

Fungi causing garlic rots in godowns and markets of Orissa and their chemical control

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Evaluation of garlic bulb rot collected from godowns and markets of Orissa State was undertaken during the year 1999-2000. Samples from five different locations of the State were collected. Eight fungi namely *Aspergillus niger*, *Curvularia lunata*, *Fusarium oxysporum*, *Macrophomina phaseoli*, *Penicillium expansum*, *Penicillium purpurogenum*, *Chaetomium species* and *Rhizopus oryzae* were isolated and then pathogenicity test were performed. Evaluation of thiram (0.3%), captan (0.3%), mancozeb (0.3%), saaf (0.1%), boric Acid (2%), unilax (0.2%), carboxin (0.2%), benlate (0.1%) and bavistin (0.15%) as pre and post inoculation treatments significantly reduced rots of garlic bulbs to varying degrees although saaf and carboxin were most effective.

Key words : Post harvest fungal diseases, garlic, chemical control

INTRODUCTION

Garlic being an important bulb crop in India has high medicinal value. Deterioration of stored garlic due to fungal pathogens have been reported in Thailand, India (Mohan, 1991) and other countries. Chemical control of fungal pathogens causing bulb rot in garlic has been tried in limited form with Hg Cl₂ (Rath and Mohanty, 1979a, b) and boric acid. Present investigation was undertaken to study on the occurrence of fungi on garlic bulb collected from different regions of Orissa together with the efficacy of different chemicals in controlling their growth.

MATERIALS AND METHODS

The diseased garlic bulb/cloves were collected from godowns and markets of five locations, namely, Bhubaneswar, Cuttack, Balasore, Puri and Berhampur during 1999 to 2000. Visual examination revealed the occurrence of white rot, black rot, yellow rot, pink rot, gray rot and black rots. The rotting of cloves were either entire or partial. The diseased cloves after washing with tap water were cut into pieces and surface sterilized

with 1 : 1000 mercuric chloride solutions for 2 to 3 minutes and then washed with sterile water for 3 to 4 times for isolation of fungi on potato destrose agar medium. Then petri plates were incubated at 25+10°C for 5 days and growth of the fungus were recorded on the 5th day of incubation. For pathogenicity test, incision method and pin prick method was adopted.

For testing efficacy of nine chemicals viz., thiram (0.3%), captan (0.3%), mancozeb (0.3%), saaf (0.1%), boric acid (2.0%), unilax (0.2%), carboxin (0.2%), benlate (0.1%) and bavistin (0.15%) solutions at desired concentrations were prepared in sterilized water and used for post inoculation treatment. In pre-inoculation treatment, 12 sets per test fungus (each of 50 healthy cloves) were selected from a healthy sample lot and were treated with the test chemical at the rate of 2 sets per test chemical for 5 minutes. Sterilized polythene bags were incubated at 35°C (100% RH) for 24 hours. After incubation 2 sets of each were inoculated with each test fungus by incision method.

In post inoculation treatment 12 sets per test fungus (each of 50 healthy cloves) were taken, surface

sterilized and inoculated with the test fungi. These were taken in perforated sterile polythene bags and incubated at 35°C (100% RH) for 24 hours. After incubation, the materials were treated with test chemicals and incubated again at 35°C (100% RH). Control 1st set of healthy cloves inoculated by the fungi was not treated with chemicals. Control 2nd set of healthy cloves were neither treated with chemical nor with the test fungi.

RESULT AND DISCUSSION

Collected rotten samples of garlic from five locations yielded eight genera of pathogenic fungi (Table 1). The frequency of *Aspergillus niger* (60 to 64%) and *Rhizopus oryzae* (59 to 63%) exhibiting black rot symptoms was high in all places. *Macrophomina phaseoli*, *Fusarium oxysporum* caused rotting to an extent of 41-45% and 23 to 43% respectively in all the five locations. Incidence of *Curvularia lunata*, *Penicillium expansum*, *P. purpurogenum* and *Chaetomium* species varied from 28 to 60% exhibited symptoms of grayish green and white rots. *Fusarium oxysporum* was also associated with garlic bulbs in every location in the frequency range of 30-40%.

Table 1 : Association of different fungi with diseased garlic cloves collected from different locations.

Isolated Fungi	Locations				
	Balasure	Berhampur	Bhubaneswar	Cuttack	Puri
<i>Aspergillus niger</i>	63.55	62.29	59.15	52.77	60.07
<i>Chaetomium sp.</i>	60.19	35.25	33.16	34.23	38.19
<i>Curvularia lunata</i>	53.76	28.85	54.78	44.04	40.16
<i>Fusarium oxysporum</i>	23.69	39.21	32.14	41.16	42.13
<i>Macrophomina phaseoli</i>	41.66	49.80	15.75	39.21	44.04
<i>Penicillium expansum</i>	37.25	33.16	32.14	38.19	28.85
<i>Penicillium purpurogenum</i>	47.88	41.15	37.25	44.04	33.16
<i>Rhizopus oryzae</i>	59.00	57.52	61.22	55.77	63.55
C.D. at 5% level	10.00	9.28	10.00	9.72	9.93

* Figure in parenthesis indicate angular value.

Table 2 : Efficacy of fungicides treated against the test pathogens in pre-inoculation stage.

Chemical	Test Pathogens (In percent infection)					
	F1	F2	F3	F4	F5	F6
Thiram	19.89	21.34	28.85	18.44	25.30	26.44
Captan	77.70	34.23	31.07	55.77	27.70	82.40
Mancozeb	79.54	25.30	25.92	28.85	21.34	81.38
Saaf	31.07	5.74	5.74	6.66	3.66	28.33
Boric acid	85.69	24.04	64.69	42.13	37.25	83.85
Unilax	43.07	21.34	27.70	45.95	22.57	85.69
Carboxin	77.07	32.14	14.76	65.95	31.07	68.66
Benlate	25.30	5.74	62.29	34.23	28.85	31.14
Bavistin	21.34	18.44	16.60	72.14	43.08	64.69
Control	90.00	62.29	75.24	71.56	64.69	90.00
C.D. at 5% level	5.13	5.51	7.86	8.35	6.94	5.24

* Figure in parenthesis indicate angular value.

* F1 — F6 Test fungus : F1 — *Penicillium expansum*
 F2 — *Rhizopus oryzae*
 F3 — *Curvularia lunata*
 F4 — *Aspergillus niger*
 F5 — *Penicillium purpurogenum*
 F6 — *Macrophomina phaseoli*

Table 3 : Efficacy of fungicides treated against the test pathogens in post-inoculation stage.

Chemical	Test Pathogens (In percent infection)					
	F1	F2	F3	F4	F5	F6
Thiram	19.89	5.74	5.74	5.74	5.74	61.14
Captan	25.30	31.07	19.89	5.74	5.74	73.40
Mancozeb	62.29	37.25	19.89	68.66	5.74	44.04
Saaf	5.74	59.00	5.74	21.34	5.74	27.70
Boric acid	85.69	28.85	5.74	5.74	16.60	73.79
Unilax	19.89	5.74	16.00	65.69	5.74	81.38
Carboxin	14.76	5.74	5.74	16.60	5.74	31.07
Benlate	5.74	31.07	5.74	18.89	5.74	93.33
Bavistin	14.76	5.74	5.74	5.74	5.74	64.67
Control	90.00	65.95	90.00	65.95	71.56	90.00
C.D. at 5% level	7.63	6.12	4.01	6.20	2.97	13.79

* Figure in parenthesis indicate angular value.

* F1 — F6 Test fungus : F1 — *Penicillium expansum*
 F2 — *Rhizopus oryzae*
 F3 — *Curvularia lunata*
 F4 — *Aspergillus niger*
 F5 — *Penicillium purpurogenum*
 F6 — *Macrophomina phaseoli*

Pre-inoculation treatment of the garlic cloves with thiram (0.3%), mancozeb (0.3%), saaf (0.1%), benlate (0.1%) and bavistin (0.15%) checked the storage rot effectively in case of *A. niger* and *R. oryzae* but that due to other fungi like *C. lunata*, *M. phaseoli*, *P. expansum*, *P. purpurogenum* the efficacy remained for a longer period longer time.

Bavistin was less effective against *R. oryzae*. Saaf exhibited better response of control against all the fungi in pre inoculation treatment. (Carboxin showed poor response of control against fungus *C. lunata*). Saaf and unilax were the highly effective against the growth of the fungus *P. purpurogenum*. *P. expansum* and *M. phaseoli* and was also better controlled with thiram also showed better result in checking growth of *P. expansum*. In case of post inoculation treatment, all the chemicals were most effective against *M. phaseoli*, *P. expansum* and *P. purpurogenum*. Carboxin and saaf were effective significantly against all the test pathogens but Mancozeb was moderately effective against the pathogens except *P. purpurogenum* where it worked well. Similarly chemicals like mancozeb and boric acid was found less effective against *A. niger*. However, all the chemicals gave satisfactory performance against the growth of the fungus in post-inoculation treatment. Thiram, unilax, carboxin and bavistin were found effective against the growth of the fungus *C. lunata*. Specifically saaf and carboxin gave the best result in restricting the growth of all the fungi reported in Table 1 followed by unilax which was also found very much effective in controlling all the test fungi in this investigation.

In India rotting of bulbs by *A. niger*, *M. phaseoli* and *F. oxysporum* have been reported earlier. Rot disease of garlic caused by *Penicillium pazilli* (Roy et al., 1977) has also be reported in India. There have been several reports that rotting of bulbs infected by fungi cause great damage and loss. Growth of pathogen after wounding in moist condition was found to be favourable in causing such rots. However, present study revealed new reports of infection of garlic bulbs by *Penicillium expansum*, *P. purpurogenum* in Orissa markets. Surprisingly the bulb rots were also found to have been caused by *Chaetomium* species as a first record of causing infection in garlic bulbs. The earlier findings (Rath and Mohanty, 1986) on garlic bulbs by *Curvularia pallescens*, *Fusarium oxysporum* were interestingly seen with bulb rots

caused by *Curvularia lunata* in the present investigation. The pathogenicity test of the each fungus was undertaken and the reported fungi was found pathogenic.

Earlier limited chemicals were tried to control post harvest rots of garlic bulbs in which limited success were achieved in certain cases (Rath and Mohanty, 1985) with boric acid and mercuric chloride in controlling *A. niger* and *Fusarium oxysporum*. In this study efficacy of nine chemicals, thiram, carboxin, benlate, bavistin etc. were tried against six fungi both in pre and post inoculation treatments. All chemicals significantly reduced the fungus growth. Thiram (0.3%), saaf (0.1%) and carboxin (0.2%) gave the best result in restricting fungal growth. So far there have been no reports on controlling post harvest rot fungi by application of saaf, unilax, carboxin etc. and the present report will be very much useful in controlling other fungi also. Avoidance of bruising and injury of bulbs, periodic eradication of diseased cloves from stored lots and chemical treatment followed by storing under low temperature and low relative humidity are essential for minimizing storage losses of garlic bulb infected with fungus.

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