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Management of wilt and root rot disease of sugarcane in nursery

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ABSTRACT

Sugarcane (*Saccharum officinarum* L.) is one of the most important cash crops cultivated in Maharashtra. Many biotic and abiotic factors limit the sugarcane production. Among the biotic factors fungal diseases are major constraints in reducing the yield of sugarcane. Wilt and root rot diseases of sugarcane are major threat to sugarcane cultivation in Maharashtra. The pure culture of wilt and root rot causing pathogen *Fusarium moniliforme.* and *Pythium gramenicola* sp. was successfully isolated from sugarcane wilt and root rot diseases infected samples. Pathogenicity was proved by Koch postulate test was carried out in pot culture under glasshouse conditions by inoculating the soil with pathogenic culture of *Fusarium moniliforme* and *Pythium gramenicola*. *In vivo* management of wilt and biofertilizer and *Trichoderma* indicated that *Fusarium moniliforme* and *Pythium gramenicola* were found in carriers (cocopeat, vermicompost, bagasse, FYM and soil) and the bioagent *Trichoderma* was proved to be the best antagonists in inhibiting the growth of the fungus. Among these, cocopeat was found most superior and recorded maximum germination percentage, plant height and minimum wilt and root rot disease incidence at 30 and 45 DAP *in vivo* conditions. it was observed that Blitox and Bavistin inhibited mycelial growth of test fungus at 0.2 per cent concentration and lower disease incidence. It clearly indicated that, these two fungicides are quite effective against the wilt and root rot diseases of sugarcane nursery caused by *Fusarium moniliforme* and *Pythium gramenicola*. All the treatments of bio-fertilizers and *Trichoderma* were observed to minimize the diseases incidence.

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INTRODUCTION

Maharashtra is one of the leading states in sugar and sugarcane production in India. Sugarcane industry in Maharashtra is second largest agro based industry next to cotton in which higher investment is made and has brought about desirable changes in social, economic, educational and political life in rural areas. In Maharashtra the highest harvested cane yields by farmers for Adsali and Ratoon have been 269, 217 and 202 T/ha, respectively. These production potential can be achieved

by adopting better irrigation water management and scientific crop production practices. The crop is subjected to several diseases caused by fungi, bacteria, phytoplasma, nematodes, viruses. Out of this wilt and root rot disease caused by *Fusarium* sp. *and Pythium* sp. is gaining economic importance as it entailing the considerable losses in cane yield varies from 40-60 per cent. It was decided to undertake the studies on wilt and root rot disease of sugarcane in nursery"

MATERIAL AND METHODS

The diseased plant samples of wilt and root rot of sugarcane caused by *Fusarium* sp. and *Pythium* sp. were collected from Sugarcane Foundation Seed Production Scheme, Pravaranagar, Tal. Rahata Dist. Ahmednagar (Maharashtra). The micro-organisms responsible for wilt and root rot of sugarcane were isolated on PDA medium by employing tissue isolation method from infected disease samples.

Pathogenicity of the isolated fungus was tested by cocopeat inoculation technique. Pure cultures of fungus were multiplied on sand maize medium for to test of in sterilized flasks and flasks were kept in incubator at 27° ±1^{0}C for eight days. Then the pots were filled with sick soil. The sugarcane sets were planted in these pots. The pots were kept in glasshouse at 30° ± 2^{0}C temperature and observations recorded. The symptoms of the disease were observed under glasshouse condition after artificial inoculation of fungus (Sen and Kapoor, 1975).

Morphological characters of pathogens were studied by observing the cultures grown on PDA and EANA media. Microscopic observation of macroconidia, microconidia and chlamydospores were recorded with the help of ocular micrometer.

Effect of biofertilizer and biological agent on incidence of wilt and root rot of sugarcane was carried out at nursery condition. For planting of sugarcane single eye budded sets were selected for planting on plastic tray and treated with biofertilizer, Azotobacter, PSB, (as per recommended dose *i.e.* 2.5 ml/lit of water), biocontrol agent *Trichoderma* sp. (5 g/lit of water) and fungicides Bavistin and Blitox.(2 g/lit of water *i.e.* (0.2%) (20 g in 10 lit. water) (Soni and Kanwar, 1989). The treatment details are T_1-(Cocopeat), T_2- (Vermicompost), T_3- (Cocopeat 75% +Vermicompost 25%), T_4- (Cocopeat 75%+Vermicompost 25% + *Trichoderma* soil application), T_5- (Cocopeat 75% + Vermicompost 25%+ *Trichoderma* sett application), T_6- (Cocopeat 75%+ Vermicompost 25%+ *Trichoderma* soil application + *Trichoderma* sett application), T_7- (T_6+ Biofertilizer soil application), T_8- (T_6+ Biofertilizer sett application), T_9- (T_6+ Biofertilizersoil application+ Biofertilizer sett application), T_{10}- (T_3+Bavistin sett treatment) and T_{11}- (T_3+ Blitox soil application)

Disease incidence of wilt and root rot on sugarcane seedlings in nursery under greenhouse condition was recorded at 30 and 45 days after planting.

$$\text{PDI} = \frac{\text{Infected plants}}{\text{Total plants}} \text{ x } 100$$

RESULTS AND DISCUSSION

The experiment on the wilt and root rot of sugarcane caused by *Fusarium* sp. and *Pythium* sp. were conducted at the Sugarcane Foundation Seed Production Scheme, Pravaranagar, Tal. Rahata, dist. Ahmednagar (M.S.).

Isolation and pathogenicity :

The sample of wilt and root rot of sugarcane were collected from experimental greenhouse nursery tray. The affected portion of the root and stem of the sample were cut in to small pieces, washed thoroughly in tap water to remove dirt. The fungus was isolated from root portion of plants and characters of the fungus produced on EANA and potato dextrose agar were studied. The pure cultures of the fungus isolated from the root portion were used for the further studies. The pathogenicity test of *Fusarium moniliforme* and *Pythium gramenicola* on sugarcane variety CO-265 was proved by soil inoculation method and carried under glasshouse condition as per the procedure described earlier in the chapter material and methods. The control was maintained in each treatment. The pathogen infected the plant at collar and root region. The leaves of such infected plant became initially yellow in colour followed by browning during the advanced phase of the infection. The white mycelium growth around the collar root region completely was noticed. The base of the stem turned brown and sunken. The plant gradually dried and toppled within 15 days. These results are in accordance with the studies of Viswanathan *et al.* (2011) and Messiaen and Hountondji (1989) who obtained the results that soil conditions favorable for the development of sugarcane root rots by *Pythium* sp. and nematodes are described. *P.*

graminicola was isolated from sugarcane and its pathogenicity was confirmed on maize, sorghum and sugarcane roots.

Symptomatology :

The symptoms of the disease were observed under nursery condition after artificial inoculation of fungus. The pathogen showed symptoms as loss of turgidity, yellowing and browning followed by drooping of leaves, stunting of plant and in advance stage, plants were completely wilted and dried. Blackening of vascular element was observed in root. The infected sugarcane plants were showed characteristics browning of leaves followed by loss of vigour and death of plants. The diseased plants were easily pulled out from soil. Lee and Hoy (1992) who compared the effects of infection of sugarcane by several *Pythium* sp. caused significant reductions in root weight, browning of leaves, but had varying effects on shoot number and weight. Root rot symptoms induced by these species were mild or not evident. *P. catenulatum* and the unidentified *Pythium* sp. were nonpathogenic. These results are in accordance with earlier investigation.

Morphological characters :

Morphological characters of the fungal pathogen under study were recorded from eight days old culture grown on potato dextrose agar medium. Mean length, breadth, septation of conidia was measured with ocular micrometer.

Fusarium moniliforme:

The colonies were circular, compact with smooth margin and white in colour. Microconidia in chains, or in fall heads formed in white to isabella colour, mycelium spindle to ovoid in shape and measured 5 to12 x 2.0 to 4 µm. Macroconidia were slender, sickle shaped, pedicellate, scattered or in sporodochia or pinnotes, brownish white to orange cinnamon, mostly three septate, sclerotia blue, stroma violet, chlamydospore absent, macroconidia measured 43 to 46 x 3.0 to 3.5 µm.

These results are in close agreements with Martyn (1932) who reported the morphological characters of *Fusarium moniliforme i.e.* three septate macroconidia measured 26.4-49.5 x 3.3-4.9 µm. The non-septate microconidia measured 6.6-13.2 x 3.3-4.9 µm.

Pythium gramenicola:

Mycelium smooth walled hyaline 2.0-9.0 µm. Antridium and ogonium produce abundantly on CEMA and may be seen two days after inoculation on to this medium. When grown at 28 ^{0}C. The fungus is homothallic with oospores 27.9 – 46.5 µm in diameter which are thick walled (2.5-5.5 µm) and have large blunt projections (4.5-9.5 µm) long. This result are close agreements with

Table 1: Effect of sett inoculation with biofertilizer and *Trichoderma* on wilt and root rot disease of sugarcane

Treatments	Treatment details	Wilt and root rot incidence % at 30 DAP	Wilt and root rot incidence % at 45 DAP
T_1	Cocopeat	0.17	0.20
T_2	Vermicompost	0.77	0.80
T_3	Cocopeat 75% +Vermicompost 25%	0.67	0.73
T_4	Cocopeat75%+Vermicompost 25%+ *Trichoderma* soil application	0.73	0.77
T_5	Cocopeat75%+Vermicompost25%+ *Trichoderma* sett application	0.70	0.73
T_6	Cocopeat75%+Vermicompost25%+ *Trichoderma* soil application+ *Trichoderma* sett application	0.43	0.47
T_7	T_6+ Biofertilizer soil application	0.37	0.43
T_8	T_6+ Biofertilizer sett application	0.47	0.53
T_9	T_6+ Biofertilizersoil application+ Biofertilizer sett application	0.23	0.30
T_{10}	T_3+Bavistin sett treatment	0.27	0.33
T_{11}	T_3+ Blitox soil application	0.57	0.60
GM		0.49	0.54
S.E. $\pm$		0.03	0.03
C.D. (P=0.05)		0.11	0.11

Croft and Magarey (1984).

Disease incidence of wilt and root rot on sugarcane in nursery under green house condition :

Disease incidence of wilt and root rot diseases on sugarcane seedlings in nursery under greenhouse condition were recorded at 30 and 45 days after planting.

In experiment the data presented in Table 1 showed that, the treatment T_1 (cocopeat) found significantly superior and recorded minimum disease incidence (0.17%) and it was statistically at par with T_9 (75 % cocopeat + 25%, vemicompost + *Trichoderma*, acetobactor, PSB to soil and set application) and T_{10}(75% cocopeat + 25%, vemicompost + bavistin set treatment) recorded (0.23% and 0.27%) disease incidence, respectively. The maximum disease incidence (0.77%) observed in treatment T_2 (vermicompost). At 45 days after planting, the disease incidence on sugarcane seedling was recorded, the treatment T_1 (cocopeat) found significantly superior over all other treatments and recorded minimum disease incidence (0.20%), it was statistically at par with treatment T_9 (75 % cocopeat + 25 % vemicompost + *Trichoderma*, acetobactor and PSB to soil and set application) recorded (0.30%) disease incidence and T_{10} (75 % cocopeat + 25% vemicompost + bavistin set treatment) recorded (0.33%) disease incidence, respectively. The treatment T_2 (vermicompost) recorded maximum disease incidence (0.80%). The maximum inhibition zones of the pathogen causing wilt and root rot disease of sugarcane were recorded by Acetobacter, PSB and *Trichoderma*. Similar results were recorded by Sabalpara *et al*. (2009) noticed that for the purpose of controlling sugarcane wilt and root rot pathogen and to obtained efficient isolates, of *Trichoderma* were tested. The results indicate that all the tested isolates were effective. Gawade *et al*. (2012) reported that the study showed that the different *Trichoderma* isolates have good antagonistic effect on the mycelium growth of *Fusarium* sp. and *Pythium* sp. These results are in accordance with earlier investigation. All the above mentioned reviewed will strongly support the present study. These two fungicides were found to be most effective against the wilt and root rot diseases of sugarcane nursery caused by *Fusarium* sp. and *Pythium* sp.In the present investigation is in agreement with Goodall *et al*. (1998) who reported that the effects of fungicide treatments on the germination of single-budded sets (SBS) of sugarcane were described. Sugarcane sets treatment in cold water with (carbendazim + difenoconazoletes) improved germination percentage and reduce the disease incidence. Similarly Gohil and Vala (2003) who found that Bavistin (carbendazim), Dithane M-45 [mancozeb] set dip treatments, on sugarcane germination and wilt (*Fusarium moniliforme)* incidence were studied under pot culture conditions. Bavistin was the most effective in improving germination and controlling the incidence and spread of wilt infection. These results are in accordance with earlier investigation. All the above mentioned reviewed will strongly support the present study.

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