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Leaf stripe resistance of spring barley cultivars

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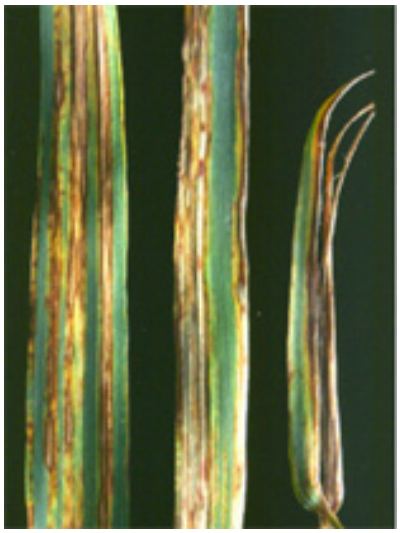
Effective resistance against barley leaf stripe is available, also in modern barley cultivars. This was shown in 5-year Danish studies. Modern cultivars should be considered in practice when barley leaf stripe is expected to be a problem. However, the useful resistance properties of older cultivars should still be considered not at least for use in resistance breeding-related contexts.

Introduction

Leaf stripe (*Pyrenophora graminea*, picture 1) is an important seed-borne disease of barley, especially in organic seed production where efficient chemical means to control the disease are not available.



Picture 1. Symptoms of barley leaf stripe (*Pyrenophora graminea*).

The use of resistant varieties is a cost-effective and environmentally friendly way to cope with the disease in organic production systems. This requires resistance testing of cultivars to describe their resistance properties, which is relevant information for resistance breeding and disease management.

The objective of this work was to obtain up-to-date information on resistance properties of important Danish spring barley cultivars. The work was part of the **ORGSEED project** funded by the DARCOF.

Field tests during 2000 to 2005

Inoculated resistance tests were conducted in the field from 2000 to 2005. Conducting an individual test took two years. In the first year, the cultivars were inoculated via natural infection from border rows of a mixture of highly susceptible cultivars infected by a seed-borne leaf stripe population. The grains of each cultivar were harvested and sown in the second year. The infection incidence (= percent infected plants) was then determined based on visual assessments after heading.

Data on infection incidence were transformed to ln(x+0.05) and analysed

by generalised linear models (GLM) to examine additive effects of the genotype (G) and environment (E). Data adjusted for additive E effects were used to describe the expression of resistance of individual cultivars.

Variation across years and cultivars

The leaf stripe levels varied greatly across years and the cultivars differed substantially in their expression of resistance to leaf stripe (**Table 1**, see **planteinfo** for a more complete list). Additive G and E effects were both highly significant with respect to explaining the variation in leaf stripe levels of which E effects alone explained about 25 percent (adjusted R^2=0.25) while G and E effects together explained about 75 percent (adjusted R^2=0.75; results not shown).

Figure 1 shows the mean versus the standard deviation (SD) of the E-adjusted leaf stripe incidence of the barley cultivars. These two variables indicate the overall varietal susceptibility level and its variability, respectively. The plotting symbol size indicates the number of years of testing of the individual cultivars.

Among the spring barley cultivars that are currently most widely grown in Denmark, Cabaret, Troon, Sebastian, Justina and Brazil thus appear most resistant - but only Brazil combines a favourable resistance performance (low mean and SD of E-adjusted leaf stripe incidence) with a high number of observations (years of testing). However, the cultivars appearing most resistant over the years are relatively old ones such as Vada, Alabama, Odin and particularly Scarlett, which has been resistant in all years in which it was tested. Amongst the new cultivars, Marigold, Native and SW Immer appear to have the most promising resistance properties so far. However, they have only been tested in two years of which only one had reasonably high infection levels.

Benefits of modern and older cultivars

The results of the screening trials clearly indicate that effective resistance against barley leaf stripe is available, also in modern cultivars. Such cultivars should be considered in practice when barley leaf stripe is expected to be a problem. However, the useful resistance properties of older cultivars, such as Scarlett, should not be forgotten, especially in resistance breeding-related contexts where such cultivars could serve as resistance donors. The results furthermore indicate huge year-to-year variation in infection levels, presumably due to variation in environmental conditions related to leaf stripe infection. This underlines the need to improve the methodology for leaf stripe resistance testing, especially with respect to optimising infection conditions.