WASHINGTON STATE UNIVERSITY EXTENSION

WESTERN POPLAR CLEARWING MOTH

Insect Pest Management in Hybrid Poplars Series

By
Neal T. Kittelson, Inspector-Field Services, Colorado Department of Agriculture - Division of Plant Industry. **John J. Brown**, Department of Entomology, Washington State University

WSU PEER REVIEWED
FS266E

Western Poplar Clearwing Moth

Paranthrene robiniae (Hy. Edwards) (Lepidoptera: Sesiidae)

Introduction

As a result of Washington State University integrated pest management (IPM) research (Brown et al. 2006; Kittelson 2006), all commercially grown poplars in the Pacific Northwest for Forest Stewardship Council (FSC) certified products are now protected by a pheromone-based male confusion strategy against western poplar clearwing moths. Professional IPM practitioners can use this publication as a guide toward control of this moth in the Pacific Northwest.

Taxonomy

The larvae of clearwing moths (Figures 1 and 2) that attack poplars can be found throughout the US. *Paranthrene robiniae* occurs west of the Rocky Mountains, *P. dollii* (Neumoegen) is found throughout the southeastern states (Ostry et al. 1988), and *P. tabaniformis* (Rottemburg), sometimes called the European poplar clearwing moth, can overlap with both *P. robiniae* and *P. dollii* in the central portion of the US. Using commercially available sex pheromones which are species-specific for clearwing moths, we captured another clearwing moth, *Sesia tibialis* (Harris), also called the cottonwood crown borer, or American hornet moth in eastern Washington (Kittelson 2006). Although not a clearwing species, LaGasa et al. (2001) reported capturing a European species, the poplar shoot moth *Gypsonoma aceriana* (Duponchel), damaging poplar in western Washington. Another twig borer , *G. haimbachiana* (Kearfott) has been found in the eastern US attacking *P. deltoides* (Morris 1967). Both these *Gypsonoma* species are members of the Tortricidae family of Lepidoptera.

Two burrowing Lepidoptera larval pests of poplar have the species name *robiniae*. These are the western poplar clearwing moth, *P. robiniae*, and the carpenterworm moth, *Prionoxystus robiniae*.

Poplar-and-willow borer larvae, *Cryptorhynchus lapathi* (L.) (Coleoptera: Curculionidae), also burrow into poplar branches and boles (Hannon et al. 2008).

Hosts

Larvae of *P. robiniae* attack poplar, willow, aspen, and birch.

Range

Western poplar clearwing moths are found throughout the states west of the Rocky Mountains, and British Columbia (Lee 2014). Pearson et al. (2010) have reported *P. robiniae* as far east as western Colorado.

Life History

Five larval instars develop within galleries in the bole and stems (Figure 1) of poplars. Multiple pupal cases (Figure 2) are evidence of a large population.

Third through fifth larval instars overwinter (Figure 3) within boles and stems culminating in adults (Figure 4) that emerge from April through July the following year. In April, adults mate and gravid females deposit eggs individually. Pupae found in first year whips suggest a small proportion of each year's population can be completed within one season.

Figure 1. Western poplar clearwing moth larva burrowing within the pith of poplar branch (Photo by N. Kittelson).

Figure 2. A heavy infestation of western poplar clearwing moth galleries with several pupal cases at the exit holes (Photo by N. Kittelson).

Figure 3. Various immature stages of western poplar clearwing moth extracted from a single tree in January 2003 (Photo by J. Brown).

Figure 4. An adult male western poplar clearwing moth (Photo by N. Kittelson).

Eggs deposited after mid-June complete partial larval development and overwinter as late instar larvae. Eggs are brown, ovate, and slightly concave dorsally and ventrally, with a surface usually sculptured with minute ridges in hexagonal designs (Eichlin and Duckworth 1988). Larvae hatch from eggs in about 14 days, depending on ambient temperatures (Forschler and Nordin 1989).

Damage

Larval galleries weaken stems (Figure 5) and boles of host trees which causes wind-lodging and occasional girdling, resulting in poor growth patterns or death of plantings. Cuttings from nurseries are sometimes infested with late instar larvae. Four extensive reviews of insect pests of poplar by Ostry et al. (1988), Chastagner and Hudaki (1999), Coyle et al. (2005), and Charles et al. (2014) did not identify *P. robiniae* as a pest of poplar. Brown et al. (2006) reported that 44% of trees surveyed were infested with clearwing moths and 35,731 newly planted cuttings had to be replanted due to clearwing attack.

Biological Control

Clearwing larvae have been found parasitized within galleries of limbs in eastern Oregon. Although not identified, these parasitoids could be either a Braconidae (Greorgiev 2001a) or Ichneumonidae (Greorgiev 2001b) wasps. Kaya and Lindegren (1983) and Kaya and Brown (1986) reported that *Steinernema feltiae* and *S. bibionis* nematodes controlled clearwing moth larvae in alder and sycamore. These authors reported successful use of nematodes for biological control of clearwing larvae and their research finding was corroborated by Shapiro-Ilan and Cottrell (2006).

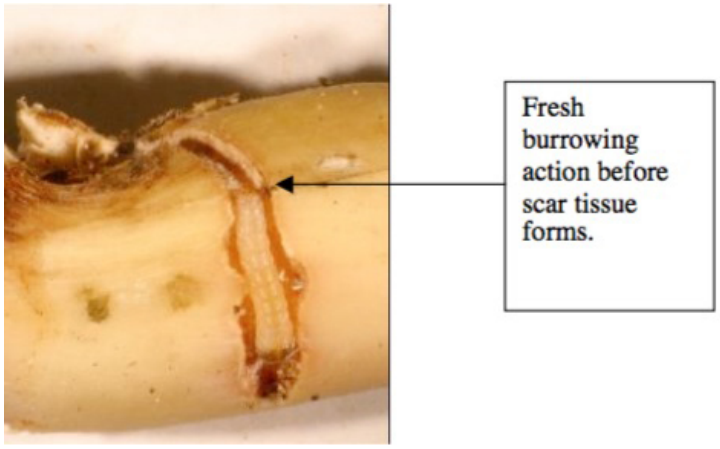

Figure 5. Girdling action of a first instar western poplar clearwing moth (Photo by J. Brown).

Monitoring

Cowles et al. (1996) identified the sex pheromone of *P. robiniae* as a 4:1 ratio of (E, Z): (Z, Z)-3, 13-octadecadienyl alcohol. A red septum loaded with one milligram of the *P. robiniae* sex pheromone should be used in Oregon and Washington to bait each bucket trap (Unitrap). Both the septa and trap can be purchased from Suterra (Bend, Oregon). One trap loaded with synthetic sex pheromone and a one-inch strip of Pest Strip containing dichlorvos as a killing agent should be positioned in the center of each 160-acre (65 hectare) unit of poplars. These traps should be deployed in mid-April, and each week the traps need to be emptied. The number of moths captured should be counted and recorded. Lures should be replaced approximately every two months, and monitoring should continue throughout the season until no moths are captured. The capture date of the first *P. robiniae* adult male using these sex pheromone-baited traps over a decade is related to our degree-day models.

Degree-day models are scientifically validated measures of insect development achieved by rearing specific insect populations in laboratory conditions (i.e., temperature/lighting/humidity controlled incubators). A model enables a pest manager to make predictions as to when the first pest species adult will be observed or captured each spring. Once captured, that date becomes the 'biofix' for subsequent accumulated degree days (ADD) data. That additional ADD information will then predict when various developmental stages of that pest species can be expected during the growing season. This knowledge can be used to time pest management strategies to effectively lower pest populations. The ADD calculations below were made using pheromone baited traps for western poplar clearwing male moths and temperature information gathered from the 'HERO' AgriMet weather station (Oregon State University) near Hermiston, Oregon. The 'single-sine' method (Jones and Brunner 2015) with a 10°C (50°F) minimum threshold, beginning January 1, was used to predict first male moth capture each spring. In eastern Oregon and eastern Washington the first flight of male clearwing moths has been observed in pheromone-baited traps over the past decade. Adult males have been captured as early as 12 April 2003 and 2004 and as late as 13 May 2009. Typically, the first clearwing moths, the biofix, can be expected after the accumulation of 123° ± 8° ADD.

After leaves drop off the trees in late autumn, an annual survey should target infestations of stem, bark, and bole pests. A chunky, sand-like texture of detritus indicates a western poplar clearwing moth larval gallery. If the detritus has a stringy texture, the gallery is probably occupied by a poplar-and-willow borer larva (*Cryptorhynchus lapathi* L.), rather than a clearwing larva. These observations should be shared with other employees and revisited each year to determine the areas with the most serious infestations.

Management

Bentley et al. (1994) recommended repeated applications of chlorpyrifos for control of adult clearwing moths in California, but this did not work in Oregon and Washington (Brown et al. 2006). Saturation of the ambient air with synthetic sex pheromone has proven successful toward the control of clearwing moths in large (>3,000 hectares) plantations of poplars grown east of the Cascade Mountains (Kittelson 2006). In these poplar plantings where a male confusion strategy results in a saturated pheromone situation, monitoring traps baited with just one milligram of pheromone will be shutdown. A 'super' lure loaded with 10 milligrams of pheromone should be used in monitor traps within a pheromone-saturated situation.

References

Bentley, W.J., J.F. Karlik, and W. Affleck. 1994. Annual Sprays May Control Western Poplar Clearwing Moth. *California Agriculture* 48: 37–40.

Brown, J.J., N.T. Kittelson, E.R. Hannon, and D. Walsh. 2006. An Endemic Population of Western Poplar Clearwing Moths (Lepidoptera: Sesiidae) Invades a Monoculture of Hybrid Poplar. *Journal of Economic Entomology* 99: 771–779.

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. In Poplars and Willows: Trees for Society and the Environment, 459–542, J.G. Isebrands and J. Richardson, eds. CABI: Boston, MA.

Chastagner, G., and J. Hudaki. 1999. Crop Profile for Hybrid Poplars in Washington and Oregon. Washington State University Extension Publication.

Cowles, R.S., J.G. Millar, E.J. Perry, J.S. McElfresh, and N. Garrison. 1996. Identification of the Sex Pheromone of the Western Poplar Clearwing Moth (Lepidoptera: Sesiidae). *Environmental Entomology* 25: 109–113.

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

Eichlin, T.D., and W.D. Duckworth. 1988. Sesioidea: Sesiidae. In The moths of America North of Mexico, 1–39, R.B. Dominick et al., eds. Wedge Entomological Research Foundation: Washington, D.C.

Forschler, B.T., and G.L. Nordin. 1989. Techniques for Rearing the Wood Borers *Prionoxystus robiniae* Lepidoptera Cossidae and *Paranthrene dollii* Lepidoptera Sesiidae. *Florida Entomologist* 72: 224–226.

Greorgiev, G. 2001a. Notes on the Biology and Ecology of the Parasitoids of the Poplar Clearwing Moth, *Paranthrene tabaniformis* (Root.) (Lep., Sesiidae) in Bulgaria. I. *Apanteles evonymellae* (Bouche, 1834) (Hym,. Braconidae). *Journal of Applied Entomology* 125: 141–145.

Greorgiev, G. 2001b. Notes on the Biology and Ecology of the Parasitoids of the Poplar Clearwing Moth, *Paranthrene tabaniformis* (Root.) (Lep., Sesiidae) in Bulgaria. II. *Eriborus terebrans* (Gravenhorst, 1836) (Hym,. Ichneumonidae). *Journal of Applied Entomology* 125: 289–292.

Hannon, E.R., N.T. Kittelson, J.A. Eaton, and J.J. Brown. 2008. Screening Hybrid Poplar Clones for Susceptibility to *Cryptorhynchus lapathi* (Coleoptera: Curculionidae). *Journal of Economic Entomology* 101: 199–205.

Jones, V.P., and J.F. Brunner. 2015. Degree-Day Models. Orchard Pest Management http://jenny.tfrec.wsu.edu/opm/displaySpecies.php?pn=-50

Kaya, H.K., and J.E. Lindegren. 1983. Parasitic Nematode Controls Western Poplar Clearwing Moth *Paranthrene robiniae,* Pest of Birch, Poplar, and Willow Trees, *Neoaplectana carpocapsae, Xenorhabdus nematophilus,* Biological Control, Field Tests in California. *California Agriculture* 37: 31–32.

Kaya, H.K., and L.R. Brown. 1986. Field Application of Entomogenous Nematodes for Biological Control of Clear-Wing Moth Borers in Alder and Sycamore Trees. *Journal of Arboriculture* 12: 150–154.

Kittelson, N.T. 2006. Biology and Control of the Western Poplar Clearwing Moth, *Paranthrene robiniae* (Hy. Edwards), in Hybrid Poplars. PhD. Dissertation Department of Entomology, Washington State University.

LaGasa, E.H., P. Hertzog, D. Barshis, K. Turner, and H. Smith. 2001. Western Washington Pheromone-Trap Delimiting Survey and Field Observations for European Poplar Shoot Borer, *Gypsonoma aceriana* (Duponchel) (Lepidoptera: Tortricidae), an Old World Poplar Pest New to North America. *WSDA Pub 061* (N/12/01).

Lee, S. 2014. Preliminary List of the Lepidopterous Insects in the Arizona State University Hasbrouck Insect Collection. *Journal of Asia-Pacific Biodiversity*. 7(1): e76–e94.

Morris, R.C. 1967. Biology of *Gypsonoma haimbachiana* (Lepidoptera: Olethreutidae), a Twig Borer in Eastern Cottonwood. *Annals of the Entomological Society of America* 60: 423–427.

Ostry, M.E., L.F. Wilson, H.S. McNabb, and L.N. Moore. 1988. A Guide to Insect, Disease, and Animal Pests of Poplars. USDA Forest Service Agriculture Handbook 677. USDA Forest Service: Washington, D.C.

Pearson, C.H., A.D. Halvorson, R.D. Moench, and R.W. Hammon. 2010. Production of Hybrid Poplar Under Short-Term, Intensive Culture in Western Colorado. *Industrial Crops and Products* 31(3): 492–498.

Shapiro-Ilan, D.I., and T.E. Cottrell. 2006. Susceptibility of the Lesser Peachtree Borer (Lepidoptera: Sesiidae) to Entomopathogenic Nematodes under Laboratory Conditions. *Environmental Entomology* 35: 358–365.

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.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, and national or ethnic origin; physical, mental, or sensory disability; marital status or sexual orientation; and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local WSU Extension office. Trade names have been used to simplify information; no endorsement is intended. Published June 2017.