Interactions of Phylloplane Microfungi with Blast Disease of Rice Crop

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Abstract

In the present investigation the interactions of phylloplane fungi with disease development of blast of rice caused by Pyricularia oryzae were studies qualitatively under field conditions. Mostly plants were infected with blast disease in control plot when spray with conidial suspension of pathogen but the infection of disease was inhibited in the plot which was sprayed with the spore suspension of individual phylloplane fungi. Maximum inhibition was seen by Trichoderma viride, Cephalosporium acremonium and penicillium chrysogenum. It may be due to their interactions with pathogen.

Keywords: Phylloplane fungi, biological control, Antagonism & Micro Fungi.

Introduction

Phylloplane microorganisms interact with leaf pathogens for nutrition and space (Sinha, 1965; Skidmore, 1975 and Niwas and Sharma, 1988) Which is helpful in relation to control of pathogen by antagonism (Baker and Cook, 1974 Sharma et al, 1999; Campbell, 1989;) Biological Control of Plant Pathogen is new approach (Khetan, 2001) to minimize the loss of crop productivity without ecological disturbance by industrial production of bio-control agent. (Khachatourians, 1986). The cost of gross input for in vitro production of bio-control agents include the use of media, energy, time and labour (Sharma and Singh, 1990 and Sharma 1994 and Sharma, 2004). Biotechnological approach (Swaminathan and Vineeta, 1991) will lead to the improvement in the process technology (Burgess, 1981) cost of production could be reduced by using cheaper fermentation media and shorter fermentation cycles (Blakemen and Fokkema, 1984; Sharma et al 1999; and Dubey, 2002).

Research on biological control of rice pathogens (Vasudeven et al, 2002) started mainly in the 1980. Research is still concentrated on the identification, evaluation and formulation of bio-control agents for deployment. A number of fungus, bacteria (Rangaswami, 1984) virus, nematode and mycoplasma like organisms cause diseases to rice plants (Table 1). Among these the fungal diseases viz. Blast (Pyricularia oryzae) brown spot. (Bipolaris oryzae), Stem not (Sclerotium oryzae), Sheath blight (Rhizoctonia Solani),

Sheath rot (Sarocladium oryzae), Bacterial diseases such as bacterial bligh (Xanthomonas oryzae) and viral diseases such as tungro (rice tungro virus) are most important. These diseases are considered as a serious constraint for rice production (Vasudevan et al, 2002).

Rice disease management strategies strategies mainly aim at prevention of out break or epidemics through the use of host plant resistance and Chemical pesticides the persistent injudicious use of chemicals has toxic effects on non-target organisms and can cause, undesirable changes in the environment. Most of these chemicals are too expensive for the resource poor formers of Asia, where 90% of world's rich is grown. Large scale and long term use of resistant cultivars is likely to result is significant shift in the virulence characteristics of pathogens, culminating in resistance, break down. However, research during previous two decades indicates another potential option of rice disease management. That is biological control of rice diseases. Bio control assumes special significance being and eco-friendly and cost effective strategy (Table 1) which can be used in integration in other strategy for a greater level of production with sustained rice yields.

In the present investigation an attempt has been made to study the interaction of phylloplane micro-fungi with blast pathogens (Pyricularia oryzae). The aim of the present investigation is to identify the potential antagonistic micro-fungi for biological control of blast disease of rice crop.

It is a common and destructive disease in India.

Materials and Methods

Cultivation of Rice Plants

Rice plants were cultivated in different plots for the study of interaction between Pyricularia oryzae pathogen and individual phylloplane micro fungi under natural field conditions.

Isolation of Phylloplane Micro-fungi

The phylloplane micro-fungi were isolated by dilution plate techniques. For the present studies five common phylloplane fungi i.e. Alternaria alternata, Aspergillus niger Cephalosporium acremonium, Penicillium chrysogenum and Trichoderma viride were selected to study their antagonistic nature with reference of Blast diseases of rice caused by Pyricularia oryzae.

Isolation of Spores of Phylloplane Fungi

Spores of Phylloplane fungi were scrapped from the seven days old culture grown on sterile PDA slants. These spores along with mycelial fragments were mixed in sterile water. the mycelial fragments were removed by filtering the spore suspension through three layered cheese cloth. The spore concentration (2×10^5 spores cm^3) were measured with the help of haemocytometer. This known concentration of spore suspension was taken for interaction studies under field conditions.

Isolation of Conidia of Pathogen:

The diseased leaves were collected from the field

crops and suspended in petri dishes containing sterile water. The leaf surface was scratched with the help of forcep and needle so as to collect the conidia in the sterile water and suspension of conidia of Pyricularia oryzae was prepared under aseptic conditions.

Interactions of Phylloplane Fungi and Pyricularia oryzae (in vivo)

Rice seedlings were grown in controlled laboratory conditions. The 11 days old seedlings were transferred to field for further experiments. Excluding the control, fifteen experimental plots. (2m x 2m) were taken for seedling plantation. Around 20-30 seedlings were planted in each plot and left for further growth. After the three weeks of seedling plantation. The plants were sprayed with conidial suspension and spore suspension of individual phylloplane fungi. The plants of control plot were sprayed with sterile water. Sufficient care was taken so as to make free the treatment plots from undesirable contaminations. This practice was carried out by covering the rice plants with polythene bags while giving specific treatment to a desired experimental plot.

Result

In the present investigation the study of interactions of phylloplane fungi Viz. Alternaria alternata, Aspergillus niger Cephalosporium acremonium, penicillium chrysogenum and Trichoderma viride with disease development of Pyricularia oryzae causal organism of blast of rice were studied qualitatively under field conditions. Mostly plants were

infected with blast disease in control plots when sprayed with conidial suspension of pathogen but the infection of disease was inhibited in the plots which were sprayed with the spore suspension of individual phylloplane fungi (Table 2). Maximum inhibition was seen by Trichoderma viride (34%) Cephalosporium acremonium (25%) and Penicillium chrysogenum (20%) where as Alternaria alternata and Aspergillus niger inhibited the disease development in low percentage (15%) The inhibition of Pyriculeria oryzae by Cephalosporium acremonium, Trichoderma viride and Penicillium chrysogenum is may be due to their interactions with pathogen for nutrients and space. There is also the possibility of inhibition due to the biocidal activity of the phylloplane fungi in the habitat of foliar surface.

Discussion

A no. of phylloplane micro – organisms with potential for biocontrol of disease of crop plants through interaction and their biocidal activities (Morgan, 1963; Steward and Hil, 1965) and other cultivated plants (Sinha, 1965; Henis and Chat, 1975; Rai and Singh, 1982; Cook and Baker, 1983; Sharma 1985 and Paulity et al, 1987) have been in identified during the recent past (Sharma, 1994; and Sharma. et al, 1999) either in the laboratory or in green house trials. This antagonistic nature of micro-fungi may be due to direct or indirect effect of metabolites either in the form of specific inhibitor or as enzymes. (Dennis and Webster, 1971 and Elad et al, 1982; 1985) responsible for the lysis of the vegetative

structure of pathogens (Elad et al, 1982).

In the present investigation maximum inhibition of disease is achieved by Trichoderma viride and Cepholosporium acremonisum followed by Penicillium chrysogenum, Alternaria alternata and Aspergillus niger. Out of them Trichoderma viride and Cephalosporium acremonium are selected as potential bio control agents for the control of blast disease caused by Pyricularia oryzae but it is needed more researches on these test fungi under laboratory as well as field condition at different temperature moisture and other climatic conditions.

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Table -1

Major Rice Diseases and Their Bio Control Agents

Disease	Causal organisms	Bio-Control Agent
Blast Brown Spot Bacterial blight Sheath blight Sheathrot Stem rot Tungo	Pyricularia oryzae Bipolaris oryzae (Bredade Haon) Shoe Maker Xanthomonas oryzae Rhizoctonia solani Sarocladium oryzae Sclerotium oryzae Rice Tungro virus vector – Nephotettix spp.	Pseudomonas fluorescens Pseudomonas Sp. P. aeruginosa Bacillus sp. P. fluorescens, B. subtleties P. aeruginosa, Pseudomonas sp. P. Putida P. fluorescens B. subtilis. P. aeruginosa. Pseudomonas sp. P. Fluorescens P. aeruginosa B. substilis B. pumilus P. fluorescens (for vector)

(Source – Vasudevan, et al, 2002)

Table – 2
Interactions of Phylloplane Micro Fungi with Blast Diseases of rice (in vivo)

Test Fungi	Infection of Blast disease on rice plant (%)	Inhibition of Disease (%)
Control (Sterile Water)	100	Nil
Alternaria alternata	58±6	15±0.88
Aspergillus niger	85±8	15±0.88
Cephalosporium acremonium	75±6	25±3.00
Penicillium chrysogenum	80±7	20±1.75
trichoderma viride	66±7	34±2.00