

A TAXONOMIC STUDY OF THE POLYPORACEAE FUNGI OF THE
SANTA CATALINA AND PINALENO MOUNTAINS, SOUTHERN ARIZONA

by

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INTRODUCTION

No comprehensive study has ever been made of fungi of the family Polyporaceae occurring in the Santa Catalina and Pinaleno Mountains, Coronado National Forest, Arizona. Because of my avid interest in the fungi, I decided this would be the subject of my thesis. With due regard to the complexities of the problem, and knowing full well this paper would in no way be a monograph of this important family of wood rotting fungi, I believe it will constitute a careful analytical beginning for any future studies on these cryptogams. I hope to continue this work at a later date.

Although some may question the importance of this study, I should like to cite pertinent information with respect to possible objections:

1. Arizona's fourth most important industry is the production of lumber. In addition, the aesthetic value of forests for recreation has become an indispensable part of our life. Ninety per cent of the decay of our forest trees and lumber is due to the fungi of the family Polyporaceae (12:19). What does this mean to Arizona economically?

It is estimated that 15% of our merchantable trees of the southwest are destroyed by these decay organisms. This means that 15% of our standing timber is defective because of the wood rotting activities of fungi of the family Polyporaceae. This does not take into account destruction of wood in use such as fence posts, railroad ties, telephone and telegraph poles, wooden beams in bridges, and wood in storage.

2. No species of the Polyporaceae can be positively identified by macroscopic observations only. Therefore, by resorting to the microscope, one may learn a great deal about the anatomy, morphology, and taxonomy of the different species. This is indispensable in further studies such as fungus physiology.
3. It is important to take inventory of the fungi in every part of our earth. It is through these investigations that more knowledge is gained affording a basis for other scientific studies. Most of the famous personnel in the field of botany were first of all good taxonomists. They then narrowed their investigations to specifics that their interests directed.

4. It is through the taxonomy of fungi, that someday, we may hope to be able to fill some of the gaps in the present theory of evolution.
5. Finally, man's quest for the unknown seems to be imbued innately into his system of life. Man must know. Man must challenge. From the deepest to the highest, from the largest to the smallest, the quest continues. A new fungus lying before the mycologist is a thing of beauty, a challenge, a way to explore his world of the unknown, as much so, as any space traveler starting out into the voids of the universe.

It is with these points in mind that I endeavor to justify this thesis. May it add a small fraction of knowledge from which I or others may carry on.

THE FAMILY POLYPORACEAE

The plant kingdom has recently been divided into 12 main divisions. (16:306-307). Division 10 is called the Eumycophyta which is made up of the true fungi or those fungi whose plant body is usually composed of hyphae. Within this division are four classes: the Phycomycetes, the Ascomycetes, the Basidiomycetes, and the Fungi-Imperfecti. We are interested in class three, the basidium fungi or club fungi. Within this class is the order Agaricales, and, within the order, the more important families are: the Agaricaceae, the gill fungi,
the Polyporaceae, the pore fungi,
the Clavariaceae, the coral fungi,
the Hydnaceae, the tooth fungi,
the Thelephoraceae, the smooth fungi,
the Hypochnaceae.

The Polyporaceae for the past hundred years have been studied by mycologists and to some extent by mycophagists. With each new publication through the years the number of genera has changed drastically (12:4-10). (In the late eighteen hundreds, Fries in Europe listed 8 genera. Later in America, Murrill decided there were 58; then, Miss Ames included 16. Rea limited the genera

to 9. Boudot and Galzin recognized 20. Cooke lists 46 generic names.) (12:4-10).

Bessey (3:516-518) accepted 48 genera, and then placed these in 7 polymorphous genera. Overholts in 1946 (12:30-31), who has perhaps made the greatest contributions to the study of the Polyporaceae, recognized 10 genera:

Cyclomyces

Lenzites

Daedalea

Merulius

Favolus

Polyporus

Fomes

Poria

Hexagona

Trametes

Since 1946, other mycologists have added new genera or have given new names to old genera. As evidenced in volume after volume of Mycologia (11), much research has gone into classification by using culture methods, especially in separating closely related organisms into species or in the identity of those fungi in which no visible sporophore was present.

The family Polyporaceae, in general, have tubes or pores formed in a layer called the hymenium in which the basidia and basidiospores are produced. In some cases, areas may change into a somewhat toothed or lamellate hymenium. The sporophores may be either annual or perennial with the latter growth occasionally shown by stratifications of the tube layers for each season. These

basidiocarps may be sessile, effused-reflexed, resupinate, or variations of all of these. The pileus may vary from woody to coriaceous to fleshy and watery.

Most of the Polyporaceae are wood-inhabiting, living as parasites or saprophytes within or on the cell walls of the host plant. Most of these fungi invade the heartwood, while others live within the sapwood or both. All of them are able to dissolve by enzymatic action the lignin or the cellulose of the cell walls. If the remaining material left after digestion is white, then the fungus is the type using lignin as its source of food. If the remaining material is brown, then the fungus used only or mostly cellulose from the cell wall.

The spores of the Polyporaceae may be disseminated by the wind or other mechanical actions. Several varieties of spores can be produced by one species. Basidiospores, oidia, conidia, and chlamydospores may be produced and each of these may germinate, form mature mycelia, and may again produce any of the other types.

When a basidiospore lodges in a wound of a tree, and other environmental factors are favorable, the spore develops a uninucleated mycelium which invades the cells of the host. If mycelium from another germinating spore of the same species is not present, and therefore precludes

fusion to form a binucleate hyphal system then fusion will take place between hyphae from the same spore to form a binucleate mycelium (plasmogamy). This mycelium, unless conditions are favorable, may never produce a basidiocarp, basidia and basidiospores, but may produce only oidia, conidia, or chlamydospores. However, this may be called triple indemnity for the propagation of the species. Under a favorable environment, with plenty of moisture, the sporophore may be produced, which may appear as a sessile structure or in some other form visible on the host or on the ground.

The conidia and chlamydospores are reduplicating spores of the diplophase (oidia are uninucleate spores), and each germinate into binucleate mycelium. This binucleate mycelium may develop or produce uninucleate spores also or it may continue to grow and finally produce the basidiocarp. As each terminal end of the hyphae reaches maturity, then the appearance of clamp connections takes place, with each of the nuclei undergoing mitosis. Septations then appear with the familiar bypass clamp in the cross wall area.

If a sporophore is produced outside the host, it will have a hymenium or a spore-bearing surface. In general, this surface will be composed of pores lined

with club-shaped bodies called basidia. In the basidia, karyogamy takes place and then meiosis. Four sterigmata or small projections are formed at the tip of the basidium into which the four meiotic nuclei migrate. The basidiospores are formed on these sterigmata. As the spores mature, they fall, are ejected, or are blown from the sterigmata. Natural forces spread them throughout the countryside, beginning the life cycle over again and perpetuating the species.

GEOGRAPHICAL AREAS SELECTED FOR THIS INVESTIGATION.

Southern Arizona is essentially a desert covered mainly by such plants as the creosote bush, the salt bush, cacti, palo verde, bur sage, mesquite, and desert grass. Within the desert areas are extensive mountain ranges with almost complete changes in vegetation patterns. It is significant that these mountains are off-shoots of the Rockies, and that these studies involve an area on the western slopes. As one ascends one of these mountainous areas, chaparral and oak woodlands dominate the scene blending into pinon and juniper as the elevation increases. At approximately 5500 feet the small canyons become a native habitat for cypress, pine, walnut, and a variety of plants which cannot stand the intense heat and drouth of the desert. In the latter areas several of the family, Polyporaceae were collected.

In the higher mountain areas, large stands of Pinus begin at about 7000 feet. It is in these areas and above that most of the fungi of the forest can be collected. However, the north slopes of the mountains harbor more species than the southern slopes because of climatic and edaphic factors.

GEOGRAPHICAL AREAS SELECTED FOR THIS INVESTIGATION

Figure Ia.



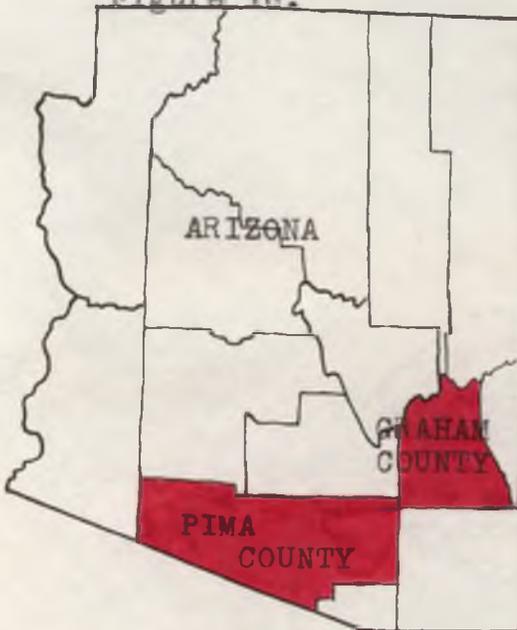
General extent of the Coronado National Forest...■

Figure Ib.



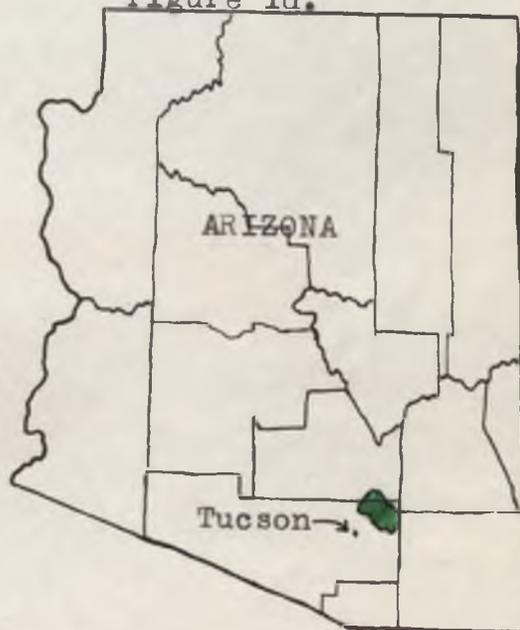
Pinaleno Mountains Collecting Area.....■

Figure Ic.



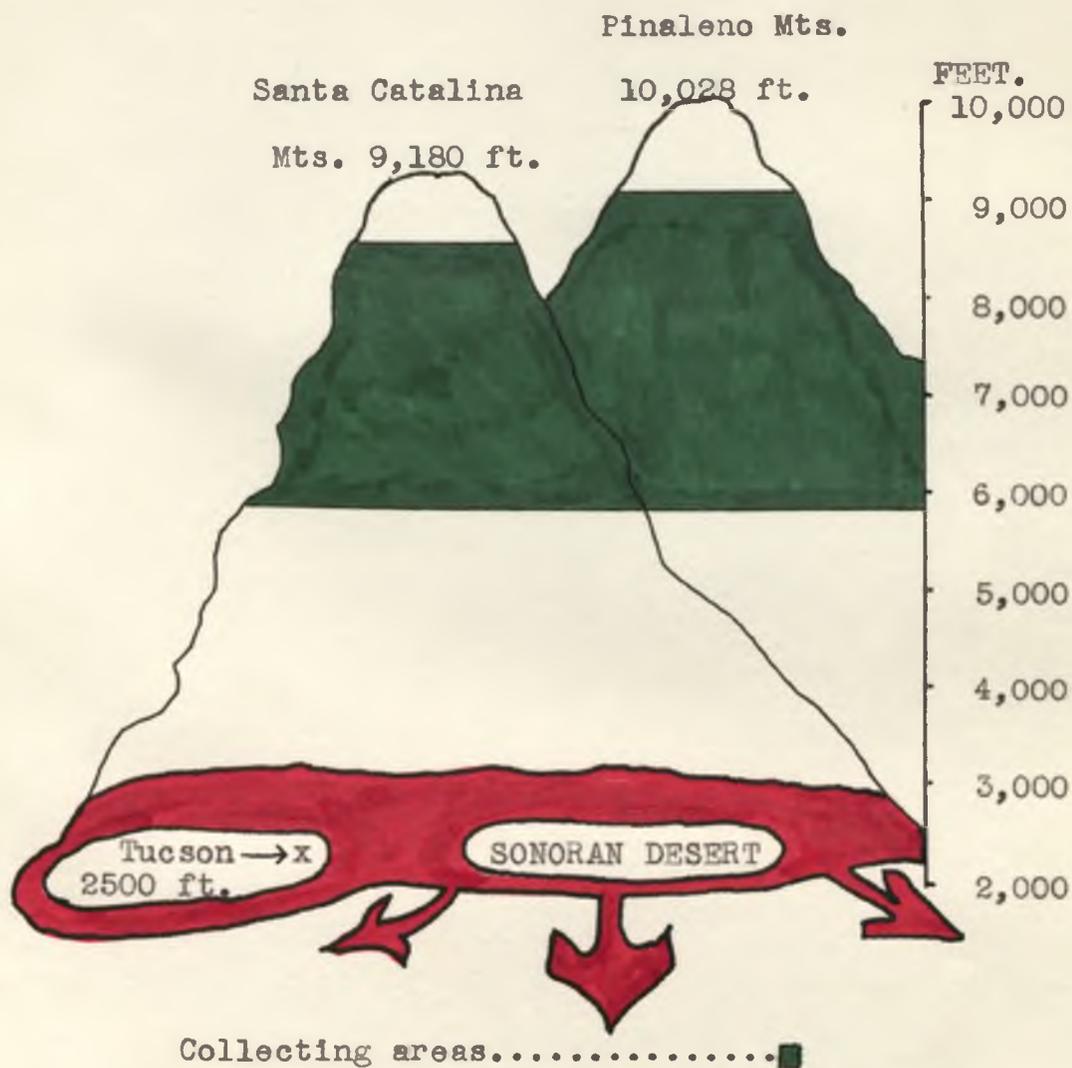
Counties.....■

Figure Id.



Santa Catalina Mountains Collecting Area.....■

Figure II. VERTICAL NORTH TO SOUTH PROFILE OF THE SANTA CATALINA AND PINALENO MOUNTAINS, CORONADO NATIONAL FOREST, SHOWING THE GENERAL COLLECTING AREAS AS TO ELEVATION.



TECHNIQUES, METHODOLOGY, and SOURCE MATERIALS
EMPLOYED in CHARACTERIZING the FAMILY POLYPORACEAE.

Techniques:

1. Collecting. Collections of these fungi were made in the summers of 1960 and 1961. Field characteristics were recorded and several experiments were carried out on proper drying procedures.
2. Macroscopic characteristics. As the identification of each fungus began, its "fresh state" characteristics were recorded. All macro-observations were recorded according to a "step by step" procedure before consulting the identification keys.
3. Microscopic characteristics. These characteristics can probably be considered the most important, however, data from all sources proved useful. Calibration of the microscope was made. After calibration, further measurements were made to verify the calibration markings against variations for this particular microscope. After all macroscopic and microscopic observations had been recorded, the keys to the Polyporaceae were checked for identification and verifications. In addition, full descriptions of species found in the literature based on collections by previous workers made elsewhere, were studied, and

comparisons made with Arizona specimens.

4. Preservation of specimens. To facilitate the checking and evaluation of the species at a later date, each sporophore or imbricated groups of sporophores were numbered, and placed in numbered boxes with the insecticide, paradichlorobenzene. These specimens will be added to the Cryptogamic Herbarium (Phytopathological Herbarium), University of Arizona, Tucson.

Methodology and Source Materials:

1. Terms used and description divisions. Each description of a species has been divided in the following way:

Sporophore	Hymenial Structure
Context	Hyphae
Pore Surface	Spores
Pores	Substrate
Stipe (if any)	Decay

This method facilitates using the description of the species, and the author feels that every mycologist should endeavor to follow this format. If one wishes to check a specific characteristic, he can immediately pin-point the area in question instead of covering the entire description of mycological terms.

2. Cumulative description. In compiling the first description of a species as set forth in this study, data from one to several known authorities were combined into a master characterization. This was done so that all essential differences in color, measurements, substrates, etc., could be taken into consideration. This composite description was divided as suggested under "terms used in descriptive divisions" (See 1., preceding).
3. Data from the Catalina-Pinaleno descriptions. Following the cumulative descriptions, the data, pertaining specifically to the Catalina-Pinaleno materials are given. Localities, morphological differences in the material, and outstanding characteristics of Arizona collections are thus emphasized and compared to those cited by authorities from collections elsewhere.

POLYPORUS VERSICOLOR L. ex Fries.

(Shope (14):323-324; Overholts (12):342-344.)

Sporophore--Sessile or effused-reflexed, imbricate, coriaceous when fresh, rigid when dry, reviving, sometimes connate, dimidiate, or conchate; pileus 7 x 10 x 0.5 cm. (larger in the tropics), concentrically zonate, at first velvety tomentose, gray to buff, with multicolored zones varying from white to yellow, reddish, greenish, bluish, and blackish, silky villose, rarely almost hirsute, alternate zones glabrous or nearly so.

Context--White, 0.5-2 mm. thick, rarely more than 1 mm.

Pore Surface--White, yellowish to brownish, rarely smoky, often glistening.

Pores--Angular, thin-walled, entire to becoming slightly lacerate, 3-5 per mm.; tubes up to 2 mm. long.

Hymenial Structures--Basidia 4-5 μ broad, hyphal pegs occasionally present, hyaline, usually incrustated; cystidia none.

Hyphae--Hyphae rarely branched, thick-walled, 3-11 μ in diameter, no cross walls or clamps; hyphal complexes often abundant with hyphae 3-4 μ in diameter.

Spores--Smooth, hyaline, cylindric to allantoid,
6-8(-10) x 1.5-3 μ .

Substrate--On dead wood or wounds of deciduous
and occasionally coniferous trees.

Decay--A general delignifying decay of the sapwood.

Description of Arizona Material:

Data--(Collection No. 115A). Sporophores from the
stumps of unidentified hardwoods. Elevation
ca. 8400 ft., Mt. Lemmon Ski run area, Santa
Catalina Mountains, Coronado National Forest,
northeast of Tucson, Pima County, Arizona.

The specimens were not only imbricated,
but also in rosettes. Even within the same
groups of sporophores from the same stump
there was considerable color variability, from
light olivaceous brown with not too well de-
fined concentric bands, to darker gray, red-
dish-brown, brown to blackish very concentric
well defined bands. The darker, more obvious
zones, under 10X or 20X consist of appressed
tomentum in these areas. The least zoned of
the sporophores were continuously villose over-
all, but as definite dark glabrous areas de-
veloped the zones between them became slightly
more strigose-villose.

The largest of the sporophores measured slightly more across (12 cm.) than the largest cited by the above authorities. The edges of the pore mouths in Arizona specimens were somewhat serrate viewed transversely. The spores were 1 μ longer than those cited by Overholts (12); however, Shope (14) found spores up to 10 μ , 3 μ larger than those of our specimens.

Sporophore--Sessile, effused-reflexed, dimidiate, imbricate to imbricate clusters or rosettes; pileus 7x12 x 0.3 cm., concentrically zonate, at first velvety-tomentose, gray-brown to yellowish-brown with glabrous to nearly glabrous zones darker brown to blackish, coriaceous when fresh, rigid when dry; margin 0.5-1 mm. wide, lighter in color, almost concolorous with the pore surface.

Context--White to yellowish-white, 1-2 mm. thick, soft-corky.

Pore Surface--Light brownish-yellow, glistening at certain angles of reflection.

Pores--Round to angular, slightly serrate, 4-5 per mm. tubes 1-1.5 mm. long.

Hymenial Structures--Basidia up to 3.5 μ in diameter, no cystidia or hyphal pegs.

Hyphae--Tramal hyphae 2-2.5 μ , hyaline, thin-walled, non-septate, some branching, a few darker hyphae up to 4.5 μ in diameter. Context hyphae 2-4.5 μ , hyaline, nonseptate, thin-walled, simple.

Spores--Hyaline, smooth, cylindric to allantoid, 7 x 2 μ .

Substrate--On unidentified hardwood stumps.

Figure 1a.



Figure 1b.

Figure 1a and 1b. Imbricated sporophores of Polyporus versicolor L. ex Fries, growing on deadwood of unidentified deciduous trees, Ski run area, Santa Catalina Mountains, Coronado National Forest.

FOMES IGNIARIUS (L. ex Fries) Kickx.

(Lowe (9)56-57; Overholts (12):60-64; Shope (14)
:382-383; Lloyd (8):245-246).

Sporophore--Sessile to decurrent, sometimes imbricate, occasionally resupinate, very hard and woody; pileus plane to convex to unguulate, 15 x 20-30 x 12 cm., grayish black to black, glabrous in age, rimose, often furrowed, with sometimes a slight crust, sometimes shiny, zonate; margin obtuse, sometimes thick and yellowish-brown, hirsute-tomentose to glabrous, grayish-black to black in age.

Context--Dark reddish-brown, up to 1 cm. thick, hard and woody.

Pore Surface--Brown to gray-brown.

Pores--Round to subcircular, rather thick-walled, entire, 4-5 (rarely 3-4) per mm., 8-10 per mm. in resupinate forms; tubes usually indistinctly stratified, white stuffed with hyphae 1-2 μ in diameter in older layers, 5 mm. long per season, chestnut to bay.

Hymenial Structures--Setae absent to infrequent to abundant, pointed, projecting 8-18 μ beyond the

hymenium, 4-8 μ broad, ventricose; basidia clavate, 9-11 x 5-7.5 μ .

Hyphae--Context hyphae dark brown, rarely branched, 3-5 μ in diameter, thick-walled; tramal hyphae 2-3 μ in diameter, brown, no clamps or cross-walls.

Spores--Smooth, hyaline, globose or subglobose, 4-7 x 3-5.5 μ .

Substrate--On trunks of living or dead deciduous trees.

Decay--A destructive heart rot, reducing wood to soft, spongy, whitened mass.

Description of Arizona Material:

Data--(Collection No. 108A, 108B, 108C). Sporophores from Populus at three locations, Ski run area at ca. 8400 ft. elev., Bear Wallow at ca. 7600 ft. elev., Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, and Soldier's Camp, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Ariz.

Characteristics of the Arizona material are well within the limits of those cited by the authorities. However, some brown spores were noted in a few of the sporophores mixed with the hyaline spores. This brown characteristic may be due to the age of the spores.

Sporophore--Sessile to decurrent to resupinate, hard and woody; pileus 10 x 12 x 7 cm., unguulate, convex, grayish-black to black, glabrous, rimose; margin obtuse, hirsute, tomentose to glabrous, and black in age.

Context--Up to 7 mm. thick, dark brown, hard, woody.

Pore Surface--Velvety-brown to gray brown.

Pores--4-5 per mm., round, thick-walled, entire; tubes slightly stratified, 2 mm. long each season, old layers white stuffed.

Hymenial Structures--Setae very rare, 3.5 μ broad, projecting 7-9 μ beyond the hymenium.

Hypogae--Mostly small, 2 μ in diameter, branching, non-septate, brown, up to 4.5 μ in diameter, average thickness of the walls.

Spores--Smooth, hyaline, rarely brown, globose, 4-5 x 3-3.5 μ .

Figure 2a.



Figure 2b.

Figure 2a and 2b. Sporophores of Fomes igniarius (L. ex Fries) Kickx, growing on living Populus tremuloides Michx., Pinaleno Mountains, Coronado National Forest.



(P. D. Keener)

Figure 2c. Cross-sectional view of a Populus tremuloides log, showing the soft, white, spongy, "aspen rot" attributed to the enzymatic action of Fomes igniarius.

POLYPORUS SUBCHARTACEUS (Murr.) Overh.

(Overholts (12): 338-339; Shope (14):331-332).

Sporophore--Sessile to slightly effused, dimidiate to conchate, broadly attached, tough and flexible when fresh, drying rigid or very slightly flexible, reviving; pileus 5 x 10 x 1 cm., gray or cinereous or with a tinge of yellowish on drying, villose-tomentose to slightly hispid tomentose, distinctly or indistinctly zonate.

Context--Duplex, hard corky below, spongy above, white to light buff, 2-5 mm. thick.

Pore Surface--Livid violet or lavender-violaceous in young plants, to bay or darker, to avellaneous.

Pores--Mouths rather thick-walled, entire then lacerate, but never irpiciform, 2-3 per mm., round or angular; tubes 1-6 mm. long.

Hymenial Structure--Cystidia usually abundant, incrusted at the apex, 4-5 μ in diameter, projecting up to 15 μ .

Hyphae--Context hyphae, of hard corky context, yellowish, branched, 4-6 μ in diameter.

Spores--Cylindric to allantoid, slightly curved, smooth, hyaline, 7-9 x 2-3 μ .

Substrate--On the dead wood of deciduous trees, especially Populus, perhaps occasionally on other substrata.

Decay--General delignifying decay of the sapwood.

Description of Arizona Material:

Data--(Collection No. 113A). Sporophores from dead wood in the Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona at ca. 8400 ft. elev.

There are two outstanding characteristics which should be stressed at this point. The context is duplex with a soft tomentose light gray upper layer lying upon a hard corky buff brown lower layer to which the tubes are attached. The capped or incrustated cystidia are very prominent, protruding from the hymenial layer. They have the appearance of protruding hyaline basidia with darker caps at their apex.

Sporophore--Sessile, dimidiate, imbricate, effused-reflexed, flexible; watery, and coriaceous when fresh, rigid when dry, reviving; pileus 6 x 9 x 0.3 cm., appanate, broadly attached, zonate with the zones covered by lighter colored (almost white) tomentum, fibrillose tomentose to glabrous,

mostly dingy grayish-white with a tinge of yellow in age.

Context--Duplex, with the upper layer soft tomentose, the lower layer hard corky, buff brown, merging into the tubes below, up to 2 mm. thick.

Pore Surface--Bay to dark gray in age, poroid to daedaloid.

Pores--2-4 per mm. where poroid, rather thick-walled, lacerate, round to angular; tubes 1-2 mm. long.

Hymenial Structures--Cystidia abundant, protruding beyond basidia 9-15 μ , 4-5 μ wide, incrusted at the apices, appearing capped.

Hyphae--Tramal hyphae hyaline, 2-5.5 μ in diameter.

Spores--8-9 x 2-2.5 μ , cylindric to allantoid, slightly curved, smooth, hyaline. It should be noted here that, primarily, the large spore size, and also the duplex context, and the lacerate pore mouths place this fungus under Polyporus subchartaceus and not under its very close relative, Polyporus pargamensis.



Figure 3a.



Figure 3b.

(P. D. Keener)

Sporophores of Polyporus subchartaceus (Murr.)
 Overh. from dead unidentified coniferous trees. Fig. 3a.
 Imbricated forms in natural habitat. Fig. 3b. View of
 pileus surface and lavender-violaceous pore surface.

POLYPORUS SCHWEINITZII Fries.

(Shope (14):347-349; Overholts (12):395-397).

Sporophore--Stipitate or occasionally sessile, infundibuliform, watery, spongy, soft corky, rigid and brittle when dry; pileus 50 cm. broad, 0.5-4 cm. thick, azonate to zonate, rugulose, strigose tomentose to woolly tomentose, ochraceous, orange, to rusty-brown.

Context--Soft, spongy, drying fragile-friable, homogeneous to somewhat duplex, 0.2-3 (-6) cm. thick, yellowish to reddish-brown, black in KOH.

Pore-Surface--Yellowish or greenish-yellow, darkening in age where bruised.

Pores--Mouths irregular, unequal size, thin-walled, entire to dentate, 1-3 per mm., some confluent up to 2 mm. broad; tubes decurrent, 1-10 mm. long.

Stipe--Concolorous with pileus, central, excentric, lateral or wanting, 0-6 cm. long, 1-4 cm. thick, tomentose, soft.

Hymenial Structures--Cystidia never abundant, often rare, brown or hyaline, or brown at the base, cylindrical, subclavate or knobbed at the apex,

projecting 20-60 μ , 8-10 μ broad; basidia yellow, 4 spored, 6-8 μ in diameter.

Hyphae--Dark brown to chestnut, branched, 6-12 μ in diameter, thin-walled, no cross walls or clamps.

Spores--Hyaline, smooth, ovoid-ellipsoid, 5.5-8 x 4-5 μ .

Substrate--Trunks or roots of coniferous trees, rarely on deciduous trees.

Decay--Cubical red brown butt rot.

Description of Arizona Materials:

Data--(Collection No. 116A, 116B, 116C). Sporophores from buried weed in the ground and from the bases of dead coniferous trees, at Bear Wallow ca. 7600 ft. elev., and the Ski run area ca. 8400 ft. elev., Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

The important aspects of the Catalina collections are the abundance and structure of the cystidia, and the large size and septations of the context and tramal hyphae. The cystidia are large with echinulate knobs which are apparently unusual. Both Shope (14:plate 25) and Overholts (12:plate 132) show cystidia for

Polyporus schweinitzii which are cylindric.

However, Overholts (12:395-396) states,

"---sometimes knobbed at the apex;---"

Both the context and tramal hyphae of our specimens were up to 18 μ in diameter, 6 μ larger than any seen by the authorities cited. Overholts gives no cross walls as a characteristic, but in both the tramal hyphae and in the context hyphae the septations are very evident in the Arizona material. All the other characteristics fit well within the limits cited by the authorities.

Sporophore--Stipitate to substipitate to sessile, infundibuliform, ascending; pileus 5 x 6 x 2 cm., very tomentose, round to irregular, rugose, dark rusty-brown to concentric bands of various shades of rusty-brown to orange brown in dry specimens. When fresh, golden brown to red orange on the edge of the pileus to yellow orange in the center of the pileus, soft and spongy, drying rigid and brittle; margin obtuse, to acute on older specimens.

Context--Rusty-brown, soft punky and fibrillose, friable when dry, up to 3 cm. thick, black in 5% KOH.

Pore Surface--Rusty-orange to yellowish-orange when fresh.

Pores--Very irregular, thin-walled, angular, 1-2 per mm., some confluent up to 2 mm. broad; tubes 1-3.5 mm. long, decurrent.

Stipe--6 cm. long, 4 cm. thick, texture and color as of the context, central, excentric, or none.

Hymenial Structures--Cystidia abundant, incrustated, knobbed, 9-10 μ in diameter, to 51 μ long, projecting beyond the hymenium. Knobs appear echinulate. Basidia 5 μ in diameter.

Hyphae--Context hyphae chestnut brown, septate, branched, 5-18 μ in diameter; tramal hyphae 3.5-18 μ , septate, branched, chestnut brown.

Spores--Ovoid to subglobose, hyaline, smooth, 5.5 x 3.5 μ .



Figure 4a.

(P. D. Keener)



Figure 4b.

Figure 4a and 4b. Sporophores of Polyporus Schweinitzii growing from buried wood, Santa Catalina Mountains, Coronado National Forest.



(P. D. Keener)

Figure 4c. Typical brown, cubical rot, caused by such fungi as Polyporus Schweinitzii and Fomes pinicola.

FOMES CAJANDERI Karst.

(Lowe (9):70-71; Overholts (12):57-60).

Sporophore--Sessile or effused-reflexed, solitary to imbricate, coriaceous to corky, drying subflexible to rigid; pileus appanate, convex, unguulate, conchate, up to 7 x 12 x 2 cm., pinkish-red to pinkish-brown changing to grayish to black with age, finely and compactly tomentose changing to nearly glabrous, or becoming radiately fibrillose or rugulose, not incrustated, never rimose, zonate to azonate; margin acute.

Context--Rosy pink, pinkish-cinnamon, or pinkish-brown, reddish-brown in age, soft-corky to corky, up to 15 mm. thick, indistinctly zonate.

Pore Surface--Pinkish-red, pinkish-brown, to reddish-brown in age.

Pores--Circular to subangular, moderately thick-walled, entire, 3-5 per mm.; tubes distinctly stratified to indistinctly stratified, not reviving for more than 2 or 3 years.

Hymenial Structures--Cystidia none; basidia clavate, 12-14 x 4-6 μ ; hymenial layer 13-15 μ thick.

Hypphae--Context hyphae rarely branched, thin to

moderately thick-walled, nonseptate, some thin-walled clamped hyphae, 2.5-5 μ in diameter, long and flexuous; tramal hyphae similar.

Spores--Narrow-cylindric, hyaline, allantoid, smooth, 4-8 x 1.5-2.5 μ .

Substrate--On the dead wood of coniferous trees, rarely on deciduous trees, throughout the north temperate zone.

Decay--A brown rot of the wood of gymnosperms, rarely angiosperms, and a carbonizing pocket rot of stone-fruit trees and Thuja.

Description of Arizona Material:

Data--(Collection No. 109A, B, C, D). Sporophores from dead coniferous logs and branches, Bear Wallow and Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, and Chesly Flat, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona.

Specimens No. 109 are well within the limits cited by the authorities. Careful considerations were given to the spores so that there would be no mistaken identity with Fomes roseus.

Sporophore--Sessile to effused-reflexed to entirely

resupinate in young developing sporophores, solitary to imbricate, in a moist habitat generally imbricate, leathery, corky, drying rigid; pileus applanate, convex, 6 x 12 x 2 cm., light pinkish-tan, to gray, to gray-brown, to grayish-black, to black, finely tomentose in the young specimens to glabrous in age, zonate to azonate; margin acute, zonate in old sporophores which are gaining new growth.

Context--Pinkish-cinnamon to pinkish-brown, corky, up to 15 mm. thick, indistinctly zonate.

Pore Surface--Rosy-pink to pinkish-brown, to tan, to cinnamon brown.

Pores--4-5 per mm., round to subangular, entire, somewhat thick-walled; tubes distinctly stratified, up to 3 mm. long per season, older tubes white-stuffed.

Hymenial Structures--Cystidia and setae none.

Hyphae--Context and tramal hyphae similar, simple; larger hyphae, up to 5 μ in diameter, light brown, to hyaline, thin to average wall thickness; smaller hyphae, 1.5 x 2.5 μ in diameter with some branching and clamps, nonseptate.

Spores--Hyaline, smooth, allantoid, cylindric, 5-7 x 1.5-2.5 μ .

Figure 5a.



Figure 5b.

Figure 5a and 5b. Basidiocarps of Fomes cajanderi Karst, growing on coniferous logs, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Southern Arizona. Previous authorities had recorded a maximum size of 12 cm. Some of the basidiocarps in Fig. 5a. attained a maximum size of 33 cm. in length.



(P. D. Keener)

Figure 5c. Basidiocarps of Fomes cajanderi growing on a coniferous stump. Pinaleno Mountains, Coronado National Forest.

GANODERMA APPLANATUM (Pers. ex Wallr.) Pat.

Fomes applanatus (Pers. ex Wallr.) Gill. (12:98)

(Shope (14):374-376; Overholts (12):98-102).

Sporophore--Sessile, perennial, applanate, rarely effused-reflexed, hard, woody; pileus 30 x 50 x 15 cm., usually grayish or grayish black, some times brown, crust 1 mm. or less in thickness, horny, hard, maybe indented by the thumbnail, cracked, or furrowed, sometimes pulverulent; margin round.

Context--Soft-punky to soft-corky, brown, sometimes whitish, zonate, 0.5-12 mm. thick.

Pore Surface--White, buff, to yellow, darker where bruised, becoming yellow or umber or with a slight olivaceous tinge in dried plants, concolorous with the tubes in age.

Pores--Mouths round, thick-walled, entire, 4-6 per mm.; tubes distinctly stratified, separated by a context layer of 0.5-2 mm. thick, 4-12mm. long each season.

Hymenial Structures--Cystidia rare, found in young hymenium as flask-shaped organs 6-10 μ in diameter; basidia 5-12 μ in diameter; simple or forked hyphae which do not have the characteristics of cystidia extending beyond the hymenium.

Hyphae--Brown, nearly simple, sparingly branched thin-walled to thick-walled, nonseptate, no clamps, up to 4-7 μ in diameter, tapering out to hyaline branched hyphae 2-4 μ in diameter, some branched hyphal complexes present.

Spores--Brown, ovoid, truncate, 6-9 x 4.5-6 μ , appearing slightly echinulate.

Substrate--Usually on logs or stumps of deciduous trees, but also found on coniferous wood.

Decay--A white or straw-colored, mottled, delignifying decay of the sapwood and the heartwood.

Description of Arizona Materials:

Data--(Collection No. 114A, 114B). Sporophores from the base of hardwood stumps, Ski run area, ca. 8400 ft. elev., Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

In some of the specimens it was noted that the tube mouths were plugged with small diameter (ca. 1 μ) branching white mycelium. This mycelium apparently gives the white color to fresh specimens when viewed by the unaided eye.

Sporophore--Sessile, applanate, hard, woody; pileus 16 x 23 x 6 cm., blackish-gray to lighter gray,

rugose; crust hard, but can be indented by the fingernail, 0.2-0.3 mm. thick.

Context--1-4.5 cm., dark brown to avellaneous, soft-punky to soft-corky, black in 5% KOH.

Pore Surface--White to darker where bruised having a slight, olivaceous tinge in these areas.

Pores--4-5 per mm., round, to angular, thick-walled; younger tubes filled with white mycelium at the mouths; older tubes white stuffed in the secondary strata; tubes to 8 mm. long per season, stratified by a distinct layer, 1-1.5 mm. thick, of brown context.

Hymenial Structures--Fine (1-2 μ), branching, hyaline mycelium projecting beyond the basidia in young pore areas; flask-shaped hyaline projections, which do not resemble cystidia, 20-23 μ long in the hymenial layer.

Hyphae--Tramal hyphae hyaline to brown, nonseptate, 1-4.5 μ , with the hyaline hyphae much branched; context hyphae brown, no branching, thick-walled, 3-4.5 μ , intermixed with hyaline hyphae 2-3.5 μ , thin-walled, very branched.

Spores--9-10.5 x 5 μ , brown, thick-walled, ovoid, truncate, appearing slightly echinulate.



Figure 6a.

(P. D. Keener)



Figure 6b.

Sporophores of Ganoderma applanatum found growing from Populus tremuloides. Figure 6a. View of top of pileus. Figure 6b. Showing distinct stratification.

FOMES PINICOLA (Swartz ex Fries) Cooke.

(Overholts ((2):42-44; Lowe (9):85; Shope (14);
377-379).

Sporophore--Sessile, decurrent on substratum, hard corky to woody; pileus sometimes entirely resupinate, unguulate or applanate, 30 x 40 x 22 cm., glabrous, sulcate, often resinous, red brown to brown to blackish, in age grayish to black; margin obtuse and usually a lighter color than the rest of the pileus.

Context--Up to 2 cm. thick, pallid to light brown, corky to woody, dark reddish-brown in KOH.

Pore Surface--White to amber to light yellow, darkening where bruised when fresh.

Pores--Round, 3-5 per mm., edges thick, entire; tubes 3-5 per mm. long each season, very distinctly stratified.

Hymenial Structures--Basidia clavate, 6-8 μ in diameter; cystidia absent; cystidial hairs 2-3.5 μ in diameter often projecting above basidial layer 30 μ , but only present in a mature hymenium.

Hyphae--Simple, hyaline, no cross walls or clamps 4-9 μ in diameter; occasionally thin-walled,

clamped hyphae 2-4 μ in diameter; tramal hyphae 3-5 μ in diameter.

Spores--Hyaline, smooth, ellipsoid to ovoid, apiculate, 5-8 x 3-5 μ .

Substrate--Dead trees, stumps, and logs of both deciduous and coniferous wood.

Decay--Carbonizing, brown, crumbly rot which fractures extensively.

Description of Arizona Material:

Data--(Collection No. 107A, B, C, D, E, F). The sporophores from coniferous logs, Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, and from coniferous trees and logs, Mt. Graham, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona.

Agriculture Handbook No. 165 (1:349) states that his fungus, the cause of brown cubical trunk rot is very widespread and is the most prevalent cause or deterioration of dead trees in Oregon and Washington. Shope (14:378) states that this fungus is "parasitic and saprophytic on all conifers." Lowe (9:84)

gives the hosts as the gymnosperms of Western United States and Alaska with the fungus being found occasionally on angiosperms. Overholts (12:43) states the fungus is found on both deciduous and coniferous trees living or dead.

Sporophore--Sessile, woody; pileus convex to unguulate, sulcate, glabrous, with the upper part brown blending to a resinous reddish-brown toward the margin; margin obtuse, varying from dark brown to light brown contrasting with the reddish brown above.

Context--Corky to woody, pallid to light brown, up to 2 cm. thick.

Pore Surface--Cream colored to brownish-yellow. (It should be noted here that of some eleven specimens collected, none show any signs of darkening where bruised when collected fresh, as was cited by the authorities.)

Pores--3-4 per mm., round, entire; tubes distinctly stratified by a solid layer, corky, up to 15 mm. long. (Only one of the many layers of tubes examined had the exceedingly long tube length of 15 mm., perhaps due to unusual environmental factors in 1959 at one of the locations cited.)

In the mountainous areas of the Southwest, rains have a tendency to strike certain areas very favorably one year while the next year the same areas may receive very sparse precipitation.)

Hymenial Structures--Cystidial hairs absent on many sporophores examined which is probably due to the immature hymenial layers, (14:378). Hairs projecting above basidial layer 27-30 μ 2-3.5 μ in diameter. Basidia clavate, sometimes broken loose and protruding above the hymenial layer as much as 48 μ .

Hyphae--Context hyphae walls medium thick, non-septate, rarely branched, 3.5-7 μ in diameter; smaller hyphae 1.5-3.5 μ in diameter with clamps; tramal hyphae 3.5-6 μ .

Spores--Absent on many of the basidiocarps examined, hyaline, smooth, ellipsoid to ovoid, 5.5-9 x 3.5-5.5 μ .

Figure 7a.



Figure 7b.

Figures 7a and 7b. Fruiting bodies of Fomes pinicola (Swartz ex Fries) Cooke., growing on dead coniferous trees, Ski run area, ca. 8400 ft. elev., Santa Catalina Mountains, Coronado National Forest.

FOMES ROBINIAE (Murr.) Sacc. & D. Sacc.

(Overholts (12):96-97; Lowe (9):22-23).

Sporophore--Sessile, hard, woody; pileus dimidiate, applanate to unguulate, 20 x 30(-43) x 15 cm., brown, velvety, dark, strigose, then glabrous, black, rimose and sulcate with age; margin brown velvety.

Context--Woody, yellowish-brown to reddish-brown, usually paler streaks, hard to soft and fibrous, up to 3 cm. thick.

Pore Surface--Yellow brown to deep rich brown.

Pores--Round, entire, edges thick, 5-8 per mm.; tubes indistinctly stratified, up to 5 mm. long each year.

Hymenial Structures--No setae.

Hyphae--Brown, walls partly thickened, occasionally branched and septate, 3-5 μ in diameter; tramal hyphae nonseptate, 2.5-3 μ in diameter, thick-walled.

Spores--Light to chestnut to dark reddish-brown, smooth, broadly oval to subglobose, 4-5.5 x 3.5-5 μ .

Substrate--On living or dead wood of the family

Leguminosae, mostly on Robinia. Also found on other deciduous trees.

Decay--Delignifying type, wood reduced to soft spongy, yellowish or pale brownish mass, in pockets or over entire width of tree.

Description of Arizona Material:

Data-- (Collection No. 106A, 106B). Sporophores from Robinia neomexicana Gray. (6:442) above the "service area" on Swift Trail near the store-lodge-cottage area, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona; and from the same host at the Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

The fungus causes a yellow heartrot of locust (9:22). Seymour (13:427) lists Robinia neomexicana Gray as the host for F. robiniae, however, the Agriculture Handbook No. 165 (1:270) uses the binomial F. rimosus (Berk.) Cke., as the fungus on Robinia neomexicana Gray. Lowe (9:22) does not agree with this binomial and states that "the fungus described here, is the one traditionally known as Fomes rimosus (Berk.) Cooke.", and then goes on to discuss

why the binomial should be Fomes robiniae
(Murr.) Sacc. & D. Sacc. Overholts (12:96)
lists the most common host as Robinia.

Sporophore--Sessile, appanate to ungnlate, growing
on the living host at approximately from 4 to 10
ft. above the ground. Pileus characterized by a
light brown, very tomentose, small area at the
top of the pileus which in turn is followed by a
large sulcate, glabrous, black and rimose area,
up to 8 x 17 x 7 cm. in size, with a wide,
1-1.5 cm., brown and velvety margin.

Pore Surface--A dark brown, but in areas covered by
tomentum the color changes to light brown.

Pores--Mouths 4-5 per mm., round, entire; tubes very
indistinctly stratified with yearly growth up
to 3 mm.

Context--Very hard and fibrous, reddish-brown, black
in KOH.

Hyphae--Context hyphae 3.5-4.5 μ , thick-walled, rare-
ly branched or septate, yellowish-brown in color.
Tramal hyphae 2.5-3.5 μ in diameter, thick-
walled, nonseptate, and yellowish-brown.

Hymenial Structures--No setae or cystidia.

Spores--3.5-4.5 x 5.5 μ , subglobose, yellowish-brown,

and smooth.

The characteristics fit very well with the authorities cited. However, the tomentum on the pore surface is not mentioned by the previous authors, but is very evident on most of the sporophores. The pores of the Arizona specimens are slightly larger, being 4-5 per mm., but fall within the range of 5-8 per mm.



(P. D. Keener)

Figure 8a. Sporophores of Fomes robiniae (Murr.) Sacc. & D. Sacc., growing from its most common southern Arizona host, Robinia neomexicana. Pinaleno Mountains, Coronado National Forest. Note the reddish-brown spore deposit on the tree bark below the hymenial layers.

FOMES PINI (Thore ex Pers.) Lloyd.

(Lowe (9):47-48; Overholts (12):76-79;

Shope (14):379-380).

Sporophore--Sessile, decurrent, hard, woody; pileus applanate to convex to unguulate, to effused-reflexed or conchate, 15 x 25 x 15 cm., tomentose in zones, in age turning glabrous, blackish, rimose, sulcate; margin velvety tomentose.

Context--Up to 5 mm. thick, tawny to ochraceous tawny, woody, black in KOH.

Pore Surface--Ochraceous orange to brown.

Pores--1-4 per mm., or in poroid forms 4-5 per mm., rounded to angular to daedaloid, thick-walled entire; tubes 2-6 mm. long each season.

Hymenial Structures--Basidia 5-6 μ in diameter; setae abundant, sharp-pointed, brown, extending 15-30 μ beyond the basidia, subulate, 7-15 μ in diameter.

Hyphae--Simple, brown, nonseptate, no clamps, 3-6 μ in diameter.

Spores--Hyaline, to brown in age, globose or subglobose, 4-6 x 3.5-5 μ .

Substrate--On living or fallen trunks of coniferous

trees, rarely on hardwoods.

Decay--Causes a greater timber loss through decay of the heartwood of living trees than does any other fungus. The rot is known as "conch rot" and is a delignifying decay of the pocket forming type, with the decayed wood having a speckled appearance. (12:78).

Description of Arizona Material:

Data--(Collection No. 111A). Sporophores from living coniferous trees, ca. 8400 ft. elev., Ski run area, Santa Catalina Mountains, Coronado National Forest near Tucson, Pima County, Arizona. Characteristics of our specimens are well within the limits cited by the authorities. However, a few minor differences will be noted. The pileus and the pore surfaces were very irregular, large amounts of crystalline granules were observed in the context amongst the mycelium, and although Overholts (12:77) states the hyphae to be nonseptate, we found thin septations in both the context and the tramal hyphae.

Sporophore--Perennial, sessile to decurrent, hard and woody; pileus dark brown to black, unguulate,

rimose, sulcate, zonate, very irregular in shape, 5 x 9 x 6 cm.; margin very irregular, chestnut brown, velvety-tomentose.

Context--Up to 2 mm. thick, dark reddish-brown to black, with large numbers of crystalline granules interspersed with the hyphae, much harder and firmer than the tube hyphae below; black in 5% KOH.

Pore Surface--Ochraceous to reddish-brown, surface very irregular.

Pores--Mouths circular to ellipsoid to daedaloid, 1-3 per mm.; tubes very indistinctly stratified, up to 5 mm. long each season; black in 5% KOH.

Hymenial Structures--Setae very numerous, subulate, brown, projecting beyond the hymenium from 27-35 μ , 7 μ wide at the base.

Hyphae--Tramal hyphae light brown, thick-walled, non-branching, septate, 3.5 μ in diameter, dark brown in 5% KOH. Context hyphae light brown, simple, non-branching, septate, 4-4.5 μ in diameter.

Spores--Hyaline to brown, globose to subglobose, 4.5 x 4 μ .



Figure 9a.

(P. D. Keener)

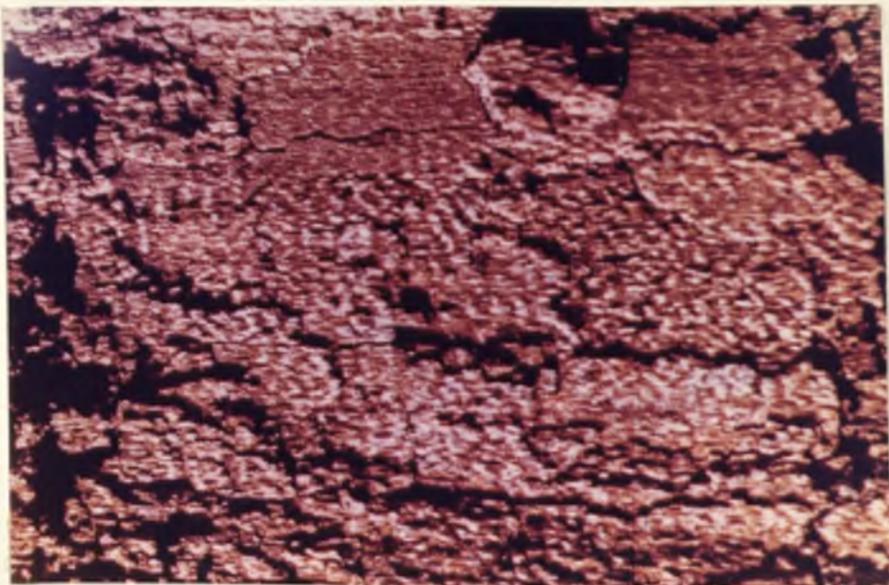


Figure 9b.

(P. D. Keener)

Figure 9a. Small sporophores of Fomes pini growing where dead branches occur on Pseudotsuga Menziesii. Figure 9b. The speckled, delignifying, pocket rot of Fomes pini which causes a greater timber loss through decay of the heartwood than does any other fungus.

LENZITES SAEPIARIA (Wulf. ex Fries) Fries.

(Overholts (12): 111-113).

Sporophore--Sessile or effused-reflexed, coriaceous to rigid; pileus dimidiate, 7 x 10 x 1 cm., bright yellowish-red to tobacco colored or dark ferruginous; margin white, yellow, or orange, hirsute-tomentose to fibrillose-tomentose or nearly glabrous or with a very compact tomentum at maturity, zonate.

Context--Yellowish-brown or rusty-brown, 1-3 mm. thick, soft-corky, black in KOH.

Pore Surface--Brown, daedaloid to poroid to toothed, but usually lamellate, the lamellae 0.5-1 mm. apart, 2-5 mm. broad.

Hymenial Structures--Cystidia rare, cylindric, pointed, hyaline, 3-5 μ in diameter, projecting but slightly beyond the basidia.

Hyphae--Mostly pale chestnut, rarely branched, thick-walled, nonseptate, no clamps, 3-5 μ in diameter, a few hyphae nearly hyaline with clamps.

Spores--Cylindric, smooth, hyaline, 6-10 x 2-4 μ .

Substrate--On the dead wood of both coniferous and hardwood trees.

Decay--A brown checked carbonizing decay of both sapwood and heartwood, especially in structural timbers, railroad ties, and the like.

Description of Arizona Materials:

Data--(Collection No. 112A). Sporophores from a dead hardwood branch at the Ski run area, ca. 8400 ft. elev., Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

The reasons for placing the specimens into Lenzites saepiaria instead of Lenzites trabea are, (a) the tobacco to buckskin brown colored pileus, (b) the bright orange color of the margin, and (c) the distinctly lamellate hymenium.

Sporophore--Sessile to decurrent to effused-reflexed, to resupinate, coriaceous to rigid; pileus 2 x 4 x .7 cm., buckskin brown, tomentose; margin orange to very light brown, tomentose, and soft.

Context--Orange brown to buff brown to rusty brown, up to 5 mm. thick, soft corky, black in 5% KOH.

Pore Surface--Tan to light buckskin color, lamellate, lamellae 0.3-1 mm. apart, length of lamellae 2-3 mm.

Hyphae--Tramal hyphae hyaline to light brown, 1.5-4.5

μ in diameter, nonseptate, no branching; context
hyphae light brown, 3.5-4.5 μ in diameter, no
branching, nonseptate.

Spores--10-12 x 1.5-3.5 μ , hyaline, curved, reniform-
ellipsoid to allantoid.



(P. D. Keener)

Figure 10a. Pileus and pore surface of sporophores of Lenzites saepiaria (Wulf. ex Fries) Fries, the fungus which causes extensive damage to structural timbers, railroad ties, lumber, etc., by enzymatic action on both the sapwood and heartwood. Specimens from a log of Populus tremuloides, Bear Wallow, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

POLYPORUS VOLVATUS Peck.

(Lloyd (7):313; Overholts (12):351-352;
Shope (14):321-323).

Sporophore--Sessile or rarely stipitate or pseudo-stipitate, globose or compressed-globose, 3 x 8.5 x 4 cm.; pileus a hollow globe with an opening behind, tough corky to woody, drying rigid, slightly incrustated with a resinous crust, whitish to yellowish, drying ochraceous, bay, or somewhat chestnut or tinged with red, glabrous; margin obtuse and continuous with the volva which forms a veil-like covering over the pore surface.

Context--White, buff, 2-10 mm. thick.

Pore Surface--White to brownish; volva opening (rarely 2-3 openings) 5-10 mm. long to 3-5 mm. wide which allows spores to escape.

Hymenial Structures--Basidia 6-10 μ in diameter, hyaline, cystidia absent.

Hypae--Grayish to hyaline, flexuous, thick-walled, branched, 3-5(-9) μ in diameter, no cross walls or clamps.

Spores--Smooth, hyaline, oblong-ellipsoid or short cylindrical, apiculate, 8-13(-15) x 3-6 μ .

Substrate--On dead standing or fallen coniferous trees, rarely on living coniferous trees.

Decay--Unknown.

Description of Arizona Materials:

Data--(Collection No. 119A.) Sporophores from the trunks of dead standing Pinus Ponderosa trees near Loma Linda summer home area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Ariz. Elev. ca. 8000 ft.

The important characteristic to be noted here is the presence of a volva membrane covering the hymenial layer. A small hole at its base enables the spores to be disseminated. Overholts states, "No other species has a similar peculiar volval overgrowth on the pore surface." (12:352). Lloyd (7:313) cited that it had been found in Japan and China, but was unknown in Europe.

Two differences noted in our specimens were the slightly smaller tube mouths and the small diameter of the hyphae.

Sporophore--Sessile, smooth, dimidiate, convex, rigid when dry, globose, 2.5 x 4 x 2.5 cm.,

glabrous, covered by a thin tan or bay crust; margin obtuse, alutaceous, continuing over the pore surface to form a volva or membrane with a small opening at the base from which the spores can be discharged.

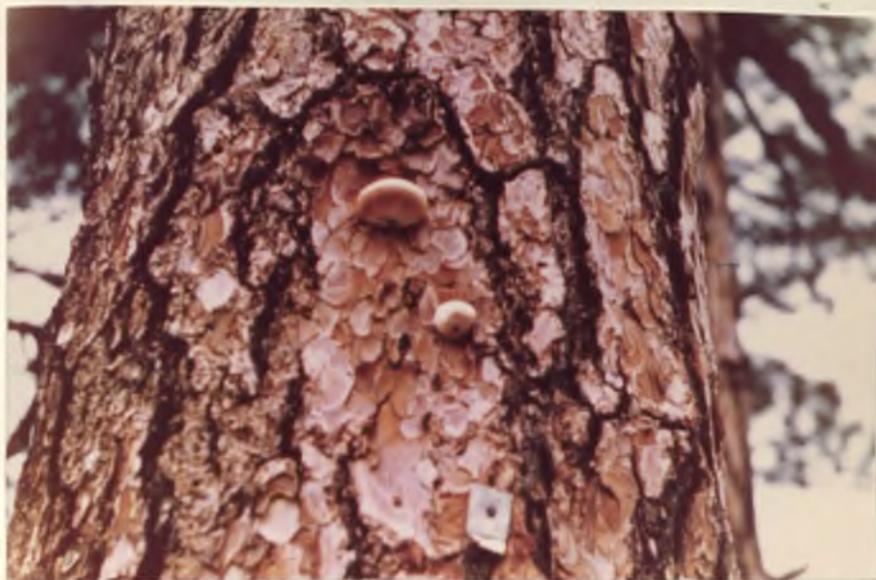
Context--Light tan, 3-4 mm. thick.

Pore Surface--Light brown covered by a tan to alutaceous crust; volva opening 4-5 x 5-6 mm.

Pores--4-5 per mm., round, entire, thick-walled; tubes up to 3.5 mm. long.

Hyphae--Trametal hyphae hyaline, branched, very inconspicuous septations, 1-3.5 μ in diameter.

Spores--Hyaline, smooth, oblong-ellipsoid, 9-10.5 x 4-4.5 μ .



(P. D. Keener)

Figure 11a. The very unusual sporophores of Polyporus volvatus on the trunk of Pinus ponderosa showing the volva covering the hymenial layer. Here again, it is demonstrated how infection may occur through a wound on the trunk. Specimens were growing near Loma Linda summer home area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

POLYPORUS SQUAMOSUS Micheli ex Fries.

(Shope (14): 356-358; Overholts (12):256-257;

Hard (5):395-396; McIlvaine (10):480-481).

Sporophore--Short stipitate, usually imbricate, fleshy-tough, watery, rigid when dry, edible; pileus 6-200 cm. (5:395) broad, 0.5-4 cm. thick, circular to subcircular to reniform, plane to depressed, whitish to ochraceous to dingy yellow brown; scales or scale-like spots imbricate, appressed, brownish to sepia.

Context--White, soft, drying to corky-friable, 0.5-3.5 cm. thick.

Pore Surface--White to yellowish to brownish-yellow.

Pores--Mouths 1-2.5 mm. wide, angular, sometimes torn, thin-walled, entire; tubes 2-8 mm., decurrent.

Stipe--Black at base, reticulate above, 1-5 cm. long, 1-4 cm. thick, lateral to subcentral, frequently rudimentary, concolorous with tubes.

Hymenial Structures--Basidia 45-55 x 6-8 μ . No cystidia.

Hyphae--Characterized by enlarged (10-21 μ) central section tapering at both ends to 3-10 μ , branched, thick-walled, nonseptate, no clamps.

Spores--10-15 (-18) x 4-6 u, smooth, hyaline,
elongate or ellipsoid.

Substrate--Growing from wounds in deciduous trees,
rarely on stumps or logs.

Decay--Unknown.

Description of Arizona Material:

Data--(Collection No. 105). Sporophores from dead
Populus tremuloides Michx., Soldier's Camp,
Pinaleno Mountains, Coronado National Forest,
near Safford, Graham County, Arizona.

Shope (14:357) states that P. squamosus is
commonly found growing from Populus stumps.
Overholts (12:256) lists Populus as one of the
host species. However, both Seymour (13:193)
and Agricultural Handbook No. 165 (1:424) do
not record Populus tremuloides as a host.

Sporophore--Short stipitate, growing in imbricate
pairs, watery and fleshy when fresh, rigid and
brittle when dry; pileus reniform, plane, cen-
trally depressed, 8-19 cm. broad x 1.5-2.5 cm.
thick, covered with mottled yellow scales, dark
yellow to brown on outer edges of appressed
edges; scales imbricate.

Context--Soft corky on drying, white, 0.3-2 cm.
thick.

Pore Surface--Brownish-yellow.

Pores--Mouths angular, 1-10 mm. wide; tubes thin-walled decurrent, 2-10 mm. long.

Stipe--More lateral than subcentral, blackish base. reticulate above the black area, stem size 1-3 cm. long x 2-3 cm. thick.

Hymenial Structures--Basidia 45 x 5.5-7 μ , clavate; no cystidia or setae.

Hypphae--Branched, 2-9 μ in diameter, nonseptate, tapering from large central areas to smaller ends; few clamps.

Spores--14 x 5 μ , elongate, hyaline, smooth with varied configurations apparent within the spore.



(P. D. Keener)

Figure 12a. Sporophores of Polyporus squamosus found growing from Populus tremuloides, Soldier's Creek Camp Grounds, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona.

POLYPORUS TSUGAE (Murr.) Overh.

(Overholts (12):210-212).

Sporophore--Sessile, stipitate; pileus watery, soft-corky, rigid and corky when dry, reniform to flabelliform, 5-20 x 6-30 x 1-5 cm., "Morocco red" with "Xanthine-orange" margin, changing to mahogany colored, brownish-orange, to almost black, shiny, incrustated surface, glabrous, sometimes pulverulent because of a brown coating of spores, azonate, margin somewhat zonate to sulcate.

Context--White to nearly white, slightly brownish next the tubes, 0.5-3 cm. thick, tough and watery changing to punky when dry.

Pore Surface--White to brown, discoloring where handled when fresh.

Pores--Mouths thick-walled, entire, 4-6 per mm. tubes 0.3-1 cm. long.

Stipe--When present usually lateral, sometimes central in plants growing on the top surface of the substrate, color and context as in the pileus or more shiny, 3-15 cm. long, 1-4 cm. thick.

Hymenial Structures--Cystidia absent or lacking.

Hypae--Hyaline to pale brown, very irregular and

much branched, branches usually smaller in diameter and attenuate at the apex, no cross walls or clamps, to 6-9(-15) μ in diameter.

Spores--Ovoid, truncate at apex, apparently echinulate, outer wall very pale, inner light brown, 9-11 x 6-8 μ .

Substrate--On or about stumps and dead trunks of coniferous trees. Noted on Picea, Pinus, and Tsuga; rarely on Acer and Betula.

Type of Decay--Soft, wet, whitish to straw-colored decay.

Description of Arizona Material:

Data--(Collection No. 110A, 1110B, 110C). Sporophores from stumps and logs of unidentified coniferous wood, Ski run area, Mt. Lemmon, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, ca. 8400 ft. elev.

The characteristics match very well with those used by Overholts (12:210-212). The context of our specimens was of a more avellaneous color than white and we find the context to be slightly thicker, up to 4 cm. The spores under oil at 970X were definitely echinulate, which Overholts did not seem to be able to confirm.

Sporophore--Sessile to substipitate; pileus appanate, flabelliform, 25 x 15 x 7 cm., at first watery, soft, shiny red, changing when dry to rigid corky, dark mahogany-colored, crust up to 0.2 mm. thick appearing shiny-varnished, glabrous, azonate; margin light cream color, up to 2 cm. thick, obtuse, zonate; stalk of pileus extending back into the substrate, appearing as dark red irregular knots; context of the stalk as in the pileus.

Context--Up to 4 cm. avellaneous to brownish cream color, watery, drying to soft corky, dark brown in 5% KOH.

Pore Surface--When dry a buckskin tan, changing to darker shades of brown where bruised.

Pores--Up to 2 mm. long, mouths 4-5 per mm.

Hymenial Structures--No cystidia.

Hyphae--Context hyphae hyaline, 2-7 μ , much branching. Tramal hyphae hyaline, 1-4.5 μ , to brown segments 3.5 μ ; no cross walls or clamps.

Spores--9 x 5-6 μ , dacryoid to pyriform, definitely echinulate, outer wall hyaline, inner wall brown.



Figure 13a.

(P. D. Keener)



Figure 13b.

Figures 13a and 13b. Sporophores of Polyporus tsugae on coniferous snags, Santa Catalina Mountains, Coronado National Forest.

POLYPORUS HISPIDUS Bull. ex Fries.

(Overholts (12): 423-424).

Sporophore--Sessile, soft, spongy, watery, then tough and firm, rigid on drying; pileus 5-30 x 8-25 x 2-10 cm., convex or plane, yellowish-brown to rusty-red to almost blackish, covered with hirsute or hispid tomentum.

Context--1-7 cm. thick, usually bright rusty-yellow above and toward the margin, dark reddish-brown.

Pore Surface--Rusty-yellow to brown to olivaceous, darker where bruised.

Pores--Angular, thin-walled, denticulate or entire, averaging 2-4 per mm.; tubes 0.5-2.5 cm. long.

Hymenial Structures--Setae absent, rare or abundant, 20-24 x 6-8 μ .

Hyphae--Simple, chestnut-brown, 5-9 (-12) μ in diameter, some cross walls, no clamps. Small hyphae light brown, some branching. All parts black in KOH.

Spores--7.5-10 x 6.5-9 μ , smooth, chestnut-brown, broadly ellipsoid to globose.

Substrate--On living trunks of deciduous trees, rarely on coniferous trees.

Decay--General delignifying type, wood becoming straw-colored to pale yellowish-brown, soft and spongy.

Description of Arizona Material:

Data--(Collection No. 103). Sporophore from about 8 ft. above ground level on living Quercus arizonica Sarg. (6:218), Hitchcock Tree Camp Grounds, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

Seymour (13:248) does not list Quercus arizonica as a host for P. hispidus. The Agriculture Handbook No. 165 (1:148) lists other species of Quercus as hosts for P. hispidus. Overholts, however, lists seven deciduous trees including Quercus and two coniferous trees as the substrate.

Sporophore--The most outstanding characteristics of the Catalina specimens were the exudation of water droplets when fresh, the brilliant coloring with the pileus a yellowish-green to a yellowish-brown turning to rusty-red when dry, the brilliant oliveaceous to greenish-gold of the pore surface which becomes brown to black

where bruised, and the very villose and tomentose pileus in the young specimen; 9 x 11 x 4 cm. when fresh, drying to 7 x 8 x 2.5 cm.

Context--2-4 cm. thick, black in KOH.

Pore Surface--Using a needle to depress the surface and viewing under 20X the pore surface has much the appearance of a sea sponge; rusty-red when dry.

Pores--Mouths varying from .1 mm. to .5 mm.; tubes 2-3 mm. long.

Hymenial Structures--No setae or cystidia.

Hyphae--5.5-7 μ , septate, simple, very little branching, chestnut-brown in color.

Spores--Ovoid to globose, 7-9 x 5.5-7 μ , chestnut-brown. All characteristics fall within the limits of the authority cited. Most probably the shortness of the tube length is due to the fact that the specimen found was quite immature. The villose tomentum, no doubt, turns hirsute and hispid with age.



Figure 14a.

(P. D. Keener)



Figure 14b.

(P. D. Keener)

Pore surface, fig. 14a, and pileus surface, fig. 14b. of a sporophore of Polyporus hispidus found growing on the trunk of living Quercus gambelii. The decay caused by this fungus is of the general delignifying type.

POLYPORUS SULPHUREUS Bull. ex Fries.

(Overholts (12):243-244; McIlvaine (10):485-486).

Sporophore--Sessile, attenuate, substipitate, in broad rosette or imbricate clusters, 20-60 cm., edible, fleshy, watery to firm, drying rigid and brittle; pileus 5-25 x 4-30 x 0.5-2.5 cm., nearly glabrous, salmon, sulphur-yellow, or bright orange, white with age, at full vigor filled with sulphur-yellow milk.

Context--0.4-2 cm. thick, white, yellow, or pale salmon.

Pore Surface--Sulphur-yellow fading with age, mouths angular, thin-walled, entire or slightly dentate, 2-4 per mm.; tubes 1-4 mm. long.

Hymenial Structures--No cystidia.

Hypphae--Thin-walled, sparingly branched, hyaline, septate, no clamps, 5-10 (-20) μ in diameter.

Spores--Ellipsoid or ovoid, smooth, hyaline, 5-7 x 3.5-4.5 μ .

Substrate--Stumps, trunks, and logs of both deciduous and coniferous trees.

Decay--Red-brown heart rot of the carbonizing type with the wood checked and cracked.

Description of Arizona Material:

Data--(Collection No. 104). The sporophores were collected from living specimens of Quercus arizonica Sarg. (6 p. 218) at the entrance to Pinery Canyon, Chiricahua Mountains, Cochise County, Arizona, Coronado National Forest by P. D. Keener. Fig. 15a., p. 81.

Seymour (13, p. 248) does not list Q. arizonica as a host. The Agriculture Handbook No. 165 (1, p. 148) lists "other species" of Quercus as the host for P. sulphureus. Overholts (12, p. 244) lists Quercus as one of many hosts upon which the fungus is found.

The characteristics are in agreement with those of the authorities cited except for a variation in pileus and context thickness and the smaller tubes mouths. All of these are due most likely to using dry specimens for measurements. Overholts states that the hyphae were sparingly branched, but branching in the Arizona collection was quite evident.

Sporophore--Attenuate and substipitate, growing in an imbricate cluster, up to 17 cm. broad, brittle when dry; pileus sulphur-yellow, almost glabrous, 16 x 17 x 4 cm.

Context--Light yellow turning to darker yellow
in KOH, up to 4 cm. thick.

Pore Surface--A yellowish-brown in dry specimens.

Pores--Mouths thin-walled, entire, 4-6 per mm. in
the dry specimens, varying in size from .1-.7
mm.; tubes 1 mm. long.

Hymenial Structures--No cystidia or setae.

Hyphae--Thin-walled, light yellow to hyaline,
branched, septate, 2-7 μ in diameter.

Spores--Ovoid, smooth, hyaline, 4-6 x 3.5-4.5 μ .



(P. D. Keener)

Figure 15a. Imbricated sporophores of Polyporus sulphureus growing on Quercus. This edible fungus causes a red-brown heart rot of the carbonizing type with the wood becoming checked and cracked.

FOMES EVERHARTII (Ell. & Gall.) von Schrenk & Spauld.

(Lowe (9):34; Overholts (12):82-83).

Sporophore--Perennial, sessile, hard and woody; pileus unguulate, rimose, sulcate, up to 15 x 30 x 15 cm.; margin obtuse, velvety-brown.

Context--Up to 4 cm. thick, reddish to yellowish-brown, black where touched with 5% KOH, woody.

Pore Surface--Various shades of reddish to yellowish-brown.

Pores--Round to angular, 3-6 per mm., edges thin, entire; tube layers up to 7 mm. long, but indistinctly stratified.

Hymenial Structures--Setae abundant to rare, ventricose, 13-35 x 6-11 μ .

Hypphae--Occasionally branched, thin-walled, septate, 3-5 μ in diameter. No clamps.

Spores--Usually dark reddish-brown, chestnut-brown in KOH, oval to subglobose, smooth, 4-5 x 3-4 μ .

Substrate--Usually on living trunks of Quercus, also other deciduous trees.

Decay--Heart-rotting organism, delignifying.

Description of Arizona Material:

Data--(Collections No. 101 and 102). Sporophores of collection No. 101 were from Juglans major (Torr.) Heller (J. rupestris Engelm. var. major Torr.) (6:214) at 5, 7, 11, and 20 ft. above ground level. Sporophores of collection 102 were from Quercus emoryi Torr., (6:219) at 5, 6, and 10 ft. above ground level. Both collections of sporophores were taken at ca. 5800 ft. elevation in Bear Canyon, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

Overholts (12:82) placed the yellow spored species under Fomes praerimosus (Murr.) Sacc & D. Sacc. However, Lowe (9:34) places both eastern and western types under the species F. everhartii. The data of Lowe and Overholts for F. everhartii agrees with the Santa Catalina Mountain material, i.e., Collection No. 101 & 102.

In Seymour (13:250) Quercus emorvi Torr. is not listed as a host for F. everhartii nor is Juglans major (13:210). However, in the Index of Plant Diseases in the United States (1:232, 147) F. everhartii is listed under the category "other species" of Juglans and of Quercus.

Sporophore--Some of the Santa Catalina Mountain specimens could be considered unguulate to resupinate or almost so. The pileus up to 10 x 16 x 10 cm. with tiny wisps of white mycelium scattered upon the black rimose covering, observable at 10X. The obtuse velvety margin may be up to 4 mm. wide and is entirely absent in some specimens.

Pore Surface--The various shades of yellowish-brown of the pore surface can be observed by the different positions of viewing whether directly or obliquely. Also, color differences may be due to environmental factors.

Pores--Round to angular, entire, 3-5 per mm.; tube layers indistinctly stratified.

Hymenial Structures--Setae large, 30-39 x 9-14 μ .

Spores--Yellowish-brown, 4.5-5.5 x 3.5-4 μ .



(P. D. Keener)

Figure 16a. Ungulate basidiocarp of Fomes everhartii growing on Quercus gambelii. This fungus usually attacks the living tree, causing a delignifying heart rot.

POLYPORUS CINNABARINUS Jacq. ex Fries.

(Overholts (12):379-380; Shope (14):342-343;

Hard (5):409).

Sporophore--Sessile, dimidiate, flabelliform, or sometimes attached by an umbo, tough, coriaceous, drying to somewhat flexible to rigid, sometimes reviving a second or third year; pileus up to 10 x 20 x 2 cm., azonate, rugulose, orange to cinnabar-red, becoming paler, sordid red, or blackish with age, compactly tomentose, glabrous in age; margin thin acute.

Context--Floccose to soft-corky, zonate, red to yellowish-red, 1-15 mm. thick, black in KOH.

Pore-Surface--Cinnabar-red.

Pores--Circular, angular, or daedaloid, 2-4 per mm.; tubes 1-4 mm. long, occasionally in 2 or 3 layers.

Hymenial Structures--Cystidia none; hyphal pegs only in old plants; basidia 6-7 μ broad.

Hyphae--Simple to considerably branched, thick-walled cross walls or clamps rare, 4-8 μ in diameter.

Spores--Hyaline to yellowish, cylindrical, or oblong. usually apiculate, smooth, 4.5-7 x 2-3 μ .

Substrate--On the dead wood of deciduous trees.

Occasionally on wood of coniferous trees.

Decay--White or straw-colored delignifying decay of the sapwood.

Description of Arizona Material:

Data--(Collection No. 120A). Sporophores from the Camp Lawton area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

The specimens of Collection No. 120A are well within the limits of those specified by authorities. Some of the Arizona sporophores were effused-reflexed which was one peculiarity.

Sporophore--Sessile to effused-reflexed, conchate, flexible to rigid when dry; pileus azonate, slightly rugulose, up to 5 x 14 x 1.7 cm., orange, finely tomentose to glabrous in age; margin acute.

Context--Orange to orange-red, zonate to azonate, floccose to soft-corky, up to 1.7 cm. thick, black in 5% KOH.

Pore Surface--Cinnabar-red.

Pores--Circular, thin-walled, somewhat serrate, 3-4 per mm.; tubes 2 mm. long.

Hymenial Structures--No setae or cystidia.

Hyphae--Trametal hyphae thick-walled, no branching,
brownish-yellow, few clamps or septations,
2-4.5 μ in diameter.

Spores--Hyaline to yellowish, cylindric, smooth,
4.5-5 x 2.5-3.5 μ .



(P. D. Keener)

Figure 17a. Sporophore of Polyporus cinnabarinus Jacq. ex Fries, showing the cinnabar-red pore surface at the left, and the pileus surface, right, which has faded to a dull orange. This fungus produces a white to straw-colored delignifying decay of the sapwood.

POLYPOROUS VARIUS Fries

(Shope (14):358-359: Overholts (12):265-266).

Sporophore--Stipitate, laterally to centrally, leathery, drying firm and rigid; pileus circular to subreniform to subcircular, 2-12 cm. broad, 0.3-1 cm. thick, depressed to plane, slightly tomentose to glabrous, tan, golden tan, sordid tan, or chestnut-brown, fading from weathering, azonate, radiate narrow streakings or fleckings of a lighter color.

Context--Pale ochraceous to white, 2-10 mm. thick, corky.

Pore Surface--White or yellowish to pale bay.

Pores--Angular, thin-walled, entire, 3-5 per mm.; tubes 1-4 mm. long, decurrent.

Stipe--Central, excentric, or lateral, woody, solid, tomentose to glabrous, tapering down, often short and rudimentary, upper portion concolorous with hymenium, lower portion abruptly black and laccate, or in reduced forms black only at the point of attachment.

Hymenial Structures--No cystidia; hyphal pegs present being conspicuous and well developed,

conical, basidia 7-8 μ in diameter.

Hyphae--Much branched, no cross walls or clamps, undulating, the larger hyphae 3-6 μ in diameter, thick-walled.

Spores--Smooth, hyaline, cylindric, 7-12 x 3-4 μ .

Substrate--On the dead wood of deciduous trees, rarely on wood of coniferous trees.

Decay--Unknown.

Description of Arizona Material:

Data--(Collection No. 121A). Basidiocarps from dead wood, Tucson Natural History Society Natural Area, Marshall Gulch, Santa Catalina Mountains, Coronado National Forest, ca. 7500 ft. elev., near Tucson, Pima County, Arizona.

Because of the very close similarity between P. varius and P. elegans, the characteristics of these two species were carefully compared both microscopically and macroscopically. The only variable factor in our collection No. 121A to definitely refer the name to P. varius was the radiate narrow streakings or fleckings of a lighter color on the upper surface of the pileus. These are not common to P. elegans. All other

characteristics are well within the limits cited by the authorities. P. picipes, from another collection, was also compared. This species, however, has the chestnut-brown to reddish-brown pileus which is quite easily distinguishable from P. varius and P. elegans.

Sporophore--Stipitate, subcentral, drying somewhat flexible to rigid; pileus subreniform, 5 cm. broad, .5 cm. thick, depressed, glabrous, yellowish-tan, azonate, radiate narrow streakings or fleckings of a lighter color.

Context--Light tan, almost concolorous with the pileus, floccose to soft-corky, up to 4 mm. thick.

Pore Surface--Brownish yellow, decurrent on stipe.

Pores--3-5 per mm., angular, entire, average thickness of the walls; tubes up to 2 mm. long.

Stipe--2 cm. long x .6 cm. in thickness, excentric, solid, glabrous, upper portion concolorous with the hymenium, the lower portion black.

Hymenial Structures--Hyphal pegs present, no cystidia.

Hyphae--Thick-walled, much branched, hyaline, non-septate, 1-4 μ in diameter.

Spores--Smooth, hyaline, cylindric, 7-9 x 2.5 μ .



(P. D. Keener)

Figure 18a. Sporophores of Polyporus varius showing the pileus surface, left, and the pore surface, right, from a down log of Populus tremuloides, Marshall Gulch, Santa Catalina Mountains, near Tucson, Pima County, Arizona.

POLYPOROUS TOMENTOSUS Fries.

(Overholts (12):390-392; Shope (14):349-350).

Sporophore--Stipitate, substipitate, to sessile, soft, watery, spongy, to subcoriaceous, rigid on drying; pileus circular, flabelliform, dimidiate, 3-20 cm. broad, 0.3-4 cm. thick, whitish, ochraceous, tan, to rusty brown, finely soft-tomentose to short hispid-tomentose, usually azonate or nearly so.

Context--3-10 mm. thick, concolorous, soft and spongy above, with a narrow firm layer 1-3.5 mm. thick next the hymenium.

Pore Surface--Hoary or brown, darker where bruised.

Pores--Angular, irregular, or daedaloid, thin-walled, entire to slightly dentate, slightly pubescent, 2-4 per mm.; tubes 1.5-7 mm. long.

Stipe--Lateral, excentric, or central, ochraceous to dark rusty brown, tomentose like the pileus, up to 5 cm. long, 0.5-2 cm. thick.

Hymenial Structures--Setae abundant to scarce, dark brown, straight, pointed, 35-65 x 10-16 μ projecting 15-50 μ .

Hypphae--Yellowish, simple to sparingly branched, septate, no clamps, 3-6 μ in diameter.

Spores--Hyaline to pale-colored, ellipsoid or oblong-ellipsoid, smooth, 4-6 x 3-5 μ .

Substrate--Usually attached to the buried wood of coniferous trees or on stumps, trunks, or roots of living or dead coniferous hosts.

Decay--White rot.

Description of Arizona Material:

Data--(Collection No. 122A). Sporophores taken from the ground under Pseudotsuga Menziesii and Pinus ponderosa, Marshall Gulch, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

All the characteristics are well within those cited by the authorities. The setae are definitely sharply pointed and straight. The setae of Var. circinatus (Fries) Sartory & Maire are hooked at the points. Overholts (12:390) gives the pore surfaces as slightly pubescent. The pore surfaces of our sporophores in collection No. 122A were entirely covered by a tan colored tomentum. The tubes of our specimens were white stuffed, with the tube walls being a rusty brown.

Sporophore--Stipitate, rigid; pileus flabelliform, dimidiate, 3 x 6 x 1 cm., rusty brown, villose-

tomentose, azonate.

Context--Up to 3 mm. thick, duplex, with the upper part of the context soft villose-tomentose, .5-1 mm. thick, the lower context firmer and more horizontal in appearance, with a lighter orange brown color, up to 2 mm. thick.

Pore Surface--A thick layer of tan villose-tomentose mycelium covering the pores in most of the sporophores, decurrent on the stipe.

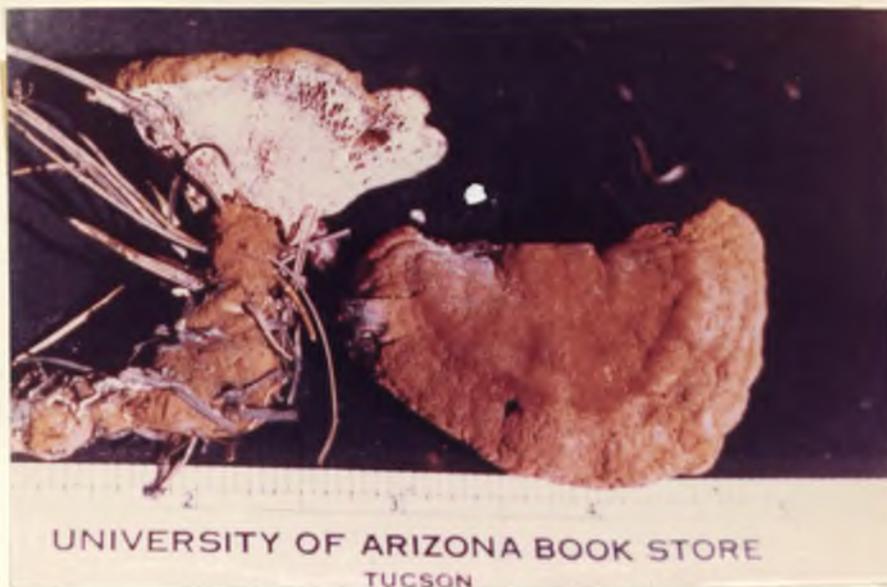
Pores--3-4 per mm., angular, very irregular, dentate; tubes up to 3.5 mm. long, tube walls brown, white stuffed.

Stipe--Excentric, rusty brown, villose-tomentose, up to 1 cm. thick, to 3 cm. long, concolorous with the context.

Hymenial Structures--Setae abundant, brown, pointed, projecting beyond the hymenium 26-39 μ .

Hyphae--Light brown to hyaline, sparingly branched, septate, up to 5.5 μ in diameter, with some small hyaline hyphae 1 μ in diameter.

Spores--Hyaline, ellipsoid, smooth, 5.5 x 3.5-4.5 μ



(P. D. Keener)

Figure 19a. Stipitate sporophores of Polyporus tomentosus taken from the ground under coniferous trees, Marshall Gulch, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

POLYPORUS ANCEPS Peck.

(Overholts (12):279-281: Shope (14):343-345.)

Sporophore--Sessile, effused-reflexed, resupinate, often imbricate, watery-tough to corky, rigid when dry; pileus 3 x 10 x 2 cm., whitish to cream-color, tan to brownish, glabrous or finely velvety-tomentose, azonate.

Context--White, bitter, 2-10 mm. thick, tough, firm and hard on drying.

Pore Surface--White to gray to yellowish.

Pores--Angular, entire, 4-5 per mm.; tubes 2-7 mm. long.

Hymenial Structures--No cystidia; occasional short-conoidal hyphal pegs, basidia 7-9 μ in diameter.

Hyphae--Hyphal complexes dendritically branched with variable sized hyphae 1-7 μ in diameter, thick-walled, clamps rare.

Spores--Hyaline, smooth, cylindric, 7-10 x 2-3.5 μ .

Substrate--The dead wood of coniferous trees.

Decay--Sap rot of dead material and a heart rot of living trees; known as "western red rot" and "red ray rot".

Description of Arizona Material:

Data--(Collection No. 123A, 123B). Sporophores from coniferous logs, Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, and High Peak road, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona.

The characteristics of collection No. 123A and 123B are well within the limits of those cited by the authorities. The dendritically branched hyphae are very evident and gives the positive identification to this species along with its other outstanding characteristics.

Sporophore--Resupinate to effused-reflexed, imbricate, rigid; pileus 1.5 x 8 x 1 cm., white to tan to brown, azonate, glabrous to finely-tomentose.

Context--Bitter, up to 5 mm. thick, white, hard-corky.

Pore Surface--White to yellowish.

Pores--Entire, angular, 4-5 per mm.; tubes with a seasonal stratification line, up to 4 mm. long per season.

Hymenial Structures--No cystidia present, hyphal pegs rare.

Hyphae--Larger hyphae 3-7 μ in diameter, thick-walled, hyaline, with hyphal complexes present composed of branched hyphae, to larger similar hyphae.

Spores--Hyaline, smooth, cylindric, 7-9 x 2-3.5 μ .



(P. D. Keener)

Figure 20a. Sporophore of Polyporus anceps growing on a coniferous log. This fungus is very extensive in the Coronado National Forest, causing a heart rot of living trees and a sap rot of dead material. It is commonly known as "western red rot" or "red ray rot".

DAEDALEA CONFRAGOSA Bolt. ex Fries.

(Overholts (12):120-122).

- Sporophore--Sessile or effused-reflexed, leathery and watery when fresh, rigid and firm on drying; pileus plane to slightly convex, 10 x 15 x 0.2-2(-3) cm., grayish, cinereous, smokey umber or brownish, sometimes blackish in extreme age, occasionally somewhat rosy when handled fresh, unchanged on drying, finely pubescent to glabrous or nearly so, sometimes radiately rugose, often multizonate at least toward the margin, and frequently drying rough; the margin thin, acute
- Context--Whitish to wood colored or pale brown, zonate, floccose to corky, 0.2-1(-2) cm. thick,
- Pore Surface--Whitish to avellaneous, isabelline, or pale brown, sometimes pinkish flesh colored where handled, poroid, daedaloid, or lamellate.
- Pores--The mouths subcircular to elongate, daedaloid, or lamellate, 0.5-1.5 mm. broad, the walls sometimes thick and regular, but often lacerate and sometimes toothed; tubes 0.1-1.5 cm. long.
- Hymenial Structures--Cystidia none, but hyaline or slightly colored, branched, inconspicuous, para-

physis-like hyphae, 2-3 μ in diameter present between the basidia, sometimes abundant, but usually only occasional and often not easily located.

Hyphae--Main hyphae simple, with the walls completely thickened, with no cross walls or clamps, 5-12 (-15) μ in diameter; smaller hyphae 4-6 μ in diameter, considerably branched to form a simple type of hyphal complex.

Spores--Cylindric, smooth, hyaline, 7-9 x 2-2.5 μ .

Substrate--On dead wood or wounds in living deciduous trees, very rarely on wood of coniferous trees.

Decay--A white delignifying decay of the sapwood, sometimes forming black lines.

Description of Arizona Material:

Data--(Collection No. 118A). Sporophores from the dead wood of Acer glabrum Torr. (6:527), Ski run area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona, Elev. ca. 8400 ft.

The characteristics of the Catalina material are in full accord with those of the authority cited, even to the paraphysis-like thin hyaline hyphae protruding slightly from the hymenium.

Sporophore--Sessile to effused-reflexed, applanate, broadly attached, leathery and watery, rigid when dry, reviving; pileus 7 x 12 x 1 cm., gray, concentrically zoned, glabrous to appressed tomentum, margin thin, acute.

Context--Corky, white to very pale yellow, up to 6 mm. thick, zonate, with the gray appressed tomentum contrasting sharply with the white context underneath.

Pore Surface--Yellow to brownish-yellow to olivaceous.

Pores--Dentate to serrate, thin-walled, angular, some mouths confluent, 2 per mm.; tubes to 3 mm. long.

Hymenial Structures--Small hyphae 2-3 μ in diameter protruding from the hymenial layer between the basidia; no setae or cystidia.

Hyphae--Tramal hyphae 2-4.5 μ in diameter, hyaline, branched, nonseptate, thin-walled; context hyphae hyaline, thin to thick-walled, nonseptate, branching, 2-5.5 μ in diameter.

Spores--Smooth, cylindrical, hyaline, 9 x 2-2.5 μ .

POLYPORUS ADUSTUS Willd. ex Fries.

(Shope (14):339-340; Overholts (12):364-366).

Sporophore--Conchate, sessile or effused-reflexed, imbricate, sometimes confluent; pileus 6 x 10 x 0.8 cm., tough to corky, rigid when dry, reviving, sometimes undulate, azonate, finely tomentose to nearly glabrous; margin thin, acute, even, often black when dry, sterile below.

Context--White to ochraceous or pale brown, 1-7 mm. thick, in large specimens separated from the tube layer by a narrow dark line.

Pore Surface--Gray or various shades of smoke color, grayish-black, darker where bruised, changing to black or sordid brown in age.

Pores--Round to angular, 4-7 per mm.; tubes 0.5-4. mm. long, sometimes becoming tufted.

Hymenial Structures--Basidia 4 spored, 8-10 x 4-5 μ , no cystidia or hyphal pegs.

Hyphae--Hyaline, branched, thick-walled, 3-7 μ in diameter, with cross walls and clamps.

Spores--Hyaline, smooth, oblong to elongate-ellipsoid, 3.5-5 x 1.5-3 μ .

Substrate--Usually on dead wood of deciduous trees, occasionally on the wood of coniferous trees.

Decay--General delignifying, affecting only the sapwood. White flecks are present.

Description of Arizona Material:

Data--(Collection No. 117A, 117B). Sporophores No. 117A from the dead wood of Pseudotsuga Menziesii (6:1038) and No. 117B from the dead-wood of Alnus, Marshall Gulch area, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona.

The characteristics are well within the limits of those cited by the authorities. However, in several of the largest sporophores with the pilei cut and viewed vertically we found stratification with two strata divided by a thin layer of context 0.2 mm. thick. This may either suggest a biennial growth or perhaps an environmental change during the growing season. The outstanding characteristics are the abundance of easily visible nuclei within the hyphae and the abundance of clamps.

Sporophore--Sessile, effused-reflexed, conchate, imbricate, tough, corky, rigid when dry; pileus 2 x 6 x 0.3 cm., light brown, tawny to light tan, finely tomentose to glabrous in age; a thin

crust present or absent, smooth, azonate;
margin drying dark to almost black, thin, acute.

Context--Pale yellow, up to 3 mm. thick.

Pore Surface--When fresh, blue green to smoky in color, changing to tan to smoky to almost black when dry.

Pores--4-7 per mm., walls average thickness, in some larger specimens the tubes distinctly stratified by a context layer 0.2 mm. thick, 1 mm. per layer, older tubes dark brown, younger tubes lighter brown.

Hymenial Structures--No cystidia or setae, basidia hyaline, 4 μ wide, some projecting 5-9 μ from the hymenial layer.

Hyphae--Tramal hyphae hyaline, thick-walled, 2.5-5.5 μ in diameter, septate, an abundance of easily visible nuclei and clamps; context hyphae hyaline, thin-walled, branched, 2-5.5 μ in diameter.

Spores--Ovoid to elliptical-elongate, smooth, hyaline, 4.5 x 2.5-3.5 μ .

The species represented in this paper constitute all the presently known fungi of the family Polyporaceae, that have been collected to date from the Santa Catalina and Pinaleno Mountains. However, further investigation will follow, and it is believed many species will be added to those which have now been collected and identified.

Although no detailed descriptions have been made in this paper for the following species of the family Polyporaceae, they have been positively identified, and are native to the Santa Catalina and Pinaleno Mountains:

Polyporus borealis Fries. Sporophores from a snag of Pseudotsuga Menziesii, Hospital Flat Forest Camp, near beginning of Trail No. 5 to High Peak, Pinaleno Mountains, Coronado National Forest, near Safford, Graham County, Arizona. Elev. ca. 9100 ft.

Trametes hispida Bagl. Sporophores from dead Salix sp., lower Bear Canyon, Santa Catalina Mountains, Coronado National Forest, near Tucson, Pima County, Arizona. Elev. ca. 3000 ft.

Polyporus alboluteus Ell. & Ev. Sporophores from a down Abies concolor (Gordon & Glendinning)

Lindl, Ski run area, Santa Catalina Mountains,
Coronado National Forest, near Tucson, Pima
County, Arizona.

Polyporus elegans Bull. ex Fries. Sporophores
from dead wood, Marshall Gulch Area, Santa
Catalina Mountains, Coronado National Forest,
near Tucson, Pima County, Arizona. Elev.
ca. 8400 ft.

Polyporus abietinus Dicks. Ex Fries. Sporophores
from coniferous log, Riggs Flat, Pinaleno
Mountains, Coronado National Forest, near
Safford, Graham County, Arizona. (These
specimens warrant further investigation
because of two peculiarities which are very
evident:

1. They are very compactly imbricate,
confluent, and have a fringed white
margin.
2. The tube lengths are only .2 mm. in
length.

All other characteristics fit well within those
cited by the authorities.)

RESULTS AND CONCLUSIONS

WHAT NEW INFORMATION HAS COME FROM THIS STUDY?

1. A detailed study has been made of the several fungi from the family Polyporaceae in Santa Catalina and Pinaleno Mountains.
2. A new method for dividing species characteristics has been used and found to be very applicable.
3. Many new variations in species characteristics were found and recorded under Data in the species descriptions.
 - a. A new maximum measurement was found for Polyporus versicolor, the specimen being 12 cm. long, which is 2 cm. longer than previous descriptions have noted.
 - b. In Polyporus schweinitzii, both the context and tramal hyphae were up to 18 μ in diameter, 6 μ larger than any seen by the authorities cited. No septations were observed previously. However, in both the tramal and the context hyphae septations were very evident in Arizona materials.
 - c. Sporophores of Fomes caianderi from the Pinaleno Mountains had a maximum measurement of almost three times that of the authorities cited, being 33 cm. in length, compared with a maximum of 12 cm.

- d. A few minor differences were noted in Fomes pini. The pileus and pore surfaces were very irregular, large amounts of crystalline granules were observed in the context amongst the mycelium, and there were thin septations in both the context and the tramal hyphae. The authorities cited no cross walls.
 - e. In Polyporus volvatus, authorities cited the pores to be 3-4 per mm. We found them to be 4-5 mm. in the Arizona material.
 - f. By studying the spores of Polyporus tsugae under oil at 970X, it was found that they were definitely echinulate, a characteristic about which Overholts (12:210-212) seems not to be certain.
 - g. An interesting peculiarity in Polyporus tomentosus of the Arizona material was that the pore surfaces were entirely covered by a tan-colored tomentum.
 - h. After cutting and viewing vertically the largest sporophores of Polyporus adustus, some stratification was noticed, with two strata divided by a thin layer of context (0.2 mm. thick).
4. Extensive research on fungi of the Polyporaceae should be continued throughout the forested areas of the Coronado and other National forests both from an economic standpoint, and from the viewpoint of basic research.

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