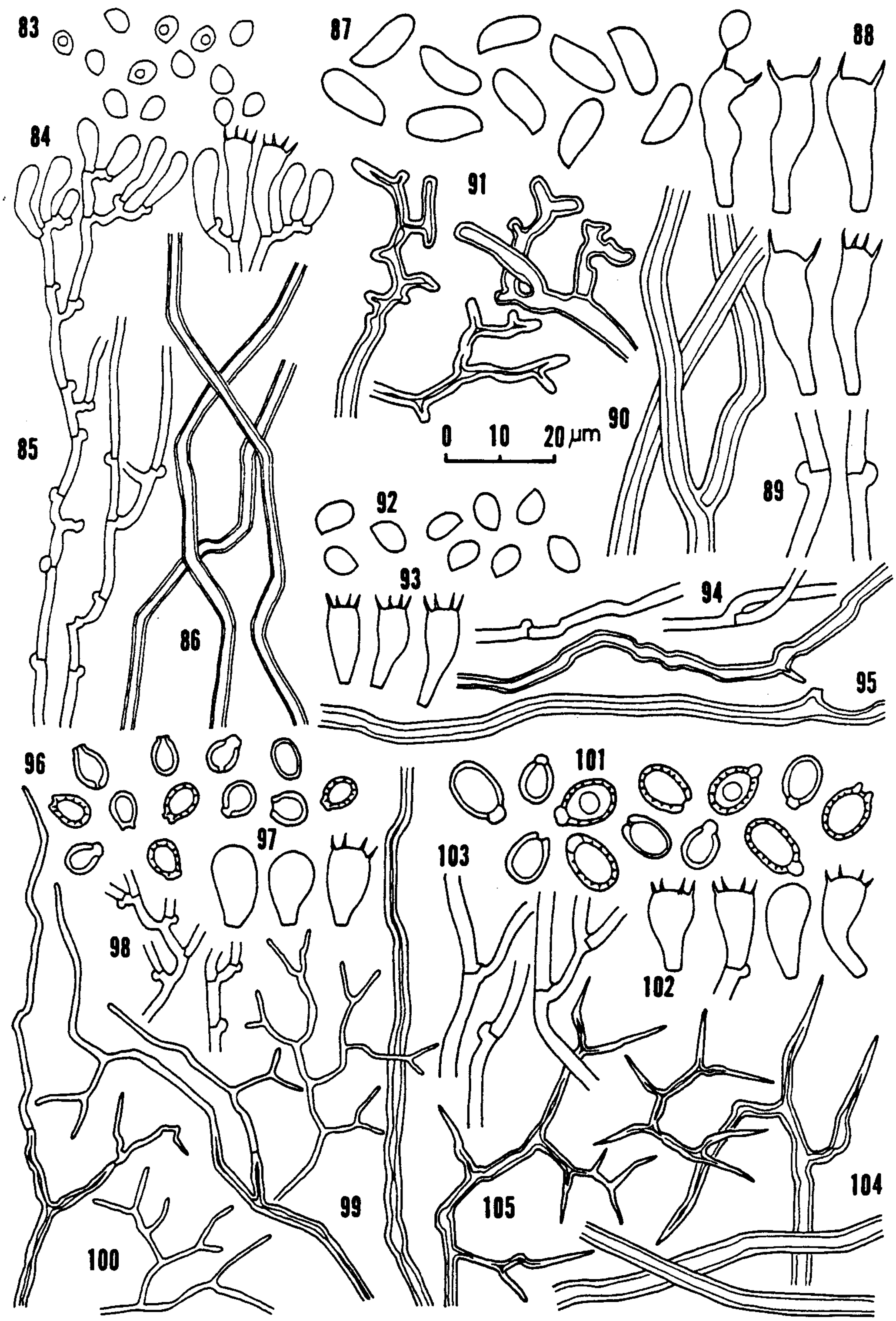
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Figure 106. Basidiospores of *Gloeocystidiellum citrinum*.

Figure 107. Basidia and paraphysoid hyphae of *Gloeocystidiellum citrinum*.

Figure 108. Gloeocystidia of *Gloeocystidiellum citrinum*.

Figure 109. Basidiospores of *Gloeocystidiellum ochraceum*.

Figure 110. Basidia of *Gloeocystidiellum ochraceum*.

Figure 111. Gloeocystidia of *Gloeocystidiellum ochraceum*.

Figure 112. Clamped hyphae of *Gloeocystidiellum ochraceum*.

Figure 113. Basidiospores of *Gloeophyllum sepiarium*.

Figure 114. Basidia of *Gloeophyllum sepiarium*.

Figure 115. Cystidia of *Gloeophyllum sepiarium*.

Figure 116. Generative hyphae of *Gloeophyllum sepiarium*.

Figure 117. Skeletal hyphae of *Gloeophyllum sepiarium*.

Figure 118. Binding hyphae of *Gloeophyllum sepiarium*.

Figure 119. Basidiospores of *Hapalopilus nidulans*.

Figure 120. Basidia of *Hapalopilus nidulans*.

Figure 121. Generative hyphae of *Hapalopilus nidulans*.

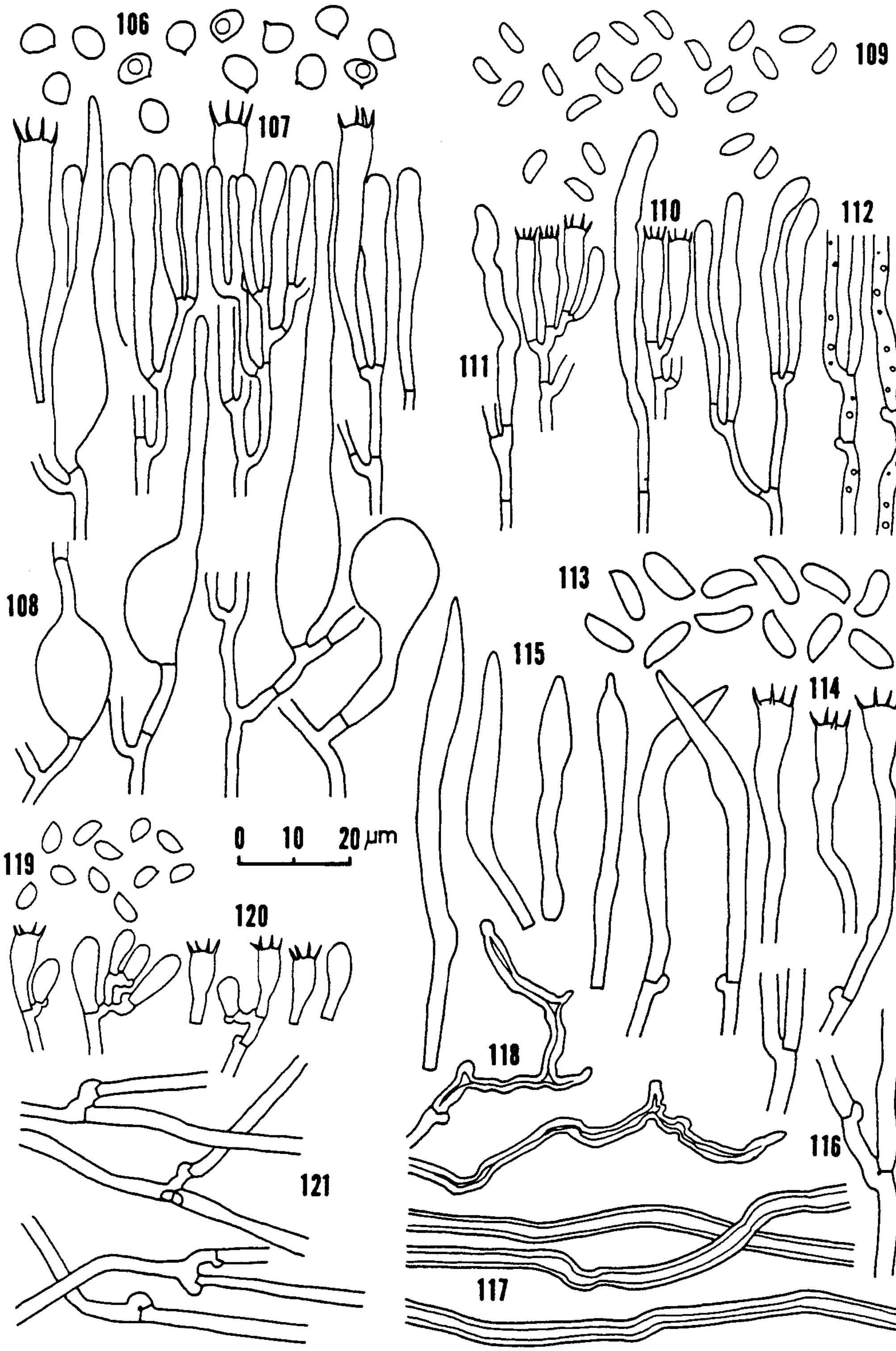
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Figure 122. Conidia of *Haplotrichum aureum*.

Figure 123. Conidiophores of *Haplotrichum aureum*.

Figure 124. Conidia of *Haplotrichum conspersum*.

Figure 125. Conidiophores of *Haplotrichum conspersum*.

Figure 126. Basidiospores of *Hirschioporus abietinus*.

Figure 127. Basidia of *Hirschioporus abietinus*.

Figure 128. Cystidia of *Hirschioporus abietinus*.

Figure 129. Skeletal hyphae of *Hirschioporus abietinus*.

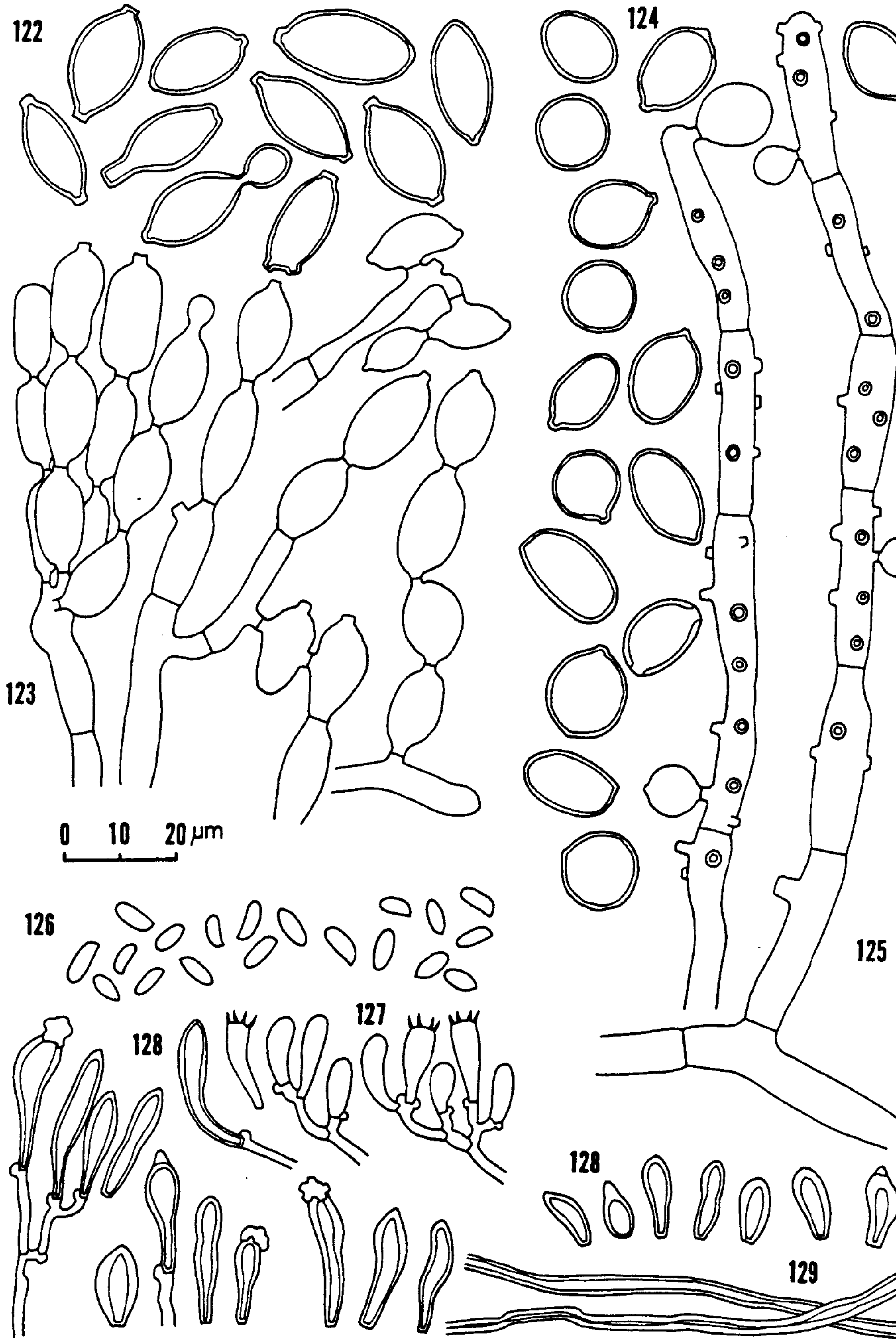
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Figure 130. Basidiospores of *Hirschioporus fusco-violaceus*.

Figure 131. Basidia of *Hirschioporus fusco-violaceus*.

Figure 132. Cystidia of *Hirschioporus fusco-violaceus*.

Figure 133. Generative hyphae of *Hirschioporus fusco-violaceus*.

Figure 134. Skeletal hyphae of *Hirschioporus fusco-violaceus*.

Figure 135. Basidiospores of *Hirschioporus laricinus*.

Figure 136. Basidia of *Hirschioporus laricinus*.

Figure 137. Cystidia of *Hirschioporus laricinus*.

Figure 138. Generative hyphae of *Hirschioporus laricinus*.

Figure 139. Skeletal hyphae of *Hirschioporus laricinus*.

Figure 140. Basidiospores of *Hirschioporus pargamenus*.

Figure 141. Basidia of *Hirschioporus pargamenus*.

Figure 142. Cystidia of *Hirschioporus pargamenus*.

Figure 143. Generative hyphae of *Hirschioporus pargamenus*.

Figure 144. Skeletal hyphae of *Hirschioporus pargamenus*.

Figure 145. Binding hyphae of *Hirschioporus pargamenus*.

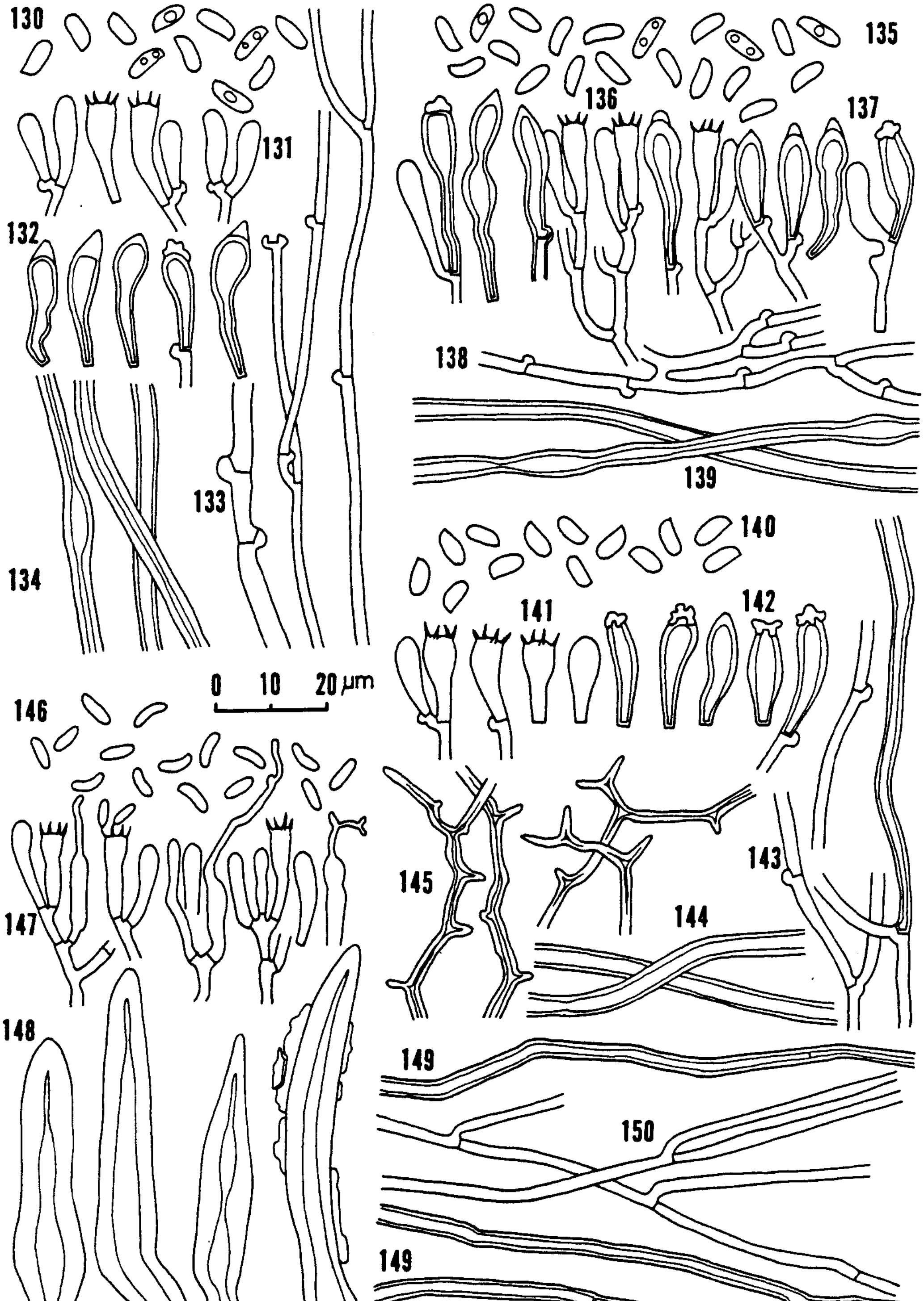
Figure 146. Basidiospores of *Hydnochaete olivaceum*.

Figure 147. Basidia and hyphal ends of *Hydnochaete olivaceum*.

Figure 148. Setae of *Hydnochaete olivaceum*.

Figure 149. Thick-walled hyphae of *Hydnochaete olivaceum*.

Figure 150. Thin-walled hyphae of *Hydnochaete olivaceum*.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0 10 20 µm

Figure 151. Basidiospores of *Hydrabasidium subviolaceum*.

Figure 152. Basidia of *Hydrabasidium subviolaceum*.

Figure 153. Hyphae of *Hydrabasidium subviolaceum*.

Figure 154. Basidiospores of *Hymenochaete cervina*.

Figure 155. Basidia of *Hymenochaete cervina*.

Figure 156. Cystidia of *Hymenochaete cervina*.

Figure 157. Setae of *Hymenochaete cervina*.

Figure 158. Crystalline masses of *Hymenochaete cervina*.

Figure 159. Hyphae of *Hymenochaete cervina*.

Figure 160. Basidiospores of *Hymenochaete cinnamomea*.

Figure 161. Basidia and paraphysoid hyphae of *Hymenochaete cinnamomea*.

Figure 162. Setae of *Hymenochaete cinnamomea*.

Figure 163. Hyphae of *Hymenochaete cinnamomea*.

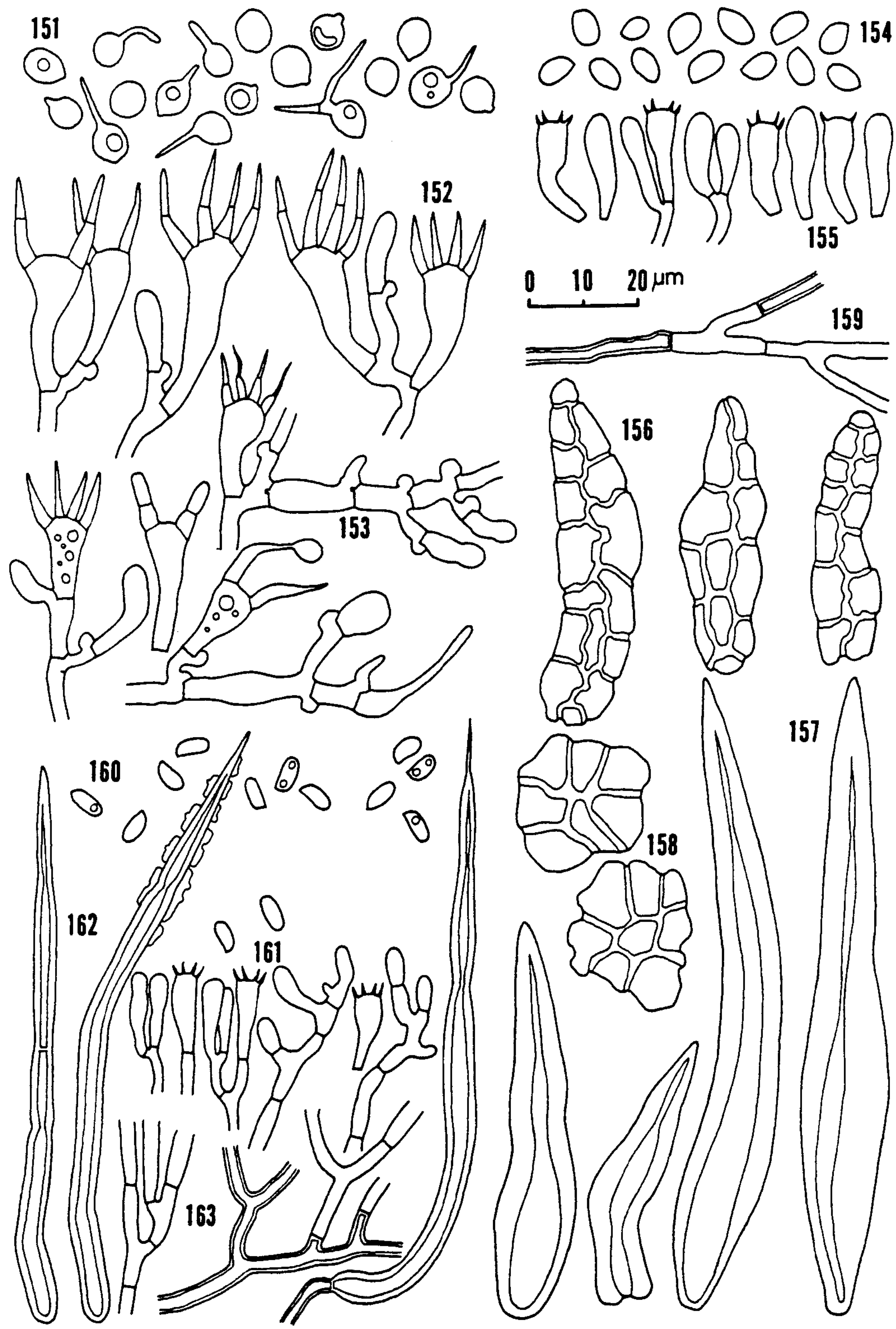
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Figure 164. Basidiospores of *Hymenochaete corrugata*.

Figure 165. Basidia of *Hymenochaete corrugata*.

Figure 166. Setae of *Hymenochaete corrugata*.

Figure 167. Basidiospores of *Hymenochaete curtisii*.

Figure 168. Basidia of *Hymenochaete curtisii*.

Figure 169. Hyphal ends of *Hymenochaete curtisii*.

Figure 170. Setae of *Hymenochaete curtisii*.

Figure 171. Hyphae of *Hymenochaete curtisii*.

Figure 172. Basidiospores of *Hymenochaete fuliginosa*.

Figure 173. Basidia and setae of *Hymenochaete fuliginosa*.

Figure 174. Hyphae of *Hymenochaete fuliginosa*.

Figure 175. Basidiospores of *Hymenochaete spreta*.

Figure 176. Basidia of *Hymenochaete spreta*.

Figure 177. Setae of *Hymenochaete spreta*.

Figure 178. Hyphae of *Hymenochaete spreta*.

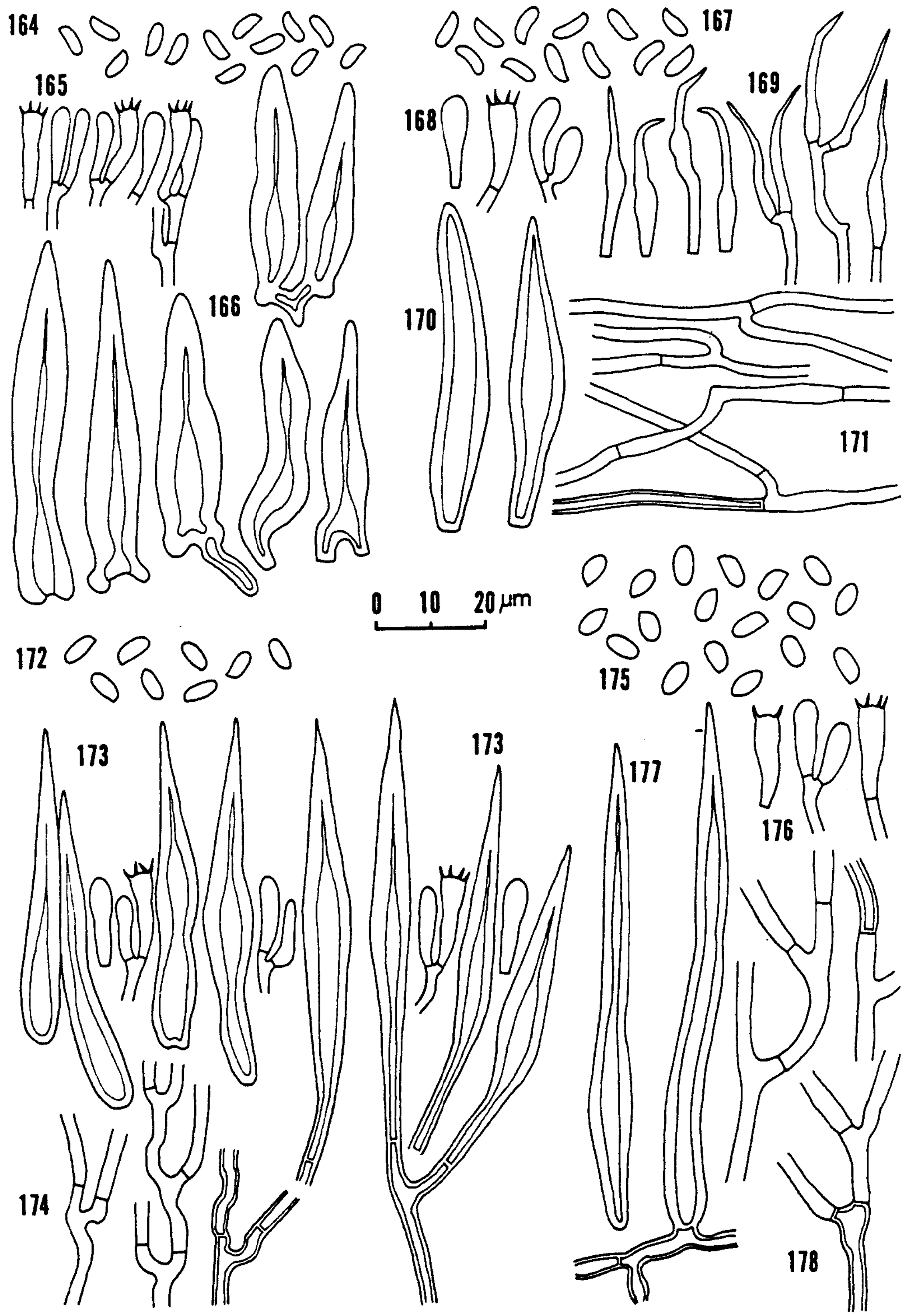
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Figure 179. Basidiospores of *Hymenochaete tabacina*.

Figure 180. Basidia of *Hymenochaete tabacina*.

Figure 181. Setae of *Hymenochaete tabacina*.

Figure 182. Hyphae of *Hymenochaete tabacina*.

Figure 183. Basidiospores of *Hyphoderma pallidum*.

Figure 184. Basidia of *Hyphoderma pallidum*.

Figure 185. Cystidia of *Hyphoderma pallidum*.

Figure 186. Cystidioles of *Hyphoderma pallidum*.

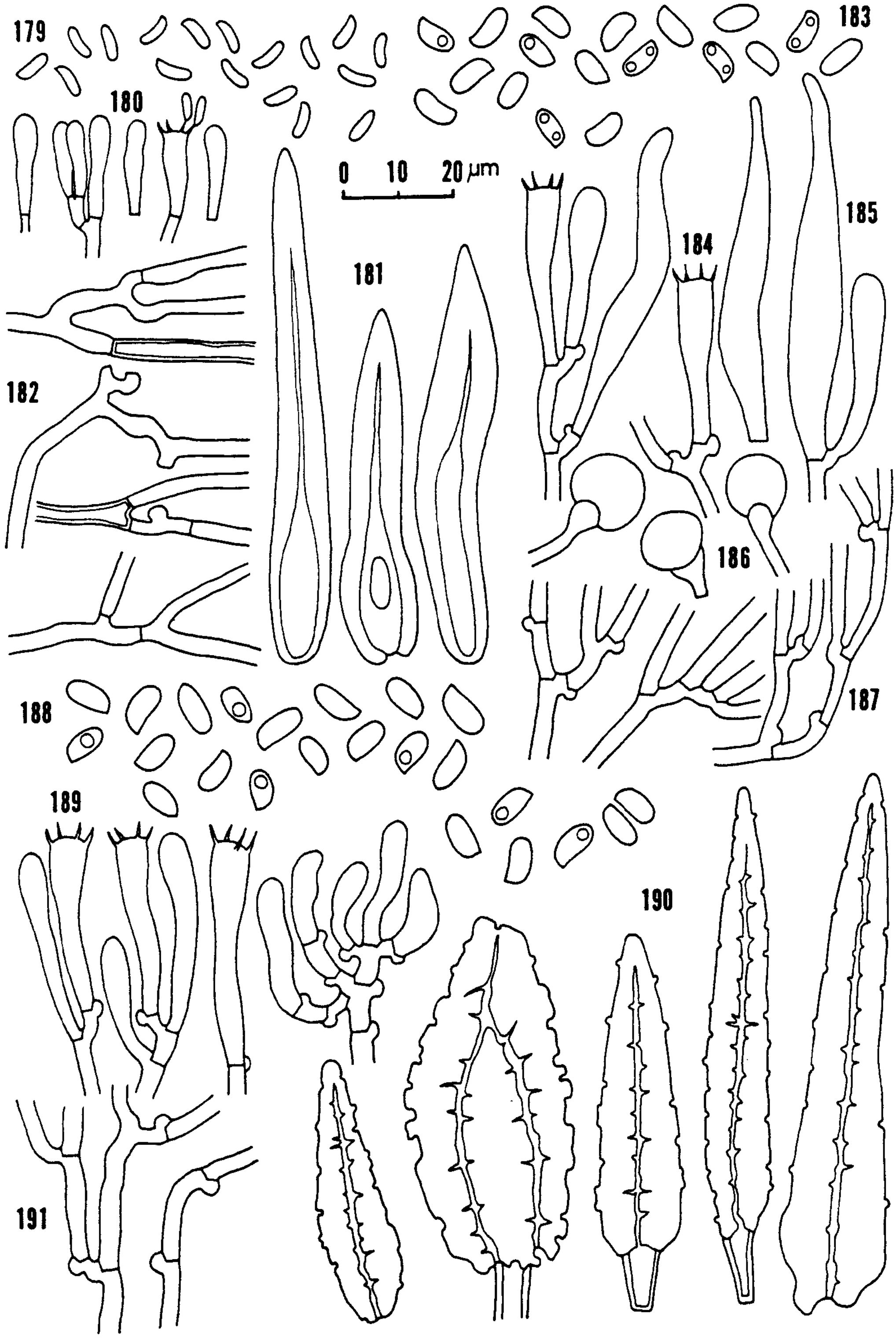
Figure 187. Hyphae of *Hyphoderma pallidum*.

Figure 188. Basidiospores of *Hyphoderma puberum*.

Figure 189. Basidia of *Hyphoderma puberum*.

Figure 190. Cystidia of *Hyphoderma puberum*.

Figure 191. Hyphae of *Hyphoderma puberum*.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0 10 20 µm

Figure 192. Basidiospores of Hyphoderma setigerum.

Figure 193. Basidia of Hyphoderma setigerum.

Figure 194. Cystidia of Hyphoderma setigerum.

Figure 195. Hyphae of Hyphoderma setigerum.

Figure 196. Basidiospores of Hyphoderma tsugae.

Figure 197. Basidia of Hyphoderma tsugae.

Figure 198. Cystidia of Hyphoderma tsugae.

Figure 199. Hyphae and resinous excretion of Hyphoderma tsugae.

Figure 200. Basidiospores of Hyphodontia abieticola.

Figure 201. Basidia of Hyphodontia abieticola.

Figure 202. Cystidia of Hyphodontia abieticola.

Figure 203. Hyphae of Hyphodontia abieticola

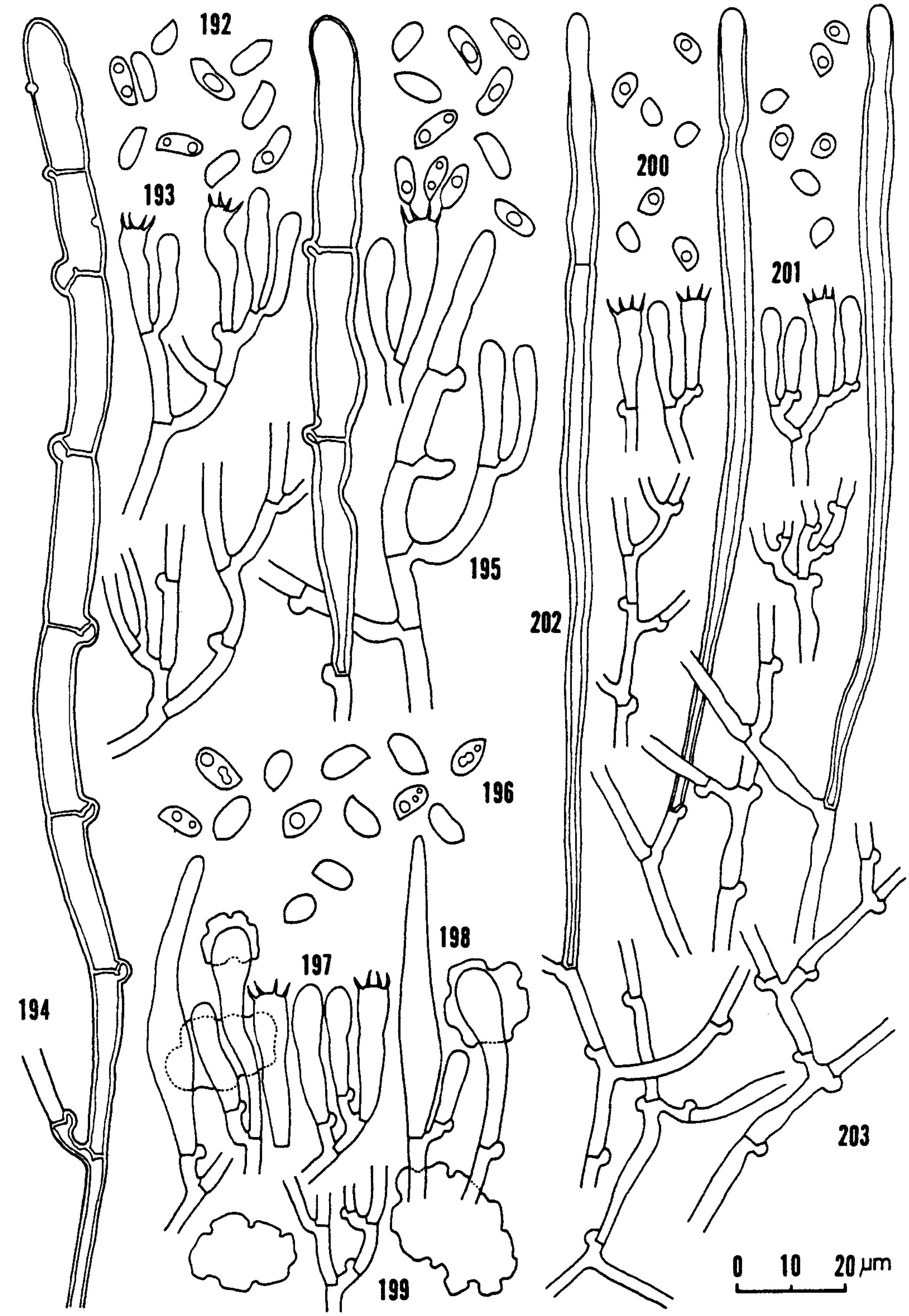
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Figure 204. Basidiospores of *Hyphodontia alutaria*.

Figure 205. Basidia of *Hyphodontia alutaria*.

Figure 206. Capitate cystidia of *Hyphodontia alutaria*.

Figure 207. Lagenocystidia of *Hyphodontia alutaria*.

Figure 208. Hyphae of *Hyphodontia alutaria*.

Figure 209. Basidiospores of *Hyphodontia arguta*.

Figure 210. Basidia of *Hyphodontia arguta*.

Figure 211. Capitate cystidia of *Hyphodontia arguta*.

Figure 212. Lagenocystidia of *Hyphodontia arguta*.

Figure 213. Hyphae of *Hyphodontia arguta*.

Figure 214. Basidiospores of *Hyphodontia aspera*.

Figure 215. Basidia of *Hyphodontia aspera*.

Figure 216. Cystidia of *Hyphodontia aspera*.

Figure 217. Hyphae of *Hyphodontia aspera*.

Figure 218. Basidiospores of *Hyphodontia breviseta*.

Figure 219. Basidia of *Hyphodontia breviseta*.

Figure 220. Capitate cystidia of *Hyphodontia breviseta*.

Figure 221. Torulose cystidia of *Hyphodontia breviseta*.

Figure 222. Hyphae of *Hyphodontia breviseta*.

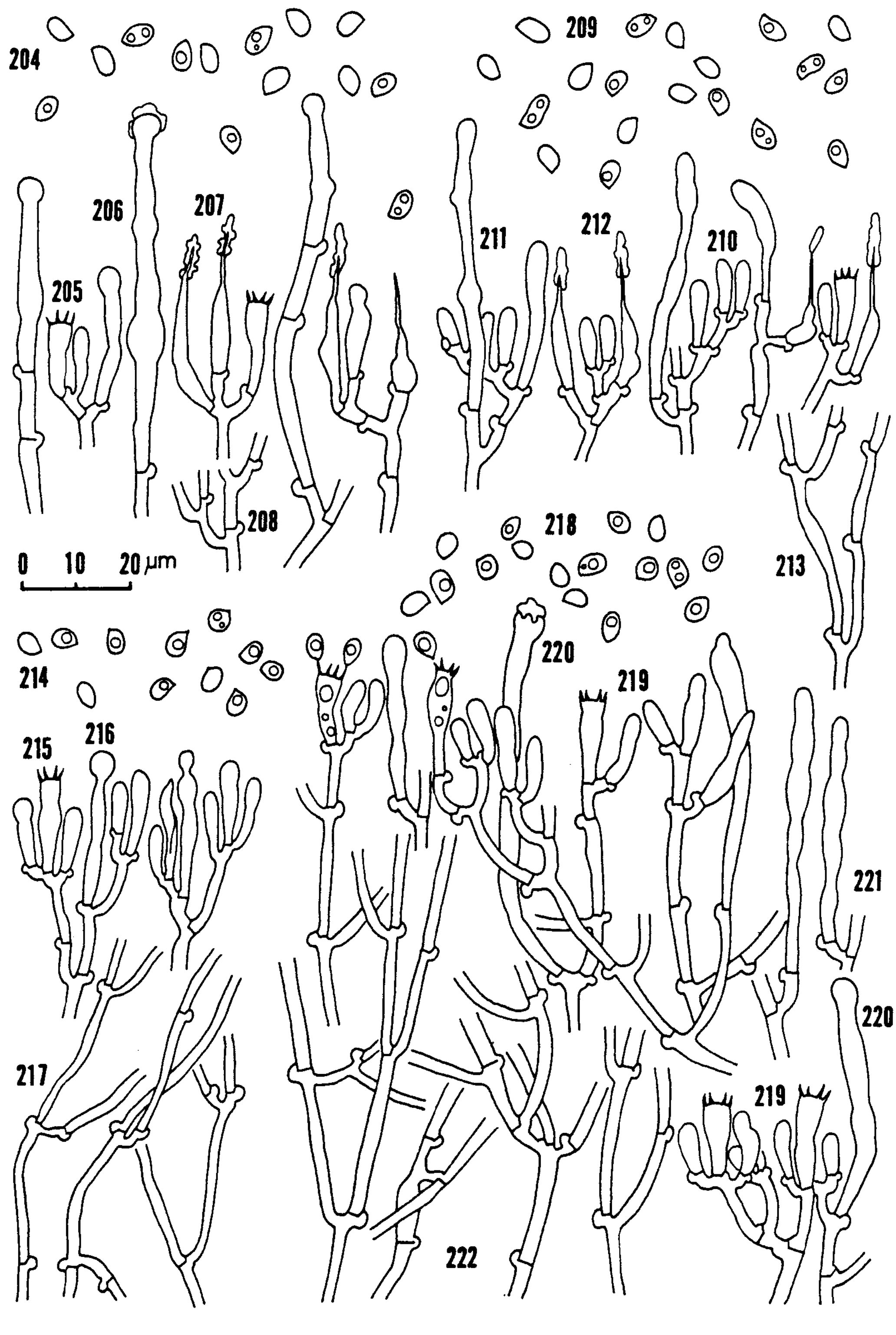
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Figure 223. Basidiospores of Hyphodontia pallidula.

Figure 224. Basidia of Hyphodontia pallidula.

Figure 225. Cystidia of Hyphodontia pallidula.

Figure 226. Hyphae of Hyphodontia pallidula.

Figure 227. Basidiospores of Hyphodontia verruculosa.

Figure 228. Basidia of Hyphodontia verruculosa.

Figure 229. Cystidia of Hyphodontia verruculosa.

Figure 230. Hyphae of Hyphodontia verruculosa.

Figure 231. Basidiospores of Hypochnicium geogenium.

Figure 232. Basidia of Hypochnicium geogenium.

Figure 233. Cystidia of Hypochnicium geogenium.

Figure 234. Hyphae of Hypochnicium geogenium.

Figure 235. Basidiospores of Inonotus radiatus.

Figure 236. Basidia of Inonotus radiatus.

Figure 237. Setae of Inonotus radiatus.

Figure 238. Generative hyphae of Inonotus radiatus.

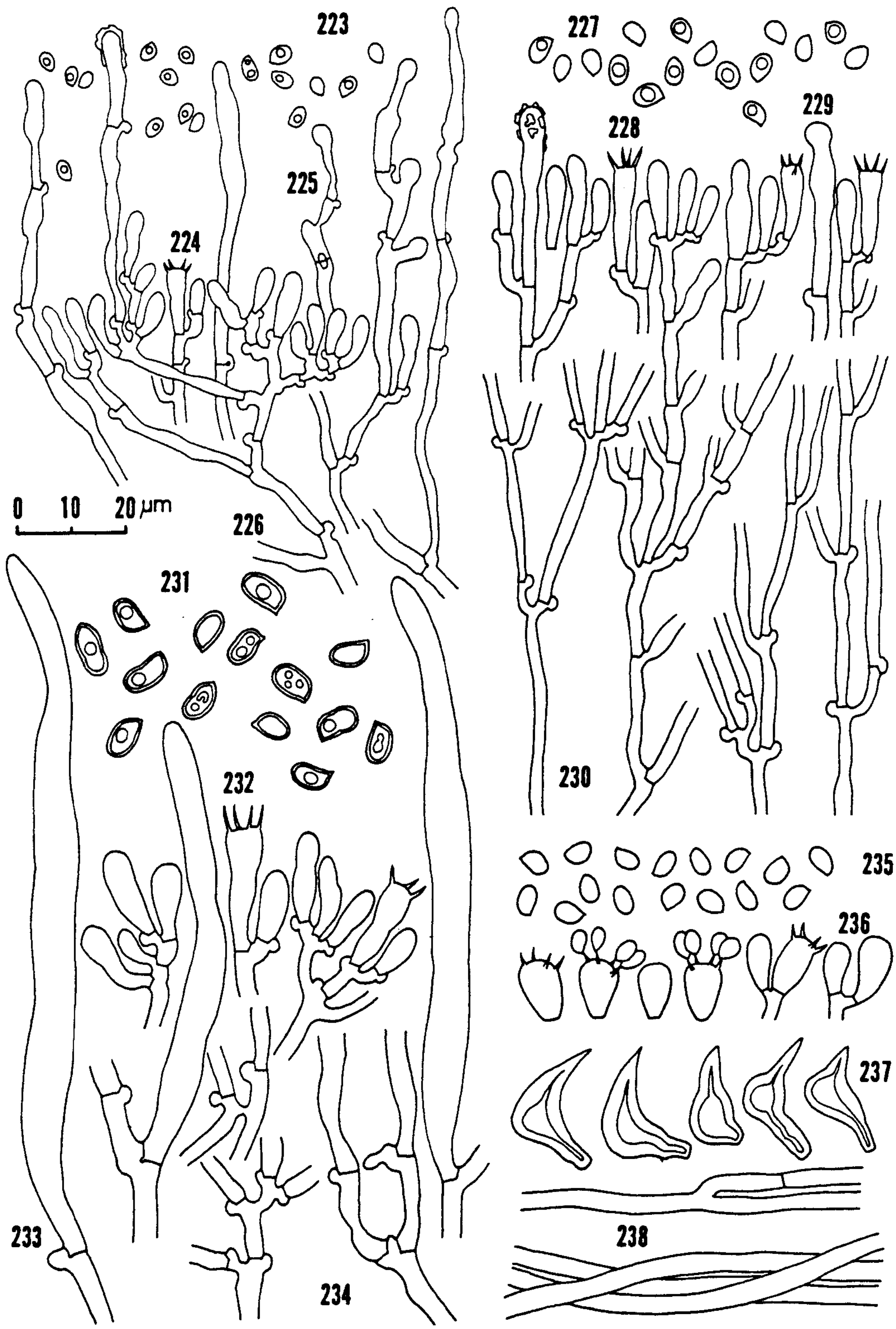
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Figure 239. Basidiospores of *Irpex lacteus*.

Figure 240. Basidia of *Irpex lacteus*.

Figure 241. Skeletocystidia of *Irpex lacteus*.

Figure 242. Generative hyphae of *Irpex lacteus*.

Figure 243. Skeletal hyphae of *Irpex lacteus*.

Figure 244. Basidiospores of *Jaapia ochroleuca*.

Figure 245. Basidia of *Jaapia ochroleuca*.

Figure 246. Cystidia of *Jaapia ochroleuca*.

Figure 247. Hyphae of *Jaapia ochroleuca*.

Figure 248. Basidiospores of *Laetiporus sulphureus*.

Figure 249. Basidia of *Laetiporus sulphureus*.

Figure 250. Generative hyphae of *Laetiporus sulphureus*.

Figure 251. Skeletal hyphae of *Laetiporus sulphureus*.

Figure 252. Contextual binding hyphae of *Laetiporus sulphureus*.

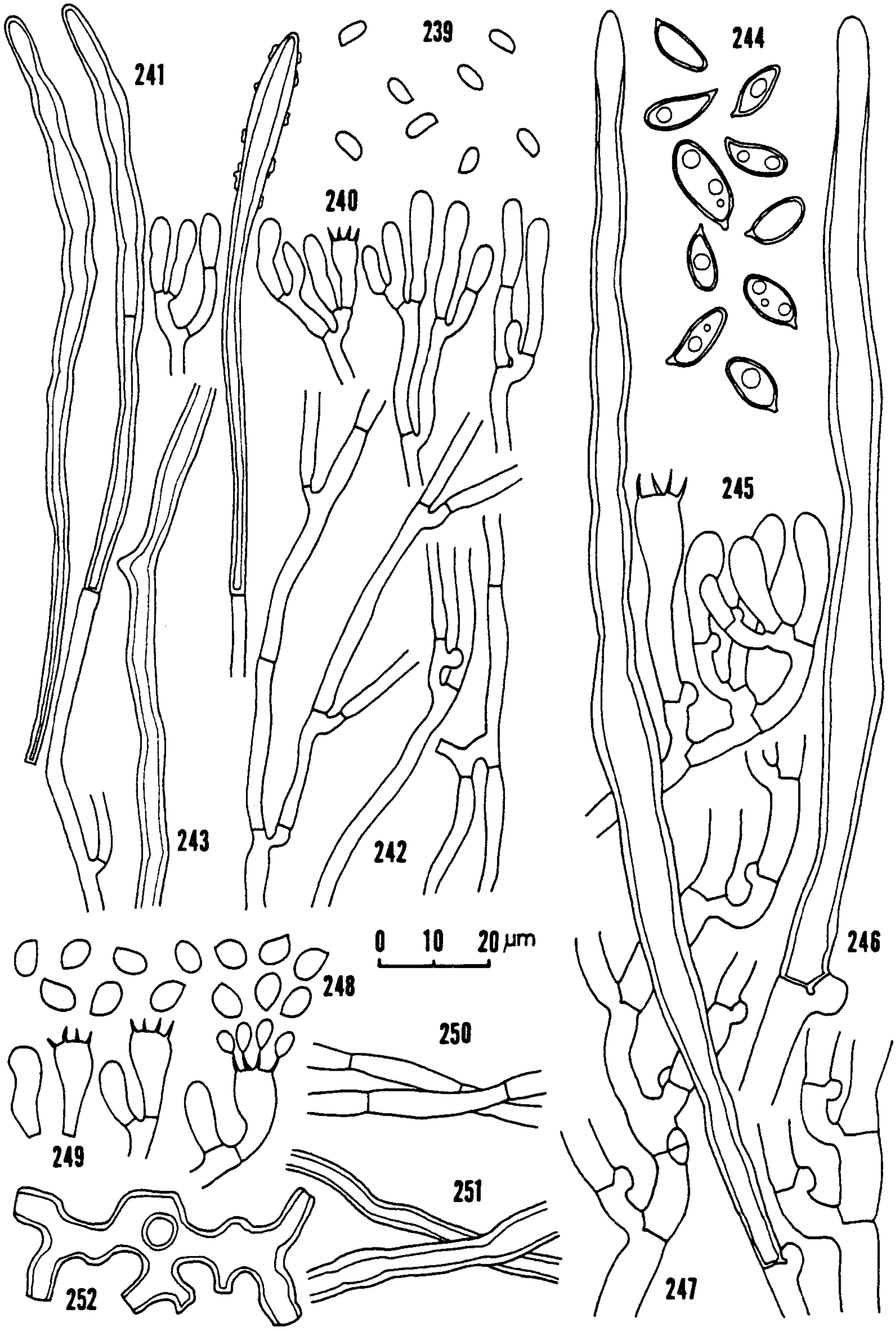
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Figure 253. Basidiospores of *Laurilia sulcata*.

Figure 254. Basidia of *Laurilia sulcata*.

Figure 255. Cystidia of *Laurilia sulcata*.

Figure 256. Generative hyphae of *Laurilia sulcata*.

Figure 257. Skeletal hyphae of *Laurilia sulcata*.

Figure 258. Binding hyphae of *Laurilia sulcata*.

Figure 259. Basidiospores of *Parmastomyces kravtzevianus*.

Figure 260. Basidia of *Parmastomyces kravtzevianus*.

Figure 261. Generative hyphae of *Parmastomyces kravtzevianus*.

Figure 262. Basidiospores of *Perenniporia medulla-panis*.

Figure 263. Basidia of *Perenniporia medulla-panis*.

Figure 264. Generative and skeletal hyphae of *Perenniporia medulla-panis*.

Figure 265. Binding hyphae of *Perenniporia medulla-panis*.

Figure 266. Basidiospores of *Perenniporia subacida*.

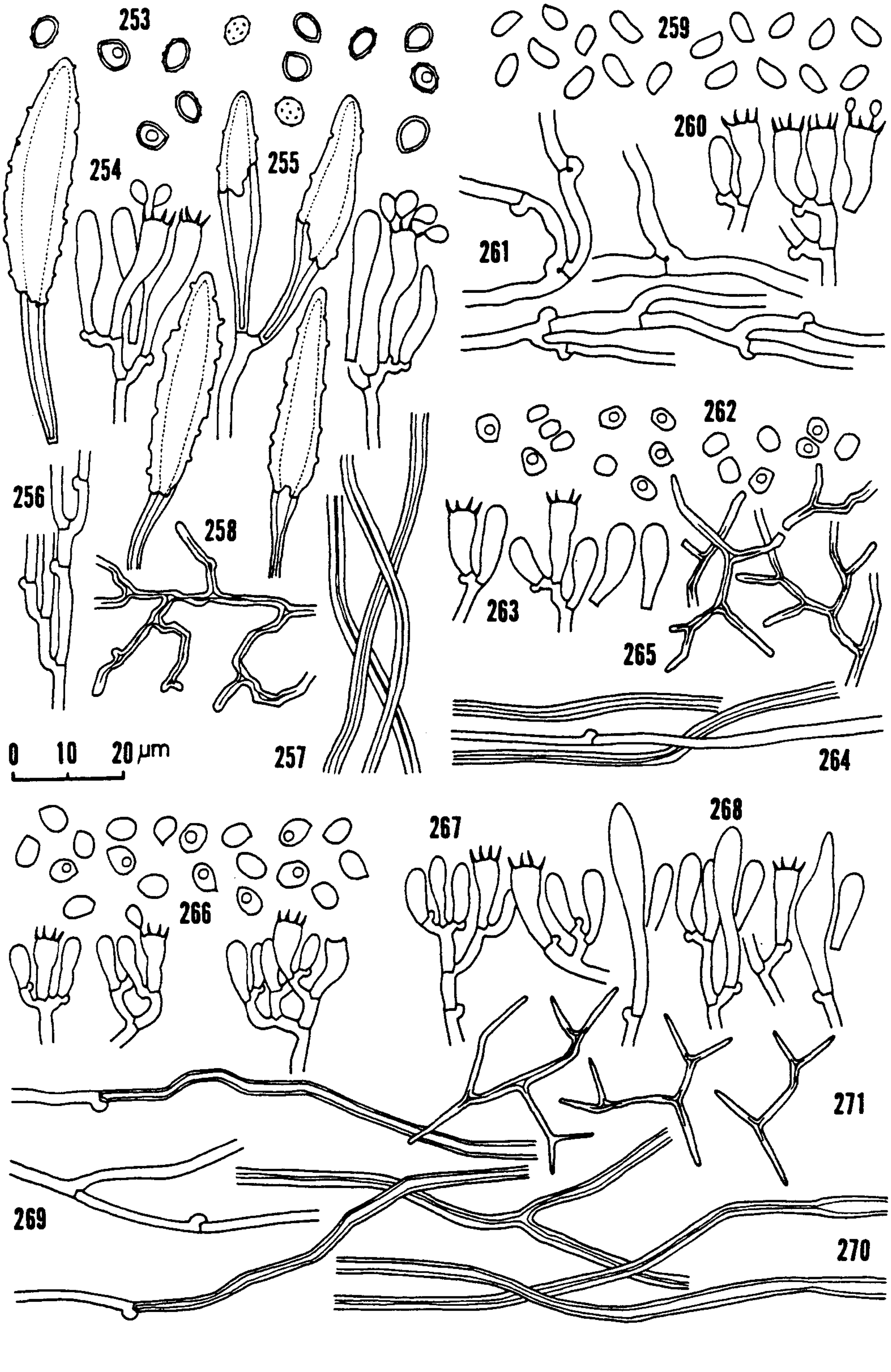
Figure 267. Basidia of *Perenniporia subacida*.

Figure 268. Cystidioles of *Perenniporia subacida*.

Figure 269. Generative hyphae of *Perenniporia subacida*.

Figure 270. Skeletal hyphae of *Perenniporia subacida*.

Figure 271. Binding hyphae of *Perenniporia subacida*.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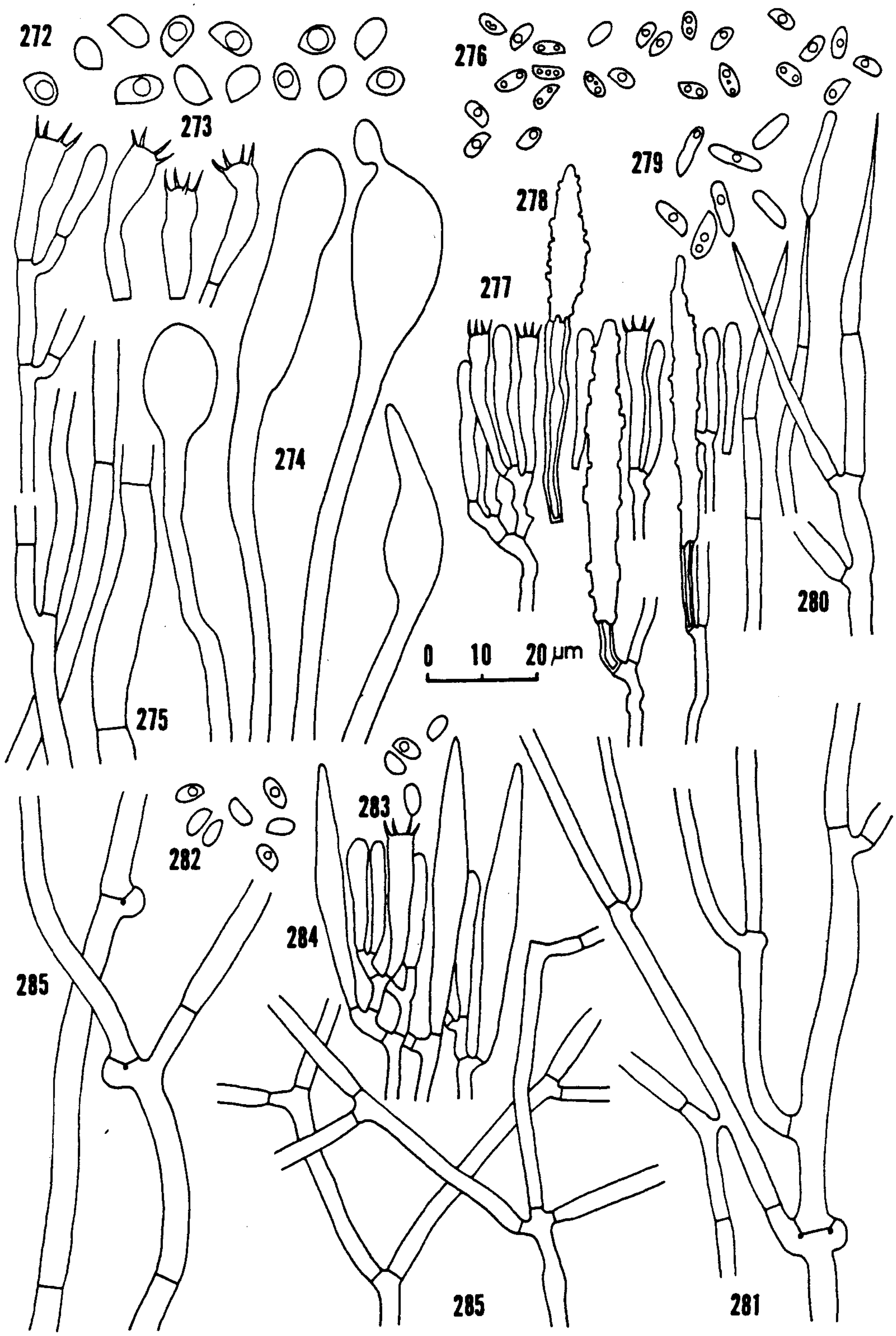
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Figure 286. Basidiospores of Phanerochaete septocystidia.

Figure 287. Basidia of Phanerochaete septocystidia.

Figure 288. Cystidia of Phanerochaete septocystidia.

Figure 289. Subicular hyphae of Phanerochaete septocystidia.

Figure 290. Basidiospores of Phanerochaete sordida.

Figure 291. Basidia of Phanerochaete sordida.

Figure 292. Cystidia of Phanerochaete sordida.

Figure 293. Subhymenial hyphae of Phanerochaete sordida.

Figure 294. Subicular hyphae of Phanerochaete sordida.

Figure 295. Basidiospores of Phanerochaete viticola.

Figure 296. Basidia of Phanerochaete viticola.

Figure 297. Cystidia of Phanerochaete viticola.

Figure 298. Hyphae of Phanerochaete viticola.

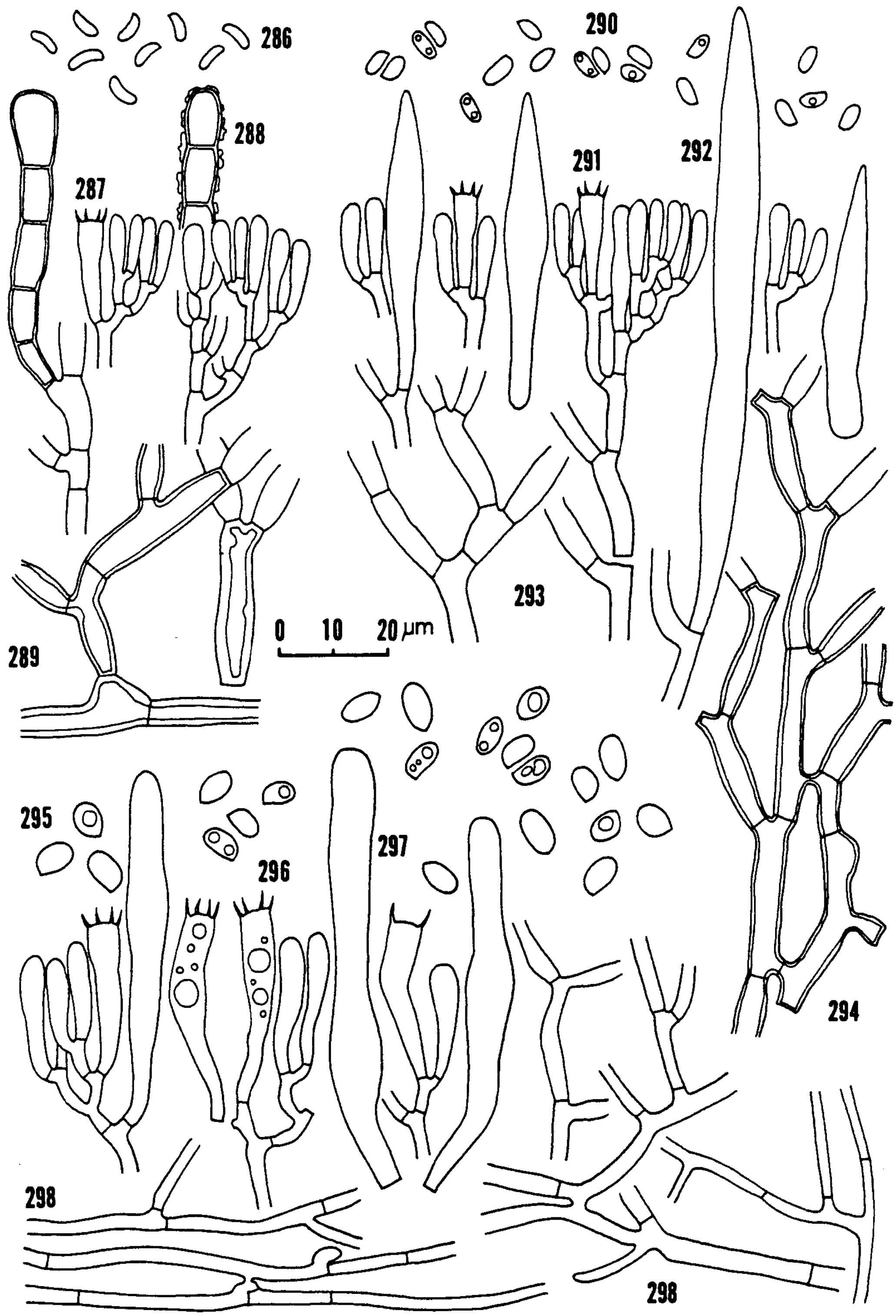
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Figure 299. Basidiospores of *Phellinus chrysoloma*.

Figure 300. Basidia of *Phellinus chrysoloma*.

Figure 301. Setae of *Phellinus chrysoloma*.

Figure 302. Generative and skeletal hyphae of *Phellinus chrysoloma*.

Figure 303. Basidiospores of *Phellinus contiguus*.

Figure 304. Basidia of *Phellinus contiguus*.

Figure 305. Setae of *Phellinus contiguus*.

Figure 306. Skeletal hyphae of *Phellinus contiguus*.

Figure 307. Basidiospores of *Phellinus ferreus*.

Figure 308. Basidia of *Phellinus ferreus*.

Figure 309. Setae of *Phellinus ferreus*.

Figure 310. Basidiospores of *Phellinus igniarius*.

Figure 311. Basidia of *Phellinus igniarius*.

Figure 312. Setae of *Phellinus igniarius*.

Figure 313. Basidiospores of *Phellinus laevigatus*.

Figure 314. Basidia of *Phellinus laevigatus*.

Figure 315. Setae of *Phellinus laevigatus*.

Figure 316. Basidiospores of *Phellinus pomaceus*.

Figure 317. Basidia of *Phellinus pomaceus*.

Figure 318. Generative and skeletal hyphae of *Phellinus pomaceus*.

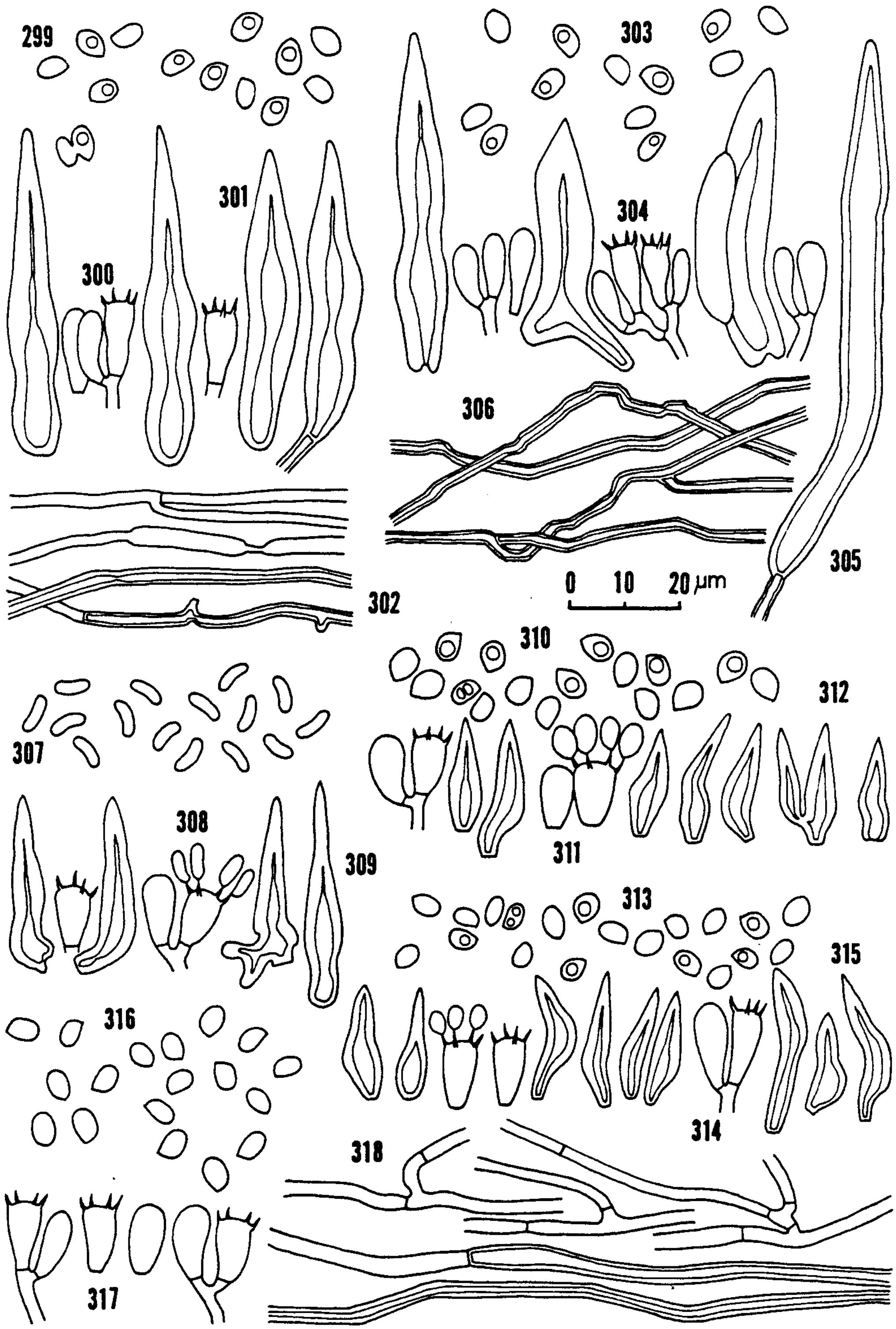
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Figure 319. Basidiospores of *Piptoporus betulinus*.

Figure 320. Basidia of *Piptoporus betulinus*.

Figure 321. Generative hyphae of *Piptoporus betulinus*.

Figure 322. Skeletal hyphae of *Piptoporus betulinus*.

Figure 323. Basidiospores of *Plicaturopsis crispa*.

Figure 324. Basidia of *Plicaturopsis crispa*.

Figure 325. Hyphae of *Plicaturopsis crispa*.

Figure 326. Basidiospores of *Poria crustulina*.

Figure 327. Basidia of *Poria crustulina*.

Figure 328. Generative hyphae of *Poria crustulina*.

Figure 329. Skeletal hyphae of *Poria crustulina*.

Figure 330. Basidiospores of *Poria spissa*.

Figure 331. Basidia of *Poria spissa*.

Figure 332. Generative hyphae of *Poria spissa*.

Figure 333. Basidiospores of *Pycnoporus cinnabarinus*.

Figure 334. Basidia of *Pycnoporus cinnabarinus*.

Figure 335. Generative hyphae of *Pycnoporus cinnabarinus*.

Figure 336. Skeletal hyphae of *Pycnoporus cinnabarinus*.

Figure 337. Binding hyphae of *Pycnoporus cinnabarinus*.

Figure 338. Basidiospores of *Resinicium bicolor*.

Figure 339. Basidia of *Resinicium bicolor*.

Figure 340. Halocystidia of *Resinicium bicolor*.

Figure 341. Asterocystidia of *Resinicium bicolor*.

Figure 342. Hyphae of *Resinicium bicolor*.

Figure 343. Basidiospores of *Resinicium furfuraceum*.

Figure 344. Basidia of *Resinicium furfuraceum*.

Figure 345. Halocystidia of *Resinicium furfuraceum*.

Figure 346. Hyphae of *Resinicium furfuraceum*.

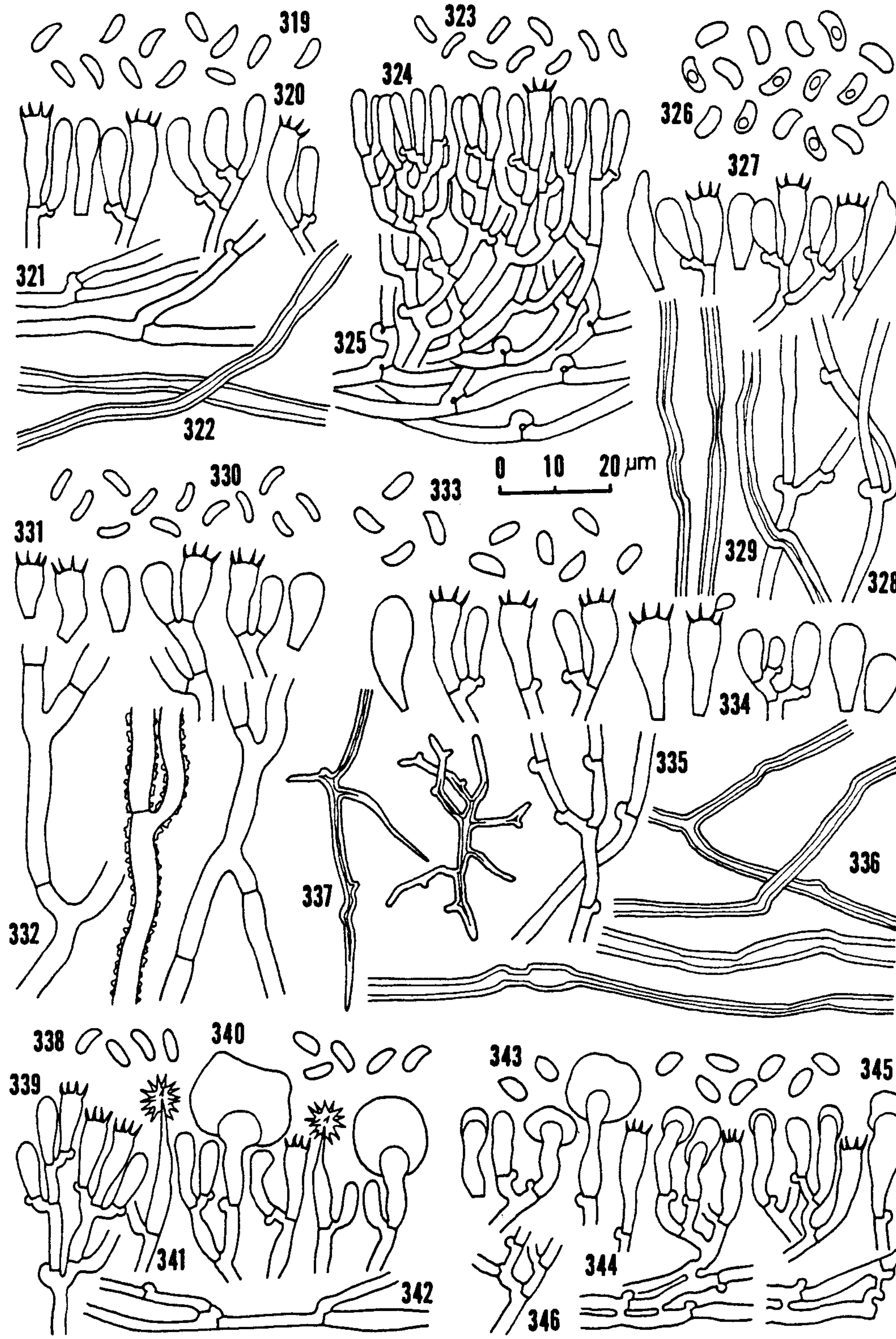
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Figure 347. Basidiospores of Rigidoporus nigrescens.

Figure 348. Basidia of Rigidoporus nigrescens.

Figure 349. Generative hyphae of Rigidoporus nigrescens.

Figure 350. Basidiospores of Schizopora paradoxa.

Figure 351. Basidia of Schizopora paradoxa.

Figure 352. Cystidioles of Schizopora paradoxa.

Figure 353. Generative hyphae of Schizopora paradoxa.

Figure 354. Skeletal hyphae of Schizopora paradoxa.

Figure 355. Basidiospores of Stereum complicatum.

Figure 356. Basidia and acutocystidia of Stereum complicatum.

Figure 357. Pseudocystidia of Stereum complicatum.

Figure 358. Subhymenial generative hyphae of Stereum complicatum.

Figure 359. Contextual generative and pseudocystidial hyphae of Stereum complicatum.

Figure 360. Basidiospores of Stereum gausapatum.

Figure 361. Basidia and acutocystidia of Stereum gausapatum.

Figure 362. Pseudocystidia of Stereum gausapatum.

Figure 363. Subhymenial generative hyphae of Stereum gausapatum.

Figure 364. Contextual generative and pseudocystidial hyphae of Stereum gausapatum.

Figure 365. Basidiospores of Stereum hirsutum.

Figure 366. Basidia and acutocystidia of Stereum hirsutum.

Figure 367. Pseudocystidia of Stereum hirsutum.

Figure 368. Subhymenial generative hyphae of Stereum hirsutum.

Figure 369. Contextual generative and pseudocystidial hyphae of Stereum hirsutum.

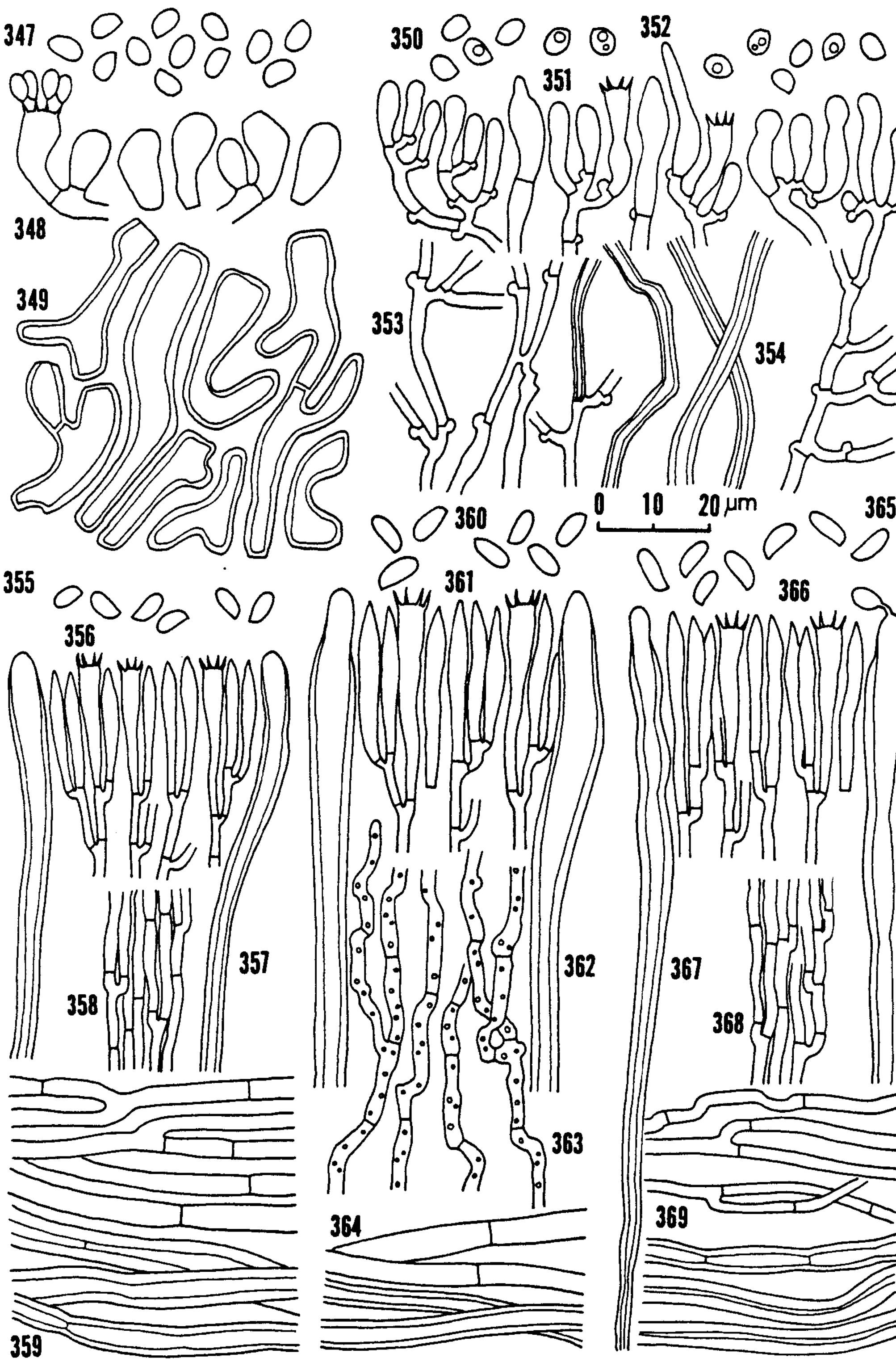
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Figure 370. Basidiospores of Stereum sanguinolentum.

Figure 371. Basidia and acanthocystidia of Stereum sanguinolentum.

Figure 372. Pseudocystidia of Stereum sanguinolentum.

Figure 373. Contextual generative and pseudocystidial hyphae of Stereum sanguinolentum.

Figure 374. Basidiospores of Trechispora alnicola.

Figure 375. Basidia of Trechispora alnicola.

Figure 376. Subicular hyphae of Trechispora alnicola.

Figure 377. Basidiospores of Trechispora farinacea.

Figure 378. Basidia of Trechispora farinacea.

Figure 379. Subicular hyphae of Trechispora farinacea.

Figure 380. Basidiospores of Trechispora mollusca.

Figure 381. Basidia of Trechispora mollusca.

Figure 382. Subicular hyphae of Trechispora mollusca.

Figure 383. Basidiospores of Trechispora vaga.

Figure 384. Basidia of Trechispora vaga.

Figure 385. Old hyphae of Trechispora vaga.

Figure 386. Fasciculate subicular hyphae of Trechispora vaga.

Figure 387. Basidiospores of Tyromyces albellus.

Figure 388. Basidia of Tyromyces albellus.

Figure 389. Generative hyphae of Tyromyces albellus.

Figure 390. Skeletal hyphae of Tyromyces albellus.

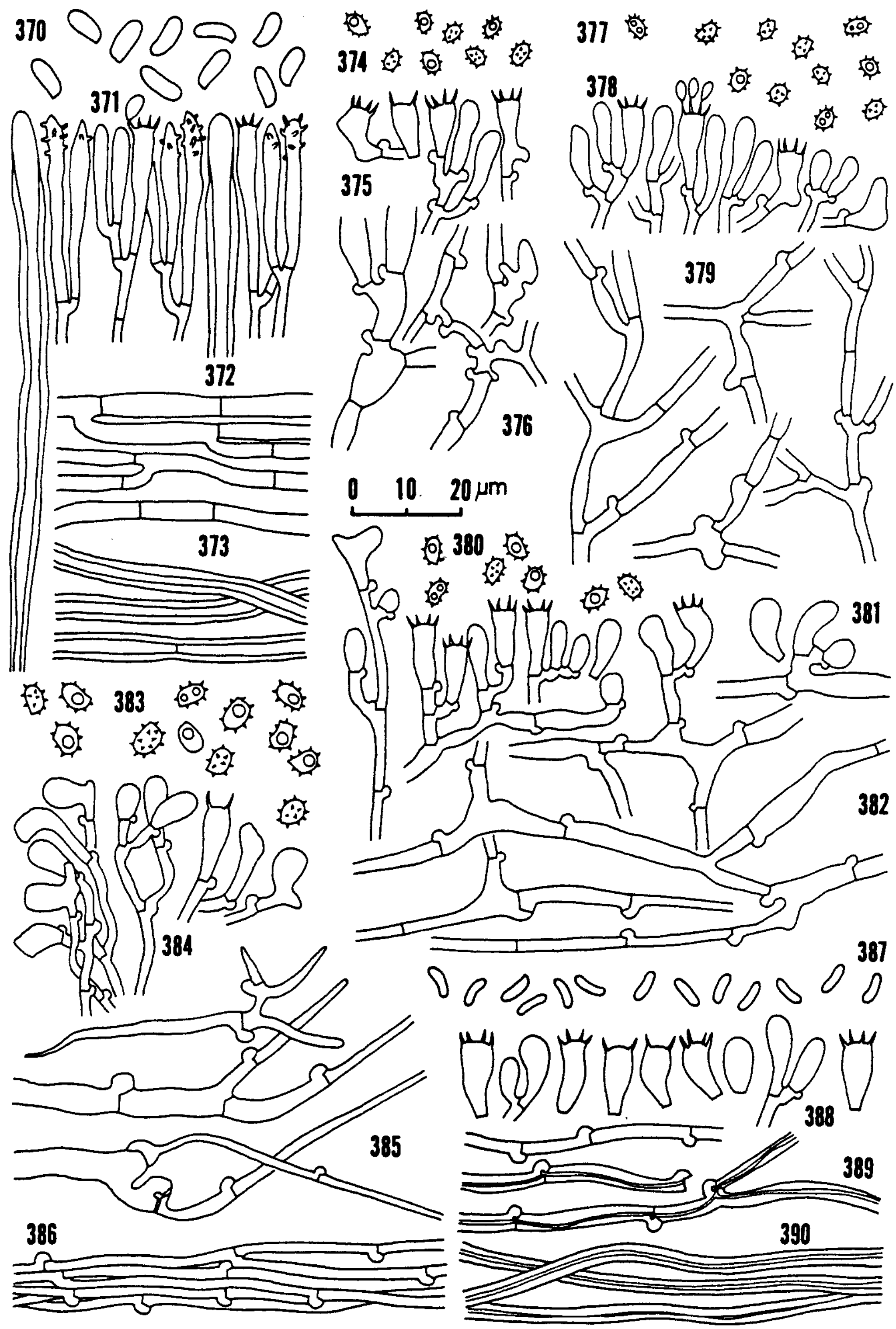
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Figure 391. Basidiospores of Tyromyces balsameus.

Figure 392. Basidia of Tyromyces balsameus.

Figure 393. Cystidia of Tyromyces balsameus.

Figure 394. Generative hyphae of Tyromyces balsameus.

Figure 395. Basidiospores of Tyromyces caesius

Figure 396. Basidia of Tyromyces caesius.

Figure 397. Generative hyphae of Tyromyces caesius.

Figure 398. Basidiospores of Tyromyces floriformis.

Figure 399. Basidia of Tyromyces floriformis.

Figure 400. Generative hyphae of Tyromyces floriformis.

Figure 401. Basidiospores of Tyromyces fragilis.

Figure 402. Basidia of Tyromyces fragilis.

Figure 403. Generative hyphae of Tyromyces fragilis.

Figure 404. Basidiospores of Tyromyces guttulatus.

Figure 405. Basidia of Tyromyces guttulatus.

Figure 406. Cystidioles of Tyromyces guttulatus.

Figure 407. Generative hyphae of Tyromyces guttulatus.

Figure 408. Moniliform hyphae of Tyromyces guttulatus.

Figure 409. Basidiospores of Tyromyces immitis.

Figure 410. Basidia of Tyromyces immitis.

Figure 411. Cystidioles of Tyromyces immitis.

Figure 412. Generative hyphae of Tyromyces immitis.

Figure 413. Basidiospores of Tyromyces undosus.

Figure 414. Basidia of Tyromyces undosus.

Figure 415. Hymenial hyphal ends of Tyromyces undosus.

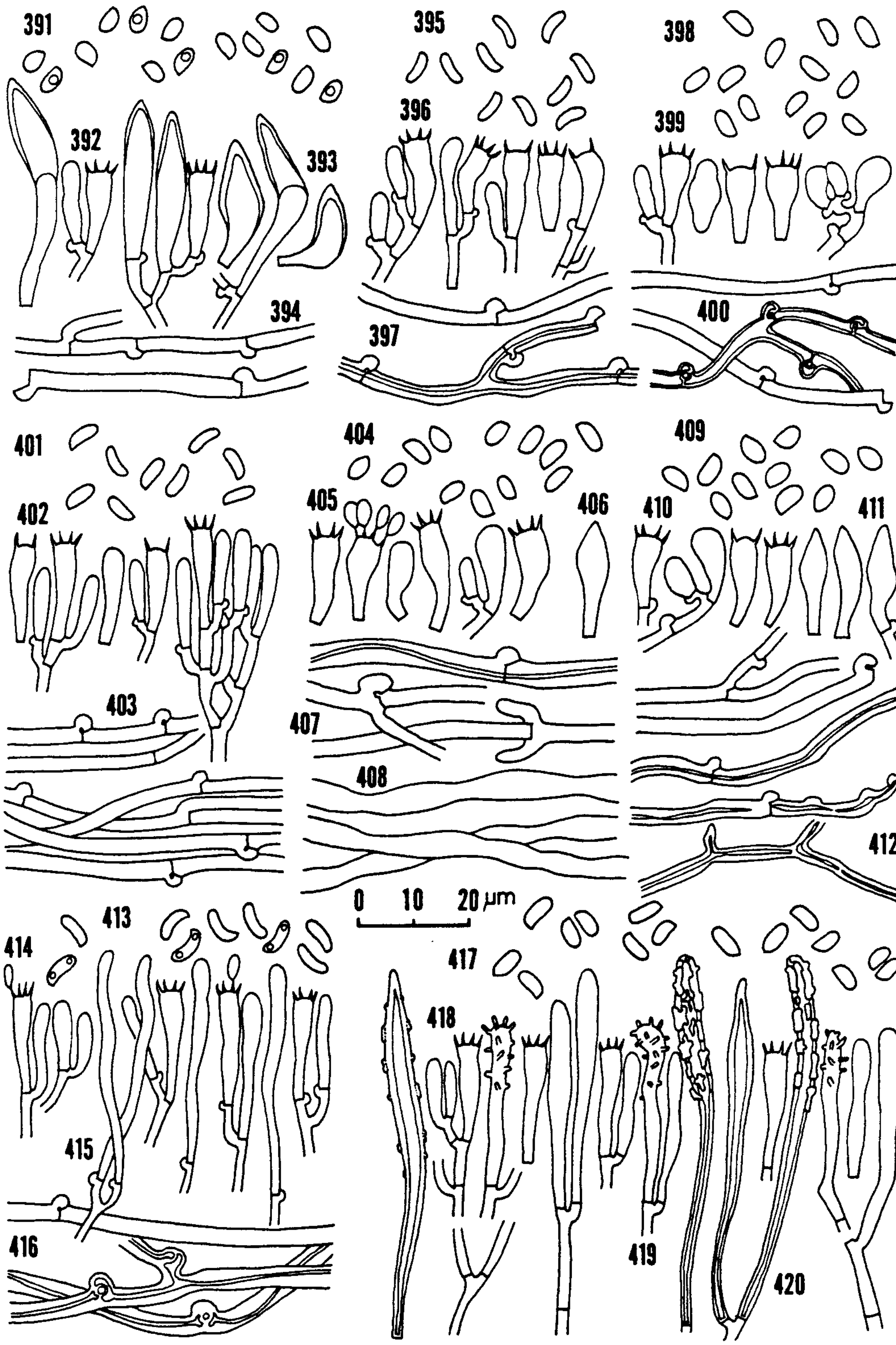
Figure 416. Generative hyphae of Tyromyces undosus.

Figure 417. Basidiospores of *Xylobolus subpileatus*.

Figure 418. Basidia of *Xylobolus subpileatus*.

Figure 419. Acanthocystidia of *Xylobolus subpileatus*.

Figure 420. Skeletocystidia of *Xylobolus subpileatus*.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VITA

Hack Sung Jung was born in Seoul, Korea, on September 9, 1946. He attended elementary and junior high schools in Pusan, and then moved in Seoul, where he graduated from Kyunggi High School in February 1965. He attended Seoul National University, Seoul, as a botany major from Spring 1965 to Winter 1972, during which time he served in the Korean Army as a medical soldier for three years.

Following his B.S., he attended the graduate school of the same university working as GA or TA and received his M.S. in Botany for the dissertation "Revision of the Korean Aphyllophorales" in February 1975. After that, he pursued a Ph.D. course but later spent most of his time working as an instructor of general biology and botany at a university and three junior and high schools.

In January of 1980, he immigrated in U.S.A., and spent two quarters at Virginia Polytechnic Institute, Virginia. After one year, he transferred to the University of Tennessee, Knoxville, to study with Professor Ronald H. Petersen in the Department of Botany. He is expecting the Ph.D. degree with a major in Botany in December, 1985. During his research, he undertook extensive field work throughout the Smoky Mountains and collected about 600 specimens mostly of resupinate fungi.

He is married to Jung Jung and has three sons, Sung and twin brothers, John and Paul.