

Infection frequencies, alkaloid content and characteristics of *Epichloë festucae* var. *lolii* in *Lolium perenne* within German grasslands along a land-use intensity gradient

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Perennial ryegrass (*Lolium perenne*) is a dominant cool-season grass species in Germany. It is native in Germany but is also often a component in commercially available seed mixtures on the German market, with numerous grass varieties for turf and pasture. Native and bred varieties can be colonised by the symbiont *Epichloë festucae* var. *lolii*, but the infection frequencies and alkaloid concentrations in German grasslands along a land-use intensity gradient are unknown.

In 2014, and again in 2017, we sampled 150 grassland sites in three German regions covering a north to south gradient. Analyses of *L. perenne* were performed to detect *E. festucae* var. *lolii* using different methods as well as alkaloids using HPLC-MS. The average infection frequencies of the endophyte were between 13-15% of individuals, with no detections in approximately 30% of *L. perenne* populations. Concentrations of the vertebrate toxic compound lolitrem B were in 5% of the individual grass samples above published toxicity thresholds for vertebrates (>2 µg/g), while concentrations of the alkaloid ergovaline were below toxicity thresholds of 0.3 µg/g. The

insect toxic/detering alkaloid peramine was in 12% of individual grass samples above published toxicity thresholds (>3 µg/g). On a population level of *L. perenne* all grassland sites had alkaloid concentrations clearly below published toxicity thresholds. As the German grasslands were also not monocultures, a toxification of livestock is improbable. Land-use intensity of grasslands had no effect on infection rates or alkaloid content. A characteristic of *E. festucae* var. *lolii* in the German grasslands is that the dmaW gene for the ergovaline synthesis is often missing. Another reason, why toxification of livestock in German grasslands is improbable. Depending on climate warming, which could enhance infection rates and alkaloid content and depending on the introduction of *L. perenne* varieties with genetically different strains of *E. festucae* var. *lolii*, the currently low toxification risk might change in the next decades. Regular surveys of infection rates and alkaloid content in grasslands across Germany once per decade seems an appropriate strategy to monitor changes.