EGU22-10834
https://doi.org/10.5194/egusphere-egu22-10834
EGU General Assembly 2022

Soil fauna modify plant growth-defence relationships through coordinating rhizosphere microbial interactions

Nan Jin, Xin Gong, Jiman Li, Xiaoyun Chen, Di Wu, Feng Hu, and Manqiang Liu
College of Resources and Environmental Sciences, Nanjing Agricultural University, Nanjing, China (nanj@stu.njau.edu.cn)

Soil fauna are now recognized as key components of soil and plant health, but how soil fauna modulates or even dictates plant stress responses remains unknown.Prior studies found the impacts of soil fauna on the plantprioritize either growth or defence depends on the feeding types of herbivores, suggesting that aboveground responses to herbivores and soil fauna are interconnected.However, the molecular and metabolism mechanism underlying this relationship is unclear.Theoretically, soil biotic interactions modified by soil fauna can drive above-ground responses, but there is still shortage of experimental evidence. Here, we aimed to test whether and how the plant survival strategies subjective to different feeding types of herbivores, were affected by rhizosphere microbial interactions exerted by soil fauna. We hypothesized that aboveground stress responses in plants can be orchestrated through coordinating belowground biotic interaction by soil fauna-root commensals.

First, we set out a complete factor design experiment under field condition by manipulating earthworms (*Metaphire guillelmi*) and the types of above-ground insects (cell-feeding, thrips: *Frankliniella occidentalis*; phloem-sucking, aphid: *Myzus persicae*). Soil physicochemical analysis and leaf RNA-seq were used to expound how earthworms dictates the trade-off between plant growth and defence. Second, to further explore the soil biotic-mediate pathway in the presence of earthworms. A microcosm experiment was performed by using a re-inoculated different soil community (obtained from 1000 and 20 μm sieves, respectively) collected from the field, with and without earthworms in the absence of herbivores. We used amplicon sequencing and plant metabolite analysis to elucidate how earthworm function by shaping rhizosphere biotic interactions.

We report here that belowground commensals can orchestrate aboveground stress responses in plants through biotic interaction. Earthworms suppressed thrips number, consistent with a resource-cost model. Contrary, earthworms promoted aphids’ number through the hormone antagonism model. Notably, soil biotic properties affected plant performance rather than soil abiotic properties mediated by earthworm. The microcosm experiment verified that rhizosphere microbial diversity and community structure shaped by earthworms reformed plant performance. In inoculated soil conditioned by earthworms, soil microbiome tended to be bacterial community towards primary metabolic processes, strengthening the interaction between fungi and bacteria in the rhizosphere. Further, the strengthened rhizosphere microbial interactions were increased

plant shoot biomass and soluble sugar accumulation but decreased JA content. Taken together, effects of soil fauna on plant growth-defence relationships depend on the feeding types of herbivores, mainly attributing to the shifts in rhizosphere microbial interactions. Phenotypic plasticity and aboveground stress responses in plants can therefore be governed by soil fauna-root commensals.