

larval development is greatly influenced by the environmental conditions of temperature and food supply. The larvae themselves are unique and readily identifiable: well-developed head; clearly segmented body; three thoracic segments, each bearing a pair of five jointed legs; ten abdominal segments: numbers 3-6 bear false feet (prolegs), the tips of which are equipped with crochets; segment ten bears one pair of claspers.

Warehouse Moth

Within 4 days of emergence, the female produces 100-150 eggs which are laid in cracks and crevices. These hatch in 10-14 days to give larvae which are creamy white with dark spots on their sides. They penetrate food, covering it with webbing as they feed. In temperate climates larvae pass through 4-5 moults to attain full growth when they are 12mm long, whereupon they will leave the food and wander for 1-3 days, searching for a dark place in which to spin a silken cocoon. They may diapause in this state throughout the winter before pupating in April or May and emerging as adults in late spring. Under temperate conditions development takes from 82-206 days.

Tropical Warehouse Moth

Egg laying commences within 24 days of the adult's emergence and up to 350 eggs are laid during the first 4 days. These hatch 3-17 days later. The larvae are dirty white and may be tinged brown or have purple spots. At 25°C they will be fully grown in 25 days. The larvae do not diapause. Pupae develop in 12-17 days in the vicinity of food, and breeding is continuous. Where temperatures are low the moth overwinters as larvae.

Mediterranean Flour Moth

Mating takes place immediately after the adults emerge. Up to 350 eggs are laid and these may be stuck to various foods by a sticky secretion. The eggs hatch in 4-28 days to give white or pinkish larvae and spin silken tubes in which they live. After 3-5 moults the larvae are full grown and 15-19mm long. They then wander away from food and pupate for 7-16 days in the dark corners of buildings or machinery. In temperate climates these moths overwinter as larvae but, in contrast to other species, usually remain in the foodstuff.

Indian Meal Moth

Females produce up to 500 greyish-white eggs which hatch in 1-18 days depending upon conditions. The larvae migrate over the foodstuff, covering it with silk as they move. Their colour depends upon the type of food: they are generally dirty-white but may be tinged pinkish-brown or green. After 4-7 moults the larvae are full grown and have attained a length of 12mm. In this

species food and environmental conditions have a dramatic influence on the larval phase, so that development may take 13-288 days. When mature the larvae leave the foodstuff and spin thick white cocoons, in which the 7mm long pupae develop. After a pupation period of 12-43 days, the adults emerge. These moths may overwinter as larvae which diapause in a silken cocoon.

Rice Moth

Up to 160 eggs are laid in or near the larval food. The larvae are dull white in colour with brown heads, and have long, fine hairs covering the body. They persist for 15-20 days under favourable conditions. Rice moth larvae produce large amounts of strong webbing and frass, before spinning a dense white cocoon in which to pupate. The pupal stage lasts 7-10 days.

Brown House Moth/ White-Shouldered House Moth

These species have similar life-cycles and mixed infestations frequently occur. The Brown house moth lays up to 650 eggs, preferring rough open surfaces, whilst those of the White-shouldered house moth are sticky and laid in crevices. Brown house moth larvae are glossy white and reach a length of 16mm. Larvae generally diapause for varying lengths of time, depending upon the conditions under which they have developed. Those of the White-shouldered house moth are dull white and rarely exceed 14mm in length. Both species burrow into the food, forming a silk tunnel. Pupal cocoons are rough and incorporate foodstuff and debris.

Common Clothes Moth

Eggs are laid amongst fibres or scattered at random. Each female lays up to 160 eggs during a period of 2-3 weeks. During the summer these hatch in 4-10 days to give an active, white translucent larva. This grows up to 10mm in length and the head becomes darker in colour. Feeding tunnels may be constructed from silk and there are at least 5 moults. Larvae construct a tough cocoon in which they moult to produce a pupa up to 7mm long. The full cycle takes between 88-254 days, depending upon conditions.

Significance

Moth larvae can cause considerable damage to stored goods by feeding or by contamination with their own products, e.g. webbing and frass. Adult insects are not responsible for damage as they either feed on liquid food and water or do not feed at all. The larval by-products, webbing and frass, are a particular problem. Webbing can entirely coat commodities and may be responsible for blocking machinery and ducts. The problem is exacerbated when webbing becomes mixed with frass, food and general debris:

Warehouse Moth

A major pest of warehouses and, more recently, retail premises. This species will infest cereals, fruit, shelled nuts, cocoa beans, fish, spices and tobacco. In the case of tobacco, "sweet" varieties are preferred and entire interveinal leaf areas may be destroyed. Moth infestations are especially serious where wheat and flour are stored in bulk, although they seldom infest goods which are stored in silos.

Tropical Warehouse Moth

A particular problem in dried fruit and nuts, although this moth will attack cereals, oil seeds and chocolate products.

Mediterranean Flour Moth

Larval webbing can cause serious blockages in provender mills. The larvae eat holes in sifting silks and may also reach the mill's finished products.

Indian Meal Moth

Another species which is a particular problem of the fruit-drying industry. It will also attack cereals, oil seeds and shelled nuts. Larval webbing may occasionally reach problem proportions.

Rice-Moth

This moth will attack grain (especially rice), oil seeds, cocoa beans, dried fruit, spices and beverages.

Brown House Moth/ White-Shouldered House Moth Both species attack a wide variety of materials including cereals, cereal products, textiles, leather and cork. The Brown house moth tends to scavenge whilst the White-shouldered house moth is generally found infesting food.

Common Clothes Moth

Attacks animal products, for example wool, fur, skins and leather. Fibres are bitten off and the loose ends discarded, thus destroying much more commodity than is consumed.