

## ***Sustainable systems of cereal crop protection against fungal diseases as the way of reduction of toxin occurrence in food webs***

Kroměříž, Czech Republic, 3-6 July, 2001

Organized by Agricultural Research Institute Kroměříž Ltd.

### ***Presentation***

*The Conference “Sustainable systems of cereal crop protection against fungal diseases as the way of reduction of toxin occurrence in food webs” took place at the Agricultural Research Institute in Kroměříž (Czech Republic), 3-6 July 2001. This was a unique opportunity for scientists deeply involved in basic and applied research on fungal diseases of cereals, mainly wheat and barley, which are widely grown in Northern and Eastern Europe, to meet and to compare their results. The main purpose of this Conference was to analyze all the possible approaches to control the fungal diseases of these crops. Epidemiological survey and identification of the pathogens are basic steps for further research and the results obtained in several countries were presented and discussed. The results of different approaches to control fungal diseases, with particular attention to pathogens producing mycotoxins, which are dangerous contaminants of food chain for human and animal consumption, were also presented, as oral and poster presentations.*

*The success of the Conference was assured by the large, active and friendly participation of researchers from different countries which have found in Kroměříž the right atmosphere and to whom our warm thanks are given.*

**Luciana Corazza, Ludvik Tvarůžek**

## **Sistemi sostenibili di protezione dei cereali contro le malattie fungine come mezzo di riduzione di tossine nella catena alimentare**

Kroměříž, Repubblica Ceca, 3-6 Luglio 2001

### **Presentazione**

La Conferenza “Sistemi sostenibili di protezione dei cereali contro le malattie fungine come mezzo di riduzione di tossine nella catena alimentare”, si è tenuta a Kroměříž, nella Repubblica Ceca, 3-6 Luglio 2001. È stata un’occasione davvero importante per ricercatori con notevole esperienza nella ricerca di base ed applicata sulle malattie dei cereali, con particolare riferimento a frumento e orzo, coltivati su ampie superfici nell’Europa del Nord e dell’Est. Lo scopo principale di questa Conferenza è stato quello di analizzare le diverse possibilità di lotta contro le malattie fungine dei cereali. Il rilievo epidemiologico e l’identificazione degli agenti patogeni è un approccio fondamentale e, a tal riguardo, sono stati presentati e discussi i risultati ottenuti nei diversi Paesi. Sono stati inoltre presentati, come poster o comunicazioni orali, i risultati di diversi metodi di lotta contro le malattie fungine, con particolare attenzione per i patogeni che producono micotossine, pericolosi contaminanti della catena alimentare per uomini e animali.

Il successo della Conferenza è stato assicurato da un'ampia, attiva e amichevole partecipazione di ricercatori di diversi Paesi, che hanno trovato a Kroměříž l'atmosfera adatta e ai quali va il nostro più sentito ringraziamento.

**Luciana Corazza, Ludvik Tvarůžek**

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## **PRESENTATIONS** (in alphabetical order of presenting authors)

Petria **12**(1-2), 7-12, (2002) Atti del Convegno/*Proceedings of the Conference*

### **A DNA sequence approach to determine the global genetic structure of *Mycosphaerella graminicola***

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A phylogenetic approach to investigate the genetic population structure of the wheat pathogen *Mycosphaerella graminicola* was used. Leaf blotch is caused by the anamorph of *M. graminicola*, *Septoria tritici*, and is an important disease that can result in significant yield losses. Most population studies done on *Septoria* diseases and similar pathogens are based RFLP markers or dominant markers like RAPD or other fingerprinting techniques (McDONALD *et al.*, 1999). In order to understand the evolutionary history of these pathogens, genetic markers that contain more phylogenetic information are needed. In this study, we used DNA sequences which give information with the ultimate precision. Constructing genealogies from DNA sequences can give detailed information regarding evolutionary events (Walker and Avise, 1998). For the present study we used DNA sequences from two known genes, the Beta-tubulin which encodes a component of microtubules and 4-hydroxyphenylpyruvate dioxygenase (HPPD) an enzyme in the melanin biosynthesis pathway. In addition, sequences were obtained from an anonymous RFLP locus used in previous studies of global genetic structure. These three markers were selected because of the high variability found for the specific region sequenced. A total of 192 isolates representing 14 different field populations from around the world were sequenced using about 500 base pairs for each locus.

**Key words:** Wheat, *Mycosphaerella graminicola*, Ascospores, Population genetics.

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Petria **12**(1-2), 13-19, (2002) Atti del Convegno/*Proceedings of the Conference*

### **Quinoxifen – sensitivity monitoring and cross-resistance patterns of wheat powdery mildew (1995 – 2000)**

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An European monitoring programme with quinoxifen for wheat powdery mildew, *Erysiphe graminis* f. sp. *tritici*, was carried out between 1995 and 2000. The mean EC50 values established by year were 0.060 mg/l in 1995, 0.052 mg/l in 1996, 0.071 mg/l in 1997, 0.039 mg/l in 1998, 0.039 mg/l in 1999 and 0.064 mg/l in 2000. No new sensitivity classes were found. The slight shift to

higher sensitivities in 1998 and 1999 was correlated with similar shifts in three wild-type isolates and was ascribed to experimental variation. Selected isolates with resistance or reduced sensitivity to strobilurins, anilino-pyrimidines, morpholines and demethylation inhibitors (azoles) were assayed for their cross-sensitivity relationships to quinoxifen. No cross-resistance was observed between quinoxifen and the other fungicidal compounds included in the bio-assay.

**Key words:** Quinoxifen, Wheat, *Erysiphe graminis*, Monitoring, Sensitivity, Cross-resistance.

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Petria 12(1-2), 21-24, (2002) Atti del Convegno/Proceedings of the Conference

### **Molecular mapping of QTL for *Fusarium* head blight resistance in spring wheat**

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*Fusarium* head blight (FHB, scab) is a fungal disease of wheat and other small cereals that is found in both temperate and semi-tropical regions. FHB causes severe yield and quality losses, but the most serious concern is the possible mycotoxin contamination of cereal food and feed. Breeding for FHB resistance by conventional selection is feasible but tedious and expensive. This study was conducted to identify and map DNA markers associated with FHB resistance genes in wheat. A population of 364, F1 derived doubled haploid (DH) lines from the cross 'CM-82036' (resistant) / 'Remus' (susceptible) was evaluated for Type II resistance (spread within the spike) during 2 years under field conditions. Marker analysis was performed on 239 randomly chosen DH lines. Different marker types were applied, with an emphasis on AFLP and SSR markers. Analysis of variance, as well as simple and composite interval mapping were applied. Three genomic regions were found significantly associated with FHB resistance. The most prominent effect was detected on the short arm of chromosome 3B, explaining up to 60% of the phenotypic variance for Type II FHB resistance. A further QTL was located on chromosome 5A and a third one on 1B. The QTL regions on 3B and 5A were tagged with flanking SSR markers, the 1B QTL was found associated with the high molecular weight glutenin locus. These results indicate that FHB resistance is under control of a few major QTL operating together with unknown numbers of minor genes. Marker assisted selection for these major QTL involved in FHB resistance appears feasible and should accelerate the development of resistant and agronomically improved wheat cultivars.

**Key words:** Head blight, Spring wheat, Molecular markers, QTL.

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### **Head blight and foot rot of wheat in Italy**

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Foot rot and head blight are damaging diseases of wheat in Italy. Their etiology and severity has been monitored, for more than ten years, in different agroclimatic conditions. The varietal response to head blight natural infection has been evaluated in Northern and Central Italy, where the disease is particularly severe. The varietal response to foot rot has been evaluated in Central and Southern Italy, where this disease is more damaging. The role of the different fungi, alone or in combination

with one or more pathogens, is not completely clear. *Fusarium graminearum* Schwabe is the most common and severe causal agent of head blight while *Microdochium nivale* (Fr.) Samuels and I.C. Hallett and *Fusarium culmorum* (W.G.Sm.) Sacc. are the most common causal agents of foot rot of wheat.

**Key words:** *Fusarium graminearum*, *Fusarium culmorum*, Epidemiology, Molecular identification.

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Petria 12(1-2), 37-41 (2002) Atti del Convegno/Proceedings of the Conference

### **Incidence of saprophytic and necrotrophic pathogens on wheat in Hungary in 2000**

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1879 leaf samples from 13 stations were collected in April, May and June, 2000. *Alternaria* spp. and *Cladosporium* sp. were found very often (70-100%), *Epicoccum nigrum* was detected on the average in 30-40% of the samples. The *Stemphylium* sp. (52%) ratio increased only for the last reading. Incidence of *E. nigrum*, *Stemphylium* sp. and *Mucor* sp. differed significantly from site to site. *Bipolaris sorokiniana* was found in 4-7% of samples in the three months, *Drechslera tritici-repentis* (24%) and *Septoria nodorum* (20%) increased in June and the ratio of *S. tritici* (22%) was the highest in April. The leaf symptoms were mostly untypical therefore the pathogens could not be identified based on visual scoring. On the other hand from leaves with typical symptoms of *B. sorokiniana* no fungus was isolated, but the fungus was mostly found in other leaf regions. Incidence of the necrotrophic pathogens differed significantly in different locations.

**Key words:** Winter wheat, Saprophytic and necrotrophic pathogens, Identification.

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### **Effects of *Fusarium graminearum* infection of wheat seed**

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Three experiments were conducted to determine the effects of *Fusarium graminearum* infection on wheat seed. 1) Seeds of two highly infected spring wheat cultivars were mixed with healthy seeds in different ratios and planted in 1998 and 1999 at Glenlea, MB. Disease severity was not different in plots planted with 100% *Fusarium*-infected seed and plots planted with *Fusarium*-free seed. Tillering, yield, TKW and percent *Fusarium* damaged kernels (FDK) were not different across treatments. Only emergence was significantly affected. 2) To investigate duration of survival of *F. graminearum*, FDK were either left exposed on the soil surface or buried at 5 or 10 cm. Survival of *F. graminearum* ranged from 85 -100% from FDK at all depths after 24 months. 3) Susceptibility of roots of different crop species to *F. graminearum* was assessed by planting an FHB-infected wheat kernel or floret beside the test crop species at seeding. Emergence of crop species was counted, and disease symptoms on roots were scored 4 weeks later. Reduction in emergence was significant in all crops except for *Brassica* spp. Inoculation resulted in significantly more root infections in most crops.

**Key words:** Wheat, Seed infection, root infection, *Fusarium graminearum*.

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### **Variability of aggressiveness and cell-wall degrading enzymes in sexual progeny of *Phaeosphaeria nodorum***

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*Stagonospora nodorum* (Berk.) Castellani and Germano (syn. *Septoria nodorum* Berk.) is the anamorph of *Phaeosphaeria nodorum* (Müll.) Hedjar. (syn. *Leptosphaeria nodorum* E. Müll.) an important leaf spot and glume blotch pathogen with a large distribution reducing wheat yields and inhibiting grain filling. Its negative impact on seed quality and yield, especially when conditions are wetter than normal, has been recognized worldwide. (Shipton *et al.*, 1971). The sexual stage of the life cycle takes place on wheat stubble during autumn and winter. The sexual stage has been induced in the laboratory and it has been demonstrated that *P. nodorum* exhibits two heterothallic alleles (Halama and Lacoste, 1991, 1992). In the *Phaeosphaeria nodorum* populations, studies have revealed that there is a significant variability in pathogenicity which have been measured by the ability of isolates to cause symptoms on wheat (Griffith and Ao, 1980; Allingham and Jackson, 1981; Yang and Hughes, 1986; Krupinsky, 1997). The variability of aggressiveness after sexual reproduction of *P. nodorum* was investigated. A large range of aggressiveness in the progeny of the parental isolates is observed. As other plant-pathogenic fungi, *P. nodorum* produces a range of cell wall degrading enzymes that enables its penetration and infection of the host tissues (Lehtinen, 1993; Magro, 1984). Very little is known about the variability of enzymes production in the *P. nodorum* population. There is, however, a need to assess the diversity of these wall degrading enzymes, and in particular the extent to which this diversity could lead to difference in the pathogenicity. The relationships between in vitro production of cell-wall degrading enzymes and aggressiveness of a tetrad following in vitro cross between two *P. nodorum* parental strains were investigated. When grown in liquid medium containing 1% cell-wall from wheat leaves as the carbon source, the isolates secreted xylanase,  $\alpha$ -arabinosidase,  $\beta$ -xylosidase, polygalacturonase,  $\beta$ -galactosidase, cellulase,  $\beta$ -1.3-glucanase,  $\beta$ -glucosidase. Time course experiments showed different levels of enzyme production and different kinetics between isolates. Highly aggressive isolates produced more xylanase, cellulase than did the weakly aggressive isolates, suggesting a key role during pathogenesis for *P. nodorum*.

**Key words:** Aggressiveness, Enzymes, *Phaeosphaeria nodorum*, *Stagonospora nodorum*, Sexual reproduction.

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### **Annual results of the project about *Fusarium* mycotoxins in spring barley**

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Spring barley appears like main malting raw material and this has big significance before the production of beer. Therefore the occurrence of pathogenic fungi producing mycotoxins in the grain of barley is very significant. The determination of these fungi namely of the genus *Fusarium* is a worldwide problem but it could be improved by using phylogenetic, biological and molecular methods (e.g. PCR) (Blackhouse *et al.*, 1997). In different areas and on different crops there are variable spectra of *Fusarium* (Šrobárová 1997, Tóth, 1997). Spring barley initially was not a main host for *Fusarium* but now appears as vulnerable as winter wheat. The species of the genus *Fusarium* produce mycotoxins, which are very important to damages of human and animal organisms (e.g. different types of cancer diseases) (De Nijs *et al.*, 1997). Spring barley is the second

ranking cereal after winter wheat in the Czech Republic. It is grown in all regions, however, a high malting quality is achieved only under specific agroecological conditions. These conditions define the regions where quality malting barley is grown with success. Quality of malting barley in the Czech Republic is done by the standard ČSN 46 1100-5 "Malting Barley" which determines parameters of two-rowed barley for malt production. These are in accordance with the standards valid in other countries worldwide. The contamination by *Fusarium* fungi is mainly in years when weather conditions are poor (cold and rainy). The extent of *Fusarium* contamination and the proportions of different *Fusarium* species which are present on barley depend on climatic conditions and geographic location. Production of mycotoxins, their harmfulness for human health, gushing (overfoaming) of beer are the most important factors for the quality of barley and the malt (Schwarz *et al.*, 1995).

**Key words:** Spring barley, *Fusarium*, Mycotoxins, Trichothecenes, DON, NIV, DAS.

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### **Approaches in breeding wheat for resistance to *Fusarium* head blight (FHB) in Romania**

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In Romania *Fusarium* head blight (FHB) has a rather sporadic occurrence, but can cause considerable damage in favorable years. Therefore, much breeding efforts have been devoted, for many years, in two centers (Fundulea and Turda) to develop new winter bread wheat cultivars with improved resistance to FHB. In this report the main approaches in breeding for resistance to FHB in Romania are reviewed:

- the development of reliable screening methods for resistance under artificial field inoculation; identification of new FHB resistant sources and recombination of resistance genes from various sources;
- combining FHB resistance with yield capacity, quality and adaptation by stepwise hybridization, recurrent selection or the DH approach.

As result of these breeding approaches, improved resistant lines, not related to the spring types of Asian and Brazilian origin, previously described, derived from complex crosses, were obtained. Particularly Fundulea 201 R and Turda 195 have shown high levels of resistance and reduced DON content, when evaluated with various methods in several environments. Following successive years of selection at Fundulea, promising derivatives of crosses between the FHB resistant parent 'F 201 R' and donors for good bread making quality (Dropia and Delabrad), combining reasonable levels for the both traits, were obtained.

**Key words:** *Fusarium* head blight (FHB, scab), Source of resistance, Breeding for resistance, Agressiveness, Toxic metabolites (DON).

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### **Contribution of non-specific leaf rust resistance in Yugoslav wheat production and breeding**

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Non-specific resistance is based on interaction between different virulence genes of the pathogen and host genotype without significant difference in expression. The numerous genotypes which show resistance characters were crossed in the Institute of Field and Vegetable Crops. The result are

varieties with satisfactory level of the resistance to *Puccinia recondita* f.sp. *tritici* (some of them occupied 20% of in the Yugoslavia by wheat covered area), for eight or more years, without cases of predictable and proved overcoming in particular region. Varieties Renesansa, Prima, Lasta and, for the investigated character, similar new genotypes possess the relative (in comparison with before or nowadays widespread varieties Novosadska Rana 2 or Europa 90) higher level of the partial resistance in the seedling (greenhouse) and adult stage in the field, without influence of pseudoresistance increasing factors (bad growing conditions, short green leaf area period). By the genealogies it is expectable that they possess known genes for the resistance effective against some virulence of the pathogen before or out of the region. Mostly they are not originated from relative species (only wheat/rye translocation is common). Variety Lasta is the most stable in expression of non-specific resistance characters.

**Key words:** Wheat, Leaf rust, Breeding for resistance, Non race-specific resistance.

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### **Importance of non-race-specific resistance in cereals breeding**

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With examples taken principally from barley powdery mildew [*Blumeria (Erysiphe) graminis* f.sp. *hordei*], wheat eyespot [*Tapesia yallundae (Pseudocercospora herpotrichoides)*], barley scald (*Rhynchosporium secalis*) and barley yellow rust (*Puccinia striiformis* f.sp. *hordei*), some aspects of quantitative resistance breeding of cereals to fungal diseases are presented. Attention is paid to a few points of terminology concerning non-race-specific, quantitative and durable resistance. Methods to study non-race-specific resistance are outlined, with emphasis on QTL mapping of partial resistance components, for applications in marker-assisted selection. Resulting breeding strategies are briefly discussed, considering monogenic, oligogenic or polygenic cases of non-race-specific resistance. Multiple race-specific resistance is also evoked, as well as possible recurrent selection schemes adapted to wide-base pre-breeding populations in cereals.

**Key words:** Non-race-specific, Quantitative resistance, Cereal breeding, Disease resistance, QTL mapping, Gene pyramiding, Wheat, Barley.

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### **Control of leaf diseases in different winter wheat varieties using thresholds and appropriate dosages**

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Since 1993 Danish farmers have been able to use the disease module of the decision support system PC-Plant Protection (PC-P) to manage cereal diseases. Variety resistance is taken into consideration when using the disease models in PC-P. For each disease all varieties are divided into five groups according to resistance. This grouping influences the thresholds and the doses recommended. During 3 seasons 10 varieties have been tested following the recommendations given by PC-P to see if recommendations have been acceptable compared to standard treatments. For most varieties the margin over fungicide cost has been better or comparable to standard treatments and the fungicides input measures as treatment frequency index has been below the input from a “two spray program”.

**Key words:** Winter wheat, Varieties, Fungicide need, Decision support systems, Value of resistance.

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### **Population structure of *Mycosphaerella graminicola*: from lesions to continents**

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Knowledge of the population structure of plant pathogens can aid in the control and management of diseases. The genetic diversity in populations of fungal plant pathogens can be measured over many spatial scales. In this study, a full hierarchical analysis was performed to determine the genetic structure of *Mycosphaerella graminicola* populations across a hierarchy of spatial scales. Diversity was measured within and among lesions, within and among fields, and within and among countries and continents. Genetic diversity was measured using eight RFLP loci and a RFLP fingerprint. At the smallest spatial scale, we used microtransect sampling to collect 40 isolates per lesion from five different wheat plants to determine the spatial distribution of genotypes within individual lesions. We found that each lesion had two to five different genotypes. In most cases, the lesion was composed of one or two genotypes that occupied the majority of the lesion, with other rare genotypes interspersed among the common genotypes. At intermediate spatial scales, three geographically separated populations from Switzerland were analysed to determine diversity within and among fields from the same region. Genotypic diversity of *M. graminicola* populations within the three fields was high, with  $\hat{G}/N$  ranging from 86.2% to 87.8% of the maximum possible diversity. No population differentiation was detected, as indicated by the low  $G_{st}$  values (highest value was 0.009) among these three populations. Corresponding values of  $Nm$  (indicating the number of individuals exchanged between populations) were high, ranging from 58 to 86. At the largest spatial scale, populations from Switzerland, Israel, Oregon (USA) and Texas (USA) were compared. Subdivision among these populations was surprisingly low ( $G_{st} = 0.04$ ), indicating low population subdivision and a high degree of genetic similarity among populations on different continents. It appears that gene flow among these countries is also high ( $Nm = 11$ ). The high genetic similarity among populations on a global scale suggests that gene flow may operate globally. Under this scenario, disease management strategies such as quarantines targeted toward infected seed or infested grain should be considered to minimise gene flow among continents. Gene flow on a regional level could be reduced by strategies that minimise the production of ascospores, such as improved stubble management. The possibility of high levels of gene flow on a regional level indicates a high risk for the regional spread of mutant alleles that enable the breakdown of resistance genes or fungicide resistance.

**Key words:** Gene flow, Multiple genotypes, Population differentiation, RFLP, Spatial scale.

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### **Distribution of toxigenic *Fusarium* species and mycotoxins associated with head blight of wheat, in Europe**

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The *Fusarium* species predominantly found associated with head blight (FHB) of wheat all over Europe are *F. graminearum*, *F. avenaceum* and *F. culmorum*. Among the less frequently

encountered species there are several others less pathogenic or opportunistic, but also toxigenic, including *F. poae*, *F. cerealis*, *F. equiseti*, *F. sporotrichioides*, *F. tricinctum* and, to a lesser extent, *F. acuminatum*, *F. subglutinans*, *F. solani*, *F. oxysporum* and *F. semitectum*. The species profile of FHB complex is determined by the prominent conducive climatic conditions of the geographical areas, particularly the temperature, but including also the influences of the tillage practices, intensive techniques and host genotype. The most frequently encountered *Fusarium* mycotoxins in FHB in Europe proved to be DON and ZEN produced by *F. graminearum* and *F. culmorum*, with the former more represented in southern (warmer) and the latter in northern (colder) European areas. In association with DON were usually found NIV, but also FUS, formed by *F. graminearum*, *F. cerealis*, *F. culmorum* and, particularly in nordic areas, also by *F. poae*. Moreover, from central to northern European countries, as consequence of *F. avenaceum* widespread has been consistently reported MON, whereas in conjunction with sporadic epidemics of *F. sporotrichioides* and *F. poae* the occurrence of T-2 toxin derivatives, such as T2 and HT2, and DAS have been respectively recorded. Finally, BEA and ENS were recently found in Finnish wheat colonized by *F. avenaceum* and *F. poae*.

**Key words:** *Fusarium graminearum*, *Fusarium*-mycotoxins, Deoxynivalenol, Nivalenol, Moniliformin, Beauvericin, Grain contamination.

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### **Control of *Fusarium* head blight with fungicides**

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As most of the commercial cultivars are susceptible to *Fusarium* head blight (FHB) their protection is possible only with fungicides. The efficacy of fungicides depends on cultivar resistance isolate aggressiveness and weather conditions. The efficacy of the best fungicides exceeds 70-80%, but differs according to the parameter measured. Therefore a mean efficacy is suggested to describe more correctly the fungicide effect. There was a very close correlation between decrease of toxin contamination and FHB reduction, above  $r=0,90$ . The most susceptible cultivars cannot be protected fully under heavy epidemic conditions, in spite of the significant decrease of infection the remaining infection can be higher to use it for food or feedstuffs. The durability for tebuconazole and metconazole reaches 21 days, the protective effect of carbendazime decrease significantly after 15 days.

**Key words:** *Fusarium* head blight, Fungicides, Toxins.

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Petria 12(1-2), 117-122 (2002) Atti del Convegno/Proceedings of the Conference

### **Molecular markers to characterise the effects of minor genes for resistance of barley to leaf rust**

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AFLP marker technology is efficient to construct dense marker maps on segregating populations, especially if the population consists of a population of homozygous lines. A mapping population of 103 recombinant inbred barley lines, derived from L94 × 'Vada', was used to construct a dense marker map, consisting of 563 markers. The same lines were tested in the seedling stage and the adult plant stage for resistance to several isolates of the barley leaf rust fungus, *Puccinia hordei*.

Processing these data by QTL-mapping software resulted in the identification of three consistent QTLs for partial resistance to this pathogen. Screening different sets of European barley cultivars for presence of the markers associated with the QTLs for partial resistance, indicated that these QTLs occur commonly in European cultivars, and explain part of their partial resistance to *Puccinia hordei*. The markers were also helpful to develop, by marker assisted backcrossing, near isogenic lines of each QTL in the susceptible background of barley line L94.

**Key words:** Barley, Leaf rust, Quantitative trait loci, Partial resistance.

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Petria 12(1-2), 123-129 (2002) Atti del Convegno/*Proceedings of the Conference*

### **Occurrence of deoxynivalenol in cereals from experimental fields in different Italian regions**

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The natural occurrence of deoxynivalenol (DON) in 275 samples of different cultivars of freshly harvested wheat was investigated during the seasons 1999-2000, in Italy. In particular, 138 samples of soft wheat (*Triticum aestivum*) and 137 samples of durum wheat (*Triticum durum*) from various Italian regions were collected from experimental fields and analysed for DON content by HPLC/immuno affinity clean-up. Depending on the geographical origin of the samples, different incidences of contamination and toxin levels were observed. In particular, samples collected in Northern Italy showed levels and incidence of contamination much higher than those collected in Central and Southern Italy. Durum wheat was generally more contaminated than soft wheat. The highest DON levels were found in durum wheat (up to 6,465 ng/g) and soft wheat (up to 3,010 ng/g) samples collected in Lombardy (Northern Italy) in the 2000 crop year. A negligible DON contamination (<100 ng/g) was found in samples from Southern Italy in 1999; in the same regions no DON contamination was observed in 2000.

**Key words:** Mycotoxins, Deoxynivalenol, *Fusarium* spp., Soft and durum wheat.

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Petria 12(1-2), 131-137 (2002) Atti del Convegno/*Proceedings of the Conference*

### **Validation of Decision Support System “PC-P Diseases” for control of wheat diseases in Latvia**

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The main task of integrated plant protection under requirements of EC to reduce using of pesticides and a request of farmers to cut down variable costs for cereal growing is to reduce fungicides ensuring the sufficient efficacy. A new tool providing these requirements is a Decision Support System based on PC program. Validation trials of PC-P Diseases in winter and spring wheat were carried out in collaboration with Danish Institute of Agricultural Sciences in 1999 and 2000, in three localities. Standard treatments were there compared with full dose of Tango Super (epoxiconazole 84 g l<sup>-1</sup>, fenpropimorph 250 g l<sup>-1</sup>, BASF) in GS 51-55, split doses in GS 37-39 and GS 51-55 and treatment according to PC-P recommendation. Incidence of diseases in field, calculated Treatment Frequency Indices (TFI) and net yield in trials were evaluated. The results of trials showed that PC-P Diseases is profitable and useful in Latvian conditions because TFI were in

average from 0.32 to 0.62 and net yield was at the same level or higher in comparison with standard dosages.

**Key words:** Wheat, Diseases, Fungicides, Dosage, PC model-program.

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Petria **12**(1-2), 139-145 (2002) Atti del Convegno/*Proceedings of the Conference*

### **Control of *Fusarium* head blight and effects on DON by tebuconazole using different nozzles and an organosilicone adjuvant**

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*Fusarium* head blight (FHB) can cause serious yield losses but the production of mycotoxins is the main reason for controlling FHB. The objective of this study was to investigate the influence of spraying tebuconazole on yield and deoxynivalenol (DON) in susceptible (Ritmo) and less susceptible (Residence, Florida) varieties that were artificially inoculated with *Fusarium culmorum* using different nozzles and an adjuvant. Most tebuconazole treatments significantly reduced FHB and increased yield. This effect was more pronounced in Ritmo than in Residence and Florida. Observations in the field showed a tendency for a lower incidence of FHB when tebuconazole was sprayed with the TwinJet nozzle compared to the standard flat fan nozzle. Adding an organosilicone adjuvant to tebuconazole tended to decrease the incidence of FHB in some trials. However, these tendencies were not observed when disease severity was assessed. The level of DON in Ritmo was significantly higher than in Residence and Florida. In three out of four trials tebuconazole treatments significantly reduced the level of DON in the harvested grains compared to the untreated. Spraying with the TwinJet nozzle resulted in one out of four trials in a significantly lower level of DON than the flat fan nozzle.

**Key words:** Adjuvants, Spray nozzles, *Fusarium* Head Blight, Mycotoxins, Grain yield, Winter wheat.

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Petria **12**(1-2), 147-152 (2002) Atti del Convegno/*Proceedings of the Conference*

### **Tolerance of wheat to *Septoria* leaf blotch**

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Tolerance is often confounded with resistance, even though these two concepts are distinct. Resistance prevents or stops the development of an infection, whereas tolerance limits the yield loss due to an infection. Therefore, when comparing the tolerance of different cultivars, one has to control for difference in resistance among these cultivars. Tolerance could be a very useful trait, especially for diseases for which only quantitative resistance is known. Tolerance is also expected to be more durable than resistance. However, to select for tolerance, we need an accurate definition and measure of tolerance. In the present study, we applied a method new to plant pathology to measure tolerance. Tolerance was measured as the slope of a regression of yield on damage, for each cultivar separately. We inoculated three spring wheat cultivars with three *Mycosphaerella graminicola* isolates. For each cultivar-combination isolate, disease severity and yield were recorded. On one cultivar, the inoculation was not successful. The two other cultivars differed in resistance. There was a strong interaction between pathogen isolates and wheat cultivars. Infection reduced yield by about 15%. The two cultivars differed slightly in tolerance.

**Key words:** *Triticum aestivum*, wheat, *Mycosphaerella graminicola*, *Septoria tritici*, Tolerance, Virulence.

## Variability of *Fusarium culmorum* isolates in relation to head blight of winter wheat

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The aim of this study was to compare the resistance of two wheat cultivars (Hana and Samanta) to inoculation with 3 isolates of *Fusarium culmorum* different in pathogenicity and to determine possible correlation between toxin formation, time of harvest and the isolate used. Differences between cultivars susceptibility to scab as well as DON (deoxynivalenol) and NIV (nivalenol) accumulation at different stages of development were observed. Profile and level of analysed toxins concentration was observed to be chemotype of *F. culmorum* isolates, inoculation and term of harvest dependent. Different yield of trichothecenes biosynthesis was observed and the highest level of the metabolites accumulation was found for the less resistant genotype Samanta. The most aggressive isolate was I3 from Slovakia and I1 (Poland) the less aggressive one. The affinity of isolate to cultivar has been proved.

**Key words:** Cultivars, Resistance, Wheat, *Fusarium culmorum*, Chemotype, Deoxynivalenol, Nivalenol.

## Residual effect of some ineffective *Lr* genes against different *Puccinia recondita* f.sp. *tritici* isolates at seedling and adult stage of wheat

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Aggressiveness of four *Puccinia recondita* f.sp. *tritici* isolates (B7-2, B18-2, B20-2 and B33-1) was tested on six susceptible NILs (IT 3-4), carrying the following genes for resistance: Lr2c, Lr3, Lr11, Lr17, Lr21 and Lr23. The susceptible cultivar Michigan Amber was used as a control. Latent period and infection frequency was assessed at seedling stage under laboratory conditions. The area under disease progress curve (AUDPC) was measured at adult stage under field conditions.

Aggressiveness of isolates B33-1, B20-2 and B7-2 was very high on Lr2c, Lr3 and Lr11 and did not significantly differ from the susceptible cultivar Michigan Amber. Aggressiveness of isolate B18-2 on Lr3 did not differ from those on the control but on Lr2c and Lr11 was significantly lower. All isolates were nearly double less aggressive on Lr17 and Lr21 and much less aggressive on Lr23 (between 6% and 18% according to Michigan Amber). Data from both experiments at seedling and adult stages were highly correlated. According to the tested isolates Lr2c, Lr3 and Lr11 had no residual effect except Lr2c and Lr11 to isolate B18-2. Lr17 and Lr21 expressed intermediate level of incomplete resistance, as Lr23 was highly resistant to all isolates. The level of incomplete resistance at adult stage was relatively higher than at seedling stage.

**Key words:** *Puccinia recondita* f.sp. *tritici*, Wheat, Resistance, *Lr* genes

## New possibilities to control *Fusarium* head blight of wheat

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The efficacy of fungicides applied against *Fusarium* head blight (FHB) was investigated in field trials. Experimental plots were artificially inoculated with suspension of conidia of *Fusarium graminearum* species at the concentration of 2 mio. conidia/ml at the stage of full anthesis. Dynamics of the disease development, proportion of infected grains after the harvest and grain contamination by DON mycotoxin were studied. In all years, all tested fungicide variants showed highly significantly lower AUDPC values vs. a control variant. An important factor in chemical control of FHB is timing of fungicide application. Significantly higher infection of stands was found at preventive application a week prior to the inoculation than at full anthesis or a week after anthesis. The results confirm previous findings that any early fungicide treatments, for instance protection measures against leaf diseases, are inefficient in FHB even if systemic preparations are applied. Reduced rates of fungicides exhibited in many cases good efficacy, particularly when applied at anthesis. Higher efficacy was determined in fungicides containing combination of triazole active ingredients (a.i.). Lower efficacy was assessed at application of triazole and morpholin combination. Lower efficacy of strobilurin preparations is related also to timing of the treatment. One of possibilities is to use them in combination with triazole substances. Improved efficacy was found in mixed application of fungicides containing prochloraz and fluquinconazole a.i. or prochloraz a.i. and the two-component preparation Charisma (flusilazole + famoxadone). A concentration of DON toxin in harvested grain was reduced to a level of reduction after tebuconazole application (250 g/ha).

**Key words:** Wheat, FHB, Fungicides.

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### **Powdery mildew resistance in common wheat (*Triticum aestivum* L.)**

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Powdery mildew is a major constraint to wheat production and optimum wheat yield worldwide. For decades, research, focused on the identification and introduction of powdery mildew resistance genes (*Pm*) into commercial cultivars. To date *Pm* genes have been identified in many wheat cultivars grown in Europe and some cultivars grown in the United States and elsewhere. An effective method to control the powdery mildew disease is to pyramid *Pm* genes in order to provide broad spectrum resistance. Breeders currently employ qualitative resistance because it is more easy handling major genes. The efficacy of identifying major and minor genes by molecular methods will influence their simultaneous deployment in a cultivar. On the long run it is envisaged that classical breeding and molecular approaches should be complementary in developing cost-effective and environmentally safe disease management programs.

**Key words:** Powdery mildew disease, Resistance genes, Gene pyramiding, Wheat.

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Petria 12(1-2), 181-186 (2002) Atti del Convegno/Proceedings of the Conference

### **Host genotype affects the genetic structure of populations of the pathogenic fungus *Mycosphaerella graminicola***

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Host genotypes strongly affected the genetic dynamics of pathogen populations. A pathogen population collected from the moderately resistant cultivar Madsen showed greater stability, higher genotype diversity, smaller selection coefficients and lower apparent infection rates than the pathogen populations collected from the susceptible cultivar Stephens or a mixture of the two host cultivars. The pathogen population collection from the mixed host population was midway between the two pure lines for most parameters measured. Our results indicated that individual fungal isolates varied in their patterns of host specialization, though on average they were adapted better to the cultivars from which they originated.

**Key words:** Wheat, *Septoria* leaf blotch, host specialization.

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## POSTERS

(in alphabetical order of poster authors)

Petria 12(1-2), 189-192 (2002) Atti del Convegno/*Proceedings of the Conference*

### **New sources of resistance to powdery mildew for Latvian barley breeding**

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130 *Hordeum vulgare* spontaneum accessions received from Israel were tested for resistance to barley powdery mildew; 73% of them showed high or moderate resistance to powdery mildew in two years field tests. Accessions with higher level of resistance were tested in laboratory with two barley powdery mildew isolates; 21 accessions showed resistance to both isolates; five of them showed infection type "0" to both isolates. Furthermore these 21 accessions showed resistance to powdery mildew in three years field tests. In 2000, as an additional source for resistance, somaclonal lines developed from susceptible Latvian barley varieties were tested in the field. Two lines showed high resistance to powdery mildew.

**Key words:** *Hordeum vulgare spontaneum*, Barley, Resistance, Virulence.

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Petria 12(1-2), 193-197 (2002) Atti del Convegno/*Proceedings of the Conference*

### **Some aspects of epidemiology of fungal diseases observed on foliage of wheat in Latvia, 1998-2000**

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Field experiments were carried out at the Research and Training Farm "Peterlauki" of Latvia University of Agriculture in central part of Latvia, during 1998-2000. Assessments were made on the upper three leaves every week from the beginning of stem elongation to full ripening. Incidence and severity of diseases were determined. Tan spot [*Pyrenophora tritici repentis* (Died.) Drechs., anamorph *Drechslera tritici-repentis*] resulted to be the most harmful and economical important wheat disease. Incidence and severity achieved 100% and 70% in 1998, 100% and 5% in 1999 and 100 and 4 - 18% in 2000, respectively. Septoria leaf blotch [*Septoria tritici* Rob. in Desm, teleomorph: *Mycosphaerella graminicola* (Fuckel) Schroeter] and glume blotch [*Stagonospora nodorum* (Berk.) sin. *Septoria nodorum*, teleomorph: *Phaeosphaeria nodorum* sin. *Leptosphaeria nodorum* (E. Muller)] were observed on the lower leaves each spring, because infections started

already in autumn. Further spreading was not observed in this period and development of the disease was not remarkable. Spreading of powdery mildew (*Erysiphe graminis*) depends on variety, agrotechniques and meteorological conditions. Yellow rust (*Puccinia striiformis*) and brown rust (*Puccinia recondita* f.sp. *tritici*) were noticed only on several varieties during the period of the experiments.

**Key words:** Wheat, Fungal disease, Epidemiology.

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Petria 12(1-2), 199-203 (2002) Atti del Convegno/Proceedings of the Conference

### **Redox potential in plants and its function in the mechanism of resistance to diseases and in plant physiology**

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*No abstract available*

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Petria 12(1-2), 205-208 (2002) Atti del Convegno/Proceedings of the Conference

### **Identification of *Fusarium* species from wheat, barley and maize grain**

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During a four-year period, wheat, barley and maize grain, collected in Slavonia and Baranya county, were examined for the presence of *Fusarium* species. Seven species were isolated from wheat grains, five species from barley grains and only three species from maize grains. *F. graminearum* was the principal seed-borne pathogen determined on wheat (51.08% out of 785 isolates from wheat) and barley (71.37% out of 227 isolates from barley). On the maize grains the most common was *F. moniliforme* (46.74% out of 582 isolates).

**Key words:** (none)

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### **Migration and the Czech population of *Blumeria graminis* f.sp. *hordei***

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In the last decade, the population of *Blumeria graminis* f.sp. *hordei* in the territory of the Czech Republic has been studied. Now contribution of individual adaptation mechanisms to development of this population is considered. The present paper focuses on typical examples of migration. Significant increase in the Va3 frequency in the sub-population of this pathogen (immigration of Va3 into the Czech Republic) and a dominance of the Czech sub-population in the occurrence and frequency of Va13 in Europe (emigration of Va13 out of the under study territory) are discussed.

**Key words:** Barley, *Hordeum vulgare*, Powdery mildew, Resistance genes, Direct selection, Virulence genes, Pathotypes, Emigration, Immigration.

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### **The response of *Fusarium* spp. to different growing systems of barley**

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In the years 1999 and 2000, four factorial experiments were carried out in barley to study the effects of fungicide treatment, nitrogen fertilization, treatment with growth regulators and their interactions. There was no effect of growth regulators on the incidence of *Fusarium* spp. In one of the two years, fungicide treatment increased the disease incidence significantly. There was also a similar effect of nitrogen application. It is concluded that, in 2000, the effect of nitrogen fertilization and fungicide treatment independently increased the level of *Fusarium* infection of the seed, so when combined, these factors will increase the contamination of the grain.

**Key words:** Azoxystrobin, Fenpropimorph, *Microdochium nivale*, Propiconazole, Trifloxystrobin.

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Petria 12(1-2), 219-221 (2002) Atti del Convegno/Proceedings of the Conference

### **Pyramiding strategy in resistance breeding against leaf rust of wheat (*Puccinia recondita* f.sp. *tritici*)**

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The aim of this work was to test the possible applicability of marker assisted introduction (MAI) principle in breeding practice for resistance against important phytopathogens and create wheat lines usable in our breeding programmes. Both genes (Lr19 and Lr24) were introgressed from donor genotypes into acceptor genotypes by MAI method. Presence of Lr19 gene in donors and offsprings was detected by the null endopeptidase allele Ep-D1c at the locus Ep-D1. Presence of Lr24 gene was analysed by the STS marker. The pyramiding of different resistance genes and creation of leaf rust resistant wheat lines were supported by the use of MAI method. F2 and F3 progenies were obtained and individual plants possessed molecular markers linked with both desired resistance genes were selected. These genotypes will be included into our wheat breeding programmes.

**Key words:** Wheat, Leaf rust, Resistance, Lr genes, Marker assisted introduction, Molecular marker.

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Petria 12(1-2), 223-227 (2002) Atti del Convegno/Proceedings of the Conference

### **Comparison of *Puccinia recondita* f.sp. *tritici* populations in Germany, Austria, Russia and Ukraine in 2000**

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Pathogenicity survey was conducted for wheat leaf rust collected in wheat-growing regions of Russia and Russia Federation, Germany, Austria and Ukraine in 2000. In total 399 single pustule isolates from Germany, 11 from Austria, 233 from Russia, 37 from Ukraine were tested on differential lines *Lr1*, *2a*, *2b*, *2c*, *3*, *3bg*, *3ka*, *9*, *10*, *11*, *12*, *13*, *14a*, *14b*, *15*, *16*, *17*, *18*, *19*, *20*, *21*, *22*, *23*, *24*, *25*, *26*, *28*, *29*, *30*, *32*, *33*, *34*, *35*, *37*, *38*, *44*, *B*, *W*. All tests of virulence were conducted on detached segments of the primary leaves. All isolates were avirulent to genes *Lr9*, *Lr19*, *Lr24*, *Lr38*. The virulence frequencies to *Lr2b*, *2c*, *10*, *11*, *12*, *13*, *14a*, *14b*, *16*, *17*, *18*, *21*, *22a*, *30*, *32*,

33, 34, 35, 37, B, W were very high at all localities. The other genes tested gave variable protection against the local isolates. In general the virulence spectrum was similar in Germany, Austria, the Ukraine and European region of Russia.

**Key words:** *Puccinia recondita* f.sp. *tritici*, Wheat leaf rust, Virulence.

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### **Presence of some important fungi on wheat seed**

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During a six-year period (1995-2000), winter wheat seed samples (8 varieties, 1294 samples dressed with fungicides) were analysed to study the presence of fungi. Deep freezing method was used. Infection or contamination was recorded in 93,06% of the samples examined. Eight genera of fungi (*Fusarium*, *Alternaria*, *Penicillium*, *Cladosporium*, *Aspergillus*, *Epicoccum*, *Trichothecium*, *Rhizopus*) were identified. The main pathogens found in wheat seeds were *Fusarium* species. The most frequent species was *F. graminearum*. *Alternaria* spp. were the most important saprophytic fungi. In most number of fungi species was established in untreated seed by deep freezing method. All the research done on treated seed showed that there was a smaller number of fungal species and the percentage of the infested seed was lower.

**Key words:** not available

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### **Disease development and selection of resistant genotypes of barley**

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In different years, the prevalence of the diseases was different, but every year either higher or lower infection of powdery mildew (*Blumeria graminis*), net blotch (*Drechslera teres*) and septoria (*Septoria* spp.) was found. The aim of the research was to test and select resistance of barley material on natural and provocative background by utilizing 200-400 varieties and lines of collection nursery and 50-100 promising lines (bread at Stende) in 1997-2000. Spring barley material examined for many years on provocative and natural backgrounds gives the information about the reaction of varieties and selected tolerant material.

**Key words:** Spring barley, Disease development, *Erysiphe graminis*, *Drechslera teres*, *Septoria* spp., *Rhynchosporium secalis*, *Puccinia hordei*, Provocative background.

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Petria 12(1-2), 239-247 (2002) Atti del Convegno/Proceedings of the Conference

### **Molecular detection of *Alternaria alternata* and *Fusarium* spp. in barley seeds and comparison with routine testing assays**

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Certain species from the genera *Alternaria* and *Fusarium* are capable of producing harmful mycotoxins which can contaminate plant products and are considered as a potential cause of cancer. The objectives of this research were to test specific primers for detection of *A. alternata* and *Fusarium* spp. on barley seeds and to compare the sensitivity of the PCR test with the routine testing assays. Naturally infected barley seed samples were tested by the deep-freeze-blotter method and plating on PDA and the mean percentage of infection was calculated. Specific primers for *A. alternata* (AAF2/AAR3), *F. sporotrichioides* and *F. pulverosum* (CNL12/PulveIGSr), *F. poae* (CNL12/PoaeIGSr, Fp82f,r), *F. culmorum* (Fc01f,r), *F. graminearum* (Fg11f,r), *F. avenaceum* (JIAf,r) and *F. avenaceum*, *F. arthrosporioides*, *F. tricinctum* (FA-ITSf,r) were tested in pure culture and on DNA extracted from barley seeds. All the primers were specific for the target species in pure culture. A good correlation was observed between the percentage of infection established by the routine testing methods and the intensity of the specific PCR amplification. The primers AAF2/AAR3, CNL12/PoaeIGSr, Fp82f,r, Fg11f,r and Fc01f,r can be used for detection of the target species in barley seeds. The rapidity of the PCR assay will contribute to the early diagnostics of the potential presence of mycotoxins in barley seeds.

**Key words:** Molecular detection, *Alternaria*, *Fusarium*, Barley seeds.

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### **“Koind” – Package of programs for calculating diversities within populations, distances between populations and measure of gene linkage**

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A new package of programs (Koind) was proposed for calculating diversities within and distances between populations characterized by asexual reproduction in addition to, or in place of, sexual reproduction. The package realized computation of recently developed Kosman's indices for measuring diversities between and within populations, and allows the calculation of the standard diversity indices as well. Bootstrapped samples from an original data table are used for calculating the set of estimates of diversity indices.

**Key words:** not available

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### **Hulless barley grain infection by fungal pathogens**

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HB (hulless barley) grain infection by fungal pathogens (*Fusarium*, *Helminthosporium*, *Penicillium*) was determined and compared to covered barley; relationships with yield, germination, grain damage, grain protein content, sprouting resistance and plant height was stated. In total, 28 and 37 HB genotypes with different origin were tested. HB germination was 21% less if compared to hulled checks in average for both years. The average percent of HB grain infected with *Fusarium* was 1.8 times higher, with *Penicillium* - 5.2 times higher in year 2000 than in 1999. There were significant differences between average infection levels of HB and covered checks. *Penicillium* infection was influenced by weather conditions; variation was little in 1999 and much wider in 2000. The negative correlation between HB grain infection (*Fusarium* and *Penicillium*), germination and yield was significant with unfavourable weather condition. Problems with HB grain use for food and feed purposes may occur in wet and cool

conditions at ripening. The average percentage of grain with visible fungal infection signs was higher among HB if compared to covered varieties. Varieties/lines with the lowest *Fusarium* infection levels during two years were pointed out as the most resistant ones.

**Key words:** Hulless barley, Grain quality, Fungal infection, Germination, Germ damage.

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### **Yellow rust of wheat in Hungary**

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During recent years, yellow rust (*Puccinia striiformis* f.sp. *tritici*) occurred in Hungary each year sporadically and in West Hungary, Rőjtökmuzsaj, was reached epidemic level in 2000. Among the Hungarian cultivars, Mv Martina (40S) Mv Kucsma (30S) and Mv Tamara (30MS-S) were highly susceptible. Wheat yellow rust isolates were tested on differentials with *Yr1*, *Yr2*, *Yr3*, *Yr4*, *Yr5*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr10*, *Yr17*, *YrA+*, *CV*, *SD*, *SPA* and *SU* resistance genes. All the isolates were avirulent to *Yr1*, *Yr4*, *Yr10*, *Yr15*, *YrSPA* and *YrSU*. There were found virulence to *Yr2*, *Yr3*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *YrA+*, *YrCV*, *YrSD*. For the first time (in 2000) virulence to *Yr3*, *Yr17*, *YrCV* and *YrSD* was detected in Hungary.

**Key words:** Wheat, Yellow rust, *Puccinia striiformis*, Virulence, Avirulence, Resistance gene.

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### **Occurrence and epidemiology of a new fungal pathogen of barley, *Ramularia collo-cygni***

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In 2000, the occurrence of *Ramularia* leaf spot was monitored at selected locations in the Czech Republic (CR). Leaf samples were taken from the fields for disease identification at the Agricultural Research Institute Kroměříž Ltd and Selgen, Co. Ltd., Plant Breeding Station Lužany. This disease occurs more often and infection is more severe towards southwest. The disease seems to spread in the direction of prevailing southwest winds that means from Germany and Austria where heavy incidence was recorded 5 and 15 years ago, respectively. Until recently, it has been assumed that the infection by the pathogen begins at the heading stage, and more often at anthesis. However, the latest studies from Bavaria and Austria confirm infections by this pathogen already in March. In winter barley, and particularly with early sowing and a longer period of warm weather in autumn, infection could occur also in autumn. This will be an objective of further investigations. The symptoms may occur not only on leaf blades, but also on stems, sheaths and ears, particularly on awns, related to disposition by solar radiation. The mentioned pathogen was observed on triticale, rye, wheat, but the most severe infections were on barley, both winter and spring. Since *Ramularia* leaf spot infected barley heavily at the Lužany in 2000, and it did not occur on the other cereals, we can assume that there are races attacking different cereal species. In experiments in the Upper Austria, yield loss in winter barley reached 16% and in spring barley 11%; 1000-kernel weight was reduced by up to 12%. Efficient fungicides when applied immediately after awn appearance, are Tilt (propiconazole) and Folicur (tebuconazole).

**Key words :** Barley, *Ramularia collo-cygni*, Yield loss.

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## Comparison of morphological characteristics of *Drechslera* isolates and their reaction on a set of varieties

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Over the last 20 years, a different form of leaf blotch (spot form) has been observed on barley worldwide. It markedly differs from the classical form of net blotch (net form) because it produces round, oval or elongated elliptical blotches. Isolates of both forms were analyzed in a comparative study at the AGRITEC, Ltd. Šumperk in 1999. After inoculation with the net form, typical net blotches occurred on barley leaves. After inoculation with the spot form, 2 to 10% were net blotches and more than 90% oval blotches. If a mixed inoculum of both forms was used, 60 to 80% of blotches were of the net form. In 20 days after the expression of symptoms, the presence of both forms was simultaneously detected using a microscope and re-isolations. Twenty to 30 days later, the net form stopped to sporulate. Sporulation of the spot form was only observed. The spot form has higher competitive ability, is more aggressive and obviously suppresses the development of the net form. In both greenhouse and field inoculation tests, the spot form exhibited its ability to move to wheat where it produced necrotic blotches and began to sporulate. The inoculation of wheat with the net form was negative similarly to the inoculation of barley with *Drechslera tritici-repentis*. Individual species and forms are differentiated according to the shape of basal cell, its dimensions, the size of conidial scar and the length of the fourth cell from the basal one in conidia with five septa. The spot and net forms also differ in the aggressiveness of isolates on a set of varieties. Tests on spring and winter barley varieties were carried out at the Agricultural Research Institute Kroměříž, Ltd. in winter months from 1996 to 2000. Seedlings were tested in the greenhouse for resistance to isolates of both forms from different locations across the Czech Republic. Aggressiveness of spot forms was higher in six-rowed winter barley than in two-rowed barley. By contrast, two-rowed barley materials were more sensitive to isolates of the net form. The assessed differences between the net and spot forms suggest that these are two different species rather than two forms of one species.

**Key words:** Barley, *Drechslera teres* f. *teres*, *D. teres* f. *maculata*.

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### Response of wheat and triticale genotypes to infection by *Puccinia graminis*

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The aim of these studies was the evaluation of the susceptibility of spring and winter wheat and triticale to infection by *Puccinia graminis* f.sp. *tritici*. The trials were conducted in experimental fields of Plant Pathology Department in Warsaw. The genotypes of wheat and triticale tested originated respectively from 10 and 5 breeding stations located in different regions of Poland. The source of primary infection were uredospores of *P. graminis* from heavy infected wheat cv. Gama previously grown in greenhouse. Inoculation of tested plants were naturally infected when optimum humidity required for infection was provided. At booting stage (40-49 Zadok's GS) half plants of each plot were cut at 10 - 15 cm above ground to promote the develop of secondary stems. Estimation of infection severity was performed two times, on primary stems in the middle of June and on secondary stems at the end of June. The infection was scored based on a six-degree scale, from 0 to 5, which represents respectively healthy and highly infected plants. Most of the wheat genotypes tested were susceptible or highly susceptible to *P. graminis*. Among 473 winter wheats,

389 (82%) were susceptible. Higher percentage of infected plants occurred among the spring genotypes; 50 out of 52 breeding lines were infected. Triticale seems to be much more resistant to stem rust than wheat. Only 29% of winter and 4% of spring genotypes were infected. The results indicate on significant differences in response of wheat and triticale to *P. graminis*. Most of the winter wheats tested exhibited high level of susceptibility. The number of susceptible genotypes was four times higher than the resistant one. As to spring wheats, resistant lines occurred sporadically. Response of triticale to infection by *P. graminis* reflects earlier opinions considering this cereals as a resistant crop. As it has been stated, 75% of tested genotypes of winter triticale were resistant to stem rust. Better ratio resistant to susceptible plant was observed in the case of spring triticale. Symptoms of stem rust occurred only on plants of one breeding lines out of the 25 tested. These results indicate generally high susceptibility of wheat genotypes to infection by *Puccinia graminis* while triticale is significantly more resistant to stem rust.

**Key words:** not available

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### **A survey of spring barley contamination by *Fusarium* mycotoxins (artificial and natural infection) in 2000**

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During the last year, barley samples for human consumption from several parts of the Czech Republic and a set of samples inoculated with *Fusarium* spp. were investigated for their content of the most common mycotoxin deoxynivalenol (DON). DON was found in all tested naturally contaminated samples in acceptable level below the limit accepted in the Czech Republic. A highly significant relation between DON content and thousand grain weight (TGW) in artificially infected samples was found.

**Key words:** Barley, Deoxynivalenol, TGW, *Fusarium*, ELISA.

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### **Effect of timing and fungicides on the development of *Fusarium* head blight (FHB) and accumulation of deoxynivalenol (DON) in winter wheat**

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Control of FHB in winter wheat by fungicides applied late in the season (GS 55-59) has proved to be inconsistent under field conditions. In order to determine the effect of fungicides applied early in the growing season on FHB development and mycotoxin accumulation, a field trial was undertaken during the harvest year of 2000. Wheat plots were sprayed either at GS31 + GS39 or GS39 + GS59 with metconazole, azoxystrobin, fluquinconazole or metconazole+azoxystrobin. Factorial ANOVA showed that none of fungicides applied at GS 31+39 provided significant control of FHB severity when compared to the control treatment. A mixture of metconazole+azoxystrobin applied at GS39+GS59 proved to be the most effective treatment, reducing disease symptoms by 32% when compared to unsprayed control treatments. The quantity of the tricothecene-producing gene Tri5 in harvested grain was significantly lower ( $P < 0.05$ ) when plots were treated with either metconazole or metconazole+azoxystrobin at GS 39+GS 59. Visual assessment of Fusarium Damaged Kernels (FDK) indicated that only metconazole significantly reduced the number of FDK when applied at

GS39+GS 59 in comparison with the control treatment. Analysis of variance showed that none of the fungicide treatments significantly affected ( $P>0.05$ ) DON concentration in harvested grain.

**Key words:** *Fusarium* head blight, Fungicides, Metconazole, Deoxynivalenol, Tri 5 DNA.

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### **Evaluation of the response of selected winter wheat cultivars to artificial infection with *Fusarium culmorum* in field conditions**

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Response to artificial infection of spikes with *Fusarium culmorum* was evaluated in two sets of winter wheat cultivars (mostly cultivars registered in Czech Republic) in 1992-1999. On average, pathogen caused reductions of grain number per spike, thousand grain weight and grain weight per spike were 28.6%, 50.7% and 64.9%, respectively. The development of *Fusarium* head blight (FHB) differed in the years of testing, which mainly influenced the reduction of grain number per spike. VSS (visual symptom scores) and ADPC values were in every year significantly correlated with reductions of thousand grain weight and grain weight per spike due to infection. Besides the cultivars Bizel, Arina, Praag 8 and Kooperatorka, resistance to FHB was manifested also in the Czech advanced breeding lines SG-U-466 (Bona) and SG-U 513, coming from the cross Brock/Hana. It was found that resistance/tolerance to FHB infection in certain years was influenced by genotypic differences in flowering date.

**Key words:** Winter wheat, *Fusarium culmorum*, Resistance of cultivars, Indicators of resistance and tolerance.

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### **Improvement of spring barley resistance to *Fusarium* head blight (FHB) by utilization of androgenesis *in vitro* and molecular markers**

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Eight varieties or lines of spring barley which showed susceptibility or resistance in inoculation screening were used for the evaluation and preparation of markers for *Fusarium* head blight resistance. Chevron (N1628), Zhaoshu 3 (N1633), line PEC 210 (N1641), line CI 4196 (N1622) and Viktor (Czech variety) were resistant. Foster (N1636), line PI 383933 (N1618) and Olbram (Czech variety) were susceptible. These genotypes became initial donors for isolation of genomic DNA and analysis of amplified fragment length polymorphism (AFLP). Totally 21 microsatellites were tested, 8 of them provided polymorphic alleles. Furthermore, primer combinations for identification of individual lines were found. Followed number of products was 23 at primer CTA/AGC and lowest 5 at primer CAC/AGG highest. Screening of varieties by means of primers is demonstrated on dendrogram showing relative genetic distances among genotypes. The lowest was genetic distance (0,12) has in followed groups resistance type N1633 (Zhaoshu 3) and N1622 (CI 4196). On the contrary highest genetic distance (0,40) manifested susceptible type N1618 (PI 383933). According to similarity AFLP profiles individual genotypes showed a relatively high genetic divergence, and this is an important result for further activity.

**Key words:** *Fusarium* head blight, Molecular markers, AFLP, Barley.

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## **Seed treatment with silthiofam for control of cereal take-all**

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*No abstract available*

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## **Response of winter wheat varieties to *Puccinia striiformis* f.sp. *tritici***

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Response of winter wheat varieties from five European countries to yellow rust was tested in two years. Among seven varieties evaluated in both years, five were resistant and two were attacked by yellow rust. In 1999, twenty one varieties from twenty four varieties were resistant. From twenty one varieties tested in 2000 eleven varieties to yellow rust were resistant. The variety Niagara was very susceptible, the variety Vlasta was moderately susceptible and the same reaction to the disease had the variety Boka but with lower disease severity. Six varieties in this year were moderately resistant. The disease severity was higher in the year 2000 than in 1999. Daily temperatures in the three decades of June 2000 were on an average about 2,3 °C higher than in the same period of the year 1999.

**Key words:** not available

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## **Screening for Catenarin production by *Pyrenophora tritici-repentis* isolates**

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A total of 88 *P. tritici-repentis* isolates originated from different hosts and localities were screened for Catenarin production. Catenarin was found in 29% of the tested strains. The level of this compound ranged from 2 to 400 ppm. Especially high level of that anthraquinone was produced by fungus variants unable to produce melanin. The pigment was not detected in the wild, typically dark pigmented strains of *P. tritici-repentis*.

**Key words:** not available

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