PURDUE UNIVERSITY

PURDUE EXTENSION

FNR-229-W

Planting and Care of Fine Hardwood Seedlings

Hardwood Tree Improvement and Regeneration Center

Northern Research Station
USDA Forest Service

Department of Forestry and Natural Resources
Purdue University

Causes of Gummosis in Black Cherry (*Prunus serotina*)

Bradley D. Barnd
Department of Forestry and Natural Resources, Purdue University
Matthew D. Ginzel
Departments of Entomology & Forestry and Natural Resources, Purdue University

Introduction

Gummosis is a non-specific defensive response of trees in which resinous gum is exuded and deposited on the bark. Gum is quite sticky and composed mostly of polysaccharides (Boothby 1983). This response is widespread among plants and is prevalent in members of the Rosaceae (e.g., *Prunus* spp.). Gummosis occurs at the cellular level and appears to be hormonally regulated. In fact, both ethylene and jasmonic acid influence gummosis in *Prunus* (Saniewski et al. 2006). This group contains many important fruit-producing trees such as peaches, cherries, apricots, and plums. Black cherry (*Prunus serotina*), however, is the only member of the genus used for commercial lumber, and is among the most marketable hardwood species. The wood is sought after for both fine furniture and paneling. Unfortunately, widespread gummosis caused by insect damage and other factors keeps many black cherry trees from reaching veneer quality, and reduces their value by as much as 90 percent (Cassens 2004). Even factory grade 1 and grade 2 logs can be reduced by a grade when large areas of gum spots are evident (Rast et al. 1973).

Black cherry is grown commercially throughout its botanical range. Nevertheless, a large portion of the industry is concentrated along the Allegheny Plateau of Pennsylvania, New York, and West Virginia, and the severity of gummosis damage varies both regionally and locally. Insect attack, whether from direct feeding or incidental damage such as oviposition, often leads to gummosis at the site of injury. Infection by fungal agents is another cause of gummosis in black cherry, but both bacterial and viral causes have been seen in other *Prunus* species. Abiotic factors, such as water stress, site conditions, and physical damage can also lead to gummosis. In this publication, we detail some of the more common causes of gummosis in black cherry and reflect on methods to reduce its occurrence and frequency.

Figure 1. *Adult peach bark beetle.* (Photo courtesy of Bradley D. Barnd)

Insects That Cause Gummosis in Black Cherry

Insects are among the best documented cause of gummosis in black cherry, and their destructive nature is only exacerbated by difficulty in controlling their populations. In fact, these insects spend the majority of their lives concealed beneath the bark of trees where they are physically protected from sprayed insecticides.

Peach bark beetle. *Phloeotribus liminaris*, the peach bark beetle, is widespread in the eastern United States and occurs throughout the native range of black cherry. This beetle preferentially attacks stressed or weakened black cherry trees, but at high population densities it is also capable of colonizing healthy trees. Trees in orchards are particularly susceptible to attack. The adults are light brown in color to nearly black, range in size from 1.5 to 2.2 mm, and are sparsely covered in long fine hairs (Fig. 1). Peach bark beetles overwinter as young adults beneath the bark of trees. Adults emerge in early spring and females colonize a host by boring through the outer bark and into the phloem. These initial attacks result in small holes through the bark surface and an accumulation of

Figure 2. *Gum spot caused by peach bark beetle.* (Pennsylvania Department of Conservation and Natural Resources - Forestry Archive, Bugwood.org)

reddish boring dust around the base of the tree. Males soon follow and mating takes place within a gallery constructed by the adults. After mating, females construct a brood gallery that is horizontal to the grain of the wood and deposit 80 to 100 eggs along its length. These galleries are often 2 to 7 cm in length. After eggs hatch, the larvae begin to feed on xylem and phloem parallel to the wood grain at right angles to the egg gallery.

Trees are not defenseless against these attacks and attempt to "pitch out" pioneer beetles by exuding large amounts of gum (Fig. 2). Gum is produced in response to colonizing adults rather than feeding larvae, and most gum spots are the result of aborted attacks by the beetle. Rexrode (1981) discussed a case in which wood infested with peach bark beetle was placed in proximity to a plantation of black cherry. Beetles emerging from the infested material attempted to colonize nearby healthy trees, and the gum was so abundant in these attacked black cherry trees that it flowed to the ground. It is also estimated that three to four attacks in a 6.5 cm^2 of bark is sufficient to create a ring of gum spots in the wood (Rexrode 1981). To a far lesser extent, other bark beetles such as *Dryocoetes betulae* (birch bark beetle) and *Scolytus rugulosus* (shothole borer) also cause gummosis in black cherry.

Peachtree borers. Damage by larval lesser and greater peachtree borers (*Synanthedon pictipes* and *S. exitiosa*, respectively) also causes gummosis in black cherry. These clearwing moths superficially resemble wasps and have blue-black colored bodies. Female *S. pictipes* often lay eggs at existing wounds (e.g., physical injury or canker) on the upper portions of the trunk and branches (Fig. 3), while female *S. exitiosa* (Fig. 4) oviposit on the trunk near

Figure 3. *Gummosis caused by lesser peachtree borer.* (Carroll E. Younce, USDA Agricultural Research Service, Bugwood.org)

Figure 4. *Male greater peachtree borer.* (Wendell Snow, USDA Agricultural Research Service, Bugwood.org)

the ground. After boring into the tree, developing larvae feed on phloem which results in large amounts of dust-like frass and gum accumulating at the site of the wound. The larvae can grow to almost 25 mm in length. The developing larvae overwinter in the tree and pupate in the spring, and adults emerge from May to June. Mating occurs shortly after the adults emerge, and females are capable of laying as many as 400 eggs.

The lesser and greater peachtree borers can be controlled by both cultural and chemical methods. For example, in small plantings where borer damage is slight, larvae can be killed mechanically. During the spring, around the time of bud break, one can smash the borers by inserting a knife or wire into the holes they create. This can also be accomplished in late fall, effectively killing the larvae before they overwinter. Another biorational control method that shows promise is the use of semiochemicals for mating disruption. Commercially available lures containing sex pheromone of the peachtree borer can be used to confuse male moths, making them unable to locate mates. As a result of this confusion, mating is prevented and females lay only unfertilized

Figure 5. *Oviposition scars caused by periodical cicada.* (Bruce W. Kauffman, Tennessee Department of Agriculture, Bugwood.org)

eggs. This strategy has proven to be quite effective in plantings larger than 2 hectares. Insecticides may be less effective in preventing borer damage, and must be applied before new eggs hatch.

Agromyzid cambium miner. Another insect that causes gummosis in black cherry is a cambium mining fly, *Phytobia pruni* (Rexrode and Baumgras 1980). Females deposit their eggs in the lenticels of small twigs in the crown of a tree from May to June. After the eggs hatch, larvae bore downwards through the cambium until they reach ground level, where they exit the tree and pupate in the ground. The passage of the miner through the cambium can lead to gummosis along the path of attack, incidentally creating a route of infection for fungal pathogens (Hepting 1971).

Additionally, cicadas can also occasionally cause gummosis in black cherry. Karban (1983) reported that black cherry trees in Pennsylvania responded to periodical cicada oviposition by gumming over the wound, reducing hatching success of the eggs (Fig. 5). These attacks occur mainly on tree branches and do not affect lumber quality, but may weaken trees and increase their susceptibility to attack by other insects or pathogens.

Management of Insects That Cause Gummosis

Cultural control. Prevention is the most effective means of managing wood-boring pests of black cherry, including the peach bark beetle. Populations of *P. liminaris* and other woodborers are largely managed through cultural practices. Specific recommendations are as follows:

- Avoid injury to roots and trunks, protecting trees from sun damage and other abiotic factors.
- Irrigate during drought and dry summer months. Irrigate around the tree (the area of the outer canopy), and avoid frequent shallow watering around the trunk of the tree.

Figure 6. *Damage caused by black knot fungus.* (Joseph O'Brien, USDA Forest Service, Bugwood.org)

- Thin stands to increase vigor and ability to withstand attack.
- Promptly remove and destroy infested, dying or dead trees, or branches before wood-borers emerge and colonize nearby trees.
- Remove freshly cut wood, which can provide an abundant breeding source for some woodborers.
- Timing of pruning is also important; do not create fresh prune wounds during the time adult insects are flying.

Chemical control. Proper monitoring is essential to correctly time pesticide applications. Virtually no insecticide will kill larvae tunneling under the bark. Chemical treatments are generally applied to healthy trees and target the colonizing insects as they chew into the bark to lay eggs. Systemic insecticides are rarely effective at saving seriously infested trees. By the time damage is evident, the insects have often already completed their development and dispersed. Landowners are encouraged to consult their local Department of Natural Resources or university Extension personnel to confirm the identity of a suspected insect pest and for current management tactics and chemical control measures.

Influence of Fungal Infection on Gummosis

A common fungal pathogen responsible for gummosis in black cherry is black knot caused by *Apiosporina morbosa* (Hepting 1971). Black knot is usually found in twigs, branches, and fruit spurs. Infection begins as light brown swellings on young tissue, which later rupture and turn black (Fig. 6). As time progresses, the growth elongates and

eventually encircles the affected branch. In the second year, the fungus dies except at the margins, and the black knot is often invaded by secondary fungi, which may change its color to white or pink. Over time, the disease may spread, severely compromise tree vigor, and increase the likelihood for insect attack. Another canker-causing fungus, *Cytospora leucostoma*, is also common on black cherry. New shoots and leaves of infected trees often yellow or wilt, and sunken lesions may develop on the bark. As these legions enlarge, gum oozes from the wound and surrounding bark. At least nine species of fungi are known to cause rot in the trunks and roots of black cherry. Fungal gummosis has been more thoroughly studied in other *Prunus* species, such as peach. The fungus *Botryosphaeria dothidea*, for example, has been a serious problem for peach growers in the United States (Beckman et al. 2003), and infected trees can produce large amounts of gum. Bacteria or viruses are not known to cause gummosis in black cherry, although other *Prunus* (e.g., peach) may be affected.

Management of fungal infection. Non-chemical methods are more effective than fungicides in controlling fungal infection in trees, and chemical treatments are rather ineffective against the most common fungal pathogens affecting black cherry (e.g., black knot). Affected portions of trees should be pruned in late winter or very early spring and destroyed. It is recommended that cuts be made approximately 15 to 20 cm below the knotty tissue. Also, severely infested trees should be removed.

Abiotic Factors Contributing to Gummosis

Abiotic factors may also cause gummosis. Trees growing in exposed areas (e.g., ridge tops or the tops of hills) are more susceptible to damage by wind, snow, and ice, and often have more gum than more sheltered trees. Gummosis has also been noted to be more severe in wet rather than dry years, suggesting that abundant water may be necessary for copious gum formation (Boothby 1983). Gumming is also prevalent in trees that experienced a forced growth as a result of too much water and or nitrogen fertilizer. Pruning and mowing injury can also cause gummosis in black cherry. These types of injuries can be quite common in plantation settings and serve as colonization sites for both insects and fungal pathogens.

Conclusion

Gum spots significantly reduce the quality of timber lumber and veneer of black cherry. Although gumming can result from wounds caused by insects, fungal infection, and abiotic factors, it appears that abortive attacks by the peach bark beetle are a major cause of gum spots in black cherry saw-timber. Rexrode and Smith (1990) studied the gum spots of 95 black cherry trees near Parsons, West Virginia, and found that approximately 90 percent of all gum spots were caused by the peach bark beetle and over 50 percent of these spots occurred in the lowest 5 m section of the boles. Also, gum spots caused by the beetles decreased with the height of the tree. Conversely, less than 5 percent of the gum spots caused by the cambium miner, *Phytobia pruni,* occurred in the log-quality zone of the tree. Damage caused by the lesser and greater peachtree borers occurred in 42 percent of the sampled trees, but accounted for less than 2 percent of the total gum spots recorded. Finally, gum spots associated with mechanical wounds accounted for another 2 percent of the total. These findings have implications on the harvest of black cherry in commercial plantings. Bark beetles often infest the tops of cut trees and slash remaining from partial harvest cuts. They may complete a generation within this material and then attempt to colonize remaining crop trees. These attacks cause gum spots in the wood, and in areas of intense harvest residual trees are often affected. As a result, the quality of black cherry can be significantly improved through cultural practices that focus on reducing breeding habitat for the beetles and thereby reducing their populations.

References

Beckman, T.G., P.L. Pusey, and P.F. Bertrand. 2003. Impact of fungal gummosis on peach trees. *HortScience* 38:1141-1143.

Boothby, D. 1983. Gummosis of stone-fruit trees and their fruits. *Journal of the Science of Food and Agriculture* 34:1-7.

Cassens, D.L. 2004. *Factors affecting the quality of hardwood timber and logs for face veneer.* Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN, FNR-239, 12 pp.

Hepting, G.H. 1971. *Diseases of forest and shade trees of the United States.* USDA Forest Service, Agriculture Handbook No. 386, Washington, DC. 658 pp.

Karban, R. 1983. Induced responses of cherry trees to periodical cicada oviposition. *Oecologia* 59:226-231.

Rast, E.D., D.L. Sonderman, and G.L. Gammon. 1973. *A guide to hardwood log grading (revised).* General Technical Report NE-1, Upper Darby, PA, USDA Forest Service, Northeastern Forest Experiment Station, 32 pp.

Rexrode, C.O. 1981. *Gum spots in black cherry caused by natural attacks of peach bark beetle.* Research Paper NE-474, Bromall, PA, USDA Forest Service, Northeastern Forest Experiment Station, 5 pp.

Rexrode, C.O. and J.E. Baumgras. 1980. *Gum spots caused by cambium miners in black cherry in West Virginia.* Research Paper NE-463, Bromall, PA, USDA Forest Service, Northeastern Forest Experiment Station, 9 pp.

Rexrode, C.O. and H.C. Smith. 1990. *Occurrence of gum spots in black cherry after partial harvest cutting.* Research Paper NE-634, Radnor, PA, USDA Forest Service, Northeastern Forest Experiment Station, 7 pp.

Saniewski, M., J. Ueda, K. Miyamoto, M. Horbowicz, and J. Puchalski. 2006. Hormonal control of gummosis in *Rosaceae. Journal of Fruit and Ornamental Plant Research* 14 (Supplement 1):137-144.

This publication is printed on recycled paper using soy-based inks.

EXPERT REVIEWED

PURDUE AGRICULTURE

11/08