

# Management of the Black Mould Disease of Onion

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## Abstract

Samples of onion seeds were collected from farmer's houses to manage the seed mycoflora of onion through fungicides, plant extracts and bioagent seed treatments. Amongst fungicides used as seed treatment, in vitro Bavistin (Carbendazim 50% WP, 2.0%) proved to be most effective against *Aspergillus niger* followed by Thiram (80% WP, 2.5%), Captan (50% WP, 2.5%), Indofil M-45 (50% WP, 2.5%) and Topsin M (75% WP, 2.5%) in improving seed germination and vigour index, by reducing pre- and post emergence mortality and number of seedlings showing symptoms. Similarly, among bioagents and plant leaf extract used, *Trichoderma viride* (5.0 ml (10<sup>8</sup> cfu/ml)/10 g seeds) followed by *Trichoderma pseudokoningii* (5.0 ml (10<sup>8</sup> cfu/ml)/10 g seeds) and Safeda (5.0 ml/10 g seeds) followed by neem leaf extracts (5.0 ml/10 g seeds) proved to be effective in improving seed germination and vigour index, by reducing pre- and post emergence mortality and number of seedlings showing symptoms.

**Keywords:** Management; Onion; Black mould; Fungicides

## Introduction

Onion [*Allium cepa* (L.)] vernacularly called 'Pyaz' in Hindi and locally known as 'Kanda', is one of the most important vegetable cum condiment crop of family *Alliaceae*, grown in over all the parts of India. Onion is used throughout the year in the form of salad or condiment or for cooking with other vegetables. Onion has several medicinal uses, its use in the case of sun strokes is known worldwide [1]. Pests and diseases continue to impact on the productivity of crops and quality of crop products worldwide despite many years of research and development on improved methods for their control. It has been estimated that an average of 0.20–0.30 of crop yield is lost annually from the field [2]. Black mould disease caused by *Aspergillus niger* van Tieghem (An) is a limiting factor in onion (*Allium cepa* L.) production worldwide [3]. *Aspergillus niger* also primary reported to survive between onion crops as a soil saprophyte (on decaying organic matter) in or on onion bulbs or on cull onions in field or storage and being ubiquitous in occurrence, it attacks/infect bulbs of onion in field/storage, whenever they find injured tissues by producing various enzymes or toxins [4]. Association of *A. niger* with onion seeds produced in hot (desert) climates and their transmission from soil and naturally contaminated seeds to onion seedlings and sets, have also been reported by [5] and causes 30 to 80% loss/spoilage of onion bulb. Seed treatment with different biocides (bioagents and plant leaf extracts) has been reported to be safest in comparison to fungicides. Several biocides have been reported to increase seed germination and vigour index by reducing the pre- and post emergence mortality in several crops including onion [6,7]. In the present investigation an attempt was made to evaluate fungicides, plant extracts and bioagents against Black mould disease of onion.

## Material and Methods

Apparently healthy surface sterilized seeds of onion were collected from farmer's houses, artificially inoculated with pathogenic *A. niger* and treated (dressing/soaking) separately by

### Fungicides

S.No.	Fungicides	Chemical Name	Dose
1	Bavistin	Methyl Benzimidazole carbamate	Bavistin @2.0 g/kg

2.	Captan	N-trichloromethyl thio-4-cyclohexane-1, 2 dicarboximide	Captan @2.5 g/kg
3.	Indofil M-45	Manganese-ethylene bis-dithiocarbamate	IndofilM-45 @2.5 g/kg
4.	Thiram	Tetra methylthiuram disulphide	Thiram @2.5 g/kg
5.	Topsin M	Tetrachloro-1, 3, benzene-dicarbonitrate	TopsinM @2.5 g/kg

### Plant leaf extracts\*

S.No.	Plant leaf extracts	Botanical Name	Concentration
1	Datura	<i>Datura stramonium</i>	@5.0 ml/10 g seeds
2	Mahandi	<i>Lawsonia inermis</i>	@5.0 ml/10 g seeds
3	Neem	<i>Azadirachta indica</i>	@5.0 ml/10 g seeds
4	Safeda	<i>Eucalyptus teriticornis</i>	@5.0 ml/10 g seeds
5	Tulsi	<i>Ocimum sanctum</i>	@5.0 ml/10 g seeds

\*Leaf extracts of each plant leaves were prepared separately by washing the leaves, chopping and grinding them in a pestle and mortar with the addition of cold water in room temperature at the ratio of 1:2 (1 part of leaf:2 parts of water). The extracts were squeezed through cotton wool and used immediately [8]. Seed were soaked for 30 minutes, dried in shade for 2 hours before plating [6].

### Bioagents

S.No.	Bioagents	Dose
(i)	<i>Bacillus pumulis</i>	@5.0 ml (10 <sup>8</sup> cfu/ml)/10 gm seeds
(ii)	<i>Pseudomonas fluorescens</i>	@5.0 ml (10 <sup>8</sup> cfu/ml)/10 gm seeds
(iii)	<i>Trichoderma harzianum</i>	@5.0 ml (10 <sup>8</sup> cfu/ml)/10 gm seeds
(iv)	<i>T. pseudokoningii</i>	@5.0 ml (10 <sup>8</sup> cfu/ml)/10 gm seeds
(v)	<i>T. viride</i>	@5.0 ml (10 <sup>8</sup> cfu/ml)/10 gm seeds

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S.No.	Treatments	Dose (%)	Percent germination	Percent mortality		Root* length (cm)	Shoot* length (cm)	Vigour index
				Pre - emergence	Post - emergence			
1.	Bavistin	2.0	75.00 (60.00)	2.25 (8.53)	2.50 (9.10)	6.00	6.25	918.75
2.	Captan	2.5	68.00 (55.55)	3.00 (9.98)	3.75 (11.09)	4.00	4.25	561.00
3.	Indofil M-45	2.5	64.50 (53.43)	3.75 (11.09)	4.50 (12.25)	3.50	3.00	419.25
4.	Thiram	2.5	72.00 (58.05)	2.75 (9.46)	2.95 (9.81)	5.25	4.50	702.00
5.	Topsin M	2.5	62.00 (51.94)	4.00 (11.83)	5.75 (13.81)	3.00	2.10	316.20
6.	Control	-	61.00 (51.35)	14.00 (21.97)	12.00 (20.27)	2.75	1.95	286.70
S.Em ±			1.08	0.21	0.23	-	-	10.45
C.D. at 5%			3.19	0.63	0.69	-	-	30.95

\*Average based on 10 seedlings

Figures given in parentheses are angular transformed value

**Table 1:** Effect of fungicide seed treatment against *Aspergillus niger* on seed germination, pre-and post emergence mortality and vigour index (*in vitro*).

S.No.	Treatments	Percent germination	Percent mortality		Root* length (cm)	Shoot* length (cm)	Vigour index
			Pre - emergence	Post - emergence			
1.	Datura ( <i>Datura stramonium</i> )	65.00 (53.73)	8.25 (16.64)	8.75 (17.16)	3.75	4.00	503.75
2.	Mahandi ( <i>Lawsonia inermis</i> )	61.75 (51.77)	8.75 (17.16)	9.00 (16.43)	3.00	2.25	324.18
3.	Neem ( <i>Azadirachta indica</i> )	70.25 (56.91)	6.50 (14.77)	6.75 (15.00)	4.95	5.25	716.55
4.	Safeda ( <i>Eucalyptus teriticornis</i> )	73.00 (58.82)	5.75 (19.81)	6.00 (14.18)	5.25	6.00	821.25
5.	Tulsi ( <i>Ocimum sanctum</i> )	67.00 (54.94)	7.00 (15.34)	8.00 (16.43)	4.25	5.00	619.75
6.	Control	61.00 (51.35)	12.00 (20.27)	14.00 (18.44)	2.50	2.00	274.50
S.Em ±		1.01	0.31	0.35	-	-	9.63
C.D. at 5%		3.00	0.93	1.05	-	-	28.54

\*Average based on 10 seedlings

Figures given in parentheses are angular transformed values

**Table 2:** Effect of plant leaf extract seed treatment against *Aspergillus niger* on seed germination, pre- and post emergence mortality and vigour index (*in vitro*).

Inoculated untreated seeds were used as control. Twenty seeds were placed at an equal distance in each Petri dish. These Petri dishes were incubated at  $22 \pm 1^\circ\text{C}$  with 12 hours of light alternating with 12 hours of dark period. Observations were recorded after 15 days instead of 7 days on seed germination, pre- and post emergence mortality and root/shoot length. Seedling vigour was also calculated by formula given by Abdul-Baki and Anderson [9].

$$\text{Vigour index} = \text{Germination \%} \times (\text{Root length} + \text{Shoot length})$$

## Results and Discussion

In this study all the seed dressing fungicides tested, Bavistin and Thiram were found to be most effective against *A. niger* but Bavistin gave highest percentage of seed germination and minimum pre-and post-emergence mortality with less number of seedlings showing symptoms followed by Thiram, Captan, Indofil M-45, Topsin M for the control of *A. niger* (Table 1). Bavistin has already been reported to be the best seed dresser against seed-borne *A. niger* of onion by Gupta et al. [10] and Singh et al. [11].

The seeds soaked in different plant leaf extracts, Safeda leaf extract followed by Neem leaf extract found to be most effective against seed borne *A. niger* in improving seed germination and vigour index by reducing pre- and post emergence mortality and number of seedling showing symptoms (Table 2). Extract of different parts of plants also reported to be effective in inhibiting the growth of *A. niger* (causing fruit rot in chilli and damping off in brinjal) by Bagri et al. [12] and Jacob and Sivaprakasam [9].

Seed treatment with the antagonists reported to be the cheapest method of delivery of antagonists to the rhizosphere of crop plants that are to be protected from seed and soil borne diseases [13]. Seed treatment with different bioagent such as *Trichoderma viride* followed by *Trichoderma pseudokoningii* was found to be most effective against seed borne *A. niger* in improving seed germination and vigour index by reducing pre- and post emergence mortality and number of seedling showing symptoms (Table 3). Seed treatment with *Bacillus subtilis*, *Chaetomium globosum*, *Gliocladium virens*, *Pseudomonas fluorescens*, *Ralstonia fluorescens*, *Trichoderma hamatum*, *T. harzianum*, *T.*

S. No.	Treatments	Percent germination	Percent mortality		Root* length (cm)	Shoot* length (cm)	Vigour index
			Pre - emergence	Post - emergence			
1.	<i>Trichoderma viride</i>	71.00 (57.42)	6.60 (14.89)	7.00 (15.34)	4.00	5.75	692.25
2.	<i>Trichoderma harzianum</i>	65.25 (53.85)	7.00 (15.34)	8.25 (16.64)	3.75	4.25	522.00
3.	<i>Trichoderma pseudokoningii</i>	67.00 (54.94)	6.75 (15.00)	8.00 (16.43)	3.85	5.00	592.95
4.	<i>Pseudomonas fluorescens</i>	63.00 (52.53)	7.50 (15.89)	9.25 (17.66)	3.50	4.00	472.50
5.	<i>Bacillus pumulis</i>	62.00 (51.35)	8.25 (16.64)	10.00 (18.44)	3.00	2.00	310.00
6.	Control	60.00 (50.77)	15.00 (22.79)	13.00 (21.13)	2.50	1.95	267.00
S.Em+		1.04	0.31	0.34	-	-	8.61
C.D. at 5%		3.09	0.92	1.00	-	-	25.50

\*Average days on 10 seedlings

Figures given in parentheses are angular transformed values

**Table 3:** Effect of bioagent seed treatment against *Aspergillus niger* on seed germination, pre- and post-emergence mortality and vigour index (*in vitro*).

*koningii*, *T. virens* and *T. viride* have been reported to give good control of associated pathogenic fungi with tomato, brinjal, chilli, blackgram and sesamum seeds, respectively [14-16]. In present investigation, we observed that seed treatment with different fungicides, increased germination percentage and vigour index on one hand and reduced pre- and post-emergence mortality and the number of seedlings showing symptom on the other.

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