Review Article
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Preliminary investigation suggests soilborne *Rhizoctonia soalni* infecting sugarcane in Uttar-Pradesh India

Abstract

A survey was conducted during April - June 2014 in Lakhimpur (kheri), Sitapur, Shahjahanpur and Hardoi, sugarcane growing districts of Uttar Pradesh, India. It was recorded that the leaves of 4-6 months old sugarcane plant varieties viz. CoS 8432 and CoS 8436 was highly infected with shoot rot caused by Rhizoctonia solani. The rotting is initiated after the chewing to leaves by the insects. The disease of rotting was rapidly spread throughout the field of sugarcane and finally infected plants were destroyed within 15-20 days. The infected parts of the leaves were brown and dark brown in colour. Leaves may also become dry during sever condition. A specific odour was also observed after uprooting and opening the infected part of the plant.

Keywords: sugarcane, CoS 8432, CoS 8436, shoot root, *rhizoctonia solani*

Volume 3 Issue 6 - 2016

Safiuddin A, Muzafar Sheikh
Department of Botany, Section of Plant Pathology and Nematology, India

Correspondence: Muzafar Sheikh, Department of Botany, Section of Plant Pathology and Nematology, Aligarh Muslim University, Aligarh-202002, Uttar Pradesh, India, Email sheikhmuzafar4@gmail.com

Received: March 03, 2016 | **Published:** July 01, 2016

Introduction

The sugar cane *S. officinarum*, a perennial plant, grows in clumps consisting of a number of strong unbranched stems. A network of rhizomes forms under the soil which sends up secondary shoots near the parent plant. The stems vary in colour, being green, pinkish, or purple and can reach 5m (16 ft) in height. They are jointed, nodes being present at the bases of the alternate leaves. The internodes contain afibrous white pith immersed in sugary sap. The elongated, linear, green leaves have thick midribs and saw-toothed edges and grow to a length of about 30 to 60cm (12 to 24 in) and width of 5cm (2.0 in). The terminal inflorescence is a panicle up to 60cm (24 in) long, a pinkish plume that is broadest at the base and tapering towards the top. The spikelets are borne on side branches and are about 3mm (0.12 in) long and are concealed in tufts of long, silky hair. The fruits are dry and each one contains a single seed.[1] Sugarcane harvest typically occurs before the plants flower, as the flowering process causes a reduction in sugar content. India is the second largest sugarcane producing country after Brazil. Largest sugarcane producing state of India is Uttar Pradesh, which has 38.61% share in overall sugarcane production as per 2013-14 figures. The second and third largest states are Maharashtra and Karnataka. Other main sugarcane producing states of India include Bihar, Assam, Haryana, Gujarat, Andhra Pradesh and Tamil Nadu.

http://www.gktoday.in/blog/major-sugarcane-producing-areas-of-india/.

Rhizoctonia solani Kuhn is a plant pathogen that attacks a large number of plant species around the world with diverse symptoms.[2] The most widely occurring species of Rhizoctonia was originally described by Julius Kuhn on potato in 1858. It also cause damping-off on tobacco,[3] A novel postharvest rot of okra pods,[4] seedling rot of chilli[5] and in many other seedlings as well as in plants cause rotting and damping off. *R. solani* do not produce asexual spores while in nature it reproduces asexually exist as vegetative mycelium and sclerotia. Thus, the *R. solani* that produce sexual spores, the basidiospores has now been put under the family- Ceratobasidiaceae in the order –Tulasinallales. The sexual fruiting structures and basidiospores (i.e. telomorph) were first observed and described in detail by Prillieux and Delacroiz in 1891. Its perfect stage has been named as '*Thanatophorus cucumeris'*.

Materials and methods

Infected part of sugarcane was taken and identified under microscope. After that infected part was cut into pieces of 0.5centimeters and surface sterilized with 0.1 % sodium hypochlorite 2-3minutes and immediately rinsed with running tap water then sterile distilled water four times to remove the traces of sodium hypochlorite and other organic debris. Small pieces of sterilized parts of infected plants were transferred on to sterilized 10mm petridishes filled with 20ml of autoclaved PDA (Potato Dextrose Agar) medium. Inoculated petridishes were incubated@28±2°C for ten days. Slides of fungal mycelium was prepared for microscopic studies (compound microscope). Fungal mycelium was taken from culture medium and stained with cotton blue+lactophenol. A cover slip was placed over the stained mycelium for microscopic studies and for photographs.

Raising of fungus culture

Fungus culture was raised on Richard's liquid medium [6] incubated@28± 2 0C for twenty days. Mycelia mat was formed on the Richard's liquid medium.

Results

The sugarcane was highly infected with *Rhizoctonia solani* {Figure 1 (A,B,C,D)}.It was confirmed after the identification of infected part under microscope by preparing the slides. The characteristic mycelium, septa, sclerotia and multinucleate cells of mycelium were observed, as shown in Figure 2. The *Rhizoctonia solani* do not produce any conidia. It was also identified by the inoculation of infected parts on PDA, Richard's liquid medium and selective medium. It was also observed that disease intensity was maximum in sugarcane growing belt of Lakhimpur, kheri and Shahjahanpur districts of state Uttar-Pradesh (India) in comparison to other sugarcane growing districts. The yield loss caused by *Rhizoctonia solani* in sugarcane depicts its potential threat to the sugarcane production.

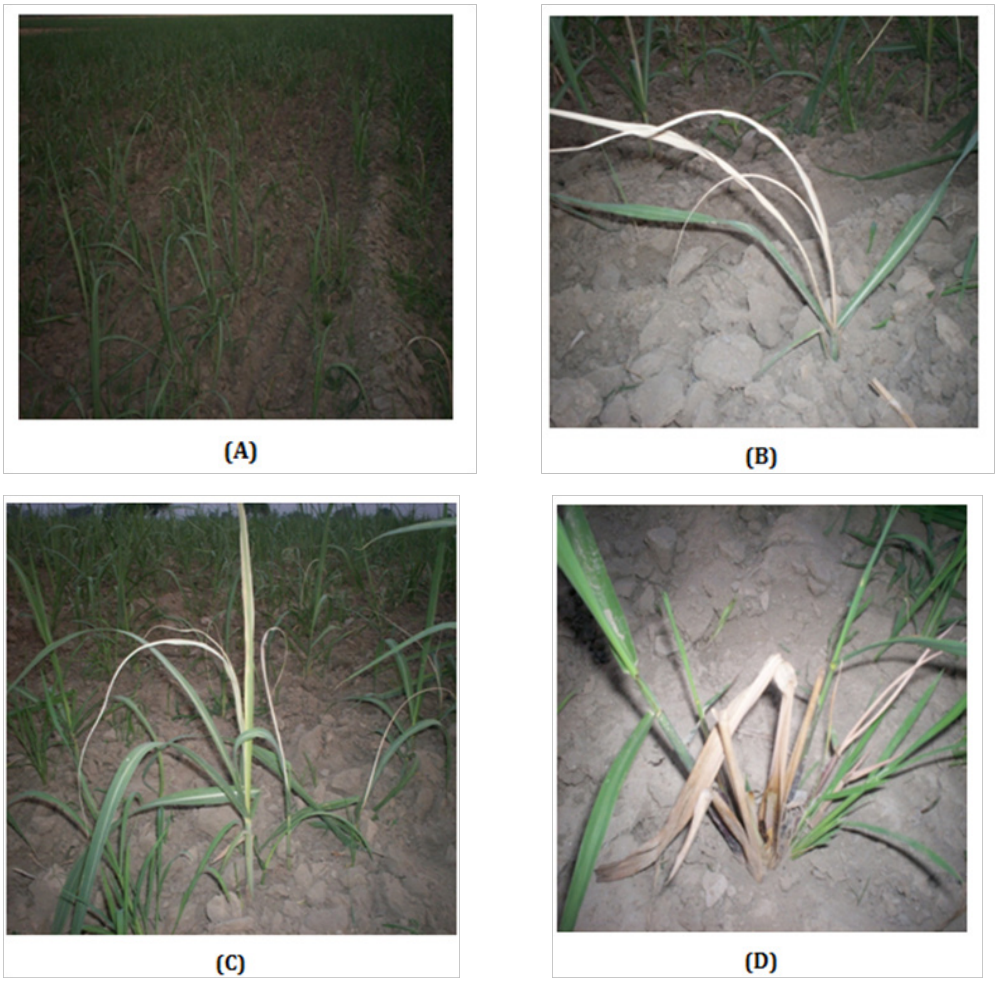

Figure 1 Infected field (A), infected plants (B, C and D) of sugarcane showing thin leaves of Sugarcane (C) and the whole stem is wiped out (D).

Figure 2 The characteristic mycelium, septa, sclerotia and multinucleate cells of mycelium of Rhizoctonai solani.

Confirmation

R. solani does not produce spores and is generally identified by characteristics of the mycelium and sclerotia. Mycelium is colourless when young, but assumes a light brown colour as it matures. Under microscopic examination hyphae are multinucleate, hyaline, septate, and branch at right angles (Figure 1). Hyphae are typically constricted and septate at the point of branching. Septae contain a doughnut-shaped pore that enables nuclei, mitochondria and septae to migrate between cells. Hyphae are 4 to 15µm wide. On agar media, *R. solani* produces white to deep brown, cottony mycelium. Sclerotia are produced abundantly in culture and on infected plant parts. Sclerotia are typically 1 to 5mm in diameter, spherical, and dark brown to black.

Agronomic impact

Rhizoctonia has the biggest impact on young seedlings. Although not common, plants can be killed if wet conditions persist, and stand losses can occur. Older infected plants may be stunted, which can result in undersized or total loss of the whole plant. Yield reductions are generally slight up to 30% where stunting occurs. This is indeed a preliminary investigation and it suggests that the pathogen. *Rhizoctonia solani* is a potent threat for the sugarcane, necessary management practices and control measures should be adopted to keep the threat at bay.

Discussion

Rhizoctonia solani is one of the most destructive species occurring globally and causing various maladies starting from seed decay,

Citation: Safiuddin A, Sheikh M. Preliminary investigation suggests soilborne Rhizoctonia soalni infecting sugarcane in Uttar-Pradesh India. *Adv Plants Agric Res.* 2016;3(6):208–210. DOI: 10.15406/apar.2016.03.00121

damping off, wire stem, root and stem rot, canker, sheth blight and ear rot of more than 500 hosts.[7–11] Its infection occurs on roots, tubers and other plant parts which develop below or above ground.[11–14] The fungus was colourless in young stage and become brown on later when cultured on medium. Brown, black coloured and irregular shaped sclerotia were produced. The fungal hyphae was branched at right angel and separated by septa below it a constriction was present which then falls over and dies. In older seedlings, the invasion of the fungus is limited to the outer cuticle tissues, which develop elongate, tan to reddish-brown lesion. The lesion may increase in length and width until they finally girdle the stem, and the plant may die. Before the plant dies the stem turns brownish, black and may bent or twisted without breaking.[11,15,16] All characters about fungus were *R. solani* and these findings are agreed with Abd-Elsalam et al.[17]

There are no effective methods to treat *Rhizoctonia* once infection has occurred. Unfortunately, plants will never grow if even at light infection. If the disease is causing a light root rot which reduces plant vigor, cultivate to mound soil around the base of the plant to promote root growth above the diseased part. Good soil and residue management can be effective in preventing problems with *Rhizoctonia. Rhizoctonia* is generally kept in balance by other fungi in well□managed, biologically active soils. Rotate with non-susceptible hosts such as small grains and corn to allow for soybean residues to degrade thoroughly. Avoid close rotations with sugar beets or dry beans if there is evidence of *Rhizoctonia* in the field.

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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