

Major pests in historic buildings: termites and wood boring beetles

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Many insects and various animals such as termites, wood boring beetles, silverfishes, rats, bats, birds, spiders and others, live in intimate contact with the man, associated with the cities, invading and colonizing inhabited places, damaging buildings, transmitting diseases to other animals and to human beings themselves. These synanthropic animals (animals that live with humans) can often be considered urban pests because of their high adaptability, reproductive capacity and the amount of food and shelter found in urbanized areas, causing great inconvenience and discomfort at all social levels. The four elements, water, shelter, food and access generated by environmental imbalance (garbage, poor sanitation, inadequate water treatment, etc.) inherent to human culture itself, which allows many pests to enjoy the unconscious hospitality of the towns, making the day-to-day life of its inhabitants difficult.

Subterranean termites

Termites belong to the order Isoptera and are considered social insects because they form colonies, due to mutual cooperation, where his subjects are divided into castes like the breeders, basically formed by the queen, king and winged breeders (siriri or aleluias), the caste of workers and the caste of soldiers, among others. The insects belonging to each caste are morphologically distinct, with different functions performed within the colony. They can present a number of individuals per colony, varying among

genres, from hundreds or thousands (of species on dry wood) to a few million in underground, arboreal or mounds nests. Depending on the habitat and on the gender considered, termites can nest in various sites, and there may be nests in trees (in roots, stems and outwardly to these), in structures inside buildings such as “lost coffins” (empty spaces between slabs), in walls and power boxes; in the ground (underground or outside in the form of mounds), with varied shapes and sizes.

It is estimated that today there are approximately 2861 living species of termites described, and, of these, 290 are found in Brazil. Actually, termites are mostly decomposers of dead trees, helping considerably in nutrient recycling as well as in soil aeration. Only a few genera are considered pests in the agroecosystem and in urbanized areas, causing considerable damage, attacking living trees (urban, native forests, reforestation and ornamentation), residential and cultivated plants, occurring in high population densities, living with man in search for food (wood and cellulose derivatives). The genres: *Coptotermes* spp., *Heterotermes* spp., *Nasutitermes* spp., *Cryptotermes* spp. (Dry-wood termite) and *Syntermes* spp, among others, stand out as highly damaging to the man economy in his home and in outdoor areas. The most important species, such as *Coptotermes gestroi*, *Nasutitermes tenuis* and *Nasutitermes corniger*, commonly found in urban areas, cause enormous damage to buildings, moving through the soil, inside conduits for electricity and telephones, within bricks of buildings, easily reaching the timbers (liners, door frames, skirting, inlaid furniture, etc.) and cellulose derivatives (books, papers, miscellaneous documents, etc..), utterly destroying them, getting to compromise the integrity of the building when the support timbers are consumed.

Dry wood termite

The dry-wood termites, mainly of the genus *Cryptotermes*, eat cellulose (wood, papers, books, etc.) but they reproduce slowly when compared to other genres. They nest in the very structure or piece of wood, eagerly eating it and thereby making a series of tunnels. The main feature of the attack is the presence of granular droppings (termite powder), left along the infested piece or structure. The mature colony, around 4 years old, releases the winged reproductive forms (siriris or aleluias) for the formation of new colonies thus infesting other wooden objects. The destructive action of these insects can be verified by the general weakening caused in part of the piece or structure under attack, as well as in aesthetic damage.

Cryptotermes has a worldwide distribution and has 47 species. It is the most important pest among the so-called dry-wood termites.

The ability to infest wooden structures and objects built by man has resulted in the introduction of several species in several regions, where they have become important urban pests. Currently, the most widely distributed species of this genus is *Cryptotermes brevis*, which occurs all around the world. In literature there are data indicating that the species had been recorded in Brazil in 1858, spreading along the coast up to Rio Grande do Sul. Today its range is very wide, but there are not very accurate records yet. It is known that it also occurs in the countryside of Sao Paulo, Belo Horizonte (MG) and in João Pessoa (PB). In southeastern Brazil, mainly in big cities like Rio de Janeiro and Sao Paulo, it is, after *Coptotermes gestroi*, the second worst plague of termites in urban areas.

Generally, it can be said that the termite colonies of the family *Kalotermitidae* (dry and wet wood termites) are relatively less populated, getting to have hundreds of individuals, when compared to some other families as in *Termitidae*, which can contain millions of individuals. However, a much infested building, even thousands of individuals can be found, from various colonies established in the same place. There are no real workers, and the general tasks are performed by "pseudo-workers." The soldiers of this species have a very dark and fragmotic head, i. e., there is a modification of the anterior region, forming a more flattened or excavated area with which the insect can plug a hole.

As in other species of the genus, the colonies established in longer pieces of wood, the galleries and cavities (chambers) extend in the direction of the fibers and follow more or less a concentric arrangement, according to the growth rings, if available. The passages between the chambers are quite narrow, but the walls get being eroded and the chambers increased, which can be empty or full of fecal pellets, which are the famous "termite dust." These pellets have different colors depending on the wood consumed, because they are the "rest" of the digestive process. The granular powder form typical of dry-wood termites, you should not be confused with the fine powder, like talc, expelled by species of beetles also xilofagous, popularly called wood bores.

While the interior is consumed, the surface of the wood remains intact and only a thin layer easily pierced with finger pressure may remain. On the surface of a infested piece there are always small circular holes through where the termites eliminate the fecal pellets, not continuously but intermittently. Also through these openings, the winged individuals may leave at the time of swarms. Some holes may be clogged by termites with liquid fecal matter that hardens, forming a solid cap. This species can also

attack, besides old, many other materials such as paper, styrofoam, and even wine corks in wine cellars.

Wood boring beetles

The insects of the Order Coleoptera (beetles) that cause damage to living trees and palm trees, freshly felled timber, manufactured and dried, using them in a general way, such as food or substrate for the growth of fungi that will serve as material energy for the development of larvae and adults are called wood boring beetles. In urban areas, the wood bores are most often found infesting timbers, as well as trees and residential and road palms, be they in streets squares or gardens, causing direct damage (consumption and gradual destruction of the plant tissue) or indirect (taking fungi or nematodes that cause diseases to living plants).

Wood boring beetles: life cycle

The infestation by dry wood bores begins when adult females, after being fertilized by the males, lay eggs in usually bare wood (without finishing, varnish, wax, sealer, etc.). The larvae originated from these eggs feed on the wood to turn into pupae and adults. The larval stage is generally longer, being this phase the main cause of damage to manufactured wood or living trees. After the emergence of adults, they bore into the wood and go out of it, and this going out is usually facilitated by the fact that the transformation of the pupae is close to the surface. Usually attacked timbers, where the larvae are still present and active inside the timber, present holes obliterated by feces (waste in the form of powder or fine particle in varied sizes). Open drilled holes (clean)

indicate the emergence of adults. Some families of beetles prefer the woods or freshly felled trees and living palm trees.

Adults inoculate fungi that will nourish the larvae, in addition to the consumption of xylem (poor energy source) as well as assist in the degradation of the wood itself, thus facilitating the consumption by larvae and adults.

Dry woods or living trees infested with borers can be easily recognized. They present fecal or excavation waste in adult emergence, in the form of powder (drill powder) deposited in the holes. This dust accumulates abundantly generally indicating the infested sites. In some coniferous trees and palms, the presence of exudates ("bleeding" of sap) is common and is indicative of infestation.

Unlike the feces of dry wood termites, with larger particle size, similar to sand, dust drill is usually thinner and typically do not oxidize (darken) over time. Pale feces of dry wood termites indicate recent infestations. As time passes, the stool will oxidize, getting darker, indicating then that the infestation is old. Totally dark stools are indicative of very old or infestations that are no longer active.

The beetles have different eating habits, varying in the region of the attacked plant (bark, sapwood or functional xylem, etc.), palm trees and monocots in general (with the metaxylem being the conducting tissue), seeds, moisture content (live, freshly harvested or dry) and fungal culture.

The wood boring beetles can be influenced by factors such as climate, moisture, color, texture, size and shape, type of wood or plant, inclination of the host (in standing, sheared, felled trees), air velocity, and presence of kairomones and pheromones, etc. From the living tree to timber in use, different families of beetles infest wood in different stages of processing. Despite the large number of families, we can classify them in a practical way of four major groups:

1. Wood boring beetles in living trees and palms (very high humidity)
2. Newly felled timber Wood boring beetles (high humidity)
3. Wood boring beetles in wood in drying process (intermediate moisture)
4. Wood boring beetles in dry wood (low humidity).

The wood boring beetles (powderpost beetles or woodworms) of importance in historical collections, as well as in urban constructions in general are those that feed on wood in drying process and dry wood (low humidity).

Wood boring beetles in wood in drying process

During the drying process of wood, it shows average moisture contents. The most common families in this phase are: Bostrichidae, Curculionidae (Scolytinae) and some Cerambycidae.

Family Bostrichidae (Powderpost Beetles)

Bostrichidae adults have elongated and cylindrical body. In some species the head is hidden by the pronotum (projection of the first dorsal plate, in the prothorax). They have antennae usually segmented in 10 parts with 2nd, 3rd or 4th segments serrated and expanded, not fused. The larvae are white, with a "C" shape. Its life cycle lasts approximately one year. They infest soft and hard woods, especially unfinished floors, window sills, furniture, bamboo, etc.

2. Wood boring beetles in dry wood

Dry woods are those with moisture contents below 30%. Insects of the Families Anobiidae and Bostrichidae (Subfamily Lyctinae) are the main wood boring beetles that

attack wood in these conditions, besides some species infest bindings, papers, book covers, etc.

Family Bostrichidae, Subfamily Lyctinae (Powder post beetles)

The Lyctinae, subfamily of the Bostrichidae, infest wood solely. They do not attack living trees, only dry wood, manufactured. Starch, primary food source of insects, is found mainly in the sapwood of angiosperms, therefore, they are not found infesting *Pinus*, pines in general. Woods rich in starch are preferentially infected, such as Virola, Cedrinho, etc. The larvae make galleries and leave residues in the form of very fine and dry powder. Perforations still obliterated by excrement (powder) are indicative of larval activity. Open and clean holes indicate the emergence of adults. Adults are about 2-7 mm in length and are usually dull brown with flattened and elongated bodies, with antennae with the last two segments dilated and not merged. They are found in extremely dry wood (with levels below 30% humidity, having already been registered in woods with only 7% moisture). Lyctinae rarely infest wood older than five years. Thus, infestations generally are encountered in new homes or newly-manufactured articles.

The species most commonly found in urban areas belong to the genus *Lyctus* and *Mintha*. The life cycle is of approximately 6 months to 4 years. The lyctinae rarely infest wood older than five years, so infestations usually occur in new timbers in recently manufactured wooden items. The infestation is usually a result of previously infested wood that contained eggs or larvae at the time of purchase.

Family Anobiidae

The adult insects size range from 1.5 to 6 mm long, somewhat showy coloration (gray, brown, black), pubescent body and serrated antennae with some species presenting the last articles dilated and elongated. They present varied feeding habits, infesting wood, books, binders, leather, textiles, grains and stored products, among others. Anobiid powerpost beetles may attack both hardwoods and softwoods, which means that infestations may be found in all the same places as Lyctinae beetles, as well as in structural timbers. Anobiids prefer to infest wood which is damp, therefore, infestations usually begin in moist, poorly ventilated areas.

Species of the genera *Anobium* and *Tricorynus* are representatives of families that are most often found in urban areas. *Anobium punctatum* is a common pest known for attacking furniture. The species *Stegobium paniceum* is commonly found infesting stored products. The *Anobiidae* are common in museums and libraries, attacking books and stuffed animals, as well as entomological collections.

Lasioderma serricorne is considered one of the most common species in urban areas, infesting stored products, mattresses, etc. The life cycle can vary from 6 months to 2 years or more. The stool features left by Anobiid are apparently fine, but of larger particle size when compared to the Lyctinae.