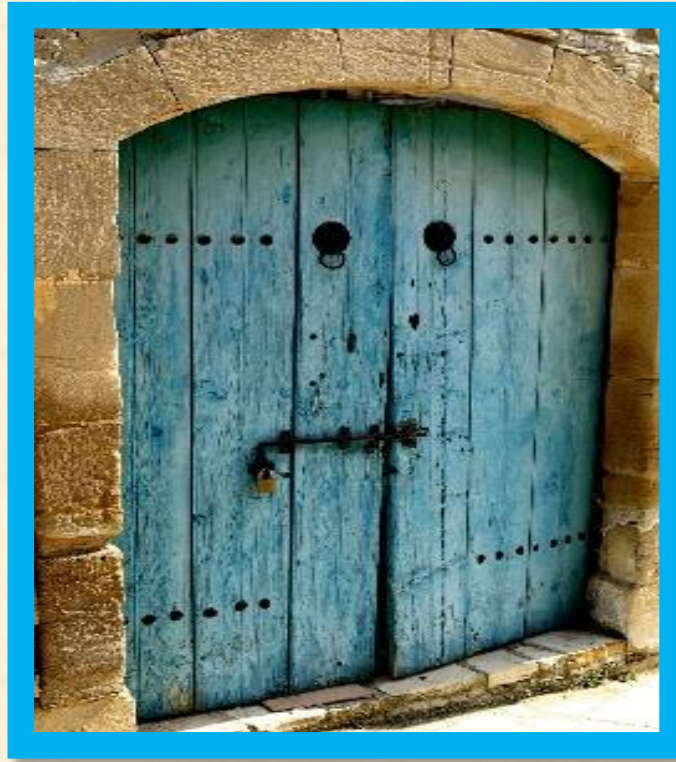


WOOD-DESTROYING ORGANISMS

Welcome to the four-part course on “Wood Destroying Organisms”. In this first module the focus is on the biological predators that can destroy the wood in your home or other residences.



MODULE 1 – THE FOCUS

This first module will focus on the following topics:

- Wood susceptibility
- How wood gets damaged
- Termites
- Beetles
- Ants
- The carpenter bee
- Weevils
- Horntail Wasps
- Borers
- Fungi



Termite damage



The Blue Carpenter Bee

WOOD SUSCEPTIBILITY TO PREDATORS

- Wood members of a building closest to the soil such as sills, joists, studs, girders and other important load-bearing elements of construction, are most likely to be severely damaged by termites.
- Failure to stop termites can cause lack of support.
- Heated buildings where wood is in direct contact with or in close proximity to the soil offer termites the ideal environment, a favorable year-round climate, and an abundant sheltered food source.



Subterranean termite damage

HOW WOOD IS DAMAGED

- Drywood termites live and feed in dry, sound wood and can cause structural damage.
- Woods that are soft and have a straight grain are preferred for easy tunneling by carpenter bees.
- Nail holes, exposed saw cuts, and unpainted wood are attractive starting points for boring.



An example of termite holes bored into a slab of wood.

HOW BEES DAMAGE WOOD

- Sometimes, several carpenter bees use the same piece of wood.
- If more than one bee uses the same entrance hole, their tunnels will extend in opposite directions, or run parallel to each other.
- Wood-destroying insects other than termites are capable of causing significant damage to structures, furniture, and other wood products.



A yellow and black
carpenter bee

WHY TERMITES LOVE WOOD

- To the misfortune of homeowners around the world, a termite's diet primarily consists of cellulose, a tough fiber found in plants, such as shrubs and trees. Cellulose must be broken down by an enzyme called cellulase.
- Termites don't produce cellulase, but they have microorganisms, including bacteria and protozoa, living in their digestive systems that help them break down cellulose into digestible substances. that give them the nutrients they need to live.
- Many termites feed on trees and rotting logs in wooded areas. However, they can't tell the difference between these types of wood and the wood that's used to build your house.
- If they manage to find exposed wood inside your house, they will eat it.



A
termite

WHO ARE THE PRIMARY PREDATORS?

Here is a list of the primary wood-destroying organisms and insects home inspectors will come up against:

- Termites
- Beetles (and weevils)
- Ants
- The carpenter bee
- Horntail Wasps
- Borers
- Additional wood-destroying organisms such as fungi



The Blue Horntail Wasp



Wood-destroying Beetle



White Pine Cone Borer

THE TERMITE

- The class ***Insecta*** is distinguished from the other arthropod classes by the three body regions—***head***, ***thorax***, and ***abdomen***.
- The head bears a single pair of antennae, ***the thorax bears three pairs of legs*** and usually wings, and the abdomen contains most of the digestive system and the reproductive organs.
- Termites live in true ***social colonies*** with a division of labor among the various types of individuals. These different types, called ***castes***, usually consist of ***reproductives***, ***soldiers***, and ***workers***.
- Castes vary considerably among the various species.



Termites at work

THE WORKERS DO THEIR JOB

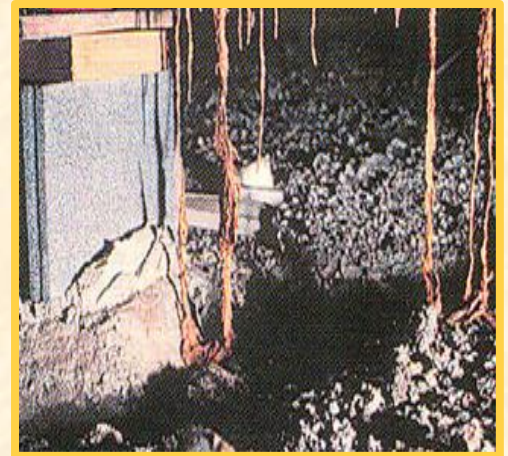
- **Workers** are the most numerous individuals in a termite colony.
- They perform all of the work of the colony (foraging, feeding, and grooming of the other castes (including the queen), building and repairing the nest, and making the tunnels.
- ***In the process of making nests and tunnels and ingesting food, they chew and eat wood,*** thus causing the destruction that makes termites economically important.
- Workers maintain the shelter tubes and close any breaks in the surface of the wood they are infesting.
- Termites must maintain this closed system to have a certain level of humidity and to protect themselves from natural enemies.



Subterranean
soldier termites

TERMITE REQUIREMENTS FOR SURVIVAL

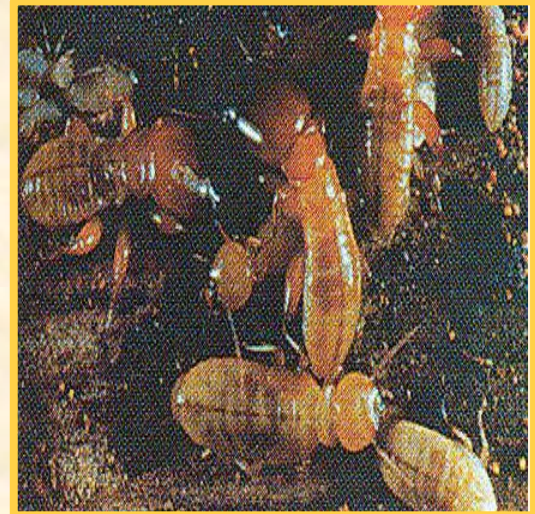
- Several species of subterranean termites are found in the United States; they live in every state except Alaska.
- In nature, termites are considered to be beneficial insects because they help to convert dead wood and other cellulose material to soil.
- Termites are considered pests, however, when they feed on wooden structures.
- Moisture is critical to termite survival because all castes except the swarmers are soft-bodied insects that lose water rapidly upon exposure to dry air.
- Thus, an available moisture source is critical to termites.
- This is why termites construct shelter tubes when they pass over exposed areas.



Free-standing
termite shelter
tubes

MORE ON TERMITE SURVIVAL

- The termite system is an extremely delicate and well-balanced system.
- Maintaining the proper levels of temperature and moisture is essential to the survival of the colony.
- The type of soil also has a great effect on the ability of subterranean termites to flourish.
- They generally prefer a sandy soil over a clay soil, though they will survive in many types of soil.



Dampwood termites

DIFFERENT VARIETIES OF TERMITES

There are approximately 3,106 species of termites, but for this course, the focus is on the following three varieties of termites.

- Subterranean termites
- Drywood termites
- Dampwood termites
- Powderpost termites



Dampwood termite



Powderpost termite

SUBTERRANEAN TERMITES

- The colonies of eastern subterranean termites are located in the soil. Their food consists of wood or wood products and other dry plant material.
 - They will also feed within the stems of some of the woody annual plants such as sunflower, dahlia, etc.
 - They attack woody material in contact with the soil. They construct **shelter tubes** (often referred to as **mud tubes**) over concrete and other inorganic material to reach wood that is not normally in contact with soil.
- Subterranean termites nest in the soil, from which they obtain most of their moisture, and feed on any wood in contact with the soil.
 - To reach wood that is separated from the soil, these termites must build a connecting mud tube or tunnel.
 - Four castes can develop from the nymphs of subterranean termites: workers, soldiers, winged (primary) reproductives, and supplementary reproductive.

DAMPWOOD TERMITES

- Dampwood termites do not require contact with the soil to obtain moisture, but they do require wood with a high-water content.
- Dampwood termites excavate large galleries, as do drywood termites. Unlike drywood termites, they do not keep these galleries clean of their fecal pellets.
- Species of dampwood termites are found along the Pacific Coast, in the southwestern United States, and along the Gulf Coast to Florida.
- Occasionally colonies may be carried to other parts of the United States, including Michigan, in shipments of lumber. However, dampwood termites are unable to become established in these areas.



A Dampwood Termite

DRYWOOD TERMITES

Drywood termites differ from subterranean termites in three ways:

- Unlike subterranean termites, drywood termites bore directly into wood and make their nests in the wood rather than below ground.
- As drywood termites feed, they cut across the grain of wood, excavating large chambers that are connected by small tunnels.
- Drywood termites produce hard fecal pellets. These hard pellets have six distinct concave surfaces on the sides.
- These pellets are often pushed out of the colony through small holes in the wood.



A Drywood Termite

POWDERPOST TERMITES

- Powderpost termites are drywood termites that produce tiny fecal pellets resembling powder.
- The ejection of this material from the gallery is usually the first indication of the presence of powderpost termites.
- Powderpost termites are smaller than other drywood termites but excavate similar galleries and can be controlled by the same methods.

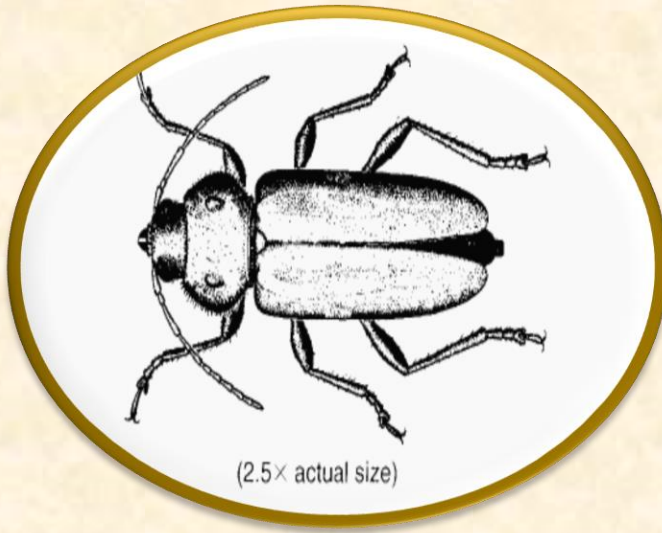


A species of
Powderpost
Termite

THE BEETLE

There are several varieties of beetles that destroy wood. The two most common are:

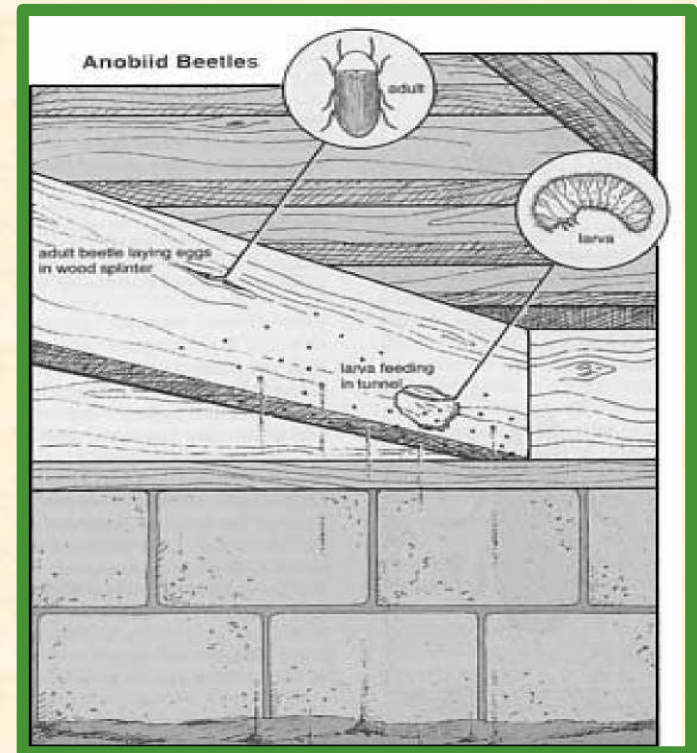
- Powderpost beetles
- Long-horned beetles
 - The Weevil



The old house borer, *Hylotrupes bajulus*, is one of the longhorned beetles of the family Cerambycidae (Provonsa).

POWDERPOST BEETLES

- The term **powderpost beetle**, used in the broad sense, applies to any of the wood-boring species of three closely related families (Lyctidae, Bostrichidae, and Anobiidae) within the superfamily Bostrichoidea.
- The common name is appropriate because the larvae of these beetles reduce timbers to a mass of very fine, powder-like material.



Powderpost beetles reduce timbers to a fine, powder-like material; hence their name.

THE LONG-HORNED BEETLE

- Long-horned beetles are large (1/2 to 3 inches long), conspicuous beetles with long, thin antennae that may be longer than their bodies.
- They usually lay their eggs on unseasoned, rough-sawn timbers or logs.
- The larvae, called round-headed borers, feed in the wood, boring large, oval-shaped holes as they move through it.
- Old house borers will attack timbers in a building, so they are the only long-horned beetles requiring control measures.
- Other species of beetles which can cause wood damage are: the bark beetle, anobiid beetle and the ambrosia beetle.



The long-horned beetle – this wood predator has a very distinctive appearance featuring large, white spots on its elongated black back.

THE WEEVIL

- Weevils are certain beetles, namely the ones belonging to the superfamily Curculionoidea.
- They are usually small, less than 6 mm (0.24 in), and herbivorous. About 97,000 species of weevils are known.
- They belong to several families, with most of them in the family Curculionidae (the true weevils).
- Some other beetles, although not closely related, bear the name "weevil", such as the biscuit weevil (*Stegobium paniceum*), which belongs to the family Ptinidae.



The Wood-boring Weevil

BLACK CARPENTER ANTS

- Ants of the genus *Camponotus* often nest in wood. The black carpenter ant varies from 1/8 to 1/2 inch in length because of the presence in most colonies of both “major” and “minor” workers.
- Carpenter ants may construct their nests in hollow trees, logs, posts, porch pillars, hollow doors, and other timbers used in homes.
- The ants do not consume the wood but simply hollow it out to form cavities for the nest.
- They are usually attracted to damp, decaying wood, but once the nest is started, they will also excavate sound wood as they enlarge the nest.



The black carpenter ant, another wood-destroying predator.

HABITS OF CARPENTER ANTS

- Carpenter ants often establish a number of interconnected nests; the parent nest houses the queen and small larvae, and the satellite nests contain larger larvae and pupae.
- The parent nest of the black carpenter ant is typically established in a cavity of hardwoods but sometimes in softwoods.
- The nest is associated with wood that has a moisture content greater than 15% that is often the result of rain, leaks and/or condensation in structures.
- The satellite nests are usually located in drier areas with higher temperatures that enhance larval and pupal development.
- There may be several satellite nests in different locations in or around a structure.



The black carpenter ant loves to nest inside wood. The image above illustrates the damage it can do.

THE CARPENTER BEE

- The carpenter bee (*Xylocopa virginica*) resembles a bumblebee in that it is robust and black with some markings of yellow hair.
- The dorsal surface of the abdomen lacks the yellow hair markings of bumblebees and is mostly devoid of any hair.
- These bees are considered pests of wood because they excavate tunnels in softwood as sites for producing their brood.
- Common nesting sites are posts, fence railings, porch support posts, wall siding, eaves, wooden shingles, windowsills, doors, wooden porch furniture, etc.



The carpenter bee bears a strong resemblance to the bumblebee, but this image illustrates the clear differences. Home Inspectors need to know which species of bee they're dealing with.

THE HORNTAILED WASP

- Horntail wasps are large insects, often more than 1¼ - inches long.
- If these large wasps emerge from finished walls in a structure, then the larval or pupal stage actually was present in the wood when the structure was built.
- One species sometimes emerges in houses from hardwood firewood.
- Horntails occasionally emerge through paneling, siding or sheetrock in new houses. It may take four to five years for them to emerge.
- Horntails attack both sapwood and heartwood, producing a C-shaped tunnel in a tree. Exit holes and tunnels are circular in cross section, with a diameter of 1/6 to ¼ inch.
- Tunnels are tightly packed with coarse frass. These tunnels are frequently exposed on the surface of lumber by milling after the development of the insect.



The
Pigeon
Horn-tailed
Wasp

VARIETIES OF HORNTAILED WASPS

There are many varieties of horntail wasps. This predator may cause cosmetic damage, but they do not pose a risk to the structure. They will not re-infest wood in a structure. The female horntail wasp may sting if handled.



The Blue Horntail Wasp



The Giant Horntail Wood Wasp



The Horntail Wood Wasp

ROUNDED-HEADED BORERS

- Several species are included in this group. They attack sapwood of softwoods and hardwoods during storage, but rarely attack seasoned wood.
- The "old house borer" is the major round headed borer that can re-infest infest seasoned wood.
- The old house borer is an introduced species.
- It is common in the U.S. along the Eastern Seaboard, but is occasionally found in states further inland, such as Ohio.
- Contrary to its name, the old house borer is found primarily in structures that are less than 10 years old.
- When round-headed borers emerge from wood, they make slightly oval to nearly round exit holes that are 1/8 -to 3/8 -inch in diameter.
- Their frass varies from rather fine and meal -like for some species, to very coarse fibers resembling pipe tobacco for others.
- Frass may be absent from tunnels, particularly where the wood was machined after emergence of the insects.

THE OLD HOUSE BORER

- The larvae of the old house borer feed on the sapwood of softwood timber, including pine, fir and spruce.
- Larval development occurs most rapidly in wood with a moisture content of more than 10% and high nutrient levels, and when the temperature is 68° F to 88° F, with a relative humidity of 80 to 90%.
- Depending on these environmental conditions, the old house borer spends from 2-10 years in the larval stage.
- Two other species to be on the look-out for are the wharf borer and the flat-headed borer. See images in the next slide.



An excellent photograph of this predator.

WHARF & FLAT-HEADED BORERS



The Wharf Borer



The Flat-Headed Borer

WOOD-INHABITING FUNGI

- Wood inhabiting fungi is a group of lower plant forms that occur occasionally in many states of the U.S.
- They can cause severe problems in areas of high moisture or humidity.
- Wood inhabiting fungi feed on both live and dead wood.
- They cannot make their own food. Some parts of fungi are so small that they can be seen only with a microscope.
- Other forms of fungi, such as mushrooms, are quite large. These fungi produce spores (similar to seeds) that are distributed by wind and water.
- Some spores are present wherever wood is being cut, processed or used.



A large growth of fungi on a tree. There are important issues related to conservation when it comes to fungi in the eco-system.

BASIC REQUIREMENTS OF FUNGI

All fungi that grow on wood have certain basic requirements, which include the following:

- The temperature range must be between 50° F and 100° F. The optimum is about 70° F to 85° F.
- The fungi cannot usually degrade wood that has a moisture content below 20%. Decay fungi require the wood to have a moisture content of about 30% in order to create serious damage.
- Fungi cannot live in water, or saturated wood.
- Fungi require a food source.



Fungi on
wood

WOOD-DESTROYING FUNGI

The 3 types of fungi that attack wood are:

- Surface fungi
 - Staining fungi
 - Decay fungi
- Some fungi attack wood only in the log stage and cannot damage or continue developing after the wood is installed in a structure.
 - No control is necessary for these fungi; however, it is important to recognize them as types that do not require control measures.



Fungus on
wood

SURFACE FUNGI

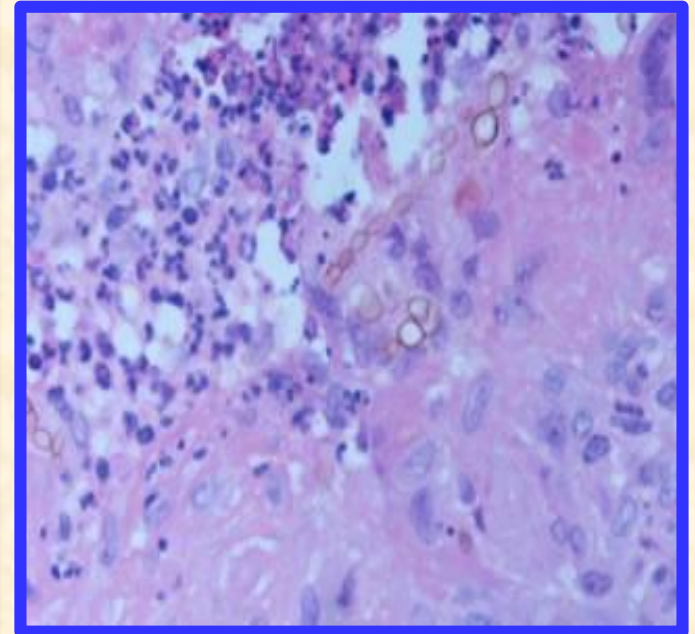
- This group includes mold. Mold grows primarily in the sapwood of coniferous and deciduous trees.
- Wood with surface fungi has a powdery appearance and/or surface discoloration. These fungi do not cause wood decay.
- They grow only in the storage cells of sapwood and do not reduce the strength (other than impact strength) of the wood.
- Treatment is not required for wood that has been previously attacked by surface fungi and then installed in a structure.



Surface fungi

STAINING FUNGI

- This group of fungi also attacks the surface of the sapwood of various hardwoods and softwoods, but their hyphae penetrate the outer layers of the sapwood.
- These fungi cause a gray to bluish stain that cannot be removed from the wood.
- They do not cause decay, but they increase the chances that serious decay fungi will enter the wood.
- They enter wood cells and use the contents as a primary food source.
- The presence of these fungi also indicates that the wood has absorbed an excessive amount of moisture.



Blue fungi

DECAY FUNGI

- Decay fungi need oxygen, water and a food source to exist. Wood as a food source is limited to those fungi which are able to utilize the components and, in the process, break down the wood.
- Since wood and wood products are used in construction of commercial and residential buildings, the key to longer lasting wood structures and products is to keep the wood dry.
- Dry wood will not decay.
- If you add water to dry wood, the cell walls absorb water up to a moisture content of about 28%.
- Decay fungi require free water so the moisture content of wood must be above 28% to decay. For practical purposes, a value of 20% is used as a cutoff, leaving a margin of error for avoidance of decay.
- Fungi have an external method for breaking down their food by secreting digestive enzymes and other chemicals into the substrate where they are growing.
- This enables the fungi to then absorb predigested food products.



Decay fungi alongside tree mushrooms

DECAY ROT

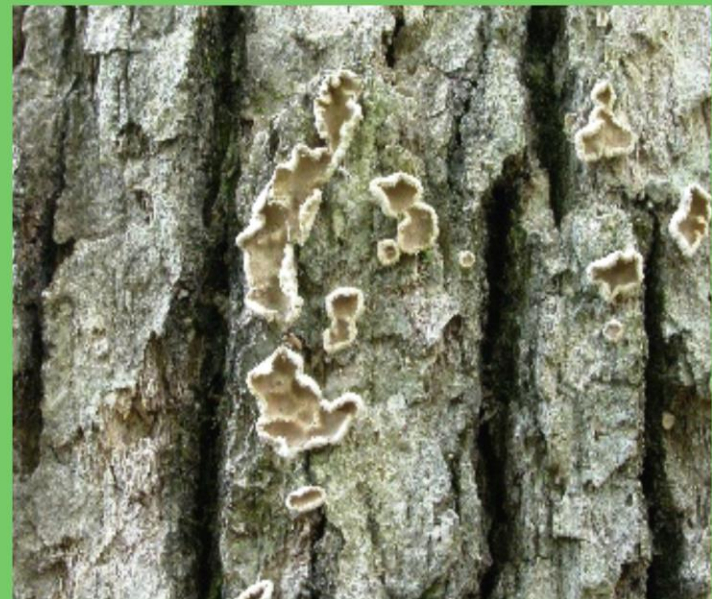
There are several types of decay fungi but the 4 most common are:

Cubical Brown Rot

White Rot

Dry Rot

Soft Rot



Wood decay fungi of living trees

SUMMARY

The primary predators classified as wood-destroying organisms are:

- Termites
- Beetles
- Ants
- The carpenter bee
 - Weevils
- Horntail Wasps
 - Borers
 - Fungi

IN SUMMARY

END OF MODULE 1

This concludes Module 1. Please proceed to the quiz, and then Module 2.



In this module, we have focused on protecting the beauty of the wood in your home.