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Injection of Emamectin Benzoate Protects Paper Birch from Birch Leafminer (Hymenoptera: Tenthredinidae) for Two Field Seasons[1]

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Ambermarked birch leafminer, *Profenusa thomsoni* (Konow) (Hymenoptera: Tenthredinidae), is an exotic, invasive pest of urban and wildland birch, *Betula* spp., first reported in the eastern United States in the early 1900s. It has since spread throughout the northern United States and Canada (MacQuarrie et al. 2007, Can. Entomol. 139: 545 - 553). *Profenusa thomsoni* was detected in Alaska near Anchorage in the mid to late 1990s. By 2003, >12,800 ha of birch were defoliated 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 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 to determine the extent of exotic leaf mining sawflies in Alaska reported *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, J. For. 105: 113 - 119).

Severe infestations of *P. thomsoni* result in extensive chlorosis of foliage and premature leaf fall, but generally do not result in tree mortality. Repeated infestations can weaken trees, perhaps increasing their susceptibility to other forest pests (Holsten 2003, U.S. Dept. of Agric. For. Serv. For. Insect and Disease Leaflet R10-TP-114). In 2010, we initiated a study in Fairbanks, AK (64.85 °N, 147.73 °W, 92.5 m elevation) to determine the efficacy of emamectin benzoate (TREE-äge®, Arborjet Inc., Woburn, MA) for reducing mining by *P. thomsoni* on paper birch, *Betula papyrifera* Marsh. Fettig et al. (2011, J. Entomol. Sci. 46: 339 - 341) provide a complete description

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Fig. 1. Bleeding surrounding an injection port on paper birch the year following treatment, Fairbanks, AK, 2011. The two dark vertical lines are shadows and are not associated with treatment.

of methods. In brief, TREE-äge® (EPA Reg. No. 100 - 1309 - 74,578) was injected undiluted at 1.97 ml/cm in diameter at breast height (dbh, 1.37 m in height) into the tree bole on 7 May 2010 (14°C, sunny) with the QUIK-jet Microinjection system (Arborjet Inc.). 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 4 points. Treatments (treated and untreated) were randomly assigned to 15 trees ($n = 30$). Experimental trees were 18.1 ± 0.9 cm (mean ± SEM) dbh.

In 2010, injection of TREE-äge® significantly reduced crown damage (percent leaf mining) compared with the untreated control (mean ± SEM = 1.1 ± 0.3 and 13.1 ± 2.2%, respectively) (Fettig et al. 2011). All experimental trees (treated and untreated) were evaluated again for levels of leaf mining (whole canopy) on 25 July 2011. Visual estimates of the amount of leaf mining were conducted by an independent, experienced observer 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).

We observed no external symptoms of phytotoxicity associated with TREE-äge®. However, bleeding occurred around some injection ports (Fig. 1), which might be considered unsightly and therefore undesirable in some environments. This was not observed in 2010. Estimates of the percent leaf mining that occurred on each tree ranged from 0% (11 of 15 TREE-äge®-treated trees) to 12% (untreated control). Whereas populations of *P. thomsoni* declined in 2011 compared with 2010 within the study area, TREE-äge®-treated trees had significantly less crown damage (percent leaf mining) compared with the untreated control ($t = 8.649$, $df = 27$, $P < 0.001$; mean ± SEM = 0.3 ± 0.1 and 4.9 ± 0.8%, respectively) in 2011. Based on these results, we conclude that a single injection of TREE-äge® provides two field seasons of protection, and holds promise for control of *P. thomsoni* on individual birch trees in Interior Alaska.

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