Final Report

Investigating Novel Control Options for Symphylan Management in Specialty Seed Crops in Oregon- Year 1

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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

The highest garden symphylan 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 the highest statistical group and resulted in significantly greater mortality than the other crop species and cultivars evaluated (Tukey's HSD, $P < 0.05$).

The remaining treatments produced intermediate to low mortality, ranging from 32.9 to 43.8%, and did not differ significantly from one another.

Table 1. Mean (± SE) mortality of *Scutigerella immaculata* following exposure to selected crop species and cultivars under greenhouse conditions.

Crop species / cultivar	Common name	Mortality (%)
Solanum tuberosum cv. Snowden	Snowden potato	81.9 ± 4.8a
Capsicum chinense	Habanero pepper	70.5 ± 8.3a
Solanum tuberosum cv. Yellow Finn	Yellow Finn potato	61.9 ± 7.7a
Withania somnifera	Ashwagandha	43.8 ± 8.2b
Capsicum annuum	Cayenne pepper	42.9 ± 5.4b
Solanum melanocerasum	Garden huckleberry	36.4 ± 5.2b
Cucurbita pepo	Ornamental gourd	36.2 ± 7.8b
Solanum lycopersicum var. *cerasiforme*	Cherry tomato	36.2 ± 2.8b
Solanum habrochaites	Wild hairy tomato	33.8 ± 9.8b
Solanum scabrum	Garden huckleberry	32.9 ± 9.2b

Means followed by the same letter are not significantly different according to Tukey's HSD test ($P < 0.05$).

The high mortality observed in Snowden and Yellow Finn potato and Habanero pepper suggests that certain members of the Solanaceae may possess characteristics that negatively affect garden symphylan survival. One working hypothesis is that these effects are associated with bioactive plant secondary metabolites, particularly glycoalkaloids and other root-associated compounds.

Preliminary laboratory assays support this hypothesis: commercial standards of the potato glycoalkaloids α-chaconine and α-solanine caused measurable mortality in garden symphylans. The consistently high mortality observed with the two potato cultivars in the greenhouse screening further justifies investigating whether naturally occurring glycoalkaloid concentrations contribute to crop-mediated suppression.

Building on the Year 1 screening, we selected six entries in Year 2 for repeat testing to validate the observed responses. An M.S. student in Kaur's laboratory assisted with greenhouse suitability screening of these six entries, processed root samples, and submitted the samples to Dr. Aymeric Goyer's laboratory at OSU for measurement of α-solanine and α-chaconine concentrations. Biochemical results are expected in early 2027. Once available, these data will be used to examine correlations between measured root glycoalkaloid concentrations and observed symphylan responses.

Additional Funding and Project Continuity

Navneet Kaur and Nick Andrews secured a Western Sustainable Agriculture Research and Education (Western SARE) extension grant to continue investigating crop-based approaches to garden symphylan management and share findings with growers and agricultural professionals.

Outreach and Dissemination

Research findings and management information were shared through the following presentations and field day materials:

- Entomological Society of America Pacific Branch meeting in Portland, April 2026: "Identifying Suppressive Crops for Garden Symphylan Management."
- IPM Festival for southern Oregon farmers in Jackson Co., May 2026: "Garden Symphylans: Biology and Management."
- Organic Vegetable Field Day in Corvallis, September 2026: "Managing Symphylans with Rotations and Biopesticides," a field day handout developed with the project team.
- PSEP workshop and Vegetable IPM Webinar, October 22, 2026: "Beneath the Surface: Advancing Garden Symphylan Research and Management."

These activities communicated emerging research findings, symphylan biology, and potential management approaches to researchers, growers, and agricultural professionals.

References

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Umble, J. R., & Fisher, J. R. (2003b). Suitability of selected crops and soil for garden symphylan populations (Symphyla, Scutigerellidae: *Scutigerella immaculata* Newport). *Applied Soil Ecology*, *24*(2), 151–163. https://doi.org/10.1016/S0929-1393(03)00095-7