



**Effects of Plant Extracts on Controlling Seed Borne Fungi of Okra  
(*Abelmoschus esculentus* L. Moench)**

S. K. Saha<sup>1</sup>, M. A. R. Khokon<sup>2</sup> and M. M. Hossain<sup>2</sup>

<sup>1</sup>Bangladesh Agricultural Development Corporation

<sup>2</sup>Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh

**Abstract**

An experiment was conducted using farmer's okra (*Abelmoschus esculentus* L. Moench) seeds in Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh to determine the efficacy of plant extracts (garlic, allmanda, neem, ginger and biskathali extracts) and vigour index of seedling for controlling the seed-borne fungal diseases of okra. In the laboratory experiment, the prevalence of seed-borne fungi associated with farmer's okra seed investigated by blotter method. The identified fungi species in the collected seeds were *Colletotrichum dematium*, *Macrophomina phaseolina*, *Fusarium oxysporum*, *Aspergillus flavus*, *Aspergillus niger*, *Penicillium* spp. and *Rhizopus* spp. The test seed materials were treated with garlic tablet, allmanda tablet @ 1:1 and 2:1 w/v and neem extract, ginger extract and biskathali extract @ 1:1 and 1:2 w/v for each to control pathogens with control treatment. The significantly highest germination (62.5%) and lowest incidence of pathogen (5.25%) were recorded in garlic tablet @ 2:1 w/v treated seeds. The okra seeds treated by garlic tablet @ 2:1 w/v was also showed the higher vigour index (545.60%) compare to untreated seed (423.40%).

**Key words:** Fungi, Germination, Okra, Plant extracts

**Introduction**

Okra is one of the important vegetables in the coastal areas of Bangladesh. People eat and cultivate more okra in Bauphal upazilla of Patuakhali district (coastal part of Bangladesh). But the yield of okra is not quite high in the coastal district Patuakhali compare to other region of Bangladesh. Various factors are responsible for low yield of okra. Seed-borne fungal disease is one of them. There are 10 seed-borne diseases of okra which are caused by at least 14 different seed-borne fungal pathogens (Fakir, 2000). Among the fungus *Aspergillus* spp., *Colletotrichum dematium*, *Fusarium oxysporum* and *Fusarium moniliforme* are mainly responsible for causing seed-rots (Fakir, 1976). *Macrophomina phaseolina* and *Colletotrichum dematium* are responsible for die-back. *Macrophomina phaseolina* alone can also cause stem rot (Fakir, Mridha, 1985). Among these fungal pathogens *Colletotrichum dematium* and *Macrophomina phaseolina* are both seed transmitted. So, management of these seed-borne fungi is very important to produce okra successfully. As there is no resistant variety, so control of these fungi through host resistance is not possible. Again control of these seed-borne fungi using chemicals increase production cost and causes environmental pollution. Therefore, the present study was undertaken to study the prevalence of seed borne fungi on farmer's okra seeds and to evaluate the efficacy of different plant extracts for controlling these seed borne fungi.

**Materials and Methods**

**Seed health test**

The farmer's okra Seeds were collected from farmers of coastal area of Bauphal Upazilla,

Patuakhali district. The seed samples were tested by standard blotter method (ISTA, 2001) in Seed Pathology Centre, Bangladesh Agricultural University, Mymensingh.

**Plant extracts**

Garlic and allamanda tablet were collected from Integrated Plant Management laboratory of BAU, Mymensingh. Neem, ginger and biskathali were collected from Bangladesh Agricultural University farm area, Mymensingh.

**Seed treatment**

Seed samples were treated followed by dipping method. One hundred seeds were dipped into garlic and allamanda tablet suspension @ 2:1, 1:1 as well as of neem, bishkatali and ginger extracts @ 1:1 and 1:2 dilutions for 30 minutes (Akter, 2008 and Islam, 2009). The treated seeds were examined followed by the standard blotter method (ISTA, 2001).

**Experimental design and treatments**

The experiment was designed by Completely Randomized Designed having four replications and the following treatments

T<sub>0</sub> = Control (Vitavax-200) (0.25g/100g seed)- no plant extract treatment

T<sub>1</sub> = Garlic tablet (2:1) [w/v= weight/volume]

T<sub>2</sub> = Garlic tablet (1:1) w/v

T<sub>3</sub> = Allamanda tablet (2:1) w/v

T<sub>4</sub> = Allamanda tablet (1:1) w/v

T<sub>5</sub> = Neem leaf extract (1:1) w/v

T<sub>6</sub> = Neem leaf extract (1:2) w/v

T<sub>7</sub> = Bishkatali leaf extract (1:1) w/v

T<sub>8</sub> = Bishkatali leaf extract (1:2) w/v

T<sub>9</sub> = Zinger rhizome extract (1:1) w/v

T<sub>10</sub> = Zinger rhizome extract (1:2) w/v

**Seed sowing and rising of seedling**

The seeds were sown @ 50 seeds per tray (1.5×1ft<sup>2</sup>) in five rows at 2-3 cm depth. Plants were watered whenever necessary.

**Vigour test of okra seeds**

Vigour test was carried out in the net house of Seed Pathology Centre followed by seed sowing in sand. After 8 days of sowing, length of shoot was measured from the base of the stem up to the growing point of the youngest leaf. Similarly, length of the root was measured from the starting point of root to the largest available lateral root apex. Shoot and roots were separated from the seedlings. Seedling vigour was determined by the following formula given by Baki and Anderson (1973):

$$\text{Vigour Index} = (\text{Mean of root length} + \text{Mean of shoot length}) \times \text{Seed germination (\%)}$$

**Statistical analysis**

The collected data were statistically analyzed using analysis of variance (ANOVA). The mean

differences among the treatments were compared by Duncan's Multiple Range Test (DMRT). A statistical computer package MSTATC was used for analyzing the data. The data were transformed whenever necessary.

**Results and Discussion**

**Prevalence of seed borne fungi associated with the Okra seed samples**

The sample which showed maximum fungal association have 10% *Colletotrichum dematium*, 3.75% *Macrophomina phaseolina*, 10.50% *Fusarium oxysporum*, 9.0% *Aspergillus flavus*, 5.25% *Aspergillus niger*, 5.25% *Penicillium spp.* and 1.25% *Rhizopus spp.* (Table 1) in different seeds samples collected from different location of Bauphal Upazilla of Patuakahli district. Similar results were reported by some previous researchers (Fakir *et al.*, 1977; Neergaard, 1979; Fakir, 1982; Gupta *et al.*, 1989; Fakir, 2000 and Jamandar *et al.*, 2001 Akther, 2008).

**Table 1.** Prevalence of different seed-borne fungi recorded on okra seed collected from different locations at Bauphal upazilla of Patuakahli district

Name of the Location	Seed-borne infection (%)						
	<i>Colletotrichum dematium</i>	<i>Macrophomina phaseolina</i>	<i>Fusarium oxysporum</i>	<i>Aspergillus flavus</i>	<i>Aspergillus niger</i>	<i>Penicillium spp</i>	<i>Rhizopus spp.</i>
Dhandi	11.00a (3.55)	3.75a (2.06)	7.50f (2.81)	8.75gh (3.04)	7.25b (2.78)	2.25b-e (1.65)	1.25ab (1.27)
Bilbilash	0.00g (0.71)	3.25a (1.93)	11.75ab (3.50)	12.25bcd (3.57)	6.50bc (2.64)	2.25b-e (1.65)	1.50a (1.35)
Kalishuri	0.75fg (1.06)	0.25c (0.84)	12.75a (3.64)	15.00a (3.94)	10.75a (3.35)	3.25b (1.93)	1.25ab (1.31)
Boga	0.00g (0.71)	1.25b (1.27)	9.75cd (3.20)	11.50b-e (3.46)	6.50bc (2.64)	2.00b-e (1.50)	0.75abc (1.06)
Lichutala	6.50de (2.64)	0.50bc (0.93)	10.25bc (3.28)	11.25c-f (3.43)	7.25b (2.78)	2.00b-e (1.50)	1.00abc (1.18)
Kalaea	0.25g (0.84)	0.00c (0.71)	9.75cde (3.20)	12.50bcd (3.60)	7.25b (2.78)	2.75bc (1.80)	0.75abc (1.06)
Kagugirpul	5.25e (2.39)	0.50bc (0.97)	8.00def (2.91)	13.25ab (3.70)	6.50bc (2.64)	0.75efg (1.06)	1.25ab (1.27)
Nurainpur	2.00f (1.48)	0.00c (0.71)	7.75ef (2.78)	13.75ab (3.77)	6.75bc (2.68)	3.00bc (1.86)	1.25ab (1.27)
Patabunea	10.75a (3.39)	3.75a (2.06)	10.50bc (3.31)	9.00fgh (3.08)	5.25cd (2.39)	5.25a (2.40)	1.25ab (1.27)
Madhanpura	5.50e (2.44)	0.00c (.071)	10.50bc (3.31)	11.75b-e (3.50)	5.75bcd (2.50)	0.25fg (0.84)	0.25bc (0.84)
Gosingga	6.00e (2.53)	0.00c (0.71)	10.25bc (3.27)	12.75abc (3.63)	5.00cde (2.34)	2.50bcd (1.73)	0.00c (0.71)
Jhilna	0.00g (0.71)	0.00c (0.71)	10.50bc (3.31)	11.25c-f (3.42)	5.50bcd (2.45)	1.50c-g (1.40)	0.25bc (0.84)
Gazimaji	7.75cd (2.86)	0.25c (0.84)	10.75bc (3.35)	10.00d-g (3.24)	5.25cd (2.39)	2.00b-e (1.48)	0.50abc (0.97)
Mallikpara	6.50de (2.64)	0.00c (0.71)	10.50bc (3.31)	10.00d-g (3.24)	4.00de (2.09)	2.50bcd (1.70)	0.00c (0.71)
Rajnagar	0.00g (0.71)	0.00c (0.71)	9.50cd (3.16)	10.00d-g (3.24)	3.50e (1.98)	0.00g (0.71)	0.25bc (0.84)
Daspara	9.00bc (3.08)	0.00c (0.71)	8.25def (2.96)	12.25bcd (3.57)	5.50bcd (2.44)	3.00bc (1.87)	0.00c (0.71)
Batkajal	0.00g (0.71)	0.00c (0.71)	8.25def (2.95)	11.50b-e (3.46)	5.50bcd (2.44)	3.00bc (1.87)	0.00c (0.71)
Najirpur	0.00g (0.71)	0.00c (0.71)	12.00ab (3.53)	13.25ab (3.71)	5.25cd (2.38)	1.00d-g (1.13)	0.00c (0.71)
Shoula	9.75ab (3.20)	0.75bc (1.06)	7.75ef (2.86)	9.50e-h (3.16)	6.50bc (2.64)	1.75b-f (1.42)	1.25ab (1.27)
Khajurbarea	6.25de (2.60)	0.25c (0.84)	7.25f (2.78)	7.50h (2.81)	6.25bc (2.59)	2.75bc (1.79)	0.25bc (0.84)
CV (%)	93.72	183.58	19.79	19.68	28.64	65.50	120.17
LSD	20.32	13.47	3.85	4.06	4.81	11.08	10.76
Level of significance	**	**	**	**	**	**	**

\*=Significant at 5% level of probability

\*\*= Significant at 1% level of probability

In a column figures with same letter(s) do not differ significantly (as per DMRT). Figures in the parenthesis are transformed

**Effect of plant extracts in reducing seed-borne infection of okra seeds**

Seed treatment with garlic tablet, allamanda, neem and biskathali leaf extract @ 2:1, 1:1,1:1,1:2 and 1:1, respectively, showed excellent performance in

controlling seed borne fungi which were presented in Table 2. Similar results were reported by Khan and Fakir, 1995; Zaman *et al.*,1997; Hossain,2001; Meah *et al.*2004; Islam 2005 and Akther, 2008.

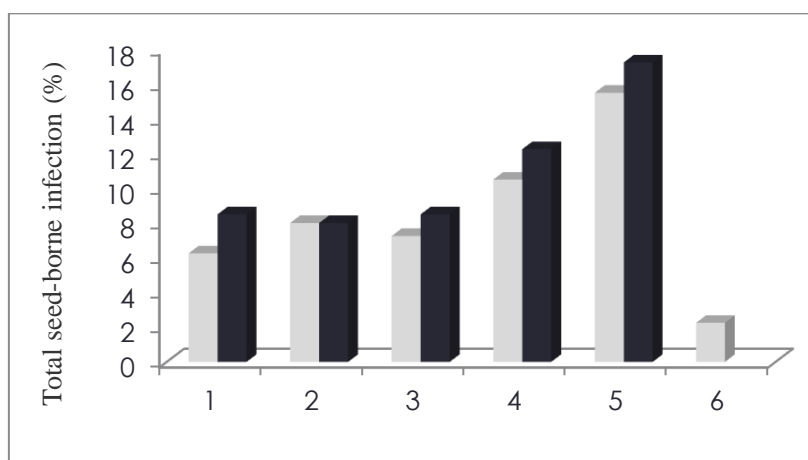
**Table 2.** Effects of different plant extracts in controlling seed-borne fungi of okra seed of Bauphal upazilla of Patuakhali district

Name of the Treatment	% Seed-borne infection							
	Germination	<i>Colletotrichum dematium</i>	<i>Macrophomina phaseolina</i>	<i>Fusarium oxysporum</i>	<i>Aspergillus flavus</i>	<i>Aspergillus niger</i>	<i>Penicillium spp.</i>	<i>Rhizopus spp.</i>
Control (Vitavax200)	64.75 a	0.00c (0.71)	0.00 (0.71)	0.75d (1.06)	0.75d (1.06)	0.25e (0.84)	0.00 (0.71)	0.50b (0.97)
Garlic tablet (2:1)	62.25 b	0.00c (0.71)	0.00 (0.71)	3.00cd (1.86)	1.75c (1.48)	0.50de (0.97)	0.00 (0.71)	0.00b (0.71)
Garlic tablet (1:1)	62.00 bc	0.25bc (0.84)	0.00 (0.71)	4.00c (2.11)	2.25bc (1.64)	2.00abc (1.54)	0.00 (0.71)	0.25b (0.84)
Allamanda tablet (2:1)	62.00 bc	0.50abc (0.97)	0.00 (0.71)	3.25cd (1.93)	2.00bc (1.53)	1.50b-f (1.40)	0.00 (0.71)	0.00b (0.71)
Allamanda tablet (1:1)	62.00 bc	0.50abc (0.97)	0.00 (0.71)	3.25cd (1.93)	2.00bc (1.53)	1.50b-f (1.40)	0.00 (0.71)	0.00b (0.71)
Neem leaf extract (1:1)	60.25 d	0.00c (0.71)	0.00 (0.71)	2.25d (1.63)	2.00bc (1.54)	1.25b-f (1.27)	0.00 (0.71)	0.25b (0.84)
Neem leaf extract (1:2)	60.25 d	0.00c (0.71)	0.00 (0.71)	3.50cd (1.63)	2.75bc (1.76)	2.75a (1.27)	0.00 (0.71)	1.00ab (1.06)
Biskathali leaf extract (1:1)	60.00 d	0.00c (0.71)	0.00 (0.71)	6.50b (2.64)	3.25abc (1.92)	1.25b-f (1.27)	0.00 (0.71)	0.25b (0.84)
Biskathali leaf extract (1:2)	59.25 e	0.25bc (0.84)	0.00 (0.71)	6.75ab (2.69)	3.75ab (2.04)	0.75cde (1.10)	0.00 (0.71)	0.75ab (1.10)
Zinger rhizome extract (1:1)	58.25f	0.75ab (1.06)	0.00 (0.71)	7.50ab (2.83)	4.75a (2.29)	1.25b-f (1.27)	0.25 (0.84)	1.00ab (1.06)
Zinger rhizome extract (1:2)	58.00f	1.00a (1.18)	0.00 (0.71)	8.00a (2.91)	4.75a (2.29)	1.75a-e (1.49)	0.25 (0.84)	1.50a (1.18)
CV	3.30	8.51	-	6.95	6.67	9.44	4.18	10.55
Level of Significance	**	**	NS	**	**	**	NS	**

\*\*= Significant at 1 % level of probability

NS= Non Significant

In a column figures with same letter(s) do not differ significantly (as per DMRT). Figures in the parenthesis are transformed value



**Fig.1.** Total Seed borne infection in different plant extracts

When seed were treated with Garlic Tablet @ 2:1, it showed better performance than @1:1 in controlling seed-borne infection. No difference was found in performance in case of allamanda @ 1:1 and 1:1. Accordingly neem, zinger and biskathali @ 1:1 and 1:2 also showed better performance. Again Garlic Tablet @ 2:1 showed excellent performance among the plant extracts.

1	Garlic Tablet @2:1 and 1:1
2	Allamanda Tablet (& 2:1 and 1:1
3	Neem Extract 1:1 and 1:2
4	Zinger Extract @ 1:1 and 1:2
5	Biskathali Extract 1:1 and 1:2
6	Vitavax 200 (@ 0.252/1002 seed

**Effect of plant extracts on germination of okra seeds**

As germination of the seed is of major concern, it was observed that the Garlic tablet @ 2:1 treated seeds showed significantly higher rate of germination (Table 2). From the results, it was also observed that all the extracts except zinger extract increased the percentage of seed germination significantly. Germination was recorded highest (64.75 %), when seeds were treated control (Vitavax200) @ 0.25 % concentrations. Comparatively higher percentage of germination was recorded in treatment with garlic tablet (62.25 %) @ 2:1 concentration. Garlic tablet @ 1:1,

allamanda tablet @ 2:1 and 1:1 concentrations also gave promising result.

Vigour index of Garlic @ 2:1 treated seeds was 545.60% where incase of untreated seed it was 423.40%.

**Vigour test of okra seeds**

**Table 3.** Vigour test of Okra seeds

Sample Name	Germinated seed (%)	Non-germinated seed (%)	Mean shoot length (cm)	Mean root length (cm)	Vigour Index (%)
Untreated Seed	58	42	5.50	1.80	423.40
Garlic tablet@2:1 Treated Seed	62	38	6.4	2.4	545.60

**Conclusions**

It can be concluded that seed separation with naked eye will help to get more apparently healthy seeds. It is also revealed from this experiment that garlic tablet, allamanda tablet or neem leaf extract can be

recommended for okra seed treatment for getting higher germination and healthy seedling that will eventually produce more fruit.

**References**

Akter, N. 2008. Effect of plant extract on the management of seed-borne fungal diseases of okra. M.S. thesis, Dept. of Plant Pathol., BAU, Mymensingh. Pp. 36 & 74.

Baki, A. and Anderson, 1973. Physiological and biological deterioration of seeds. *In Seed Biology, Vol. II.* Academic Press, New York. pp. 283-315

Fakir, G.A. 1976. Detection of seed-borne fungi in okra, their role and control. A monograph accepted by the Danish Government Institute of Seed Pathol., Copenhagen, Denmark.p.22.

Fakir, G.A.; Thirumalachar, M.J.; Mathur, S. B. and Neergaard, P. 1977. Seed-borne infection of *Macrophomina phaseolina* and *Colletotrichum dematium* in okra (*Hisbiscus esculentus*) in Bangladesh. *Bangladesh J. Agril. Sci.* 4: 75-79.

Fakir, G.A. 1982. An Annotated list of seed-borne disease in Bangladesh. Bangladesh Agricultural Information Service, Dhaka. p.17.

Fakir, G.A. and Mridha, A.U. 1985. Die-back caused by *Colletotrichum dematium* and *Macrophomina phaseolina* a new disease of lady's finger (*Hisbiscus esculentus* L.). *Bangladesh J. of Plant Pathol.* 1:25-28.

Fakir, G. A. 2000. An annotated list of seed-borne diseases in Bangladesh. Seed Pathology Laboratory. Dept. of Plant Pathol., BAU, Mymensingh.p.20.

Gupta, K.; Sindhu, I. R. and Nazz, S. 1989. Seed mycoflora of *Abelmoschus esculentus* (L.) Moench; A survey and enumeration. *Acta-Botanica- Indica.* 17(2): 200-206.

Islam, M. R. 2005. An Integrated approach for Management of Phomopsis blight and fruit Rot of Eggplant. M.S. thesis, Dept. of Plant Pathol., BAU, Mymensingh.p.167.

Islam, M.F. 2009. Health and quality of Mustard seeds collected from Fulbaria upazilla of Mymensingh district and control of its fungi by plant extracts. M.S. thesis, Dept. of Plant Pathol., BAU, Mymensingh.p.40

ISTA (International Seed Testing Association). 2001. International Rules for Seed Testing. Rules Amendments. *Seed Sci. and Tech.*, 29 (2): 1-127.

Jamandar, M. M.; Ashok, S.; Shamrao, J.; Sajjan, A. and Jahangidar, S. 2001. Studies on seed mycoflora and their effect on germination of color graded okra [*Abelmoschus esculentus* (L.) Moench]. *Crop Research Hisar.* 22(3): 479-484.

Khan, A. A. and Fakir, G. A. 1995. Seed treatment with garlic extract to control seed-borne pathogens of jute. *Bangladesh J. Plant Pathol.* 11(1-2): 1-10.

Meah, M.B.; Islam, M.R. and Islam, M.M. 2004. Development of an Integrated Approach for Management of Phomopsis blight and fruit rot of Eggplant in Bangladesh Annual Research Report, Dept. of Plant Pathol., BAU, Mymensingh, Bangladesh.p.57.

Neergaard, P. 1979. Seed Pathology, Vol. I. The MacMillan Press Ltd., London. p. 839.

Zaman, M.A.; Saleh, A.K.M.; Rahman, G.M.M. and Islam, M.T. 1997. Seed-borne fungi of Mustard and their control with indigenous plant extracts. *Bangladesh J. Plant Pathol.* 13(1&2): 25-28.