

SHORT COMMUNICATION

Brown spot of sugarcane: an emerging disease in South Western region in India

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Abstract

The foliar diseases like eye spot, brown spot, rust and others in sugarcane have been found to occur in specific season in a year or restricted to high humidity areas. However, deployment of susceptible varieties in a disease endemic regions aggravates its severity. During the last few years, we have witnessed severe outbreak of brown spot caused by *Cercospora longipes* E.J. Butler in parts of Karnataka and Maharashtra. Detailed studies were conducted to assess the disease scenario and its severity and mycological investigations on the associated pathogen. Among the different varieties under cultivation, the disease was found to occur only in the cv. CoM 0265 in the region affecting the crop productivity severely. Detailed histological studies revealed that *C. longipes* conidiophores fascicle emerged near the stomatal pores and each conidiophore fascicle ranged from 50-200µm in diameter with a height of ~50-250µm from the surface. Each fascicle had ~15-20 olive brown conidiophores arising from the stroma base. The conidia were hyaline, straight or slightly curved, broader at the base and a long tapering point with 5-8 septations and measured 40-70 x 3-7µm size (length x width). Impact of minor diseases becoming major diseases and its impact to sugarcane is discussed.

Keywords: Sugarcane; Brown spot; *Cercospora longipes*

In general, sugarcane crop faces challenges from major fungal diseases such as red rot, wilt and smut in India over the decades leading to loss of many elite varieties (Viswanathan 2012a, 2018). In addition to these, different foliar diseases were reported time to time in India and other countries (Agnihotri 1983, Rao 2002; Rott et al. 2000). Unlike the stalk infecting diseases, the infection of foliar diseases is confined to leaves and occurs during monsoon and post monsoon season. Among the different foliar diseases, occurrences of rusts, ring spot, brown spot, brown stripe, eye spot, banded sclerotial disease, leaf sheath red spot and leaf spots caused by *Curvularia* Spp. and *Periconia* were reported in India (Rao 2002; Viswanathan 2012a; Viswanathan and Padmanaban 2008). There were limited research

works on foliar diseases in sugarcane probably due to lesser economic repercussions as compared to the stalk diseases. However, in the recent years there is increasing concerns about minor diseases becoming major diseases in many crops including sugarcane. Severe outbreaks of brown rust were recently reported in the country (Selvakumar and Viswanathan 2018). Pokkah boeng was considered as a minor disease in the past decades (Patil 2002; Patil and Hapase 1987), however, the disease has attained a major disease in different states in India (Vishwakarma et al. 2013; Viswanathan 2012b; 2018). Similarly, brown spot caused by *Cercospora longipes* E. Butler has been found alarming in Northern Karnataka and Maharashtra. Hence, a detailed study has been made on its occurrence in the field and mycological characteristics of the infecting fungus.

Materials and Methods

Detailed surveys were conducted in Uttara Kannada and Dharwad districts in Karnataka during October 2019. The disease incidences were recorded in the major varieties under cultivation *viz.* Co 92005, Co 86032, CoM 0265, CoSnk 09232, PI 1110 etc. Infected leaves were examined under bright field microscope with lactophenol cotton blue stain using Leica DMLB2 (Leica Microsystems, Germany) equipped with DMC 2900 camera and Leica Application Suite (LAS) module.

Results and Discussion

Among the different varieties under cultivation, the cv. CoM 0265 was found to be the most susceptible under field conditions of the surveyed

region. Initially, the spots increased in size from a brown speck and at the same time the tissues around the spot became discoloured with a distinct yellow areola (halo). Later the spots used to show three colours, brown, red and yellow halo being formed concentrically. Usually, the affected leaves exhibited reddish-brown to dark-brown oval spots surrounded by yellow halo extended in parallel to the veins. The spots were well distributed throughout the surface of the leaves, especially old leaves and clearly visible on both sides of the leaves. The brown spot sizes were in the range of 0.25 - 3.0 mm x 5.0 - 15 mm while the surrounding yellow halo lesion ranged from 1 mm to 10 mm (Fig. 1). In the affected leaves, the spots formed a linear shape which is a distinguishing character from other foliar leaf spots in sugarcane.



Figure 1. Characteristic brown spot symptoms in young and matured sugarcane leaves (cv. CoM 0265)



Figure 2. Complete yellowing of leaves due to brown spot severity in sugarcane leaves (cv. CoM 0265)

Whereas, brown stripe will have very narrow longitudinal irregular stripes, ring spots will have larger and circular to extended lesions and eye spots will have more typical elongated spots with extended pencil line lesions on both ends running parallel to mid rib (Rott *et al.* 2000, Viswanathan 2012a). The brown spots on the laminar region rarely coalesced and show their distinctness in the matured leaves. However, in due course, yellow halo around the spots extend to form larger yellow patches engulfing the spots. In case of severity, entire leaf lamina turned to yellow to pale yellow with brown spots distinctly distributed throughout the discoloured lamina (Fig. 2).

Usually, the spots start from distal portion and progress towards proximal region of the lamina. In severe cases, the matured leaves (4 to 7) from the crown may completely covered with leaf spots and the young leaves exhibit part or complete infections with less severities. Such severe infections lead to uniform disease development throughout the field and entire field exhibited a brownish canopy from a distance, wherever the cv.

CoM 0265 is cultivated (Fig. 3). However, adjacent fields of the cvs. Co 86032 and Co 92005 were free from infections and contrasting susceptible and resistant phenotypes for brown spot were witnessed under field conditions. The disease appears when the leaves are not yet fully open and continues to affect with increasing vigour till the leaves fade. Extensive foliage drying was noticed in the severely affected plants that led to limited green lamina for photosynthesis. In partly affected plants, drying was noticed in the old leaves, either fully or towards the distal end. Severe foliage drying caused symptoms of fired foliage under field conditions in the cv. CoM 0265. The brown colour remained unaltered in the affected leaves, even after their fall from the plant. Like several other foliar diseases of the sugarcane, the disease was confined to the leaf blade and is not found on the sheath.

Infected leaves of the cvs. CoM 0265 and CoSnk 09232 were examined for fungal colonization and fruiting bodies. Microscopic observations of the symptomatic spots revealed colonization of



Figure 3. Brown spot epidemic in the cv. CoM 0265 – extensive damage to the crop due to total discolouration and premature drying of the leaves

Cercospora longipes E.J. Butler with a series of conidiophores fascicle emerged from and near the stomatal pores (Fig 4 a&b). The diameter of each conidiophore fascicle ranged from 50-200 μ m with the height of ~50 - 250 μ m from the surface, based on the maturity (Fig. 4c). Apparently the conidia did not show much variation for morphological characters. Similarly, each fascicle had ~15-20 olive brown conidiophores arising from the stroma base. The conidia were about 40-70 μ m in length with 5-8 septate, hyaline, straight or

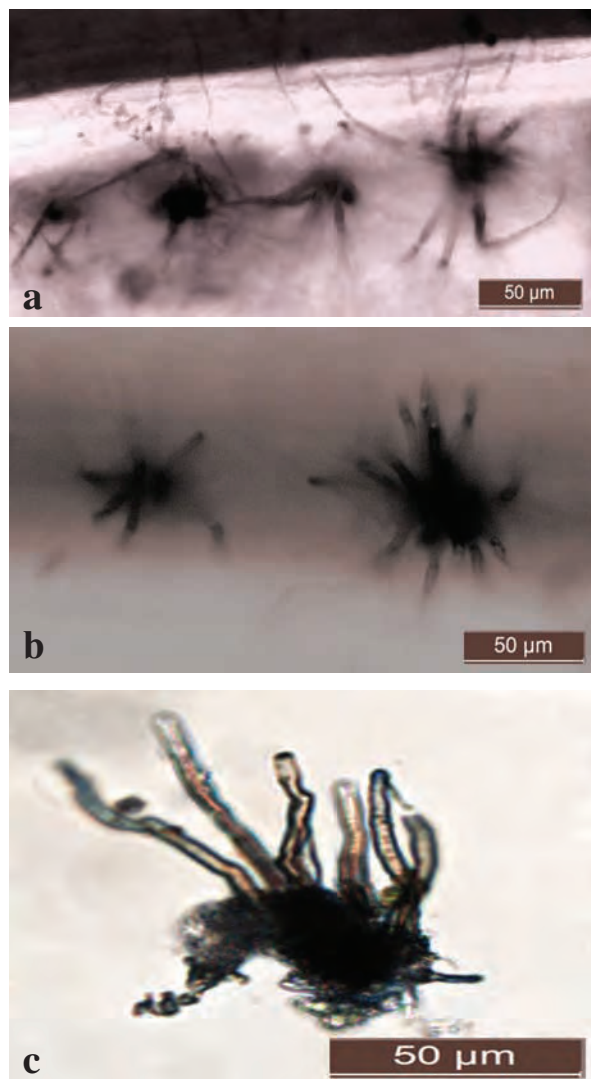


Figure 4 a. Emergence of series of fascicle from and near the stomatal pores in the affected lamina, b. close up view, c. Conidiophore

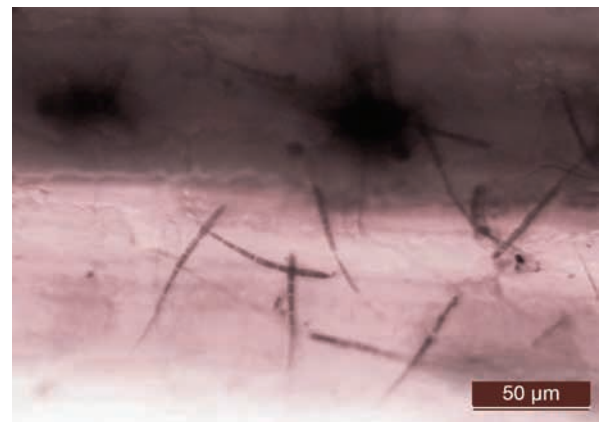


Figure 5. Typical hyaline conidia of *Cercospora longipes* with septations

slightly curved and were broader at the base with the thickness of ~3-7 μ m and a long tapering point (Fig. 5).

Apart from the brown spot the leaves of the cv. PI 1110 collected from the village Sathmani in Haliyal had brown spot like symptoms as described below; the spots initiate as chlorotic irregular spots turn to yellow and orange yellow. Unlike extensive yellow discolouration of lamina in case of brown spots, here the spots enlarge without coalescence (Fig. 6). The spots were well distributed throughout the surface of the leaves, especially old leaves as like brown spot and clearly visible on both sides of the leaves. Similar to brown spot, these yellow halo were highly coalesced to give a large path of discoloured lamina leading to early senescence of leaves. Here also the spots were distinct from the discoloured lamina. The causative agent of this symptom could not be ascertained with basic microscopic investigations and further studies are required to identify the associated pathogen, probably through molecular tools. However, a distinct ascoma with setae like structures were observed at the centre point of each spot. These ascoma with setae like structure ranged from 30 to 100 μ m in diameter, while the central globular ascoma ranged from 18 to 40 μ m (Fig. 7a, b). Approximately, 15-30 setae structures

were observed in each ascoma. Earlier, Butler (1906) observed pycnidia like fungal structures as black dots in the matured brown spots. Dr E. J. Butler for the first time reported brown spot from India (Butler 1906). He observed the disease over a large part of Bihar as the most common cane disease and seen almost in every field in North and South Bihar. Wherever the disease was prevalent he expected heavy loss in the sugar yield.

Currently, the cv. CoM 0265 is under cultivation over large areas in Maharashtra and Karnataka and the crop suffers damages. Till release of the cv. CoM 0265 in Maharashtra and its adoption in Northern Karnataka, severe incidences of brown spot were not recorded in the recent decades. After

its introduction during the last decade, suddenly brown spot epidemics occurred in major sugarcane growing areas of Maharashtra and Karnataka. Monitoring the disease scenarios for the past 10 years under AICRP on Sugarcane showed the disease on the variety with a high severity of upto 80% in Kolhapur and other high rainfall areas in South Maharashtra since 2011-12. High rainfall accompanied by high humidity favours the disease development in the region. Due to its higher cane yield, the variety has become a farmer's choice variety, however it succumbed to the disease and wherever the disease is under cultivation, huge economic loss is noticed (Fig. 3). This variety is being grown in ~3.0 lakh ha in Maharashtra state



Figure 6. Appearance of unique leaf spots in the cv. PI 1110

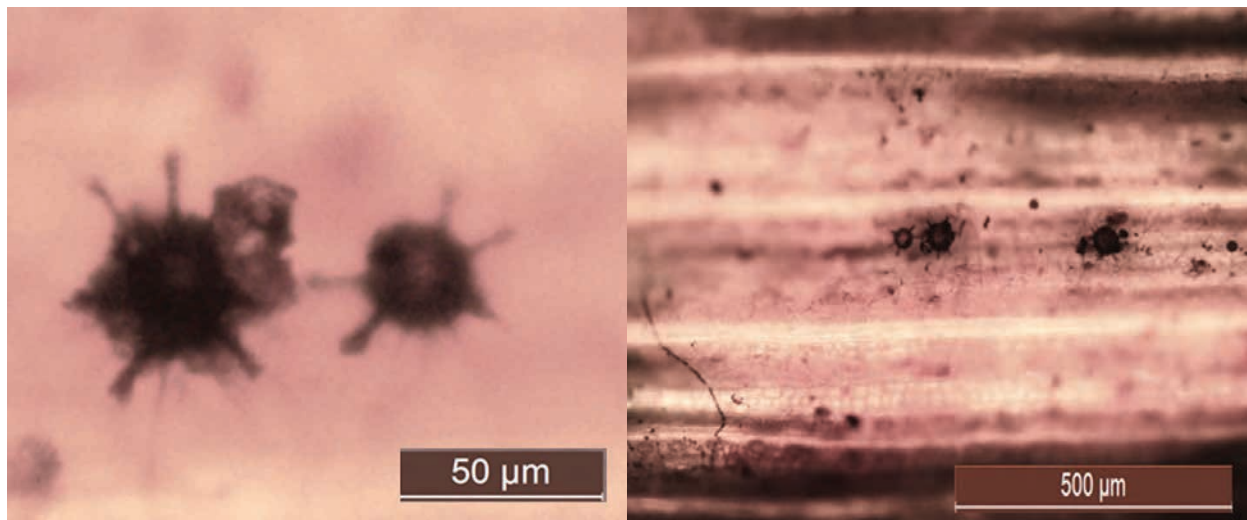


Figure 7. Distinct ascoma with setae like structures observed at the centre point of new leaf spot (left). Close up view of ascoma.

as compared to 4.85 lakh ha occupied by the cv. Co 86032 during 2017-18.

Earlier, the first author recorded brown spot in Southern Karnataka on several other varieties and the disease occurs regularly in the high humidity areas with less severity along with brown rust and ring spot. The severity of the disease has attained an alarming stage in Karnataka and Maharashtra due to the cv. CoM 0265 and hence cultivation of the variety should be discontinued in the problematic areas, otherwise other varieties under cultivation may succumb to the disease, ultimately a minor disease would become a major threat to sugarcane. Previously, pokkah boeng was considered as a minor disease in India since it occurred during grand growth phase with limited damage or no impact to cane cultivation in different states (Viswanathan and Padmanaban 2008). However, during the past 10 years, the disease attained the status of a major disease in different regions. Severe outbreaks of the disease were also witnessed throughout the country on most of the ruling varieties except on the cv. Co 86032. Severe epidemic of the disease was recorded in the parental clones of the Institute including systemic wilt

appearance after foliar infections (Viswanathan et al. 2014). Later studies confirmed that both wilt and pokkah boeng diseases are caused by the same pathogen *Fusarium sacchari* (Viswanathan et al. 2017). Farmers were resorted to go for fungicide sprays due to severity of pokkah boeng in many locations; hence, there is a need to contain the minor diseases. Removal of varieties that succumb to brown spot from cultivation or any other minor disease of sugarcane in the country is the most sustainable way of managing the minor diseases.

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