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Wax moth

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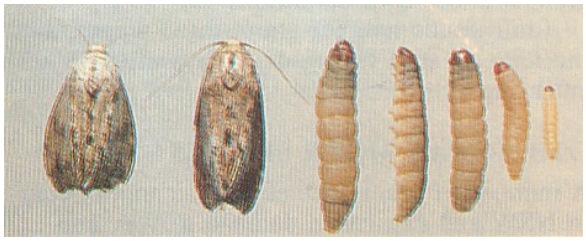

Figure 1. Greater wax moth – adult & larvae.

The greater wax moth (*Galleria mellonella*) and lesser wax moth (*Achroia grisella)* are major pests of stored or unattended combs. The greater wax moth causes the most damage; however, the lesser wax moth is generally more common, and can also cause significant damage. The two species tend to coexist, and are frequently found in the same location.

The primary concern for beekeepers is how to adequately store combs without them being destroyed or damaged by the larval stages of the moths. Destruction or damage to combs can also occur within weak hives which have died or have low populations. The presence of an adequate number of adult bees will prevent wax moth damage. It can be assumed that wax moth will never be completely eliminated from an apiary or storage shed.

Once the environmental conditions are favourable, adult wax moth activity will rise, with an ever-increasing population dependent on available food. It is in the best interest of a beekeeper to minimise any damage by understanding the life cycle of the pest and taking measures, in the field and within comb storage areas, to reduce wax moth numbers and restrict their reproduction.

Wax moths do nothing to a colony except eat combs (larval stage). They are not known to spread disease; in fact, it has been suggested that when a colony of honey bees dies from one or more diseases the wax moth will quickly clean up the contaminated combs. This would be particularly useful in the wild. Some casual observers have indicated that wax moth may have been responsible for the death of a colony; this cannot be the case. It is more likely that the decline in colony population was due to either a failing queen or a disease or other pest attacking the colony.

The wax moth simply takes advantage of unattended combs and lays large numbers of eggs, from which larvae emerge and eat the comb.

To manage this pest, knowledge of its life cycle is very important, and an understanding of the means by which it can be controlled will allow the beekeeper to make the best choice for their circumstances.

Greater wax moth life cycle

As the greater wax moth is the most destructive, information on its life cycle only will be discussed. The control measures apply to all species of wax moths.

Moths are essentially nocturnal, and wax moths are far more active during the night than during daylight hours. If combs are kept in a darkened room, the moths may be active on a continuous basis.

The whole life cycle and extent of population expansion depends on two factors: a suitable temperature range and adequate food. Adult moths are highly attracted to old brood combs – more so than to any other material. The larva growth rate is also greater on old brood combs. When compared with combs with no brood residue, the growth rate

Figure 2. Web associated with wax moth damage.

of larvae was 20% faster, probably indicating that the brood combs contained all the nutrients necessary for wax moth larval development, in a more concentrated form than any other source.

Wax moth reared on old brood combs also tended to be bigger, have a higher egg-laying capacity and live longer.

The life cycle of moths is influenced by temperature. The number of eggs laid by an individual female can vary from 300 to more than 1000. Egg laying can commence immediately after mating. The egg laying rate is at its highest in the first day after mating, diminishing over the next 4–5 days. The number of days an egg takes to hatch varies from 5 to 35, depending on temperature.

Figure 3. Wax moth cocoons.

Larvae

The larval stage may only take 20 days when food and temperature are ideal, but may take up to five months under cooler conditions. In the process of eating combs, the larvae leave behind webbing, which is a classic sign of wax moth presence in combs.

Pupae

The pupae may develop and hatch within eight days during warm conditions, and may take two months in cooler conditions. In the process of spinning a cocoon, the larvae often chew into the wood of bee boxes and frames, causing permanent damage to the material.

Adults

The life span of adult moths is said to be three weeks, and females can start laying after 4–5 days. Males have been known to live twice as long as females. Females may weigh 50% more than males, probably due to their need to lay volumes of eggs fairly soon after emerging from the pupal stage.

The male emits the mating pheromone, attracting the females. This is unusual, as with many other moth and butterfly species the female attracts the males.

Temperature

Warm and cool temperatures will influence each stage of the life cycle. Temperatures below 5°C are said to make larvae completely dormant. Another reference indicates that there is no developmental activity of moths between 8°C and 18°C. Eggs are said not be able to hatch at temperatures below 18°C or above 38°C.

At 38°C, the number of egg-laying females is seriously reduced, and the number of eggs laid at this high temperature is very low – approximately 30 eggs per female, compared with 875 when the temperature is 28°C. Maximum egg laying rates, growth rates and general activity of all stages of development appear to occur between 28°C and 30°C.

Preventing damage from larvae

During warm weather (25° to 35°C), remove supers of combs from hives that are not being covered by bees. The presence of adult bees will, in most cases, prevent any damage from wax moths, though wax moth larvae can occasionally be found in an active, healthy colony. It is not uncommon to find wax moth larvae burrowing just under the capping of the brood, although there is rarely more than one or two in the whole brood nest chamber. If a colony does decline in population, it is not uncommon during hot weather for wax moth larvae to very quickly destroy all of the unoccupied combs.

Temperature control

The use of cool rooms to slow or prevent the life cycle of wax moths is becoming increasingly common in large-scale beekeeping operations. This is a clean and residue-free method of preventing damage to combs. Unfortunately, there is a considerable cost in obtaining a sufficiently large storage container with a refrigeration unit attached. There is also the ongoing cost of the power necessary to run such a unit.

A temperature of -7°C can kill all stages of wax moth within 4–5 hours. Once boxes of combs are placed in an insulated room for freezing, they should be kept there long enough to allow the extreme cold temperature to penetrate all the material. A cool room temperature of 4°C will suspend all development of the wax moth cycle, and may kill various stages of the moth's life cycle. There is evidence that the temperature could be as high as 18°C and continue to suspend the development of wax moths.

Very hot temperatures have also been found to aid the control of wax moths. At a temperature of 38°C, the reproduction and egg laying of adults is significantly lower than at 28°C. A temperature of

46°C is lethal to wax moth development. Holding combs at 46°C for 1–3 hours will kill all stages of wax moth. It must be remembered that beeswax melts at 62° to 63°C, and can become structurally unsound and prone to collapse at 55°C. Heating combs as a means of controlling wax moth may be an option for beekeepers with hot rooms.

Phosphine

This is a toxic gas used to control insect pests in stored grains, and wax moth in stored beehives, supers and equipment. Pellets containing aluminium phosphide are exposed to moist air; the moisture in the air reacts with the pellets and produces the highly toxic phosphine gas. The gas is colourless, has a distinctive odour and is flammable. Not only does it kill all stages of the wax moth, it is also **toxic to all other insects and mammals, including humans.** Only one registered product is available to use for this purpose: Fumitoxin® fumigant coated insecticide tablets from Nufarm.

Boxes of combs to be fumigated should be placed in a sealed container, or wrapped in thick, gastight plastic. Place the pellets on a tray so they are not touching; do not heap them. Complete release of the gas will take 3–5 days. Post warning signs on all four sides of the stack or container (**danger – poison gas – keep away**). Lock and seal the exit door after application. Always refer to the label directions for use, and read the instructions for full details of how to use the product.

Whatever the method used to fumigate combs, the process should not be carried out in the vicinity of people, pets or other livestock. The fumigation area should never be part of, or attached to, a house. Do not use when temperatures are below 15°C and relative humidity within the area to be fumigated is less than 25%.

The gas will penetrate wood and combs, and will kill all stages of the wax moth; it will not, however, prevent the reinfestation of combs. Thus, it is necessary, as it is with all methods of controlling wax moth, to recheck for any new moth activity on a regular basis, depending on the degree of risk, or the ambient air temperature.

Before the combs are placed back on a colony, any residue gas should be allowed to dissipate, by thoroughly airing for not less than 48 hours. Phosphine should not be used on combs containing honey meant for human consumption.

Safety

Store unused or partly used containers in a locked room, or away from children, animals, food, feedstuffs, seed and fertilisers. Store pellets in the closed original container, in a dry, cool, well-ventilated area out of direct sunlight. A risk assessment should be conducted of the location in which the fumigation is to take place. The premises should not be attached to or be a part of a building in which people will be present during the fumigation process. Aluminium phosphide tablets should be transported in an open environment, not in an enclosed space (such as a motor vehicle interior). All pesticide users in NSW must hold a training qualification, as required under clause 7A of the NSW Pesticides Regulation 1995. Training at AQF Level 3 is required to use fumigants.

Very Dangerous

This product can kill if swallowed. It releases dangerous phosphine gas slowly in moist air and immediately if wet. Do not inhale the vapour, as it can kill if inhaled. Avoid contact with eyes and skin. Do not inhale dust. Open the container in the open air. Keep it away from water and liquids. Keep it away from naked flames, as it forms toxic gas. Wear elbow-length PVC gloves when opening the container and using the product. If dispensing by hand, wear a full-face-piece respirator with combined dust and gas cartridge (canister) or supplied air respirator. Wash your hands after use.

First Aid

If the person applying phosphine experiences headaches, or in any way feels unwell, they should immediately remove themselves from the area in which the phosphine is being used. If poisoning occurs, contact a doctor or the Poisons Information Centre (phone 13 11 26). Do not give mouth-to-mouth resuscitation if swallowed. For protection, the rescuer should use an air-viva, oxy-viva or one-way mask, and resuscitate in a well-ventilated area.

Carbon dioxide fumigation

This has been suggested as a method of controlling wax moth damage in stored combs, as it does not create any residues. Carbon dioxide is not, however, approved for this purpose, and has a

number of limitations in relation to such use. It is probably as dangerous as phosphine gas to users, because it is colourless and odourless, and persons exposed to high concentrations will be killed.

Bacteria

The bacterium *Bacillus thuringiensis* is a micro-organism that is harmless to people, honey bees and the environment, and has also been used to kill young wax moth larvae. Like carbon dioxide, it is not approved for this purpose, and there are a number of difficulties in relation to the correct strain to use, how to apply it and the shelf life of commercial products.

Parasitic wasps

There are indications that certain species of wasp in other countries may be beneficial in keeping wax moth populations under control. In the Australian context, there have been observations of some wasp species that show interest in foraging around empty combs, possibly for wax moths; however, their numbers have never been reported to be high enough to make a serious impression on wax moth populations.

Insect zapper

Electronic insect control devices designed for commercial use will kill large numbers of adult moths. These devices will also kill any other insect that comes into contact with the zapper power grids. The purple/blue light attracts adult insects, and they are electrocuted between two high voltage grids (3000 volts).

Zappers vary in their ability to attract and kill insects; a 15 watt lamp should be sufficient to cover the average comb storage area. Higher voltage grids of 5000–6000 volts are more effective if the number of insects that are coming into contact with the grid is considerable. These units are cheap to run, but require regular cleaning of the tray under the zapper. They may also need complete cleaning once or twice a year if excessive numbers of bees are being killed by the device.

The downside is that these devices only kill adult wax moth, and not the larvae; thus, any adult moth that lays eggs in stored combs must go through its full developmental stages before emerging as an adult, which may or may not be attracted to the insect zapper before it mates and lays eggs.

The devices could be very useful in monitoring the presence and numbers of adult moths. If and when adults are detected in any number, other control measures could be implemented.

General warning

Many chemicals have been suggested and occasionally used in an attempt to control wax moth in stored combs. Commercial preparations available in supermarkets for general moth control are not suitable for wax moth control. Chemical residues have been found in honey and beeswax as a result of the use of such preparations.

Do not use products not registered for the control of wax moth.

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