

Jared Gregory Ali (alijared@msu.edu)

Entomology Department, Michigan State University, East Lansing, MI 48824 U.S.A.

www.Interactions.ent.msu.edu

Abstract: Often interactions between plants herbivores and their natural enemies are studied in aboveground contexts. Major components of research in the Ali lab are understanding mechanisms that allow belowground invertebrates to find their hosts, examining the potential to manipulate the behavior of these organisms with volatiles and evaluate trophic cascades in resulting from induced plant responses. In response to herbivore feeding, damaged plants release odors that attract natural enemies of herbivorous insects. Presented here are developed techniques and data demonstrating that roots fed upon by, root-herbivores release volatiles that attracts Entomopathogenic nematodes in multiple bioassays. Isolation, identification, and deployment of these chemicals in the field increased larval mortality by attracting EPNs. Further analysis using real-time qPCR we evaluated the potential for this cue to attract nematode 'hyperparasitoids' and nematophagous fungi. We provide evidence showing subterranean herbivore induced plant volatiles behave much the same as those aboveground, attracting not only parasitoids, but also hyperparasites and other food web members. We are currently looking into how specific these induced responses are to belowground herbivores, and how additional plant defenses associated with herbivores influence the third trophic level.

Root Feeding Insects:

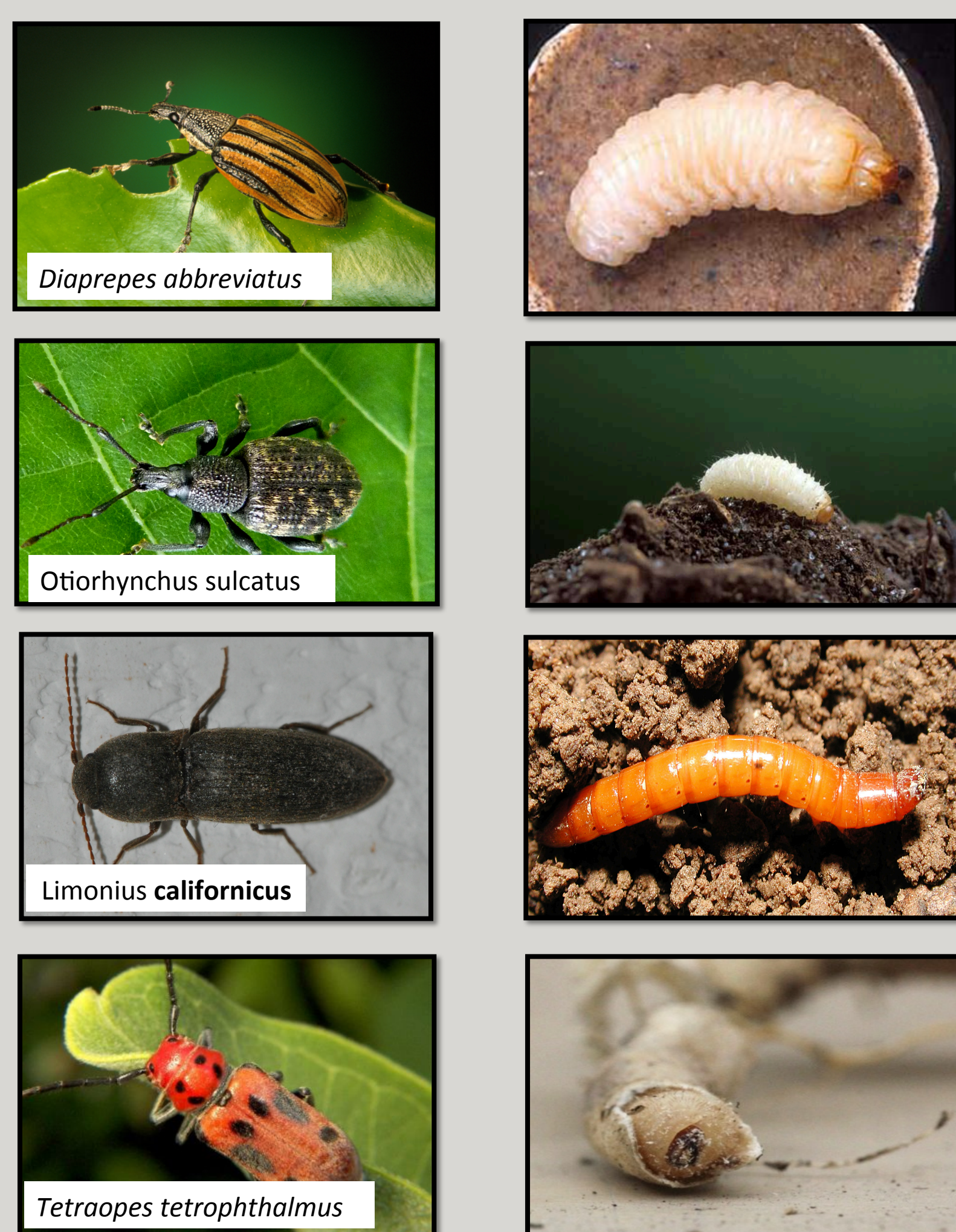


Figure 1. Belowground herbivores

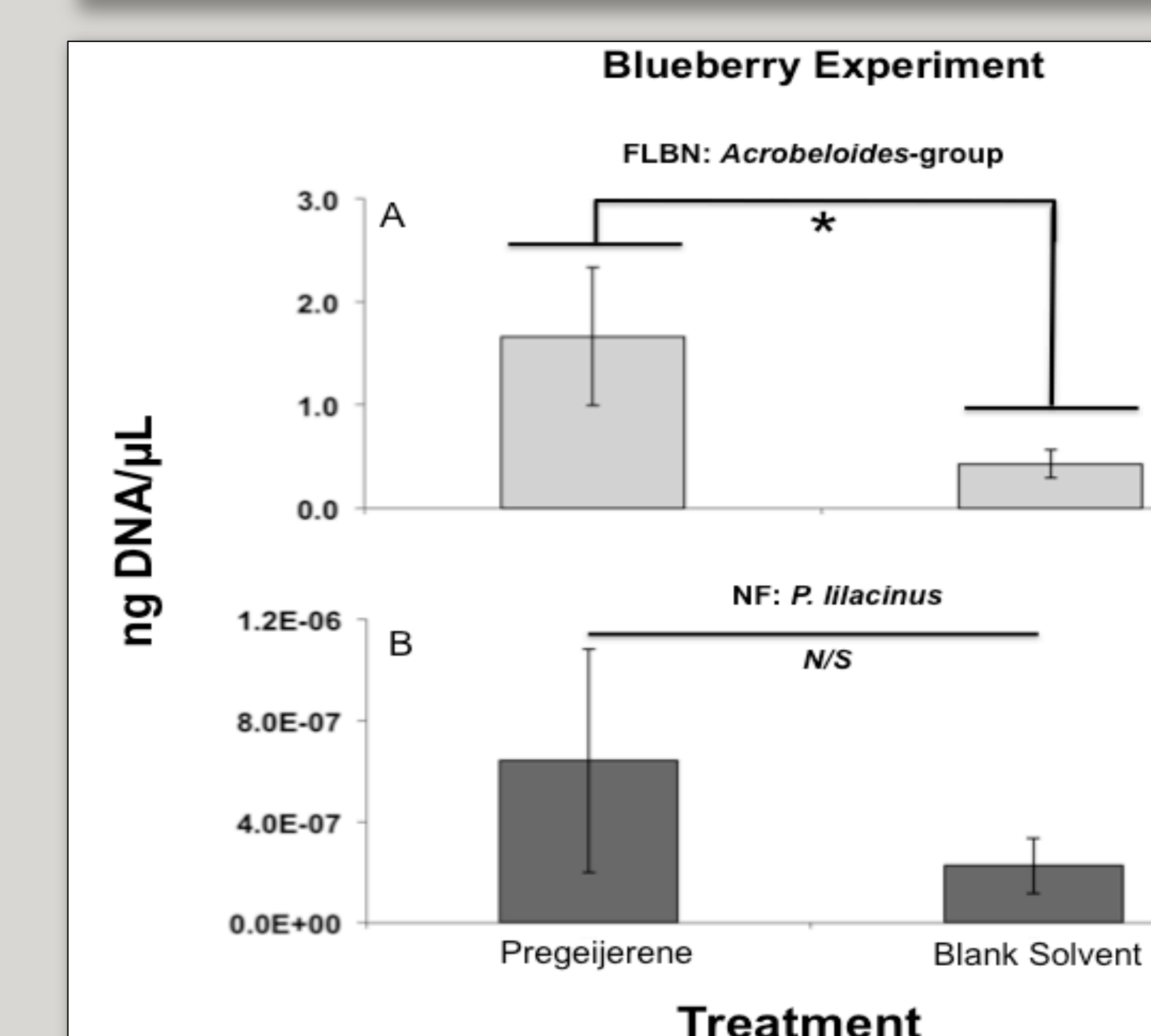
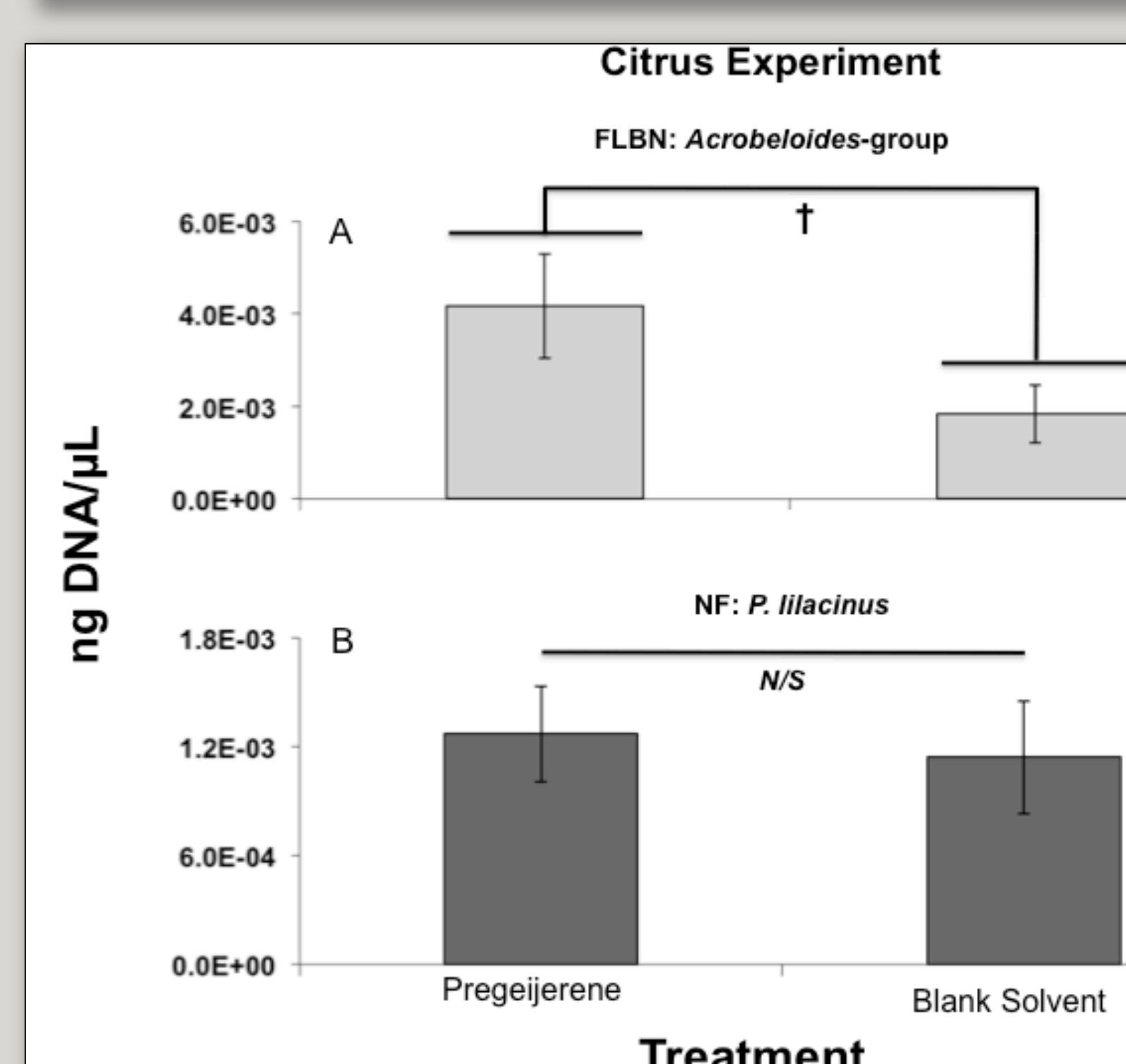
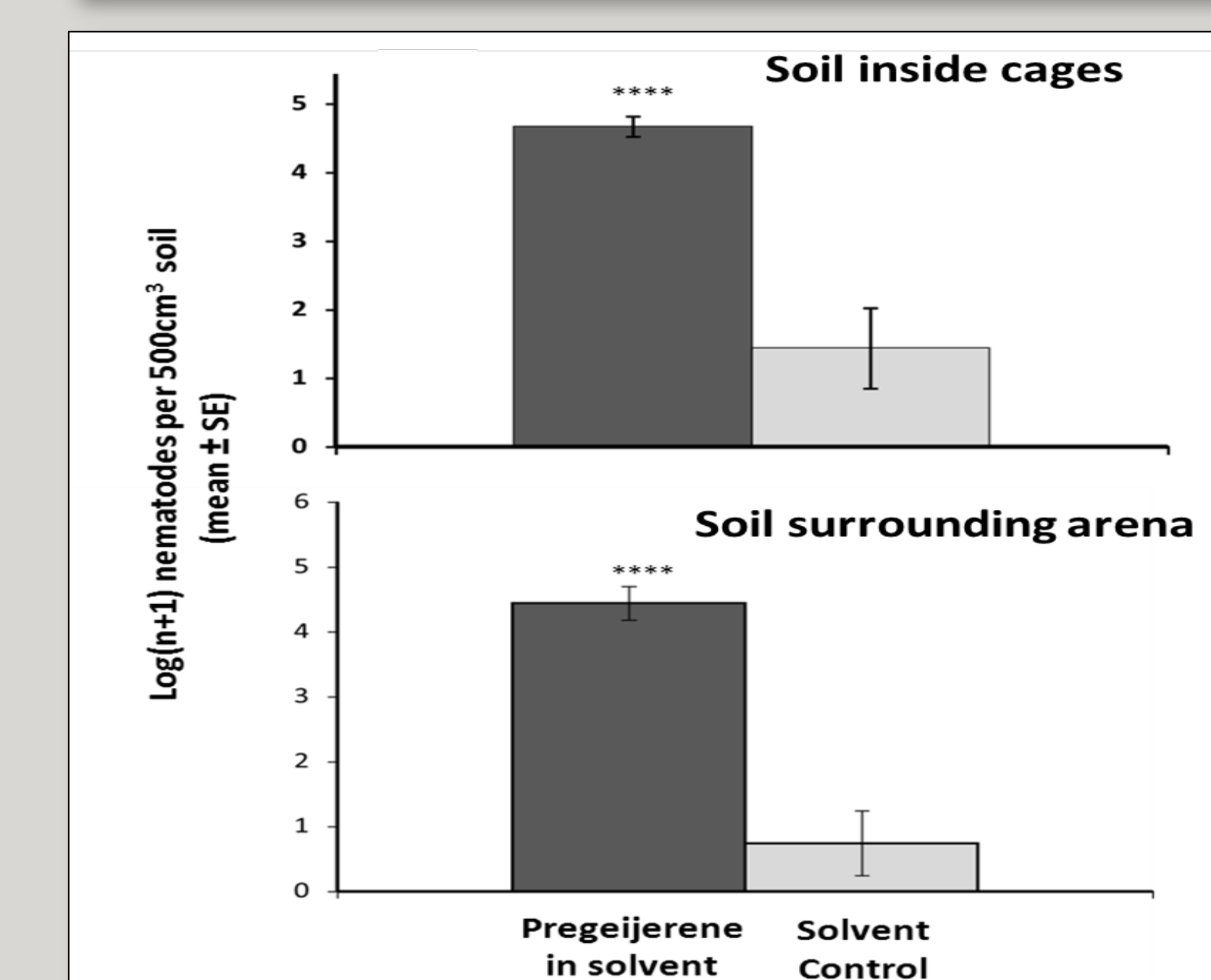
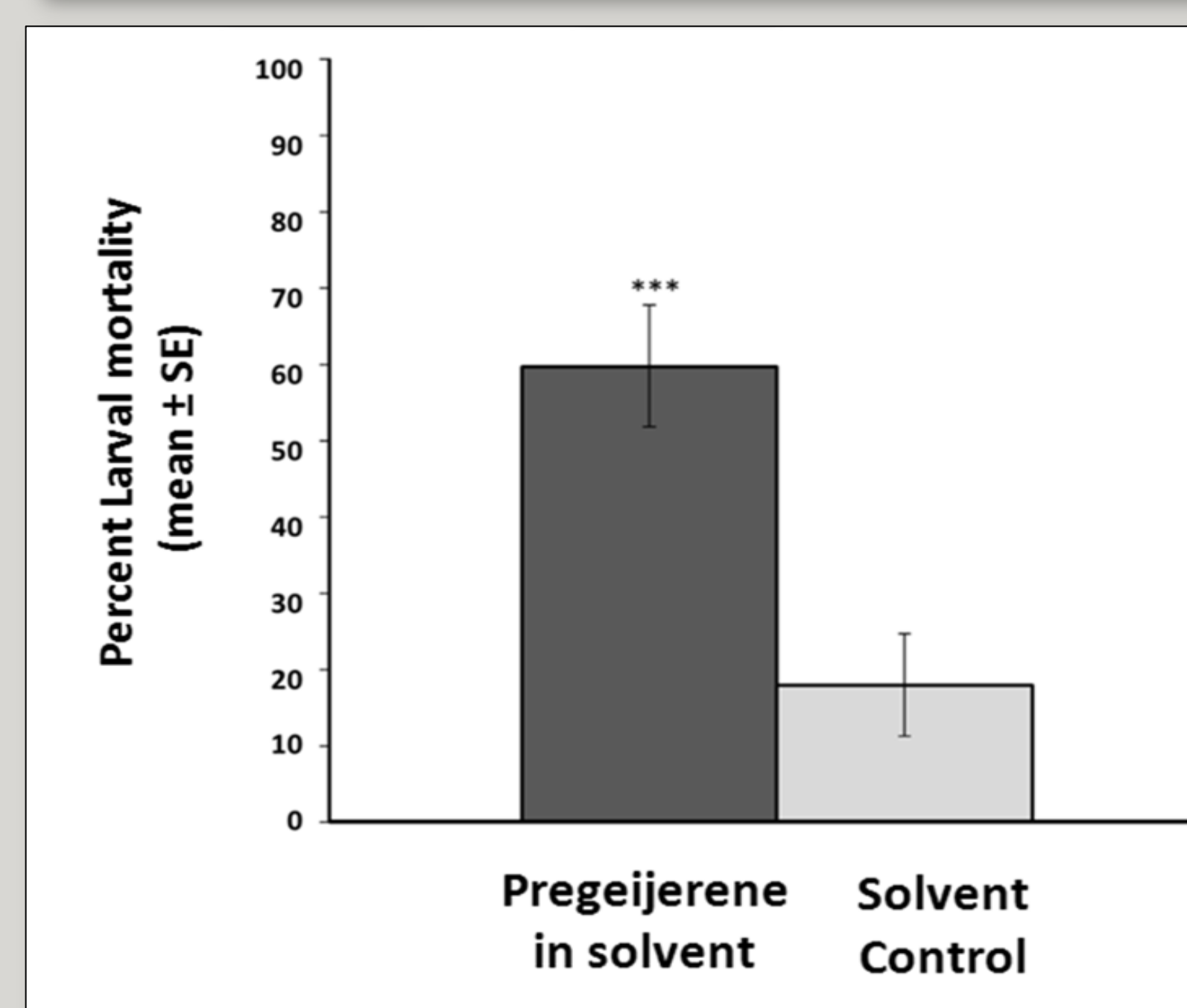
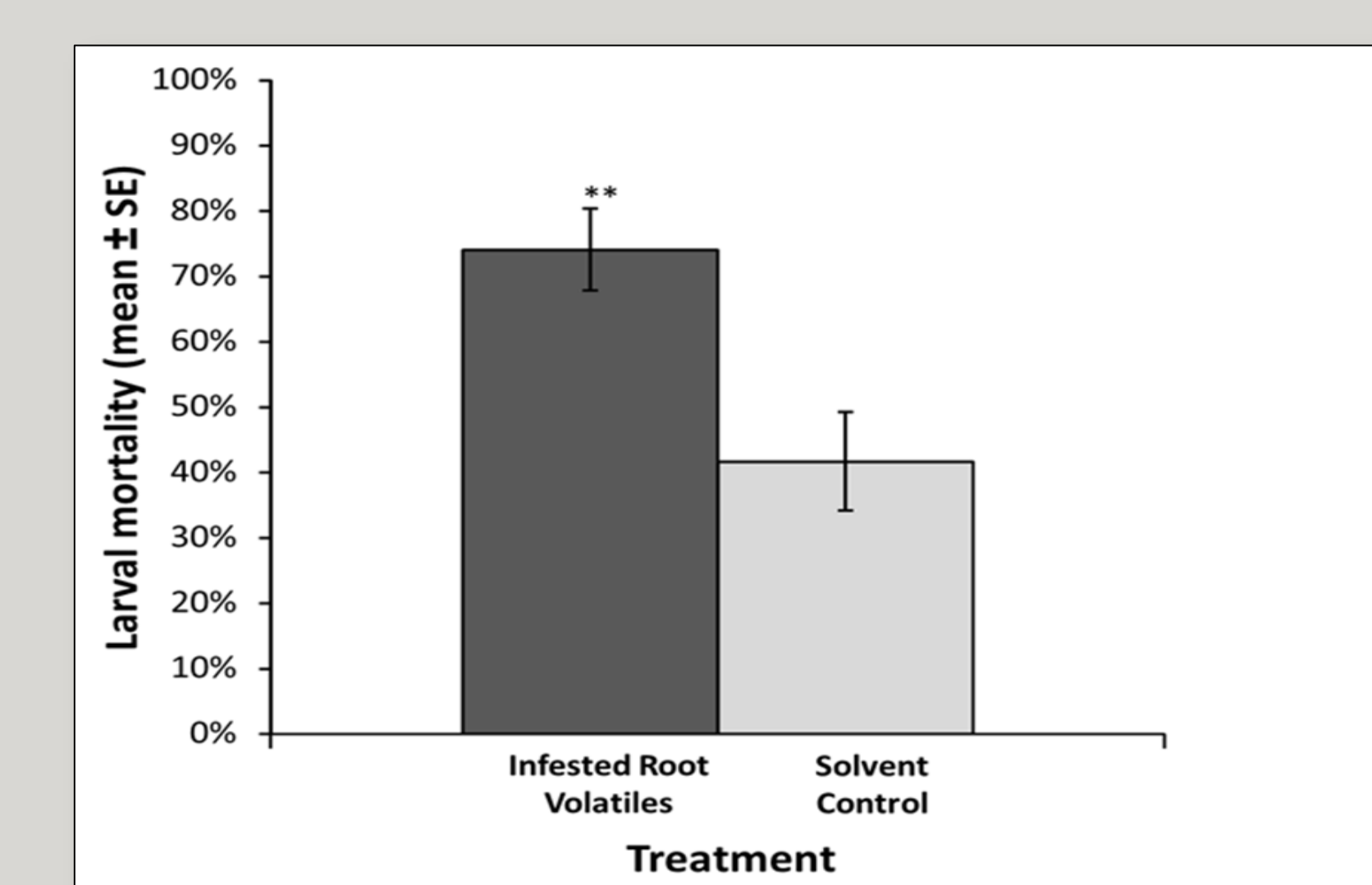
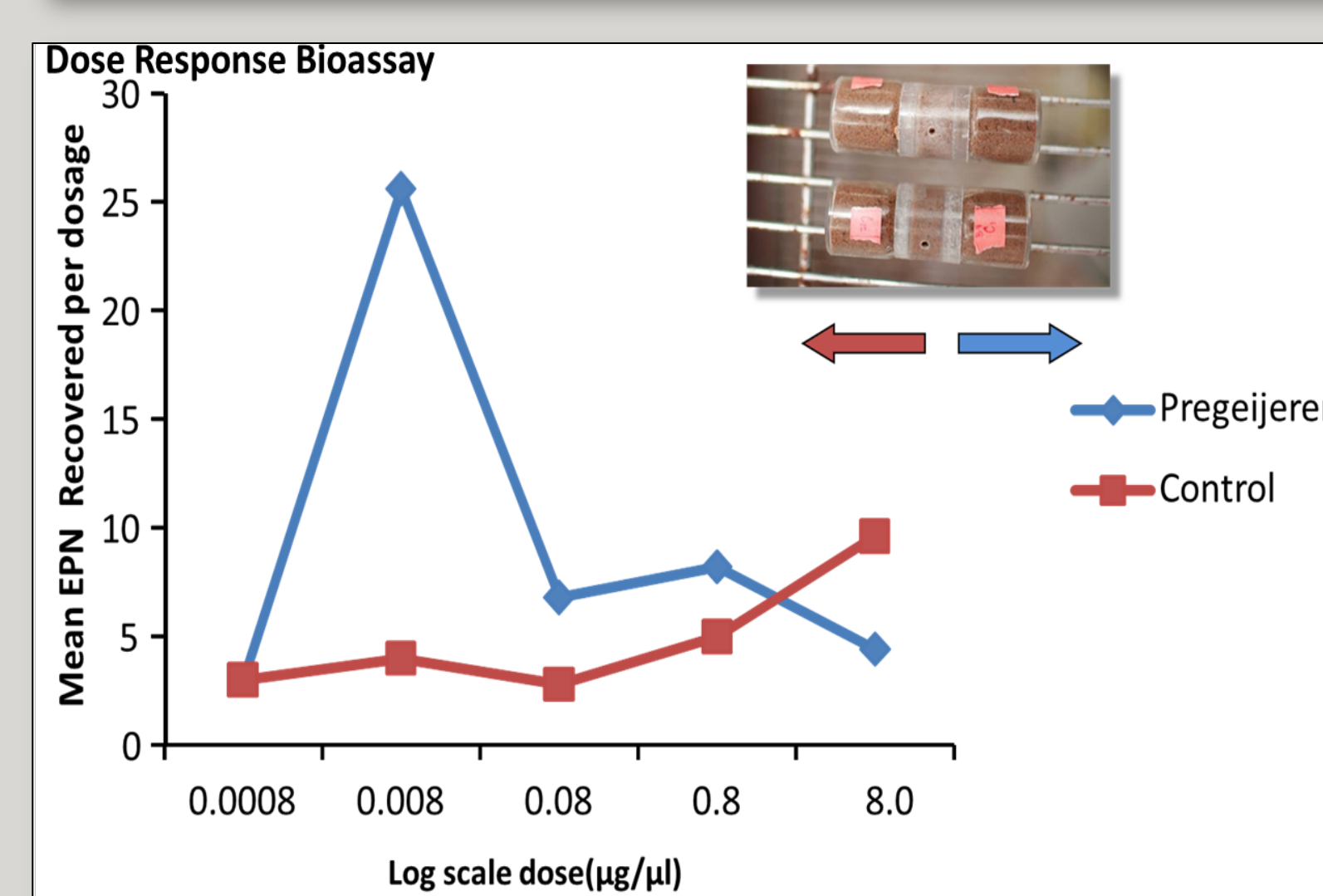
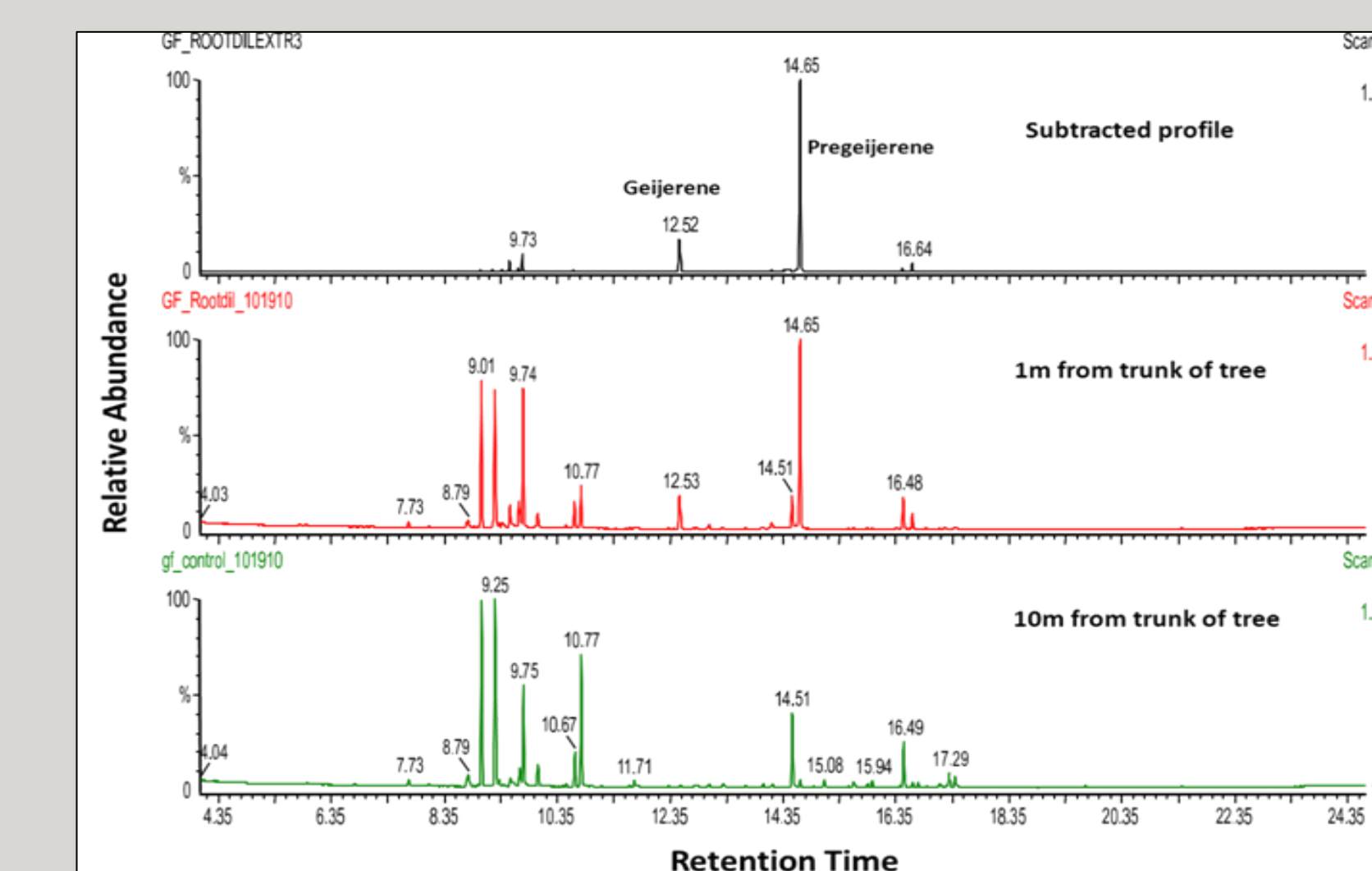
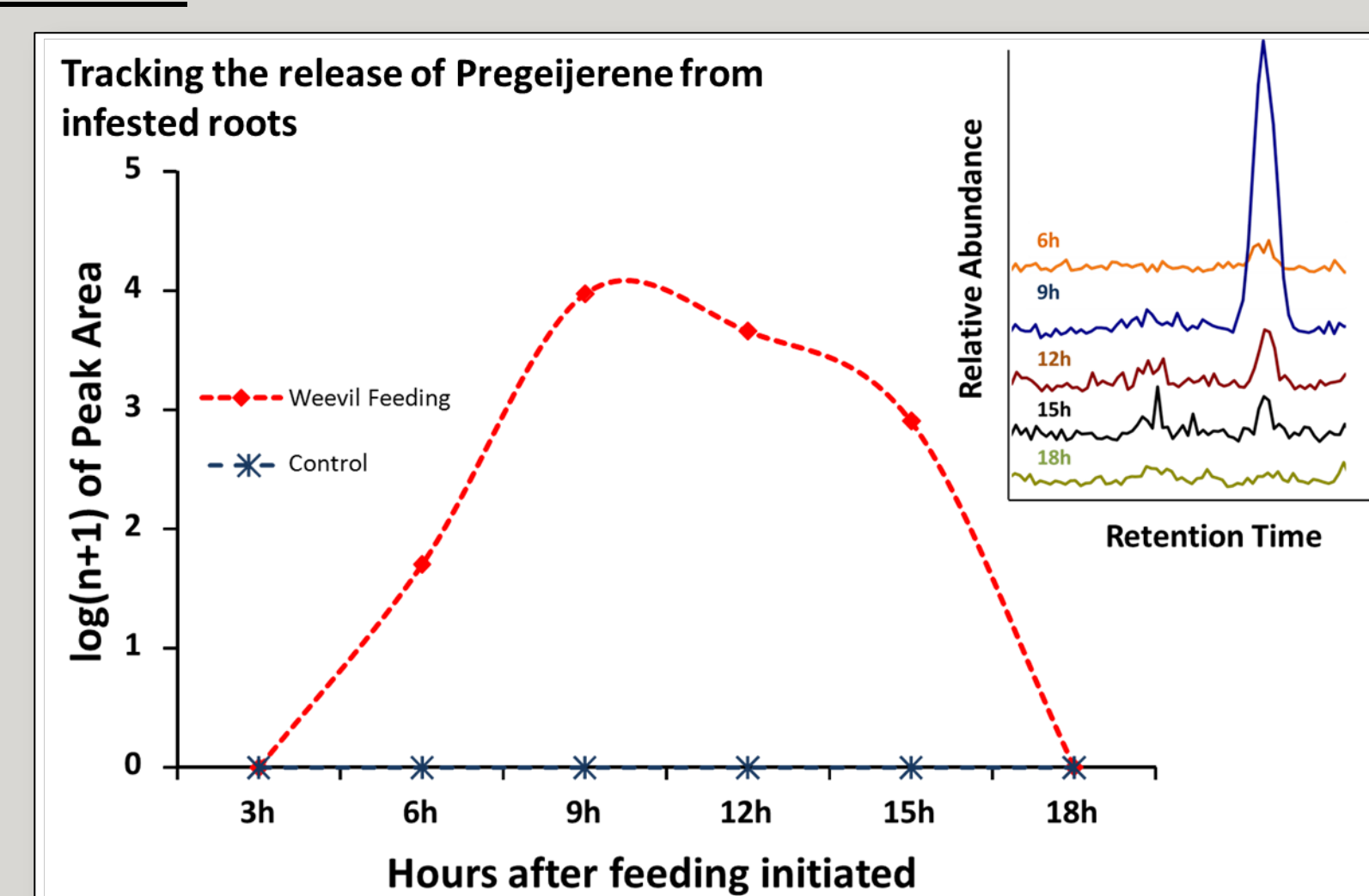
Bioassays: Response of entomopathogenic nematodes (EPNs) and insect larvae in choice assays.



Figure 2. Belowground olfactometers used to assay attraction.

Figure 3. Two-choice olfactometer used to assay additional herbivores influence host finding.

Results :



Chemical Analysis: Collection of volatiles from plant roots



Figure 4. Volatile collection systems used to sample in the lab and soil surrounding plant in the field.

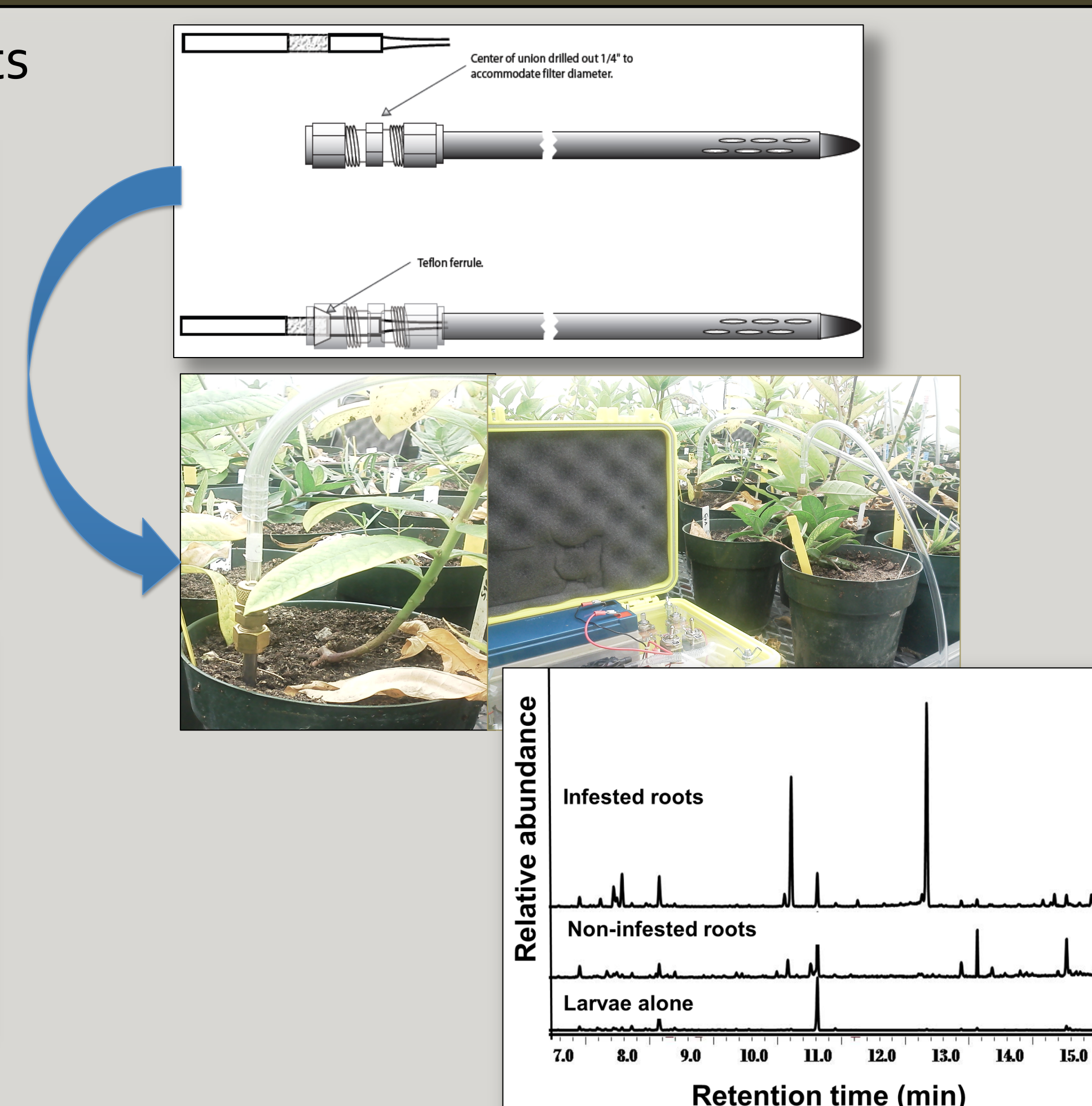


Figure 5. Volatile collection using soil probe resulting in various profiles.

Field Trials:

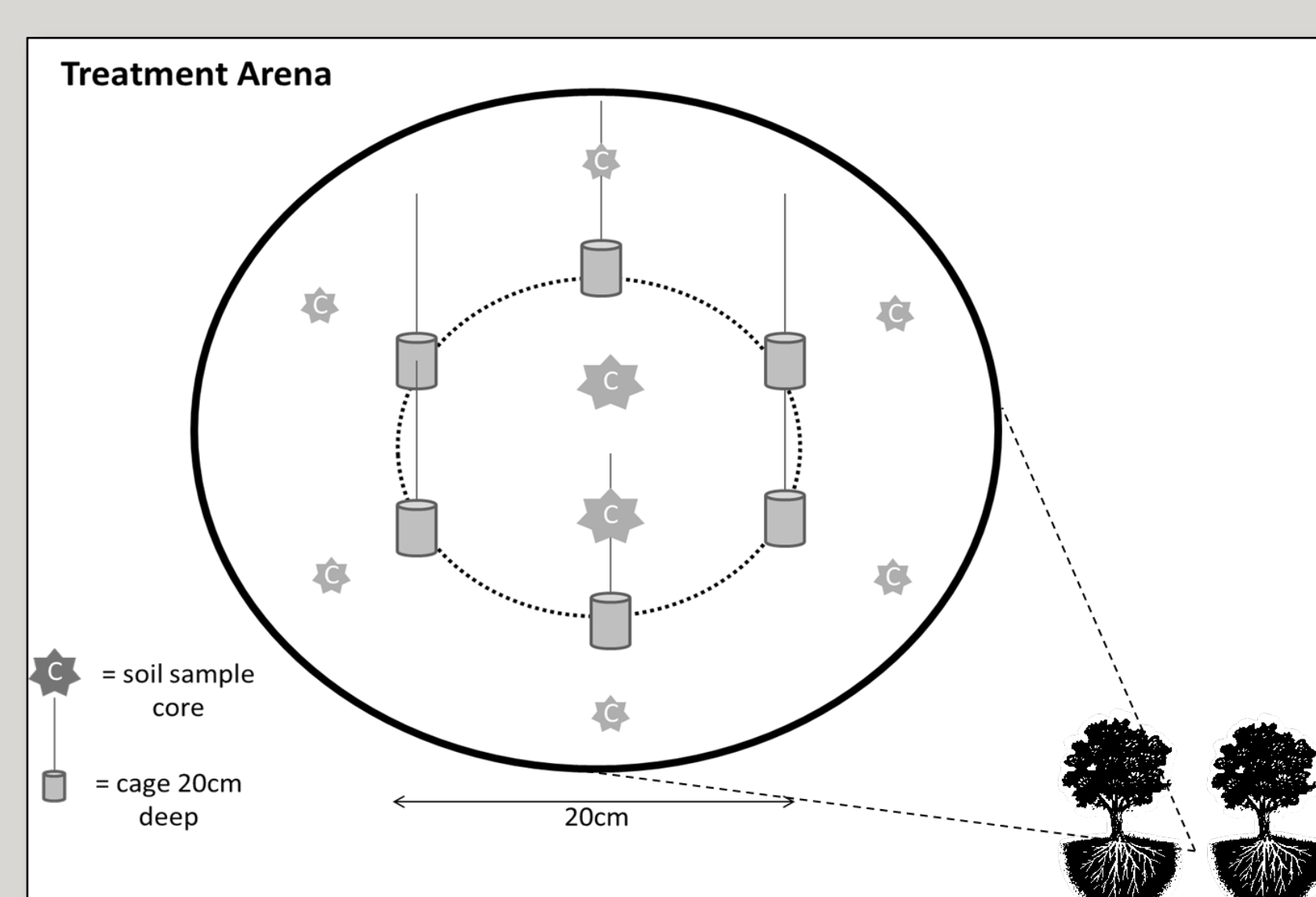


Figure 6. Bioassay arena for field experiment. Each cages buried 20cm belowground containing larva and either solvent control, infested root volatiles, or isolated pregejerene

Conclusions & Future Direction:

- We were successful in finding an induced cue that was shown to be attractive to various nematode species
- In field tests, the application of the compound increases the mortality of larvae by attracting EPN. However, additional competitors of EPN were also attracted
- Future work is necessary to evaluate if this attractant can protect plant roots so as to increase yield and the long term effect of plants that either do or don't release these signals (Ali & Agrawal 2014, Functional Ecology; Ali et al. 2013, Journal of Chemical Ecology; Ali et al. 2012 PLoS One; Ali et al. 2011, Journal of Ecology; Ali et al. 2010, Journal of Chemical Ecology)