



OCCURENCE OF *FUSARIUM* SPP. AND ASSOCIATED MYCOTOXINS IN POLISH MAIZE IN 2011 - 2012

Czembor E.¹, Waśkiewicz A.², Stępień Ł.³

¹Plant Breeding and Acclimatization Institute – NRI, Radzików, 05-870 Blonie, Poland;

²Department of Chemistry, Poznań University of Life Sciences, Wojska Polskiego 75, 60-625 Poznań, Poland;

³Institute of Plant Genetics, Polish Academy of Sciences, Strzeszyńska 34, 60-479 Poznań, Poland

Corresponding author: E-mail: e.czembor@ihar.edu.pl



In Poland maize is important for food and feed production. In 2012 the cropping area was more than 1 mln ha (520 thousands ha for silage and 534 thousands ha for grain) (fig. 1).

Ear rots caused by *Fusarium* spp. are important diseases in all of the world regions, including Poland. Mycotoxins produced by those fungi represent a risk to human and animal health.

Poland has variable weather conditions – with big differences between regions and years. It is influenced by a mild oceanic climate from the west and a dry continental climate from the east. Because of this *Fusarium graminearum* and *F. verticillioides* are two ear rotting species commonly connected with maize kernel samples and their prevalence depends on environmental conditions.

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.

In Poland, compared to wheat, much less is known about epidemiology and mycotoxin production of *Fusarium* spp. commonly connected with maize.

OBJECTIVE

The main goal of this study was to evaluate natural occurrence of *Fusarium* spp and associated mycotoxins in grain samples collected from commercial hybrids commonly grown in different regions of Poland

MATERIALS AND METHODS

Grain sampling

Maize grain samples were collected from hybrids under natural infection in the trials conducted in different regions of Poland across: 2011 – 2012 (Fig. 2)

- List of the localities: Głębokie (A), Chrzastowo (B), Świebodzin (C), Kościelna Wieś (D), Smolice (E), Krośnica Mała (F), Zybyszów (G), Koberzyce (H), Tomaszów Bolesławicki (I), Radzików (J), Kawęczyn (K), Łuśmierz (L), Przecław (M) and Węgrzycze (N)
- List of the sampled hybrids: Ronaldino, Ricardino, PR38A79

The presence of *Fusarium* species

The presence of *Fusarium* species, which colonized kernels under natural infection was determined (based on the SCAR-PCR markers and the translation elongation factor (*tef*-alpha) sequences analyses).

Mycotoxins content

Production of mycotoxins was studied in kernels of maize samples. The most important *Fusarium* mycotoxins: deoxynivalenol (DON), zearalenone (ZON) and fumonisins (FBs) were analyzed HPLC method. The following sets of detectors were used: 1) photodiode array detector for DON ($\lambda_{max}=224$ nm), 2) fluorescence detector for ZON ($\lambda_{ex}=274$ nm and $\lambda_{em}=440$ nm) and for FBs ($\lambda_{ex}=335$ nm and $\lambda_{em}=440$ nm).

Meteorological data were analyzed for each locality separately. Rainfall, max temperatures and mean temperatures were monitored from tasseling time to harvesting time (July, August, September).



Figure 2. Maize grain sampling localities.

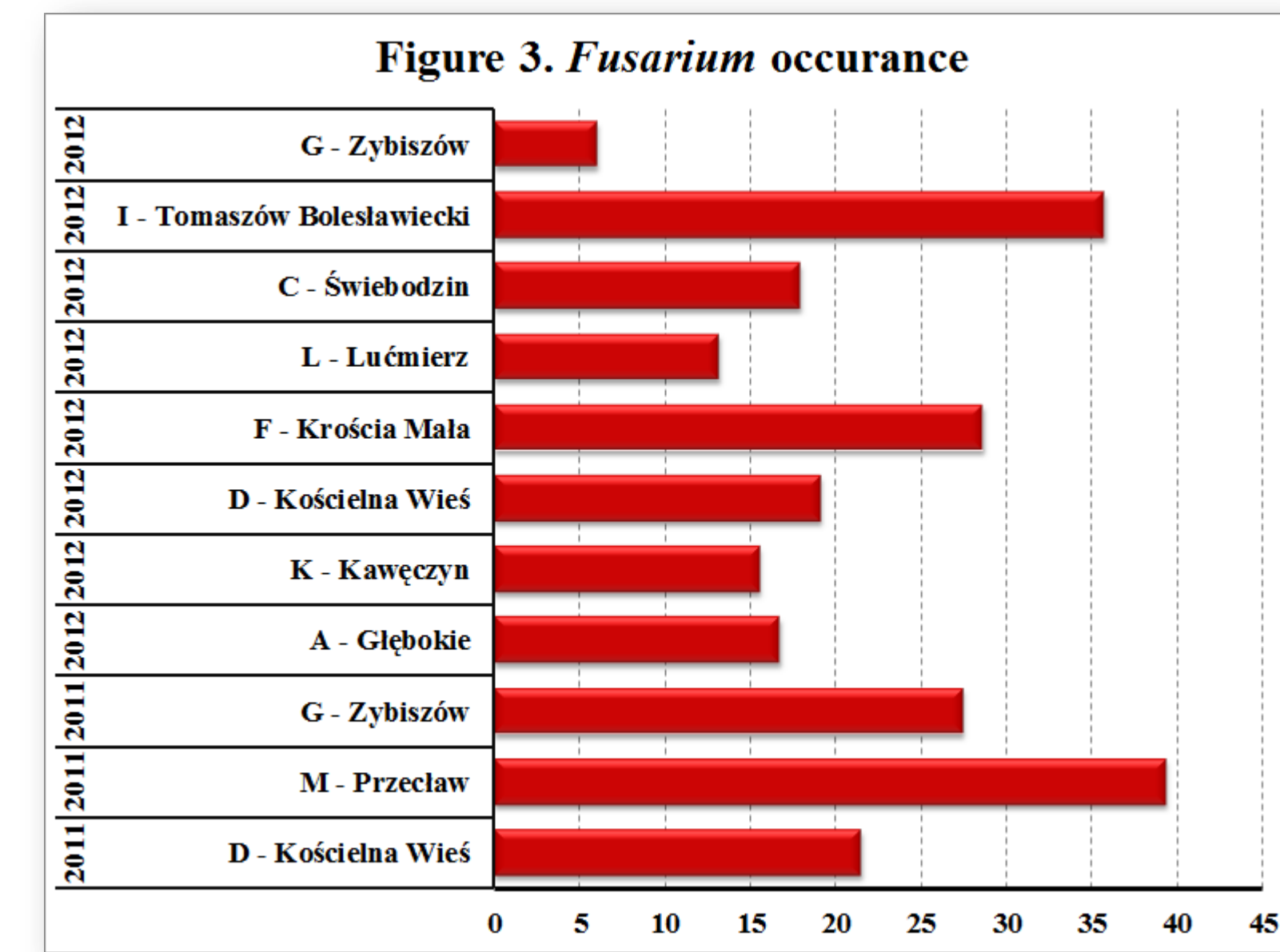


Figure 4. *Fusarium* species composition

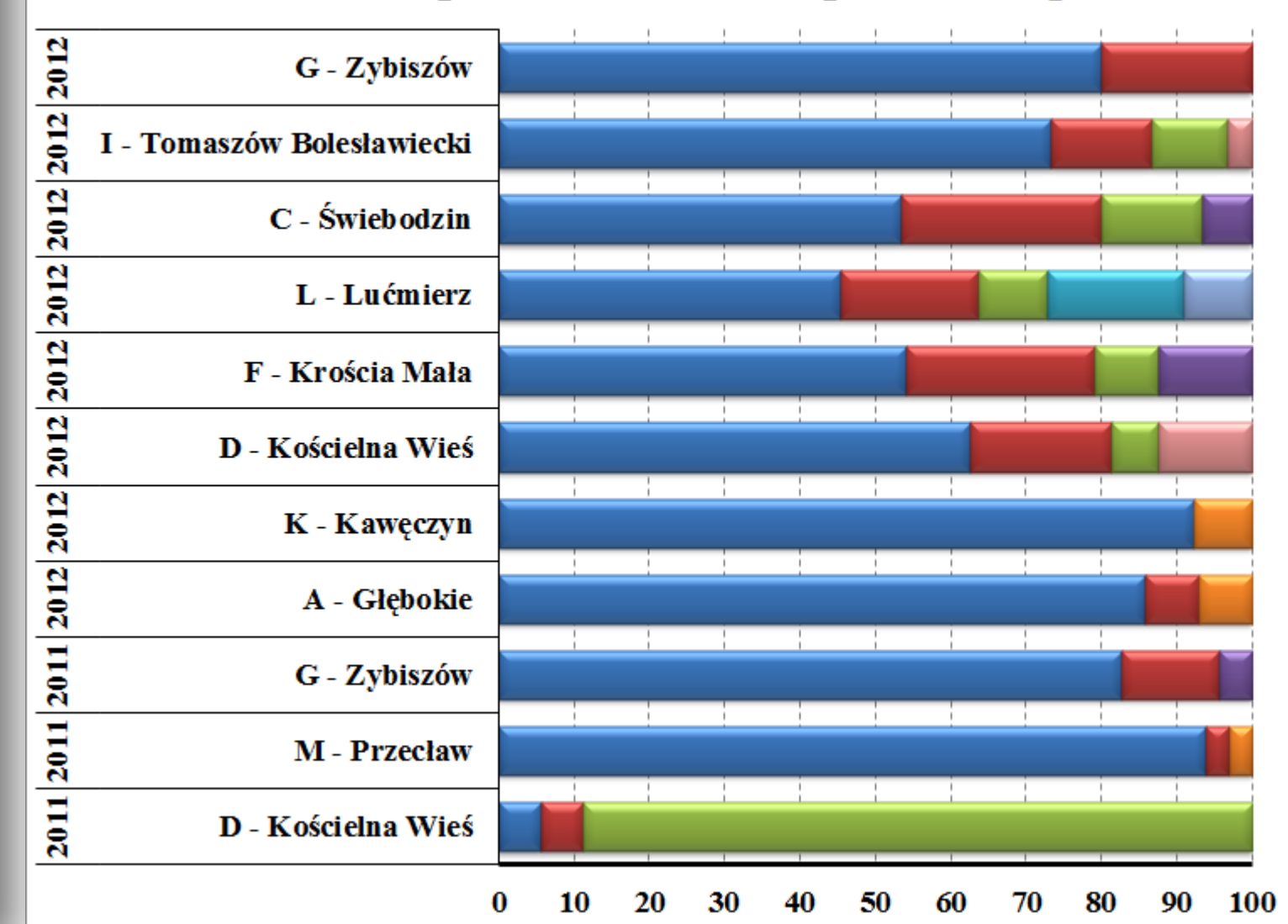
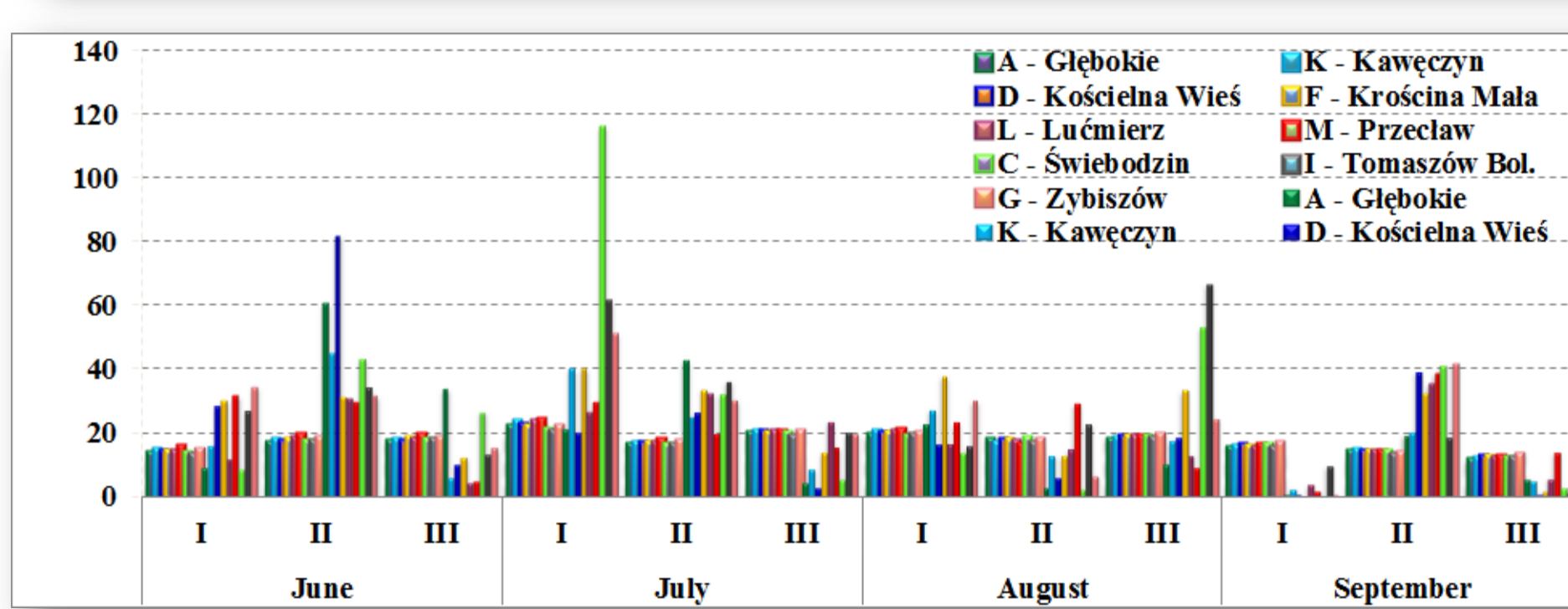
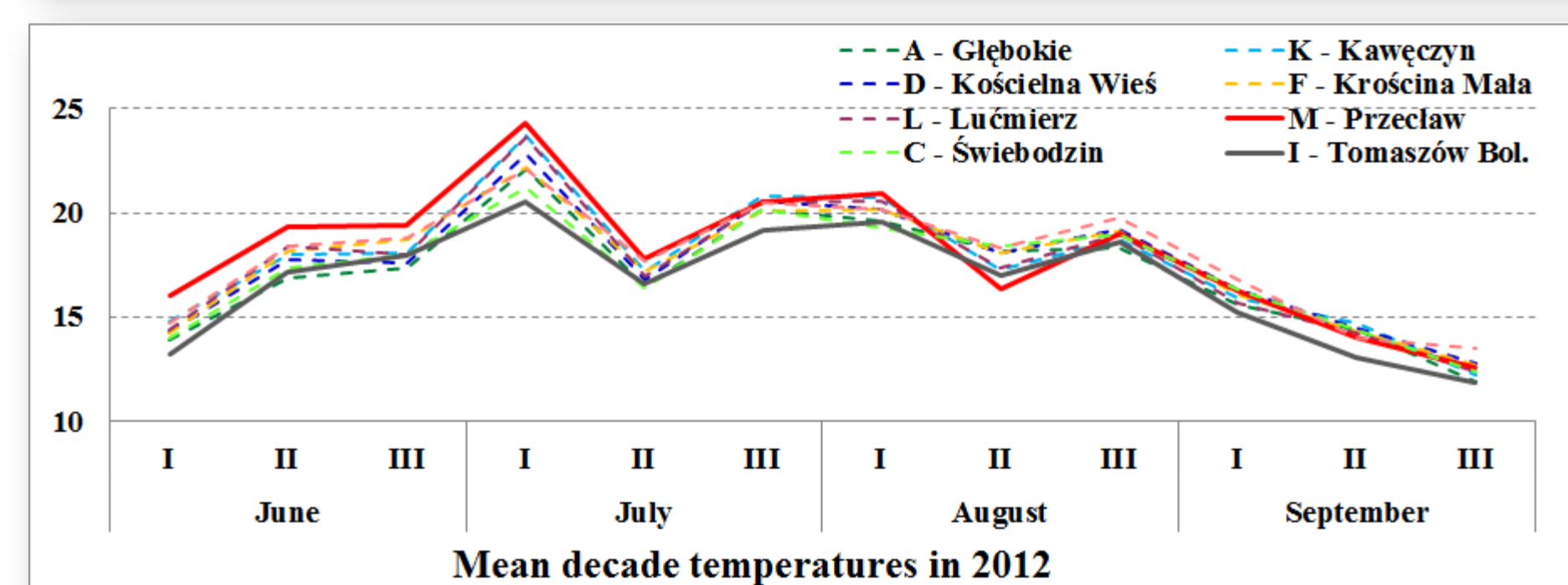
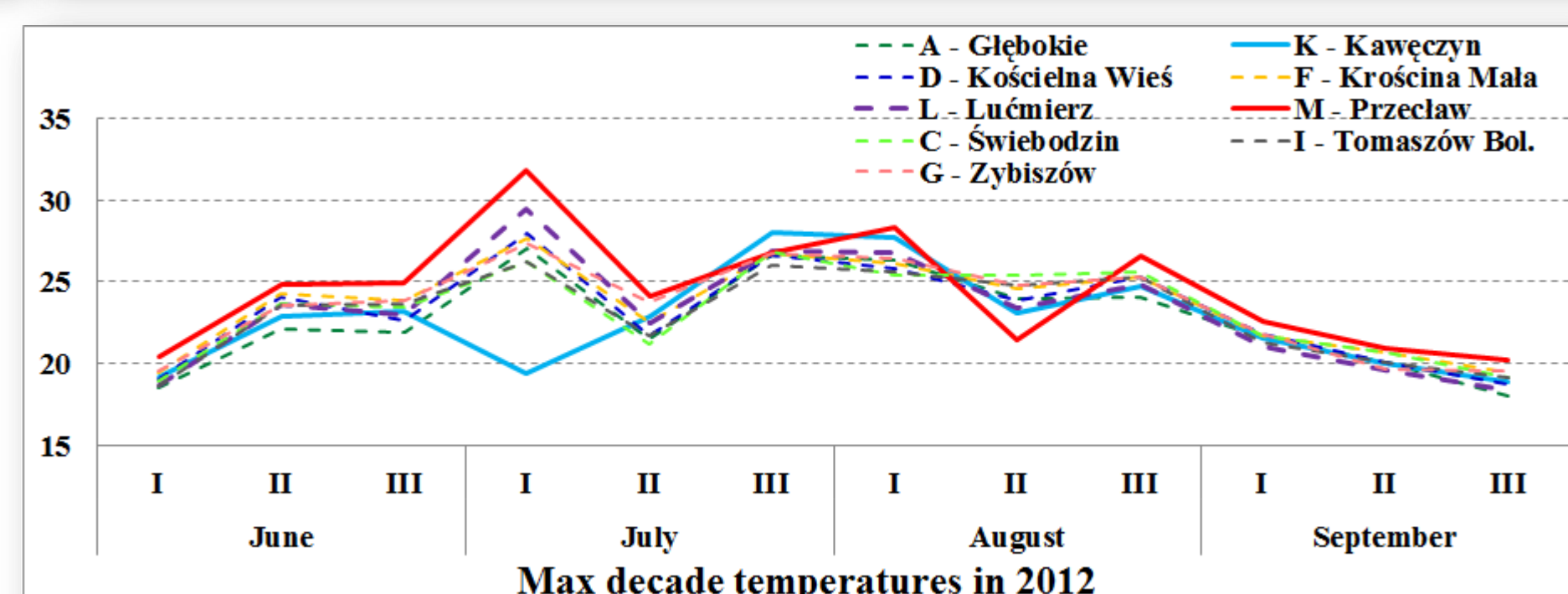
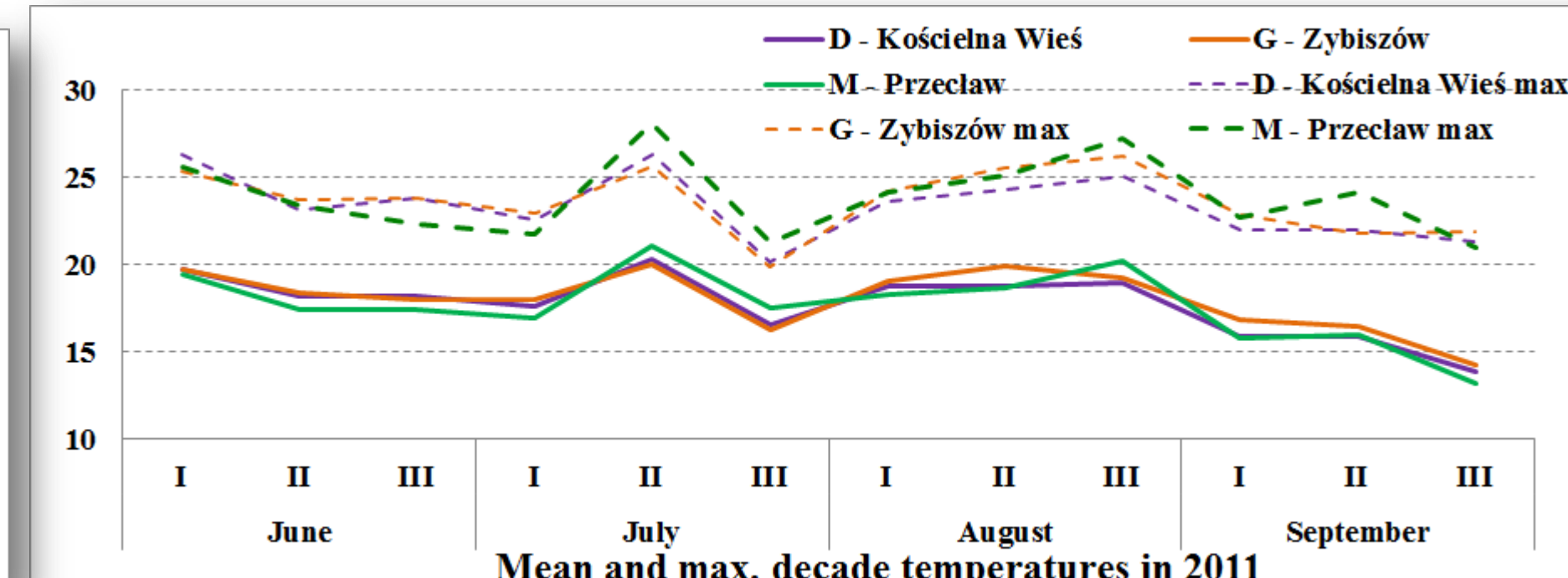
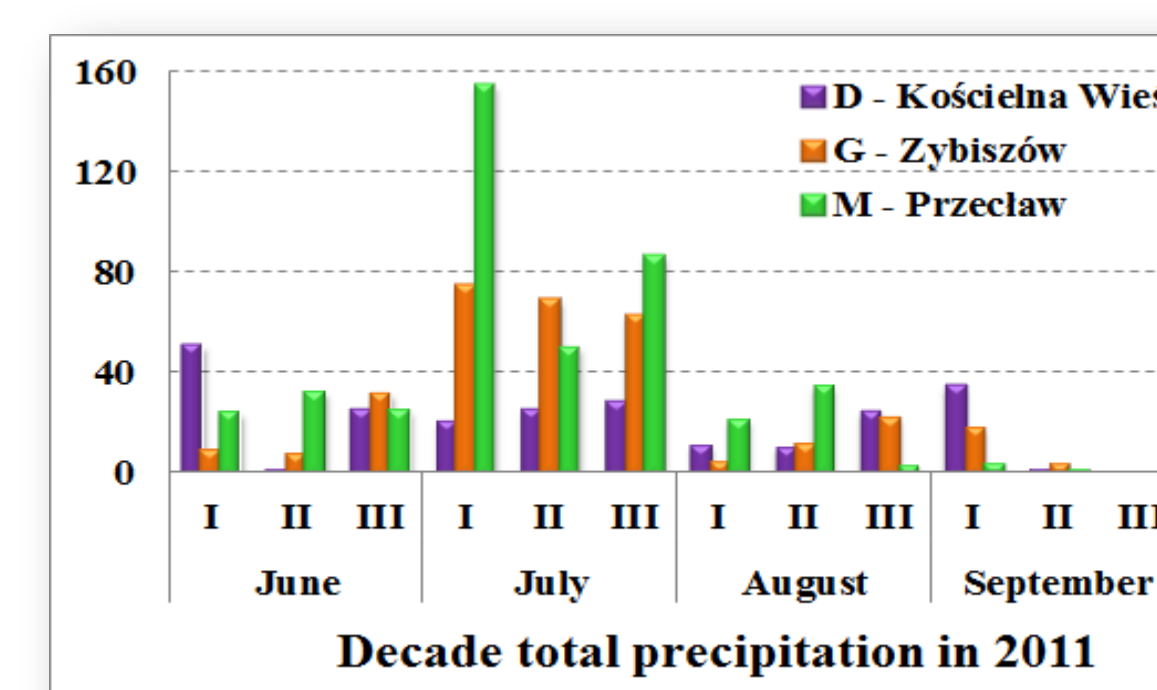


Fig. 1. Maize acreage area in different regions of Poland in 2012



CONCLUSIONS

Variability among regions for *Fusarium* spp. occurrences and mycotoxins content in kernel samples were quite large.

F. verticillioides was the prevalent species (>75% of samples tested contained this pathogen). The ability of *F. proliferatum* and *F. verticillioides* to produce fumonisins was confirmed by the identification of the *FUM1* gene presence.

Most maize kernel samples collected from hybrids grown in different part of Poland contained fumonisins. ZON and DON were not detected or their levels were much lower.

An occurrence of a new species, *F. temperatum*, closely related to *F. subglutinans* was described.

Positive correlation between colonization by *F. temperatum*, *F. subglutinans*, *F. proliferatum* and precipitation was described.

Colonization by *F. verticillioides* correlated with FB1 content.

A recent survey conducted on grain samples from commercial hybrids in the main maize growing regions revealed that levels of deoxynivalenol and fumonisins may be higher than those accepted by the EU.

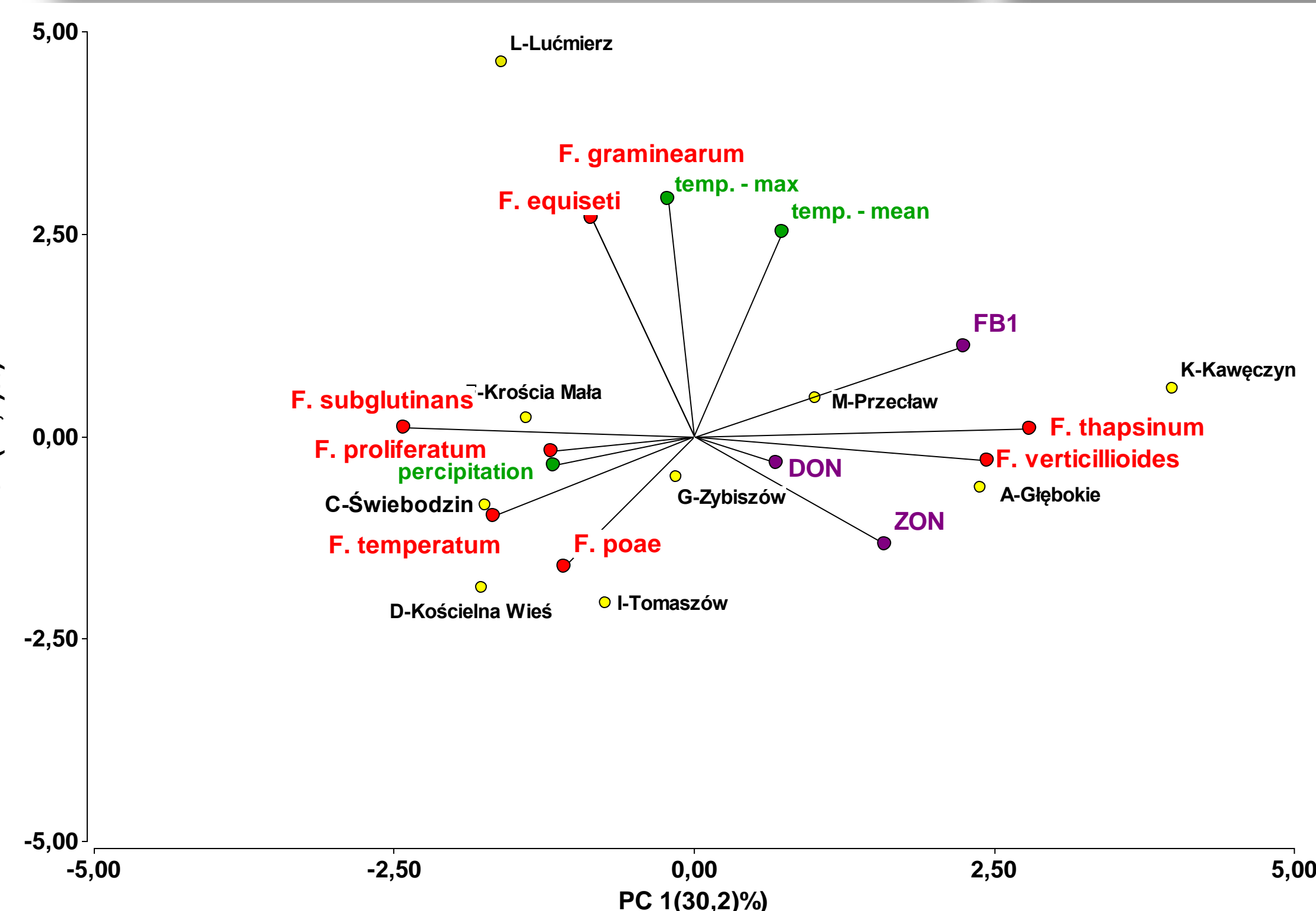


Figure 5. Bi-plot of principal component analysis (PCA) computed from *Fusarium* spp. occurrence, mycotoxins content and weather conditions in 2011 and 2012.

ACKNOWLEDGEMENT
For providing seed samples: Research Centre for
Cultivar Testing (COBORU)

CENTRALNY OŚRODEK BADANIA
ODMIAN ROŚLIN UPRAWNYCH

