GROWING KNOWLEDGE

Series content is coordinated by Dr. Jay Pscheidt, professor of botany and plant pathology at Oregon State University in Corvallis, Oregon.

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Fig. 1 Spruce container field (a), and damaged shoot tip (b) [next page]. PHOTOS COURTESY OF OREGON STATE UNIVERSITY

A beneficial breath of fresh air

Testing the use of wintergreen oil to attract beneficials that kill nursery pests

BY JANA LEE, VICTORIA SKILLMAN AND KATERINA VELASCO GRAHAM

CAN MINTY ODORS REALLY enhance pest control? When pests feed on a plant, the plant releases odors, one of them being methyl salicylate (MeSA), also known as oil of wintergreen. When MeSA is applied on plants, a wide range of parasitic wasps, ladybugs, green lacewings, and predatory bugs have been attracted into the crop field.

MeSA is available as slow-release lures to be hung next to the plant canopy (Predalure, AgBio). MeSA is also a common analgesic and flavoring used in medicinal rubs, mouthwash and mint candy.

While numerous studies have been done in food crops, few have examined MeSA in ornamental production. Also, most studies have shown natural enemies becoming more abundant in fields with MeSA application, but have not always demonstrated subsequent pest reduction or plant protection.

A two-year study was conducted in spruce container yards, red maple production fields, and nursery stock block plots to examine whether MeSA lures would draw in natural enemies, reduce pest pressure, and affect plant appearance. Plots with MeSA lures were compared to control plots with 4–5 replicated plots set up in new sites each year. Small plots contained one or three lures depending on size (rate of 76 lures/acre), and spaced at least 100–200 meters apart.

The spruce wooly aphid feeds on the shoot tips causing »

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wax deposits and twisted growth which need to be pruned off (Fig. 1b). Lures were placed in May just as aphids started colonizing fields.

Each week, spruce tips were visually examined for aphids and mummies. Mummies are aphids that develop a paper bag appearance which indicates that it was attacked by a parasitic wasp. Clear sticky traps, and yellow pan traps were also used to sample insects. Random spruce were also visually ranked as being damaged or not on the shoot tips. Sampling was within 1 m and 5–7 m away from lures, and positions of traps were changed weekly.

In the first year of the study, 50% more *Pseudopraon* wasps (attack pest aphid), and 125% more mummified aphids were observed in spruce plots with MeSA lures than control plots (Fig. 1c). Likewise, aphid abundance was 19% lower overall, and damaged spruce were 27% less frequent in MeSA plots. This trend was not observed in the second year at different sites. Reasons for this are unknown and could be due to trees being larger in the second year, or differences in management.

Red maples are attacked by spider mites, lygus bugs, aphids and thrips, and can affect leaf appearance or growth of the meristem. Lures were hung on plants in July, and sampling was done with weekly leaf inspection, sticky cards and pan traps (Fig. 2a).

Various parasitic wasps, ladybugs and rove beetles were more abundant in MeSA than control plots during one or both years. Interestingly, 54% and 32% fewer pest thrips were observed on sticky cards in MeSA plots in the first and second year, respectively (Fig. 2b), and 57% fewer aphids in the first year.

In the maple experiment, predatory rove beetles were enhanced in the second year and may have contributed to thrips control. Ladybugs were enhanced the second year and not consistent with the aphid decrease in the first year. Yet, green lacewings and predatory mirids were marginally increased the first year, and may have contributed to aphid control.

Though it was not clear whether natural enemies mediated pest control, use of MeSA lures increased natural enemy abundance and was associated with a reduction of certain pests in maples.

Maple growth as measured by diameter change near the base of the stem did not differ between seedlings grown near MeSA or in control plots. While this is not an advantage, it addresses the concern that MeSA may have a tradeoff with plant growth. MeSA volatiles can stimulate plants to invest more in defense, or have allelopathic effects as seen in rice.

The final field experiment with MeSA was set up in mature trees (*Malus, Tilia, Acer*) in stock blocks which are infrequently managed with insecticides, and ideal to draw in natural enemies. This experiment specifically studied whether MeSA application could enhance predation on the new invasive brown marmorated stink bug eggs. Vacuum samples, »

Fig. 2. Red maple production field (a), and fewer thrips found per week on sticky cards in MeSA compared to control plots, GLMM treatment $p < 0.05$ (b).

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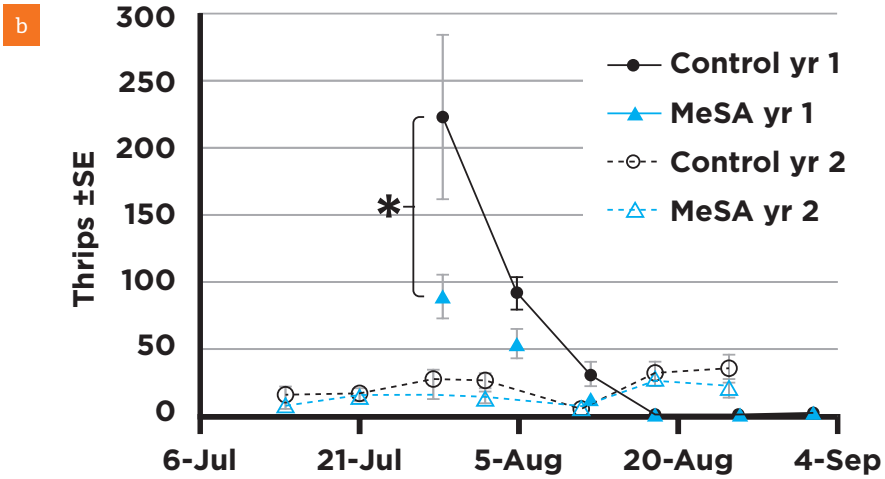

Fig. 3. Sentinel freeze-killed egg mass of brown marmorated stink bug to monitor predation (a), and green lacewing larva at the egg mass (b). PHOTOS COURTESY OF OREGON STATE UNIVERSITY

sticky cards and sentinel freeze-killed egg mases were used (Fig. 3a).

In the first year, more predatory thrips, green lacewing adults, and ladybugs were found near MeSA. There was no overall difference in predation on sentinel egg masses, except in August of the first year when 49% of eggs were predated in MeSA plots and 9% in control plots. Green lacewing larvae were observed to feed on the eggs (Fig. 3b).

No differences in natural enemy, pest abundance or predation were observed in the second year.

To summarize, use of MeSA can increase natural enemy abundance in a nursey field, and this is consistent with studies done in cotton, cranberry, hop fields, soybean, strawberry, and vineyards. A subsequent decrease in pest control can also follow, though it was not consistent each year and in all studies.

Current research among various groups are addressing what happens to natural enemies once they are drawn in. Are they more or less efficient in finding pests? Will providing floral nectar and pollen help supplement the natural enemies if few pests are available, an "attract and reward" approach?

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