Master student internship

Effect of Collembolan on soil aggregation: a trait-based approach






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Context: Soils are a vital resource for humanity, providing essential ecosystem services such as food production, water filtration and carbon storage. But one third of the world soils are already in a state of degradation, much of which is caused by declines in the soil physical structure, modifying the transport of water, nutrients and gases, and habitats for the soil biota. Soil aggregates are micro- to millimetre sized organo-mineral associations considered as the building bricks of the soil structure. There is general understanding that soil aggregates are formed by the association of mineral primary particles, coupled together by organic debris or secretions, and rearranged by the movement of roots or soil organisms through the soil matrix. But precise mechanistic understanding of how the high diversity of the soil organisms interacting in complex food webs influences the formation and stabilization of aggregates is still lacking. Abundant groups, such as collembolan, have been largely neglected despite their high potential influence respectively by crawling, moving micrometric soil particles and incorporating large amount of organic matter into their fecal pellets and molts. As they feed in fungi, known for their important role in soil aggregation, an indirect role of Collembolan is as well expected through the modification of fungal growth and biomass, hyphae branching, or even fungal spore dispersion.

Scientific aim: The aim of this internship is to investigate how collembolan influence soil aggregate formation and properties. The student will focus on the trophic interaction between collembolan and fungi and test how a set of 3-4 collembolan species (*Heteromorus nitidus, Falsomia candida, Protaphorura armata*, *Mesaphorura sp.*), with different behaviors, interact with fungi and influence soil aggregation.

Methods: Fungal-Collembolan systems will be recreated in microcosms. A two-step inoculation protocol is planned, with fungi first added and then Collembolan, 2 weeks later. After 6-8 weeks of incubation, soils will be harvested and (1) sieved to assess the dry distribution of soil aggregates (from large macroagregates > 2 mm to microaggregates < 250 µm), (2) tested for the macroaggregate stability in water (fast & slow wetting) and (3) for selected fractions, hydrophobicity will be measured (contact angle). Some relevant Collembolan traits with potential influence on soil aggregation will be determined together with the student and measured (e.g ability to transport particles, fecal pellet size and quantities, duration between molting events, ability to reduce fungal growth and/or to induce an increase in hyphae branching) All devices and equipment needed is already available (glass jars, sieves, sterile flow, incubation chamber). Collaborations are currently set to gather 4 Collembolan cultures (2 are already

available). The student will benefit from on-going collaborations with Prof. Dr. Rillig (Berlin), Prof. Dr. Carminati (Bayreuth) and Prof. Dr. Cortet (Univ Paul Valéry Montpellier 3), as well as from the research network TEBIS aiming at promoting a trait-based approach for the soil organisms.

Keywords: Soil structure, Soil ecology, Mesofauna, Fungi, soil organismal traits

Period of time: 5 to 6 months in the period from January to September 2018 – to be discussed with the student

For master 2 students, possibilities to carry on with a PhD in partnership between Prof. Dr. J. Cortet (Univ Paul Valéry Montpellier 3) and the lab of Prof. Dr. Scheu (Göttingen).