Effect of certain resistance inducing chemicals on Sheath blight disease incidence of rice var. ADT 36

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Abstract : The Pot culture studies were undertaken to investigate the resistance inducing chemicals for the management of Sheath blight of rice. Effect of certain resistance inducing chemicals viz., Acetyl Salicylic acid, Benzoic acid, Nicotinic acid, Propionic acid, Naphthalene Acetic Acid, Salicylic acid were sprayed at 20, 50 and 100 ppm conc. individually at disease initiation and repeated once at fifteen days interval under pot culture conditions. Among the various resistance inducing chemicals, salicylic acid @ 100 ppm was the most effective in reducing the sheath blight incidence followed by Salicylic Acid (@50 ppm) which was statistically at par. It was followed by Acetyl salicylic acid (100 ppm), Salicylic acid (20 ppm), Acetyl salicylic acid (50 ppm), Nicotinic acid (100 ppm), Benzoic acid (100 ppm) and Propionic acid (100 ppm). NAA at 20 ppm was least effective.

***IndexTerms* - Rice sheath blight, Resistance inducing chemical, Salicylic acid, Propionic acid**

I. INTRODUCTION

Rice is a monocotyledonous annual grass belong to family Gramineae and genus *Oryza*. Currently China and India are ranked 1st and 2nd in rice production according to Foreign Service Association of United States of Department of Agriculture Statistics. Over 90 % of the world's rice is produced and consumed in the Asian region with 6 countries (China, India, Indonesia, Bangladesh, Vietnam and Japan) accounting for about 80 % of the world's production and consumption (Abdullah *et al.,* 2015). It is grown in tropical and subtropical regions of the world. In the world, it occupies an area of 161.29 m ha with a total production of 480.02 mt with a productivity of 4.44 t/ha, and in India, it occupies an area of 44.50m ha with a total productivity of 3.59 t/ha during January 2017 (USDA Foreign Agricultural Services, 2017).

Rice production worldwide is affected by various biotic and abiotic stresses (Richa *et al.,* 2016). Among biotic stresses, diseases are considered as major constraints for rice production as 10 to 30 per cent of the annual rice harvest is lost due to infection by many diseases. (Skamnioti and Gurr, 2009). Rice cultivation is often subjected to several biotic stresses of which diseases like blast, sheath blight, stem rot and bacterial blight are the important ones (Ou,1985). Sheath blight is one of the serious diseases of rice caused by *Rhizoctonia solani* Kuhn.

Many methods of plant disease control are presently being used to control the rice sheath blight disease such as, physical, chemical and cultural methods. Normally fungicides are primary means of controlling sheath blight. But the use of chemical fungicides is under special scrutiny for posing potential environmental threat as the indiscriminate use of chemical fungicides resulted in environmental pollution and ill-health to biotic community as a whole. Even if acceptable fungicides are applied the pathogen often develops resistance and produce new biotypes. The increased consumer preference for healthy agricultural products and environmental risks associated with chemical residues in food are the major driving forces for the search of new safer control methods.

In recent decades new type of agro chemicals called "plant activators" which protect plant by activating their defense system have been widely used because of their low health and environment risk. Induced resistance by chemicals may provide an efficient approach to plant protection especially for problems not satisfactorily controlled by various fungicides (Schoenbeck, 1996). Resistant inducing chemicals are known as inducers of phytoalexins and/or elicitors of resistance in different plant species (Biswas *et al.*, 2008; Shabana *et al.*, 2008; Hadi and Balali, 2010). Several chemicals *viz.*, Salicylic acid (Sarwar *et al*., 2011), Acibenzolar – S – Methyl (Bengtsson *et al.,* 2008), Acetyl Salicylic acid (White, 1979), Nicotinic acid (Jaiganesh, 2005), Jasmonic acid (Cohen *et al.,* 1993) and Oxalic acid (Toal and Jones, 1999) have shown induced resistance in various crops.

Therefore, The present studies were undertaken to investigate the effect of certain Resistance inducing chemicals against Sheath Blight of rice.

II. MATERIALS AND METHODS

Crop, Variety and Source

Crop	: Rice (*Oryza sativa* L.)
Variety	: ADT 36
Source	: Tamil Nadu Rice Research Institute (TRRI), Aduthurai, Tamil Nadu.

The intensity of sheath blight was calculated as per cent disease index (PDI) as per the grade chart proposed by (Sriram *et al.*, 2000).

0 = No infection
1 = Less than 5 per cent of the area of leaf sheath affected
2 = 6-10 per cent of the area of leaf sheath affected
3 = 11-25 per cent of the area of leaf sheath affected
4 = 26-50 per cent of the area of leaf sheath affected
5 = More than 50 per cent of the area of leaf sheath affected
The per cent disease index (PDI) was calculated as given by McKinney (1923).

$$\text{III. PDI} = \frac{\text{Sum of numerical ratings}}{\text{Total number of tillers observed}} \times \frac{100}{\text{Maximum category value}}$$

Pot culture studies

The pot culture studies was conducted to test the efficacy of silicon based nutrients for assessing their influence on the incidence of sheath blight of rice with various treatment and combinations. The susceptible variety ADT 36 grown in rectangular pots of size, 30x45 cm was used for the study. The plants were given artificial inoculation by spraying the spore suspensions with adequate spore load (50,000 spores/ml) at 15 DAT in the evening hours. The crop was maintained in a poly house with frequent spraying of water to provide adequate moisture and relative humidity to enable successful infection by the pathogen. The experiments were conducted in a randomized block design with three replications for each treatment and a suitable control. The fungicide carbendazim 50 WP @ 0.1 per cent was used for comparison and the standard agronomic practices as recommended by the State Agricultural Department were followed.

Effect of certain resistance inducing chemicals on *R.solani* (Screening test – Pot culture)

Effect of certain resistance inducing chemicals viz., Acetyl Salicylic acid, Benzoic acid, Nicotinic acid, Propionic acid, Naphthalene Acetic Acid, Salicylic acid were sprayed at 20, 50 and 100 ppm conc. individually at disease initiation and repeated once at fifteen days interval.

III. RESULTS AND DISCUSSION

Effect of certain resistance inducing chemicals on sheath blight disease incidence of rice (Screening test – Pot culture)

Among the various resistance inducing chemicals, salicylic acid @ 100 ppm was the most effective (21.8 %) in reducing the sheath blight incidence followed by Salicylic Acid (50 ppm) (21.6%) which was statistically at par. It was followed by Acetyl salicylic acid (100 ppm) (30.3%), Salicylic acid (20 ppm) (35 %), Acetyl salicylic acid (50 ppm) (41.7 %), Nicotinic acid (100 ppm) (42.2 %), Benzoic acid (100 ppm) (42.4 %) and Propionic acid (100 ppm) (43.6 %). NAA at 20 ppm was least effective. The test fungicide was also found to be effective (22.5 %) in reducing the sheath blight incidence (Table 1). All the resistance inducing chemicals were found effective in reducing the sheath blight disease incidence when compared to control in pot culture (Table 1). Among the various resistance inducing chemicals, salicylic acid (SA) was found as the most effective when compared to other resistance inducing chemicals.

NAA has been reported to reduce *Fusarium* wilt of tomato (Corden and Dimond, 1959) and *Verticillium* wilt of potato (Corsini *et al*., 1989) through induction of host resistance. Colson *et al.* (2000) reported that, Bion 50 WG reduced the incidence of *Alternaria microspora* on cotton. 2,4-D was found effective against root rot of peanuts caused by *Pythium myriotylum* through their effect on root lipids and root lipid exudation patterns (Hale *et al.*, 1981). Bokshi *et al.* (2006) indicated that INA increased chitinase and peroxidase activities and reduced powdery mildew and downy mildew on leaves of melons. Acibenzolar-S-methyl was effective against blue mould caused by *Peronospora tabacina* (Perez *et al.*, 2003; LaMondia, 2009). Foliar application of ASM at pre flowering period to manage the postharvest rots of rock melon and Hami melons (Huang *et al.*, 2000) has also been reported. Likewise, the chemical inducer, 2,6-dichloroisonicotinic acid provided good levels of protection against pear fire blight (Kessmann *et al.*, 1994) and against apple scab (Ortega *et al.*, 1998). Vechet *et al.* (2009) observed that foliar application of salicylic acid increased the resistance in wheat plants against powdery mildew pathogen. The present findings on the efficacy of resistance inducing chemicals are also in line with these earlier reports. Also, foliar application of SA was proved to increase resistance against a variety of plant pathogens in rice (Daw *et al.*, 2008; Jaiganesh *et al*., 2012; Sood *et al.*, 2013; Usharani *et al.*, 2014; Singh *et al.*, 2015; Thanh *et al.*, 2017).

Further, resistance inducers when applied exogenously induced the expression of PR (pathogenesis related) genes, increased the growth characters and also conferred resistance against various pathogens of viral, bacterial and fungal origin in monocot plants (Morris *et al.*, 1998; Pasquer *et al.*, 2005; Makandar *et al.*, 2006). Thus, induced resistance may provide an alternative approach to plant protection especially for problems not satisfactorily controlled by fungicides (Schoenbeck, 1996). Foliar application of the resistance inducing chemicals at low conc. along with their non-hazardous nature, simple application procedure, systemic effect and low cost marks this approach as an effective, feasible and an eco-friendly alternative to conventional chemical management (Eswaran *et al.*, 2011).

IV. REFERENCES

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Table 1. Effect of certain resistance inducing chemicals on Sheath blight disease incidence of rice var. ADT 36 (Screening test – Pot culture)

Concentration	ASA	BA	NA	PA	NAA	SA	Hexaconazole (0.1 %)
20 ppm	47.2	54.5	53.5	55.1	56.3	35.0	22.5
50 ppm	41.7	49.2	46.4	50.8	52.8	21.6	
100 ppm	30.3	42.4	42.2	43.6	45.1	21.8	
Control	62.4						
C.D. (p=0.05)	1.29	0.10	0.12	0.05	0.08	2.09	