Investigating Novel Control Options for Symphylan Management in Specialty Seed Crops in Oregon- Year 2

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Various grower cooperators and crop consultants throughout the Willamette Valley, including Jon Umble, Fall Creek Farm, and Nurseries, Inc.

Background

Symphylans (*Scutigerella immaculata* Newport) are a persistent soil pest that affects many seed crops in Oregon's Willamette Valley, resulting in poor stand establishment and economic damage. This project will demonstrate the potential of a few high-value solanaceous crops to serve as viable rotation or cover crop options under Oregon conditions. Research at OSU (Umble and Fisher 2003a, Umble and Fisher 2003b) showed that symphylan populations drop significantly after potato crops. Cultivation of potatoes was found to cause a 2- to 4-fold reduction in pest populations over a broad range of conditions, with populations remaining low into the following cropping cycle. In greenhouse trials, the population decreased in 6 potato varieties with different alkaloid profiles. These plant protection benefits were attributed to the presence of *α-chaconine and α-solanine, two major glycoalkaloids* in commercial potatoes (Friedman and Dao 1992).

What is the potato effect? In general, potato roots and leaves tend to have much higher concentrations of glycoalkaloids that are toxic to symphylans than tubers. Thus, potatoes can become good rotation crops where symphylan pressure is high. Ideally, late- or no-tuber-forming varieties can be a suitable pest-management cover crop on farms that aren't interested in growing and selling potatoes. Preliminary discussions with the OSU potato breeder, Dr. Sathuvalli, and Dr. Jim Myers, OSU vegetable breeder, suggested that short-day potatoes or non-tuber-forming wild types could avoid the potential side effect of volunteer potatoes becoming weeds. Other Solanaceous crops (litchi, tomatoes, peppers, ashwagandha, etc.) with high levels of α-chaconine and α-solanine could also serve as cover crops or rotation crops.

During the first year, we observed some tolerance attributes in certain crop species in greenhouse experiments, including reduced symphylan survival and higher root biomass in exposure experiments. In this study, we intend to continuously measure the effects on symphylan survival and population densities when symphylans are reared on crops with high α-chaconine and α-solanine content, and to assess their potential as cover crops or rotational options in Oregon. In this study, we aim to conduct the following

Objectives

1. Investigate the suitability of various solanaceous crops with high glycoalkaloid contents for symphylan survival under greenhouse conditions.

Procedures

An initial round of greenhouse suitability test was concluded in Spring 2026 following the general approach of Umble and Fisher (2003b). Crop species and varieties were evaluated for their effects on the population development of the garden symphylan*, Scutigerella immaculata*, and plant performance under greenhouse conditions. Crop species and cultivars were selected based on previous research and observations suggesting that certain solanaceous crops may influence symphylan abundance and feeding behavior.

Each crop or cultivar was established in PVC pots with six replicates per treatment and infested with 35 adult symphylans. Symphylan population development was assessed by comparing initial infestation levels with final population densities after seven to eight weeks. Plant performance was evaluated by measuring root biomass and overall root health.

Results

Symphylan mortality differed significantly among crop species and cultivars ($P < 0.05$). The highest mortality was observed in *Solanum tuberosum* cv. Snowden (81.9 ± 4.8%), followed by *Capsicum chinense* (Habanero) (70.5 ± 8.3%) and *S. tuberosum* cv. Yellow Finn (61.9 ± 7.7%). These three treatments formed a distinct statistical group (Tukey's HSD, $P < 0.05$) and resulted in significantly greater mortality than all other crop species evaluated.

The remaining treatments produced intermediate to low levels of mortality, ranging from 32.9 to 43.8%, and were not significantly different from one another. Mortality in these treatments was 43.8 ± 8.2% for *Withania somnifera* (Ashwagandha), 42.9 ± 5.4% for *Capsicum annuum* (Cayenne pepper), 36.4 ± 5.2% for *Solanum melonocerasum* (Garden huckleberry), 36.2 ± 7.8% for *Cucurbita pepo* (Ornamental gourd), 36.2 ± 2.8% for *Solanum lycopersicum* var. *cerasiforme* (Cherry tomato), 33.8 ± 9.8% for *Solanum habrochaites* (Wild hairy tomato), and 32.9 ± 9.2% for *Solanum scabrum (*Garden huckleberry*)*.

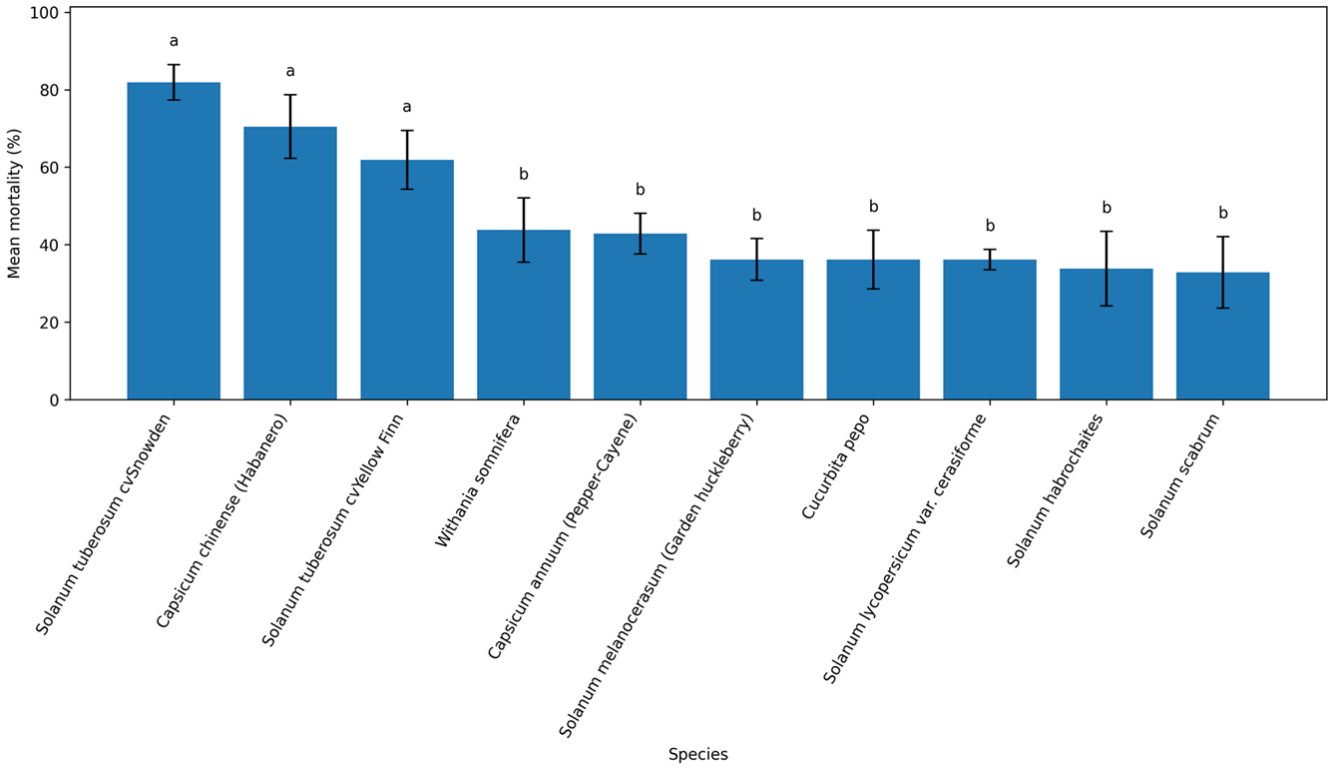

Figure 1. Mean (± SE) mortality of *Scutigerella immaculata* after exposure to selected crop species and cultivars under greenhouse conditions. Bars sharing the same letter are not significantly different according to Tukey's HSD test ($P < 0.05$).

Next steps

The pronounced mortality observed in the Snowden and Yellow Finn potato cultivars and the Habanero pepper suggests that certain members of the Solanaceae possess characteristics that adversely affect garden symphylan survival. These effects may be associated with elevated concentrations of bioactive secondary metabolites, including glycoalkaloids and other root-associated compounds known to influence soil-dwelling arthropods. The consistently high mortality observed in potato cultivars is particularly noteworthy and aligns with previous observations suggesting that potato-based rotations may suppress symphylan populations. As a next step, an M.S. student will begin this summer to further evaluate selected crop entries identified from the greenhouse screening trial. The student will conduct additional replicated greenhouse assays to confirm the suppressive potential of the most promising crops and cultivars against garden symphylan.

In parallel, in-house analytical studies will be conducted to quantify glycoalkaloid concentrations in plant tissues. These biochemical analyses will help determine whether differences in symphylan mortality are associated with variation in plant secondary metabolites. This work will strengthen our understanding of the mechanisms underlying crop-mediated suppression and support the selection of candidate crops for future field demonstrations.

References

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