13. Annex: Regulated Pests

Stenocarpella maydis

July 2023

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1. Technical description of the plague

1.1 Disease name Spanish: pudrición de

la mazorca de maíz (corn ear rot).
English: leaf spot of maize

1.1.1 Agent etiological

Preferred name: *Stenocarpella maydis* (Berk.) B. Sutton

Synonymy: *Diplodia maydis* (Berkeley) Saccardo
Diplodia zeae (Schweinitz) Léveillé
Diplodia zeae-maydis Mekhtieva
Dothiora zeae (Schweinitz) Bennett
Hendersonia zeae (Léveillé) Hazslin.
Macrodiplodia zeae (Schweinitz) Petrák & Sydow
Sphaeria maydis Berkeley

Taxonomic categorization:

Class: Sordariomycetes
Subclass: Sordariomycetidae
Order: Diaporthales
Family: Diaporthaceae
Genus: *Stenocarpella*
Species: *Stenocarpella maydis*

1.2 Hosts / Species affected

Zea diploperennis
Zea mays
(maize)
Zea mays subsp. *mays* (sweet corn)
Bambusa spp.

1.3 Cycle of the disease

1.3.1 Transmission and survival

The fungus is seed-borne and soil-borne. It overwinters as spores called conidia contained in the aforementioned pycnidia produced on infected corn stalk debris and as mycelium or loose conidia on seed. When the fungus is seed-borne, it can cause seedling wilting and seedling death at any time after germination. Overwintering pycnidia exude, when atmospheric conditions are warm and humid, slimy masses of conidia that can be carried by rain, wind or insects to corn plants and thus cause infection.

Normally, the fungus attacks corn plants in the collar area and spreads some distance into the stalk and roots. Although it can attack the nodes between the collar and the ear, infection of the ear is almost never by growth of the fungus through the stalk but by spores that reach the ear directly.

Spores of *Stenocarpella maydis* are released from cirrus in warm, moist conditions, singly or in clusters bound by a gelatinous matrix. Spores are transmitted by wind or rain (Shurtleff, 1980).
S. maydis is also transmitted by seed- and soil-borne propagules (Sutton and Waterston, 1966; CABI, 2007).

Plant parts that can carry the pest in trade and transport are flowers, inflorescences, roots, stems (above ground), shoots, trunks, branches, seeds including grain.

Seed is considered to be an important source of inoculum for *Stenocarpella maydis*. Transmission of the pest from seed to seedling mesocotyl has been demonstrated (McNew, 1937 cited in CABI, 2021). Casa *et al*. (1998 cited in CABI, 2021) demonstrated the transmission of pathogens from seeds to coleoptiles, seminal roots and subcorona internode in seedlings (CABI, 2007).

Pathogen development is favored by dry conditions early in the season, followed by warm temperatures (28 - 30 ºC) and high ambient humidity near flowering (Shurtleff, 1980 cited in CABI, 2021; Miranda *et al*., 2016).

Drought conditions early in the season, hot and humid weather after spiking favor the development of Diplodia stem rot. High nitrogen content in the soil and low potassium content, high plant density, loss of leaf area, insect damage or hail also favor the disease (Senasa Argentina).

This disease is more frequently found in warm and humid areas or regions. The ears present necrotic areas and

irregular in the bracts, which when detached, show the cobs dissected and with whitish mold between the grains (Centa, 2014).

1.3.2 Incidence

A 1941 survey showed that average infection in seed lots ranged from 18.4% in the south to 66.7% in the east-central United States (Hoppe, 1942 cited in CABI, 2021). Infection levels of 38% have been reported in Nigeria (Nwigwe, 1974 cited in CABI, 2021). The pathogen has been detected in the embryo and endosperm (Edwards, 1939; Miller, 1952 cited in CABI, 2021).

A recent study was conducted to determine the extent of colonization of maize scion, ear and kernel tissues by *Stenocarpella maydis*. Stems, cobs, and kernels of inoculated and non-inoculated plants were divided into segments and colonization by *Stenocarpella maydis* was determined. Infection of the pedicel portion of maize kernels was significantly higher than that of the apical portion. Preferential colonization of embryos was observed. Colonization of cobs occurred mainly at the cob joint end, and sclerenchymatous tissues showed the highest frequency of re-isolation. Mango segments showed no significant differences in the frequency of re-isolation of *Stenocarpella maydis*, although a tendency for higher re-isolations at the stem junction end was observed. It was concluded that colonization of *Stenocarpella maydis* occurs at the base of the ear with mycelial penetration toward the ear tip. The sclerenchyma and placenta were the primary colonized ear tissues, as were the embryos in the kernels (Bensch, 1995a cited in CABI, 2021).

The efficacy of crop rotation in reducing corn ear rot caused by *Stenocarpella maydis* in reduced and conventional tillage systems was determined over five and four seasons, respectively, at two sites in South Africa (at Bethlehem from 1992-93 to 1996-97 and at Viljoenskroon from 1993-94 to 1996-97). *Stenocarpella maydis* was isolated from grain more frequently in maize monoculture and crop rotation where maize was planted for two consecutive seasons than when maize monoculture was interrupted by a rotation crop. Surface stubble mass and, consequently, inoculum pressure were similarly affected by crop rotation. Positive linear relationships were recorded between Stenocarpella ear rot incidence, surface stubble mass, and pycnidial counts. Wheat, soybean, and peanut were the most effective rotation crops and sunflower the least effective in reducing *Stenocarpella maydis* ear rot (Flett *et al*., 2001 in CABI, 2021).

1.3.3 Symptoms associated with different organs and phenological stages

This pathogen causes infections whose symptoms are influenced by the stage of development of the ear at the time of infection and the climatic conditions following infection. The rot progresses from the base to the top producing a massive colonization of the ear. The mycelium forms an abundant grayish-white mass between the kernels that leaves them firmly attached to the ear. Subsequently, dark structures (pycnidia) are produced on the affected areas.

There is also subepidermal presence of dark brown to black pycnidia clustered near the nodes. White mycelium may be observed on the surface. The pathogen overwinters in residues, and when the inoculum is carried by the seed it produces seedling blight.

1.3.3.1 Stage 1: Stage 1: Seedling stage

Stenocarpella maydis (Berkeley) Sutton is a plant pathogenic fungus that affects corn plants and causes both ear rot and stalk base rot of corn (foot rot). It is a necrotrophic fungus that is found and persists in plant tissue debris. It is most prevalent in countries with temperate to warm and humid climate regions such as South Africa, Australia, New Zealand and the United States (Flett *et al.,* 2001; Darvall, 1964 cited in Miranda *et al*., 2016).

1.3.3.2 Stage 2: State of panicle

This fungus survives on corn stalks and stubble from season to season. Under favorable environmental conditions, it produces dark fructifications called pycnidia, inside which pycnidiospores (spores, conidia) are formed. When the stigmas emerge in corn, the spores, splashed by raindrops or transported by insects and wind, reach the leaves and are carried by water to the pods. There they germinate, penetrate directly and infect the tissues causing ear rot and damaging the grains from the base to the apex of the ear (Bensch, 1995 in CABI, 2021). First the grain embryo is infected, then the endosperm and later the pericarp (Bensch, 1995). The most susceptible stage of the crop is expressed from the time of 50% stigma emergence and lasts for one to two weeks (Vincelli, 1997).

1.3.4 Behavior and distribution in the batches

The spots advance on the leaf lamina parallel to the veins, reaching up to 45 cm in length. Leaf damage caused by *Stenocarpella* can be confused with *Helminthosporium* leaf blight. *Stenocarpella* can cause damage to foliage, stem and ear.

The fungus survives as pycnidia and conidia on infected plant debris. Under conditions of high humidity and suitable temperatures, the conidia emerge from the pycnidia and are disseminated by air or rain, penetrating the plant through the root, crown or mesocotyl. Corn is the only known host of this fungus.

1.3.5 Similarities with other pathogens

Like *S. maydis, Stenocarpella macrospora* (Syn *D. macrospora)* can affect leaf and ear. In the initial stages, small brown spots with a chlorotic halo and irregular growth are observed on the leaf. In the central part of the lesion, a circular spot of a more intense brown than the rest of the lesion can be seen, giving the appearance of a chicken eye. As the infection progresses, the spots advance covering a large part of the leaf lamina, and keep their chlorotic halo. In some occasions it presents irregular and elongated growth and in others it can grow parallel to the main rib, and reach a length of up to 45 centimeters long.

2. Bibliography

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3. Annex: Figures

Figure 1: Epidemiological aspects of *Stenocarpella maydis* (Formento, 2021).

Figure 2: Symptoms produced by *Stenocarpella maydis* on maize (Formento, 2021).

Figure 3: Straw coloration on spike and spike leaf.

Figure 4: Whitish mycelium at the base of the spike (left) and severe infection, mycelium spread throughout the spike (right) (Miranda *et al.*, S/F).