

Pest Alert

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

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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 Miami-Dade, Broward and Collier counties. 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* sp. horticulture stock imports from the Philippines (Sasscer 1915). CLM is a serious threat to Florida citrus. It has not previously been reported mining fruit rinds, but several cases have been observed in Florida.

DIAGNOSIS: Adults of the citrus leafminer 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 (Fig. 1). The hind wings and body are white, with long fringe scales extending from the hindwing margins. In resting pose with wings folded (Fig. 2), 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. Citrus leafminer is most easily detected by its meandering serpentine larval mine (Fig. 3), usually on the 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 evenings.

DISTRIBUTION: A widespread Asian species (Clausen 1931, 1933; CAB 1970), described from Calcutta, India (Stainton 1856), CLM now 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 pers. comm.). The Australian introduction occurred before 1940, and has since 1969 been reported from northern Queensland. Since May 1993, CLM has spread to all Florida citrus counties, with isolated sites as far north as Pensacola, plus Alabama, Louisiana, and southern Texas. Since 1994, CLM has also moved through most of Latin America (other than Brazil, Chile, and Argentina) and entered previously CLM-free areas around the Mediterranean (Spain, Italy, Israel, and Turkey).

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. Serr. 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 (*X Citrofortunella microcarpa* (Bungel) D. O. Winjands).



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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), Latif and Yunus (1951). Eggs of CLM are laid singly on the underside of host leaves. Egg eclosion occurs within 2-10 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 2 or 3 mines per leaf; up to 9 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 4 instars and development takes from 5-20 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 6-22 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: 6 in southern Japan (Clausen 1931), 9-13 in northcentral India (Lal 1950); 10 in southern India (Pandey and Pandey 1964). Development time totals about 13-52 days (Pandey and Pandey 1964), depending on weather and temperate conditions. Adults live for only a few days. Florida generations are produced about every 3 weeks.

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).

CONTROL: Parasites reported for CLM include 39 species from Southeast Asia, Japan, and Australia, mostly Chalcidoidea (Heppner 1993; Kalshoven 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, timing of growth flushes, and promotion of biological control are recommended in Australia (Beattie 1989). In Florida, chemical control recommendations are still being evaluated, but biological control and semiochemical trapping may be the most likely methods to help reduce populations of CLM in the long run.

REFERENCES:

- Ando, T., K. Y. Taguchi, M. Uchiyama, T. Ujiye, and H. Kuroko. 1985. (7Z-11Z)-7,11-hexadecadienal: sex attractant of the citrus leafminer moth, *Phyllocnistis citrella* Stainton (Lepidoptera, Phyllocnistidae). *Agric. Biol. Chem. Tokyo* 49:3633-3653.
- Badawy, A. 1967. The morphology and biology of *Phyllocnistis citrella* Staint., a citrus leaf-miner in the Sudan. *Bull. Soc. Ent. Egypte* 51:95-103.
- Beattie, G. A. C. 1989. Citrus leaf miner. *NSW Agric. & Fisheries, Agfact, H2. AE.4:1-4.*
- Chiu, S. C. 1985. Biological control of citrus pests in Taiwan. *Taiwan Agric. Res. Inst., Spec. Rep.* 19:1-8.
- Clausen, C. P. 1927. The citrus insects of Japan. *USDA, Washington, D.C. Tech. Bull.* 15:1-15.
- _____. 1931. Two citrus leaf miners of the Far East. *USDA, Washington, D.C. Tech. Bull.* 252:1-13.
- _____. 1933. The citrus insects of tropical Asia. *USDA, Washington, D.C. Cir.* 266:1-35.
- Commonwealth Agricultural Bureaux (CAB), Commonwealth Institute of Entomology. 1970. *Phyllocnistis citrella* Stnt. In: *Distribution maps of pests. Ser. A, Map No. 274. The Eastern Press Ltd., London.*
- Fletcher, T. B. 1920. Life histories of Indian insects. *Microlepidoptera. Mem. Dept. Agric. India* 6:1-217, 68 pl.
- Heppner, J. B. 1993. Citrus leafminer, *Phyllocnistis citrella*, in Florida (Lepidoptera: Gracillariidae: Phyllocnistinae). *Trop. Lepid.* 4:49-64.
- Hill, G. F. 1918. History of citrus canker in the Northern Territory (with notes of its occurrence elsewhere). *N. Terr. Austr. Bull.* 18:1-8.
- Kalshoven, L. G. E. 1981. *Pests of crops in Indonesia. Jakarta: Ichtar Baru. [reprint]*
- Margabandhu, V. 1933. Insect pest of oranges in the northern Circars. *Madras Agric. J.* 21:60-68.
- Lal, K. B. 1950. Insect-pests of fruit trees grown in the plains. *Agric. Anim. Husb. Uttar Pradesh* 1:30-45.
- Latif, A., and C. M. Yunus. 1951. Food plants of citrus leaf miner in Punjab. *Bull. Ent. Res.* 42:311-316.
- Lo, K. C., and S. C. Chiu. 1988. The illustrations of citrus insect pests and their natural enemies in Taiwan. *Taihung: Taiwan Agric. Res. Inst.* 75 p.
- Pandey, N. D., and Y. D. Pandey. 1964. Bionomics of *Phyllocnistis citrella* Stt. (Lepidoptera: Gracillariidae). *Indian J. Ent.* 26:417-423.
- Pruthi, H. S., and M. S. Mani. 1945. Our knowledge of the insect and mine pests of the citrus in India and their control. *Imp. Council Agric. Res. Sci. Monog.* 16:1-42.
- Reinking, O. A., and G. W. Groff. 1921. The kao pan seedless Siamese pummelo and its culture. *Philipp. J. Sci.* 19:389-



Fig. 1. *Phyllocnistis citrella* Stainton, adult (4 mm wing spread).
Photo credit: Jeffrey Lotz, FDACS/DPI



Fig. 2. Adult in resting pose (2 mm).
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Fig. 3. Leaf mine on citrus in Florida.
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