

## ABSTRACT

# VERMICOMPOST SUPPRESSION OF *PYTHIUM APHANIDERMATUM* SEEDLING DISEASE: PRACTICAL APPLICATIONS AND AN EXPLORATION OF THE MECHANISMS OF DISEASE SUPPRESSION

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Composts, vermicomposts and their liquid extracts can suppress plant infections caused by a variety of pathogens, however this suppression is highly variable, which limits their use in commercial crop production. In addition to the inherent variability of these materials, conflicting information abounds in the industry and extension educational materials regarding liquid compost extracts which were critically evaluated with respect to the existing scientific literature. As a case study, non-aerated liquid vermicompost extract was produced that promoted seedling growth, consistently suppressed zoospore-mediated infections of *Pythium aphanidermatum* on cucumber and maintained suppressiveness for 60 days at room temperature. As both a liquid fertilizer and a cultural practice for the suppression of seedling damping off, this material could satisfy multiple needs for organic growers.

After decades of study, we still lack critical insight into the mechanisms of action of suppressive composts. We sought to uncover potential mechanisms by which vermicomposted dairy manure suppresses *Pythium aphanidermatum* infections on cucumber by investigating the interactions between seed-associated microbial communities and *P. aphanidermatum* zoospores. We found that vermicompost-derived

seed-colonizing microbes prevented the arrival of zoospores on the seed surface and greatly reduced infection in disease suppression bioassays. When microbially modified seed exudates were collected from the bioassay apparatus and exposed to zoospores *in vitro*, fewer zoospores swam towards, encysted on and germinated in response to exudates from seeds colonized by a suppressive microbial community than to those from seeds sown in sterile sand. Combining control and modified exudates failed to restore zoospore response, indicating the presence of a toxin or repellent confirmed by the consistent lysis of zoospores in the vermicompost and combined treatment, but not the sand controls. Exposing zoospores to control and modified seed exudates that had been ethyl acetate fractionated provided evidence that the putative toxin/repellent is exclusively present in the organic fraction.