TRANSACTIONS, ILL. STATE ACAD. SCI.
Vol. 69, No. 3 (1976)

POROID FUNGI DETRIMENTAL TO PINE IN SOUTHWESTERN ILLINOIS

K. Andrew West
Department of Botany
Southern Illinois University
Carbondale, Illinois 62901[1]

ABSTRACT. *Phaeolus schweinitzii*, *Phellinus pini*, *Fomes annosus*, and *Fomes pinicola*, all species of polypores (Aphyllophorales) which are known to attack standing pine, were collected in southwestern Illinois. This report represents the first Illinois record of *F. pinicola*, and the first known report of *P. schweinitzii* in southern Illinois. Distributional data and descriptions of the southwestern Illinois material and a discussion of their impact on introduced pine are included.

INTRODUCTION

Although pines are common trees in farm forest plantations and have been an introduced part of the southern Illinois flora for almost fifty years, there is very little documentation of their associated fungal flora. Because pines are economically important as pulpwood and Christmas-tree crops and since their ability to tolerate harsh sites makes them useful in stabilization of eroded abandoned fields and strip mine spoils, knowledge of their fungal associates would seemingly contribute to proper management practices. Therefore, I initiated a study of pine-associated Homobasidiomycetes (West, 1975). This report considers those polypores (Aphyllophorales) found in southwestern Illinois which are pathogenic to standing pine.

---

[1]Present address: Natural Areas Biologist, Illinois Department of Conservation, Region 5 Headquarters, P. O. Box D, Benton, Illinois 62812.

MATERIALS AND METHODS

Description of study area

Pinus echinata Mill. (shortleaf pine) is native as only two relict populations in southwestern Illinois. It and three other species, *P. taeda* L. (loblolly pine), *P. strobus* L. (eastern white pine), and *P. sylvestris* L. (Scotch pine) were introduced to other areas formerly inhabited by native hardwoods. Although other pine species are sometimes encountered in southern Illinois plantations, only these four were considered in this study.

Within a five-county area of southwestern Illinois (Fig. 1), four plantations each of *P. echinata* and *P. taeda* were chosen as major collecting sites. Eight plantations of *P. echinata*, three of *P. taeda*, three of *P. sylvestris*, and one of *P. strobus* were utilized as minor sites. The major sites were visited at least once a month and the minor sites were visited irregularly. The native stand of *P. echinata* at Pine Hills (Union Co.) was frequently visited but only three collecting trips were made to the one at Piney Creek (Randolph Co.). All but a few collections were made within the five counties and during 1973.

Examination of specimens

Morphological data were taken from fresh specimens. Colors were described by comparison with standard color plates. Most color names and code numbers included here are those of Kornerup and Wanscher (1967; e.g., "milk white" [1A2]). Some color data were obtained by comparison with Ridgway's plates (Ridgway, 1912; e.g., Milk White). When it was not possible to match colors with a standard or where standard nomenclature seemed unclear, a common (author generated) name was employed and, if used, the standard nomenclature follows (e.g., white ["milk white", 1A2]).

Anatomical data were compiled largely from freehand sections of dried specimens mounted in 2.5% KOH. Contrast of hyaline structures was enhanced by adding 1% aqueous phloxine, and Iodine reactions were determined from mounts in Melzer's reagent.

Unless noted otherwise, dried collections were annotated and deposited in the Southern Illinois University Herbarium [SIU], Carbondale. Other collections were examined at the herbaria of the University of Illinois [ILL], Champaign-Urbana, the Field Museum of Natural History [F], Chicago, and Brandon University, Brandon, Manitoba, Canada.

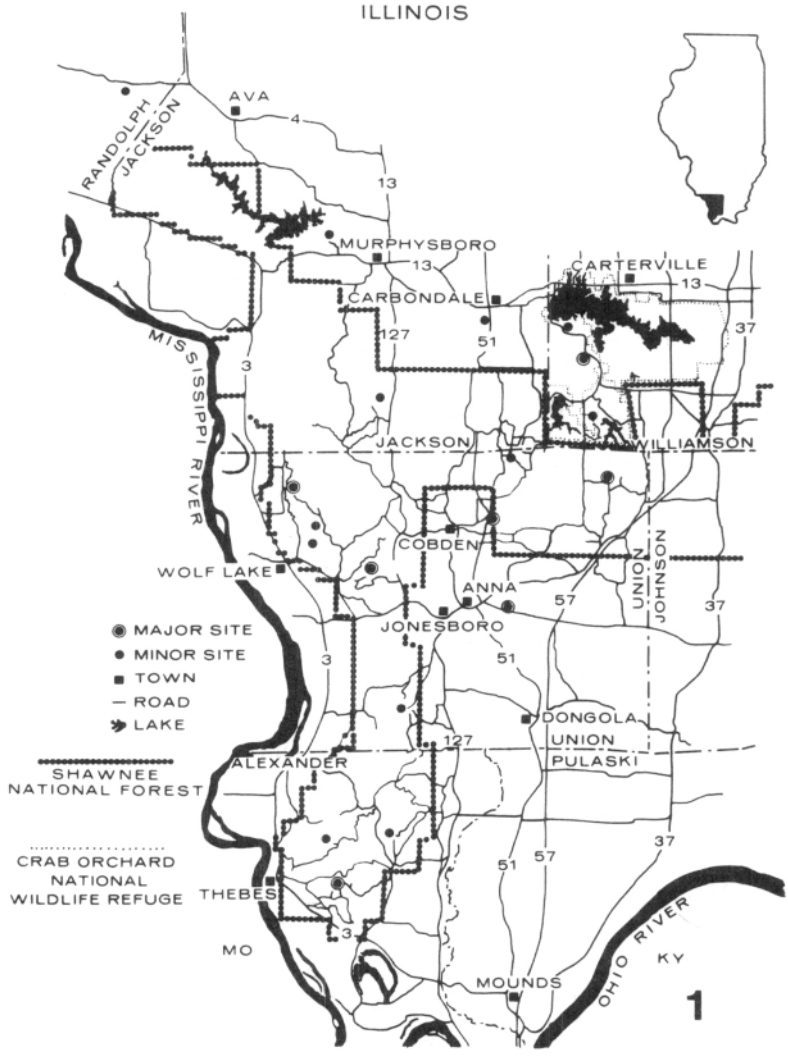


Fig. 1. Study Area.

RESULTS

Four species of pore fungi which are known to attack living pine were found during the survey.

Phaeolus schweinitzii (Fries) Pat. Figs. 2-3

Basidiocarps stipitate or substipitate, soft and fleshy when fresh, rigid and brittle when dry. Pileus 6.2 cm broad, depressed; surface dry, tomentose, azonate, rusty brown at the disc; margin entire, up to 5 mm thick, yellow-brown, scantily tomentose to glabrous. Context up to 1.2 cm thick, solid, yellow, soon turning brown when cut, turning red then quickly black where touched with KOH. Tube layer 1-6 mm thick, decurrent, concolorous with the context. Pore surface mustard yellow, darker where bruised and upon drying. Pores 1-3 per mm, walls angular, breaking up, becoming irregular and subdentate. Stipe 4.5 cm long, 1.4 cm broad at apex, tapering downward; surface dry, tomentose, light yellow-brown at apex, rusty brown at base.

Basidiospores (5-)6-7 x (2.5-)3-4 µm, ovate to elliptical; surface smooth; walls thin; hyaline, inamyloid and not dextrinoid. Basidia 14-18 x 5-6 µm, clavate, 4-spored. Cystidia scattered, 26-72 x 4-6 µm, cylindrical to slender-clavate, sometimes mucronate; walls thin, smooth; light brown; originating in the trama and protruding up to 60 µm beyond the adjacent basidia. Tramal hyphae monomitic, 2-6 µm broad, septa uncommon; walls thin, smooth; brown. Clamp connections absent.

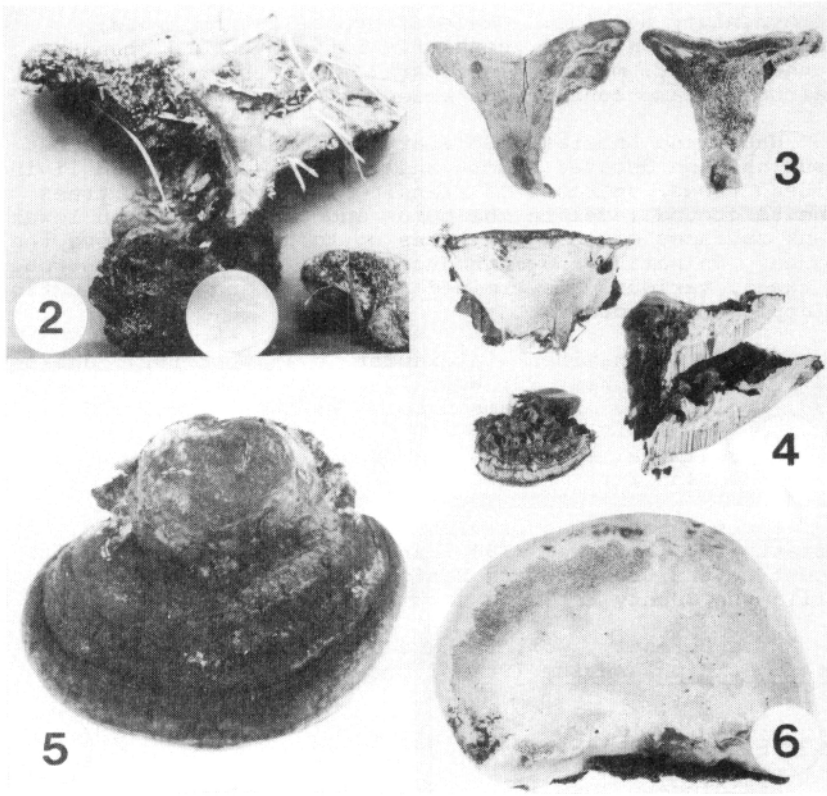
Habit and habitat: Solitary on well decayed Pinus log.

Specimen examined: Williamson Co.: Halbrendt 2.

Extralimital specimens examined: ILLINOIS. Ogle Co.: RWS 61 (Ex herb. R. W. Schanzle). INDIANA. Lake Co.: Harper s.n. [F].

Fomes annosus (Fries) Karst. Fig. 4

Basidiocarps effused-reflexed to sessile, occasionally resupinate, solitary to imbricate, leathery when fresh, rigid and hard when dry. Pileus 3.2-11.2 cm broad, 0.4-5.5 cm thick, protruding 1.7-5.4 cm, applanate; surface sparsely tomentose to glabrous, often encrusted with a hard, brown pellicle which appears as a black layer up to 1 mm thick over the lighter context, azonate and "greyish red" (7B5) to "brownish orange" (7C5) or zonate with alternating bands of "grey" (4B1), "greyish red" (7B3), and "brown" (7E6); margin entire, up to 2 mm broad, brown ("red haired", 6C4 to "Sahara", 6C5), glabrous to sparingly tomentose. Context 0.2-1 cm thick, "milk white" (1A2) to "yellowish white" (4A2), leathery when fresh, rigid upon drying. Tube layer not distinctly stratified, 3-9 mm thick, the separate layers 1-7 mm long, "cream" (4A3) to "orange white" (6A2). Pore surface "milk white" (1A2) to "greyish orange" (5B4) to brown ("red haired", 6C4). Pores 2-4(-5) per mm, usually round to



Figs. 2-3. Phaeolus schweinitzii. 2. Harper s.n., X 2/5. 3. Halbrendt 2, X 2/5.

Fig. 4. Fomes annosus. West 1085, X 1/4.

Figs. 5-6. Fomes pinicola. BU 110, X 1/5.

angular, sometimes varying to daedaleoid; walls moderately thick, entire.

Basidiospores 3-5 x 3-4 µm, globose to subglobose; surface smooth; walls thin; hyaline, inamyloid and not dextrinoid; usually uniguttulate. Basidia 12.5-24 x 4-5 µm, clavate to cylindrical, most 4-spored, but occasionally 2-spored. Tramal hyphae dimitic. Generative hyphae 2.5-3.5 µm broad; sparingly branched, scattered and uncommon in the context, more commonly found in the tube trama near

the hymenium; hyaline. Skeletal hyphae 2-4 µm broad; occasionally contorted, compactly interwoven and abundant in the context, more or less parallel in the tube trama; hyaline. Clamp connections absent.

Habit and habitat: Solitary to imbricate, sometimes resupinate on decayed stumps and roots of wind-thrown living or dead trees, on roots of standing living and dead trees beneath ground level in the humus and occasionally on lower trunk surfaces of standing trees up to three feet above the ground. On native and introduced Pinus echinata, P. strobus, P. taeda, various undetermined Pinus spp. and one collection on apple tree roots.

Specimens examined: Alexander Co.: West 892. Jackson Co.: Hinkle and West 90; West 295, 1045. Union Co.: West 1038, 1041, 1088. Williamson Co.: West 199, 200, 826, 1085.

Extralimital specimens examined: Hardin Co.: West 1051. Johnson Co.: West 033.

Fomes annosus was previously reported from Illinois by Moffatt (1909), Graham (1944) and Schanzle (1971), and its extent on the Crab Orchard National Wildlife Refuge in Williamson County has been documented (Jordon, 1969).

More recently, workers have applied the name Heterobasidion annosum (Fries) Brefeld to this species.

Fomes pinicola (Swartz ex Fries) Cooke Figs. 5-6

Basidiocarp sessile, hard and rigid. Pileus 2.6 cm broad, 2.3 cm thick, protruding 1.9 cm, subcircular, ungulate; surface glabrous, hard and appearing resinous, azonate, "brownish orange" (6C6) to "reddish golden" (6C7); margin distinctive, obtuse, entire, soft-corky and easily indented when fresh, drying rigid, "milk white" (1A2) to "pale yellow" (1A3), turning red upon application of KOH, glabrous. Context up to 1 cm thick, cream to "light orange" (5A4-5), changing to red when touched with KOH, corky when fresh, drying rigid. Tube layer distinctly stratified, up to 3 mm thick, more or less concolorous with context. Pore surface "milk white" (1A2), turning red in KOH. Pores 3-5 per mm, round to angular; walls rather thick and entire.

Basidiospores 5-6 x 2-3 µm, ovoid to elliptical; surface smooth; walls thick; hyaline, inamyloid and not dextrinoid. Basidia 11-13 x 5-8 µm, clavate, 4-spored. Cystidia scattered, 23-28 x 2-3 µm, clavate to cylindrical, originating within the trama, protruding up to about 15 µm beyond the adjacent basidia; walls smooth; clamp connections often at basal septum. Tramal hyphae dimitic. Generative hyphae

1.5-3 µm broad, scattered throughout the context; clamp connections present. Skeletal hyphae 4-6 µm broad, interwoven in the context and tube trama; clamp connections absent.

Habit and habitat: Solitary on the lower trunk surface of living native P. echinata.

Specimen examined: Union Co.: West 224.

Extralimital specimens examined: CANADA. Manitoba: BU 110, West 601 (Ex herb. Brandon University). TENNESSEE. Sevier Co.: West 1064.

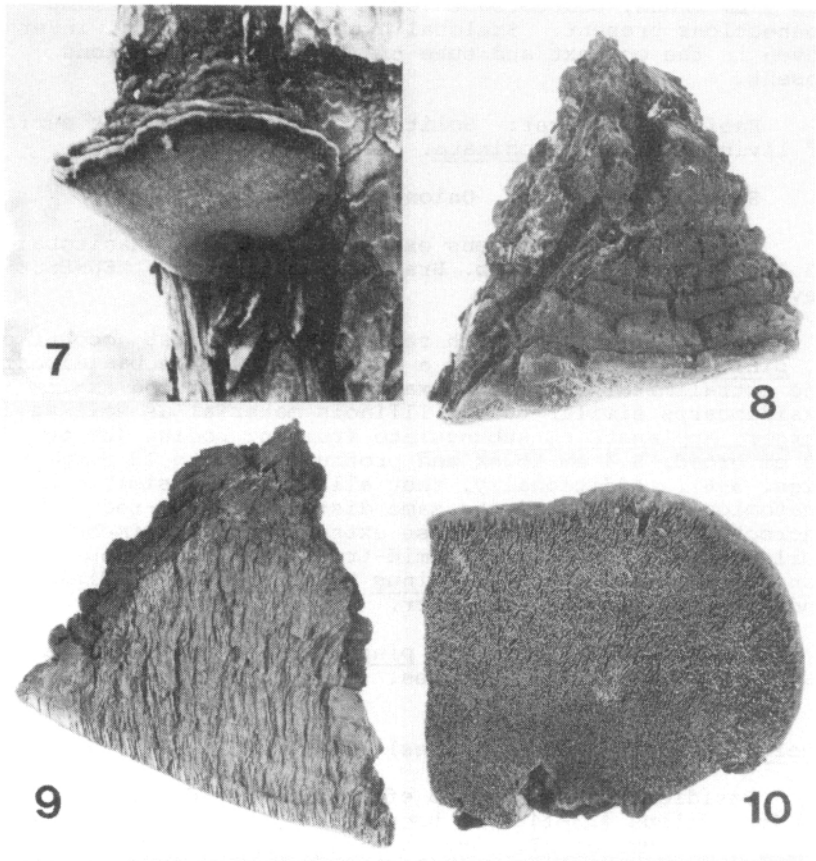
This collection, which represents the first account of F. pinicola in Illinois, is a small diminuative basidiocarp. The extralimital specimens examined also produced small basidiocarps similar to the Illinois material as well as larger, applanate to subungulate fruiting bodies (up to 20 cm broad, 5.4 cm thick and protruding up to 12.5 cm; Figs. 5-6). Additionally, they all exhibited similar anatomical details and the same distinctive KOH-red macrochemical reaction. These extralimital specimens were collected from the lower to mid-trunk area of various coniferous hosts including Pinus banksiana Lamb., Picea sp. and Tsuga canadensis (L.) Carr.

The binomial Fomitopsis pinicola (Sw. ex Fries) Karst. is often used for this species.

Phellinus pini (Thore ex Fries) Pilát Figs. 7-10

Basidiocarps sessile to effused-reflexed, hard and woody. Pileus 4.3-14.1 cm broad, 2.4-7.4 cm thick, protruding 2.9-9.2 cm, usually ungulate but occasionally applanate; surface tomentose to glabrous, becoming encrusted and cracked-rimose with age; "brown" (6E5) to reddish brown ("Titan red", 7D6 to "greyish brown", 7F5), all parts black where touched with KOH; margin prominent, rounded or furrowed, often zonate and appressed-fibrillose, entire, 2-5 mm wide, "brown" (6E5-6) to reddish brown ("brick red", 7D7). Context 0.5-6.8 cm thick, golden yellow ("Indian yellow", 5B7) to "brownish orange" (6C6-8) to "greyish red" (7B5-6). Tube layer 3-5 mm thick, distinctly stratified, often sunken unequally into context, separate layers 1-3 mm broad, "reddish white" (7A2) to "greyish red" (7B6). Pore surface "greyish orange" (6B3-6) to "brownish orange" (6C6-7C5). Pores from less than 1 up to 3 per mm, round to daedaleoid; walls thick, entire.

Basidiospores (4-)5-6 x 4-6 µm, globose to subglobose; surface smooth; walls thin to moderately thick; hyaline to



Figs. 7-10. Phellinus pini. West 1040. 7. Habit on living Pinus echinata. 8. Upper surface, X 1/4. 9. Context and tube layers, X 1/4. 10. Pore surface X 1/4.

brown; inamyloid and not dextrinoid. Basidia 15-29 x 4-6 µm, clavate, sometimes medially constricted, 4-spored. Setae abundant, 37-71.5 x 5-13 µm, subulate to lanceolate; walls up to 4 µm thick, smooth; reddish brown. Tramal hyphae dimitic. Generative hyphae scattered, 2-3 µm broad, hyaline. Skeletal hyphae tightly interwoven in context, more or less parallel in the tube trama, 2-4 µm broad, brown. Clamp connections absent.

Habit and habitat: Solitary on living, standing native

P. echinata; mostly on trunks up to 10 feet above ground, but occasionally at the base or on exposed roots.

Specimens examined: Randolph Co.: West 1056. Union Co.: West 046, 836, 1040, 1043; J. K. Bouseman s.n. [ILL].

Phellinus pini was not evident in plantations. It has previously been recorded from Illinois only by Owens (1936) and Schanzle (1971).

This species is often cited as Fomes pini (Thore ex Pers.) Lloyd or Trametes pini (Thore) Fries in forestry literature.

DISCUSSION

The perennial basidiocarps of Fomes annosus and Phellinus pini can be found during all seasons. Basidiocarps collected in early spring through late fall were usually fertile while the majority of those collected in winter were not, suggesting a seasonal periodicity in sporulation. Anatomical details of the hymenia of winter collections were often obscured by Fungi Imperfecti, or the hymenia were collapsed or sterile. Although data are lacking for Fomes pinicola, it also produces perennial basidiocarps and probably follows a similar pattern to the preceding species in southern Illinois. Phaeolus schweinitzii produces annual basidiocarps which deteriorate relatively slowly. It fruits in late summer in Arkansas (Hepting and Chapman, 1938) and midsummer to late fall in the northeastern United States (Smith, 1970). Thus, its appearence in southern Illinois in July is not surprising, but more collections are needed to establish its fruiting period with certainty.

Phaeolus schweinitzii causes red-brown butt rot in living conifers (Harvey, 1962). In pine stands of the southeastern States, where it is responsible for much commercial cull, it gains entrance mainly through fire wounds; less commonly root infection also occurs (Hepting and Chapman, 1938). Although collected from only one area in Crab Orchard National Wildlife Refuge, many of the pine plantations there have trees with butt and root decay, and it is probable that P. schweinitzii, as well as F. annosus, may be responsible. In the Crab Orchard stands, prescribed burning is used to inhibit native hardwood reproduction under the plantations, and since fire apparently predisposes pine to infection by P. schweinitzii, this fungus will probably become a more prevalent pathogen in those stands where fire is used in management.

Phellinus pini is responsible for much commercial cull in Douglas fir in the northwestern United States, in eastern white pine in the northeast, and in the yellow pines of the southeast (Hepting, 1971). Its decay ("red heart" or "red rot") is most important in stands older than 80 years (Hepting and Chapman, 1938). Even though now present in only the two native pine stands, it will most likely spread to plantations managed using long term rotations, and will probably be particularly damaging to those managed in sawlog production. However, if mechanical damage (careless pruning, logging wounds, fire scars) is prevented, infection frequency may be reduced in older stands.

Fomes pinicola is common in most coniferous forests excepting those of the southern United States. It too causes trunk rot, but probably attacks only weakened individuals since it is much more prevalent in decays of fallen timber (Overholts, 1967). Its presence in southern Illinois is interesting because it was found on native P. echinata, a southern pine species, and the major part of its known range is the northern, Appalachian, and western coniferous forests, notably on Pseudotsuga, Abies, Picea and Tsuga. Even though only one collection is now documented, it is possible that it is more widely distributed in the native stands at Pine Hills but is not actively fruiting.

Fomes annosus was collected in almost all plantations examined, particularly in those which were cut over. It invades exposed stump surfaces, infecting root grafts of adjacent healthy trees. Its presence as a serious root pathogen will continually be a management problem. Treatment of freshly cut stumps during thinning operations should reduce the incidence of infection in the remaining trees of the stand.

CONCLUSIONS

Distribution and occurrence of Fomes annosus, F. pinicola, Phellinus pini, and Phaeolus schweinitzii in southwestern Illinois are apparently influenced by stand conditions. Although the two heart-rotting species, P. pini and F. pinicola, are currently known only from native pine stands, they will probably spread to older plantations. If a pine lumber market is projected for southern Illinois, these species will most likely adversely affect local plantations just as they affect those in the southern States. Ultimately, however, losses from root and trunk rots caused by the more aggressive species F. annosus and P. schweinitzii will perhaps be even more significant.

Because the presence of these pathogenic fungi will

ultimately influence forest management, future studies should be constructed to monitor the occurrence and spread of these species in southern Illinois.

ACKNOWLEDGEMENTS

I wish to thank Dr. Walter J. Sundberg for his guidance during this study and for his help in preparing the manuscript and illustrations. I also acknowledge the help of Mr. Wayne D. Adams in obtaining a permit allowing Dr. Sundberg and myself to collect on Crab Orchard National Wildlife Refuge land. A U. S. Forest Service Research Permit for study in the Pine Hills Ecological Area was kindly provided by District Ranger Joseph Newcomb. I am grateful to Dr. Patricio Ponce de Leon for providing research space and encouragement during partial preparation of this paper. Both he and Dr. Rolf Singer reviewed parts of the manuscript and made many helpful suggestions. Finally, recognition is given to Dr. D. P. Rogers, Mr. R. W. Schanzle, and Mr. J. M. Halbrendt who provided both specimens and valuable information, and thanks to Veronica Bagdonas-West for her assistance in the field.

LITERATURE CITED

Graham, V. O. 1970. Mushrooms of the Great Lakes region: The fleshy, leathery and woody fungi of Illinois, Ohio and the southern half of Wisconsin and of Michigan. Dover Publications, Inc., New York. 390 pp. [Reprint of original 1944 edition].

Harvey, G. M. 1962. Heart rots of Douglas-fir. U.S.D.A., Forest Service, Forest Pest Leafl. 73. 8 pp.

Hepting, G. H. 1971. Diseases of forest and shade trees of the United States. U.S.D.A., Forest Service, Agr. Handbook 386: 1-658.

Hepting, G. H. and A. D. Chapman. 1938. Losses from heart rot in two shortleaf and loblolly pine stands. J. Forestry 36: 1193-1201.

Jordan, C. B. 1969. The extent of Fomes annosus in pine plantations of the Crab Orchard Wildlife Refuge. M. S. Thesis. Southern Illinois University, Carbondale. 71 pp.

Kornerup, A. and J. H. Wanscher. 1967. Methuen handbook of colour. Methuen and Co., Ltd., London. 243 pp.

Moffatt, W. S. 1909. The higher fungi of the Chicago region. I. The Hymenomycetes. Chicago Acad. Sci. Natur. Hist. Survey Bull. 7: 1-156.

Overholts, L. O. 1967. The Polyporaceae of the United States, Alaska, and Canada. Univ. Michigan Press, Ann Arbor. 466 pp. [Reprint of original 1953 edition]

Owens, C. E. 1936. Studies on the wood-rotting fungus, Fomes pini. II. Cultural characteristics. Amer. J. Bot. 23: 235-254.

Ridgway, R. 1912. Color standards and color nomenclature. Washington, D. C.

Schanzle, R. W. 1971. The pileate pore fungi of Illinois. Trans. Illinois State Acad. Sci. 64: 347-349.

Smith, W. H. 1970. Tree pathology: A short introduction. Academic Press, Inc., New York. 309 pp.

West, K. A. 1975. Homobasidiomycetes associated with pine in southwestern Illinois. M. A. Thesis. Southern Illinois University, Carbondale. 196 pp.