

Citrus Leafminer, *Phyllocnistis citrella* Stainton (Insecta: Lepidoptera: Phyllocnistinae)¹

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Introduction

The small leafmining moth, *Phyllocnistis citrella* Stainton, family Gracillariidae (subfamily Phyllocnistinae), or the citrus leafminer (CLM), was found in late May 1993 in several citrus nurseries in Homestead, Florida, other parts of Dade county, and in Broward and Collier counties. It now occurs everywhere in Florida where citrus is grown, and has spread to other Gulf Coast areas. CLM is a new New World, continental United States, and Florida resident. It is potentially a serious pest of citrus and related Rutaceae, and some related ornamental plants (Beattie 1989; Clausen 1933; Kalshoven 1981). CLM has previously been intercepted in the USA in 1914 (ports not noted) on citrus and *Atalantia* horticulture stock imports from the Philippines (Sasscer 1915).

Distribution

A widespread Asian species (Clausen 1931, 1933; CAB 1970), described from Calcutta, India (Stainton 1856), CLM not is known from East Africa -- Sudan to Yemen (Badawy 1967), through southern Asia -- Saudi Arabia to India (Fletcher 1920) and Indonesia (Kalshoven 1981), north to Hong Kong

and China, Philippines (Sasscer 1915), Taiwan (Chiu 1985; Lo and Chiu 1988) and southern Japan (Clausen 1927). It is also found in New Guinea and nearby Pacific Islands (CAB 1970), and Australia (Beattie 1989; Hill 1918; Wilson 1991). CLM also occurs in South Africa and more recently in parts of West Africa (CAB, personal communication). The Australian introduction occurred before 1940, and has since 1969 been reported from northern Queensland. CLM has spread to all Florida citrus counties, and to Louisiana and Texas.

Description

Adults of the CLM are minute moths (4 mm wingspread) with white and silvery iridescent scales on the forewings, with several black and tan markings, plus a black spot on each wingtip. The hind wings and body are white, with long fringe scales extending from the hindwing margins. In resting pose with wings folded, the moth is much smaller in appearance (about 2 mm). The head is very smooth-scaled and white and the haustellum has no basal scales. CLM is most easily detected by its meandering serpentine larval mine, usually on the

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ventral side of the leaf. Larvae are minute (to 3 mm), translucent greenish-yellow, and located inside the leaf mine. The pupa characteristically is in a pupal cell at the leaf margin. Adults generally are too minute to be easily noticed, and are active diurnally and in the evenings.



Figure 1. Adult citrus leafminer, *Phyllocnistis citrella* Stainton, (4 mm). Credits: Jeffery W. Lotz, Florida Department of Agriculture and Consumer Services, Division of Plant Industry



Figure 2. Adult citrus leafminer, *Phyllocnistis citrella* Stainton, in resting pose. Credits: Jeffery W. Lotz, Florida Department of Agriculture and Consumer Services, Division of Plant Industry

Biology

The biology of CLM has been reported by a number of researchers, including Badawy (1967), Beattie (1989), Clausen (1927, 1931, 1933), Fletcher (1920), Kalshoven (1981), and Latif and Yunus (1951). Eggs of CLM are laid singly on the underside of host leaves. Egg eclosion occurs within two to 10 days, whereupon larvae immediately enter the leaf

and begin feeding. Larvae make serpentine mines on young leaves (sometimes also young shoots), resulting in leaf curling and serious injury. Leaf mines are usually on the ventral leaf surface, except in heavy infestations when both leaf surfaces are used. Usually only one leaf mine is present per leaf but heavy infestations may have two or three mines per leaf; up to nine mines on large leaves have been found in Florida. As with similar leafminers, larvae are protected within the leaf during their feeding cycle. Larvae have four instars and development takes from five to 20 days. Pupation is within the mine in a special pupal cell at the leaf margin, under a slight curl of the leaf. Pupal development takes six to 22 days. Adults emerge about dawn and are active in the morning; other activity is at dusk or night. Females lay eggs evenings and at night (Badawy 1967; Beattie 1989). CLM may help spread citrus canker (Hill 1918; Ando et al. 1985) because of leaf damage from the mine.

Generations per year appear to be nearly continuous: six in southern Japan (Clausen 1931), nine to 13 in northcentral India (Lal 1950); 10 in southern India (Pandey and Pandey 1964). Development time totals about 13 to 52 days (Pandey and Pandey 1964), depending on weather and temperate conditions. Adults live for only a few days. Florida generations are produced about every three weeks.

Host Plants

CLM is common on species of citrus and related Rutaceae within its range (Kalshoven 1981). CLM is most commonly found on leaves of grapefruit *Citrus X paradisi* Macfad.) and pummelo (pomelo) (*Citrus maxima* (Burm.) Merr.) (Badawy 1967). Recorded Rutaceae include *Aegle marmelos* (L.) Corr. Serv. in India (Fletcher 1920), *Atalantia* sp. in the Philippines (Sasscer 1915), *Murraya paniculata* (L.) Jack. in India (Pruthi and Mani 1945), *Poncirus trifoliata* (L.) Raf. in India (Clausen 1933), and various native Rutaceae in Indonesia (Kalshoven 1981). Other reported hosts include *Jasminum sambac* (L.) Aiton (Oleaceae) in India (Fletcher 1920), mistletoes on citrus (*Loranthus* sp., Loranthaceae) in the Philippines (Reinking and Groff 1921), *Pongamia pinnata* Pierre (Leguminosae) in India (Margabandhu

1933), and *Alseodaphne semecarpifolia* Nees (Lauraceae) in India (Latif and Yunus 1951). Florida records include various *Citrus* spp., kumquat (*Fortunella crassifolia* Swingle), and calamondin (*Citrofortunella microcarpa* (Bungel) D.O. Winjnands).

Several other hosts have been reported for CLM, but larvae do not complete their life cycle on these incompatible hosts *Murraya koenigii* L. Sprengel (Rutaceae) in India (Fletcher 1920), *Jasminum* sp. and *Jasminum cinnamomum* Kobuski (Oleaceae) in India (Pruthi and Mani 1945), *Dalbergia sissoo* Roxb. ex DC (Leguminosae) in India (Latif and Yunus 1951), *Salix* sp. (Salicaceae) in India (Pruthi and Mani 1945), and *Grewia asiatica* L. (Tiliaceae) in India (Latif and Yunus 1951).

Survey

Symptoms of infestation include:

1. leaves with serpentine mines, usually on ventral surfaces;
2. curling of leaves (may harbor mealybugs);
3. epidermis appearing as a silvery film over leaf mines;
4. pupation chamber near leaf margin, the edge of which is rolled over, and exposed portion of chamber with a distinct orange color; and
5. succulent branches of green shoots may also be attacked (Beattie 1989; Pandey and Pandey 1964).

Management

Parasites reported for CLM include 39 species from Southeast Asia, Japan, and Australia, mostly Chalcidoidea (Heppner 1993; Kalshover 1981; Lo and Chiu 1988). A pheromone to attract males of CLM has been developed in Japan by Ando et al. (1985), called (7Z, 11Z)-7, 11-hexadecadienal. Most work has been done using chemical control, especially in India. Various spray regimes, time of growth flushes, and promotion of biological control are recommended in Australia (Beattie 1989). In Florida, chemical control recommendations are still



Figure 3. Leaf mine of citrus leafminer, *Phyllocnistis citrella* Stainton, on citrus in Florida. Credits: Jeffery W. Lotz, Florida Department of Agriculture and Consumer Services, Division of Plant Industry

being evaluated, but biological control and application of oil are suitable methods to help reduce populations of CLM. An encyrtid parasitoid, *Ageniaspis citricola*, was introduced from Australia to Florida in 1994-95, and seems to have the key element in suppressing this leafminer to an acceptable level.

For more management information see: Florida Citrus Pest Management Guide (http://edis.ifas.ufl.edu/BODY_CG025).

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