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Verbenone Flakes May Help Slow Mountain Pine Beetle's Spread

According to "Aerially Applied Verbenone-Releasing Laminated Flakes Protect *Pinus contorta* Stands from Attack by *Dendroctonus ponderosae* (mountain pine beetle) in California and Idaho," a US Forest Service–funded study appearing in the February issue of *Forest Ecology and Management*, not only has the "current epic mountain pine beetle outbreak in British Columbia, Canada, affected more than 9.2 million hectares and breached the Continental Divide," but it is "expected to continue until either the host is depleted or severe cold weather reduces beetle populations."

Yet as dire as that forecast sounds, there may be reason for hope. As the study's title implies, researchers have found that applications of flakes containing verbenone—a natural organic compound used in aromatherapy and herbal teas—may be used to protect trees from the mountain pine beetle (MPB) at both the individual and stand level.

Scientists have long known that the application of verbenone, which beetles release to inhibit aggregation by members of their own species, is one of the safest strategies for deterring MPB infestations. They also were aware, however, that manual application is difficult in remote and difficult terrain, and altogether impractical where infestations cover thousands of acres.

"My colleagues and I were concerned and frustrated at our inability to control damage by bark beetles at both large and small scales," said Nancy Gillette, research entomologist, US Forest Service's Pacific Southwest Research Station and lead author of the study. "We felt that a pheromone-based approach would be the most effective because pheromones are airborne and possibly more effective for large-scale treatments, and I had been looking for a dispersible beetle pheromone device."

Seeing what was done with the gypsy moth "Slow the Spread" program in the northeastern United States, Gillette and her colleagues decided to adopt a similar approach.

"We knew that this flake formulation worked well and had been used for more than 15 years over hundreds of thousands of acres. We figured it had a good track record, so we talked with the pheromone industry about formulating it with beetle pheromones instead of moth pheromones," she said.

To test the effectiveness of the verbenone flakes, the researchers conducted a study in 2005 in which they identified 10 50-acre plots with similar conditions (species composition, stand structure, and infestation levels) at two sites—one near Mount Shasta in northern California and another in Idaho's Bitterroot Mountains—and then treated half of them with aerial applications of the flakes at a rate of one kilogram of flakes per acre.

After the treatments, the researchers placed beetle traps in each plot to monitor beetle flight into the stands throughout the summer. At the end of the season, they compared the current attack rate with that of the previous year.

In another study that took place in 2004 on industrial forestland in Siskiyou County, California, Gillette and her colleagues tested the manual application of verbenone flakes sprayed on individual trees with a modified hydroseeder spraying apparatus. In that experiment, the researchers identified 40 trees of similar size and crown ratio and at least 50 meters apart. Of those trees, 20 were selected at random and treated with flakes, and the others served as controls. After the treatment, all the trees were baited at breast height with a mountain pine beetle lure, which was refreshed after four weeks. Then, at 11 months after treatment, the trees were inspected and ranked into one of three categories: obviously dead, obviously alive, or uncertain status.

John Mateski, Western Helicopter, Oregon

Nancy Gillette, research entomologist with the US Forest Service's Pacific Southwest Research Station, poses with a helicopter used to disperse flakes containing verbenone, a pheromone beetles release to inhibit aggregation by members of their own species. A recent Forest Service–funded study found that aerial application of the flakes reduced the rate of mountain pine beetle attack by 50 to 75 percent in low to moderate infestations.

The results of both studies are encouraging.

"We were able to achieve reduction in attack rate ranging from 50 to 75 percent using the aerial application study," Gillette said. "In the individual tree application study, protection was virtually complete."

She cautioned, however, that the use of pheromone flakes is more difficult when beetle populations are high.

"Anyone planning to use this approach should seek the advice of someone familiar with the use of pheromones in

forest systems, such as one of her agency's forest health protection entomologists," she said. "You need to be certain that you've got the right insect species and that the timing and the application rate are correct, because at higher beetle populations a higher application rate of pheromone is required."

Silvicultural treatments should enhance the effectiveness of the aerial applications, too, Gillette said.

"The common understanding among all of us who work in this field is that you'll get better efficacy if you remove infested trees, and you can help beetle-proof the stands by thinning. So, good silviculture is really the first step and this pheromone-based approach is very helpful, but it is an adjunct to good silviculture, not a replacement for it."

And although it's promising, this use of pheromone flakes is unlikely to signal the end of the MPB epidemic.

"We have a very good individual tree treatment technique that has been very successful. For area-wide stand treatment, we have an approach that gives significant protection, but it's not 100 percent."

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