INTRODUCTION

Of the different food grains produced in India, rice (*Oryza sativa* L.) occupies the most important position and nearly a third of total area under food grains in the country is devoted to rice cultivation alone. It is to be remembered, however, that a substantial portion of the yield potential of this crop remains unrealized every year because of disease, pest and weeds. To meet the ever increasing demand of a fast growing population in this country, increase in yield potential and maximization of the actual yield has to be given top priority. To achieve this, many new varieties, particularly those of high yielding type have been intorduced. Greater use of fertilizer for such varieties and their intensive cultivation year after year have led to the emergence of some new diseases of rice crop in severe form and total disease picture has undergone a sea-change. Sheath blight disease of rice probably the best example of in this regard. Sheath blight incited by *Rhizoctonia solani* Kuhn, the imperfect stage of *Thanatephorous cucumeris* (Frank) Donk, was previously not of much concern but has now become a major disease of rice, probably second only to blast, in its crop damage potential, Losses usually vary from 10-50% depending on growth stage of plants when the disease occurs.

Sheath blight is usually severe on cultivars that are short, high tillering, more erect and responsive to high fertilizer in comparison to tall cultivars, with few tillers, *R. solani* can attack rice plants at any growth stage from seedling but tillering stage, when the leaf sheath becomes discoloured at or above water level is the most conducive. Disease symptoms appears as spots or lesion mostly on leaf sheath, extending to the leaf blades under favourable conditions. The spot or lesion appear greenish grey at first, ellipsoid or ovoid and about 1cm. long. They enlarge and may reach 2 or 3 cm in length and become greyish white with brown margins and some what irregular in outline (Plate 1). In the advanced stages brown sclerotia are formed which are easily detached from these spots. Under humid conditions, the fungus mycelium may spread to other leaf sheaths and blades. Eventually the whole leaf rots. In severe cases all the leaves of a plant are blighted resulting in death of the plant.

R. solani is a soil borne pathogen of very aggressive nature, it survives in soil as sclerotia as well as thick walled lobate mycelia. The pathogen is characterized by its

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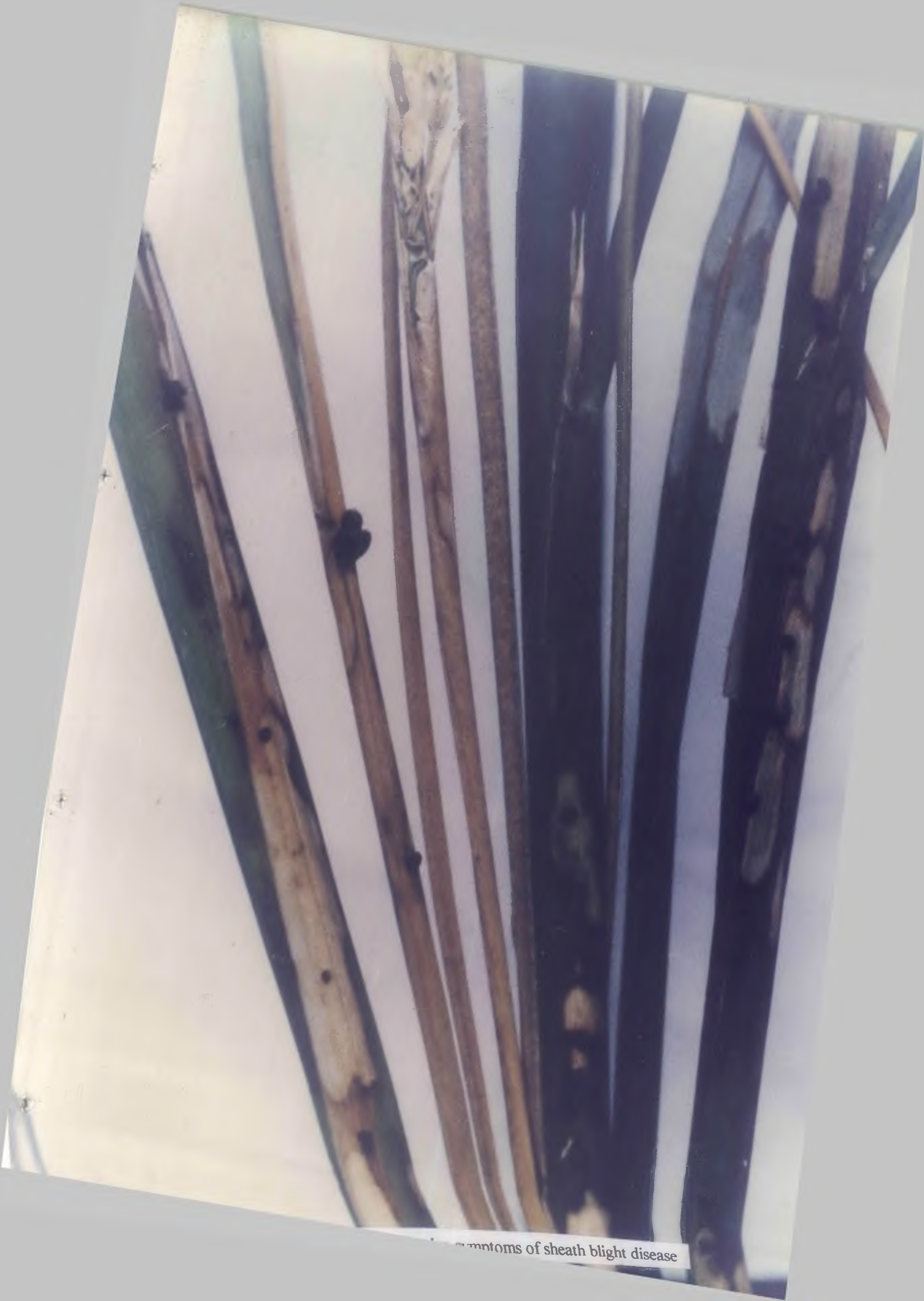

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hyphal and sclerotial characteristics. The hyphae are hyaline when young, yellowish brown when old. Fungus produces dark brown sclerotia more or less globose in shape. It survives is the soil for several months depending on temperature and moisture conditions. The sclerotia float to the surface of the water during soil puddling, levelling, weeding and other operations and infect the plants with which they come into contact.

Soil-borne nature of the pathogen and prolonged survival of its sclerotia make the control of the disease a difficult proposition. Practically there is no known sources of resistance against *R. solani* in the rice germplasm. To cope with this situation, both an improvement in the traditional practices for disease for disease control as well as the introduction of some novel, useful approaches have become necessary. It is now an established fact that conventional chemical control using toxic chemicals has an immediate impact on disease, but it is also true that their indiscriminate and continued use is fraught with danger in the from of environmental pollution leading to ecological disaster. So, there is a realisation now for an urgent need for intensive exploration of some alternative, effective but ecofriendly approch for controlling the disease. In fact, a viable technology for controlling the disease in field condition is yet to be prefaced.

One of the suitable option in this regard is to capitalise hosts own multicomponent coordinated defense potential. The fact that even plants of susceptible varieties do not always get much damaged by a disease under certain cropping conditions or stress situation. Many plants may effectively defend themselves against their pathogen are of much significance. This implies that even a susceptible variety, lacking gene(s) for resistance may have its own latent defense potential which when activated under certain conditions, may limit the spread and activity of the pathogen sooner or later. This suggest that activators of such latent defence potential in susceptible host by artificial manipulation may be a distinct possibility and serve as a useful new approaches in disease management. In this context , one distinct possibility is to trigger the activation of susceptible host's latent defence potential either by prior inoculation with the same. related or even unrelated infections agent(s) of both home and hetorogeneous nature or by treatment with the metabolites of such biotic agents, almost in the line of immunization so effectively practised against some disease of man and animals. Reports are available that effective resistance can also be developed in susceptible plant host against its pathogen by prior treatment with many non-conventional, often non-toxic or mildly toxic chemicals (Wain and Carter, 1972; Chakraborty and Purkayastha, 1987; Lazorits, 1988; Sinha, 1989; Purkayastha, 1994; Mohr and Cahill, 2001). Biologically induced resistance may be effective against more than one pathogen, often of different kind and may persist for long. Excellent reviews on various aspects of such induced resistance are available (Matta 1971, 1980, Sequeira, 1983, Purkayastha, 1994; Mukhopadhaya, 1997 Rakwal *et. al.* 2000; Oostendorp *et. al.* 2001). There are also reports that extract from plant and microorganisms have induced resistance in rice plants (Oostendorp et. al., 2001).

It is an established fact that plants are often challenged by pathogens capable of triggering an array of systemic response that may be beneficial or detrimental to plant health and productivity. Inducible defence in plants against pathogen can be strongly influenced by the mix of signals generated by external biotic factor as well as by abiotic stresses. Our ability to capitalize on inducible defences and utilize them optimally in agriculture depends, in part, upon a fundamental knowledge of their biochemical nature, and of the specificity and compatibility of their expression. One type of biochemical response that is strongly associated with defence is the accumulation of phytoalexin (Hammerschmidt, 1999) which are defined as low molecular weight antimicrobial compounds that are produced after infection. Besides, pathogenesis related (PR)-proteins, oxidised phenols and several other compounds mobilize to from a complex network for active defence. Accumulation of transcripts for PR-proteins and peroxidase in rice plants triggered by *Pyricularia oryzae*, blast pathogen has been demonstrated by Manandhar et. al. (1999).

There are also reports that systemic acquired resistance (SAR) induced in rice plants increased to a maximum at 30 days and lasted for about 75 days (Arimoto et al. 1976). After successful induction of resistance following integrated approach of disease control with potential bio-control agents, soil amendments or suitable plant extract may be considered as alternative control measure for the next phase of rice plant.

Major aims of the present investigation were:

a. Using select group of non-conventional chemicals for seed treatment at a range of concentrations and for different periods to determine the optimum concentrations and duration for treatment for each chemicals that provide the most effective and durable protection to rice plant susceptible to *Rhizoctonia solani.*

b. Induction of resistance in rice plant against *R. solani* by some selective plant extracts as well as potential biocontrol agents.

c. Determination of levels of proteins, phenolics, peroxidase, polyphenol oxidase as well as phenylalanine ammonia lyase after induction of resistance.

d. Elucidation of the possible biochemical mechanism underlying induction of resistance with special reference to defence enzymes and phytoalexin production.

Importance of this research work lies in the fact that effective disease control is being attempted by the use of non-hazardous compounds through an activation of host's own defense potential which some how remains suppressed in case of a compatible host parasite interaction and that an attempt is being made to gain an insight into multicomponent co-ordinated defence system of the plant by studying the associated bio-chemical change during pathogenesis with special reference to synthesis of PR-proteins such as chitinase and β-1, 3 glucanase, accumulation of phytoalexin and other defense related compounds.

The use of non-toxic, hazard free and eco-friendly natural compounds in developing high level systemic acquired resistance (SAR) in rice plant against one of its major disease, sheath blight by seed treatment at extremely low doses has exceptional promises in plant disease control. Use of such compounds, potential antagonist and suitable biocides are expected to reduce our dependence on pesticides to some extent thus bring the benefit of disease control within the reach of poor farmer and of course in a eco-friendly way.