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COTTONWOOD LEAF BEETLE

Insect Pest Management in Hybrid Poplars Series

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Introduction

Large moncultures of *Populus* spp. grown for pulp, non-structural timber, or biofuels are commonly attacked by *Chrysomela scripta.* Integrated pest management (IPM) professionals in the Pacific Northwest (PNW) need to be able to identify leaf beetle damage, prepare a monitoring program, and develop a management protocol to prevent or remedy an outbreak of this pest.

Taxonomy

Chrysomeloidea is a superfamily with four families, one of which is Chrysomelidae, the leaf beetles. The genus *Chrysomela* identified by Linnaeus, was further divided into a subgenus *Chrysomela (Macrolina).* The species name *scripta* was attributed to Fabricius. Two other Chrysomelidae species attack Salicaceae trees. These include the imported willow leaf beetle, *Plagiodera versicolora* (Laicharting), introduced into the US in 1915 from Europe and widely distributed in the eastern US and southern Canada. It is sporadically found throughout North America (Riley et al. 2003). The other species is *Altica populi,* a defoliating leaf beetle found in the US; however, its distribution is unknown (Charles et al. 2014).

Hosts

Cottonwood leaf beetle hosts include poplar, willow, aspen, and alders.

Range

Cottonwood leaf beetles are common from southeastern Alaska, coast to coast throughout the northern states, and south to Florida in the east.

Life History

Adults survive the winter under leaf litter or within bark crevices. They become active in April. Gravid females deposit yellowish, oval-shaped eggs in clusters (Figure 1) on leaves. Each female can deposit multiple egg masses during her lifespan. Upon hatching, first instars feed gregariously as they skeletonize the leaf surface. Larvae consume large portions of the leaf in later instars. Eversible larval glands secrete salicylaldehyde as a defensive secretion.

Length of larval development is temperature dependent, requiring 19 days at 27°C (80°F) to complete their three instars. The larval instars are followed by a pre-pupal period, when an individual attaches itself to a midrib, petiole, or small branch and pupates. All three instars and adult beetles defoliate (Figures 1 and 2) host trees. There can be five generations per year in southern states (Coyle et al. 2005), and three to four generations in northern states and in the PNW.

Poplars grown for biofuels retain a large proportion of their biomass as succulent, long-shoot foliage preferred by *C. scripta* (Coyle et al. 2005). Cottonwood leaf beetle defoliation can reduce tree volume in certain clones by 70% over three growing seasons (Coyle et al. 2002).

Figure 1. Clockwise from top left, eggs (1 mm each), first instar aggregated feeding that causes leaf to be skeletonized, second and third instars exuding salicylaldehyde as a defensive white liquid, and the adult cottonwood leaf beetle (6 mm) on a leaf (Photos by J. Brown).

Figure 2. Terminals damaged by cottonwood leaf beetle (Photo by R.A. Rodstrom).

Damage

Cottonwood leaf beetle is an intense defoliator (Figure 2). Multiple generations throughout the growing season rapidly increase the population, where both adults and larvae feed on the leaves (Harrel et al. 1982). Fang et al. (2002) estimated the economic injury level for poplars grown for pulp to be 0.2–0.9 egg masses per terminal in Iowa.

Carlson (2010) reported that *C. scripta* fed on young leaves, avoiding apical meristems, leaf mid-veins, and primary lateral veins. Carlson's research concluded that (1) *Populus trichocarpa* completely compensates for low levels (<30%) branch defoliation by *C. scripta* through increased leaf thickness and increased lateral branching and (2) defoliation by *C. scripta* physically causes a decrease in leaf nitrogen content compared to artificial defoliation due to the insect's selective removal of nitrogen-rich inter-vein tissue. Carlson's action threshold for level of defoliation (>30%) and concern for loss of nitrogen in the plants is specific for hybrid poplars grown under an irrigated system and fertilized with chemigation through the drip lines.

Biological Control

In Minnesota a tachinid fly, *Cleonice setosa* (Reinhard), and a pteromalid wasp, *Schizonotus sieboldi* (Ratzeburg), were found parasitizing cottonwood leaf beetle larvae and pre-pupae (Kendrick et al. 2005). We have not evaluated beneficial insects that specifically attack *C. scripta* in the PNW. We have observed generalist predators attacking *C. scripta* larvae (Figure 3).

Figure 3. Generalist Pentatomidae nymph feeding on cottonwood leaf beetle larva (Photo by R.A. Rodstrom).

Monitoring

Weekly visual monitoring starting in April through September in eastern Oregon should alert growers to where damaging populations of *C. scripta* could need chemigation. Growers should be most concerned about beetle damage to the terminals of trees in their second and third year of growth. Sample five trees in a row, move left or right five rows and down the row ten trees, sample five more trees, and repeat this pattern at least three times. Concentrate your attention on the terminals, and examine ten leaves in the top four branches in each cardinal direction. Thinning of leaves on the terminal shoot of plants, especially in May and June, can be indicative of beetle damage. When defoliation triggers a management decision, a final pretreatment examination of as many trees as possible should be made. A V-pattern can be used, where you examine three trees, move three rows over and down five trees, sampling three more trees in that row. Repeat this pattern three times and then reverse the pattern to return back to the edge of the stand. If an entire block is in question regarding a treatment, repeat this pattern on the opposite side of the block. Chemigation, or an aerial application of chemical control agents, is deemed necessary when: leaf damage is to the mid-rib on 30% or more of the leaves sampled; terminal buds damage is noted on 25% or more trees; or when even marginal leaf damage is found on 40% or more leaves sampled. Leaf beetle eggs and first instars could be confused with those of lady beetles (Figure 1). However, lady beetles generally have solitary behavior compared to gregarious pest populations.

Management

A prudent grower should invest in a delivery system for systemic pesticides. In eastern Oregon, a drip-line irrigation system can deliver equal amounts of an insecticide to each tree. Management decisions depend upon the intended end-use product (biomass, pulp, or non-structural timber) and the time of the year that the attack occurs. Trees grown for biomass can sustain 30% defoliation and recover if the damage occurs in mid to late summer.

Chemical Control

Hybrid poplars grown from cuttings need protection during their first three years of growth. If the end product is to be sold as Forest Stewardship Council (FSC) certified wood, there are limited insecticides available. Imidacloprid delivered through a drip-line irrigation system at a rate of eight ounces per acre has been successfully used since 2004.

Coragen (chlorantraniliprole) is a synthetic anthranilic diamide analog of a botanical insecticidal ryanodine, a poisonous alkaloid found in the South American plant *Ryania speciosa* (Flacourtiaceae). Ryanodine works by preventing the calcium uptake in the excited muscle, thus the muscle fibers cannot relax. Coragen controls both larval and adult cottonwood leaf beetle populations (Rodstrom 2013). Chlorantraniliprole has a Special Local Need permit for its use on hybrid poplars in both Oregon (OR-100009) and Washington (WA-160005). Chlorantraniliprole can be applied by either chemigation or aerial sprays: chemigation delivery provided season-long control, whereas a second aerial application may be needed.

Poplars not grown for FSC-certified products can be protected from *C. scripta* defoliation with synthetic pyrethroids (Cyhalothrin, Gamma-cyhalothrin, and Lamda-cyhalothrin) and chlorpyrifos, an organophosphate insecticide.

Clone Variation

Larval performance was generally poor on clones with higher *P. trichocarpa* parentage (Coyle et al. 2001). This might explain why *C. scripta* is considered the most serious defoliator in the eastern US (Coyle et al. 2001).

References

Carlson, B.R. 2010. Compensatory Response of Black Cottonwood to Defoliation by Cottonwood Leaf Beetle. MSc. Biology Thesis, School of Biological Sciences, Washington State University.

Charles, J.G, L. Nef, G. Allegro, C.M. Collins, A. Delplanque, R. Gimenez, S. Hoglund, J. Jiafu, S. Larsson, Y. Luo, P. Parra, A.P. Singh, W.J.A. Volney, and S. Augustin. 2014. Chapter Nine: Insect and Other Pests of Poplars and Willows. In Poplars and Willows: Trees for Society and the Environment, J.G. Isebrands and J. Richardson. CABI Boston, MA.

Coyle, D.R., J.D. McMillan, R.B. Hall, and E.R. Hart. 2001. Cottonwood Leaf Beetle (Coleoptera: Chrysomelidae) Larval Performance on Eight *Populus* Clones. *Environmental Ecology* 30: 748–756.

Coyle, D.R., J.D. McMillin, R.B. Hall, and E.R. Hart. 2002. Cottonwood Leaf Beetle (Coleoptera: Chrysomelidae) Defoliation Impact on *Populus* Growth and Above- Ground Volume in a Short-Rotation Woody Crop Plantation. *Agricultural and Forest Entomology* 4: 293–300.

Coyle, D.R., T.E. Nebeker, E.R. Hart, and W.J. Mattson. 2005. Biology and Management of Insect Pests in Intensively Managed North American Hardwood Forest Systems. *Annual Review of Entomology* 50: 1–29.

Fang, Y., L.P. Pedigo, J.P. Colletti, and E.R. Hart. 2002. Economic Injury Level for Second-Generation Cottonwood Leaf Beetle (Coleoptera: Chrysomelidae) in Two-Year-Old *Populus*. *Journal of Economic Entomology* 95: 313–316.

Harrel, M.O., D.M. Benjamin, J.G. Berbee, and T.R. Burkot. 1982. Consumption and Utilization of Leaf Tissue of Tissue Cultured *Populus* x *Euramericana* by the Cottonwood Leaf Beetle, *Chrysomela scripta* (Coleoptera: Chrysomelidae). *Canadian Entomology* 114: 743–749.

Kendrick, A.P., K. Raffa, S.J. Krauth, and N.E. Woodley. 2005. Notes on Incidence and Biology of the Predominant Parasitoids Attacking the Cottonwood Leaf Beetle in Minnesota. *Great Lakes Entomologist* 38: 203–208.

Riley, E.G., S.M. Clark, and T.N. Seeno. 2003. Catalog of the Leaf Beetles of America North of Mexico (Coleopera: Megalopodidae, Orsodacnidae and Chrysomelidae, excluding Bruchinae). *Coleopterist Society Special Publication* 1: 290.

Rodstrom, R.A. 2013. Epigeal Insect Communities & Novel Pest Management Strategies in Pacific Northwest Hybrid Poplar Plantations. PhD dissertation, Department of Entomology, Washington State University.

Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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