

SEED HEALTH EFFECT ON PHOMOPSIS BLIGHT AND FRUIT ROT DISEASE OF EGGPLANT CAUSED BY *PHOMOPSIS VEXANS*



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Abstract

Phomopsis blight and fruit rot caused by *Phomopsis vexans* is an important disease of eggplant (*Solanum melongena* L.) in Bangladesh. It decreases the production of eggplant to a great extent. The present research work was conducted to assess the effect of different levels of seed infection on phomopsis blight and fruit rot disease and yield of eggplant based on physical seed sorting at Plant Pathology Field, Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh during 2017-2018, 2018-2019 and 2019-20 cropping seasons. The levels of seed infected were 5, 10, 20, and 100%. Each level represented a treatment. Farmers saved seeds and apparently healthy seeds (0% infection) were also included which served as two controls. It was found that healthy seed effectively control the Phomopsis blight and fruit rot disease of eggplant. Same trend of the results was observed in all three consecutive years. In case of three years average, healthy seed showed the lowest disease incidence (8.33 %) whereas the highest disease incidence (84.33%) was observed in 100% seed infection. The highest yield of 44 t/ha of eggplant was found in treatment with 100% healthy seed. The highest disease incidence with lowest percentage of germination and yield were observed in 100% seed infection. The yield decreased with the increase of percent seed infection. The maximum yield incidence of disease and lowest yield were observed in 100% seed infection. The yield loss increased with the increase of percent seed infection.

Keywords: Brinjal, Phomopsis blight and fruit rot, Seed health, and Yield.

Introduction

Eggplant (*Solanum melongena* L.) is an important vegetable in Bangladesh cultivated round the year in all districts of the country (Anon. 1988). Eggplant or brinjal is a popular fruit vegetable widely also grown in Asia, Africa, and the subtropics, including the Southern USA and the Mediterean region with world production of 50.60 million tons for the year 2015 (FAO 2016). Asia has the largest eggplant production which comprises more than 90% of the world production area and 87% of the world production (Choudhury and Gaur 2009). In Bangladesh, the district of Jamalpur, Sherpur,

Mymensingh, Rangpur, Faridpur, Rajshahi, Pabna, Cumilla and Joshore are the major growing areas of eggplant. The total acreage of eggplant is 51,165 hectares with total annual production of 5,16,007 tones with an average yield of 10.09 tons per hectare (Anon. 2019).

Eggplant is a good source of nutrients, vitamins and minerals. It supplies 25 calories per serving and has virtually no fat. Its “meaty” texture makes eggplant a staple in vegetarian diets. Eggplant is also called as the ‘King of Vegetables’. Due to its low calorie it is one of

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the best foods for weight watcher. In Bangladesh, its position is second in vegetable crops in terms of production next to potato. This is a vegetable available throughout the year in the market and especially during the lean period. Eggplant is thus regarded as a cash crop.

Bangladesh is considered as one of the center of origins of eggplant thus a large number of eggplant cultivars are grown in Bangladesh, which show a wide range of variations in yield performance. The eggplant suffers from 12 diseases of which fruit rot caused by *Phomopsis vexans* (Sacc. and Syd) Harter is a devastating one. The causal organism of the disease remains viable for about 14 months in soil debris and in the seed from infected fruits (Khan 1999, Kalda *et al.*, 1977). The pathogen is reported to be both externally and internally seed borne. The disease was first reported from Gujrat in 1914 and since then from many parts of India. Occurrence of the disease in Bangladesh has been reported by Fakir (1983) and Ahmad (1987). The disease has become a major constraint in intensive cultivation of eggplant. Crop losses due to this disease are evident, loss ranges from 15-20% in general but 30-50% in severe case (Das 1998). It is a serious disease which may cause damping off symptom if attacked at seedling stage. When the leaves are infected, small circular spots appear which become grey to brown with a light color centre. The infected leaves may turn yellow and die. Lesion may also develop on petiole and stem causing blighting of affected portions. In course of time, the spot enlarges and produces concentric circular area. Ultimately, the fruits become mummified and rotten (Kumar *et al.* 1986). Many developing countries give importance to use healthy seeds to prevent seed borne disease in the field (Islam 2005). Moreover, use of healthy seeds considered as a low cost approach. There is no recognized resistant variety of eggplant against fruit rot disease till today. Our farmers are reluctant to buy fungicides. Conversely, they are now indulged to indiscriminate use of pesticide, causing environment pollution. Under this scenario, it appears that a single input would be the best suited preventive approach for this disease and obviously it is use of healthy seed. It must be a basic component of disease management for eggplant production. However,

comprehensive research yet to conduct by using different level of infected seeds against phomopsis blight and fruit rot disease and yield of eggplant in Bangladesh. Therefore, the present research work was undertaken to assess the effect of different levels of infected seeds on phomopsis blight and fruit rot disease of eggplant.

Materials and Methods

The experiment was conducted to assess the effect of different levels of infected seed on incidence of phomopsis blight and fruit rot disease and yield of eggplant during 2017-2018, 2018-2019 and 2019-2020 cropping seasons in the month of October to April at the Plant Pathology Field, Bangladesh Agricultural Research Institute (BARI), Gazipur-1701, Bangladesh. The seeds of BARI begun-4 (Kajla) were collected from Horticulture Research Center (HRC), BARI from the local market and farmers in August 2017, 2018 and 2019. The levels of seed infected were 5, 10, 20, and 100%. Each level represented a treatment. Farmers saved seeds and apparently healthy seeds (0% infection) were also included which served as two controls. The experiments were conducted following Randomized Complete Block Design with three replications. The plot size was 6 m² (3 m X 2 m) and plot to plot distance was 0.5 m. The Row to row distance was 100 cm and plant to plant 75 cm. Seedlings was raised in plastic trays in the net house with proper care and management in the consecutive three years. Trays were prepared by mixing soil, sand and well decomposed cow dung in the proportion of 2:1:1. The prepared soil was heaped like a square block. Formalin solution (4%) @ 200 ml/cft soil was mixed with the soil heap and the soil was covered with a polythene sheet for 48 hours. After 7 days, surface sterilized trays were filled up with the sterilized soil (Dhasgupta 1988). Seeds were sown in a diametric line and labeled by a permanent marker. Watering was done to maintain the soil moisture. Shade was provided to save the young and delicate seedlings from heavy showering and scorching sun. A piece of medium high land with well drainage system was selected and prepared by ploughing followed by laddering. The soil was well pulverized for good tilth condition. Weeds and stubbles were removed. During field preparation, fertilizers and

manures were applied at recommended doses (Anon. 2012). Seedlings of 25 days age were transplanted in the field followed by watering. Fifteen seedlings were planted in each subplot maintaining plant-to-plant distance 75 cm and line-to-line 1 m. Inoculation of 5 plants in each plot of each cultivar/entry was done at flowering stage and 5 plants at fruiting stage. Seventy milliliter spore suspension (5×10^6 spore/ml) sprayed for each plant (Khan 1999). Another 5 plants were kept uninoculated. For ensuring better infection, the spraying was done in the afternoon and inoculated plants were covered with moist transparent polythene sheet for 24 hours. Intercultural operations were done to maintain the normal conditions of the crop in the field.

After inoculation, records on expression of symptom on leaf, flower and fruit were taken at an interval of seven days. Infection was expressed in percentage. Data on seed germination, disease incidence and yield were recorded.

Disease incidence, disease reduction over 100% infected seeds and yield loss over 100% healthy seeds were computed using the formulae as suggested by Islam (2001) with little modifications as shown below.

The recorded data were analyzed by MSTAT-C to find out the level of significance and the variance was analyzed following Duncan's New Multiple Range Test (DMRT).

$$\text{Disease incidence \%} = \frac{\text{Number of infected plants}}{\text{Total number of plants checked}} \times 100$$

$$\text{Disease reduction \%} = \frac{\text{Disease incidence in 100\% infected seed} - \text{disease incidence in treatment}}{\text{Disease in 100\% infected seed}} \times 100$$

$$\text{Yield loss \%} = \frac{\text{Yield under 100\% healthy seeds} - \text{Yield under a treatment}}{\text{Yield under 100\% healthy seeds}} \times 100$$

Results and Discussion

Results of the experiments of three consecutive years are presented in this chapter chronologically.

Effect of different levels of seed infection on germination, phomopsis blight and fruit rot yield of eggplant in 2017-18 cropping season

The ranges of seed germination were from 67-92%. The highest germination of 92% was recorded in 100% healthy seeds followed by 84% and 81% in 5 and 10% seed infection, respectively. The lowest seed germination percentage of 67% was found in 100% seed infection followed by 69% in farmer's saved seed (Table 1).

In case of disease incidence, the highest 84% disease incidence was recorded in the 100% seed infection while the lowest disease incidence (8%) was observed in 100% healthy seed (Table 1).

In case of disease reduction over 100% seed infection, the highest disease decreased of 90% was found in 100% healthy seed followed by 89% in 5% seed infection. The lowest reduction in disease incidence over 100% seed infection (26%) was found in farmer's saved seed followed by 61% in 20% seed infection (Table 1). The highest yield 45 t/ha were recorded in the treatment T₆ (healthy seed) (Table 1).

The lowest eggplant yield of 15 t/ha was recorded in 100% seed infection. The yield was decreased with the increase of percent seed infection. Considering yield loss over healthy seeds, the highest yield loss of 67% was recorded in 100% seed infection followed by farmer's saved seed (51%). The lowest yield loss of 11% was recorded in 5% seed infection followed by 10% seed infection (22%). The yield loss was increased with the increased of percent seed infection (Table 1).

Table 1. Effect of six different levels of seed infection with *Phomopsis vexans* on seed germination, incidence of phomopsis blight and fruit rot of eggplant in 2017-2018.

Level of seed infected seed (%) (Treatments)	Seed germination (%)	Disease incidence (%)	% Disease reduction over 100% infected seed	Yield (t/ha)	% Yield loss over 100% healthy seed
5% seed infection	84.0	9.0e	89.0	40.0a	11.0
10% seed infection	81.0	22.0d	74.0	35.0b	22.0
20 % seed infection	78.0	33.0c	61.0	29.0c	36.0
100% seed infection	67.0	84.0a	-	15.0e	67.0
Farmer's practice	69.0	62.0b	26.0	22.0d	51.0
100% Healthy seed	92.0	8.0f	90.0	45.0a	-
CV%	8.5		-	7.9	-

Means within the same column with a common letter(s) do not differ significantly (P=0.05) by DMRT.

Effect of different levels of seed infection on germination, phomopsis blight and fruit yield disease of eggplant in 2018-2019 cropping season

The seed germination ranged from 69-94% in 2018-2019 cropping season. The highest germination 94% was recorded in 100% Healthy seed followed by 5% seed infection (86%) and 10% seed infection (83%). The lowest germination of 69% was found in 100% seed infection followed by farmer's saved seed (71%) (Table 2).

The highest incidence of 86% was found in 100% seed infection while the lowest disease incidence of 10% was observed in 100% healthy seed. The highest reduction of 88% in disease incidence over 100% seed infection was found in 100% healthy seed followed by

5% seed infection (87%). The lowest disease reduction of 26% was recorded from farmers saved seed (Table 2).

The highest yield of 43 t/ha was recorded in 100% healthy seed followed by 5% seed infection showing 38 t/ha. The lowest yield of 13 t/ha was recorded in 100 % seed infection. The yield was decreased with the increase of percent seed infection. The highest yield loss of 60% over 100% healthy seed was recorded from 100% seed infection followed by farmers saved seed 51%. The lowest yield loss of 12% was recorded in 5% infected seed followed by 10% seed infection (23%). It was noticed that the yield loss was increased with the increased of percent seed infection (Table 2).

Table 2. Three years average in effect of three fungicides on vine rot (*Phytophthora* sp.) disease and yield of pointed gourd.

Level of seed infected seed (%) (Treatments)	Seed germination (%)	Disease incidence (%)	% Disease reduction over 100% seed infection	Yield (t/ha)	% Yield loss over 100% healthy seed
5% seed infection	86	11e	87	38a	12
10% seed infection	83	24d	72	33b	23
20 % seed infection	80	35c	59	27c	37
100% seed infection	69	86a	-	13e	60
Farmer's practice	71	64b	26	21d	51
100% Healthy seed	94	10e	88	43a	-
CV%	-	8.50	-		-

Means within the same column with a common letter(s) do not differ significantly (P=0.05) by DMRT.

Effect of different levels of seed infection on phomopsis blight and fruit yield of eggplant in 2019-2020 cropping season

The trends in results recorded during 2019-2020 were almost similar to the findings recorded during two previous years. The range of seed germination was 66-91%. The highest germination was recorded in 100% healthy seed followed by 5% seed infection (83%) and 10% seed infection (80%). The lowest germination of 66% was found in 100% seed infection followed by farmers' saved seed (68%) (Table 3).

In case of disease incidence, the highest incidence of 83% was recorded from 100% seed infection, while the

lowest disease incidence (7%) was observed in 100% healthy seed. The highest reduction of 92% was recorded from 100% healthy seed followed by 5% seed infection (83%). The lowest disease reduction of 27% was found in farmers saved seed (Table 3).

The highest yield of 44 t/ha was recorded in 100% healthy seed and the lowest yield of 14 t/ha was recorded from 100% seed infection. The maximum yield loss of 68% over 100% healthy seeds was recorded in 100% seed infection followed by farmers saved seed (52%). The lowest yield loss of 11% was recorded in 5% seed infection followed by 10% seed infection (22%). The yield loss increased with the increase of percent seed infection (Table 3).

Table 3. Effect of six different levels of seed infection on seed germination, incidence of phomopsis blight and fruit yield of eggplant in 2019-2020.

Level of seed infected seed (%) (Treatments)	Seed germination (%)	Disease incidence (%)	% Disease reduction over 100% seed infection	Yield (t/ha)	% Yield loss over 100% healthy seed
5% seed infection	83	8e	90	39a	11
10% seed infection	80	21d	75	34b	22
20 % seed infection	77	32c	61	28c	36
100% seed infection	66	83a	-	14e	68
Farmer's practice	68	61b	27	21d	52
100% Healthy seed	91	7e	92	44a	-
CV %	-	9.6	-	7.9	-

Means within the same column with a common letter(s) do not differ significantly (P=0.05) by DMRT.

Table 4. Average seed germination, incidence of phomopsis blight and fruit rot of eggplant during 2017-2018, 2018-2019 & 2019-2020.

Level of seed infected seed (%) (Treatments)	Seed germination (%)	Disease incidence (%)	% Disease reduction over 100% seed infection	Yield (t/ha)	% Yield loss over 100% healthy seed
5% seed infection	84.33	9.33e	88.67	39a	11.3
10% seed infection	81.33	22.33d	73.67	34b	22.3
20 % seed infection	78.33	33.33c	60.33	28c	36.3
100% infected seed	67.33	84.33a	-	14e	65.0
Farmer's practice	69.33	62.33b	26.33	21d	51.3
100% Healthy seed	92.33	8.33e	90.00	44a	-
CV %	-	9.07	-	7.66	-

Means within the same column with a common letter(s) do not differ significantly (P=0.05) by DMRT.

Average germination, incidence of phomopsis blight and fruit yield of eggplant at different levels of seed infection during 2017-18, 2018-19 and 2019-2020

The average seed germination was 67.33 - 92.33%. The highest seed germination was recorded from 100% healthy seed followed by 5 and 10% seed infection showing 84.33 and 81.33% germination, respectively. The lowest seed germination of 67.33 % was found in 100% seed infection followed by farmer's saved seed (69.33%) (Table 4).

In case of average disease incidence, the maximum of 62.33% disease incidence was found in 100% seed infection while the lowest disease incidence of 8.33% was observed in 100% healthy seed (Table 4). The highest reduction of 90% in disease incidence over 100% seed infection was recorded from 100% healthy seed followed by 5% seed infection showing 88.67% disease reduction. The lowest disease reduction over 100% seed infection was 26.33% in farmers saved seed followed by 20% infected seeds (60.33%) (Table 4).

The highest average yield of 44 t/ha was recorded in 100% healthy seed. The lowest yield of 14 t/ha was recorded in 100% seed infection. The yield was decreased with the increased of percent seed infection (Table 4). The highest yield loss of 65.0% was recorded in 100% seed infection followed by farmers saved seed (51.3%). The lowest yield loss of 11.3% was recorded at 5% seed infection followed by 10% infected seed (22.3%). The average yield loss was increased with the increase of percent seed infection (Table 4).

The findings of the present experiment reveal that the lowest incidence of phomopsis blight and the maximum germination and fruit yield are obtained when 100% healthy seeds are planted. On the contrary, the highest disease incidence, and yield loss was recorded from 100% infected seeds. Level of infected seed is positively correlated with disease incidence, and yield loss. The findings of the present experiment are in agreement with the findings of many other researchers. An experiment was conducted to observe the effect of different categories of eggplant seeds on germination, disease incidence and yield. All the categories of seeds showed significant effect on increase of germination and yield, and decreased of disease incidence. Five percent infected seed showed the highest germination and yield and lowest disease incidence followed by

10% and 20% infected seeds. The highest disease incidence with lowest percentage of germination and yield were observed in 100% seed infection. The yield was decreased with the increased of percent seed infection (Anon. 2018).

In another experiment Anon. (2019) found that healthy seed showed the highest seed germination and yield with lowest disease incidence. The highest disease incidence with lowest percentage of germination and yield were observed in 100% seed infection. The yield was decreased with the increased of percent seed infection. Similar findings were also reported by other investigator (Anon. 2020). Seed is the primary infection source of *Phomopsis vexans* and may serve as a substrate for pathogen survival (Pan and Acharya 1995). Incidence of *Phomopsis vexans* on eggplant seeds collected from different growing areas of Bangladesh varied from location to location (Islam *et al.* 2009). The pathogens remains on the seed coat and the cotyledons of eggplant seeds causing various degrees of seed discoloration and minute black pycnidial bodies distinctly observed on the surface of the dry seed (Karuna *et al.* 1994) which attribute the opportunity to avoid the pathogens by discarding the infected, abnormal and discoloured seed. Apparently healthy seed could be the easiest and economical practice for the growers to avoid the disease (Islam *et al.* 2009). Khan (1999) and Karuna *et al.* (1994) reported similar relationship between seed infection and incidence of phomopsis blight and fruit rot of eggplant.

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