Fungal endophytes decrease aphid performance in grasses: effects on virus transmission?

Päivi Lehtonen[1)], Kari Saikkonen[2)] and Marjo Helander[1)]
[1]University of Turku, Section of Ecology, Department of Biology, Turku, Finland
[2]MTT Agrifood Research Finland, Plant Production Research, Jokioinen, Finland
Correspondence to: patule@utu.fi

Systemic grass fungal endophytes have been suggested to form a mutualistic relationship with their host plants (Clay 1988). Endophytes live asymptomatically within the host tissues, receiving protection, nutrients, and vertical transmission to the next plant generation via host seeds. The plant may benefit from endophyte infection through improved drought and flooding tolerance, increased biomass production and improved herbivore resistance, resulting in the improved competitive ability of endophyte-infected individuals compared to uninfected conspecifics. Grass endophytes were first noted because they caused health disorders in livestock grazing on infected forage in the USA and New Zealand in the mid-20th century (Ball 1993). Grass endophytes have been shown to be able to produce toxic alkaloids, thereby negatively affecting a wide variety of invertebrate and vertebrate herbivores (Schardl and Phillips 1997). The focus of endophyte studies has been on tall fescue (*Festuca elatior* = *Festuca arundinacea*) and mostly, on its cultivar Kentucky 31.

We examined how endophyte infection and nutrient availability affects the performance of bird-cherry aphid (*Rhopalosiphum padi*) in meadow fescue (*Lolium pratense* = *Festuca pratensis*). Endophyte infection drastically reduced aphid survival and reproduction in our study. The negative effects of endophyte infection appeared to be conditional on the amount of nutrients available in the soil; aphid survival and reproduction decreased considerably when host plants were fertilized. This presumably indicates improved ability for investment in nitrogen-based alkaloid mycotoxins. These results focus attention on the importance and applicability of endophytic fungi in the agronomic arena. In contrast to their role in animal disorders, which cause considerable and widespread economic losses in the USA and New Zealand, endophytes could have a positive economic value when applied to agricultural practises. The direct antiherbivore properties of endophytes can be exploited for instance in biocontrol, through the development or improvement of herbivore-resistant cultivars by endophytes.

Barley yellow dwarf viruses (BYDVs) are aphid-transmitted viruses, which have worldwide distributions and infect species from all subfamilies of the Poaceae. *R. padi* is an important vector species of BYDV. We are interested in the interactions between BYDV, endophyte infection and aphids, and presently conducting experiments in greenhouse and field to find out whether endophyte infection inhibits virus transmission. In preliminary field experiments we have detected differences in virus incidences between endophyte-infected and uninfected *L. pratense,* indicating lower virus frequencies in endophyte-infected plants.

References

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