

Aboveground endophyte affects root volatile emission and host plant selection of a belowground insect

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1. Plants emit specific blends of volatile organic compounds (VOCs) into the environment that serve as multitrophic, multifunctional signals. Fungi colonising aboveground or belowground plant structures are known to modify such VOC patterns, thereby altering the information content for aboveground insects. Whether aboveground microbes can affect the emission of root volatiles and play a role in the foraging decisions of belowground herbivores remains unresolved. 2. The endophytic fungus *Neotyphodium uncinatum* colonizes the aerial parts of the grass hybrid *Festuca pratensis* x *Lolium perenne* and is responsible for the presence of insect-toxic loline alkaloids in the roots. We investigated whether *N. uncinatum* affects the host location behaviour of the root feeding beetle *Costelytra zealandica* by carrying out belowground olfactometer experiments to assess the gustatory and olfactory choices the larvae. Root volatiles of infected and uninfected plants were analysed by gas chromatography - mass spectrometry (GC-MS) and proton-transfer-reaction mass spectrometry (PTR-MS). 3. Grubs of *C. zealandica* were more attracted to roots from uninfected than from endophyte-harboured grasses. Likewise, larvae showed a clear feeding preference for uninfected plants. This correlated with lower root VOC production in endophyte-infected grasses but higher carbon dioxide emission. 4. The results show that soil insects can use root volatiles to assess host plant quality and furthermore demonstrate that fungi colonizing aboveground plant parts may influence the behaviour of belowground herbivores.

