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PHYSODERMA BROWN SPOT DISEASE IN HYBRID MAIZE

W.A.P.G. WEERARATNE and J. A.V.J. JAYASINGHE
Field Crop Research and Development Institute, Mahailluppallama

ABSTRACT

A brown spot disease has been reported from hybrid maize cultivation at Galenbidunuwewa area for the first time during *maha* 2005/06 season. The high disease incidence (>50%) was observed in the highly susceptible variety 'Jumbo'. Brown spot lesions first appeared as very small, round to oblong, yellowish spots on the leaf blade, sheaths and stalks. Spots on leaf midribs were circular, chocolate brown to reddish brown in colour while lesions on the laminae continued as yellowish spots. In severe infections, these lesions coalesced to form large irregular, angular blotches resulting in the weakened stalks frequently breaking at the infection centers. On the basis of microscopic observations and the pathogenicity test, the pathogen was identified as '*Physoderma maydis*'. This identification was confirmed by comparing it with CMI description chart No. 753. This is the first reported incidence of *Physoderma* brown spot in hybrid maize in Sri Lanka. Heavy rains that prevailed during November to January coupled with susceptible hybrid varieties seemed to have favored development and spread of the disease. Usually, leaf spot caused by *Helminthusporium* spp is the prominent disease in maize during *maha* season. However, *Physoderma* brown spot will be another potential threat for maize cultivation in Sri Lanka in the future.

KEYWORDS: Leaf spot disease, Maize, *Physoderma maydis*.

INTRODUCTION

Maize is the second most important grain crop after rice in Sri Lanka; it is used as human food as well as animal food. More than fifty fungal pathogens are known to infect maize throughout the world but only a few of them were reported in Sri Lanka (Shurtieff, 1980). Among them, sheath blight and *Helminthusporium* are the two diseases reported in Sri Lanka infecting maize. However, these two diseases did not appear economically significant since they could be controlled successfully by adopting correct agronomic practices.

An attempt is being made to increase maize production in Sri Lanka by cultivation of hybrid maize varieties. As a result, importation of hybrid maize seeds has increased in recent years. There is a potential of introduction of new pathogens to the country with imported hybrid maize seeds. It has been reported that the farmer fields of hybrid maize at Galenbidunuwewa area have been affected by a leaf spot disease during *maha* 2005/2006 season. It attacks leaf blades, sheaths and stalks and the high disease incidence (>50%) was observed in affected hybrid varieties. The causal organism was not identified and, therefore, it was important to find out the causal organism before formulating control measures for this disease. The

disease symptoms on affected plants, the causal organism and its pathogenicity were studied in detail in this experiment.

MATERIALS AND METHODS

Microscopic observation of sporangia

Disease symptoms were studied in both hybrid varieties 'Jumbo' and 'Pacific'. Seeds and infected plant parts were collected from farmer fields at Galenbidunuwewa area for pathogen isolation. Dusty pustules were picked from infected plant tissues and crushed on a drop of distilled water on slide and observed for sporangia of pathogen under the compound microscope. Further, thin sections of infected leaf and midrib tissues were also observed directly under the compound microscope for the identification of the pathogen.

Blotter test

Seeds collected from susceptible variety "Jumbo" were surface sterilized by immersing them 2-3 minutes in 70% Ethanol. Twenty seeds were incubated on water moistened blotters in Pyrex sterilized Petri dishes (95 mm) at room temperature (25°C ±) under normal day light conditions for 7 days. Fungi developing from contaminated seeds were identified microscopically from their growth characteristics and identification confirmed by examining slide preparation with a compound microscope. A minimum of 200 seeds were tested.

Pathogenicity test

The inoculation techniques were carried out according to the methods explained by Lal and Chakrawarti, (1977). Ten plants of 'Jumbo' variety were raised in autoclaved soil in clay pots in the green house and inoculations were made by pouring 2 ml of sporangial suspensions (approximately 20,000/ ml) into the whorls of 15 day old maize plants. Humidity was maintained in the whorls after every inoculation. The inoculation was repeated 3 times at intervals of 3 days. Another ten plants inoculated with sterile distilled water were used as the control treatment. Disease symptoms were observed and recorded one month after inoculation.

RESULTS AND DISCUSSION

Disease symptoms observed in the field

The symptoms appeared in late December, 2005 when the crop was at the reproductive stage. The high disease incidence (>50%) was

observed in "Jumbo" variety while less incidence (10% - 20%) was observed in 'Pacific' variety. Brown spot lesions first appear as very small, round-to-oblong, yellowish spots on the leaf blade (Plate 1). The spots may occur in bands across the leaf blade. Symptoms are most prominent in the leaf midrib area (Plate 2). Infected tissues turn to chocolate brown to reddish brown and merge to form large blotches with an irregular, angular appearance. Cells of infected tissues disintegrate exposing dusty pustules (brown blisters). Under favorable conditions, severe stalk rot will develop at nodes beneath the leaf sheath and yield reduction may have occurred by the lodging of infected plants.

Microscopic observation of sporangia

Microscopic observation revealed large numbers of round shaped brown sporangia (resting spores) as well as corn midrib cells. The sporangia were identified by comparison of their colour, shape and size with published data (Walker, 1983; Shurtieff, 1980). The shape and colour of the sporangia were similar to those of *Physoderma maydis* described in the CMI description chart No. 753. Walker (1983) reported that sporangia produced in pustules in infected leaf tissues are brown, flattened on one side with a circular cap or lid and 18-24 x 20-30 cm and it requires water on leaf surfaces and relatively high temperatures (23 to 30°C) for germination and release of 20-50 zoospores. Zoospores move in water on leaf surfaces, and attack young maize tissues within the leaf whorl, forming infectious hyphae. The resulting mycelium enters mesophyll or parenchyma cells forming large vegetative structures. The development of symptoms and the germination of new sporangia occur approximately 6-20 days after infection, completing the disease cycle (Hebort and Keiman, 1958).

Blotter test

In blotter test, elongated mycelia that lack cross walls, large number of round shape, brown sporangia and zoospores were observed. These structures were similar to that of sporangia of *Physoderma maydis* reported in maize. This suggests that this fungus could be associated with seeds collected from 'Jumbo' hybrid maize plants.

Pathogenicity test

After one month of inoculation, typical symptoms of the leaf spot developed on the inoculated plants which were identical to those observed in the field. But, all the control plants remained healthy. The pathogen was reisolated from infected plants and observed mycelial characteristics.

According to disease symptoms, pathogenicity test and microscopic observation of sporangia, the pathogen was identified as "*Physoderma maydis* (Miyabe)" and its pathogenicity was established. This identification was further confirmed by comparing it with CMI description chart No. 753 (Walker, 1983). Physoderma is a lower fungus which belongs to class phycomycetes and sub class chytridiomycetes. Sporangia of the fungus are released from infected pustules, disintegrating corn debris, and soil and are carried to susceptible plants by air currents, insects splashing rain or flowing water and humans (Broyles, 1962; Walker, 1983).

Development of the disease is favored by high relative humidity (73- 90%) and temperature of 23-30°C in susceptible plants (Walker, 1983). The weather conditions during November to January were favourable for the development and spread of the disease. The relative humidity range of 70-92%, mean temperature of 23-30°C and heavy rains received (104- 330 mm) during November to January coupled with highly susceptible hybrid varieties 'Jumbo' and 'Pacific' seemed to have favored the disease development in this particular field.

In Sri Lanka, there may be a potential to cause heavy losses by this disease when the susceptible hybrid maize varieties are cultivated during the *maha* season. This is the first report of brown spot caused by *Physoderma maydis* of maize cultivation from Sri Lanka. *Physoderma* is known to remain viable in the soil, as sporangia, for about 3 years (Walker, 1983). Therefore, crop rotation and ploughing infected corn debris back into the soil after harvest will reduce the infection and the use of resistant varieties is also important to control the disease. Use of pathogen free planting material is also essential in commercial cultivation in the future. It is important to carryout awareness programme for seed importers regarding the risk of introducing new pathogens to the country with the imported seeds, and to follow the quarantine regulation strictly.

CONCLUSIONS

Brown spot of hybrid maize has been identified as a fungal disease caused by *Physoderma maydis* (Miyabe) in Sri Lanka. Affected 'Jumbo' maize seeds were contaminated with fungus *Physoderma maydis*. Further research on epidemiological studies, screening of fungicides and selection of resistant varieties in controlling the disease needs to be carried out.

Plate 1. Small yellowish spots on corn leaf blades.

Plate 2. Chocolate brown blotches on midrib of corn leaf.

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