CHAPTER 7

WOOD-DAMAGING FUNGI

LEARNING OBJECTIVES

After completely studying this chapter, you should:

- Know the characteristics of fungi that invade wood—i.e., their classification, reproduction, appearance, etc.
- Know the environmental conditions in wood that favor fungal growth.
- Know the two main groups of wood-damaging fungi, the types of fungi found in each, and the signs and symptoms of the damage they cause.
- Know which insects are associated with wood-destroying fungi and the environmental conditions that favor them.
- Know where and how to inspect for evidence of wood-damaging fungi.
- Be familiar with the techniques needed to prevent infestations by wood-destroying fungi.
- Be familiar with habitat modification techniques for controlling wood-destroying fungi.
- Know which chemicals are used to treat wood and control wood-destroying fungi, the relative effectiveness of each, and how they can be applied safely.

Wood is subject to attack and degradation by fungi and insects. These organisms attack in a variety of ways, some utilizing wood substances for food, some using it for shelter, and others for food and shelter. Pest management professionals must recognize and understand the nature of these wood-attacking organisms to prescribe the appropriate treatment and to assure proper performance of their treated products.

Fungi are a major cause of wood degradation. Fungi used to be classified in the plant kingdom but are now classified in a kingdom separate from plants and animals. Like animals, fungi are heterotrophic—i.e., they must consume preformed organic matter rather than manufacture their own food as plants do during photosynthesis. Fungi consist of microscopic threads called ***hyphae*** that are visible to the naked eye only when many of them occur together. Deadwood conks and mushrooms are easily visible examples of the fruiting bodies of fungi from which the reproductive spores are produced and disseminated. Some fungi merely discolor wood, but wood-decaying fungi can change the physical and chemical properties of wood, thus reducing its strength. Therefore, the many wood-inhabiting fungi can be divided into two major groups, depending on the damage they cause:

- Wood-decaying fungi (wood-rotting fungi).
- Wood-staining fungi (sapstaining fungi, molds).

All fungi produce spores (which are like tiny seeds) that are distributed by wind and water. The spores can infect moist wood during storage, processing, and use.

All fungi have certain basic requirements:

- Favorable temperatures(usually ranging between 50 and 90 degrees F. The optimum is about 70 to 85 degrees F. Wood is basically safe from decay at temperatures below 35 and above 100 degrees F.
- Adequate moisture(fungi will not attack dry wood (i.e., with a moisture content of 19 percent or less). Decay fungi require a wood moisture content (M.C.) of about 30 percent (the generally accepted fiber saturation point of wood). Thus, air-dried wood, usually with an M.C. not exceeding 19 percent, and kiln-dried wood, with an M.C. of 15 percent or less, may be considered safe from fungal damage.

- Adequate oxygen—most fungi cannot live in water-saturated wood.
- Food source—wood substance (cellulose, hemicellulose, lignin).

WOOD-DECAYING FUNGI

The sapwood and heartwood of most tree species are susceptible to decay. Decay fungi grow in the interior of the wood or appear on wood surfaces as fan-shaped patches of fine, threadlike, cottony growths or as rootlike shapes. The color of these growths may range from white through light brown, bright yellow, and dark brown. The spore-producing bodies are the ***fruiting bodies*** of the fungus and may take the form of mushrooms, shelflike brackets, or flattened, crustlike structures. Fine, threadlike fungal strands called ***mycelia*** grow throughout the wood and digest parts of the wood as food. In time, the strength and other properties of the wood are destroyed.

Once decay has started in a piece of wood, the rate and extent of deterioration depend on the duration of favorable conditions for fungal growth. Decay will stop when the temperature of the wood is either too low or too high or when the moisture content is lower than the fungi's requirements. Decay can resume when the temperature and moisture content become favorable again. Early decay is more easily noted on freshly exposed surfaces of unseasoned wood than on wood that has been exposed and discolored by the weather.

Wood decay fungi can be grouped into three major categories: brown rot, white rot, and soft rot.

Brown Rot

Poria monticola, Serpula lacrymans

Fungi that cause brown rot are able to break down primarily the ***cellulose*** component of wood for food, leaving a brown residue of ***lignin***. Wood infested with brown rot can be greatly weakened even before decay is visible. The final stage of wood decay by the brown rots can be identified by:

- The dark brown color of the wood.
- Excessive shrinkage.
- Cross-grain cracking.
- The ease with which the dry wood substance can be crushed to a brown powder.

Brown rot fungi are probably the most important cause of decay of softwoods used in aboveground construction in the United States. Brown rot-decayed wood, when dry, is sometimes called "dry rot." This is a poor term, because wood must have moisture and will not decay when it is dry.

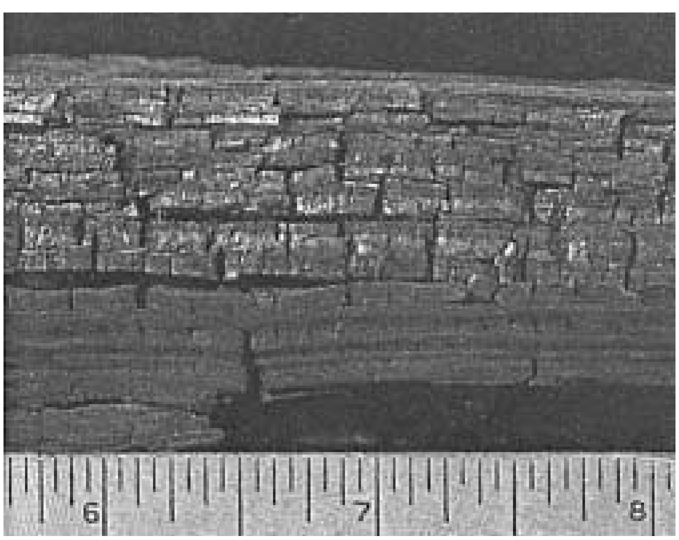


Figure 7.1. Brown rot with characteristic cracks along the grain.

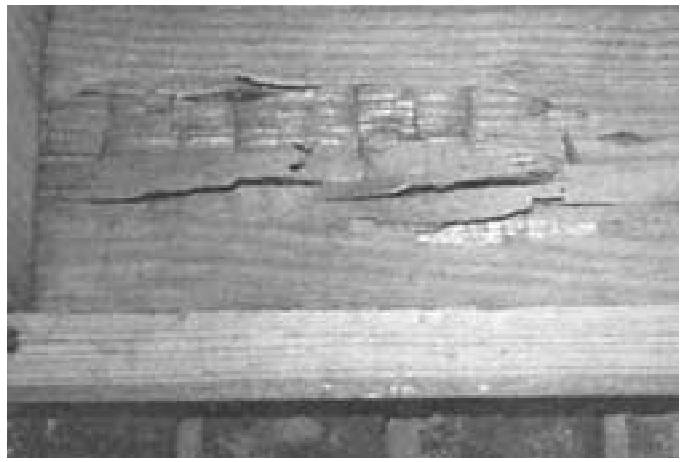


Figure 7.2. Wood damaged by *Poria*, with apparently sound surface and severe rot below surface.

A few fungi that can decay relatively dry wood have water-conducting strands (rootlike structures called ***rhizomorphs***) that can carry water from damp soil to wood in lumber piles or buildings. These fungi can decay wood that otherwise would be too dry for decay to occur. They are sometimes called the "dry rot fungi" or "water-conducting fungi."

Figure 7.3. Rhizomorphs of *Poria* growing from earth-filled porch.

White Rot

Phellinus megaloporus, Poria contigua

White rot fungi, which break down both lignin and cellulose, have a bleaching effect that may make the damaged wood appear whiter than normal. Affected wood shows normal shrinkage and usually does not collapse or crack across the grain as with brown rot damage. It loses its strength gradually until it becomes spongy to the touch. Sometimes white rot fungi cause thin, dark lines to form around decayed areas, referred to as ***zone lines***. The wood does not shrink until decay is advanced. White rot fungi usually attack hardwoods, but several species can also cause softwood decay.

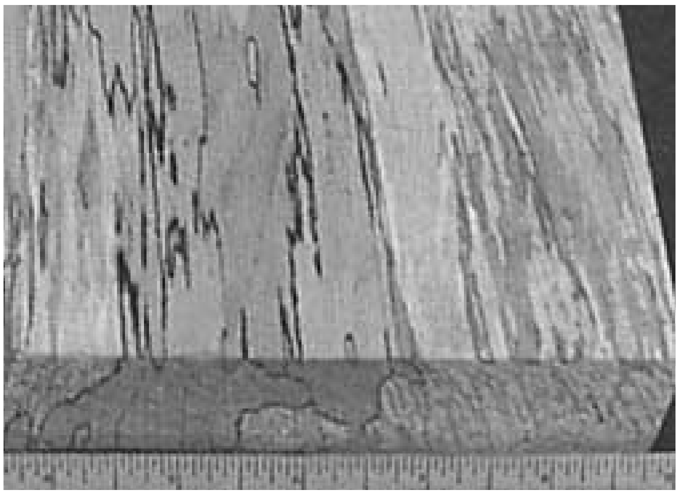
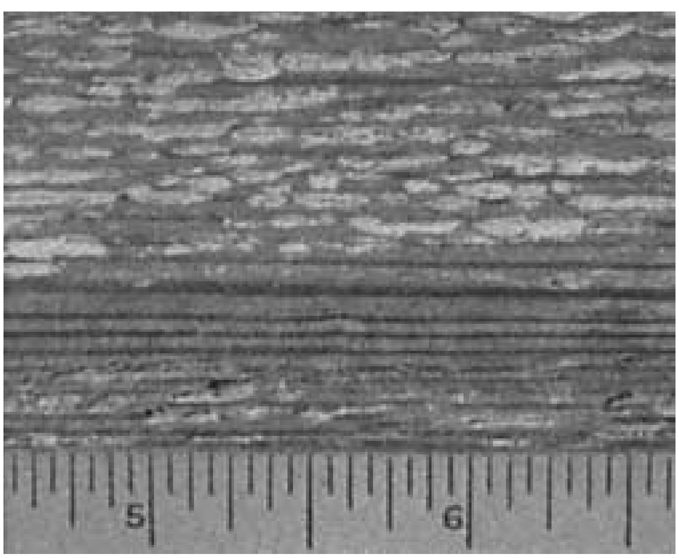


Figure 7.4. White rot with black zone lines sometimes found in the early stages of decay.

One species of white rot fungi, called white pocket rot, attacks the heartwood of living trees. The decayed wood contains numerous small, spindle-shaped, white pockets filled with the fungus. These pockets are generally 1/8 to 1/2 inch long. When wood from infected trees is seasoned, the fungus dies. Therefore no control is necessary. White pocket rot generally is found in softwood lumber.



7.5. White pocket rot.

Soft Rot

Chaetomium globosum

Soft rot fungi usually attack green (high-moisture) wood, causing a gradual and shallow softening from the surface inward that resembles brown rot. The affected wood surface darkens, and this superficial layer, up to 3 to 4 mm deep, becomes very soft, giving the decay its name.

WOOD-STAINING FUNGI

Stain fungi are usually visible as a discoloration of the wood, often bluish, and are of little importance as destroyers of wood. Sometimes lumber stores will even sell wood with blue stains for a higher price because of its decorative value. Though the stain fungi are feeding on the wood in their active stage, they do so at a very slow rate and do not cause much damage. Their presence as an active growth indicates that conditions are right for potential growth of other fungi that may be a problem, however.

Sapstaining Fungi

Ceratostomella spp., *Diplodia* spp.

These fungi penetrate and discolor sapwood, particularly of softwood species. Typical sapstain, unlike staining by mold fungi, cannot be removed by brushing or planing. Sapstain fungi may become established in the sapwood of standing trees, sawlogs, lumber, and timbers soon after they are cut and before they can be adequately dried. The strength of the wood is not greatly affected, but the wood may not be fit for use where appearance is important (such as siding, trim, furniture, and exterior millwork that is to be clear-finished).

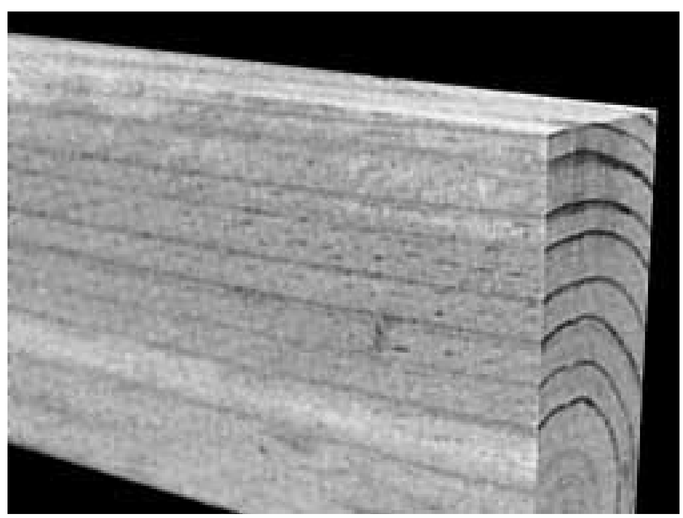


Figure 7.6. Sapstain fungi in pine sapwood.

Sapstaining fungi include several fungus types. Some of the most common are called blue stain fungi. They commonly produce a bluish, threadlike fungal growth deep within the wood that gives it a bluish color. The blue color may completely cover the sapwood, or it may be visible as specks, streaks, or patches in varying shades of blue.

The color of the stain depends on the kind of fungus and the species and moisture content of the wood. Other stains may be yellow, orange, purple, or red.

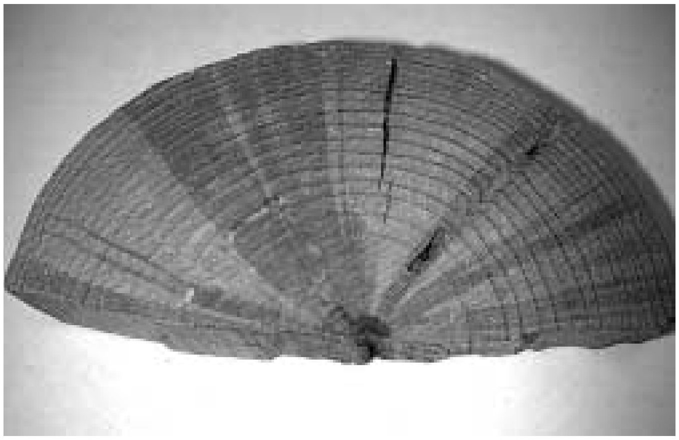


Figure 7.7. Blue stain fungi (Michigan State University).

Mold Fungi

Fusarium spp., *Penicillium* spp.

These fungi first become noticeable as green, yellow, brown, or black, fuzzy or powdery surface growths on the wood surface. The colored spores they produce can usually be brushed, washed, or surfaced off. On open-pored hardwoods, however, the surface molds may cause stains too deep to be easily removed. Freshly cut or seasoned wood stockpiled during warm, humid weather may be noticeably discolored with mold in less than a week. Molds do not reduce wood strength, but they can increase the capacity of wood to absorb moisture, thus increasing the potential of attack by decay fungi.

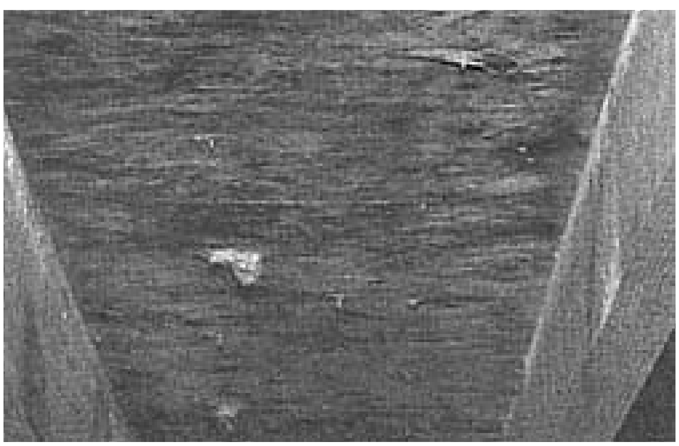


Figure 7.8. Surface molds on plywood attic.

Chemical Stains

Chemical stains may resemble blue or brown stains but are not caused by fungi. These stains result from chemical changes in the wood of both softwoods and hardwoods. Staining usually occurs in logs or in lumber during seasoning and may be confused with a brown sapstain caused by fungi. The most important chemical stains are brown stains that can downgrade lumber for some uses. They usually can be prevented by rapid air drying or by using relatively low temperatures during kiln-drying.

INSECTS ASSOCIATED WITH WOOD-DESTROYING FUNGI

Many insect pests are encouraged to take up residence in wooden structures by excessive moisture conditions. Termites, particularly the dampwood termites and subterranean termites, require moisture in their living quarters. Subterranean termites provide moisture for themselves by bringing moisture and soil up from their subsurface colonies and placing it within the wood as they feed on it or around the outside of wood to form their enclosed runways. In some cases, subterranean termites may be found separated from soil contact when sufficient moisture, in the form of water leaks, is found inside a structure.

The retention of moisture is not the only important water-related factor in the life of the termite. The warm, moist conditions that prevail within the closed system of the nest provide an ideal site for the growth of microorganisms, particularly fungi, which provide a source of protein and vitamins essential to the termite. The accumulation of termite fecal material in the nest, in turn, helps to promote the growth of the fungi.

The most striking fact of this intricately interdependent system is the delicacy with which it is balanced. It is not uncommon to discover the remains of a termite colony that is slowly being crowded out by the growth of fungi that has for some reason progressed at such a rate that the termites could not keep up with it. If sudden temperature shifts or other factors result in the accumulation of water within the galleries, the termites may drown.

A number of beetles are associated with excessive moisture and fungus problems in structures. The furniture beetle, an anobiid beetle, is commonly attracted to moisture and fungus. Anobiid larvae eat the wood, and the beetle may reinfest over many generations, reducing the wood to little more than powder. Anobiid larvae will not survive in wood with a moisture content below 12 percent. The drier the wood, the slower their growth.

Other families of beetles are also associated with excessive moisture in structures, but with all these families, it is the fungus growth to which they are attracted. These "fungus beetles" include:

- Cisidae—the minute fungus beetles.
- Cryptophagidae—he silken fungus beetles.
- Lathridiidae—minute brown scavenger beetles.
- Tenebriodiae—darkling beetles.
- Cucujidae—flat bark beetles.

These beetles and their larvae feed on fungus growth on wood, such as *Poria*, or may be present in damp foods where even tiny amounts of fungus growth or fungal spores are present. The fungus beetles are not wood-damaging pests but are associated with moisture problems and are a good indication that such problems are present.

Carpenter ants are another group of insects that are attracted to moist wood. They prefer to do their tunneling in wood that has been softened in some way and is easier to chew through. They do not feed on the wood but merely excavate large chambers to create a suitable place to live and rear their larvae. Control of moisture sources will help to keep these pests out of the structure as well.

In addition to the beetles and ants, a number of other pests are attracted to moisture conditions in buildings. Most are merely nuisances that cause no problem beyond their mere presence. Some of these are springtails, silverfish, mites, millipedes, fungus gnats, and booklice.

CONTROL AND MANAGEMENT OF WOOD-DESTROYING FUNGI

Inspection

The inspector may use the **pick test** to detect loss of wood toughness and the presence of wood decay at as little as 5 to 10 percent loss of weight. In this test, a sharp pointed object, such as an icepick, is used to poke into and pry up a segment of wood, especially to "latewood" areas of darker rings. In decayed wood, the pried-up section will break abruptly, directly over the tool, whereas in sound wood the break will occur at a point away from the tool. This test is very subjective, but it is possible to detect very early stages of decay by both brown rot and white rot.

The surface molds and stain fungi grow more rapidly than decay fungi and often appear on wood during construction. Fungus growth will not continue after construction if the wood dries out. However, the presence of stain fungi indicates that conditions at one time were suitable for decay, and an inspection using a moisture meter should be conducted to see if the wood is still moist enough to support decay fungi.

Measuring wood moisture with a moisture meter is an important method to determine:

- Whether wood has a moisture content (20 percent or above) that will lead to decay.
- Small changes in the moisture content of wood to demonstrate the success of a moisture control program over time.
- The likelihood of infestation or reinfestation by wood-boring insects.
- Whether fungi seen on the wood surface are still actively growing.

The electric resistance of wood decreases as its moisture content increases. This is the basis for the operation of portable **moisture meters**. They measure the resistance between two needles inserted into wood and give a direct readout of moisture content. The higher the meter reading (decreasing electric resistance), the higher the amount of moisture in the wood. Moisture meter readings can be affected by the wood species involved, moisture distribution, grain direction, chemicals in the wood, weather conditions, and temperature. Thus, directions and information supplied with the meter must be understood and followed to ensure accurate readings. Some common sources of moisture in structures are listed below. These areas should be inspected for signs of wood-decaying fungi and moisture above 20 percent.

- Water vapors from the combustion of natural gas that improperly vent into the attic or other enclosed areas.
- Condensation on windows flowing down onto and into sills.
- Moisture from crawl spaces and the dirt below (up to 100 pounds / day / 1,000 square feet).
- Absent or improperly placed drain pipes, downspouts, etc.
- Leaking roofs.
- Poor side wall construction.
- Improperly sealed foundations, basement walls.
- Direct contact of wood with soil or concrete, allowing "wick" action that pulls water into wood.
- Improper drainage of water away from structure or out of crawl spaces.
- Improperly fitted flashings at roof lines or shingles with improper overhang.
- Improper moisture barriers under stucco, shingles.
- Sweating water pipes.
- Improper exterior grade that allows water to drain toward the structure and remain in contact with it.
- Dripping air conditioners or swamp coolers.
- Leaking plumbing, appliances, toilets, shower stall pans.
- Improper seals or caulk around bathtubs and showers.
- Lack of vents or windows in bathrooms that allow moisture from baths and showers to accumulate.
- Plugged or leaking downspouts from roof gutters.

Condensation is free water or ice extracted from the atmosphere and deposited on any cold surface. The term **relative humidity** is a means of describing the amount of water vapor held by air. If more water vapor is injected into air than the air can hold at that temperature, the excess condenses into visible droplets.

In recent years, the shift in building practices to larger homes that are more airtight has led to additional condensation problems. Energy conservation practices have increased the airtightness of buildings. Also, emphasis has been placed on the installation of humidifiers in heating units to create a more comfortable environment. The also increase the likelihood of moisture problems in wood. Finally, improperly installed insulation may contribute to moisture problems.

There are numerous sources of water vapor in buildings. Mopping floors, washing clothes, cooking, baking, and so forth introduce an estimated 1 pound of water per day into the air of an average home. A poorly ventilated crawl space may produce up to 100 pounds of water per day per 1,000 square feet. These moist environments are favorable for the reproduction and survival of decay fungi, termites, and other moisture-loving insects.

Prevention

Simply maintaining a building properly by fixing leaky pipes and faucets, repairing a leaky roof, etc., is often all that is needed to control wood-destroying fungi. Simple repairs such as these will often save thousands of dollars by preventing damage and expense from wood-destroying fungi. Prevention, however, begins even before the maintenance stages—the structure must be built properly to begin with.

When wood is used in the construction of a building, it should be well seasoned so that it does not contain enough natural moisture to support decay fungi. Wood should not be used in those parts of construction where it can be moistened by wet soil. In extremely wet or humid areas, construction lumber is frequently treated with preservative chemicals to prevent fungus damage.

Water should drain away from a properly constructed building. This is accomplished through proper grading and roof overhang and the use of gutters, downspouts, and drain tile. Proper grading should be taken care of before construction; it is usually an expensive task if done later. The other methods should be used to move water away from the foundation walls. It is important that condensation (e.g., from air conditioners) be properly drained. Indoors, dehumidifiers should be used where moisture in the air is likely to be a problem

Proper ventilation in crawl spaces can be obtained by installing 1 square foot of opening for each 25 linear feet of wall. These openings should be located so as to provide cross-ventilation. This opening should be unobstructed. Where screening, wire mesh, or louvers are used, the total opening should be greater than 1 square foot per 25 feet of wall. Provision should be made to close vents off during the winter.

Attic vents are recommended at the rate of 1 square foot of vent for every 150 to 300 square feet of attic floor space. Vents should be located both near the ridge and at the eaves to induce airflow. Where louvered openings cannot be used, globe ventilators, fan exhaust ventilators, or special flues incorporated in a chimney may be best. Inlet openings under the cornice or roof overhang are required in all cases. Flat roofs where the same framing is used for ceiling and roof require openings between the joists. Any opening provided should be screened and protected from the weather.

Vapor barriers are a preventive measure usually applied to the subareas of buildings. Installation of a vapor barrier on the soil surface will cause soil moisture to condense on the barrier and return to the soil rather than condense on the floor and joists above. Covering the soil with roofing paper or 4-mil to 6-mil polyethylene sheets can make adequate barriers. Proper installation of these barriers is essential; a small portion of the soil surface should be left uncovered. Leaving spaces between strips, for example, allows the subarea to “breathe” better and any standing water will have a place to go. This is particularly important if the subarea is very wet prior to installation. This will also allow wood in the crawl space to dry slowly, minimizing warping and cracking. Inspection 1 to 3 weeks after installation will allow for proper adjustments of the vapor barrier so that the wood can slowly recover from excess moisture.

Habitat Modification

The first step in correcting a fungus condition is to determine the source of moisture and eliminate it, if possible. All badly rotted wood should be removed and replaced with sound, dry lumber. When it is not possible to eliminate the source of moisture entirely, the replacement lumber should be pressure treated with a wood preservative before installation. Wood should not be allowed to remain in contact with the soil.

Chemical Control

In most cases, spraying chemicals will not control wood-decaying fungi. Eliminating moisture sources and replacing decayed wood with pressure-treated wood is the recommended control. Chemical use, however, may be warranted in situations where wood cannot be easily dried.

Prevention

Chemical wood preservatives are an effective means of preventing wood decay. Pressure treatment with preservatives such as creosote, zinc chloride, pentachlorophenol, and/or copper naphthenate has been used extensively. The pest management professional needs to be aware of the high toxicity of these chemicals. Pentachlorophenol, for example, is no longer readily available to the consumer in either the ready-to-use (5 percent penta) or the concentrated (40 percent penta) formulation because of its high toxicity and status as a carcinogen. Pest management professionals should be careful when handling pretreated wood. Wear rubber gloves and long-sleeved clothing and wash thoroughly after handling. ***Never dispose of preservative-treated wood by domestic incineration or use as a fuel in fireplaces or wood-burning stoves***. Treated wood, end pieces, wood scraps, and sawdust should be disposed of at a sanitary landfill. Small quantities may be disposed of with household trash.

Control

Less toxic, more environmentally friendly fungicides than the pressure-treated wood preservatives are commercially available. These fungicides are often borate-based. To control fungi on existing wood structures, the wood should be kept clean with periodic high-pressure washings and a fungicide application to kill remaining fungal spores to prevent reinfestations. It is most important to point out that the application of fungicides or insecticides to fungus-infested wood or soil will not stop the wood decay. Only by eliminating the moisture source can wood decay be completely controlled. Therefore, the application of chemicals by pest management professionals is of minor importance in fungus control work.

Before the application of toxic chemicals for wood-destroying fungus control (as is true for any aspect of pest control), all physical, sanitary, and other means of control must be implemented. Not only will the control be more effective in the end, but fewer chemicals, or none at all, will be placed into the environment where humans and animals may come into contact with them. Removal of all sources of excessive moisture and replacement of obviously fungus-infested wood with sound timber are the keys to fungus control in structures.

Borates as fungicides

A number of boron-containing products are available and referred to generically as "borates." The borate known as disodium octaborate tetrahydrate (DOT) is actually a combination of several borates. Borates are well suited to fungus control because they are low hazard, easy to apply, long lasting, and quite effective against both fungi and wood-destroying insects. Part of their success as a wood treatment can be attributed to their high solubility in water. They are easy to mix in a water carrier and are carried along by water diffusing through the wood.

They are available in a variety of formulations that allow spraying, brush-on, gel, and foam applications. There is also a formulation available consisting of solid rods that are inserted into holes drilled into the wood. These are designed for use in wood with high moisture content that cannot be easily dried.

SUMMARY

The pest management professional must be able to distinguish the signs and symptoms of wood-damaging fungi from insect damage. Damage from fungi is often more easily controlled than insect damage with less dependence on pesticides. Prevention by controlling moisture sources, limiting soil to wood contact, and replacing damaged wood with chemically treated wood offer the best control.

CHAPTER 7

Review Questions

Chapter 7: Wood-damaging Fungi

Write the answers to the following questions and then check your answers with those in the back of the manual.

1. What are the two main groups of wood-damaging fungi?

2. Which is NOT true about fungi?

   A. Reproduce by spores.

   B. May discolor wood.

   C. Include mushrooms and conks.

   D. Belong to the plant kingdom.

3. Which environmental conditions would favor the growth of fungi?

   A. Temperature below 35 degrees F, moisture content of air-dried wood less than 19 percent.

   B. Temperature between 35 and 100 degrees F, water-saturated wood.

   C. Temperature above 100 degrees F, moisture content of air-dried wood 19 to 30 percent.

   D. Temperature between 35 and 100 degrees F, moisture content of air-dried wood 19 to 30 percent.

4. What is considered the optimal temperature range for fungal growth?

   A. 10 to 35 degrees F

   B. 35 to 70 degrees F

   C. 70 to 85 degrees F

   D. 85 to 100 degrees F

5. Which is NOT a characteristic of decay fungi?

   A. Attack sapwood and heartwood of most tree species.

   B. Mycelial fans appear on wood surfaces.

   C. Fruiting bodies may be mushrooms, shelflike brackets, or crusty, flattened structures.

   D. Early decay is more easily noted on weathered, discolored wood than on freshly exposed, unseasoned wood.

6-14. Match the following decay fungi to the appropriate description.

A. Brown rot

B. White rot

C. Soft rot

____ 6. Usually attacks green (water-saturated) wood.

____ 7. Probably the most important decay of soft woods used in aboveground construction.

____ 8. Symptoms include excessive shrinkage and cross-grain cracking of wood.

____ 9. Both lignin and cellulose are broken down; wood looks bleached.

____ 10. Wood infected with this fungus can be greatly weakened before decay is visible.

____ 11. Affected wood shows normal shrinkage, does not collapse or crack across the grain, and loses strength gradually until spongy to the touch.

____ 12. Affected wood surface darkens and a superficial layer up to 3 to 4 mm deep becomes very soft.

____ 13. The affected wood is easily crushed to a brown powder.

____ 14. Includes a few fungi that can infect relatively dry wood because of water-conducting strands.

____ 15. Breaks down cellulose, but not lignin.

16. What should the pest management professional do if white pocket rot is found in a home?

A. Recommend treatment

B. Replace infested wood

C. Nothing

D. A & B

17. “Dry rot” refers to brown rot fungi infecting completely dry wood.

A. True

B. False

18. Which is NOT true of wood-staining fungi?

A. Often cause a bluish discoloration of wood.

B. Significantly reduce the strength of wood.

C. Their presence indicates favorable conditions for the growth of other fungi.

D. Feed on wood at a very slow rate.

19-26. Match the following to the appropriate description.

A. Sapstaining fungi

B. Mold

C. Chemical stains

D. All of the above

____ 19. Discolor sapwood, particularly of soft wood species.

____ 20. Commonly produce a bluish, threadlike fungus growth deep within wood.

____ 21. First noticeable as green, yellow, brown, or black, fuzzy or powdery surface growths on the wood.

____ 22. Blue or brown stain not caused by fungi.

____ 23. Colored spores can usually be brushed, washed, or surfaced off.

____ 24. Fungal stains can not be removed by brushing or staining.

____ 25. Includes *Penicillium* species.

____ 26. Can downgrade the value of lumber.

27. When do chemical stains occur? How might they be prevented?

28. Describe the interdependent relationship between fungi and termite colonies.

29. Termite colonies may be crowded out by rapid fungal growth.

A. True

B. False

30. Which of the following fungus-associated insects actually feeds on wood?

    A. Anobiid beetle
    B. Carpenter ant
    C. Fungus beetle
    D. Millipede

31. Describe the pick test as a diagnostic tool of wood decay. To what level (percent) does the pick test indicate wood decay?

32. What important factors about wood can be indicated with the use of a moisture meter?

33. List factors that can affect moisture meter readings.

34. List at least 5 common sources of moisture in structures.

35. The shift in recent years to larger houses that are more airtight has decreased condensation and moisture problems in homes.

    A. True
    B. False

36. A poorly ventilated crawl space may produce up to 100 pounds of water per day per 1,000 square feet.

    A. True
    B. False

37. What methods can be used to move water away from foundation walls?

38. Which is the appropriate spacing of openings for proper ventilation in crawl spaces?

    A. 1 square foot of opening per 25 feet of wall.
    B. 1 square foot of opening per 50 feet of wall.
    C. 1 square foot of opening per 75 feet of wall.
    D. 1 square foot of opening per 100 feet of wall.

39. Which in an appropriate spacing for vents in attics?

A. 1 square foot of vent for every 50 to 150 square feet.

B. 1 square foot of vent for every 150 to 300 square feet.

C. 1 square foot of vent for every 300 to 450 square feet.

D. 1 square foot of vent for every 450 to 600 square feet.

40. What is the purpose of installing a vapor barrier?

41. When installing a vapor barrier, make certain the entire soil surface is covered.

A. True

B. False

42. What is the first step in correcting a fungus condition?

A. Replace all badly rotted wood with sound, dry lumber.

B. Determine moisture sources and eliminate them.

C. Insert borate rods.

D. Apply fungicides to the area.

43. When working with wood treated with pressure-treated chemical preservatives, what precautions should you take?

44. The application of fungicides or insecticides is the only treatment necessary to stop wood decay.

A. True

B. False

45. List some positive aspects of using borates as fungicides.