BREEDING MAIZE FOR RESISTANCE TO FUSARIUM EAR ROT: IMPACT OF PLANT MORPHOLOGY FOR DISEASE DEVELOPMENT AND DEOXYNIVALENOL FORMATION

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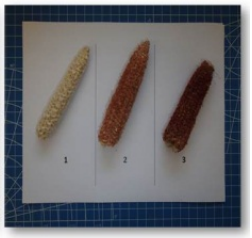
Red and pink ear rots caused by *Fusarium* spp. are important factors affecting the yield and its quality, mainly because of its contamination with mycotoxins produced by the fungi.

In Poland, it is commonly caused by *F. graminearum* producing deoxynivalenol (DON) and zearalenone and by *F. verticillioides* which produces fumonisins.

It was observed, that during the last years contamination of grain by these toxins increase also in Poland.

Using genetic resistance is one of the best methods for disease management. The resistance of maize to ear rots is very complex and depends on several components such as, resistance to initial infection by fungal degradation of silk tissues, resistance to fungal spreading being influenced by some traits as wax layer in grain or morphology and chemical compounds of the pericarp. The accumulation of mycotoxins can also be affected by the plant genotype.



OBJECTIVE

The main goal of this study was to determine which plant traits play important role for red ear rot development and deoxyniwalenol formation in grain and rachis

MATERIAL AND METHODS

Plant material

- parental inbreed lines (K1, K4, K6, S2, S3, S4, S5, S6, S7 and S8)
- F1 hybrids (F2 – F30):

F2 (S2xS8), F3 (S3xS8), F4 (S4xS8), F5 (S5xS8), F6 (S6xS8), F7 (S7xS8), F8 (S3xxS7), F9 (S8xS7), F10 (S1xS6), F11 (S2xS6), F12 (S4xS6), F13 (S8xS6), F14 (S3xS5), F15 (S1xS4), F16 (S2xS4), F17 (S3xS4), F18 (S8xS4), F19 (S7xS3), F20 (S1xS2), F21 (S6xS2), F22 (S8xS2), F23 (S2xS1), F23 (S2xS1), F24 (S4 x S1), F25 (S6xS1), F27 (K6xK4), F28 (K4xK6), F29 (K1xK2) and F30 (K2xK1)

Fusarium graminearum (GER) ear rot severity tests

Field experiments were conducted in three replications - Central Poland (Radzikow), in For each line eight plants were inoculated with *F. graminearum* and 8 plants were used as a control in each replication. Because of different ears morphology - kernel inoculation method was used (tooth-picks: 7 - 9 days after silking). Disease development was visually assessed every 10 days from the plants milk stage till harvesting time using 1 - 7 scale.

Mycotoxin content

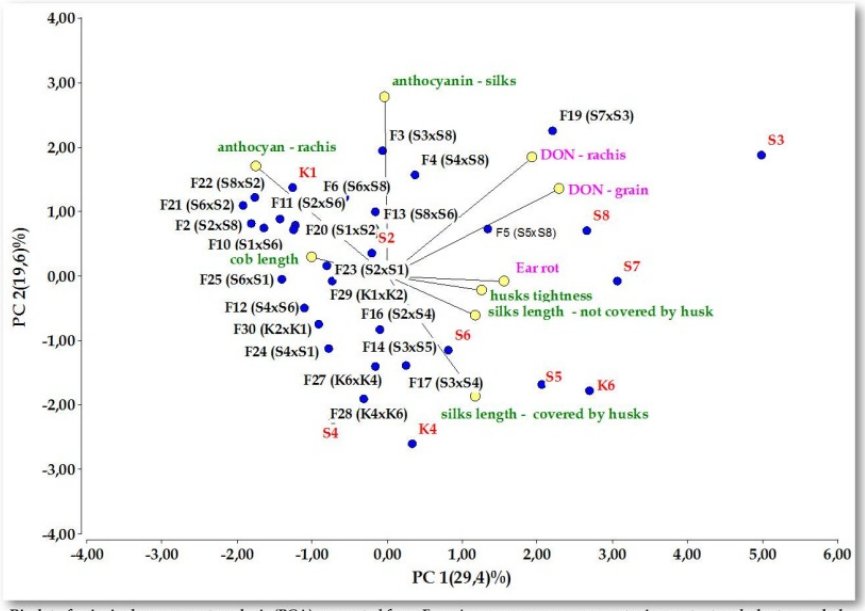
DON content was evaluated separately in grain and rachis samples with RIDA®QUICK SCAN using immunochromatographic tests.

Ears morphology

Cob and silks length (separately, covered and not covered by husks) were measured (cm).

Additionally, for each inbreed line *anthocyanin* content in silks was described.

Relationships between disease severity, DON contamination, anthocyanin content and ear morphology were calculated using PCA.



Bi-plot of principal component analysis (PCA) computed from *Fusarium* spp. occurence, mycotoxins content and plant morphology traits.

CONCLUSIONS

- There were significant differences in the level of ear rot resistance and the DON contamination in grain and rachis.
- After inoculation severity of the disease was on average about 3 degrees higher than under natural infection. DON content in samples taken from rachis was much higher than in grain samples.
- Disease severity and DON contamination, both in grain and rachis samples, negatively correlated with *anthocyanin* content in silks and positively correlated with the length of silks which were not covered by husks.
- DON content in samples collected from the most resistant inbreed line was low under natural infection and also after inoculation.
- Inbreed line S3 was the most susceptible for ear rot and DON content in the grain or in the rachis was high (after inoculation 117 and 465 ppm, respectively).
- Inbreed lines K6, S2, S5, S6, S7 and S8 belong to the moderate resistant group and after inoculation DON content ranged from 20 to 117 ppm in the grain and from 105 to 254 ppm in the rachis.
- Inbreed lines S4 and K4 were the most resistant genotypes (after inoculation DON content in the grain or rachis samples was under 20 ppm). They were the best combiner for low infection severity.
- Hybrids which involved those parents expressed useful significant heterosis for ear rot infection (F28, F27, F24, F16).