

Effects of powdery mildew (*Blumeria graminis*) severity on durum wheat cultivars

Tomás A., Solís I.

in

Royo C. (ed.), Nachit M. (ed.), Di Fonzo N. (ed.), Araus J.L. (ed.).
Durum wheat improvement in the Mediterranean region: New challenges

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 40

2000

pages 417-419

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=600069>

To cite this article / Pour citer cet article

Tomás A., Solís I. **Effects of powdery mildew (*Blumeria graminis*) severity on durum wheat cultivars**. In : Royo C. (ed.), Nachit M. (ed.), Di Fonzo N. (ed.), Araus J.L. (ed.). *Durum wheat improvement in the Mediterranean region: New challenges* . Zaragoza : CIHEAM, 2000. p. 417-419 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 40)



<http://www.ciheam.org/>
<http://om.ciheam.org/>

Effects of powdery mildew (*Blumeria graminis*) severity on durum wheat cultivars

A. Tomás* and I. Solís**

*S.C.A. Campo de Tejada-Agrovegetal S.A., Demetrio de los Ríos 15, 41003 Sevilla, Spain

**Dpto de Ciencias Agroforestales, EUIT Agrícolas, Universidad de Sevilla, Crtra Utrera km 1, 41013 Sevilla

SUMMARY – Powdery mildew, caused by *Blumeria graminis*, is an important disease of durum wheat (*Triticum turgidum* L. var. *durum*) in Mediterranean conditions. In 1999, the environmental conditions were very favourable for the development of the disease in the South of Spain and the mycelium of the pathogen was evident from February to May in almost all the durum wheat cultivars sown by Agrovegetal S.A. in Jerez de la Frontera (Cádiz) and Escacena del Campo (Huelva). The cultivars showed a large variation in disease severity in the field, ranging from 0 to 70%, with different values in each repetition of the same place due to the spatial irregularity of the inoculum. The yield data collected in each plot of the same cultivar in Escacena del Campo is highly correlated with his final disease severity. In Jerez de la Frontera the yield ranking of varieties is also correlated with their powdery mildew severity. We have not observed other pathogens nor environmental irregularities in the field trials, and we concluded that the reductions in grain yield are mainly caused by powdery mildew.

Key words: Durum wheat, powdery mildew, *Blumeria graminis*, severity, yield.

RESUMÉ – “Effets de la sévérité de l'oïdium (*Blumeria graminis*) sur les cultivars de blé dur”. L'oïdium est une importante maladie du blé dur (*Triticum turgidum* L. var. *durum*) en conditions méditerranéennes causée par *Blumeria graminis*. Pendant l'année 1999 les conditions environnementales ont été très favorables pour le développement de la maladie dans le sud de l'Espagne, et le mycélium du champignon a été évident de février jusqu'au mois de mai sur pratiquement la totalité des variétés essayées par Agrovegetal S.A. à Jerez de la Frontera (Cádiz) et Escacena del Campo (Huelva). On a trouvé dans le champ des grandes variations dans le niveau de sévérité de chaque variété, de 0% jusqu'à 70%, avec des différences entre les valeurs de chaque répétition dans le même lieu dû à l'irrégularité spatiale dans la quantité d'inoculum. Le rendement de chaque parcelle de la même variété récoltée à Escacena del Campo est hautement corrélé avec la sévérité de l'oïdium. A Jerez de la Frontera, le rendement moyen des variétés aussi est corrélé avec sa sévérité moyenne. On n'a pas observé d'autres pathogènes ni des irrégularités dans les essais, donc on peut conclure que les réductions de production de grain ont été dues principalement à l'oïdium.

Mots-clés : Blé dur, oïdium, *Blumeria graminis*, sévérité, rendement.

Introduction

Blumeria graminis f. sp. *tritici* (*Erysiphe graminis* f. sp. *tritici*), the causal agent for powdery mildew in durum wheat, is very well known by farmers growing cereals in Mediterranean conditions, but not much data is published about yield losses caused by this pathogen in field conditions. Low levels of severity at the beginning of the cycle of wheat do not apparently cause significant yield losses. Sometimes the disease appears simultaneously with other leaf diseases like rust or septoria, and it is very difficult to delimit the yield losses due to each one in field conditions.

Powdery mildew micelium has been evident from February to May of 1999 in all the durum wheat cultivars growing in trials sown by Agrovegetal S.A. in Jerez de la Frontera (Cádiz) and Escacena del Campo (Huelva). There is no evidence of the presence of other pests or pathogens in trials, and therefore can study the correlation between yield and powdery mildew severity in each plot of each cultivar.

Knowledge about the effect of powdery mildew in yield losses in durum wheat cultivars will permit the breeders in Mediterranean conditions to better estimate the importance of this criterion in durum wheat breeding.

Materials and methods

The durum wheat trials were sown in Jerez de la Frontera and Escacena del Campo with 25 cultivars, 5 checks (SIMETO, GALLARETA, DON PEDRO, VITRÓN AND SENADUR) and 20 advanced lines (F7) from the CIMMYT breeding program (TDA 1 to TDA 20).

The statistic design was an equilibrated square lattice with 25 cultivars, 3 repetitions and elemental plots of 6 m² (6 rows of 5 m spaced 20 cm).

The fungus diagnosis was made by direct observation of the white micelium over the leaf surface followed by observation at optical microscopy of the hyphae and conidia (Zillinsky, 1983). The powdery mildew severity was determined following the modified scale of Cobb (Peterson *et al.*, 1948), used to measure the percentage of tissue affected by rusts in wheat leaves.

The data analysis was made with STATISTIX 1.0 (Analytical software, 1996).

Results and discussion

The trials in Jerez de la Frontera and Escacena del Campo were sown in dryland the 25th of November and 3rd of December respectively, but they did not emerge until the beginning of January thanks to the first winter rains.

First symptoms of disease were evident at the end of February in plants with phenological growth stages between 20 and 30 according to BBCH scale (based in Zadoks *et al.*, 1974 and Lancashire *et al.*, 1991). The white or greyish micelia was present over the leaves until the beginning of May in growth stages between 70 and 80 (BBCH scale). At this moment the strong drought induced fast maturity of cultivars with disappearance of visible structures of the fungus.

The yield and powdery mildew severity results of each plot collected in Jerez de la Frontera showed a high uniformity in three repetitions data and a negative correlation between the average yield for each cultivar and its powdery mildew severity ($r = -0.580$; $p < 0.05$) (Fig. 1). The negative correlation is much higher ($r = -0.839$; $p < 0.001$) if we do not take into account three cultivars (SENADUR, TDA 4 and TDA 10) with off-type results.

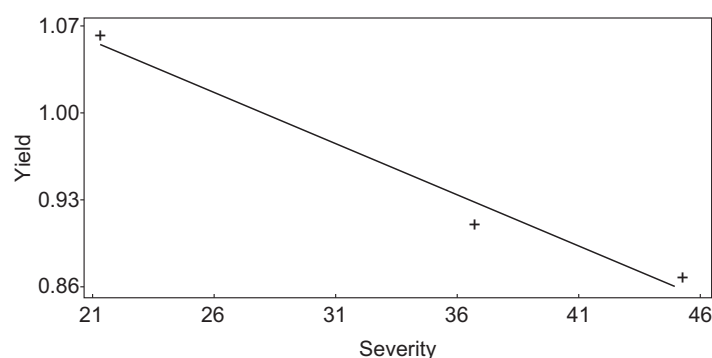


Fig. 1. Relationship between grain yield and powdery mildew severity for 25 durum wheat cultivars in Jerez de la Frontera.

The yield and severity results of each plot collected in Escacena del Campo did not show uniformity in three repetitions data, with increasing average yield and decreasing average severity from the first to the third repetition. There is a negative correlation between the average yield and average powdery mildew severity of each repetition ($r = -0.989$; $p < 0.1$) (Fig. 2).

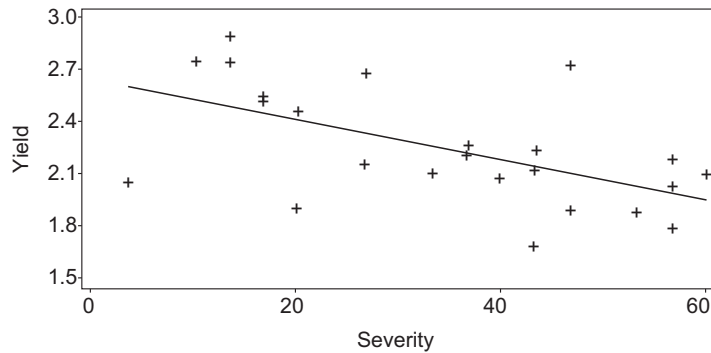


Fig. 2. Relationship between average grain yield and powdery mildew severity of three repetitions data from a durum wheat trial in Escacena del Campo.

Conclusions

Powdery mildew may cause economically important grain yield losses on durum wheat cultivars grown in Mediterranean conditions in favourable agroclimatic conditions.

In Jerez de la Frontera conditions, with an average grain yield of 3742 kg/ha (ranging from 4837 kg/ha of TDA 6 to 2910 kg/ha of TDA 19) and average powdery mildew severity of 34.9% (ranging from 3.3% of TDA 4 to 60% of TDA 12) there is a high negative correlation between the two analysed characters. Then, in absence of other pests and diseases, the resistance to powdery mildew of each cultivar has been critical in order to have a high yield.

In Escacena del Campo conditions, with an average grain yield of 1578 kg/ha (ranging from 2229 kg/ha of SIMETO to 1159 kg/ha of TDA 11) and average powdery mildew severity of 34.4% (ranging from 0% of TDA 4 to 63.3% of TDA 7) there is a negative correlation of the two analysed characters in the three plots data of each cultivar, and the average yield increases from 1st to 3rd repetition in +22% when powdery mildew severity decreases in -53.1%. In this case, resistance to powdery mildew of each cultivar has been important but not critical in order to have a high yield. Probably the most important character has been drought tolerance.

None of the observed cultivars showed immunity reaction to the powdery mildew races present in the South of Spain.

From these results we concluded that resistance to powdery mildew is an important selection criterion in durum wheat breeding programs in Mediterranean conditions.

References

- Lancashire, P.D., Bleiholder, H., Langelüddecke, R., Van den Boom, T., Weber, E. and Witzemberger, A. (1991). An uniform decimal code for growth stages of crops and weeds. *Ann. Appl. Biol.*, 119: 561-601.
- Peterson, R.F., Campbell, A.B. and Hannah, A.E. (1948). A diagnostic scale for estimating rust intensity of leaves and stem of cereals. *Can. J. Res. Sect.*, C26: 496-500.
- Zadoks, J.C., Chang, T.T. and Konzak, C.F. (1974). A decimal code for the growth stages of cereals. *Weed Res.*, 14: 415-421.
- Zillinsky, F.J. (1983). *Common Diseases of Small Grain Cereals: A Guide to Identification*. CIMMYT, Mexico.