CHAPTER SEVEN

Wood Destroying Fungi

This chapter will familiarize you with the fungi often found infesting buildings. You will learn what conditions are important to their growth and how to recognize their presence. It is important for inspectors to be able to differentiate wood destroying insect evidence from wood destroying fungi evidence, as a potential conducive condition to wood destroying insects.

Fungi are members of the Plant Kingdom. Unlike other members of this kingdom, however, fungi do not contain chlorophyll. Green plants use chlorophyll to convert sunshine to energy, and to help process carbon dioxide and other nutrients into the food they need for their biological processes. Wood-decay fungi probably cause as much, and perhaps more, damage to structures each year as do termites. In fact, fungi are the primary recyclers and composters of organic material. Not all fungi are detrimental. Consider that penicillin and many other drugs are of fungal origin, fungi make the bread rise and the champagne bubble. Some fungi are, of themselves, serious pathogens of man, beast, and plants…and some, like mushrooms, are a direct food source.

Most wood decay fungi require a wood fiber saturation point of 28 – 32% for growth, while non-decay fungi require only 20%. Below these moisture levels these fungi are inactive, but not dead. They enjoy an ambient temperature range of 70 – 85 degrees Fahrenheit, and require only 5% of the amount of oxygen found in air.

A microscopic fungal **spore** lands on a susceptible piece of lumber. Spores may be transported by the wind or other air currents, by water, or on the bodies of various animals. A spore will germinate if temperature and moisture conditions are favorable, otherwise, they may remain dormant for periods up to several years. A thread-like structure called the **hypha** emerges from the spore and penetrates into the wood. It grows, branches and feeds on the wood cells.

As the hyphae grow together, they form a mat-like structure called the **mycelium.** Eventually fruiting bodies or **sporophores** are formed. These fruiting bodies are the toadstools or mushrooms that we are all familiar with as well as the shelf-like structure seen growing on tree trunks. The sporophore produces new spores, frequently by the millions, which become airborne and spread everywhere until they contact suitable wood on which to grow. Figure 7 – 1 illustrates this cycle.

The environmental conditions required by the fungi are: **warm temperatures, moisture, poor ventilation and the presence of oxygen.** Wood fungi will not grow if temperatures are too low (optimum temperature is between 70º and 90º F), the moisture content is less

than 20%, and if oxygen is absent. Wood submerged in water will not support fungal growth since the oxygen is not available below the water's surface.

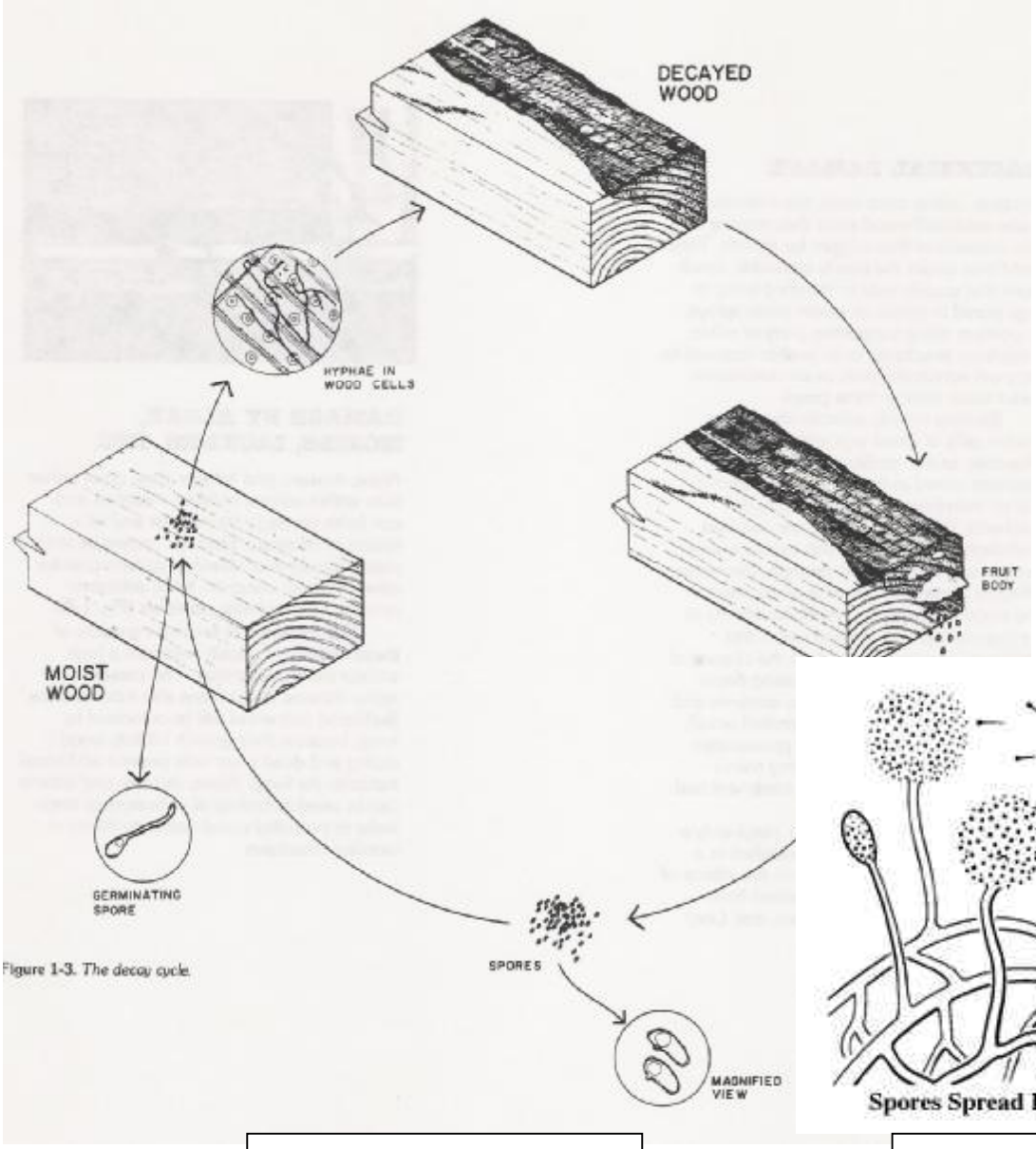

Figure 7 - 1

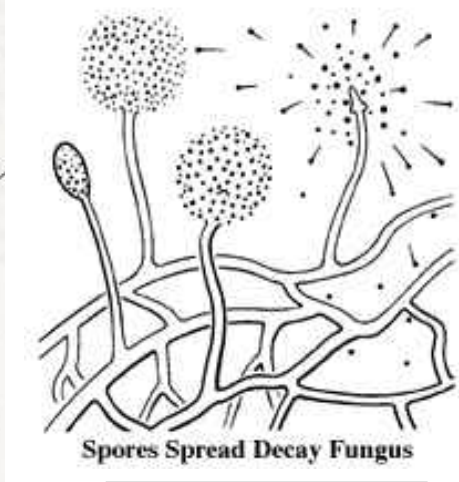

Figure 7 – 1 a

The fungi that attack wood are basically of three types:

1. **<u>Surface growing fungi</u>** or molds and mildews (fig. 7-2). These fungi primarily attack the surface of wood. They do not penetrate very deeply into it neither do they affect the structural strength of the wood. They may cause staining of the wood's surface which is usually easily removed. Finding mold on the wood does indicate a moisture

problem of 20% or more presently exits or did exist. This amount of moisture can favor the growth of decay fungi that do cause damage to the wood.

Figure 7 - 2

2. **Stain fungi** also called blue stain fungi, does penetrate deeper into the wood but as in the case of molds, does not cause structural damage. They produce a stain that is gray to blue- black and is not easily removed since it exists deep within the wood. The presence of this type of fungus indicates a past or current moisture problem. It also increases the ability of the wood to absorb moisture.

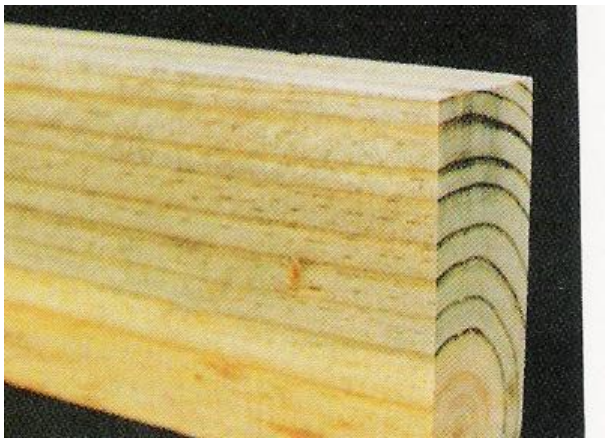

Figure 7 - 3

3. **Decay fungi** are those that cause considerable damage to structural wood. Decay fungi consist of the following four types of rot: white rot, soft rot, brown rot, and white pocket rot.

A. **White rot** (fig 7-4) gets its name because the wood it attacks becomes lighter in color. It has a bleached appearance and is very fibrous or stringy looking. There are usually darker stains deep within the wood. White rot usually attacks hardwoods. White rot utilizes both cellulose and lignin. Lignin is not a sugar based compound as is cellulose. Lignin helps bind the plant cells together. With the removal of lignin the wood becomes spongy. Visible reproductive structures such as mushrooms may eventually develop.

Figure 7 - 4

B. **Soft rot** occurs where wood is quite wet such as under leaky water towers. These fungi degrade cellulose and may partially digest lignin. The surface of the wood becomes soft or spongy, darkened in color. Shrinkage of wood does not occur when the wood dries. It does, however, develop cracks or fissures. Soft rot usually attacks hardwoods, and may be undifferentiated in appearance from brown rot.

Figure 7 - 5

C. **Brown rot** is the most common decay fungi found in buildings. These fungi are rapid in their destruction of wood. Brown rot utilizes cellulose and some lignin. Cellulose is a polysaccharide or sugar based compound. Glucose is its main sugar component. Cellulose is the main constituent of the plant's cell wall. It gives the cells their strength. Affected wood loses its strength, picks up water easily and retains it for a long time. When drying occurs, the wood shrinks greatly and develops cracks running perpendicular to its grain. When lifted, damaged wood is almost weightless and if you compress it between your fingers, it crumbles into a powder. Brown rot usually has white mycelia.

Brown rots can be separated into what is known as wet rot and dry rot. Wet rot (fig. 7-6) requires wood moisture content of 40 to 50%. The infested wood becomes darker in color (almost black) because of the concentration of tannins in it after the fungus removes the other cellular components. The surface of the wood seems to be intact but there could be considerable damage present internally.

Figure 7 - 6

Dry rots are those brown rot species that are found growing on what looks like dry wood. The wood you see them growing on does not appear to be wet however; moisture content usually is from 20 - 40%. These fungi produce a thick root-like growth called a **rhizomorph** that extends downwards to a moisture source. The rhizomorphs conduct water upwards from the ground to a distance as far as 25 feet away. This transported moisture al-lows the fungus to grow in apparently dry places where they would not normally be able to survive. Rhizomorphs may attain a thickness of ¾" (20 mm). Dry rot usually attacks softwoods. A common dry rot species in North America is *Poria incrassata.*

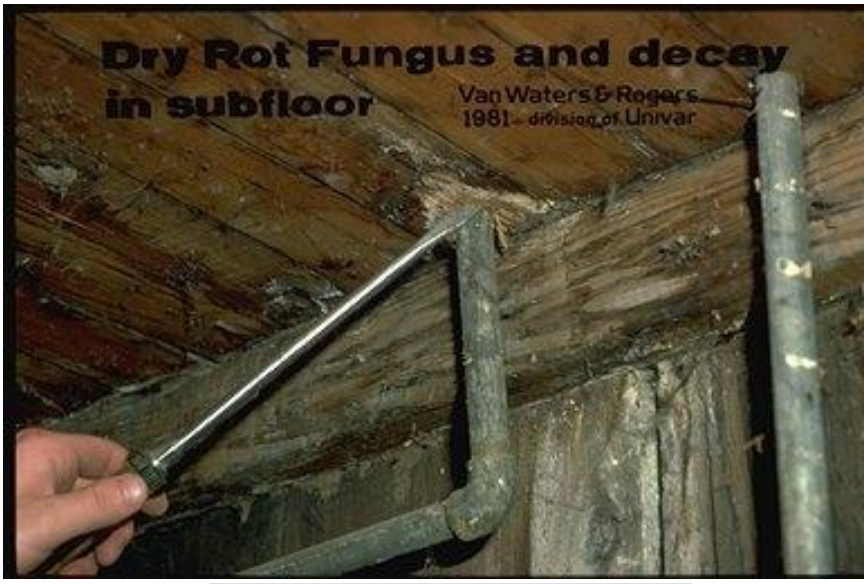

Figure 7 - 7

D. **White pocket rot** sometimes will be seen in structural timber. Wood attacked is usually softwood. This rot may be seen as shallow pockets of white on the surface of the wood. This fungus will not survive in structural wood since it does not continue to grow, even if the wood remains wet.

Figure 7 - 8

Damage caused by fungi will be quite different from that caused by wood destroying insects. Table Seven - 1 compares the appearance of fungal damaged wood with wood damaged by insects. Remember, however, both fungi and insects may be present in damaged wood.

Table 7 - 1 Comparison of wood damaged by fungi and insects.

FUNGAL DECAY	INSECT DAMAGE
Wood appears solid but is almost weightless when lifted.	Wood is not surprising lighter than it appears.
Galleries not evident	Galleries present
Frass is absent	Frass present inside galleries or beneath damaged wood.
Wood appears discolored.	Color of damaged wood about the same as undamaged wood.
Fungal mycelia seen growing on the surface of damaged wood.	Fungal mycelia absent on wood surf ace.
Wood shows cracks at right angles to its grain.	Cracking of the wood surface not present.
Fruiting bodies (mushroom - like or shelf - like structures) may be visible on woods.	Fruiting bodies not present.

INSPECTING FOR FUNGI

As already mentioned the presence of moisture is an important factor needed to promote the growth of decay fungi. What can you look for when making your inspection that would indicate a moisture problem? Look for any of the following conditions:

- Saturated or sagging insulation due to present or past or present wetness.

Figure 7 - 9

- Leaking pipe, or pipes showing condensation.

Figure 7 - 10

- Cracking or peeling paint.

Figure 7 - 11

- Mold growth or musty odor.

Figure 7 - 12

- Rusty roofing nails.

Figure 7 - 13

- Buckled shingles.

Figure 7 - 14

- A secondary termite colony.

Figure 7 - 15

- A leaking roof.

Figure 7 - 16

- A leaking ceiling

Figure 7 - 17

- A leaking shower, toilet, faucet, or garbage disposal.

Figure 7 - 18

- The presence of certain insects such as fungus gnats, fungus beetles [figure 7 – 19], mosquitoes, live sow bugs [figure 7 – 20] or live millipedes.

Figure 7 - 19

Figure 7 - 20