

Fusariosis not only “hits” the yield, but also contaminates food

Author(s): Растителна защита
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Fusarium disease in maize is a widespread disease caused by various pathogens of the genus Fusarium. The disease occurs in two different forms: root and stalk rot, and ear fusarium. Most commonly observed are the species Gibberella zeae (Schw.) Petch (Anamorph Fusarium graminearum Schwabe), Gibberella fujikuroi (Sawada) Ito et Kimura (Anamorph Fusarium moniliforme Sheldon), Fusarium culmorum (W.G. Smith), Fusarium poae (PK.) Wr. and Fusarium proliferatum (T. Matsushima) Nierenberg.

The economic importance of the disease is expressed in the immediate yield loss, especially during periods of prolonged rainfall in August, September and October, as well as in reduced germination of seed material and

deterioration of product quality. Of particular importance is the risk of mycotoxins in feed, formed by fungi of the genus *Fusarium*, which may lead to cases of poisoning in animals.

The first symptoms of root and stalk rot usually appear after the end of flowering in the form of dark brown discoloration of the tissues in the lower part of the stalk. Within a relatively short time the necroses expand, the tissues beneath them soften as a result of the destruction of the pith of the stalks, and only the cortex and the conducting tissue retain their stability. The leaves of the plants dry prematurely, and in cases of severe infestation the plants break at the base. When the ears are attacked, they are partially or completely covered with a white/pink mould. In some cases the husk leaves also become pink in colour and are stuck together by white mycelium. The infected kernels are brown-red and their interior is rotten. The pith of the cobs is yellowish, rots quickly and is easily breakable. Heavily infected ears with *Fusarium poae* emit a typical peach-like odour and are completely covered with white mould. Infections with *Fusarium moniliforme* and *Fusarium graminearum* are manifested by damage to individual kernels or groups of kernels, most often with a pink mould.

The fungi causing fusarium disease in maize are widespread saprophytes and parasites in nature and are preserved in plant residues and in the soil. Infection of the plants may occur through the root system, resulting in rot at the base of the stalks, or the pathogens attack the aboveground part of the stalks and the infection then progresses down to the roots. Infection through the aboveground parts occurs most frequently during flowering or at the milk stage of maturity through various entry points: the base of the stalks, the stem nodes and the leaf sheaths. The significant physiological changes that occur in plants after flowering favour the development of the disease. With the decrease of sugar content in the stalks, the rotting process intensifies.

Infection of the ears occurs during their formation after the spores land on them with the help of rain and wind. This is followed by mycelial growth towards the tip of the ears, while the actual rot is observed comparatively later. Mechanical injuries caused by birds, as well as infestation by European corn borer (*Ostrinia nubilalis*) and cotton bollworm (*Helicoverpa armigera*) favour the development of the disease. Higher susceptibility has been recorded in cultivars with relatively short husk leaves on the ears.

Infection with fusarium and ear rot is also observed as a consequence of the development of root and stalk rot in maize caused by the same phytopathogens. In dry years the species *Fusarium moniliforme* is more widely distributed and is successfully transmitted by seed. The above-mentioned species are not strictly specialized on maize but have a wide range of hosts, including the main cereal crops and cereal grass species.

The harmful effect of phytopathogenic fungi of the genus *Fusarium*, in addition to directly reducing yield, is also characterized by the formation of secondary metabolites (mycotoxins) with different chemical structures.

Regulations (EC) No 1881/2006 and (EC) No 1126/2007 of the European Commission establish maximum permissible levels of certain contaminants in foodstuffs, including mycotoxins contained in maize and maize products.

On the basis of data submitted to the European Commission regarding fumonisins, control results from recent harvests show that maize and maize products may have a very high level of contamination with fumonisins, and it is recommended that measures be taken to prevent maize and maize products with such an unacceptably high degree of contamination from entering the food chain.

Direct control of the disease in the field is not possible, therefore preventive and agrotechnical measures must be taken. Adequate potassium supply to the plants suppresses the development of the disease by increasing the mechanical strength of the stalks. The choice of suitable cultivars and areas for cultivation is an important measure to ensure timely ripening of the plants before the onset of cool and humid weather in autumn. Timely harvesting, processing (drying of the grain to 15% moisture) and proper storage of the harvest substantially reduce the development of the disease in storage facilities.