

Effect of the Treatments in Controlling Purple Blotch Complex of Onion (*Allium cepa* L.)

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Abstract: A field experiment was conducted during the rabi season to study the management of Purple blotch of onion through some chemicals and plant extracts. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 (three) replications of each treatment. There were 11 treatments in the experiment comprising Dithane M-45, Rovral, Bavistin, Cupravit, Proud, Champion, Tilt, Ridomil, Neem extract, Alamanda extract and Control. Results exhibited that all the plant parameters were increased with applying different fungicides and plant extracts with their effectiveness. The % plant infection, % leaf infection, % Leaf Area Diseased (% LAD) and Percent Disease Index (PDI) were observed five times. All of these parameters were found lowest in foliar spray of Rovral and highest was found in control treatment. After Rovral, Ridomil and Dithane M-45 were found most effective to minimize the disease severity as well as increase of yield. Between two plant extracts Neem extract performed better than Alamanda extract.

Key words: Purple blotch • Isolation • Pathogens • *Dextrose agar (pda) medium* • Onion (*Allium cepa* L.)

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important and familiar crop spices specially bulb onion through the world. It is a member of the family Alliaceae. It is also used as popular vegetable in many countries of Asia and very common and favorable spice in Bangladesh. The major onion growing areas are Faridpur, Comilla, Manikgonj Dinajpur, Jessore, Pabna, Rajshahi, Mymensingh Jamalpur and Rangpur. Recently, Bunching onion (*Allium fistulosum*) is coming up as a popular vegetable too. It does not form bulbs but grow in clusters with long white stems [1].

In terms of global weight of vegetable produced, nearly 28 million tons onion bulbs per annum next to tomatoes and cabbages bears importance [2]. In Bangladesh, the production of onion is nearly 1,27,000 metric tons from 34,000 hectares of land [3]. The present production of onion is nearly 1,50,000 metric tons from 36,800 ha of land [4]. The national annual yield is only 4.07 t/ha [4] which are quite low compared to other onion growing countries of the world.

Onion crops are affected by a number of diseases [5, 6, 7]. Among those diseases purple blotch, commonly known as leaf blotch, caused by *Alternaria porri*, is noted as the major disease throughout the world including Bangladesh [5, 6, 7, 8, 9]. Nowadays, *Stemphyllium botryosum*, the causal agent of white blotch of onion are being considered as an organism involved indirectly with the causation of purple blotch of onion. It is considered that *Stemphyllium botryosum* initiate the infection and *Alternaria porri* facilitates for causing purple blotch and hence the disease is treated as purple blotch.

The cultivars Faridpuri and Taherpuri are susceptible to the disease [10]. Onion production in Bangladesh is gradually decreasing due to the disease [3]. For its less production Bangladesh are being dependent to the neighboring countries like India, Barma, Pakistan for importing onion to meet up the nutrient demand. The disease is characterized with small water-soaked lesions initially on leaves and seed stalk that quickly develop white centre. As lesions enlarged, they become zonate, brown to purple, surrounded by a yellow zone and extents

upward for some distance. Under humid condition, the surface of the lesion may be covered with brown to dark gray structures of the fungus. A few large lesions have been formed, in a leaf or seed stalk, which may coalesce and girdle of the leaf or seed stalk and tissues, distal to the lesions, will die. Usually the affected leaves fall down and die within four weeks if the environment favors the disease [11].

In Bangladesh, no resistant source is available. The varieties grown in the country are highly susceptible to the disease. Role of environmental factors on disease development has not yet been studied systematically. Therefore, quite a little information is available on fungicidal control; and mostly those are on bulb production only [12, 13] but not on seed production. Further, people globally are conscious about environmental deterioration due to use of costly and toxic spray chemicals. So, to save the nature and getting balanced environment, a judicious use of fungicides, plant extracts are to be employed. So the present study was undertaken with the following objectives: to identify the effective fungicides in controlling purple blotch complex of onion for seed production to screen the effectiveness of fungicides for management of the purple blotch complex of onion and also to evaluate the performance of some plant extracts in controlling purple blotch disease of onion.

MATERIALS AND METHODS

A field experiment was conducted during the rabi season to study the management of Purple blotch of onion through some chemicals and plant extracts. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 (three) replications of each treatment. The experimental site was located at 23077' N latitude and 9003' E longitude with an elevation of 1.0 meter from sea level. The soil of the experimental site belongs to Tejgaon series under the Agro-ecological zone, Madhupur Tract (AEZ -28). The unit plot size was 1.5 m x 2 m and experimental plot size was 10.5m x 19.5 m. The row to row and bulb to bulb distance was maintained 30 cm and 15 cm, respectively. There were 11 treatments in the experiment comprising T₁ = Dithane M-45, T₂ = Rovral, T₃ = Bavistin, T₄ = Cupravit, T₅ = Proud, T₆ = Tilt, T₇ = Champion, T₈ = Ridomil, T₉ = Neem extract, T₁₀ = Alamanda extract (*Azadirachta indica*) and T₁₁ = (Control).

Table 1: The concentration of the spray solution of the fungicides

Treatments	Concentration
1. Dithane M-45	10L/45g
2. Rovral	10L/20g
3. Cupravit	10L/70g
4. Bavistin	10L/10g
5. Proud	10L/10g
6. Tilt	10L/10ml
7. Champion	10L/20g
8. Ridomil	10L/20g
9. Neem extract	1: 4 (Leaf: water)
10. Alamanda extract	1: 4 (Leaf: water)
11. Control	No concentration (only water)

At recommended dose suspension/solution of fungicides and plant extracts were prepared by mixing thoroughly with requisite quantity of chemical with normal clean water. The concentration of the spray solution (for 5 decimal land) of the fungicides or plant extracts used in the experiment presented below (Table1).

Isolation and Identification of Pathogens: Isolation and identification pathogen were made in two ways

By Direct Observation: The diseased leaves of onion plants were collected and kept in polythene bags and tagged. The samples were then taken to the laboratory. Then slides were prepared from the diseased samples, observed under microscope and identified the pathogen according to CMI Description.

By Growing on Potato Dextrose Agar (Pda) Medium: The diseased leaves were cut into pieces (4mm diameter) and surface sterilized with HgCl₂ (1:1000) for 30 seconds. Then the cut pieces were washed in sterile water thrice and were placed on to acidified PDA in Petri dish. The plates containing leaf pieces were placed at room temperature for seven days. When the fungus grew well and sporulated, then slides were prepared from pathogenic structures and was observed under microscope and identified with the help of relevant literature (CMI Description).

Statistical Analysis of Data: The recorded data on different characters were statistically analyzed to find out the significant differences among the treatment means. Data were analyzed statistically using MSTAT Computer Program. Data were transformed, whenever necessary, following Arcsine transformation. Means of treatment were separated using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

Effect of the treatments in controlling purple blotch complex of onion caused by *Alternaria porri* and *Stemphylium botryosum* was assessed based on the result of percent plant infection, percent leaf infection, percent leaf area diseased (%LAD) and percent disease index (PDI).

Percent (%) Plant Infection: Results obtained on the effect of spray of Dithane M-45, Rovral 50 WP, Bavistin, Cupravit, Proud, Tilt, Champion, Ridomil, Neem extract and Alamanda extract in controlling purple blotch of onion in terms of plant infection was presented in Table 2, Fig 1 at 15 days interval. The effects were differed significantly among the treatments with some extents. The lowest plant infection (7.143%) was observed with the spraying of Rovral applied at 15 DAT (Days After Transplanting) followed by Dithane M-45 (8.627%), Ridomil (10.94%), Tilt (11.69%), Bavistin (14.15%), Proud (15.35%), Champion (15.80%), Cupravit (16.68%), Neem extract (17.38%). The effect of Alamanda extract was statistically identical in comparison to control. The highest infection was found in control treatment. Further at 30, 45, 60 and 75DAT the plant infection was lowest in treatment T₂ (Rovral) and the highest infection was observed in control treatment. Again between two-plant extract Neem extract had significant effect compare to Alamanda extract in controlling purple blotch of onion. From the Table it was cleared that leaf infection was increased with increasing the age of onion.

Percent (%) Leaf Infection: Data on percent leaf infection of onion by fungus was influenced by different fungicides and plant extracts. The effects of fungicides and plant extracts were found positively significant (Table 3, Fig. 2). Results showed that the spray of Rovral gave the lowest leaf infection (3.460% at 15 DAT, 7.417% at 30 DAT, 13.23% at 45 DAT, 18.07% at 60 DAT and 25.15% at 75 DAT) followed by Ridomil and Dithane M-45. The highest leaf infection was found in control treatment in all the intervals. In case of plant extract, Neem extract was more efficient in controlling purple blotch of onion than Alamanda extract. The table showed that leaf infection was increased with increasing the age of onion.

Leaf Area Diseased (%LAD): The disease severity of purple blotch disease of onion i.e % LAD caused *A. porri* suppressed significantly due to the application of different fungicides under field condition (Table 4). The %LAD was as high as 31.94 at 75 DAT in the control plot where fungicide was not sprayed. The lowest %LAD of 0.1067 was recorded at 15 DAT in treatment T₂, where Rovral was sprayed. The results showed that at different interval Rovral was best fungicide for suppressing %LAD followed by Dithane M-45, Ridomil, Champion, Tilt, Proud, Cupravit and Bavistin. Again between two-plant extract Neem extract had significant effect compare to Alamanda extract in controlling purple blotch of onion. The effect of Alamanda extract was statistically identical in comparison to control. From the Table it was cleared that % leafs Area Diseased (%LAD) was increased with increasing the age of onion.

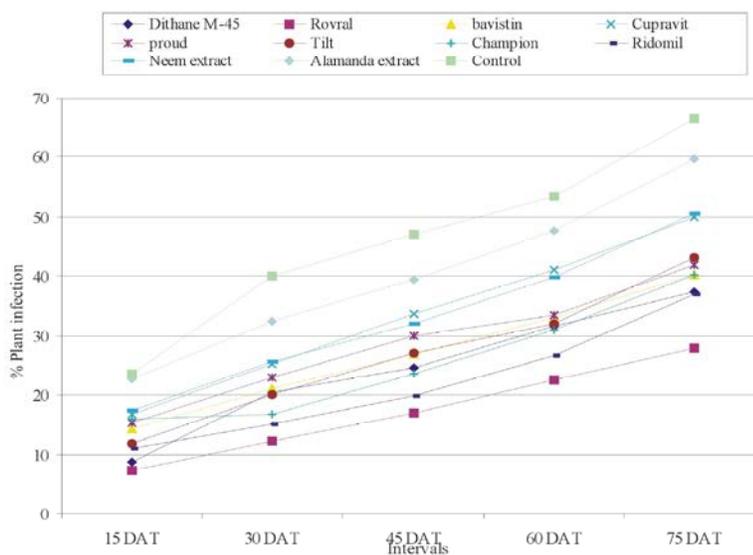


Fig. 1: Showing % plant infection at different intervals of onion

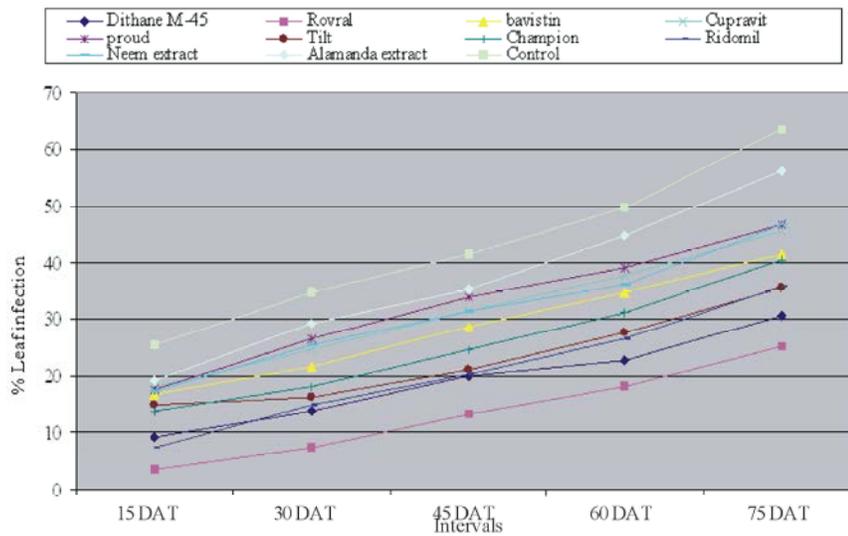


Fig. 2: Showing % leaf infection at different intervals

Table 2: Effect of fungicides and plant extracts on % plant infection of purple blotch of onion at 15 days of interval

Treatment	% plant infection				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
T ₁ = Dithane M-45	8.627 d	20.37 cde	24.65 cde	31.66 cd	37.35 de
T ₂ = Rovral	7.143 d	12.12 e	16.91 e	22.53 d	27.96 e
T ₃ = Bavistin	14.15 bc	21.00 cde	26.84 cde	32.98 cd	40.34 cd
T ₄ = Cupravit	16.68 b	25.13 bc	33.76 bc	41.03 bc	49.94 bc
T ₅ = Proud	15.35 bc	23.01 cd	30.03 bed	33.36 cd	41.82 cd
T ₆ = Tilt	11.69 cd	19.99 cde	26.95 cde	32.10 cd	43.14 cd
T ₇ = Champion	15.80 bc	16.63 cde	23.54 cde	31.04 cd	40.34 cd
T ₈ = Ridomil	10.94 cd	15.16 de	19.72 de	26.57 d	36.91 de
T ₉ = Neem extract	17.38 b	25.64 bc	32.10 bc	39.79 bc	50.53 bc
T ₁₀ = Alamanda extract	22.69 a	32.43 ab	39.51 ab	47.77 ab	59.73 ab
T ₁₁ = Control	23.55 a	39.98 a	47.11 a	53.38 a	66.54 a
CV (%)	15.48	17.4	16.47	14.03	12.98
LSD _(0.01)	4.438	8.098	9.68	9.733	9.937

Figure in column, having same letter(s) do not differ significantly at 1% level of significance.

Table 3: Effect of fungicides and plant extracts on % leaf infection of purple blotch of onion at 15 days of interval

Treatment	% leaf infection				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
T ₁ = Dithane M-45	9.260 cd	13.80 de	20.16 de	22.80 fg	30.63 de
T ₂ = Rovral	3.460 e	7.417 e	13.23 e	18.07 g	25.15 e
T ₃ = Bavistin	16.81 b	21.72 bed	28.76 bcd	34.66 cde	41.49 bc
T ₄ = Cupravit	18.23 b	24.60 bc	31.43 bc	37.82 bc	45.52 b
T ₅ = Proud	17.70 b	26.47 b	33.90 abc	39.04 bc	46.64 b
T ₆ = Tilt	14.91 b	16.35 d	21.19 de	27.74 def	35.54 cd
T ₇ = Champion	13.82 bc	18.11 cd	24.70 cd	31.12 c-f	40.52 bc
T ₈ = Ridomil	7.320 de	15.00 de	20.46 de	26.54 efg	35.86 cd
T ₉ = Neem extract	17.49 b	25.52 bc	31.38 bc	36.17 bcd	46.62 b
T ₁₀ = Alamanda extract	19.17 b	29.41 ab	35.29 ab	44.76 ab	56.07 a
T ₁₁ = Control	25.57 a	34.75 a	41.56 a	49.77 a	63.44 a
CV (%)	17.48	107.73	19.65	14.44	10.90
LSD _(0.01)	5.221	7.485	9.19	8.237	7.882

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Table 4: Effect of fungicides and plant extracts on % leaf Area Diseased (%LAD) of onion at 15 days of interval

Treatment	% leaf Area Diseased (%LAD)				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
T ₁ = Dithane M-45	0.1833 d	1.156 f	2.987 de	5.867 e	10.31 g
T ₂ = Rovral	0.1067 d	0.440 g	2.283 e	2.853 f	10.06 g
T ₃ = Bavistin	0.6287 cd	2.680 c	5.540 c	10.64 c	16.51 d
T ₄ =Cupravat	1.099 bc	2.437 cd	5.127 c	9.987 cd	15.73 de
T ₅ =Proud	0.5967 cd	2.090 cde	5.043 c	10.55 cd	15.18 def
T ₆ = Tilt	0.1400 d	1.893 de	4.350 cd	9.123 cd	13.91 def
T ₇ = Champion	0.4733 cd	1.683 ef	4.140 cd	9.190 cd	12.96 efg
T ₈ = Ridomil	0.1690 d	0.9833 fg	2.813 de	7.367 de	12.67 fg
T ₉ = Neem extract	0.9730 bc	3.493 b	7.690 b	15.67 b	23.13 c
T ₁₀ =Alamanda extract	1.347 ab	4.710 a	10.71 a	17.09 b	26.69 b
T ₁₁ = Control	1.898 a	4.870 a	11.64 a	22.93 a	31.94 a
CV (%)	19.98	14.44	13.74	14.41	9.21
LSD _(0.01)	0.590	0.673	1.52	2.893	2.696

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Table 5: Effect of fungicides and plant extracts on the severity of purple blotch disease of onion

Treatment	Percent Disease Index (PDI) (%)				
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT
T ₁ = Dithane M-45	0.2433 c	1.533 f	3.983 de	7.813 e	13.75 g
T ₂ = Rovral	0.14 c	0.5867 g	3.007 e	3.807 f	8.450 h
T ₃ = Bavistin	0.8367 bc	3.580 c	7.390 c	14.19 c	22.01 d
T ₄ =Cupravat	1.467 b	3.250 cd	6.833 c	13.32 cd	20.98 de
T ₅ =Proud	0.8033 bc	2.787 cde	7.170 c	14.07 cd	20.24 def
T ₆ = Tilt	0.6300 bc	2.523 de	5.80 cd	12.17 cd	18.55 def
T ₇ = Champion	0.6333 bc	2.243 ef	5.523 cd	12.25 cd	17.27 efg
T ₈ = Ridomil	0.2300 c	1.313 fg	3.753 de	9.827 de	16.89 fg
T ₉ = Neem extract	1.300 b	4.66 b	10.26 be	20.89 b	30.85 c
T ₁₀ =Alamanda extract	2.537 a	6.283 a	14.29 a	22.79 b	35.58 b
T ₁₁ = Control	2.617 a	6.493 a	15.53 a	30.58 a	42.59 a
CV (%)	19.57	14.42	13.87	14.41	9.39
LSD _(0.05)	0.878	0.896	2.05	3.86	3.59

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Percent Disease Index (PDI): There were significant differences among the fungicides and plant extracts on Percent Disease Index (PDI) of purple blotch of onion (Table 5). On the basis of the effectiveness of the fungicides and plant extracts in reducing PDI of purple blotch Rovral showed the highest performance followed by Ridomil, Dithane M-45, Tilt, Cupravat, Proud, Bavistin, Neem extract and Alamanda extract. The results showed that at 15 DAT Lowest PDI (0.14%) was found in treatment T₂, where Rovral was sprayed, which was statistically same as Dithane M-45 and Ridomil. Further, Tilt was identical with Champion, Proud and Bavistin. The highest Disease Index was observed in control treatment, where only plain water was sprayed, which was identical with the treatment Alamanda extract. The experiment also showed that with increasing the age of onion the disease index was increased. But in every case,

control treatment showed the highest disease severity, which was not statistically dissimilar with Alamanda extract except 60 DAT and 75 DAT. Between two plant extract, Neem extract showed better performance as compare to Alamanda extract for reducing disease severity. Among all the treatments, Rovral was best for reducing Percent Disease Index (PDI).

CONCLUSIONS

On the basis of the above findings of the present investigation After Rovral, Ridomil and Dithane M-45 were most effective to minimize the disease severity as well as increase of yield. Between two plant extracts Neem extract performed better than Alamanda extract. Fungicide Rovral was highly effective to control purple blotch disease of onion. Neem extract was potential plant extract

than Alamanda extract against *Alternaria porri*. Further research works at different regions of the country are needed to be carried out for the confirmation of the present findings.

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