

Orgilus

Potato tuber moth parasite

Biocontrol organism

☞ *Orgilus lepidus*

Orgilus lepidus is a wasp parasite and an important biological control agent for potato tuber moth in most potato-growing districts in Australia. It is one of three species that are well established in Australia following importation and release several decades ago; the other two are *Copidosoma* spp. and *Apanteles subandinus*. *Orgilus* is the largest of these (the female is about 9 mm long including the ovipositor). The wasp is mostly black but has a red mid-section to its body.



Plate 66: *Orgilus* wasp parasitising potato moth larvae within a leaf mine

The adults are strong flyers, and will move through crops searching for suitable hosts. They prefer to parasitise the very youngest potato tuber moth caterpillars (first instar), but will also attack later stages.

The immature (larval) stages of all these wasps are internal parasites hidden in the bodies of their hosts. They are maggot-like, being white and legless, with the head not clearly distinguishable from the rest of the body. The jaws are large and at the front of the head.

In between the larval and adult stages, the wasp passes through a pupal stage. At this stage it takes over the host and spins its own cocoon. The pale yellow cocoon can be seen easily and, unlike the larval stages, can be identified in the field.

The generation time for these wasps varies with temperature, but at an average of 23°C *orgilus* takes about 30 days to develop from egg to adult; the potato tuber moth takes 40 days.

Orgilus is a solitary endoparasite, with only one wasp developing inside one host caterpillar. The life cycle of the wasp is linked very closely to that of its host. From a batch of *orgilus* eggs all laid at the same time, the males emerge on average one day before the females; and female wasps emerge before the host (potato moth). The males can then mate with the females as soon as they are ready, and the females are mature enough to begin laying eggs when the hosts have produced offspring. If females are

not mated quickly, they will produce only male offspring. It seems that this mechanism is a response to insufficient males in the population, thus ensuring that the next generation will include enough males for mating.

There can be competition between wasps for hosts. The wasps use chemical markers to tell others of the same species which hosts have already been parasitised, but there is still competition between species within the host. Such competition means that some wasps will die, but the prospect for control of the pests is very good.

Target pest

☞ Potato tuber moth, tomato leafminer or potato moth *Phthorimaea operculella*

Potato moth is an important pest of solanaceous crops (e.g. potatoes, tomatoes, eggplants, tobacco) throughout much of the world. The adult moth is about 8 mm long and grey-brown

flecked. Caterpillars can be up to 12 mm long, and are variable in colour; they can be cream, green or pink, with a black head.

Damage is caused by the immature (caterpillar) stage, not by the adult moth. Female moths lay their eggs on foliage, soil, plant debris or exposed tubers. Caterpillars emerge from the eggs and tunnel into leaves if they are present, or into tubers or fruit if the growing stage of the crop is over. Caterpillars live between the upper and lower surfaces of potato leaves, eating the internal tissue. They often move along veins in the leaf, so that most congregate in the mid-vein. Damage becomes greater and more obvious as the caterpillar grows. If infestations are heavy, there can be severe leaf loss, resulting in a reduction in yield.

Damage to tubers or fruit (depending on the crop) is more often the major concern. In potato crops, moths and caterpillars can crawl through soil cracks or burrow a short distance

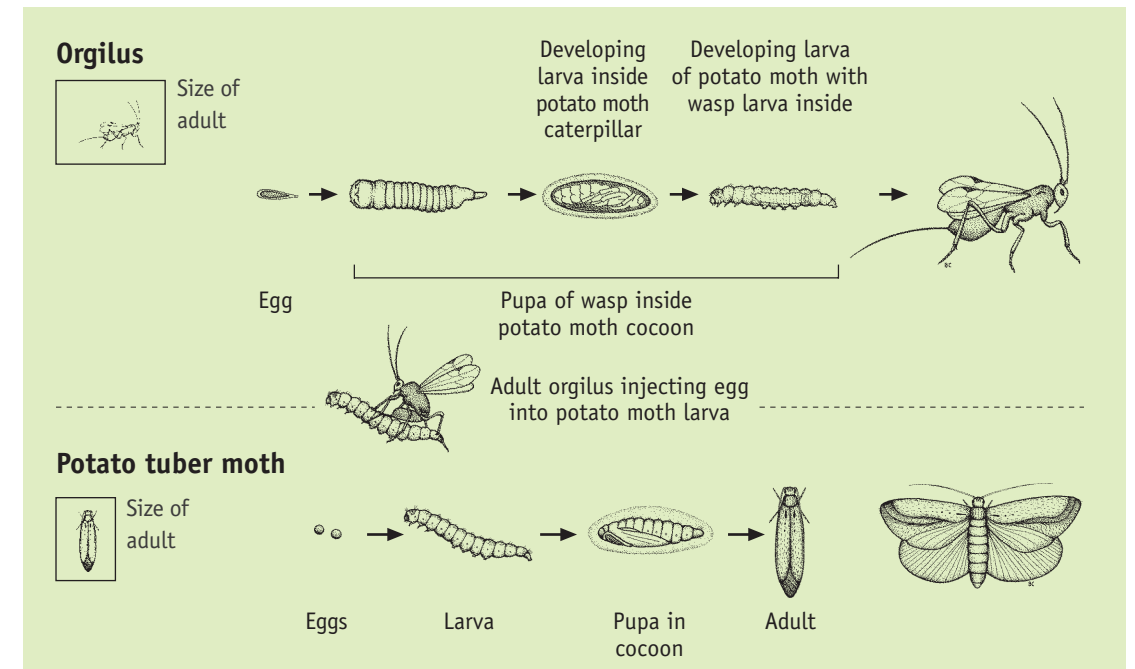


Figure 14: Life cycles of *orgilus* and potato tuber moth



Plate 67: Unparasitised potato moth pupa (*left*); pale yellow parasitised pupa (*centre*); and darker parasitised pupa with wasp about to emerge (*right*)



Plate 68: Potato moth adult



Plate 69: Potato moth egg, 0.5 mm long, laid on potato leaf

through loose soil to reach the tubers. The caterpillars then tunnel into the tubers, initially moving just under the surface and then moving deeper. Droppings from the caterpillars accumulate at the entrance to the mine. When larvae have finished feeding they exit the tuber to spin silk cocoons on the soil surface or in debris under the plant, and develop into smooth brown pupae. Pupation normally does not occur within tubers. Damage to tubers can occur in the field or in storage.

Adult moths mate and females begin laying eggs soon after they emerge from the pupa. Adults are active at night and at dusk. During the day they hide in sheltered parts of the plant or on the ground.

The potato tuber moth completes a generation in just 3 weeks in hot summer conditions, but takes up to 3 months in cold conditions. Larvae and adults can survive for long periods at temperatures near freezing. Feeding and breeding resume when temperatures increase above 11°C.

Suitable crops/environments

Orgilus will attack potato tuber moth wherever it is present; but research so far has focused on obtaining effective control in potatoes.

Before release

Orgilus wasps will be effective only if used as part of an IPM strategy that involves the use of cultural controls and other naturally occurring biological control agents. Cultural controls include the control of volunteer plants, overhead irrigation, and maintaining intact soil cover over tubers. Naturally occurring predatory insects will improve the effectiveness of orgilus wasps.

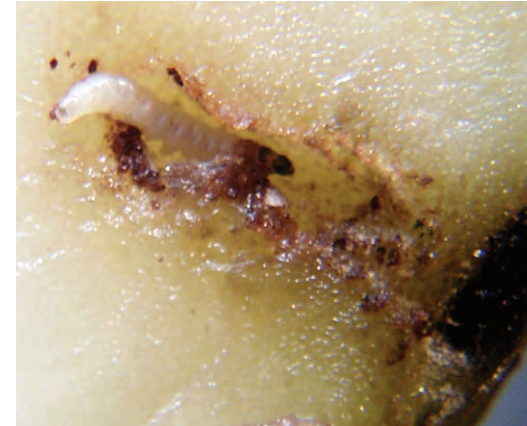


Plate 71: Potato tuber moth larva and damage caused to tuber

At release

Plan to release orgilus wasps within 2 weeks of crop emergence. Release for 5–6 weeks in each crop. Release at two locations, preferably on the perimeter, where potato moth is first seen.

In warm to hot weather, potatoes will be subjected to about three generations of potato moth per crop. The first and second generations cause leaf damage that is typically of little economic significance unless moth numbers are very large. Releases of orgilus starting soon after crop emergence enable parasitism and orgilus numbers to increase over the following weeks. This results in a much-reduced third generation of potato moth. Using orgilus in this way, in combination with the cultural practices mentioned above, will minimise damage to tubers.

Orgilus is usually supplied in plastic tubs containing pupae, but some adults may also be present. Remove the tape covering the tabs cut in the container. Pull up the tabs and place the tub on the ground in the shade of a plant, weighting it down with a clod of earth or a rock. The orgilus wasps will then emerge and move into the crop.



Plate 70: Potato tuber moths feed between the surfaces of leaves, creating 'mines'.

Recommended release rates

In plantings where tuber moth pressure is anticipated to be moderate, release 500 orgilus per week for 5 weeks. This is enough for crops up to 12 hectares. Where pressure is expected to be high, release 800 wasps per week for 6 weeks. In larger crops the shape of the paddock can influence the number required. Contact your supplier for more information.

After release

Continue to monitor for potato tuber moth activity. Potato tuber moth eggs are laid either on foliage or directly on the soil. Large caterpillars in leaf mines can drop directly onto tubers if the soil is cracked when the crop senesces; also, tiny caterpillars can hatch from eggs laid on soil and reach shallow or exposed tubers. After the crop senesces or is killed, control depends on cultural methods. If the risk is high, application of insecticide may be needed also to prevent moths laying eggs, and caterpillars developing, on tubers in the ground.

Adult moths are most active at dawn and dusk, and fly close to the ground. They usually move from plant to plant within or just above the

canopy. Damage is often worse (or first noticed) on the edge of crops where moths first invade.

Chemical use

Most fungicides appear safe, but many insecticides commonly used in potato crops are toxic to orgilus. The chemical toxicity table gives some idea of which chemicals are harmful and which are safe to use with beneficials.

Additional information

Most information on the use of orgilus relates to potato crops. However, suppliers are always

interested in hearing from growers of solanaceous crops other than potatoes who may wish to use orgilus.

Other natural enemies of potato tuber moth

Spiders

Egg parasite *Copidosoma* spp.

Larval parasite *Apanteles subandinus*

Damsel bugs, e.g. *Nabis kinbergii*