

Cottonwood Leaf Beetle

Chrysomela scripta F.

Coleoptera: Chrysomelidae

Fang, Y.; Hart, E. R. 2000. Effect of cottonwood leaf beetle (Coleoptera: Chrysomelidae) larval population levels on *Populus* terminal damage. *Environmental Entomology* 29: 43-48.

Objective: To relate density of *C. scripta* egg masses to defoliation levels on a hybrid poplar using a damage rating system.

Abstract: Cottonwood leaf beetle, *Chrysomela scripta* Fabricius, is an important pest of poplar and aspen, *Populus* spp., and willow, *Salix* spp., in North America. Larvae prefer to feed on young leaves and can produce significant defoliation. The second generation of *C. scripta* has fewer natural enemies and is less susceptible to abiotic factors, therefore it is more damaging than the first or third generations. *Populus* grown in plantations as a short-rotation woody crop is particularly susceptible to damage by *C. scripta* during the first 3 years when the trees produce abundant new growth. Reichenbacher et al. (1996) reported that approximately 75% defoliation in *Populus* reduced the above ground, root, and total biomass by approximately 33% after 2 years of defoliation.

A study was conducted on the relationship between larval density and resulting defoliation on the hybrid poplar *Populus deltoides* Marsh. X *Populus nigra* L. var. 'Eugenei' in Iowa, U.S.A. For second-generation *C. scripta*, there was a significant relationship between the egg mass equivalent per actively growing terminal and the resulting defoliation on open trees ($R^2 = 0.8714$; $P = 0.0001$), as expressed by the equation $y = -0.91x^2 + 3.79x + 0.61$, where y = damage rating and x = egg mass equivalent per terminal. An egg mass equivalent was defined as an egg mass or a newly eclosed larval clutch. When the density of egg mass equivalents was >1 per leaf terminal, the expected level of defoliation was $>75\%$. However, the relationship between beetle densities of <1 egg mass equivalent per terminal and expected level of defoliation was not as well defined.

Based on these data, the authors concluded that defoliation by *C. scripta* should reduce biomass by $<33\%$ over the first two years of plantation establishment as egg mass densities increase from 0 to 1 per terminal in each generation. In addition, the damage rating standard developed in this study offers a quick and reliable method of determining the defoliation level present in a stand comparable to measuring percent defoliation.

Sampling Procedure: Randomly sample actively growing leaf terminals of hybrid *Populus* spp. during peak oviposition by the second generation of *C. scripta*, in late June-early July in Iowa. An actively growing terminal has new growth with leaves in good health and a leaf plastochron index (LPI) of 0-8. Briefly, designate the terminal, expanding leaf with a blade length nearest to 3 cm as LPI = 0. Designate the next leaf counted consecutively down the stem from apex to base as LPI = 1. Continue to number the leaves in this manner until a total of 8 leaves have been selected (as described in Fang et al. 2002). Examine each of these 8 leaves in the terminal and calculate the mean egg mass or newly eclosed larval clutch per terminal, referred to as the egg mass equivalent by the authors. Use the following equation to predict the expected damage rating from second-generation *C. scripta*:

$$y = -0.91x^2 + 3.79x + 0.61$$

where y = damage rating and x = egg mass equivalent per terminal. Relate the expected damaging rating to the leaf plastochron index using the following table:

Damage rating	Damage on Leaf Plastochron Index (LPI)
0	No feeding on LPI 0-8
1	Light feeding, sample feeding only on LPI 0-8; <33% of LPI 0-8 consumed
2	Light to moderate feeding; 33-50% of LPI 0-8 consumed
3	Moderate to heavy feeding; approx. 50-75% of LPI 0-8 consumed; main leader intact
4	Heavy feeding; >75% of LPI 0-8 consumed; main leader and terminal bud heavily damaged

In general, consider treating for *C. scripta* when the density of egg masses or larval clutches is >1 per leaf terminal, as the expected level of defoliation associated with this density is >75%.

Notes: The authors did not specify how many trees or how many terminals per tree should be sampled. Managers may want to review the economic injury level determined for second-generation *C. scripta* on 2-year old *Populus deltoides* Marsh. X *Populus nigra* L. var. 'Eugenei' (Fang et al. 2002), also included in this volume.

References:

- # Fang, Y.; Pedigo, L. P.; Colletti, J. P.; Hart, E. R. 2002. Economic injury level for second-generation cottonwood leaf beetle (Coleoptera: Chrysomelidae) in two-year-old *Populus*. *Journal of Economic Entomology* 95: 313-316.
- Reichenbacher, R. R.; Schultz, R. C.; Hart, E. R. 1996. Artificial defoliation effect on *Populus* growth, biomass production, and total nonstructural carbohydrate concentration. *Environmental Entomology* 25: 632-642.