

Effects of the Botanical Composition and Weather Conditions on Mycotoxins in Winter Forage from Grassland

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Abstract

The paper focuses on possible effects of the botanical composition and weather conditions on the extend of zearalenone and ochratoxin A concentrations in various grass swards in winter pasture systems. Zearalenone is only detectable in pure stands of *Lolium perenne* or in *Lolio-Cynosuretum* plant communities, respectively. The occurrence of ochratoxin A is more frequent and less specific concerning the botanical composition. This mycotoxin was found in both, *Lolium perenne* and *Festuca arundinacea* in varying years. The incidence of ochratoxin A depends on year and is apparently related to the weather conditions in autumn and winter. There was no evidence that particular locations have a higher or a lower risk for high ochratoxin A or zearalenone concentrations than others. Peak values in individual swards are not intermittent over the years.

Keywords: winter pasture, botanical composition, ochratoxin A, zearalenone

Introduction

In Central European grassland mycotoxins are usually not detectable in herbage of spring and summer growth, but in the course of the growth period it is more likely that toxins like zearalenone and ochratoxin A occur (Opitz v. Boberfeld et al. 2000). Regarding animal health, this could pose a problem for low-input grassland systems, where the extension of the grazing period or year-round outdoor-keeping could improve productivity by reducing costs for conserves and stables (Opitz v. Boberfeld & Sterzenbach 1999, Opitz v. Boberfeld, W. 2000). Quality aspects like energy concentration and crude protein of winter pasture herbage apparently fulfil the requirements for suckler cows at least until December, assuming an adequate management (Opitz v. Boberfeld & Wolf 2002, Opitz v. Boberfeld & Wöhler 2002). This paper focuses on the problem of forage spoilage by fungal contamination in different grass swards used in winter pasture systems.

Materials and Methods

Two experiments were established to investigate the possible effects of the botanical composition and weather conditions on the extend of mycotoxin concentrations in various grass swards in autumn and winter. Pure stands of *Festuca arundinacea* and *Lolium perenne* were observed under standardized conditions in experiment 1, experiment 2 was focused on mixed swards considering the plant communities *Lolio-Cynosuretum* and *Festuco-Cynosuretum* in ten different locations in altitudes from 320 to 475 m above sea level. In both experiments, samples of three successive years were analysed to compare the effects of different courses of weather. The samples were taken mid of December. There was not any harvest between mid of June and this date to obtain sufficient winter yield. The concentrations of zearalenone and ochratoxin A were determined by HPLC using a immuno-affinity column at a flourescence detector (Anonymus 1993). The ergosterol concentration in herbage was measured by HPLC at an UV detector after saponification in petrolether (Schwadorf & Müller 1989, Anonymus 1993). Ergosterol is a substance that mainly occurs in fungi used to estimate the extend of fungal infections.

Results and Discussion

In comparison of the pure stands of the two grass species the **extend of fungi infection** (see figure 1) – estimated by the concentration of **ergosterol** – was higher for *Lolium perenne* than for *Festuca arundinacea*. Apparently, structural differences influence the extend of fungal infections. The more erect growth type of *Festuca arundinacea* in combination with its solid fibre component with silicate inclusions reduces the penetration in tissue by fungi, whereas flattened *Lolium perenne* leaves in ground level lay themselves more open to attack and generate a suitable micro climate for fungi.

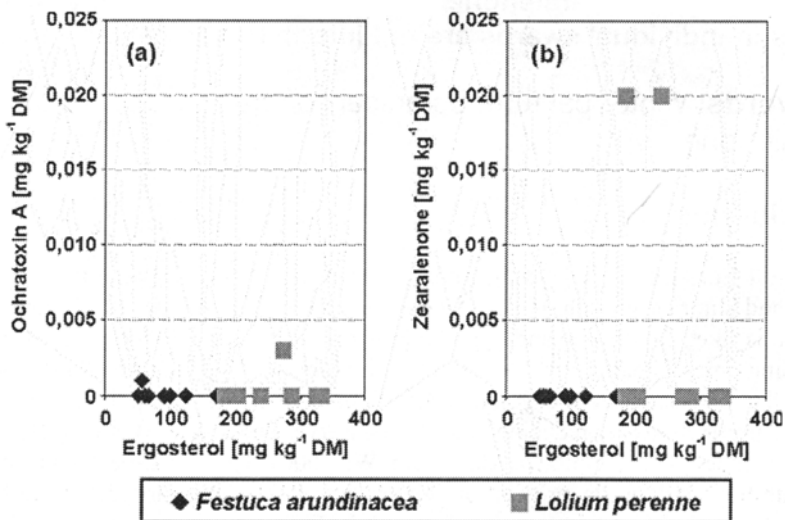


Figure 1: Comparison of ergosterol concentrations with concentrations of ochratoxin A (a) and zearalenone (b)

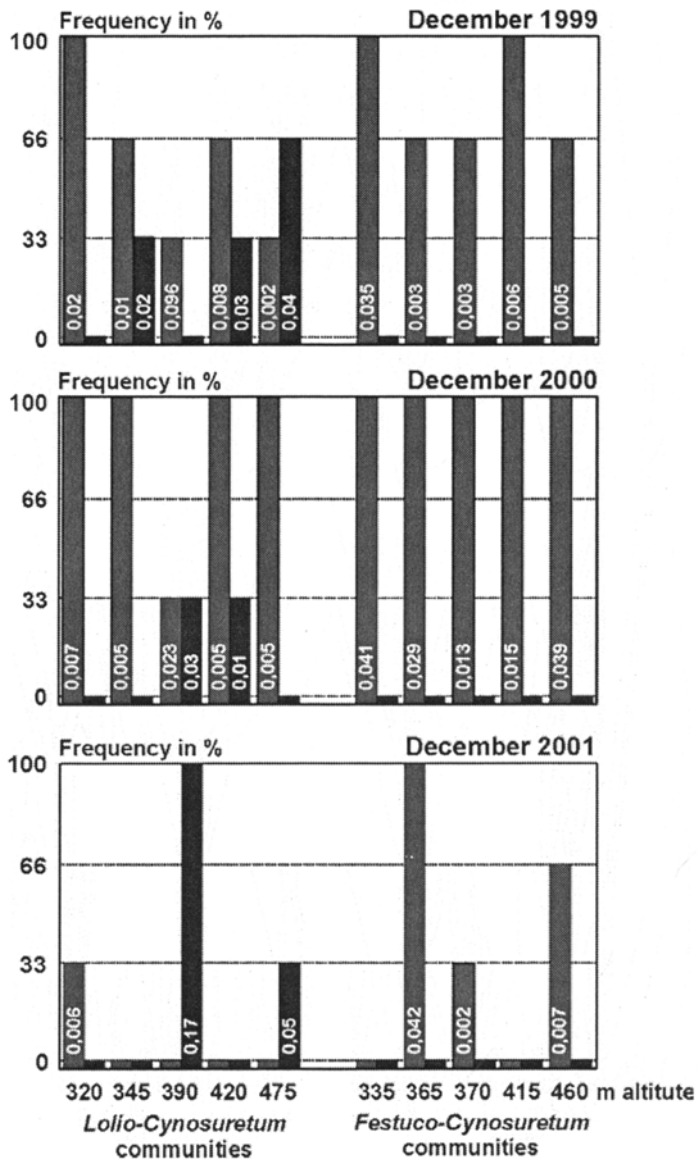


Figure 2: Incidence and maximum concentrations [mg kg⁻¹ DM] of ochratoxin A and zearalenone in two pasture plantcommunities in different locations

Analogously, the *Lolio-cynosuretum* communities, with usually high proportions of *Lolium perenne*, are more liable to fungi infections than *Festuco-Cynosuretum* plant communities (Data not shown). However, high amounts of ergosterol are no indication for high mycotoxin concentrations in herbage (figure 1). Zearalenone is only detectable in pure stands of *Lolium perenne* or in *Lolio-Cynosuretum* plant communities (figure 2), respectively. The occurrence of this toxin in individual

swards is not intermitted over the years. Swards with relatively high zearalenone concentrations might have non-detectable values twelve months later. The occurrence of ochratoxin A is more frequent and less specific concerning the botanical composition. Regarding the pure stands (figure 1) this mycotoxin was found in both, *Lolium perenne* and *Festuca arundinacea* in varying years. The incidence of this toxin in mixed swards (figure 2) is apparently related to the weather conditions in autumn and winter. After the relatively moist and mild course of weather before December 2000 ochratoxin A was found in the majority of the samples whereas it was only detectable in few samples in 2001 with a more dry summer and a cool November and December. There was no evidence that particular locations have a higher or a lower risk for high ochratoxin A concentrations than others. This could be emphasized by the sward with maximum concentration (=0,096 mg ochratoxin A kg⁻¹ DM) in 1999 and null detection in 2001. In conclusion, mycotoxins have the potential decrease the forage value of forage from winter pastures. The prediction of health hazards for particular swards or locations is hardly possible because of external effects (e.g. course of weather).

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*Presented at the 25th Mykotoxin-Workshop in Giessen, Germany,
May 19-21, 2003*