Compendium of Apple and Pear Diseases and Pests

SECOND EDITION

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Edited by

Turner B. Sutton
North Carolina State University, Raleigh

Herb S. Aldwinckle
New York State Agricultural Experiment Station
Cornell University, Geneva

Arthur M. Agnello
Department of Entomology
New York State Agricultural Experiment Station, Geneva

James F. Walgenbach
Mountain Horticultural Crops Research and Extension Center
North Carolina State University, Mills River

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Fruit Surface Damage

Pests that cause fruit surface damage feed or oviposit on the exterior of the fruit.

Leafrollers and Fruitworms

Brazilian Apple Leafroller

The Brazilian apple leafroller, *Bonagota salubricola* (Meyrick), was first identified as *Phtheochroa cranaodes* Meyrick (Lepidoptera: Tortricidae), later as *Bonagota cranaodes* Meyrick, and recently as *Bonagota salubricola*. It was also cited as *Eulia salubricola* Meyrick in Uruguay. In Brazil, it is considered one of apple's main pests. It achieved importance as a pest in the 1980s, when the damage caused was greater than 15% in commercial orchards. The identification and synthesis of the pheromone, studies on its ecology, and correct use of insecticides all resulted in reduction of the damage to less than 2%.

Fig. 215. Brazilian apple leafroller adult. (Courtesy A. Kovaleski)

Fig. 216. Surface feeding damage caused by a Brazilian apple leafroller larva. (Courtesy A. Kovaleski)

This insect is originally from southern Brazil. It is also found in Uruguay and Argentina but is of greatest importance in Brazil and Uruguay. This species is considered to be polyphagous, attacking a wide number of cultivated and wild plants, including apple, poplar, plum, hydrangea, turnip, pear, roses, sow thistle, and clovers.

Life History and Description

Adults are light gray and 7–10 mm long and have a 15-mm wingspan (Fig. 215). They have a crepuscular habit, mating between 5 and 9 p.m. Females deposit about 200 eggs, in batches of about 40 eggs each, usually on the smooth side of the leaf. The eggs are milky white but turn darker close to eclosion. Eggs have an incubation time of 8 days at 25°C. First-instar larvae have a dark head and a yellow body. As the larva starts to feed, its color may change to predominately green. The pupa, which is initially green as well, turns dark brown. The egg-to-adult period lasts about 45 days.

In the apple production region of Brazil, *B. salubricola* may be observed year-round. During the winter, when there are no leaves, the larvae can be found in alternative hosts, mummified fruit, and remaining apple leaves. Its population peaks at the end of August and between December and May, this last period being the most important because the larvae can cause direct damage to the fruit.

Damage

Damage occurs to both leaves and fruit of apple. After eclosion, the larvae conceal themselves on the underside of the leaf, especially along the midvein. Larvae build shelters as they develop by joining leaves, affixing leaves to fruit, or hiding within the fruit cluster. It is also common for them to partially cut the petiole, which makes the leaf roll to create a hiding place inside. Leaf injury does not result in economic loss. The main damage is that caused by larval feeding on the fruit surface (exocarp) (Fig. 216), which lowers the fruit's commercial value and also allows the establishment of fungal pathogens.

Management

Adults are monitored using delta-style pheromone traps; commercially available rubber septa lures last 90 days. Moth counts are made twice a week, with a treatment decision recommended after a mean capture of 20 males per trap per week.

Control can be achieved using organophosphate insecticides, growth regulators (especially those with ovicidal activity), and mating disruption, which must be used in combination with insecticides to control other pests, such as the South American fruit fly and the oriental fruit moth. Many parasitic hymenoptera can be found attacking larvae in the orchard, mainly after harvest, at times when there is reduced insecticide use. Ichneumonidae and Chalcididae are among the most important families represented.

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(Prepared by A. Kovaleski and A. P. Kovaleski)

Chilean Fruit Leafroller

Proeulia auraria (Clarke) is a South American leafroller species of major quarantine importance in pome and stone fruits, table grapes, kiwifruits, berries, and oranges destined for export. Even though it is not yet locally considered to be of primary importance, as are other fruit insect pests, it has nevertheless become the most important native species of this genus, reaching worldwide quarantine status. Other leafrollers of the group are also gradually moving from their native host plants to a variety of orchard crops, where they are not easily separated taxonomically from *Proeulia auraria*.

Biological and pheromone studies have been conducted on this species since the 1980s. One significant outcome of which has been the identification of the sex pheromone, which was determined to be identical to that of another important leafroller species, the tufted apple bud moth, *Platynota idaeusalis* (Walker).

Life History, Description, and Damage

The female moth has a 18–20 mm wingspan (Fig. 217). Its general body color is variable, depending on the host plants utilized for food, one factor necessitating the use of genitalia for taxonomic determinations. Generally, female forewings have a brown-orange pattern, except for a clear triangular area located in the medial posterior portion of the wing fascia, more noticeable on the upper wing surface while at rest. Equally characteristic is a grayish color pattern in the basal part of the wing costal margin. Males are readily captured in tufted apple budmoth traps. They are smaller than females, and their front wings show a similar golden color pattern; however, the middle internal borders have a darker triangular area, thus forming a rhomboidal spot when the wings are held at rest.

Eggs are generally laid on the upper leaf surface, in small groups of 15–20. After 5–7 days, they turn intense yellow and the blackhead larvae start to become visible. Newly hatched larvae are yellowish with a black head. After the first molt, the body turns bright green (Fig. 218) and develops a prominent anal fork. Characteristics used to separate *Proeulia auraria* larvae from other members of this genus include a dark brown fringe situated basally on both sides of the head; also, the eighth abdominal segment has a large lateral spiracle, with a long seta arising in front of the spiracular ring. From the first to fourth larval instars, larvae can be recognized by their green body and black head and prothoracic plate. Once they have reached their final instar, the head and prothoracic plate turn light brown.

They normally pupate in folded leaves, protected by a white silken cocoon. The first spring generation usually pupates at the end of the spring and emerging adults may or may not continue development into a second generation on the same host. This second brood is present until late summer; adults lay their eggs in early autumn, giving rise to overwintering first-instar larvae. After a short feeding period, they move to the woody parts of the trunk and limbs to overwinter in diapause.

By the end of the winter, the tiny larvae begin to move to newly emerging buds. Second larval instars remain inside the buds until leaves are present and continue attacking the flowers and young fruit. They very rarely penetrate the fruit, since their damage is usually external in nature. Damage is more severe in fully expanded leaves, which are folded and webbed with silken threads. Larvae are very active. During foliar examination, they can readily escape by jumping to the ground. Complete larval development of this first generation from the third to last instar may take 50–70 days.

It is important to note that two successive generations almost never occur on the same host plant. The spring generation is commonly found in pears and other pome fruits, stone fruits, blueberries, cherries, and assorted berry crops. Preferred second-generation hosts include grapes, kiwifruits, oranges, and mandarins.

Management

Pheromone traps are essential in leafroller control programs. Traps should be installed in midspring just prior to the first flight. Male moths fly after midnight, at temperatures above 7°C. A regular insecticide schedule directed against either the codling moth or the oriental fruit moth can control the early *Proeulia* larval stages, but fourth- to fifth-instar leafrollers are rarely well controlled with these programs; pyrethroids or chloronicotinyls have better performance.

With respect to natural enemies, a few generalist parasitoids belonging to the families Tachinidae (Diptera) and Ichneumonidae (Hymenoptera) occasionally attack this species in ornamental trees.

Fig. 217. Chilean fruit leafroller adult. (Reprinted, by permission, from Gilligan and Epstein, 2012)

Fig. 218. Chilean fruit leafroller larva. (Courtesy R. H. González)