

NOTE

Field Evaluations of Emamectin Benzoate for Control of Birch Leafminer (Hymenoptera: Tenthredinidae) in Interior Alaska¹

Christopher J. Fettig,² Roger E. Burnside,³ Christopher J. Hayes,
and Mark E. Schultz⁴

Pacific Southwest Research Station, USDA Forest Service, 1731 Research Park Drive, Davis, California
95618 USA

J. Entomol. Sci. 46(4): 339-341 (October 2011)

Key Words Ambermarked birch leafminer, *Betula papyrifera*, insecticides, paper birch, *Profenusa thomsoni*, tree injections

Ambermarked birch leafminer, *Profenusa thomsoni* (Konow) (Hymenoptera: Tenthredinidae), is an exotic, invasive pest of urban and wildland birch, *Betula* spp., in portions of North America. *Profenusa thomsoni* was first reported in the eastern United States in the early 1900s and has spread rapidly throughout the northern United States and Canada (MacQuarrie et al. 2007, Can. Entomol. 139: 545 - 553). The most likely mode of introduction was overwintering pupae present in the root balls of horticultural stock imported from Europe (Digweed and Langor 2004, Can. Entomol. 136: 727 - 731), although this has not been documented. In Alaska, 3 exotic birch leaf mining sawflies have been found in recent years with the most significant tree damage attributed to *P. thomsoni* (Snyder et al. 2007, J. For. 105: 113 - 119) in most areas. These species are readily distinguished on the basis of location of injury in the tree crown and the characteristics of the leaf mines (Lamb and Winton 2010, U.S. Dept. of Agric. For. Serv. Protect. Rep. R10-PR-21).

A few infestations of *P. thomsoni* were detected in Anchorage, AK, during the mid to late 1990s. By 2003, *P. thomsoni* accounted for >12,800 ha of birch defoliation in the Anchorage Bowl (Wittwer 2004, U.S. Dept. of Agric. For. Serv. Gen. Tech. Rep. R10-TP-123). Aerial detection surveys of the Anchorage Bowl and surrounding areas of Eagle River and the Matanuska-Susitna Valley in 2004 reported the outbreak had expanded to >55,000 ha (Wittwer 2005, U.S. Dept. of Agric. For. Serv. Protect. Rep. R10-PR-3). Since then, an extensive survey conducted by the USDA Forest Service specifically to determine the extent of exotic leaf mining sawflies in Alaska reported

¹Received 24 January 2011; accepted for publication 22 February 2011.

²Address inquiries (email: cfettig@fs.fed.us).

³Forest Health Protection Program, State of Alaska, Department of Natural Resources, Division of Forestry, 550 West 7th Avenue, Suite 1450, Anchorage, Alaska 99501.

⁴Forest Health Protection, USDA Forest Service, 11305 Glacier Highway, Juneau, Alaska 99801.

P. thomsoni to be present in >20% of the area surveyed, with the largest populations in South-central Alaska and portions of Interior Alaska (Snyder et al. 2007).

Profenusa thomsoni overwinters in the prepupal stage in soil beneath defoliated birch. Pupation occurs in the summer and adult sawflies, mostly females, generally emerge in early July. Eggs are deposited singly in slits cut in the central area of young leaves, and larvae feed on the tissues between the leaf surfaces. As individual larval mines increase in size they coalesce and form large, hollowed-out brown areas readily visible in the leaf. Severe infestations result in extensive chlorosis and premature leaf fall, but generally do not directly cause tree mortality. Repeated infestations can weaken trees, perhaps increasing their susceptibility to other forest pests. Mature larvae chew their way out of the leaf and drop to the ground by late August. There is one generation per year (Holsten 2003, U.S. Dept. of Agric. For. Serv. For. Insect and Disease Leaflet R10-TP-114).

Extensive defoliation of ornamental birch in Alaska requires that suitable control measures be evaluated and developed. Based on previous work with the systemic insecticide emamectin benzoate for protecting individual trees from bark beetle attack (Grosman et al. 2010, W. J. Appl. For. 25: 181 - 185), and anticipation of its registration by many in the forest health community, our objective was to gain data to determine if emamectin benzoate (TREE-äge®, Syngenta Crop Protection LLC, Greensboro, NC) holds promise for control of *P. thomsoni* in Interior Alaska. The Environmental Protection Agency (EPA) approved the use of TREE-äge® for "control of mature and immature arthropod pests of deciduous, coniferous and palm trees, including, but not limited to, those growing in residential and commercial landscapes, parks, plantations, seed orchards, and forested sites (in private, municipal, state, tribal and national areas)" in December 2010, pending some changes to the label.

This study was conducted in Fairbanks, AK (64.85 °N, 147.73 °W, 92.5 m elevation) in 2010 in cooperation with the City of Fairbanks. Two treatments were applied: (1) emamectin benzoate (TREE-äge®) injected undiluted at 1.97 ml/cm in diameter at breast height (dbh, 1.37 m in height) into the tree bole with the QUIK-jet Microinjection system (Arborjet Inc., Woburn, MA), and (2) an untreated control. Each treatment was randomly assigned to 15 paper birch, *Betula papyrifera* Marsh., trees ($n = 30$). Experimental trees were 18.1 ± 0.9 cm (mean $\pm$ SEM) dbh. Trees <15 cm dbh were treated through 3 injection ports (Arborplugs [#4, 0.95 cm diam.], Arborjet Inc.) placed equidistant around the bole at ~0.75 m in height, and trees ≥ 15 cm dbh were injected at four points. Injections occurred on 7 May 2010 (14°C, sunny) when birch leaves were just beginning to unfold (i.e., a few weeks prior to peak egg laying by *P. thomsoni*). Total treatment time, including uptake, was about 5 min per tree.

All experimental trees (treated and untreated) were evaluated for levels of leaf mining (whole canopy) on 29 July 2010. One tree (untreated control) could not be located and was assumed to be removed in association with nearby road construction activities. Visual estimates of the amount of leaf mining were conducted by 3 independent, experienced observers without knowledge of treatment. A test of normality was performed, and angular (arcsine square root [% leaf mining]) transformations were used when data deviated significantly from a normal distribution. t-Tests were performed on the percent leaf mining that occurred using $\alpha = 0.05$ (SigmaStat version 2.0; SPSS Inc., Chicago, IL).

Individual estimates of the percent leaf mining that occurred on each tree ranged from 0% (19 of 87 estimates by all three observers; TREE-äge®-treated trees only) to

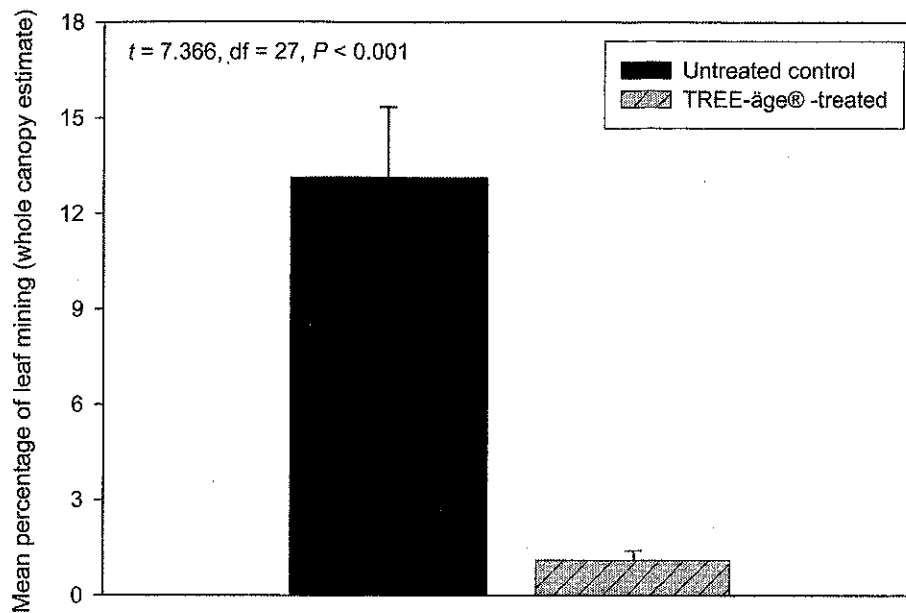


Fig. 1. Mean percentage of leaf mining (+ SEM) observed in the crowns of paper birch, Fairbanks, AK, 2010.

40% (2 of 87 estimates; untreated control only). Estimates provided for each tree by the 3 observers were within five percentage points 75.9% of the time (22 of 29 trees). TREE-äge® significantly reduced crown damage (percent leaf mining) compared with the untreated control ($t = 7.366, df = 27, P < 0.001$; Fig. 1). Based on these results, it appears that TREE-äge® holds promise for control of *P. thomsoni* on individual birch trees in Interior Alaska and should be further evaluated for this use. Subsequent studies should include larger samples sizes implemented during periods of higher *P. thomsoni* populations, and analysis of the distribution and concentration of emamectin benzoate in birch foliage at different times following tree injection.

Acknowledgments

The authors thank C.P. Dabney and S.R. McKelvey (Pacific Southwest Research Station, USDA Forest Service), and S. Nickel (Alaska Department of Natural Resources, Division of Forestry) for technical assistance. In addition, the authors thank J. Fox (City of Fairbanks) for providing our study site, and D.L. Cox (Syngenta Crop Protection LLC) for his helpful insights regarding treatment. Syngenta Crop Protection LLC provided the TREE-äge® and loan for several injection systems from Arborjet Inc. This research was supported, in part, by a small grant from Syngenta Crop Protection LLC (FS Agreement No. 10-CO-11272164-003) to C.J.F., the Pacific Southwest Research Station, Forest Health Protection (both USDA Forest Service), and Department of Natural Resources, Division of Forestry, State of Alaska.

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides in the United States must be registered by appropriate State and/or Federal agencies before they can be recommended. This article was written and prepared by U.S. Government employees on official time and it is, therefore, in the public domain and not subject to copyright.