Investigations on asparagus spears during the main harvest in regard to infections by endophytic fungi and a contamination by mycotoxins

Goßmann, Monika[1]; Beran, Franziska[1]; Plenk, Astrid[2], Oehlinger, R.[3]; Humpf, H.-U.[4] and Büttner, Carmen[1]

[1]Humboldt-University of Berlin, Institute of Horticultural Science, Department of Phytomedicine, Lentzeallee 55-57, D-14195 Berlin

[2]AGES, Institut of Plant Health, Spargelfeldstr. 191, A-1226 Wien

[3]AGES; Competence Center Chemistry, Wieningerstr. 8, A-4021 Linz

[4]University of Münster, Institute of Food Chemistry, Corrensstr. 45, D-48149 Münster

Introduction

Heavy endophytic contamination of crowns, roots and stems with pathogenic *Fusarium* species was detected in diseased new and established stands of asparagus in Germany and Austria in the spring and fall of 2000. *F. oxysporum* was the dominant *Fusarium* species, followed by *F. proliferatum* (Fig. 1), then *F. sambucinum*, *F. culmorum*, and *F. avenaceum*, among others. Fumonisin B_1 (FB_1) concentration in nine out of ten *F. proliferatum*-infected asparagus spears collected from several mature, declining stands in southern Germany at the beginning of July 2001 ranged from 36 to 4514 µg/kg (dry weight basis). The purpose of the current two-year project was to determine the occurrence of entophytic infection of asparagus spears by *F. proliferatum* and other *Fusarium* spp., and to determine the contamination frequency and concentration of FB_1 in infected spears.

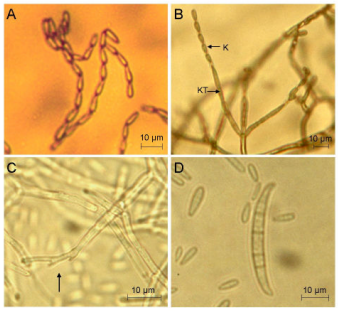


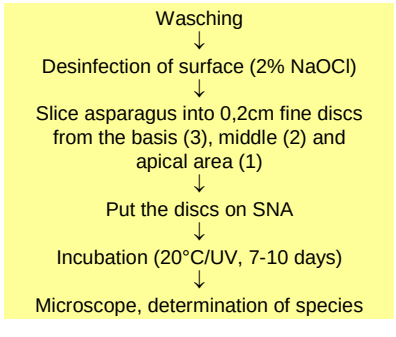
Figure 1: Microconidia in chains (A, B), polyphialide (C), and macro- and microconidia (D) of *F. proliferatum.*

Materials and Methods

Samples of spears of harvestable length were collected from plant crowns at five field locations in Austria (Table 1) during the main harvest periods in May and June of 2003 and 2004. Samples were collected at up to 25 sampling locations in each of the five fields according to a standard protocol; sample locations were separated from one another by at least 75m. Sample preparation (Fig. 2) in the laboratory was followed by incubation and morphological identification of fungi. The concentration of FB_1 in *F. proliferatum*-contaminated spears was determined by HPLC in 2003 and LC-ESI-MC in 2004.

Table 1: Variety, planting year, preceding crops, planting method, mulching method and soil type of the five fields sampled in 2003 and 2004.

Location	Variety	Plant. year	Proceding crops	Planting and mulching methods	Soil type
1	Gijnlim, Backlim	1995	cereals	Asparagus (green)	sand
2	Spaganiva	1995	Chinese cabbage, Lucerne	Asparagus (green)	black earth
3	Boonlim	1996	Wheat, Maize,Beet	Asparagus (white, foil)	loess
4	Boonlim	1994	Wheat, Potato	Asparagus (white, foil), Asparagus (green)	black earth
5	Gijnlim, Vulkan	1996	Wheat, Maize,Beet	Asparagus (white, foil), Asparagus (green)	sand



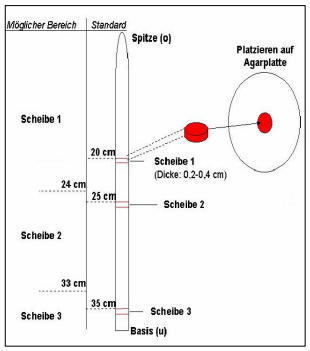


Figure 2: Procedure for sample preparation and species determination by morphological examination by light microscopy.

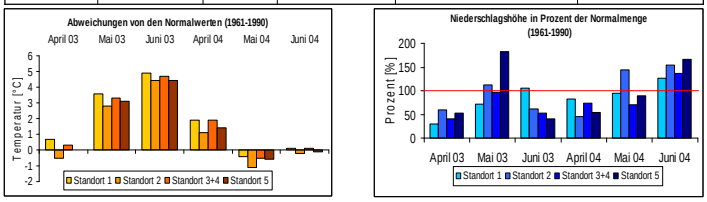


Figure 3: Weather data at the sample locations during asparagus harvest in 2003 and 2004

Results

In total, ca. 800 asparagus spears from the 2003 and 2004 main harvest period at five Austrian production fields were examined for the presence of endophytic fungi. The dominant *Fusarium* species was *F. oxysporum* (Table 2). Incidence of *F. proliferatum* ranged from seven to 37%, and was strongly dependant on location and sampling date. *F. sambucinum*, *F. culmorum* and *F. avenaceum* were identified in up to 10% of the spears examined, depending on location (Table 2). HPLC and LC-ESI-MC analyses revealed average Fumonisin B_1 levels of 10 and 30 µg/kg, respectively (Figs. 4 and 5).

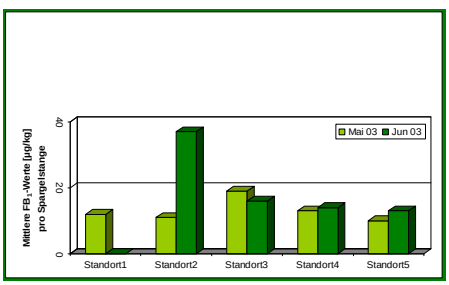


Figure 4: Median Fumonisin B_1 values (HPLC) in *F. proliferatum*-infected asparagus spears in 2003.

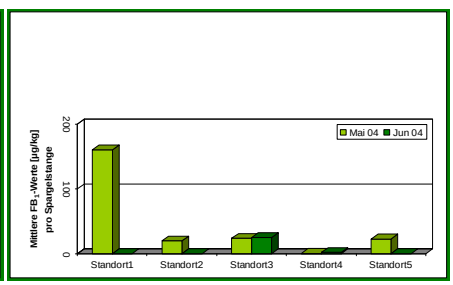


Figure 5: Median Fumonisin B_1 values (LC-ESI-MC) in *F. proliferatum*-infected asparagus spears in 2004.

Table 2: Incidences of identified *Fusarium* spp. in asparagus spears (n=790) examined at time of harvest in 2003 and 2004.

***Fusarium*-Art**	Location 1 (n=153)	Location 2 (n=189)	Location 3 (n=184)	Location 4 (n=150)	Location 5 (n=114)
F.oxysporum	**20%**	**21%**	**82%**	**80%**	**67%**
F. proliferatum	**7%**	**7%**	**37%**	**20%**	**5%**
F. culmorum ***F. sambucinum***	**0**	**6%**	**0**	**11%**	**9%**
F. avenaceum	**7%**	**0**	**0**	**0**	**0**
F. spp.	**10%**	**6%**	**9%**	**0**	**0**

Literatur

[1] Goßmann, M., Büttner, C., Bedlan, G. (2001): Untersuchungen zum Spargel (*Asparagus officinalis* L.) aus Jung- und Ertragsanlagen in Deutschland und Österreich auf Infektionen mit *Fusarium*- Arten. Pflanzenschutzberichte 59, 45 - 54.

[2] Seefelder, W., Goßmann, M. and H.-U. Humpf (2002): Analysis of Fumonisin B_1 in *Fusarium proliferatum* infected asparagus and garlic tubers from germany by liquid chromatography/ elektrospray ionisation-mass spectrometry, Journal of Agriculture and Food Chemistry 50 (10), 2778-2781.