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PALE GREEN WEEVIL

Insect Pest management in Hybrid Poplars Series

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Pale Green Weevil

Polydrusus impressifrons Gyllenhal (Coleoptera: Curculionidae: Entiminae)

Introduction

Hybrid poplars (*Populus* spp.) are propagated by inserting 12–15 inch cuttings next to each water emitter in a denuded 160 or 271 acre (65 or 110 hectare) field. The number of stems/hectare depends upon the final product: 500 for sawlogs, 1,750 for pulp, and 2,750–5,500 for biomass. Adult pale green weevils are strong fliers. They immigrate into these newly planted areas from adjacent mature stands where they are not considered serious pests to mature trees. Adult pale green weevils are considered reestablishment pests, damage is more likely when propagation follows a harvest of an earlier rotation of trees. Our objectives are (1) to alert growers that the pale green weevil is a potential reestablishment problem for propagation using cuttings, and (2) to suggest how to protect these new plantings from weevil attack.

Taxonomy

Curculionidae is one of the largest insect families, with 20 subfamilies. Within hybrid poplars in eastern Oregon and eastern Washington, *Polydrusus* and the strawberry root weevil, *Otiorhynchus ovatus* L. belong to the broad-nosed weevil subfamily Entiminae (Figure 1). *Cryptorhynchus lapathi* L., the poplar-and-willow borer, another pest of poplars, is in the subfamily Molytinae. Finally, the bark beetle subfamily Scolytinae is represented by *Xyleborinus saxesenii* (Ratzeburg), commonly known as the fruit-tree pinhole borer. All four of these Coleoptera species are found in hybrid poplar plantings in the Pacific Northwest.

Hosts

The pale green weevil has a wide range of hosts but prefers poplar, birch, willow, apple, and pear; however, it also feeds on elm, linden, locust, rose (Parrott and Glasgow 1916a), and yew (Windels and Flaspohler 2011).

Range

The pale green weevil is native to Germany and France. It was first reported from a nursery in Geneva, New York, in 1906 (Parrott and Glasgow 1916a). It was first collected in hybrid poplars grown in eastern Oregon in 2004.

Life History

Partial life history studies were conducted in New York in 1916 (Parrott and Glasgow 1916a; Pierce 1916). Washington State University researchers in the Pacific Northwest conducted a more recent and detailed study (Niedbala 2013). Adults emerge from the ground at the base of host trees starting in late April or early May. The adult female weevil is slightly larger (5.5 mm) than the male weevil (4.25 mm). Adults are black, covered with greenish or sometimes yellowish scales (Figure 1); hence their common name: pale green weevil. They immediately begin to mate (Figure 2A) and females lay eggs (Pierce 1916). There is no report that the weevils need to feed before mating; however, they feed vigorously in the first week or more after their emergence. Eggs are laid in crevices, holes in the bark, or in wounds on the tree surface; however, there is nothing in the literature stating an attraction to any volatiles given off from the wounds. Eggs are found deposited on the sides of the trees exposed to the sun (Parrott and Glasgow 1916b). Eggs are laid singly or in groups (Figure 2B and C) of up to 85 (Parrott and Glasgow 1916b) and are approximately 0.5 mm in length. Under laboratory conditions these eggs hatch in 13 days at 25°C (77°F).

Figure 1. *Polydrusus impressifrons* adult weevil on the left (Photo by John C. Niedbala Jr.), and Otiorhynchus ovatus L. adult weevil on the right (Photo by R.A. Rodstrom).

Parrott and Glasgow (1916b) reported that newly eclosed larvae are 0.72–0.80 mm, and mature larvae measure from 4.0–6.5 mm. Larvae are legless and use undulating movements to crawl from the hidden egg depository, drop to the ground, and move into the soil to feed on the roots of the host plant (Figure 2D). Larval head capsule measurements fell into five size ranges, suggesting five instars (Niedbala 2013). According to Parrott and Glasgow (1916b), mature larvae are approximately 5 mm in length and overwinter in that instar. Research conducted by Pinski et al. (2005a) in northern hardwood forests in the Great Lakes Region found that the larvae of the related species *P. sericeus* occur in the top 10 cm of the soil. Pale green weevil pupation (Figure 2E) occurs in the late April.

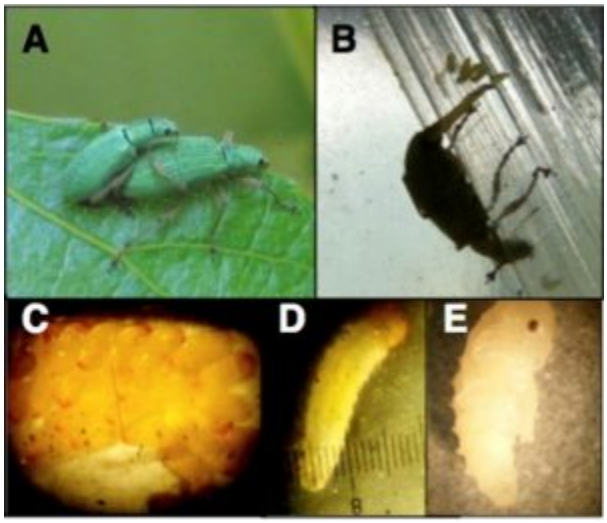

Figure 2. (A) Mating adult weevils, (B) female weevil ovipositing eggs, (C) eggs deposited in masses, (D) larva, and (E) pupa of pale green weevil (Photos by John C. Niedbala Jr. and R.A. Rodstrom).

Damage

Rotation of poplar plantings causes large numbers of *P. impressifrons* adults to emerge after the harvest of mature trees, when newly formed leaves of coppice sprouts or planted sticks provide the only food source. Pale green weevil damage to new plantings can be devastating due to the high number of adults feeding on new buds and leaves (Figure 3). Older stands can withstand attack from adult weevils because of the large number and size of leaves in an older canopy; however, new plantings and young trees can be easily defoliated. New plantings also lack the energy reserves and photosynthetic material required to outgrow the damage inflicted by *P. impressifrons*. Without visually confirming the presence of *P. impressifrons* adults, damage to new leaves could be the result of *O. ovatus*, the strawberry root weevil (Figure 4).

Figure 3. *Polydrusus impressifrons* adults attacking newly flushed poplar leaves (Photo by R.A. Rodstrom).

Figure 4. Newly planted stick damaged by adult strawberry root weevil (Photo by R.A. Rodstrom).

Biological Control

There were two active predators found in eastern Oregon that preyed on the adult weevil: an active, searching species of spider and a nymphal stage hemipteran. There is a Braconidae parasitoid wasp, *Diospilus polydrusi* (Gahan), that was described in 1916 as a new species. According to Parrott and Glasgow (1916b) this wasp attacks the eggs and larvae of the weevil; however, we have found no information on this wasp.

Monitoring

Polydrusus impressifrons adults are known to be strong fliers and, in the plantation situation, can easily move from an infested mature stand of trees to a planting block with newly planted sticks or vulnerable young trees. In this way, beetles can cause significant amounts of damage to the vital new growth. If high numbers of adult weevils are monitored in adjacent mature trees, those involved in establishing a new planting should be alerted to the possible threat.

Management

Insecticidal foliage sprays (indoxacarb, chlorantraniliprole) are commonly used to control aboveground herbivores on all ages of trees. These foliage sprays can be applied in multiple ways (hooded sprayer, aerial application, or backpack spray) in an operational setting, but all have notable drawbacks. The first is that the cutting's initial leaf area is small and new leaf growth post-application is often untreated. Also, hooded and backpack spraying represent large investments in labor and time to treat a production area, while aerial applications treat large areas of non-target vegetation and bare ground. The inherent nature of these insecticides also poses a challenge, whether it is a brief persistence (indoxacarb) that potentially requires multiple applications or leaf ingestion (chlorantraniliprole) over several days resulting in post-treatment damage. Concerns about belowground herbivory have recently emerged in hybrid poplar propagation and there are currently no management strategies to control pests that attack the roots and living tissue of new cuttings.

Under a coppice management system, the existing root system can take up systemic insecticides and provide protection to the newly formed leaves. However, dormant cuttings generally flush their leaves before the formation of rooting structures. The lack of roots poses a unique challenge to conventional pest management strategies (Osborne 1986). Unlike rooted stems, these hybrid poplar cuttings are unable to take up systemic pesticides that can provide protection to trees with established root structures (Lawson and Dahlsten 2003; Tenczar and Krischik 2007).

Dipping or soaking propagules (seed, cutting, transplant) is a common agricultural practice in both nursery and forestry crops as a pest control strategy (Neel 1969; Walstad et al. 1973; Osborne 1986; Watkins et al. 1996; Simms et al. 2002; Gajanana et al. 2006). This technique introduces a systemic pesticide to the cutting that can reduce both above and belowground herbivory (Neel 1969; Walstad et al. 1973; Tenczar and Krischik 2006).

Soaking dormant, rooted cuttings in a systemic pesticide successfully reduces aboveground pest damage in chrysanthemum and peach crops (Lindquist et al. 1980; Shearer and Frecon 2002). Root and cutting dips have also shown promise in controlling belowground herbivory. Sidebottom (2004) illustrated that *Abies fraseri* (Pursh) root dips of bifenthrin* reduces root damage by both adult and larval insect pests. Root dips have commonly been used on pine plantations in the southern US for several decades to prevent root damage by weevils (Walstad et al. 1973). Both Neel (1969) and Abrahamson et al. (1977) explored the use of several insecticides as cutting dips to control several herbivore (*Chrysomela scripta* F.) and wood-boring pests (*Paranthrene dollii* (Neumögen) in *Populus*. Work done by Tenczar and Krischik (2007) suggests that soaking dormant cuttings in a solution of imidacloprid reduces the survivorship of the larval stage of a common *Populus* herbivore, *C. scripta*, in both container and field experiments.

Soaking cuttings in imidacloprid or thiamethoxam* at rates of 0.48 grams active ingredient per liter for 24 hours prior to planting can provide newly planted poplars protection from above and belowground pests. This strategy is still considered experimental, and variations of insecticide concentration and lengths of time that sticks are soaked may improve protection (Rodstrom 2013).

**Some of the pesticides discussed in this presentation were tested under an experimental use permit granted by ODA or WSDA. Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties up to $7,500. In addition, such an application may also result in illegal residues that could subject the crop to seizure or embargo action by ODA, WSDA, and/or the U.S. Food and Drug Administration. It is your responsibility to check the label before using the product to ensure lawful use and obtain all necessary permits in advance.*

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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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