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Integrated Disease Management of Brown Spot in Rice Var. ADT 36 Caused by *Bipolaris oryzae*

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A B S T R A C T

The pot culture studies were undertaken to investigate the effect of integrated disease management of Brown spot in Rice Var. ADT 36 caused by *Bipolaris oryzae*. The strategy for the management of brown spot disease consisting of seed treatment with fluorescent Pseudomonads, Resistance inducing chemical salicylic acid and an organic immunity booster Navagavya were evaluated. In terms of biological control, the seed treatment with fluorescent Pseudomonads to the sprouted rice seeds at the rate of 10 g/kg of seeds was used. In terms of chemical control foliar spray of resistance inducing chemical Salicylic acid (50 ppm) was sprayed at different time intervals. In addition to that foliar application of organic product Navagavya (5%) also sprayed at different time intervals. Among the combinations of the above three management practices treatment-8 was recorded the minimum disease incidence, maximum biometrics and yield parameters of ADT 36 in pot trials.

***Key words*:** *Bipolaris oryzae*, Integrated disease management, Fluorescent Pseudomonads, Salicylic acid, Navagavya

Rice (*Oryza sativa* L.) is considered as queen of the cereals, because it is one of the most important crops of the world [1]. It is the second most cultivated cereal crop worldwide and is central to the lives of billions of people around the world [2]. Rice (2n=24) is a plant belonging to the family of grasses, *Gramineae* (*Poaceae*). India has a long history of rice cultivation. Globally, it stands first in rice area and second in rice production, after China. It contributes 21.5 per cent of global rice production. Within the country, rice occupies one quarter of the total cropped area, contributes about 40 to 43 per cent of total food grain production and continues to play a vital role in the national food and livelihood security system [3].

Rice crop is widely affected by a number of diseases caused by fungi, bacteria, viruses and mycoplasma which results in considerable yield losses [4]. Among the various fungal diseases of rice, brown spot or sesame leaf spot incited by *Helminthosporium oryzae* (Breda de Haan) Subram and Jain is found to occur in most rice growing areas. The pathogen attacks the crop from seedling to milk stage. The symptoms appear as minute spots on the coleoptile, leaf blade, leaf sheath and glume, being most prominent on leaf blades and glumes and causes about 67 per cent of yield loss [5].

Regarding the disease management practices Host plant resistance to the disease is the most economical way to manage brown spot of rice. Salicylic acid is one of a range of chemicals that induce systemic resistance [6]. It was also reported that SA induced plant resistance against pathogens and stimulated plant growth [7]. Regarding the biological control Spray application of talc based fluorescent Pseudomonads has been found effective in reducing brown spot severity [8]. Apart from the above management practices, there are many reports available on the use of organic amendments for improving the efficacy of the activity of antagonists. Among them Navagavya which is being prepared by mixing nine indigenous products (Cow dung, Ghee, Milk, Curd, Cow urine, Jaggery, Well ripen banana, Tender coconut and water) will promote plant growth and improves immunity of the plants.

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MATERIALS AND METHODS

Crop, variety and source

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

The disease incidence was assessed by adopting 0-9 scale according to "Phytopathometry" by Mayee and Datar [9] and the per cent disease incidence /index was calculated based on the formula suggested by Vidhyasekaran *et al*. [10].

Disease severity	Description of disease index
0	No lesions
1	Affected leaf area less than 1%

3	1-10% affected leaf area
5	11-25% affected leaf area
7	26 -50% affected leaf area
9	> 50% leaf area affected

$$\text{Per cent disease index} = \frac{\text{Total ratings}}{\text{Total number of leaves graded} \times \text{Maximum grade in the score chart}} \times 100$$

Pot culture studies

The pot culture studies were conducted to assess the efficacy of combined application of fluorescent Pseudomonads, Salicylic acid and Navagavya on the incidence of brown spot of rice. Rice variety ADT 36 which is susceptible to brown spot of rice in grown in a rectangular pot (30×45 cm). The test plants were artificially inoculated with the spore suspension which was sprayed at a spore load of 50,000 spores/ml at 15 DAT. The crops were maintained in a polyhouse with optimum temperature (25-30°C) and relative humidity (> 92.5%) for successful pathogenic infection. The experiments were conducted in a randomized block design with three replications for each treatment. The fungicide Mancozeb 75 WP at 0.2 per cent was used as comparative fungicide.

Efficacy of fluorescent pseudomonads, salicylic acid, Navagavya on B. oryzae

Talc based Fluorescent Pseudomonads was added to the sprouted seeds @ 2.5, 5.0, 7.5 and 10.0 g per kg of seeds with two per cent CMC and sown in cement pots. The effective concentrations of resistance inducing Salicylic acid (50 ppm) and Navagavya (5%) were sprayed at different time intervals.

Treatment schedule

T_1:	SA_1 (15 DAT)	T_6:	$T_3 + T_4$
T_2:	SA_2 (30 DAT)	T_7:	$T_3 + T_2$
T_3:	NG_1 (15 DAT)	T_8:	$T_1 + T_4$
T_4:	NG_2 (30 DAT)	T_9:	Mancozeb @ 0.2% (comparison)
T_5:	$T_1 + T_2$	T_{10}:	Control

RESULTS AND DISCUSSION

In pot culture experiments, seed treatment with fluorescent Pseudomonads @ 10 g/kg and combined application of Salicylic acid (50 ppm) and Navagavya (5%) sprayed at 15 DAT and 30 DAT respectively, were found to be significantly superior over test fungicide Mancozeb (0.2%) in respect of reducing disease intensity and increasing biometrics and yield parameters. The (Table 1) showed that the seed treatment with Pseudomonads @ 10 g / kg, foliar application of SA_1 (15 DAT) and NG_2 (30 DAT) effectively (T_8) controlled the Brown spot disease incidence (10.51 per cent) followed by (T_5) which recorded a disease incidence of 10.82 per cent. The test fungicide Mancozeb 0.2 per cent recorded 11.76 per cent while control recorded the maximum disease incidence with 60.67 per cent.

Table 1 Efficacy of FP, SA, NG and *B. oryzae* inoculation on the disease incidence on rice var. ADT 36

Treatments	Disease incidence (%)	Per cent decrease over control
T_1: SA_1	11.98	80.25
T_2: SA_2	12.30	79.72
T_3: NG_1	12.54	79.33
T_4: NG_2	12.86	78.80
T_5: $T_1 + T_2$	10.82	82.16
T_6: $T_3 + T_4$	11.30	81.37
T_7: $T_3 + T_2$	11.12	81.67
T_8: $T_1 + T_4$	10.51	82.67
Mancozeb (0.2%)	11.76	80.61
Control	60.67	-

The data mentioned, on the effect of different treatments on the physical characteristics was recorded in (Table 2). Among the treatments, the maximum plant height (89.56cm) was observed in application of Salicylic acid and Navagavya (T_8) and significantly produced higher number of productive tillers per clump, when compared to control. And also, the treatment T_8 recorded maximum number of productive tillers (13.87) followed by T_5. Also, the maximum panicle length was recorded in T_8 (18.89 cm) when compared to comparison fungicide (17.98 cm) and control (16.85 cm).

Table 2 Efficacy of FP, SA, NG and *B. oryzae* inoculation on the biometrics of rice var. ADT 36

Treatments	Plant height (cm)	No. of tillers / clump	No. of productive tillers / clump	Panicle length (cm)
T_1: SA_1	86.67	13.38	11.72	17.81
T_2: SA_2	86.12	13.05	11.01	17.65
T_3: NG_1	85.43	12.98	10.43	17.51
T_4: NG_2	84.76	12.82	13.87	17.34
T_5: $T_1 + T_2$	88.85	14.34	12.68	18.76
T_6: $T_3 + T_4$	87.56	13.76	12.18	18.35
T_7: $T_3 + T_2$	88.37	14.13	12.37	18.63
T_8: $T_1 + T_4$	89.56	14.98	13.87	18.89
Mancozeb (0.2%)	87.15	13.65	11.99	17.98
Control	80.29	11.64	10.07	16.85

The data mentioned on the (Table 3) revealed the effect of various treatments on the thousand grain weight. The treatment T_8 recorded the maximum thousand grain weight of 20.65 g, the maximum filled grain percentage (84.07%), maximum grain yield (35.60 g/pot) and straw yield (88.27 g/pot).

Data in the present study clearly shows that the seed biopriming with Fluorescent Pseudomonads (@ 10g/kg of seeds), foliar application of SA_1 (@ 50 ppm) along with NG_2 (@ 5 per cent) considerably reduced the disease incidence, increased plant height, number of tillers, number of productive tillers per clump, panicle length, thousand grain weight, percentage of filled grain, grain yield and straw yield when compared to other treatments in pot culture experiments (Table 1-3). Seed treatment with Fluorescent Pseudomonads had been widely used for the management of plant diseases

[11]. A talc-based powder formulation of *P. fluorescens* was effective for the control of rice brown spot [12-14]. The present study also indicated the effectiveness of the talc-based formulation of *P. fluorescens* for the control of blast of paddy.

Table 3 Efficacy of FP, SA, NG and *Bipolaris oryzae* inoculation on yield parameters of rice var. ADT 36

Treatments	Thousand grain weight (g)	Filled grain (%)	Grain yield (g/pot)	Straw yield (g/pot)
T_1: SA_1	20.56	80.53	35.22	85.21
T_2: SA_2	20.55	79.91	35.14	84.66
T_3: NG_1	20.53	79.12	35.03	83.45
T_4: NG_2	20.53	75.61	34.90	82.80
T_5: $T_1 + T_2$	20.65	82.82	35.52	87.90
T_6: $T_3 + T_4$	20.63	81.69	35.36	87.07
T_7: $T_3 + T_2$	20.63	82.43	35.44	87.34
T_8: $T_1 + T_4$	20.65	84.07	35.60	88.27
Mancozeb (0.2%)	20.57	80.79	35.28	86.40
Control	20.53	53.61	30.86	79.42

The induction of systemic resistance in crops by exogenous application of SA represents a potentially valuable method in pathogen management strategies complementary to conventional control methods. It was evident that SA is an important endogenous signal molecule involved in the transduction pathway and is required for the establishment of SAR [15]. Foliar application of salicylic acid increased the biometric characters and suppressed brown spot of rice [16].

CONCLUSION

Results of the present series of investigations clearly proved that cow products induced appreciable resistance in rice plants against *Bipolaris oryzae* and the reduction in disease incidence reflected in the increased yield as well. They Increases phenols and defense enzymes which led to the development of resistance in rice plants. More over cow products such as *Panchagavya*, *Navagavya*, *Dasagavya* acted both as fertilizer and bio-pesticide. The cumulative effect chemical spray SA_1 and NG_2 spray not only minimized the disease incidence but also had positive influence on the biometrics and yield of ADT 36. This might be due to the positive interaction and synergism between Salicylic acid and Navagavya in minimizing the disease incidence and enhancing the plant growth and grain yield of ADT 36.

LITERATURE CITED

1. Qudsia, Akhter M, Riaz A, Haider Z, Mahmood A. 2017. Comparative efficacy of different chemical treatments for paddy blast, brown leaf spot and bacterial leaf blight diseases in rice (*Oryza Sativa* L.). *Applied Microbiology* 3: 138. doi: 10.4172/2471-9315.1000138
2. Nguyen NV, Ferrero A. 2006. Meeting the challenges of global rice production. *Paddy, Water and Environment* 4: 1-9.
3. FAO. 2014. Food and Agriculture Organization of the United Nations.
4. Ou SH. 1985. *Rice Diseases*. 2nd Edition, Common Wealth Mycological Institute, U.K. pp 380.
5. Sunder S, Singh R, Agarwal R. 2014. Brown spot of rice: an overview. *Indian Phytopathology* 67(3): 201-215.
6. Gorlach J, Volrath S, Knauf-Beiter G, Hengy G, Beckhove U, Kogel KH, Oostendorp M, Staub T, Ward E, Kessmann H, Ryals J. 1996. Benzothiadiazole, a novel class of inducers of systemic acquired resistance, activates gene expression and disease resistance in wheat. *Plant Cell* 8: 629-643.
7. Vidhyasekaran P. 1990. Basic research on physiology of disease resistance for crop disease management. *In*: (Eds) Vidhyasekaran P. Basic Research for Crop Disease Management. Daya Publishing House, Delhi. pp 102-109.
8. Joshi N, Brar KS, Pannu PPS, Singh P. 2007. Field efficacy of fungal and bacterial antagonists against brown spot of rice. *Journal of Biological Control* 21: 159-162.
9. Mayee CD, Datar VV. 1986. *Phytopathometry* – Technical bulletin-I (Special Bulletin 3). Marathwada Agricultural University, Parbhani. pp 218.
10. Vidhyasekaran P, Umapathy G, Gopalan M, Ramakrishnan G, Sivaprakasam K. 1989. *Pest and Disease Surveillance*, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore-3, Tamil Nadu. pp 237.
11. Vidhyasekaran P, Sethuraman K, Rajappan K, Vasumathi K. 1997. Powder formulation of *Pseudomonas fluorescens* to control pigeonpea wilt. *Biological Control* 8: 166-171.
12. Raji P, Sumiya KV, Souvidya P, Sheela MS, Narayanankutty MC. 2016. Evaluation of *Pseudomonas fluorescens* against brown spot, sheath blight and glume discolouration of rice. *Int. Jr. Ag. and Research* 6(2): 65-72.
13. Kamei D, Simon SD. 2018. Comparison of selected fungicides and *Pseudomonas fluorescens* on brown spot disease incidence and plant growth parameters of paddy. *The Pharma Innovation* 7(5, Part J): 702.
14. Balgude YS, Gaikwad AP, Kshirsagar CR. 2018. *Pseudomonas fluorescens*, a Potential Bioagent for Effective Management of Diseases in Organic Rice Production. Agricultural Research Station, Pune, India.
15. Shulaev V, Leon J, Raskin I. 1995. Is salicylic acid a translocated signal of systemic acquired resistance in tobacco? *Plant Cell* 7: 1691-1701.
16. Jaiganesh V. 2012. Studies on the use of resistance inducing chemical and macro-micro nutrients for the management of brown spot of rice (*Oryza sativa* L.) caused by *Helminthosporium oryzae* (Breda de Haan). *Ph. D Thesis*, Annamalai University, Annamalai Nagar, India.