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# Problems of Wax Moth in Apiculture

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In our country bee, enemies are more dangerous taking a heavy toll on life, as a result of which many colonies are abandoned by bees each year. Among these enemies, the wax moth is one of the most serious pests of apiculture, capable of quickly destroying stored bees wax combs. There are two species of wax moth, the Greater wax moth (*Galleria mellonella*, family: galleridae) and the Lesser wax moth (*Achroia grisella*, family: pyralidae). Both of these species are active hive pests. These are observed throughout the year but their occurrence is severe from July to October and November to December. Empty combs, rendered wax, comb foundation sheet, and bee collected pollen, if not properly stored and left unattended, almost always suffer considerable damage from wax-moth infestation. Wax moths rarely cause colony destruction, but their larvae can damage combs in weak colonies that aren't covered and protected by bees. Both the Greater and Lesser wax moths are more likely to damage combs in storage if they are left unattended, especially in dark, warm, and poorly ventilated areas.

The life cycle of both species of wax moths consists of four stages: eggs, larva, pupa, and adult moths. The development of each stage of the wax moth's life cycle depends significantly on environmental factors, particularly temperature. The optimum temperature range for rapid reproduction and development of wax moths is between 28-30$^{o}$C.

**Eggs**

After mating, a female wax moth begins laying eggs immediately and continues for about 5 days. The number of eggs laid by a female wax moth varies depending on the temperature, but it usually ranges from 300 to 600. The eggs are laid in batches by the female in dark, out-of-the-way locations. When the temperature is between 29 and 35 $^{o}$C, it takes between 3-5 days for the eggs to hatch, and up to 35 days when the temperature is 18$^{o}$C.

**Larvae**

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The larvae of the wax moth is called caterpillar. The newly-hatched larvae feed on honey and pollen before burrowing into pollen storage cells or the outer edge of cell walls, later extending their tunnels to the midrib of the comb as they grow. In warmer temperature, it can take only 20 days for the larvae to grow, but in cooler conditions, it can take upwards of 5 months. The larvae will find a place to pupate once they have grown large enough, which is usually on the hive's wooden frames. Before forming a cocoon from silk thread, the larvae will chew a cavity into the frame, causing permanent damage to the equipment (2-3 days).

**Pupae/cocoon**

Fully developed larvae spin silky cocoons, which can be found in a mass of webbing in the comb, on the frames, and the hive's internal surfaces. Larvae may spin their cocoons in small cone-shaped depressions in the wooden hive components. Larvae can also eat their way through wooden frame bars. The larvae begin the pupal stage after spinning the cocoon, which involves the transformation of the juvenile larvae into adult wax moths. The newly formed pupa inside the cocoon is white to yellow at first, then dark brown as pupation progresses. In warm climates, a pupa can develop and hatch in 3-8 days, but in cooler climates, it can take up to two months.

**Adults**

Adult moths are pale brown to grey in color and measure about 20 mm in length. When folded over the body, the grey wings are mottled and shaped like a roof or a boat. The adult wax moth has a lifespan that varies depending on its sex. Males can live up to 21 days, while females live for about 12 days. Wax moths do not feed during their adult lives. Males use a combination of chemical pheromones and ultrasound signals to attract females. Female moths lay 300 to 600 eggs in clusters on the comb or small cracks in the hive's material. The nearly spherical, pinkish to white eggs have a diameter of about 0.5 mm.

**Infestation by wax moth**

Both species attack bee colonies in which the number of bees is insufficient to cover the entire comb. Caterpillars create tunnels near the midrib of a comb, causing damage to brood comb and honeycomb cells. When larvae need food, they will attack bee brood in addition to pollen and wax stored in the hive. Damage to cells in brood comb can sometimes result in the bald brood. When wax moth larvae burrow through the comb, they partially

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remove cell caps, resulting in the bald brood. Worker bees then chew away at the remaining capping, exposing the heads of bee pupae, which can result in deformed legs or wings in newly formed adult bees. When the infestation is severe, the comb becomes covered with silken webs containing numerous black caterpillar faeces, rendering the bees incapable of defending themselves and causing them to abandon the comb. The larvae of the greater wax moth infested migratory bee swarms on a large scale, resulting in colony loss, absconding, and a reduction in the size of the swarms. Damage to the caps, as well as the presence of larval webbing, faeces, and other debris, can reduce the yield and sellability of honey products.

**Management of wax moth**

The most effective method for protecting against wax moths is the honey bees themselves. It is worth noting that the wax moth can never be completely eliminated from an apiary or storage shed, so it is important that beekeepers always practice good colony management. Following management practices can be undertaken to avoid wax moth infestation in apiary and stores.

**Cultural Control**

- Maintaining good sanitation
- Keeping the colonies strong with adequate food sources
- Sealing cracks and cervices
- Removing all debris
- Minimize pesticide application
- Replace comb regularly
- Destroy infested comb showing signs of galleriasis
- Exposing equipment and combs at high or low temperature for few days

**Chemical Control**

Fumigants have been shown to be effective against all the stages of wax moth include

- Sulphur
- Acetic acid
- Ethylene bromide
- Calcium cyanide
- Methyl bromide

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- Phosphine
- Paradichlorobenzene (when combs are not filled with honey)
- Naphthalene
- Carbon dioxide (when combs are filled with honey)

**Biological Control**

Many biological agents and bio products are also effective incuding

- *Bacillus thuringiensis*
- *Bracon hebetor*
- *Trichogramma* species
- Fire ant, *Solenopsis sp.*

**Conclusion**

The greater and lesser wax are the major challenges to bee health and the beekeeping industry worldwide. Poor beekeeping management weakens the colony, making it vulnerable to the wax moth pest. As a result, the colony's functioning is disrupted and annoyance is caused by these pests. Therefore, successful implementation of the aforementioned practices may aid in the more efficient management of these pests.