



ANTIFUNGAL EFFICACY OF BOTANICALS AGAINST SEED BORNE FUNGAL PLANT PATHOGENS OF BASMATI RICE

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Abstract : Rice seed sample varieties of PB-1121, PB-6 and VB 22 were collected from Chirodi farm of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh. From these rice varieties, seven seed borne fungi were detected and identified. The identified fungi were *Fusarium oxysporum*, *F. moniliforme*, *Alternaria padwickii*, *Aspergillus flavus*, *Aspergillus niger* and *penicillium* spp. To check the efficacy of five different plant extracts viz. Turmeric, Garlic, Lemongrass, Bael and Neem were evaluated against identified fungi. Plant extracts diluted with organic solvent chloroform, Benzene and later with distilled water @ 1:10 ratio for seed treatment. Among the plant extract, Garlic + H₂O (1:10 dilutions) found best for three varieties which successfully reduced seed borne infection as 83.33% in PB-6, 85.25% in VB-22 and 89.33% in PB-1121 respectively. Garlic extract also increased seed germination up to 79.32% in PB-6 varieties, 82.69% in VB-22 and 79.32% in PB-1121 over control (check). The other treatments Lemongrass + chloroform, Garlic + Benzene, and Bale + distilled water also increase the seed germination up to 78.19%, 79.48% and 72.83% respectively. Based on the present study, it may be concluded that among the five plant extracts diluted with solvent were most effective in controlling seed borne fungal infection of rice.

Key words : Turmeric, Garlic, Lemongrass, Bael and Neem.

1. Introduction

Rice is one of the most important food crops in the world and forms the staple food for more than half of the global population [Rekabder *et al.* (2004)]. In Asia, more than 90% of the world's rice is grown and consumed. In India, rice is extensively grown and occupies about 23.3% of the gross cropped area of the country, covering about 44.8mha of land. Rice contributes 43% of the total food grain production and 46% of the total cereal production in India [Krishnamurthy *et al.* (2005)]. Basmati rice from the Indian subcontinent is highly priced in the international market for its unique quality. Diseases especially in Basmati and other high value varieties of rice are important constraints to obtain higher crop productivity. Among the various constraints one of the major problems in the production of rice are seed borne pathogens. More than 50 fungal pathogens have been reported to be seed-borne in rice [Agrawal (1999)]. The most destructive seed-borne fungi of rice are *Bipolaris oryzae*, *Pyricularia oryzae*, *Sarocladium*

oryzae, *Rhizoctonia solani*, *Bipolaris oryzae*, *Sclerotium rolfsii*, *Fusarium spp.*, *Curvularia oryzae* and *Nigrospora oryzae* [Agrawal *et al.* (1989)] which causes pre- and post-infections and considerable quality losses viz., seed abortion, seed rot, seed necrosis, reduction or elimination of germination capacity, seedling damage and their nutritive value have been spoiled [Miller (1995); Janardhana *et al.* (1998); Kavitha *et al.* (2005)]. Natural plant extracts are important sources for control of seed borne diseases [Tripathi and Dubey (2004)]. Many plant and plant products have been reported to be antifungal activity against seed borne pathogens [Bowers and Locke (2000)]. In the past couple of years, trials on plant extract against several seed borne fungi were made and the results were highly promising [Islam (2005)]. Use of plant extracts in the management of seed borne pathogens is a recent approach and can be explored as better supplementary measures for plant disease management.

2. Materials and Methods

The experiment was carried out at Centre of Excellence for SPS, Department of Plant Pathology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. Three rice varieties selected for the study were Panjab Basmati-6, PB-1121 and Vallabh Basmati-22. The experiment was conducted following completely Randomized Design (CRD) with three replications. The seed sample was collected from Crop Research Centre (CRC) of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. The sample enclosed in the paper bags with proper labelling brought to the SPS laboratory and kept in the refrigerator at 5°C until used for subsequent studies. Five different plant species namely Garlic, Neem, Lemongrass, Turmeric and Bale collected from area of University. Plants extracts were used as seed treatment.

Preparation of Plant Extracts

The collected plant parts were chopped with the help of scissors after cleaning in running tap water. The extracts were prepared by crushing the plant parts and clove of garlic in mortar and pestle. Then the plant extracts dilute with distilled water, Benzene and Chloroform @ 1:10 ratio and the dilution were kept for 48 hours in shaker and then the extracts were filter through cheese cloth. The extracts were kept in the refrigerator at 4°C for further used.

Seed Treatment with the Plant Extracts

Selected seed sample of rice were treated following dipping method. The seeds were dipped in 1:10 dilutions for one hour in the previously prepared plant extracts of Neem, Lemongrass, Bael, Turmeric and Garlic. Five treatments which were used are listed below

S. No.	Local Name	Scientific Name	Family	Concentration
1	Turmeric	<i>Curcuma longa</i> linn.	Zingiberaceae	1:10
2	Garlic extract	<i>Allium sativum</i>	Alliaceae	1:10
3	Lemongrass	<i>Cymbopogon citratus</i>	Poaceae	1:10
4	Bael	<i>Aegle marmelos</i> linn.	Rutaceae	1:10
5	Neem	<i>Azadirachta indica</i>	Meliaceae	1:10

extracts. After 1 hour plant extracts were drained out from the Petri dishes. The treated seeds were allowed to be dried up on the filter paper for 50 minutes. And then treated seeds were kept in Petri plate following the standard blotter paper method [ISTA (2001)]. For this, 20 seeds placed in each Petri dish with three replications were maintained. Control Petri dishes were also maintained without treatment. These all Petri dish were incubated at 23 °C ±2 in the BOD incubator. These Petri dishes were regularly observed for fungal colonies on the seeds.

3. Treatments Employed

Statistical Analysis

The data collected from the experiment were analyzed for test of significance and compared the treatment mean following Completely Randomized Design by using at 5% level of probability.

4. Results and Discussion

Effect of Plant Extracts on Seed Germination

In this experiment five different plant extracts were used in controlling seed borne fungi. Table 1 and Plate 1 results show that in case of rice varieties, Punjab Basmati-6 was recorded with the highest germination (93%) when the seed treated with Garlic + H₂O @ 1:10 dilution and it increases the germination by 79.48% over control. Among the other extracts Lemongrass +

Table 1 : Effect of plant extracts (1:10) on germination on rice seed of (PB-6).

Treatments	Seed Germination	Germination increase Over control
Bale+ Benzene	80.33	54.48
Bale +chloroform	80.01	53.86
Bale +Distil water	80.21	54.25
Neem + Benzene	85.66	64.73
Neem +chloroform	92.33	77.55
Neem +H ₂ O	90.00	73.07
Turmaric +Benzene	76.66	47.42
Turmaric+chloroform	84.00	61.53
Turmaric+H ₂ O	91.66	76.26
Lemongrass+Benzene	89.33	71.78
Lemongrass+chloroform	92.66	78.19
Lemongrass+H ₂ O	80.00	53.84
Garlic+Benzene	78.33	50.63
Garlic+chloroform	89.66	72.42
Garlic+H ₂ O	93.33	79.48
Control	52	

Table 2 : Effect of plant extracts (1:10) on germination on rice seed of (VB -22)

Treatments	Seed Germination	Germination increase Over control
Bale+ Benzene	89.33	65.42
Bale +chloroform	90.21	67.05
Bale +Distil water	93.33	72.83
Neem + Benzene	80.33	48.75
Neem +chloroform	83.33	54.31
Neem +H ₂ O	91.66	69.74
Turmaric +BenZene	90.00	66.66
Turmaric+chloroform	80.00	48.14
Turmaric+H ₂ O	90.66	67.88
Lemongrass+Benzene	90.00	66.66
Lemongrass+chloroform	80.00	48.14
Leamongrass+ H ₂ O	92.66	71.59
Garlic+Benzene	88.33	63.57
Garlic+chloroform	88.33	63.57
Garlic+H ₂ O	96.66	79.32
Control =	54	

chloroform and Neem + Chloroform 1:10 dilution also increase the germination by 78.59% and 77.98 respectively over control. Table 3 and Plate 3 results indicate that varieties Vallabh Basmati-22 was found with highest germination (95%) when the seed treated with the garlic + H₂O and it increases the germination 82.69% over control. Among the other extracts, Garlic + Benzene and Neem chloroform also increase the germination by 79.48 % and 79.03 respectively over control. Table 2 and Plate 2 results indicate that varieties PB-1121 was found with the highest germination 96.66% when the seed treated with the Garlic + H₂O and it increase the germination 79.32% over control. Among the other extract Bale + H₂O, Lemongrass + H₂O increase the seed germination 72.83%, 71.59% over control respectively. Similar result was found by Yeasmin and Hossain (2012). To evaluate effect of Garlic (*Allium sativum*) clove extract @ 1:0, 1:1, 1:2 dilutions with water treatment of rice Seeds for controlling seed borne fungi, when the seed samples of three rice varieties viz. Katharee, Gutee Aus and Kalijira were collected from farmer's storages of Bangladesh. The seed germination under control ranged from 64 to 77% where treatments resulted up to 100% germination. The identified seed borne fungi of rice were *Bipolaris oryzae*, *Curvularia oryzae*, *Fusarium oxysporum*, *F. moniliforme*, *Nigrospora oryzae*,

Table 3 : Effect of some plant extracts on germination Effect of plant extract on seed borne infection of three rice varieties of rice seed (PB-1121).

Treatments	Seed Germination	Germination increase Over control
Bale+ Benzene	81.66	57.03
Bale +chloroform	92.23	77.36
Bale +Distil water	86.66	66.65
Neem + Benzene	81.66	57.03
Neem +chloroform	93.10	79.03
Neem +H ₂ O	80.34	54.05
Turmaric +BenZene	86.66	66.65
Turmaric+chloroform	89.66	72.42
Turmaric+H ₂ O	90.66	74.34
Lemongrass+Benzene	81.66	57.03
Lemongrass+chloroform	85.66	64.73
Leamongrass+ H ₂ O	91.66	76.26
Garlic+Benzene	93.33	79.48
Garlic+chloroform	75.31	44.82
Garlic+H ₂ O	95.00	82.69
Control =	52	

Aspergillus flavus, *Aspergillus niger* ad *Penicillium sp.*, where prevalence of *Bipolaris oryzae* (7.5%) and *Fusarium moniliforme* (8.3%) were the maximum. All the treatments significantly reduced the seed borne fungi up to 100% over the control, where garlic was found best @ (1:1) extract against seed borne pathogen of rice. Similar result also was found by Analia *et al.* (2013) who tested the efficacy and the high control potential testing of garlic extract against seed-borne wheat fungi. Such results suggest that using garlic extract can minimize the risk of infection and enhanced seed germination of wheat. Similar result was found by Bhuiyan *et al.* (2013). The study was carried on seed-borne fungi detected from forty rice (*Oryza sativa*) seed samples (cv. BR11 and BRRI dhan 28) collected from two up szilas (Narshingdi Sadar and Shibpur) of Narshingdi district in Bangladesh. The identified species were *Bipolaris oryzae*, *Alternaria padwickii*, *Sarocladium oryzae*, *Curvularia lunata*, *Aspergillus niger* and *Fusarium spp.* An attempt has been made to control the seed-borne fungi by different plant extracts and chemicals. Garlic extract (1:1) dilution found best which successfully reduced seed-borne infection (80.3%) and also increased seed germination by 10.69% over control. Neem, allamanda and bishkatali extracts also increased seed germination by 8.99%, 7.10% and 5.84%,

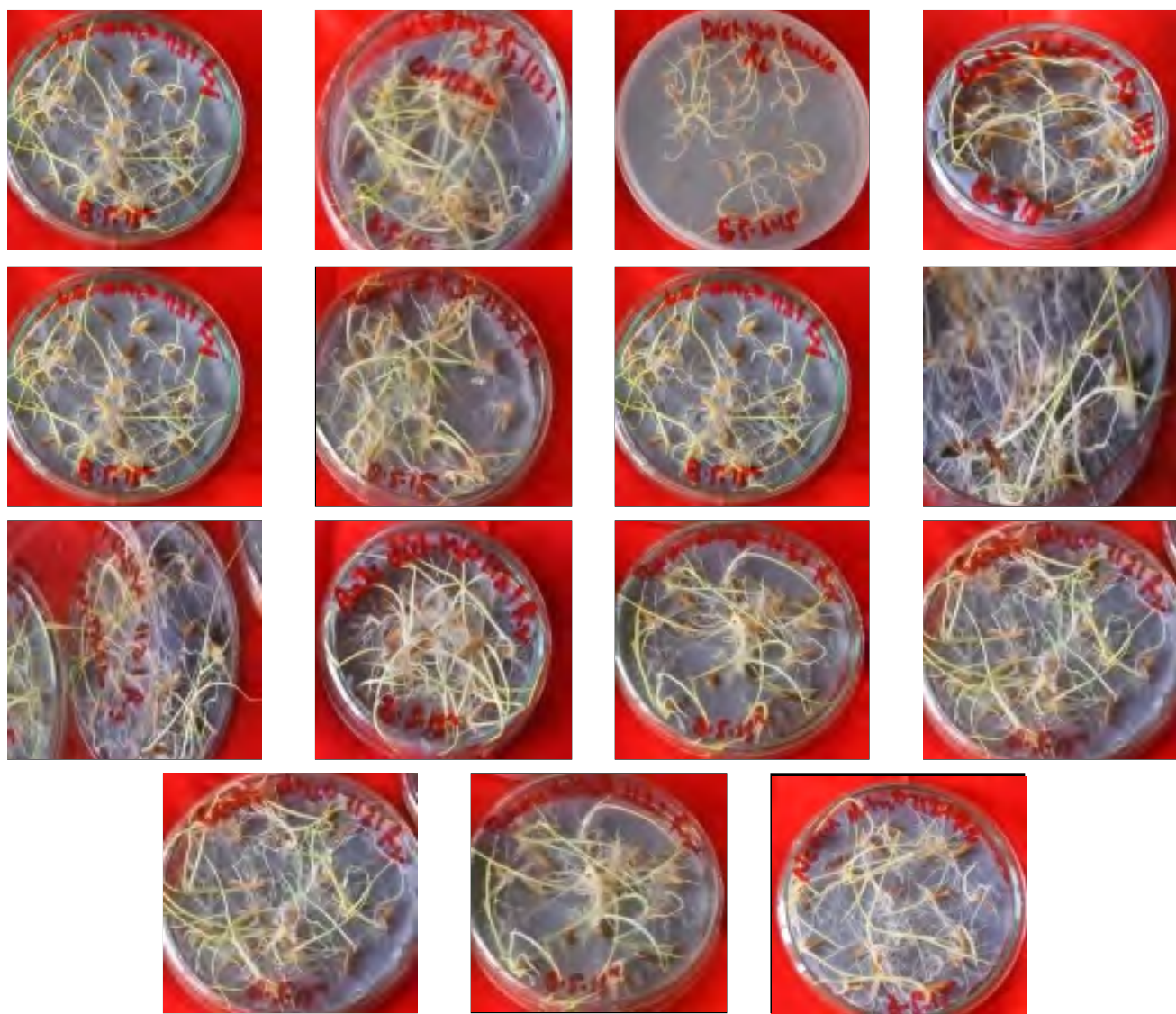
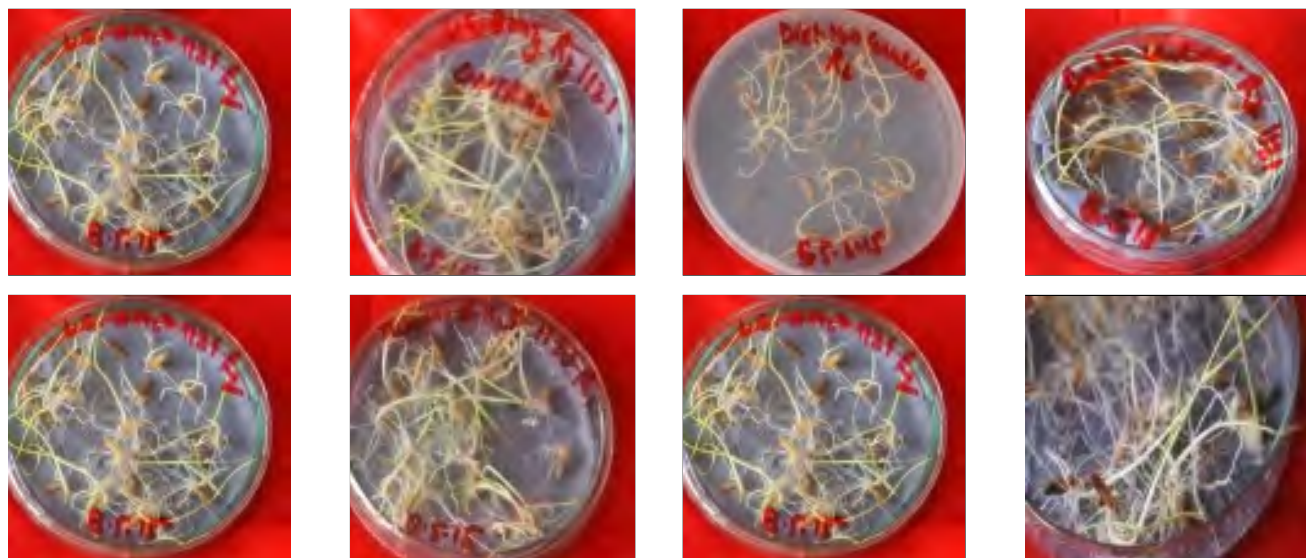


Plate 1 : Effect of plant extract on germination of rice varieties (Panjab Basmati-6).



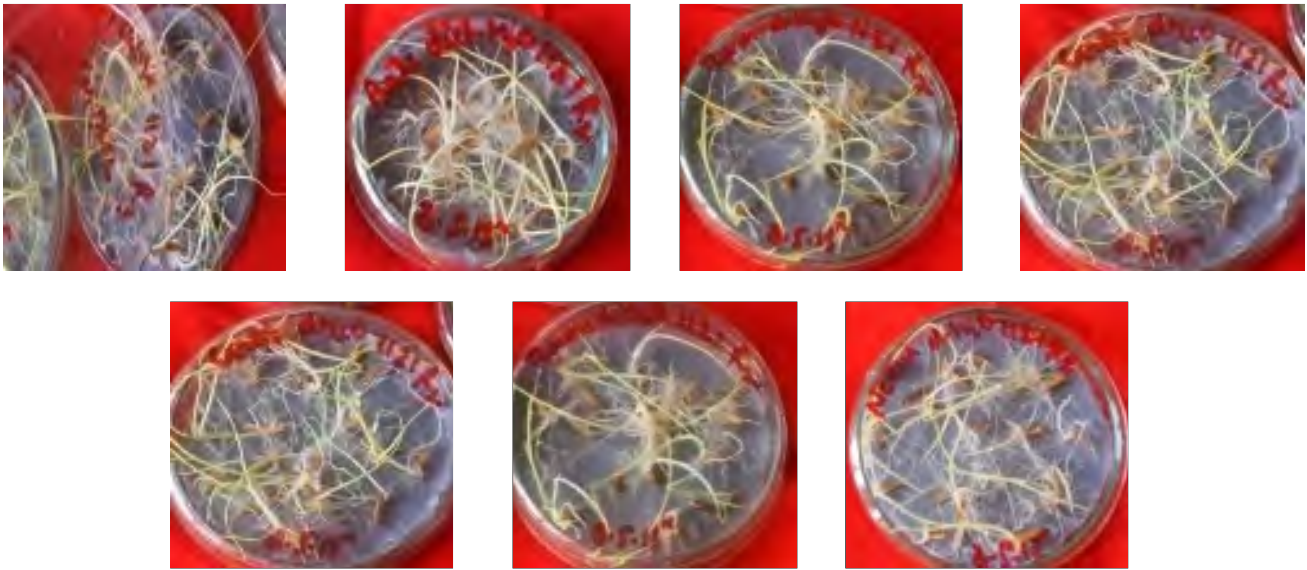


Plate 2 : Effect of plant extract on germination of rice varieties (Vallabh Basmati-22).

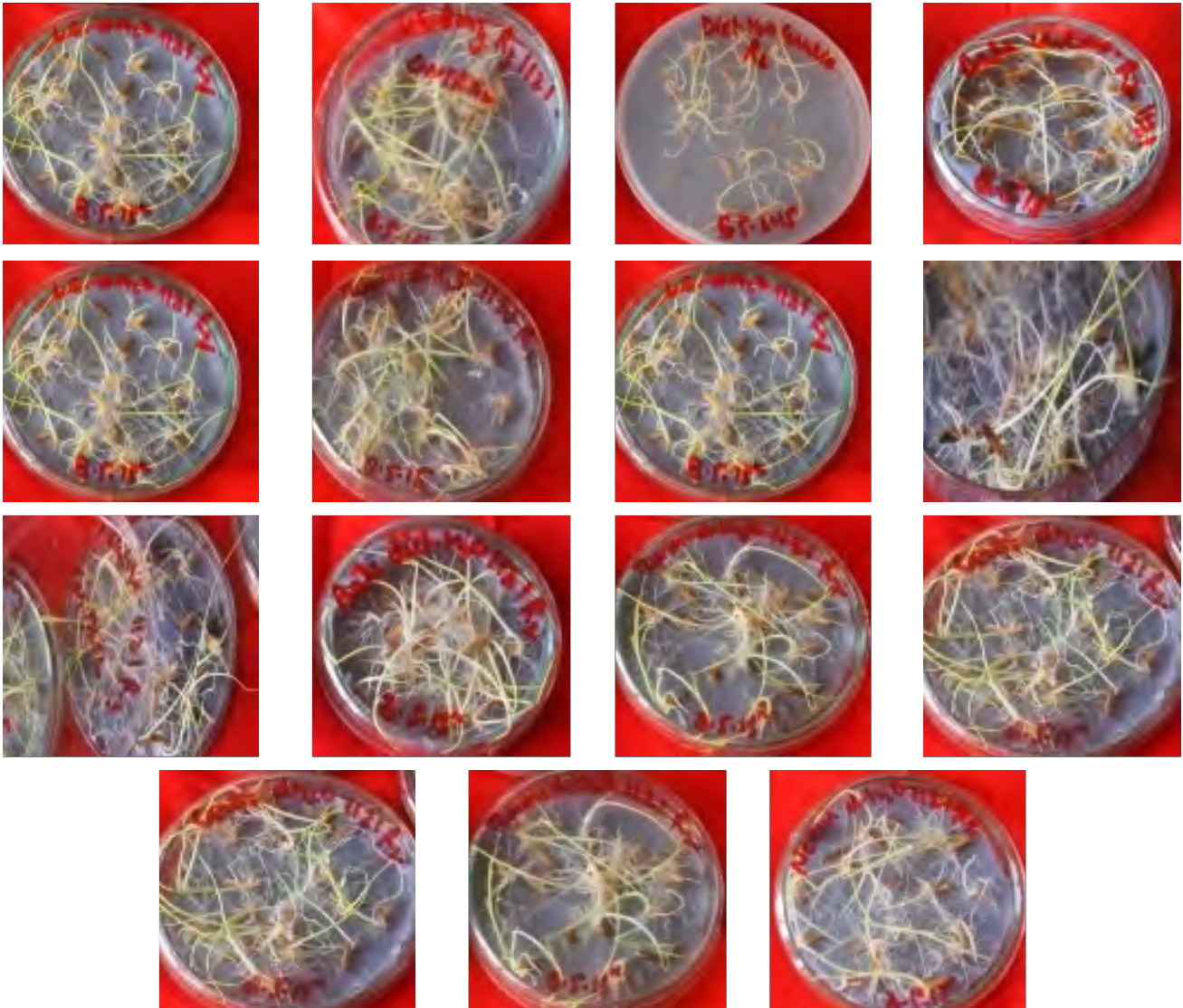


Plate 3 : Effect of plant extract on germination of rice varieties(Pusa Basmati 1121).

respectively. Similar result was also found by Faruq *et al.* (2014). An experiment was carried out to evaluate the efficacy of some selected plant extract for seed treatment of hybrid rice. Nine plants extracts *viz.* onion bulb, kalijira seed, allamonda leaf, garlic clove, neem leaf, datura leaf, turmeric rhizome, biskatali leaf and shimul leaf extract were evaluated against seed borne pathogens of hybrid rice. All of the botanical were used as per 1:1 (w/b) ratio. Two strains of a single bacterium and seven seed borne fungi were detected where *Xanthomonas oryzae* pv. *oryzae* (two strains), *Rhizopus stolonifer*, *Aspergillus* spp., *Fusarium moniliforme* were predominant. It was observed that among the plant extracts, datura leaf extract, turmeric rhizome extract; allamonda leaf extract and garlic clove extract showed best performance against the seed borne pathogens.

Among the plant extracts best performance in term of reducing percent seed borne infection was obtained treating the seed of variety Panjab Basmati-6 with garlic + H₂O at 1:10 dilution which reduce (94.33%) seed borne infection and also increases the seed germination by 79.48% over control and other plant extracts Lemongrass + choloform, Neem + choloform, Turmaric +H₂O at @ 1:10 extracts reduce (90.59%) (86.66%) (86.67%) reduce seed borne infection and also increase the germination by (78.19%), (77.55%), (77.26%) respectively over control. Plate 2 indicates that in case of variety Vallabh Basmati-22 best performance in terms of reducing per cent seed borne infection was obtain through treating the seed with garlic + H₂O at (1:10) dilution and Garlic + Benzene which reduced (85.25%) and (80.25%) seed borne infection respectively and also increase seed germination by (82.69%) and (79.48%) respectively over control. Table 3 indicates that in case of variety, PB-1121 best performance in term of reducing per cent seed borne infection was obtained through treating the seed with garlic + H₂O at (1:1) dilution with reduced (89.33%) seed borne infection and also increase the seed germination by (79.32%) over control. Similar result was found by Ahmed *et al.* (2013). They tested five different plants extracts *viz.* garlic, allamanda, neem, chirata and bishkatali with two dilutions (1:1 and 1:2) as seed treatment. Garlic extract (1:1) dilution found best for three varieties which successfully reduced seed-borne infection and also increased seed germination up to (68.39%) over control. Based on the present study,

it may be concluded that among the five plant extracts with two dilutions (1:1 and 1:2), garlic (1:1) is most effective in controlling seed-borne fungal pathogens of rice.

5. Conclusion

From the present study it is clear that seed borne fungi are threat to health of rice seed. Thus situation demands that due attention should be paid to health status of rice seed prior to sowing. Seed treatment may be quick technique in this regard as it reduces or eliminates seed borne fungi and also increases seed germination. Seed treatments with the garlic + H₂O 1:10 dilution significantly increase seed germination of three varieties and also effectively control the seed borne pathogens of rice.

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