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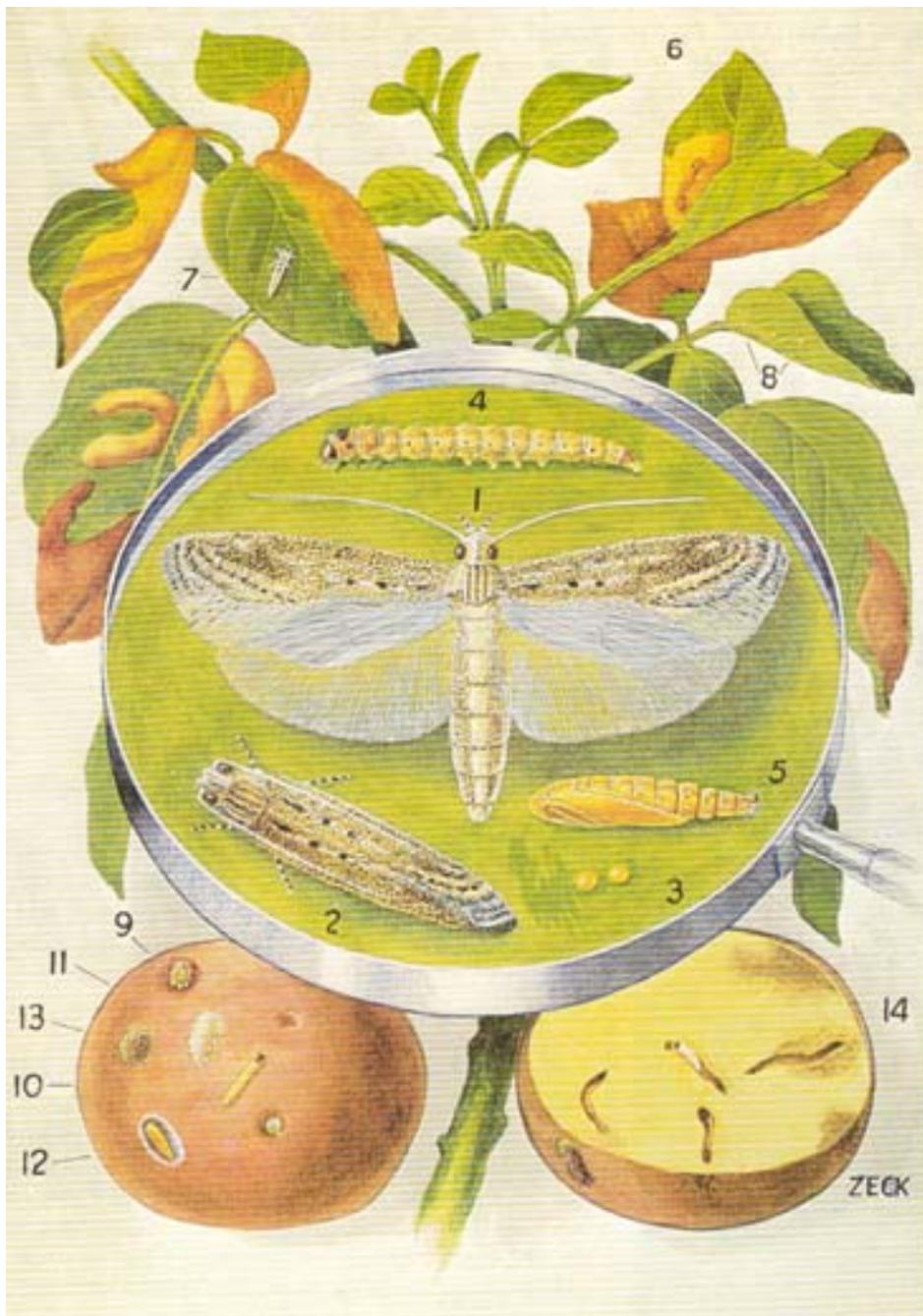
Potato moth

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(Revised July 2003)



Potato moth

- 1 Adult;
- 2 adult resting;
- 3 eggs; (1-3 enlarged seven times).
- 4 Larva or caterpillar;
- 5 pupa; (4-5 enlarged five times).
- 6 Potato plant showing blistering of foliage caused by caterpillars mining leaves;
- 7 moth on leaf;
- 8 eggs on leaf;
- 9 eggs laid on eye of tuber;
- 10 larva;
- 11 cocoon;
- 12 cocoon opened to show pupa;
- 13 frass where larva has entered tuber;
- 14 tuber showing decay and tunnels where larvae have fed; (6-14 actual size).—Illustration: E. H. Zeck

Potato moth, *Phthorimaea operculella*, is the most destructive pest of potatoes in New South Wales. It is also a serious pest of tomatoes, tobacco and eggplant and infests weeds of the potato family, such as black berry nightshade, *Solanum nigrum*, common thornapple, *Datura stramonium*, and apple of Peru, *Nicandra physalodes*. The larvae mine in foliage, stems and fruits and in the tubers of potatoes. Potato moth is widespread in New South Wales and is particularly damaging in warm dry weather.

The tops of heavily infested potato plants die prematurely, so that potential yields are reduced. The tubers developing beneath the plants then become infested by larvae from the plant tops, or by new larvae developing from eggs laid on the tubers. The larvae mine in the tubers, filling the tunnels with excrement, and the damage allows entry of decay organisms. Egg-laying on the tubers and development of the larvae continue after harvest and in store. Neglected stored potatoes can be reduced to a decaying mass.

DESCRIPTION AND LIFE HISTORY

The adult is a brownish grey moth (wingspan 12 to 16 mm) with tiny dark scattered marks on the forewings. The moths hide among the foliage or on the ground by day. At dusk they fly about actively and the females lay eggs. They commence egg-laying about 2 days after emerging from their cocoons and deposit 50 to 100 or more eggs over about 2 weeks.

On potato plants the females usually lay the eggs on the undersides of the leaflets, placing them singly or

Potato moth cocoons on inside of potato bag.



in groups. On tubers in storage they place the eggs near the eyes or near surface scars. The egg is oval, about 0.5 mm long and pearly white at first, later becoming yellowish. It hatches in about 5 days in summer and about 14 days in cool weather.

The newly emerged larva is about 1 mm long and very active, and soon commences to mine. It develops through four larval stages. When fully fed it is about 12 mm long, with a dark brown head and a body which is greenish if the larva developed in foliage or pinkish grey if it developed in a tuber. The larval period lasts about 14 days in summer, but is much longer during cool weather.

When fully grown the larvae leave the plants or the tubers and spin flimsy cocoons amongst clods or plant debris on the ground. If they are in stored potatoes they make the cocoons between tubers, in the entrances to tunnels in the tubers or on the sides of bags or containers.

In the cocoons the larva becomes a prepupa, then a pupa, which is dark brown and about 8 mm long. The prepupal stage lasts only 1 day in summer, but about 2 weeks in cool weather. The combined prepupal and pupal time, until the moth emerges from the pupa, is about a week in summer and about 4 weeks in cool conditions.

In the field the time from egg to adult is about 4 weeks during summer, but much longer during cooler months. There are several generations during the growing season. In winter in coastal districts the pest continues to develop, infesting volunteer potato plants, tubers left on the ground and weeds related to potato. In tableland areas it is too cold in winter for development of larvae, so the pest overwinters in sheltered places as a pupa. Breeding in stored potatoes can go on throughout the year except at low temperatures, such as in tableland districts from May to September.

INFESTATION AND DAMAGE

Potatoes. The larva mining in the leaflet causes brown blistering that can involve the whole of the leaflet. Sometimes these larvae web adjacent leaves together and mine in them also, or tunnel into leaf stalks and main stems. New larvae also often mine at growing points of terminal shoots or in the axils of leaves, and, as they develop, tunnel into the stem for up to 5 cm. Heavily infested plants die off prematurely.

Larvae that develop in the tubers tunnel either shallowly or deeply for up to 8 cm. The tunnels are packed with excrement. Attack on the tubers begins in

the field when the plants are starting to die. At this time the development of the tubers is bringing them closer to the surface, often making the soil crack. Larvae move down from dead or dying foliage to infest them and moths lay their eggs directly on or near the tubers.

Tuber damage is most severe in heavy soils which crack readily when conditions are dry, late in the growing season. With heavy infestation in dry weather tubers as deep as 10 cm may be affected, and 80 per cent or more of the crop may be damaged. In friable, self-mulching soils, with good rainfall or irrigation, little tuber damage occurs.

In coastal districts the pest is most troublesome during dry spring weather, infesting the foliage and stems in September to November and attacking tubers in November and December, particularly at harvest. In tableland areas infestation of the plants is worst during dry periods in summer and autumn, from January to April.

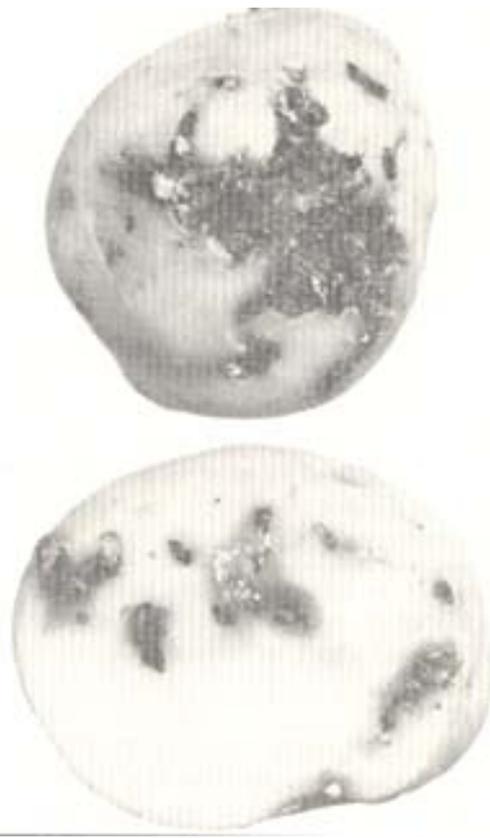
Tomatoes. Potato moth can cause significant damage to tomatoes, particularly on the north coast. If the eggs are laid on the undersurfaces of young leaves the larvae mine in the leaves or stems. If the eggs are laid on the calyx the larvae burrow into the fruit beneath. They may also enter stems through pruning scars. Stem mining damages young plants severely.

Tobacco. Potato moth in tobacco crops is usually referred to as tobacco leaf miner. Damage by the larvae affects the growth of seedlings and young transplants and may seriously reduce the yield and quality of leaf on older plants.

The larvae usually mine in lower leaves, but may tunnel in the stems and buds of young plants. In leaves, damaged areas are greyish, then become brown and brittle and tend to drop out when the leaf is cured. Leaves which are mined near the veins may also become distorted and misshapen.

NATURAL ENEMIES

Potato moth is parasitised by a number of wasps. The most important are *Apanteles subandinus* (Hymenoptera: Braconidae), *Copidosoma desantisi* (Hymenoptera: Encyrtidae), *C. koehleri* (Hymenoptera: Encyrtidae) and *Orgilus lepidus* (Hymenoptera: Braconidae), all introduced from overseas. Parasitism as high as 80% has been recorded. Predators of potato moth include spiders, earwigs, the ladybird beetle *Brumoides suturalis* (Coleoptera: Coccinellidae), and the Red and blue Beetle *Dicranolaius bellulus* (Coleoptera: Melyridae). In



Potato tubers damaged by potato moth.
—Photo: M. Hill.

addition, the larvae are attacked by granulosis virus, which can cause mortality in over 90% of larvae.

MANAGEMENT

Cultural control is the mainstay of potato moth management. The use of insecticides is only needed. Occasionally. With minimal insecticide usage, parasitic wasps and predators can be expected to exert significant pressure on potato moth populations. Further enhancement of biological control can be achieved by providing nectar sources to the beneficial insects, for example, by planting flowering plants within the crop. Regular monitoring of the crops is encouraged before any management decision (particularly the decision to spray) is made. Pheromone traps offers an easy and quick tool for monitoring potato moth both before harvesting and in storage.

Crop rotation. Maintain the humus content of heavy soils by suitable rotation of crops, including short term pastures. This will reduce the tendencies of heavy soils to crack in dry weather and expose tubers to infestation.

Potatoes planted in land previously under long term pastures may be attacked by soil insects. District Horticulturists can advise on rotations for potato land.

Do not grow successive crops of potatoes in the same ground, as the second crop will be attacked early (and usually heavily) by moths which have bred on the remains of the first crop.

Destroy alternative hosts. In preparing land for potatoes, keep it free of volunteer potato plants and weed hosts of potato moth for several months before planting. Destroy these hosts near growing crops of potatoes. Plough in spent crops of tomatoes or potatoes promptly.

At harvest, collect rejected tubers, remove them from the field and dispose of them so that they are not a source of further infestation.

Planting. Plant at least 15 cm deep. Do not use infested seed potatoes in isolated areas where potatoes are being grown for the first time, and where potato moth may not be present. In other areas there is no disadvantage in using infested seed if the sets are not seriously damaged and have intact eyes for initiation of growth.

Irrigation. Tuber infestation in the field is usually more damaging in dryland crops. Spray irrigation can ensure that the ground will not crack and give larvae and moths easy access to the tubers.

Hilling. Good hilling at the right time substantially reduces tuber infestation. To avoid damage to tubers by the hiller the rows must be at least 1 metre apart, and the plants must not be out of line in the row. Hilling must be done late in the season when the tubers are large but before they become exposed. The hills should be wide, with the soil thrown well up around the bases of the plants. The crop must be free of tall weeds which would interfere with the hilling.

Harvesting. Newly dug tubers can be attacked heavily while awaiting removal from the field, especially in warm weather. Never use potato plant tops to cover harvested tubers. Move the tubers from the field as soon as possible after digging and do not store them near any sources of potato moth.

Storage. Severe infestations can develop in tubers stored in warm conditions. Temperatures below 9° C will check development of larvae.

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DISCLAIMER

The information contained in this publication is based on knowledge and understanding at the time of review (July 2003.) However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Agriculture or the user's independent adviser.