

## Collembolas For Biocontrol?

The potential loss of methyl bromide fumigants is forcing us to take a harder look at biocontrol of soil pathogens. As discussed in the Section on Soil Management Plans, nursery soils are a complex of physical, chemical, and biological factors. The possibility of biological control has not been thoroughly investigated in forest and conservation nurseries, but the future direction of disease management is likely to involve increasing the biological density and diversity of beneficial organisms in nursery soils. Fumigated soils are "brittle" because the balance between pathogens and beneficials has been seriously disturbed.

The change from a simplified soil ecosystem managed by periodic fumigation to a healthy soil ecosystem where pathogens are limited by natural dynamics requires greater understanding of the soil microorganisms and a more holistic approach to management. Most biological control research regarding pathogenic soil fungi has focused on bacteria or beneficial fungi while soil animals have been largely ignored.

Many small animals, especially the collembolans, are mycophagous and feed on fungi associated with plant roots. Collembolans are small [0.5 to 8 mm (0.02 to 0.31)] wingless insects that are found in virtually all soils, and over 5,000 species have been described. Along with mites, they are the most abundant arthropods in soil. They are known as springtails due to the presence of the furculum on their abdomen, which serves as a spring and allows them to jump away from predators (Figure 1).

Collembolans are especially common in the rhizosphere, where fungal food sources are readily available. Several species are active feeders on pathogenic soil fungi such as *Fusarium* spp. and thus, there is a potential for biocontrol. Tests in Japan have demonstrated effective management of *Fusarium* on cucumbers by the collembolan *Sinella curviseta*. Examination of gut contents of collembolans from pot cultures have revealed that they also eat mycorrhizal fungal hyphae and spores. In natural soil systems, however, collembolans are very selective and feeding preference studies found that they preferred conidial forming fungi, such as *Fusarium*, and did not damage

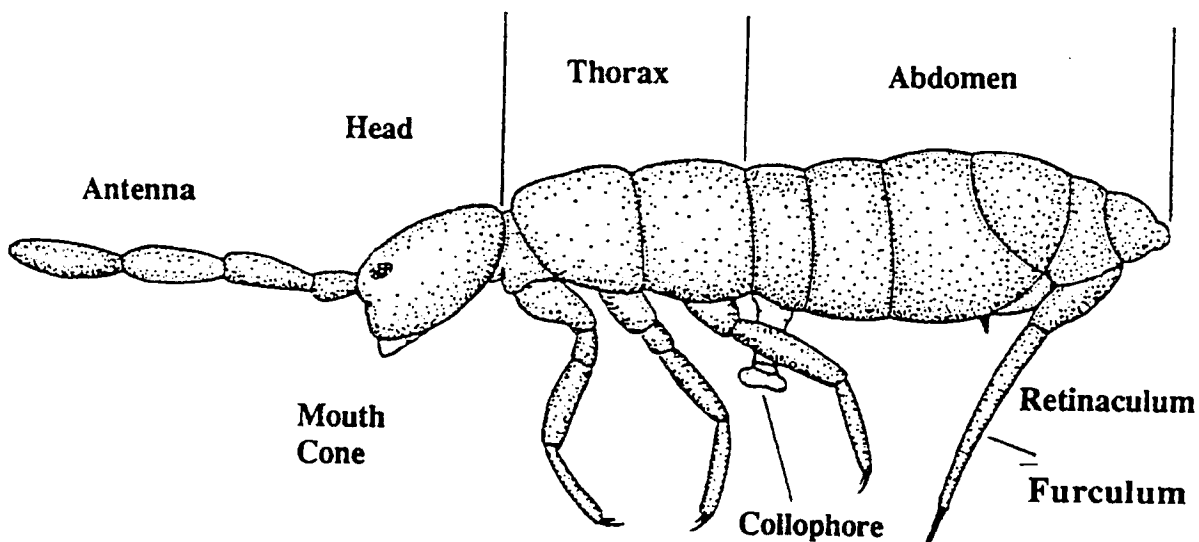


Figure 1. A typical Collembola, or springtail (modified from Eisenbeis and Wichard, 1987)

mycorrhizae. The best possibilities for biocontrol may involve a combination of collembolans and beneficial soil fungi. *Rhizoctonia solani* on cotton was suppressed by a combination of three biocontrol fungi, *Trichoderma harzianum*, *Gliocladium virens*, *Laetisaria arvalis* and the collembolan *Proisotoma minuta*.

Further research is needed to identify the appropriate collembolan species that feed on a particular fungal pathogen, and to manage the soil environment to facilitate suppression. Collembolans have been shown to be sensitive to changes in soil structure, temperature, water content, and pH and so the challenge will be to maintain an attractive soil environment: high organic matter, good soil structure, and moist water content. A better understanding of natural control mechanisms, such as collembolans and beneficial soil fungi, will allow nursery managers to maintain a healthy soil micro-environment and less the need for chemical control.

**Source:**

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Nakamura, Y.; Matsuzaki, L; and Itakura, J. 1992. Effect of grazing by *Sinella curviseta* (Collembola) on *Fusarium oxysporum* f. sp. *cucumerinum* causing cucumber disease. *Pedobiologia* 36: 168-171.