Simultaneous Epidemic Development of Scald and Net Blotch on Single Leaf Layers of a Spring Barley Crop

Jeanette H. Vollmer[1], Hans O. Pinnschmidt[2], Lisa Munk[3] & Hanne Østergård[1]

[1] Risø National Laboratory, P.O. Box 49, 4000 Roskilde, Denmark; (2) Danish Institute of Agricultural Sciences, Research Centre Flakkebjerg, 4200 Slagelse, Denmark; (3) The Royal Veterinary and Agricultural University, Thorvaldsensvej 40, 1871 Frederiksberg C, Denmark

Background & Objectives

Two pathogens growing on the same leaf compete for the same resources, i.e. space and plant nutrients, which may lead to different types of interactions. The importance of such interactions for epidemics of simultaneously occurring pathogens has received little attention.

The objective of this study is to investigate the epidemics of scald (caused by *Rhynchosporium secalis*) and net blotch (caused by *Drechslera teres*) when occurring together on spring barley leaves in the field.

Here, data are presented focusing on the predominant disease net blotch.

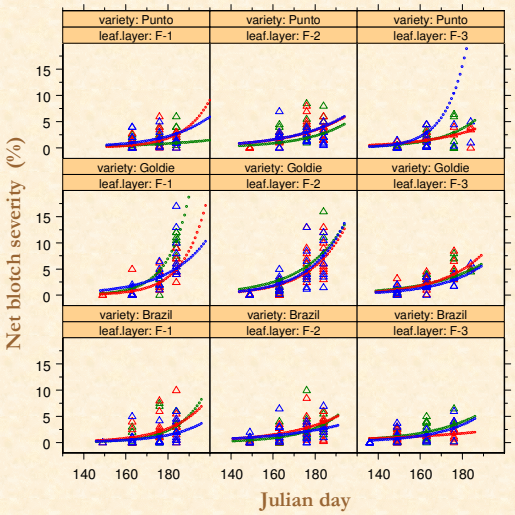

Fig 1. Disease severity over time on individual leaves. 3 varieties, 3 leaf layers and 3 treatments, for colour code see Materials & Methods. Lines show exponential model fit. Data from one replicate.

Material & Methods

Field trial

- *D. teres* and *R. secalis* were applied artificially in different combinations and timing (6 treatments) in field plots of 3 spring barley varieties in 3 replications. Here only 3 treatments are considered:
  - 1: ***D. teres*** **at Julian day 123 (2-3 leaf stage)**
  - 2: ***D. teres*** **+ *R. secalis* at Julian day 123 (2-3 leaf stage)**
  - 3: ***D. teres*** **at Julian day 123 (2-3 leaf stage) + *R. secalis* at Julian day 149 (6-7 leaf stage)**

Data collection

- 9 plants were harvested from each plot 5 times during the season
- Leaves were dried. Disease severity and senescence observed.
- Only leaves with < 50 % senescence are included in the analysis.
- Only results for leaf layers F-1, F-2 and F-3 are shown (F = flag leaf).

Analysis

- Different models were fitted to severity data over time for each leaf layer per variety, treatment and replication. An exponential model ($y(t)=y_0*\exp(r*t)$) gave the best fit. Only the growth rates (r) are considered here.
- Association between scald and net blotch severity on individual leaves from the last 3 observation dates was estimated by Kendall's τ per leaf layer and variety. Only leaves from plots inoculated with both pathogens at Julian day 123 (Treatment 2) were included.

Results

Fig. 1: Net blotch developed on all leaf layers but scald developed very little on upper leaf layers (data not shown). On individual leaves, disease severity levels up to 30 % for net blotch (data shown for one replicate only) and 10 % for scald were observed (data not shown).

Fig. 2: Growth rates of net blotch per leaf layer were significantly affected by variety and, for variety Goldie, by leaf layer. There was a slight tendency for growth rates to be lower in the presence of scald in the crop (Treatment 2 + Treatment 3) (test not shown). Treatments had a significant effect on initial disease severity in the complete field trial (data not shown).

Fig. 3: Significant negative associations between the severity of the two diseases on individual leaves for several combinations of leaf layer and variety were observed.

Discussion & Conclusion

- The disease development curves on individual leaves where best described by an **exponential model.**
- **Reduced growth rates** were implicated for net blotch in the presence of scald in the crop although this effect was not significant.
- **Significant negative associations** between the two diseases on individual leaves were revealed in the association analysis, confirming indications above.
- This suggests an **interaction** between the two pathogens.
- The **mechanism** behind this interaction could be induced resistance in the plant.
- These results show that the **individual leaf approach** can provide new information and highlights the importance of considering interactions between pathogens in the field.

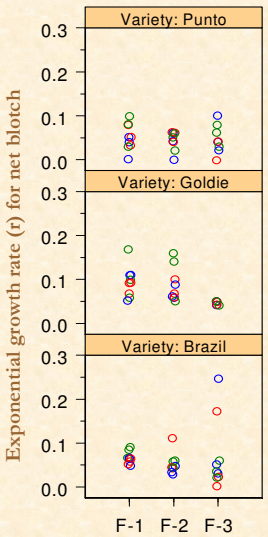

Fig. 2 Exponential growth rates categorised by treatment, leaf layer and variety. Colour code in Materials & Methods.

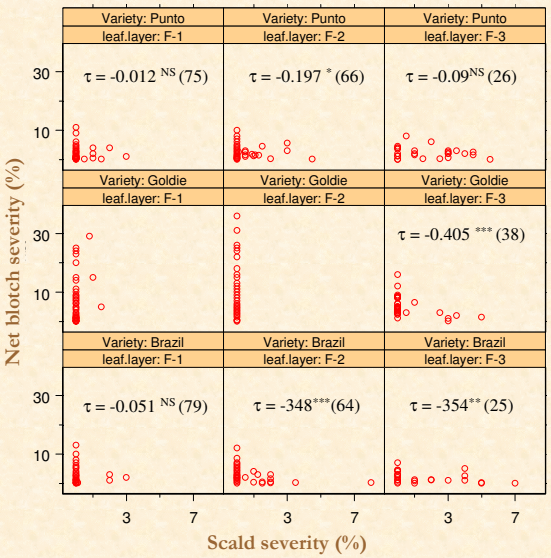

Fig. 3 Association between net blotch and scald severities on individual leaves. Kendall's τ (sample size). Data from Treatment 2 for the last 3 sampling dates

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