Symphylans

Integrated Pest Management Options
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 (UC IPM)

Background Info

- Aka garden centipede, *Scutigerella immaculata*: elongate, white "centipede-like" arthropods (myriapods) with long antennae. When full grown, they are approximately ½ inch long or less with 11-12 pairs of legs.
- Damage: they feed on living roots, sprouting seeds, and fungal hyphae. Feeding damage causes root death, gnarled appearance, corky tissues in older roots, stunting, increased susceptibility to soil-borne pathogens. They cause patchy distribution of symptoms in the field and often occur in hotspots which can be several square feet to several acres in size. They create a dramatic distinctive circular pattern of crop stunting in a field.
- Hosts: include brassicas, solanaceous crops, root crops, cucurbits, some leafy greens such as spinach and mustards. They especially love carrots, beets, other root crops.
- Timing: often high numbers are observed in April/May especially during rainy springs.
- Soil moisture: symphylans tend to occur in heavier soils with high irrigation. Symphylans may be spread by flooding and are common in alluvial soils in California. Symphylans tend to congregate in the upper soil layer when conditions are warm and moist.
- Soil Organic Matter: they cause problems in organic systems with high SOM and plant residue incorporations. They are more often associated with non-decomposed organic matter and good soil structure than soils that are compacted or sandy.
- Mobility: they rely on soil pore spaces made by roots and other organisms to move. Very vertically mobile in soil profile when soil pores, cracks, and channels are present. They need well aggregated soil for movement, so sandy soils are less hospitable. They can be found more than 3 ft below the soil surface. All life stages occur in the soil. They molt in the deeper soil layers and migrate up to the root zone to feed.
- Ironically, they could be considered the single pest that is an indicator of good soil management where soil aggregation and soil organic matter are high.

Management Options

IPM provides a toolbox approach to pest management: choose a combination of management options that makes sense for your context.

Damage Prevention

- Plant tolerant crops in problem areas such as beans, small grains, spring oat cover crops.
- Do not allow excessive soil organic matter levels to build up beyond what is necessary for soil and plant functioning if symphylans are known to be an issue in the area.

Monitoring

- If you can see them in the soil before planting, it means symphylans are numerous enough to cause economic damage.
- Record keeping: keep track of which fields have symphylans issues. Consider making a map of symphylans hotspots based on bait trapping results.
- Bait trapping: just before planting in the spring, use bait trapping to monitor garden symphylans and determine population levels present.
- Potato Test: (bait trapping)
    1. <u>Install potato slices in soil.</u> Cut raw potatoes, beets, or carrots in thick slices. Carefully rake away the upper drier soil layer until moist soil is exposed. Scratch the cut surface of the potato immediately before placing it on the moist soil surface. Be careful when removing dry soil from the surface not to disturb the soil pores which could prevent symphylans from reaching the bait. This can be done by raking the surface soil away with a lettuce knife. Use at least 1 bait trap per acre, ideally more for small-scale farms. It can be helpful to compare symptomatic areas with nearby high performing areas.


    2. <u>Cover the bait and wait.</u> Cover potato slices with a cup to protect them from drying out. Make sure the cup is large enough to prevent excessive heating of the area or to accumulate a lot of condensation. A Styrofoam cup or white plastic pot (with no drainage holes) about 6 inches x 6 inches is adequate. Cover with a stone or some soil to prevent the wind from removing it. Leave the bait in place for 24 to 36 hours.

    3. <u>Count symphylans present.</u> Remove the cover to count the symphylans on the potato slice and on the soil surface underneath. Count the soil surface first as the symphylans there will quickly run away and hide (they're fast). If any symphylans are present on the bait, significant stand loss can occur. If any symphylans are detected on the bait, taking action would be justified (see management options below).

Biological Control

- Promote predatory organisms (such as predatory mites, ground beetles, true centipedes, fungi) by installing and maintaining insectary plants to attract natural enemies of symphylans, but bear in mind biocontrol alone will likely not be enough to control symphylans.

Mechanical Methods

- Tillage: an effective traditional control tactic for reducing symphylans populations. Tillage directly kills symphylans and destroys the pore spaces and channels symphylans use to move thru the soil. However, it decreases populations of key predators of symphylans as well (such as centipedes and predaceous mites), and over time reduces soil organic matter content and soil structure. Tillage when symphylans are near the soil surface can provide several weeks of control, however it does not control symphylans at lower soil depths. Consider benefits and tradeoffs of tillage.
- Potato rotations: decrease symphylans populations and in some cases can allow other more susceptible crops to be planted after potatoes.
- Limit organic matter inputs: reduce input of undecomposed organic matter.
- Pack down the soil surface after planting to compress pore spaces symphylans use to travel through the soil, compacting soil can help reduce symphylans movement thru soil.

Cultural Methods

- Limit organic matter remaining in the field: remove crop residues, do not till in crop residues where symphylans are present, and do not leave any unharvested root crops in the field.
- Sanitation: clean farm equipment between going from field to field and to new farms.
- Wait to seed/transplant until organic materials have visibly broken down.
- Overplanting: plant a higher number of seeds/transplants in problem areas to help compensate for damage.
- Using transplants rather than seeds can help give crops more of a head start.

- Soil amendments vary greatly in their effects and reports are often contradictory.

Organic Insecticides

- Likely most effective if applied before planting.
- Azadirachtin (an active ingredient extracted from the neem tree) insecticides such as AzaGuard drench and Aza-Direct.
- Pyrethrin (an active ingredient found naturally occurring in Chrysanthemum flowers) provides some low level of control, insecticides such as Monterey Bug Buster-O from Arbico Organics.
- EcoTec G (clove oil, cinnamon oil, thyme oil) provides some control.
- Some growers have found that Ecovia (thyme oil, rosemary oil, phenethyl propionate) can provide moderate control.
- Notes: insecticides will kill symphylans near the surface and allow better root establishment. Spot treatments with insecticide may be adequate. However, symphylans deeper in soil may eventually reinfest the root zone. Using a combination of IPM strategies will provide the highest level of pest control.

Remaining Questions

- What is the mechanism behind the reduction of symphylans populations after a potato rotation?
    - Physical soil disruption involved with harvesting them? (-idea from Johnny Campbell)
    - A biochemical effect from the potatoes? (-idea from Jen Lang)
    - A long term bait effect: since there are usually a small number of potatoes left in the field after harvesting them, maybe those leftover ones act as baits and distract the symphylans away from any new transplants? (-Emma Torbert)
    - This could be a great research question for an entomology PhD student. As more and more growers adopt healthy soil practices, we'll probably continue to see symphylans pressures increase.
- Exactly how long do the benefits of the potato rotation last in the field?
- Does solarization help? Emma Torbert (UC Davis Student Farm) noticed that there is often lower symphylans damage after soil solarization.
- There has been some limited research on chitin-containing shrimp or crab shell applications for symphylans control but no significant effects have yet been found (WSARE Farmer/Rancher Project link).
- There is a need for more science-based research results from randomized and replicated field trials that are centered around grower-driven priorities.

Mention of pesticide products do not constitute endorsements, merely examples of registered products that can be used for this specific pest. Always follow the pesticide label carefully and consult ipm.ucanr.edu for further resources.

Please email Ellie Andrews at eandrews@ucanr.edu for an electronic version of this outline.

See this ATTRA article for more information and helpful photos:
https://attra.ncat.org/publication/symphylans/

References

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Communications with Jim Leap, retired UCSC Farm Manager
Communications with Rex Dufour, ATTRA NCAT
Communications with Emma Torbert, UC Davis Farm Manager