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Garlic Bulb as an Effective Eco-Friendly Strategy to Manage the Blast Disease of Paddy

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Abstract

Rice plant diseases such as blast need to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Allium sativum, commonly known as garlic, has been found to have antibacterial, antiviral, and antifungal activity. From garlic bulbs, solutions of different concentrations (.25%, .5%, 1%) were prepared. In order to quantify the inhibitive effect of garlic bulb crude extract against P. oryzae, different quantities of the control agent was tested In vitro. At .25% concentration, garlic bulb crude extract inhibited the fungal growth to 43.50%, at .5% concentration the inhibition percentage increased up to 61.68% and with the increase in concentration to 1%, the diameter of mycelia growth also showed a downward trend and resulted in 72.11% inhibition effect.The unexploited substances garlic bulb solution should be used in the field for disease control as an alternative source to the systemic fungicides. The results of the present research work will be useful for devising effective eco-friendly strategies to manage the blast disease of paddy.

Keywords: Systemic, Fungicides, Mycelia.

Introduction

Rice plant diseases such as blast need to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Consequently, some pest management researchers have focused their efforts on developing alternative inputs to synthetic chemicals for controlling pests and diseases (Pal 2006).The main objective of the present study was to assess the impact of garlic bulb on the mycelial growth of P. oryzae. Allium sativum, commonly known as garlic, is a species in the onion genus, Allium. Garlic has been found to have antibacterial, antiviral, and antifungal activity. When crushed, Allium sativum yields allicin, an antibiotic and antifungal compound (phytocide). also affords the sulfur-containing compounds alliin, ajoene, diallyl polysulfides, vinyldithiins, S-allylcysteine, and enzymes, B vitamins, proteins, minerals, saponins, flavonoids, and Maillard reaction products, which are not sulfur-containing compounds. Furthermore, a phytoalexin (allixin) was found, a nonsulfur compound with a γ-pyrone skeleton structure with antioxidant effects and antimicrobial effects (Kodera Y et al 2002). The composition of the bulbs is approximately 84.09% water, 13.38% organic matter, and 1.53% inorganic matter, while the leaves have 87.14% water, 11.27% organic matter, and 1.59% inorganic matter.

Aim of the Study

This piece of work is aimed to study the garlic bulb as an eco-friendly control measure for control of plant disease

Material and Method

The agro climatic conditions of Bundi are most favourable for production of rice crop. The blast disease caused by Pyricularia oryzae has been frequently associated with rice crop. Therefore it is necessary to develop suitable technology for the management of Pyricularia oryzae in rice. To full fill this objective, during present investigation, experiments were carried out to test the efficacy of garlic bulb extract.10 gram fresh garlic bulbs were surface-sterilized with sodium hypochlorite (NaOCl, 10%) for 10 min and then rinsed in three changes of sterile distilled water. Then it was grounded by a grinder and homogenized in100 ml sterile distilled water to give a concentration of 100 %. This was grinded and filtered through doubled layered cheese cloth. This extract was poured into a sterile tube and centrifuged at 10.000 rpm for 10min.The supernatant was filtered through membrane filters. The prepared solution was considered as

a pure stock solution. From this, solutions of different concentrations (.25%, .5%, 1%) were prepared.

For testing the efficacy of garlic .25ml, .5ml and 1ml of stock solution of garlic bulb extract were mixed separately in 100 each of sterilized oat meal agar supplimented with paddy powder medium and poured into Petri plates to make the .25%, .5% and 1% concentrations of the control agent respectively. In control plates, sterilized distilled water is added in the medium in place of control agents. Each treatment was replicated three times. After solidification of the medium, 5mm. diameter plug from7days old colony of Pyricularia oryzae was inoculated separately in the center of each Petri plates and incubated at 25±2°C. Mycelial growth was recorded when the growth of the selected pathogens was completed in the control treatment. Mean radial mycelial growth of each control agent was recorded and data were subjected to statistical analysis. Radial mycelial growths of fungus on different conc. of garlic extract was transformed into inhibition percentage by using the formula as suggested by Naz et al 2006.

$$I = \frac{C - T}{C} x \ 100$$

Where

I = Per cent inhibition
C = Radial growth in control
T = Radial growth in treatment

Observation

In order to quantify the inhibitive effect of garlic bulb crude extract against P. oryzae, different quantities of the control agent was tested In vitro. The data presented in Table indicates that all the concentrations of garlic bulb crude extract were found to be significantly effective in controlling P. oryzae growth in culture as compared to control. At .25% concentration, garlic bulb crude extract inhibited the fungal growth to 43.50%, at .5% concentration the inhibition percentage increased up to 61.68% and with the increase in concentration to 1%, the diameter of mycelia growth also showed a downward trend and resulted in 72.11% inhibition effect.

S. N.	Treatments	Concentrations (%)	Percent Inhibition
1	Garlic Bulb Extract	0.25	43.50%,
		0.5	61.68%
		1.0	72.11%
SEM ±			2.451
CD=5%			7.154
CV=1%			9.695

Result and Discussion

The present study revealed the antagonistic property of Garlic Bulb extract on mycelia growth of P. oryzae. The data on the inhibition percentage of mycelia growth of P. oryzae revealed that at .25%,.5% and 1% concentration of garlic bulb extract the growth inhibitory percentage 43.50%,61.68% and 72.11% was recorded. The results revealed that the inhibition rates increased with increasing concentrations of the control agent.

The results of the present investigation are in conformation with Garcia et al (1987) who advocated the effect of Allium extract on Aspergillus fumigatus, Aspergillus niger, Candida albicans, Trichophyton mentagrophytes and Microsporum gypseum. Chaudhary et al (2003) also proved that bulb extracts of Allium sativum caused 59% inhibition of mycelial growth against Alteraria alternata causing early blight of potato. Wszelaki and Miller (2005) also reported that garlic extracts significantly reduced the early blight disease on tomato. The results are further in conformation with Bhuiyan et al (2008) who found Garlic to be effective to control fungal growth of Colletotrichum dematium at 20% concentration.

The antifungal effects of garlic may be ascribed mainly to allicin and ajoene. Allicin (allyl-2-propenethio-sulfinare) which is generated from alliin (S-allylcystein-S-Oxide) after injury of the garlic tissue, is a rather labile compound and is further transformed into a variety of substance. The volatile organic compounds mainly consisted of linear chain aldehydes (5-hexenal, hexanal, and octanal), allylsulfides, and disulfides (allyl disulfide allyl methyl disulfide) (Oneageba et al 2004 and El Mahmood et al 2008).

Allicin might inhibit the main essential enzymes for pathogen infection (Miron et al 2000) and ajoene (allicin derivative) might be inhibiting fungal growth by disrupting the cell wall (Naganawa et al 1996, Yoshida et al 1987). Same may be possible in the present finding, that supports antifungal property of garlic against P. oryzae. . The results of the present research work will be useful for devising effective eco-friendly strategies to manage the blast disease of paddy.

Conclusion

From the present research work it is concluded that we should put emphasis on some eco-friendly control agests as promising bio pesticides.

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