Evaluating compatibility of horticultural oils and sulfur with vineyard IPM

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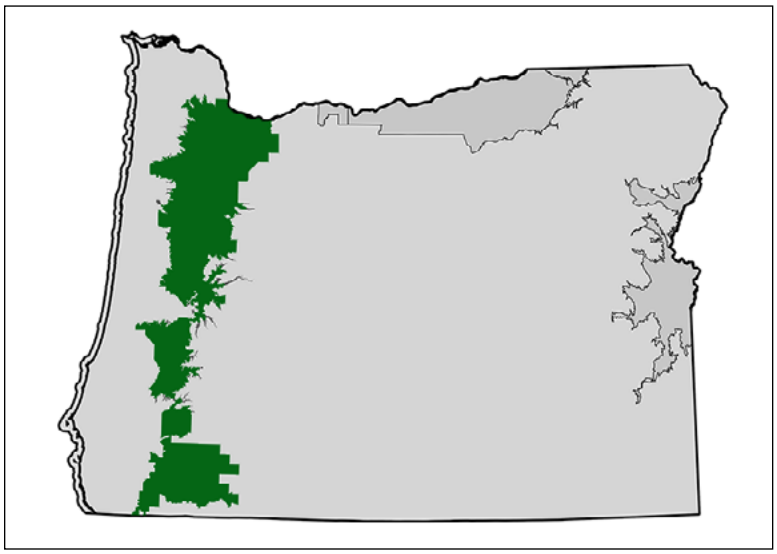
Horticultural (paraffinic) oils and sulfur are widely used in vineyards and other perennial cropping systems for control of diseases and pest insects and mites. They are often used in vineyards to control grape powdery mildew, in part due to their efficacy and relatively low cost. Oil and sulfur are approved for use in organic production systems, but they have a broad mode of action that can affect non-target organisms such as predatory mites, potentially reducing the control of arthropod pests.



Map by Gregory V. Jones, Southern Oregon University

Green area indicates where T. pyri is common.

Typhlodromus pyri is a beneficial predatory mite, common in vineyards west of the Cascade Mountains. It is a key predator of the pest mite *Calepitrimerus vitis* (Figure 1). In the Pacific Northwest wine-producing region, damaging infestations of *C. vitis* can cause stunted shoot growth and reduced fruit yield and quality (Figure 2a and 2b, page 2). In order to better understand the affect of these materials and enable informed decision-making, we evaluated the acute and sub-lethal effects of oils and sulfur on *T. pyri* adults and immature stages.

Photo by Christopher Hedstrom, Oregon State University

Figure 1. Beneficial predatory mite *Typhlodromus pyri* feeding on pest mite *Calepitrimerus vitis*.

Mortality of *T. pyri* in both stages was used to measure acute effects (i.e., death within 24 hours of exposure) when directly sprayed with paraffinic oil or sulfur. Sub-lethal effects include reduced numbers of eggs laid by *T. pyri* females or changes in development and fertility of immature stages. The sub-lethal effects of paraffinic oil and sulfur were determined for *T. pyri* females exposed as adults or immature mites. Immature mites were assessed once they had

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developed into adults. Materials were tested at three concentrations: the average label rate, one and one-half times the label rate, and twice the label rate.

Direct sprays of horticultural oil on adult predatory mites resulted in high mortality, ranging from 35 to 80 percent, compared to untreated mites (control). We found even greater levels of mortality (more than 80 percent) when *T. pyri* immatures came into direct contact with oil applications at all rates tested. There was no significant reduction in *T. pyri* reproduction when adult females were exposed to oil. We were unable to determine sub-lethal effects on immature mites due to the high mortality levels caused by acute exposure.

There were no significant acute mortality effects on adults or immature mites treated with micronized sulfur at all rates tested compared to control mites. However, we did find that mites exposed to sulfur in the immature stages had reduced fertility once they developed into adult females. Although this is a more subtle effect compared to high mortality levels, this affect may result in a significant reduction in beneficial mite populations.

These results suggest that growers should minimize the use of paraffinic oils. Micronized sulfur may be an effective tool to control disease, while having limited impact on beneficial mites. Results from these studies can assist Pacific Northwest vineyard producers in choosing lower risk, more selective pesticides in their disease management programs, thereby conserving non-target and beneficial organisms.

Photo by Vaughn Walton, © Oregon State University

Figure 2a. New vine growth showing symptomatic evidence of rust mite infestation. Left-branching shoot from bud shows zig-zagging growth habit with short internodes; right-branching shoot from bud shows "railroad" scarring symptomatic of mite infestation. Curled leaves are further evidence of rust mite infestation.

Photo by Vaughn Walton, © Oregon State University

Figure 2b. Comparison of rust mite-infested shoot (left) with healthy shoot (right). Infested material shows characteristic zig-zagged growth pattern with reduced leaf size and severely reduced or absent flower clusters. Healthy shoot has smooth growth with average-length internodes and healthy flower clusters.

Frequently Asked Questions

When can producers apply these materials with reduced risk to *T. pyri* adults and immature stages?

This question doesn't yet have a good answer. *T. pyri* adults become active in early spring and have overlapping generations throughout the season. Reducing the frequency of early-season oil and sulfur sprays could conserve the overwintering or active predatory mite stages, giving them a chance to build their populations. However, this is a tough decision for growers because these materials are both effective and inexpensive compared to other fungicides. Probably the most feasible option is to rotate sulfur and oils with other more selective materials, such as Rally® (Myclobutanil) or Pristine® (Boscalid + pyraclostrobin), neither of which had significant effects on *T. pyri* in our study. The *PNW Insect Management Handbook* and *PNW Plant Disease Management Handbook,* both updated annually, should always be a grower's guide when making decisions about pest management programs. They can be found at http://pnwhandbooks.org/insect and http://pnwhandbooks.org/plantdisease.

How can producers apply this information to their powdery mildew management programs?

At present, we don't have a good way to avoid exposure of predatory mites to oils and sulfur. We have determined the developmental temperatures for *T. pyri* in additional studies; but, unfortunately, a validated phenology model for predicting the seasonal activity of *T. pyri* has not yet been developed.

Are there other strategies besides timing that would permit growers to have *T. pyri* populations present and still gain the benefits of oil and sulfur?

A focus on application timing is probably not the optimal strategy at this point for the reasons explained above. Choosing a material that is more selective and rotating that with oils or sulfur is one way to make a small difference, but it requires that you monitor your vineyards and know which pest and beneficial insects are present. Another strategy is to supplement predatory mite populations by inoculating vineyards through the transference of leaves or prunings bearing *T. pyri* from one vineyard to another. *T. pyri* has been dispersed with good success in reducing European red mites *(Panonychus ulmi)* in North American vineyards.

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Gadino, A.N., V.M. Walton, and A.J. Dreves. 2011. Impact of vineyard pesticides on a beneficial arthropod, Typhlodromus pyri (Acari: Phytoseiidae), in Laboratory Bioassays. *Journal of Economic Entomology*, 104(3): 970-977.

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