



Apple Maggot Fly

Rhagoletis pomonella



Fig. 1 Adult female *Rhagoletis pomonella*, © Joseph Berger, Bugwood.org image 5402802

Background

Rhagoletis pomonella (apple maggot fly) (Diptera: Tephritidae) is a major pest of apple cultivation in North America, reducing fruit quality and yield. It has spread from its native range in the eastern USA, Canada and Mexico to western USA and has jumped from its native host (hawthorn) to introduced cultivated apple. The species has not been intercepted in the UK in recent years but could become established as a major pest in commercial orchards and/or on garden apple trees if introduced.

Geographical Distribution

This species is native to eastern USA, Canada and (probably) Mexico where its native host is hawthorn. Following the introduction of apples to North America, genetically distinct, host-specific populations of *Rhagoletis pomonella* evolved, some of which specialise on apple. The species has also spread west within the USA, where it is now present in all but four of the continental states. It has not become established outside of North America.

Host Plants

The *Rhagoletis pomonella* feeds exclusively on fruit in the family Rosaceae, the main cultivated host species is apple (*Malus domestica*), and the native host is hawthorns (*Crataegus* spp.) The pest has also been recorded feeding on other plant species, including other fruit crops in the Rosaceae family, such as other *Malus* spp., *Prunus* spp. (e.g. cherry and plum) and *Pyrus* spp. (pear), but these are less significant hosts. It has also been recorded on other wild and horticultural plants in the Rosaceae family, such as *Cotoneaster* spp., *Rosa* spp. (roses) and *Sorbus* spp. (e.g. rowan).

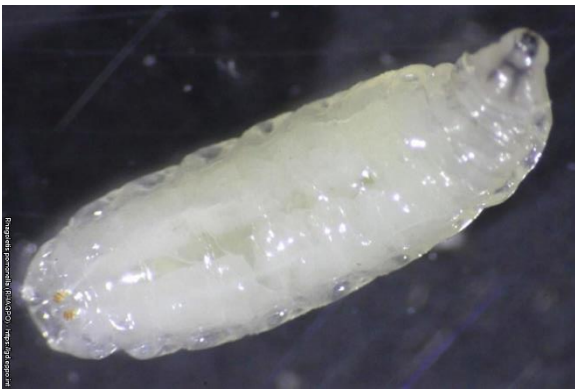


Fig 2. Larva of *Rhagoletis pomonella* © Wee L. Yee



Fig 3. Pupa of *Rhagoletis pomonella* © Wee L. Yee



Fig. 4. Adult female *Rhagoletis pomonella*, with F-shape on the wings visible © Joseph Berger, Bugwood.org, image number 5402797



Fig. 5. Adult female *Rhagoletis pomonella*, with the four abdominal stripes visible © Joseph Berger, Bugwood.org

Description

Eggs are smooth, white in colour and semi-opaque, elliptical in shape and about 0.9 mm long and 0.23 mm wide.

Larvae (maggots) are white, cream or yellowish in colour 8-11mm long and 1.5-2 mm wide in their final larval stage with the body tapering towards the head where dark mouth hooks are visible (Fig. 2).

Pupae are oval, yellow to brown in colour and about 5 mm long and 2.3 mm wide (Fig. 3).

The **adults** are small flies with a mostly black body, a yellow/orange coloured head and green-orange eyes. Each wing has four irregular black bands, of which three form an F-shape (Fig. 4). Adult body length varies between 4-6mm, with males being smaller than females. The females have four white horizontal stripes on the abdomen (Fig. 5) and a wingspan of 9.3 mm, whilst the smaller males have a wingspan of 7.5 mm and three horizontal stripes on the abdomen.

The species is a member of the *Rhagoletis pomonella* species group, comprising at least six closely related and highly similar species, which makes it difficult to separate them on physical features alone. Each species is related to a specific host plant family, so definitive identification requires expert examination and knowledge of the host.

Biology

In North America, different host races emerge at different times in the summer, corresponding to the availability of their host species, but this section will detail the biology of populations specialised on apple, as these pose greater risk.

Adults live for up to 40 days, taking 7-10 days to reach sexual maturity, and will feed on a variety of food sources. Adult females insert their eggs singularly under the skin of the fruit, producing characteristic puncture marks (Fig. 6). A female may lay up to 300 eggs in her lifetime. Larvae hatch after 3-10 days and burrow into the flesh of the fruit. The larvae may feed for two weeks or several months depending on the host, with longer feeding occurring on winter apples. Larvae tunnel through the fruit when feeding, distorting the apple and introducing fungal and bacterial pathogens. Infested fruit will often drop to the ground, from which larvae will emerge to burrow into the soil to pupate. Larval emergence from fruit may continue until early December. The species overwinters as pupae, then emerge as adults in the following summer. The species tends to have a single generation per year, or occasionally a partial second generation, and some individuals may persist as pupae for several years.



Fig. 6. Puncture marks caused by egg laying into the apple, © Whitney Cranshaw, Colorado State University, Bugwood.org



Fig. 7. Apples cut open to show tunnelling by *Rhagoletis pomonella* larvae © H.J. Larsen, Bugwood.org



Fig 8. Damage to apples by *Rhagoletis pomonella* © Wee L. Yee



Fig. 9. Damaged apple with a 3rd instar *Rhagoletis* larva (arrow) © Andrew A. Forbes, CABI

Dispersal and Detection

The pest is most likely to enter the UK in infested fruit imported from North America. The adults are capable of dispersing to host plants over 1km away, which could lead to further spread following introduction.

Adults are unlikely to be intercepted on imported apple fruit, it is more likely that eggs and larvae will be present within the fruit and later stage larvae and pupae in the packing boxes or crates. Adult flies are likely to have already exited the fruit. Signs of infestation on imports and in the field include puncture marks on the surface of fruit where females have laid their eggs, these appear sunken and discoloured around the edge of the puncture mark (Fig. 6). Larval burrowing into the flesh of the apple produces irregular tunnels, which turn brown (Fig. 7). As larval feeding continues fruit can become distorted, and in severe cases can become brown and rotten (Fig. 8 and 9). In the field, as the pest causes premature fruit drop, dropped fruit can be inspected for symptoms. These symptoms do have some overlap with the damage caused by other pests of apple and are not themselves diagnostic of *Rhagoletis pomonella* infestation. Pest species which cause

similar damage to apples as *Rhagoletis pomonella* include *Hoplocampa testuclinea* (apple sawfly), *Cydia pomonella* (codling moth) and *Rhynchites aequatus* (Rhynchites weevil).

Economic Impact

Rhagoletis pomonella specifically targets fruit, reducing fruit quality and crop yield. As a result, it is a major pest of apple production in North America. A 10-year study showed that *R. pomonella* reduced crop yield by 16.9% annually in an untreated apple orchard in Quebec, Canada. In addition to potential impacts on the apple industry in the UK, it is also possible that the species could impact production of cherries, pears and plums, and horticultural species such as rose and hawthorn.

Pest Management and Reporting

This species is a regulated quarantine pest, so is prohibited from being introduced into, or spread within, the UK. The most likely means of entry for this species to the UK is through infested apples from North America. Import of *Malus*, *Crataegus* and some other hosts as plants for planting is prohibited (pending a risk assessment) from countries where this pest is present. There is also a risk of entry from fruit and soil moved in passenger baggage and sold through the internet. Control measures against this pest in its native and introduced range include: treatment of growing crops (e.g. kaolin clay or aluminium silicate hydroxide treatment), quarantine treatments of fruit (cooling to 0°C for 40 days) and chemical control (including insecticide baited traps). There is also a potential use of natural enemies such as parasitoid wasps against this species.

Further guidance on management options in the event of an outbreak [can be found here](#).

Suspected outbreaks of *Rhagoletis pomonella* or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, York.

Tel: 0300 1000 313

Email: planthealth.info@apha.gov.uk

For **Scotland**, contact the **Scottish Government's Horticulture and Marketing Unit**:

Email: hort.marketing@gov.scot

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch**:

Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

Web: www.daera-ni.gov.uk/topics/plant-and-tree-health

For additional information on UK Plant Health please see:

planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/

planthealthportal.defra.gov.uk/

www.gov.uk/plant-health-controls

www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases

www.daera-ni.gov.uk

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