Apr 19 Pathogen of the month – April 2019

Colletotrichum graminicola (Ces.) G.W Wilson (1914)

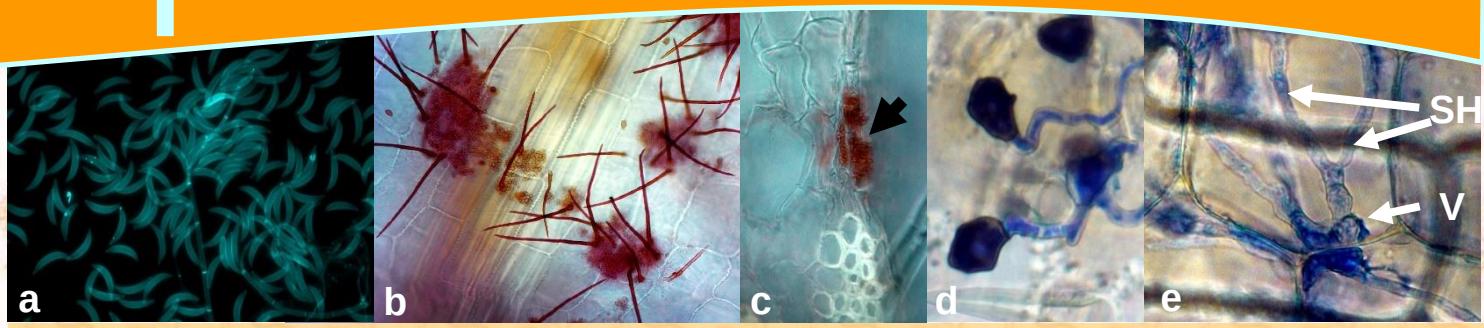

Fig. 1. (a) *Colletotrichum graminicola* asexual falcate conidia stained with calcofluor white; (b) acervuli with setae; (c) cross section of an acervulus (black arrow); (d) lobed, melanized appressoria, and (e) intracellular hyphae in a mesophyll cell. Note two distinct types of hyphae: vesicles (V; also known as biotrophic hyphae) and necrotrophic secondary hyphae (SH). Figs (b-e) were observed on maize leaf sheaths. Figs (b- e) were cleared in chloral hydrate and (d-e) stained with lactophenol blue.

Common Name: Maize anthracnose fungus

Disease: Maize Anthracnose; Anthracnose leaf blight (ALB); anthracnose stalk rot (ASR)

Classification: K: Fungi P: Ascomycota C: Sordariomycetes O:Glomerellales F: Glomerellaceae

The hemibiotrophic fungal pathogen, *Colletotrichum graminicola (*Teleomorph – *Glomerella graminicola D.J.* Politis (1975)*)* causes anthracnose in maize (corn) and is a major problem as some varieties of engineered maize seem more susceptible to infection resulting in increasing economic concerns in the US. With a 57.4-Mb genome distributed among 13 chromosomes, it belongs to the graminicola species complex with other 14 closely related species. Such graminicolous *Colletotrichum* species infect other cereals and grasses such as *C. sublineolum* in sorghum, *C. falcatum* in sugarcane and *C. cereale* in wheat and turfgrass. Of the 44 *Colletotrichum* species that exist in Australia, graminicolous *Colletotrichum* isolates still need to be verified in the Australian collection.

Biology and Ecology:

The fungus forms fluffly aerial mycelium and produces two differently shaped hyaline conidia: (a) falcate (24-30 x 4-5 μm in size) and oval (6-10 x 3-5 μm in size). *C. graminicola* develops sclerotia within 5 to 7 days. The homothallic *C. graminicola* (*G. graminicola*) is capable of producing heterothallic offspring. Its anamorph overwinters in soil and decaying plant material as mycelium, sclerotia, acervuli and melanized hyphopodia. It can survive on crop debris for 20 months. Water splash and blowing raindrops aid in the transfer of the asexual spores. Key morphological features which identify the genus are its acervular conidiomata, often with setae (dark-pigmented, unbranched, thick-walled sterile hyphae usually pointed at the tip), producing elongated slimy conidia, and the presence of appressoria needed for attachment to the host surface prior to tissue penetration. Penetration of the host appears to occur only in the narrow range of 25 to 30°C. The fungus uses an intracellular hemibiotrophic infection strategy involving: (1) a biotrophic phase, where infected plants show no symptoms, forming vesicles or haustoria-like structures and; (2) a necrotrophic phase where secondary hyphae degrade plant tissue. Symptoms in maize are: (a) leaf-blight where long, oval, yellow to necrotic lesions appear on the leaves at any time during corn plant development; (b) top die-back, when the upper leaves and stem internodes are killed during the early stages of grain formation and; (c) stalk-rot, which is characterized by black discolouration of rind tissue, and also black discolouration and disintegration of pith tissue in the corn stalk around the stalk internodes. Maize roots can be infected by the fungus leading to asymptomatic systemic colonization of the plants.

Host Range:

The main host of this pathogen is *Zea mays* L. (maize) and *Zea mays* L. var. rugosa (sweet corn). It has been known to be pathogenic on humans.

Impact:

As the world's most produced crop, maize is a source of food, feed and biofuel. Maize anthracnose was one of the ten most destructive maize diseases between 2012-2015. It caused a reduction in the grain yield in the US via low kernel weight and lodging and it is estimated to cause considerable losses of up to one billion U.S. dollars in the Americas per year alone.

Distribution:

It is found in maize worldwide. It is throughout the major corn-production regions of the United States and there are new reports of the disease in Portugal and Switzerland.

Management options:

Maize anthracnose is controlled in the USA through the use of resistant cultivars/hybrids, crop rotation with non-grass crop e.g. soybean. Residue management such as tillage, chopping and disking fields after harvest aid maize residue decomposition. Mitigating stress caused by other pathogens such as root lesion nematodes, stalk boring insects e.g. European corn borer, and abiotic factors, can reduce the damage caused by *C. graminicola*.

Further Reading: Bailey JA and Jeger MJ (1992) *Colletotrichum*: Biology, Pathology and Control. CAB International, Wallingford; Bergstrom GC and Nicholson RL(1999) Plant Dis 83 (7): 596- 608; Crouch JA and Beirn LA (2009) Fungal Diversi. 39:19-44; Crouch et al. (2009) Mycologia 101 (5):717-732; Hyde et al. (2009) Fungal Divers. 39: 147-182; Frey et al. (2011) Crop Sci. 51: 15551-1563; Muller et al. (2016) Plant Health Progr. 17: 211-222; O'Connell et al. (2012) Nature Genet. 44(9):1060-1065; Politis DJ (1975) Mycologia 67: 56-62; Ritterband et al. (1997) Cornea 16: 362–364; Sanz-Martín et al (2016) Plant Dis. 100 (3): 648; Shivas et al. (2016) Australasian Plant Pathol. 45:447-464; Sukno et al. (2008) Appl. Environ. Microbiol. 74 (3) 823-832; Sukno et al. (2014) Plant Dis. 98 (5): 694; Wilson GW (1914) Phytopathol.4: 106-112

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