# Evaluation of Entomopathogenic Nematodes (EPNs) Against Plum Curculio (PC): Effects of Nematode Species, Application Rates, and Persistence.

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## Background

*Conotrachelus nenuphar* (commonly known as Plum Curculio = PC) is a troubling weevil for apple growers throughout the northeast. Although there are insecticides on the market to combat them, growers must make sure to spray at the right time, with a very short window of opportunity. Entomopathogenic nematodes act as a form of biological control, working to control PC larvae in the soil. This biological control method could lead to a more effective, easier and sustainable way to control this pest.

## Objectives

This research is broken into two objectives:

1. **Experiment 1:** Determine which species of nematodes, and in what concentration is most effective at controlling adult PC emergence.
2. **Experiment 2:** Evaluate the persistence of EPNs in the soil from 2020 applications.

## Materials and Methods

**Experiment 1: EPN Species and Application Rate**

1. Collected PC larvae from apple fruitlets.
2. At the UMASS Cold Spring Orchard (CSO) 36 PC larvae, 30 apple fruitlets, and nematodes (Table 1) were placed under each emergence cage (Pic. 1).
3. Checked cages once a week for adult PC.

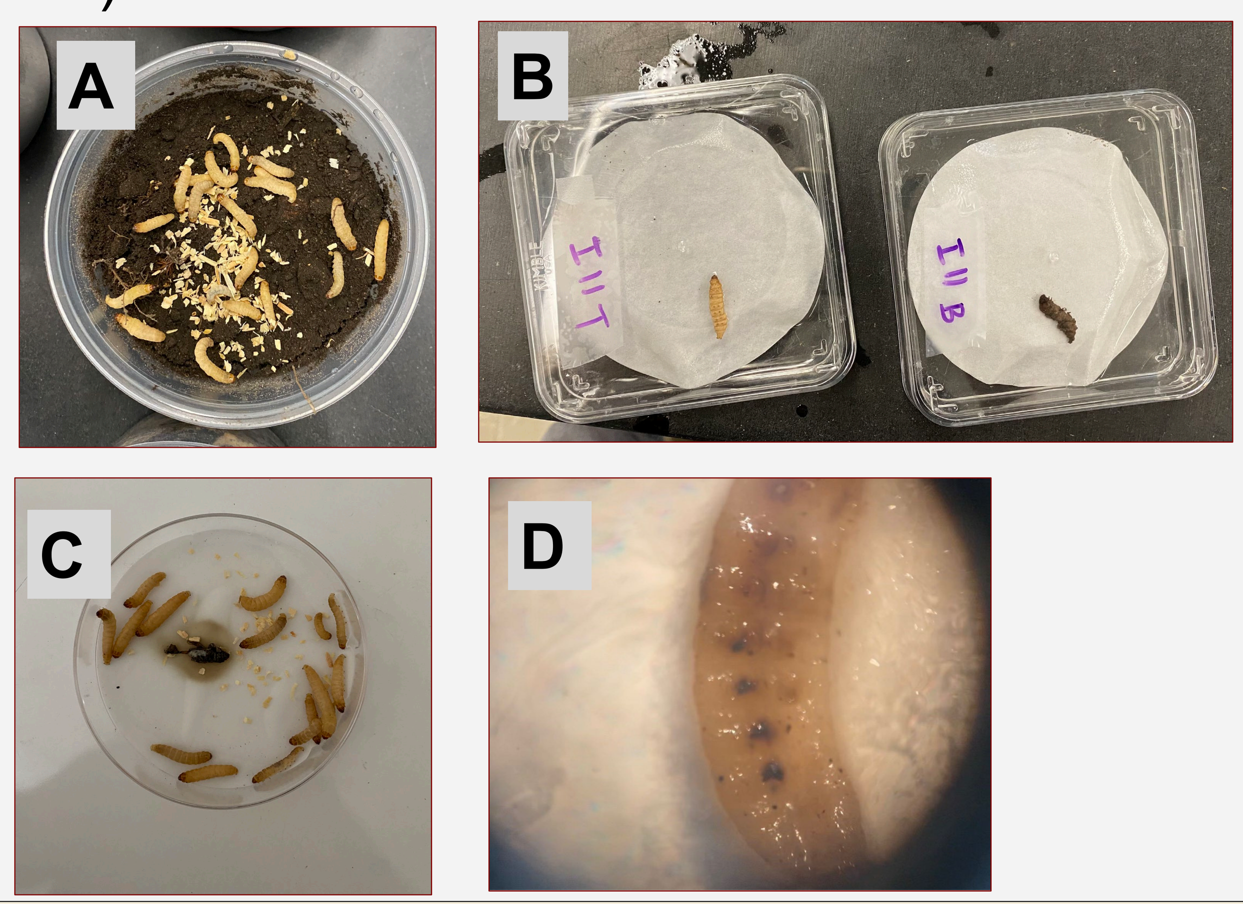
| Species | Concentration |
|---|---|
| *S. riobrave* (low rate) | 500,000 IJ/m$^2$ |
| *S. riobrave* (high rate) | 1 million IJ/m$^2$ |
| *S. carpocapsae* (low rate) | 500,000 IJ/m$^2$ |
| *S. carpocapsae* (high rate) | 1 million IJ/m$^2$ |
| *S. riobrave* + *S. carpocapsae* (low rate) | (250,000 IJ S.r. + 250,000 IJ S.c.)/m$^2$ |
| *S. riobrave* + *S. carpocapsae* (high rate) | (1 million IJ S.r. + 1 million IJ S.c.)/m$^2$ |
| Control | Water only |

Table 1: Application rates of two EPN species

Picture 1: The emergence trap fully set up.

**Experiment 2: EPN Persistence in Soil**

1. Soil samples collected from two areas of CSO where EPN's were sprayed in 2020.
2. Placed wax moth larvae in each sample, recorded mortality (Pic. 2A).
3. Tested Koch's Postulate, which proves that larvae died from EPNs with White traps (Pic. 2B).
4. Reinfected wax moth larvae and plum curculio larvae to confirm Koch's postulates (Pic. 2C).
5. Dissected dead PC larvae and found EPNs (Pic. 2D).




Picture 2 (A): 20 wax moth larvae placed on top of each soil sample, (B) White traps set up for wax moth larvae suspected to be infected from each sample, (C) Reinfection of wax moth larvae from the cadaver that was found to have EPNs, (D) EPNs under the microscope in a PC larvae.

## Results

**Experiment 1:** Figure 1 shows that compared to the control there was higher mortality of PCs (less PC adults found), proving that the EPNs did have an effect on mortality.

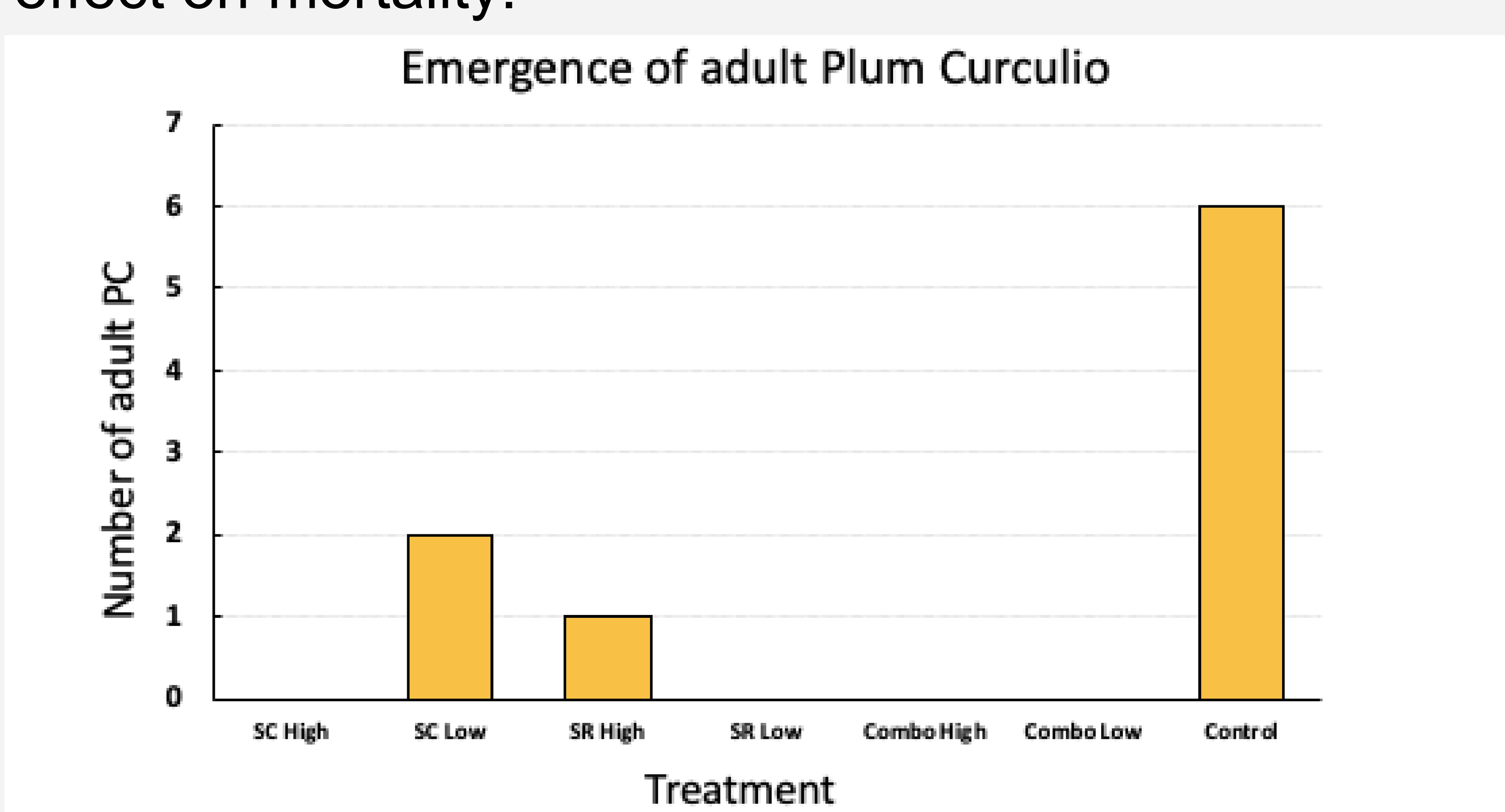



Figure 1: Total number of adult PCs recovered from emergence cages (UMass CSO)

**Experiment 2**: X-Block: The EPN *S. carpocapsae* in a high concentration (= S.c. HIGH) successfully survived the winter (Figure 2A). Although there was mortality in every treatment the S.c. HIGH treatment was the only one that was statistically different from the control.

Rock Mountain: The results show that S. riobrave, the EPN applied in 2020 over the winter, survived (Figure 2B).This is shown by the high mortality rate of wax moth larvae in the exterior and interior samples vs. the control, which was from the center of the block.

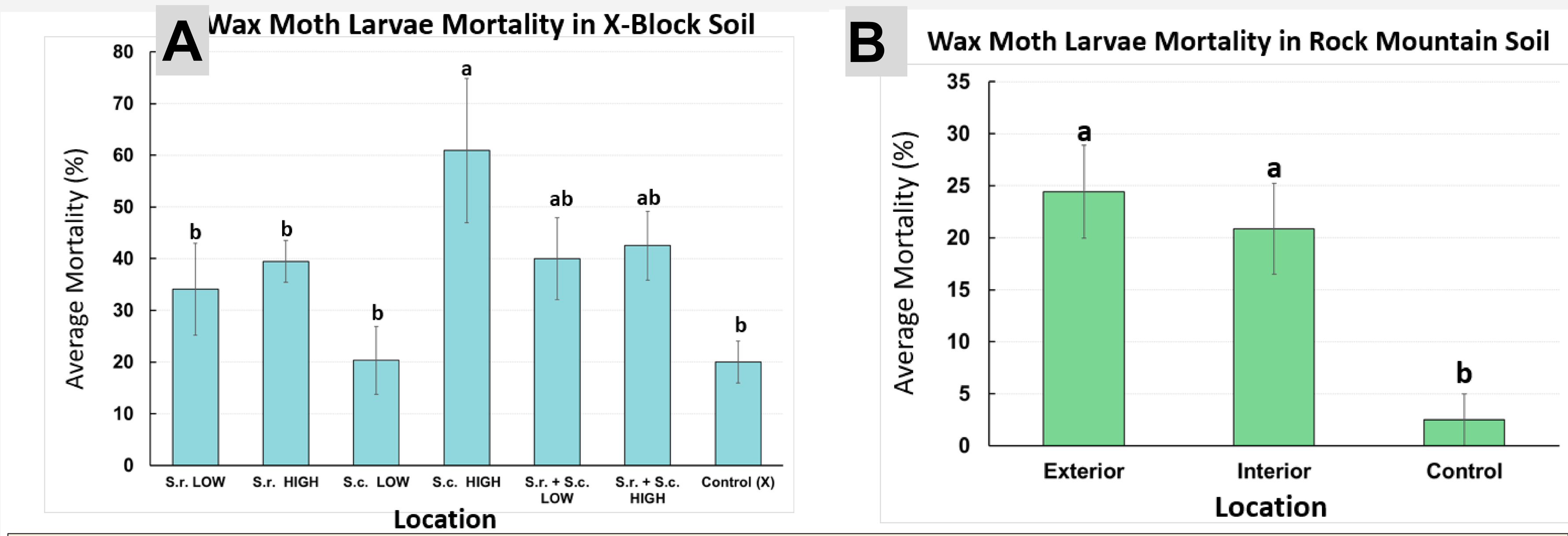



Figure 2: Average mortality of wax moth larvae in the soil samples from (A) X-block, (B) Rock Mountain.

## Conclusions

**Experiment 1:** Through this field work it was shown that EPNs are effective at suppressing the emergence of adult PC when compared to the water control.

**Experiment 2:** The soil samples processed in the lab proved that the EPNs from last year survived through the New England winter. Whether EPNs have enough pathogenicity so that they would not have to be applied again is unknown.

**Overall:** EPNs have potential for pest reduction leading to reduced pesticide use. EPNs could also be another tool for organic farmers in their fight against pests.

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