Plant Archives Vol. 25, No. 1, 2025 pp. 2741-2746 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.1.396

FUNGICIDE STRATEGIES FOR COMBATING ONION BLIGHTS IN JAMMU : A FIELD STUDY

Rupali Kaushik[1]*, Rupinder Kaur[1], Prerana Badoni[2], Manish Chauhan[3] and Ashok Kumar Singh[4]

[1]Department of Agriculture, Tula's Institute, Dehradun (U.K.)-248001, India
[2]Department of Microbiology, CIMSR, Dehradun (U.K.)-248001, India
[3]School of Agriculture, Abhilashi University, Mandi (H.P.)-175028, India
[4]Division of Plant Pathology, SKUAST- Jammu, (J&K)-180009, India
*Corresponding author email: kaushik.rup96@gmail.com
(Date of Receiving-12-01-2025; Date of Acceptance-22-03-2025)

ABSTRACT

Indian politics have been greatly impacted by onions, whose prices have the power to affect public opinion and even decide election results. India ranks as the second-largest cultivator of onions globally and exports a substantial amount to countries such as Bangladesh, Malaysia, and the United Arab Emirates. The research was conducted at Sher-e-Kashmir University, Jammu, during the 2020 growing season to evaluate the impact of chemicals and botanicals on onion fungal blights. In recent years, onion cultivation has faced various challenges, including disease outbreaks caused by both biotic and abiotic factors. Among the biotic factors, *Alternaria porri* and *Stemphylium vesicarium* are the most severe diseases, significantly contributing to the decline in onion productivity. Integrated disease management for the crop was explored using chemical treatments (Mancozeb at 0.25%, Hexaconazole at 0.1%, Carbendazim at 0.1%, Propineb at 0.2% and 0.3%, Propiconazole at 0.1%, and Thiophanate-methyl at 0.1%) along with botanicals such as *Azadirachta indica*, *Datura stramonium*, and *Cannabis sativa*. Hexaconazole at 0.1% was the most effective in managing both onion diseases, performing on par with Propiconazole at 0.1%. Among the botanicals, *Azadirachta indica* and *Cannabis sativa* were found to be the most effective and statistically comparable, followed by *Datura stramonium*.

Key words: *Alternaria porri*, chemicals, botanicals, *Stemphylium vesicarium*, onion, cultivators.

Introduction

From Ancient Soil to Sacred Sustenance: *Allium cepa L.*, a vital bulb crop of the *Allium* genus within the *Alliaceae* family, has been an integral part of human history and culture since ancient times. Classified as *Tamsik Bhojan*, onions have sparked debates dating back to the Vedic era. Even today, they wield significant socio-political influence, with fluctuations in their availability and pricing capableof shaping governmental stability in India. Believed to have originated in Central Asia, onions have been cultivated and consumed for centuries. In India, they are celebrated as the "Queen of the Kitchen," renowned for their distinctive flavor, pungency, and unparalleled versatility. Beyond their culinary significance, onions also play a crucial role as eco-friendly stored grain protectants, a testament to their multifaceted utility (Jaggi, 2005).

Onions contain bioactive compounds such as quercetin, which are associated with potential anti-inflammatory, anti-cholesterol, anti-cancer, and antioxidant properties (Slimestad *et al*., 2007). They are available in various forms, including fresh, frozen, canned, pickled, and dehydrated, making them a versatile ingredient in a wide range of culinary applications. India stands as the largest producer of onions, with a productivity of 97.58 million tonnes per hectare and an annual production of 2.24 million tonnes (FAO, 2017). In the Jammu division, onion production averages 35,810.85 metric tonnes from a cultivated area of 1,783 hectares (Anonymous, 2016). However, a major challenge to successful onion cultivation

is the prevalence of diseases. Onions are highly vulnerable to various foliar, bulb, and root pathogens, which significantly diminish both yield and the crop's nutritional value (Khar *et al*., 2022). Onion productivity is affected by a total of 66 diseases, including 10 bacterial, 38 fungal, 6 nematode, 3 viral, 1 phytoplasmal, 1 phanerogamic plant parasite, and 7 other diseases and disorders. Among these, fungal diseases are particularly damaging, with purple blotch being one of the most destructive. This disease is prevalent in nearly all onion-growing regions worldwide and can lead to substantial yield losses, ranging from 2.5% to 87.8% (Srivastava *et al*., 1994). The term "Purple blotch" was first introduced by Nolla in 1927, who identified the causal organism as *Alternaria alli*, later reclassified as *Alternaria porri*. Another significant disease affecting onion crops is Stemphylium blight, caused by *Stemphylium vesicarium*. This disease is highly problematic and has been reported to cause yield losses of up to 90% (Miller *et al*., 1978). The incidence of these diseases is less prevalent during the *Rabi* season compared to the *Kharif* season. Under favorable environmental conditions, such as high relative humidity (80–90%) and an optimal temperature of 24 ± 2°C, yield losses can range from 30% to 100% (Nivithaa Shree *et al*., 2020). Observations by (Awad *et al*. 1978) further highlight the complex nature of these diseases, with losses escalating from 30% to 100% under conducive conditions.

Material and Methods

Field experiments were conducted at the research farm of the Division of Plant Pathology, SKUAST-J, Chatha, Jammu, situated at 32.69° N latitude, 74.65° E longitude, and an altitude of 336 meters above mean sea level. The percent disease intensity (PDI) was calculated using the formula provided by Wheeler (1969):

$$PDI = \frac{TNR}{TIL \times MDR} \times 100$$

Where,

TNR = Total sum of numerical rating
TIL = Total number of infected leaves observed
MDR = Maximum disease rating

The influence of environmental factors, such as air temperature, relative humidity, and rainfall, on disease development was assessed at the university farm in Chatha. For this purpose, three plants were randomly selected from each replicated plot, and observations were recorded weekly. Data on temperature, relative humidity, and rainfall were obtained from the Agro-meteorological Unit of the Agronomy Division, FOA, SKUAST-Jammu.

The efficacy of various fungicides and botanicals against onion blights was evaluated under field conditions using the onion variety *Nasik Dark Red*. The experiment was conducted in a Randomized Block Design (RBD) with 11 treatments and 3 replications, including an untreated control. The treatments applied were as follows:

Results

The data collected from the field trial conducted under the confounded Randomized Block Design (RBD) was analyzed statistically. The results indicated that the main effects of fungicides and botanicals were statistically significant during the testing year.

The mean disease intensity of fungal blights in onions was recorded at the Research Farm, Chatha, from the 2nd to the 14th standard week. This data was collected alongside weather parameters, including maximum and minimum temperatures, maximum and minimum relative

Treatment	Common Name	Chemical Name	Trade name	Dose (%)
T_1	Propiconazole	1-(2,4-dichlorophenyl) 4-propyl-1-3-dioxalan-2-methyl) H-1, 4-triazole)	Tilt 25EC	0.1
T_2	Hexaconazole	(RS)-2-(2,4-dichlorophenyl)-1 H-1,2,4-triazol-1-yl) hexan-2-0l)	Contaf 5EC	0.1
T_3	Mancozeb	Manganese zinc ethylene bisdithiocarbomate	Dithane M-45	0.1
T_4	Propineb	polymeric zinc 1,2-propylenebis (dithiocarbamate)	Antracol 75WP	0.2
T_5	Propineb	polymeric zinc 1,2-propylenebis (dithiocarbamate)	Antracol 75WP	0.3
T_6	Carbendazim	Methyl-2-Benzimidazole Carbamate	Bavistin 50WP	0.1
T_7	Thiophenate methyl	Dimethyl [(1,2-phenylene) bis- (iminocarbonothioyl)] bis [carbamate]	Topsin-M 70WP	0.1
	Plant Name	**Botanical Name**	**Plant Part Used**	
T_8	Neem	*Azadirachta indica*	Leaf extract	20
T_9	Datura	*Datura stramonium*	Leaf extract	20
T_{10}	Bhang	*Cannabis sativa*	Leaf extract	20
T_{11}	Control	-	-	-

Table 1: Impact of Meteorological Parameters on the Development of Fungal Blights in Onion.

MSW	DOO	PDI%				Temperature (°C)			Relative Humidity (%)			RF
		PB	PP	SB	PP	Mx	MN	M.	MX	MN	M.	(mm)
2	08.01.2020	0	0	1.1	0	15.6	6.84	11.2	92.71	66.29	79.5	24
3	15.01.2020	0	0	1.1	0	15.8	5.76	10.76	92.71	66.57	79.6	39.4
4	22.01.2020	5.32	5.3	1.8	0	17.7	7.54	12.64	90.43	58	74.2	0
5	29.01.2020	9.1	3.8	4.07	2.3	17.6	6.37	11.99	90.4	58.86	74.6	18.2
6	05.02.2020	15.4	6.3	9.96	5.9	17	4.5	10.77	95.86	60.57	78.2	2.8
7	12.02.2020	21.3	5.9	15.8	5.8	19.5	5.36	12.44	91.57	51.71	71.6	1.3
8	19.02.2020	25.6	4.2	28	12	24.4	8.54	16.47	93	65.9	79.5	20.6
9	26.02.2020	28	2.5	24	-4	23.6	10.24	16.93	92.3	58.6	75.5	3.7
10	04.03.2020	32.4	4.3	27	-4	24.4	11.93	18.19	93	52	72.5	3.55
11	11.03.2020	29.7	-2.7	13.2	-6	21.1	11.16	16.14	90.86	49	69.9	2.98
12	18.03.2020	37	7.4	4.04	-9	25	11.11	18.06	93	56.6	74.8	12.5
13	25.03.2020	38.5	1.5	3.21	0.8	26	13.91	19.96	92.3	51.2	71.8	7.6
14	01.04.2020	38.1	-0.4	3.21	0	25.3	14	19.66	91.1	48.23	69.7	7.59

DOO: Date of Observations PB: Purple Blotch PP: Periodical progression SB: Stemphylium blight MX: Maximum MN: Minimum M.: Mean RF: Rainfall

humidity, and rainfall, as presented in Table 1.

The data presented in the table indicate that the disease intensity of purple blotch was 0.00% during the 2nd and 3rd standard weeks. However, it gradually increased over time, reaching 38.12% by the 14th standard week. In contrast, the disease intensity of Stemphylium blight increased from 1.10% to 3.21% during the same period.

The highest increase in disease intensity for purple blotch was recorded during the 12th standard week, whereas the maximum increase in disease intensity for Stemphylium blight was observed during the 8th standard week.

All the fungicides and botanicals were found to significantly reduce the disease infection as compared to the untreated control.

Results revealed from table 2 at 60 days after transplanting that minimum disease intensity was recorded from treatment hexaconazole (5.24%) followed by propiconazole (6.10%), both were statistically at par. While, maximum disease intensity among all fungicides was recorded in thiophenate methyl (12.08%). In case of Stemphylium blight minimum disease intensity was observed in hexaconazole (3.70%) and propiconazole (4.80%). These treatments were statistically at par to each other while, maximum disease intensity was recorded in thiophenate methyl (10.58%). Among botanicals, neem extract (18.67%) was most effective followed by bhang extract (20.84%) and datura (21.49%).

At 75 days after transplanting, the disease was

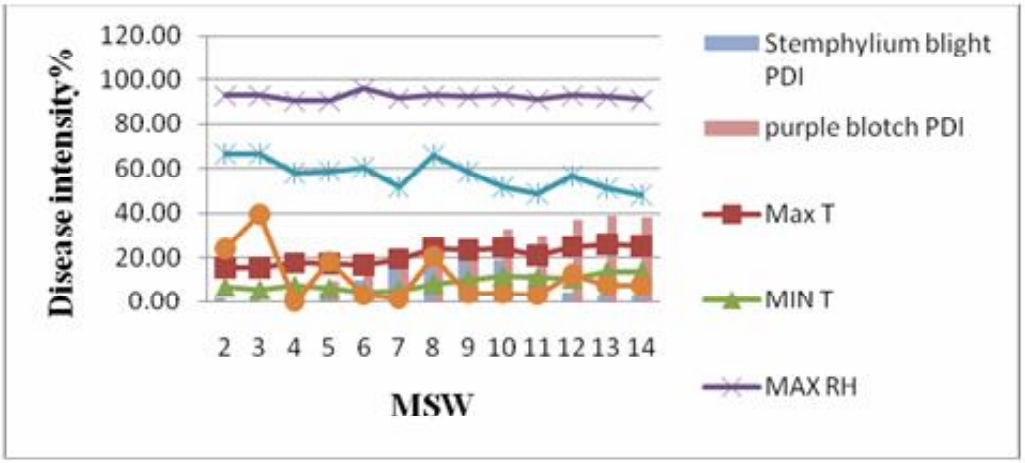

Fig. 1: Impact of Weather Factors on Disease Development

Table 2: Management of fungal blights of onion through fungicides and plant extracts.

Treatment	Dose	Disease intensity (%)						Disease reduction over control	
		60DAT		75DAT		90DAT			
		PB	SB	PB	SB	PB	SB	PB	SB
Mancozeb	0.25	11.14 (19.50)	9.69 (18.14)	15.39 (23.10)	13.45 (21.51)	18.30 (25.32)	11.73 (20.03)	71.88	63.25
Hexaconazole	0.1	5.24 (13.23)	3.70 (11.09)	7.78 (16.19)	5.74 (13.87)	10.81 (19.19)	4.30 (11.97)	83.39	86.51
Carbendazim	0.1	7.06 (15.41)	5.45 (13.50)	12.00 (20.27)	10.84 (19.22)	15.78 (23.41)	8.57 (17.03)	75.74	73.13
Propineb	0.2	10.06 (18.50)	8.36 (16.80)	14.99 (22.78)	12.35 (20.57)	20.87 (27.18)	10.78 (19.17)	67.93	66.21
Propineb	0.3	7.96 (16.38)	6.34 (14.58)	9.03 (17.49)	7.59 (15.99)	16.80 (24.20)	5.79 (13.92)	74.17	81.86
Propiconazole	0.1	6.10 (14.30)	4.80 (12.65)	8.70 (17.15)	6.45 (14.71)	11.81 (20.10)	4.93 (12.82)	81.85	84.56
Thiophenate methyl	0.1	12.08 (20.34)	10.58 (18.99)	16.06 (23.63)	14.52 (22.40)	22.81 (28.53)	13.66 (21.69)	64.95	57.2
Neem extract	20	20.03 (26.59)	18.67 (25.60)	25.05 (30.03)	23.88 (29.26)	32.64 (34.84)	21.82 (27.85)	49.84	31.61
Datura extract	20	23.14 (28.75)	21.49 (27.62)	30.34 (33.43)	28.17 (32.06)	35.06 (36.31)	25.16 (30.10)	46.12	21.16
Bhang extract	20	21.84 (27.86)	20.84 (27.16)	28.82 (32.47)	26.79 (31.17)	33.40 (35.30)	23.49 (28.99)	48.67	26.4
Control	-	30.30 (33.40)	28.23 (32.09)	45.45 (42.39)	35.80 (36.75)	65.06 (53.77)	31.91 (34.39)	0	0
SE(m)±		**0.453**	**0.673**	**0.129**	**1.379**	**0.626**	**1.212**		
CD (P= 0.05)		**1.344**	**1.998**	**2.326**	**4.098**	**1.861**	**3.601**		

PB: Purple Blotch SB: Stemphylium Blight

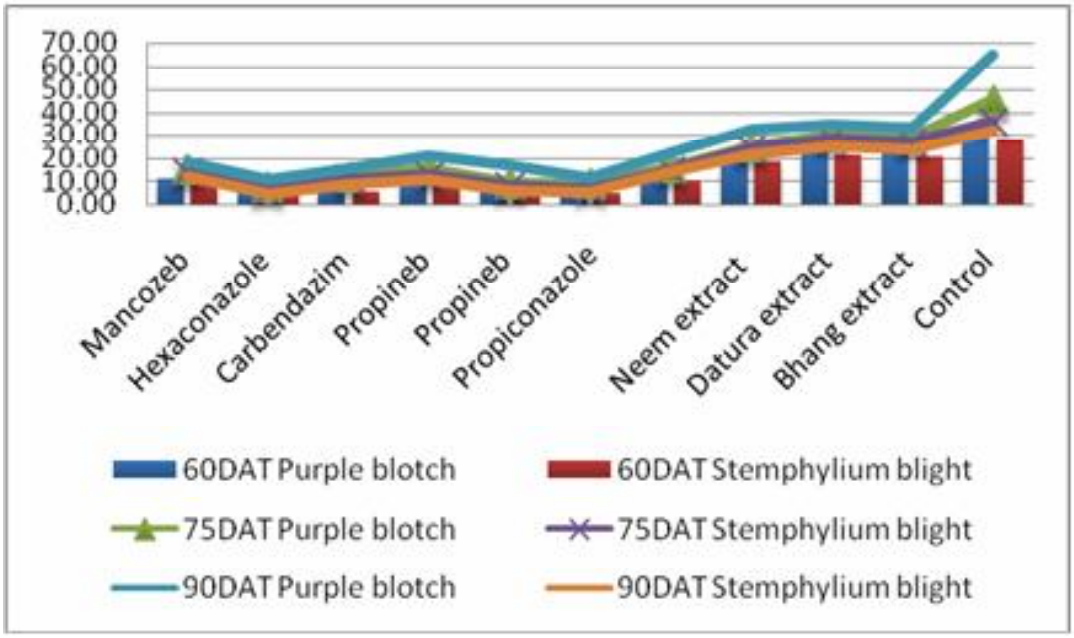

Fig. 2: Performance of fungicides and botanicals for the management of fungal blights of onion

Plate a: Symptoms of purple blotch infection in onions

Plate b: Symptoms of Stemphylium blight infection in onion

effectively controlled by all the treatments. Least disease intensity was observed in hexaconazole (7.78%) which was at par with propiconazole (8.70%). In case of botanicals neem extract (25.05%) was the most effective, followed by bhang extract (28.82%) however, datura (30.34%) was the least effective among all the botanicals. In case of stemphylium blight maximum disease intensity was noticed in 75 days after transplanting in thiophenate methyl (14.52%) and minimum was noticed in hexaconazole (5.74%). Among the botanicals, neem extract (23.88%) was the most effective, followed by bhang extract (26.79%). However, Datura extract (28.17%) was the least effective.

The data revealed at 90 days of transplanting showed that each fungicide significantly minimized the disease intensity in comparison to control. In case of purple blotch, hexaconazole recorded least disease intensity at 90 days after transplanting (10.81%), followed by propiconazole (11.81%). Both the treatments were statistically at par in controlling the disease. In the case of botanicals neem extract (32.64%) and bhang extract (33.40%) were recorded superior and statistically at par, followed by datura extract (35.06%). In case of Stemphylium blight the perusal of data revealed that each fungicide tested were significantly top-notch over control. The minimum disease intensity (4.30%) was recorded in hexaconazole followed by propiconazole (4.93%) and these both chemicals were statistically at par. In the case of botanicals neem extract (21.82%) and bhang extract (23.49%) were recorded superior and statistically at par, followed by datura extract (25.16%).

In both diseases purple blotch and stemphylium blightmaximum disease reduction were recorded in hexaconazole (83.39 and 86.51% respectively) followed by propiconazole (81.85 and 84.56% respectively).

Discussion

Epidemiological studies conducted on the purple blotch and Stemphylium blight of the Nasik Dark Red onion cultivar revealed a significant positive correlation between disease intensity and both maximum and minimum temperatures, as well as maximum relative humidity. This indicates that as temperature and maximum relative humidity increase, the intensity of the diseases also rises. Conversely, a negative correlation was observed between disease intensity and minimum relative humidity and rainfall, meaning that as one variable increases, the other decreases. These findings align with those of Dipankar *et al*. (2022), who identified maximum temperature, maximum relative humidity, and wind velocity as statistically significant factors influencing disease development.

In the present study, purple blotch disease was first detected at the end of January, with an incidence of 5.32%. The disease intensity increased as the crop grew, reaching its peak frequency of 38.12% by the end of the cropping season, in the first week of April. These findings are consistent with those reported by (Chawda and Rajasab 1994), who observed that purple blotch symptoms appeared within five days following the first rainfall after transplantation.

While, stemphylium blight detected on onion leaves before the occurrence of purple blotch (1st week of January) and after that it was decreasing frequently. In this case maximum disease intensity was showed in mid of February (28.02%) after that it was decreased. The conformity with the findings were given by (Jakhar*et al*. 1996) who concluded that the disease caused by *Stemphylium vesicarium* first increased gradually, and then decreased late in the season.

Data on disease intensity demonstrated that all the fungicides and botanicals tested significantly reduced disease intensity compared to the untreated control. Among the fungicides, hexaconazole was the most effective in controlling the purple blotch disease, followed by propiconazole. In the case of botanicals, neem proved to be the most effective in managing the disease. Our

findings are consistent with those of (Nisha *et al*. 2020), who identified hexaconazole (0.1%) as the most effective treatment for purple blotch of onion. Similarly, (Brahmane and Akter 2015) reported that neem seed kernel extract provided the highest inhibition of purple blotch disease. (Chethana *et al*. 2011) also found that mancozeb at a 0.3% concentration was the most effective in inhibiting the growth of *Alternaria porri* (Uddin *et al*., 2006; Rashid *et al*., 2015).

All treatments in the present study were found to be significantly effective in reducing the intensity of Stemphylium blight in onions. Among the plant extracts tested, neem leaf extract was the most effective in managing the disease, followed by bhang leaf extract. Regarding fungicides, hexaconazole was particularly effective in reducing disease intensity, with propiconazole following closely. These findings are in line with those of (Mohan *et al*. 2004), who reported that hexaconazole performed better and could be a more economically viable option for controlling Stemphylium blight in onions.

Acknowledgement

The authors sincerely acknowledge the Dean of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu for providing the necessary facilities and guidance to conduct the various experiments.

References

Anonymous (2016). *Package of practices for vegetable crops*. Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu. pp. 127.

Anonymous (2017). National Horticulture Board, at www.nhb.gov.in (accessed on March 15, 2020)

Awad, M.A., EI-Shenawy, Z., Omran, A.F. and Shatla, M.N. (1978). Cultural practices in relation to purple blotch disease of onion. *Scientia Horticulturae*., **9**: 237-243.

Brahmane, P.R., Dandnaik, B.P. and Abhang, P.B. (2015). Efficacy of bioagents and plant extract against *Alternaria porri* causing purple blotch of onion. *International Journal of Plant Protection*., **8**: 265-269.

Chawda, H.T. and Rajasab, A.H. (1994). Aerobiology of *Alternaria porri* and its relation to purple blotch disease in onion. *Indian Journal of Mycology and Plant Pathology*., **24**: 41-45.

Chethana, B.S., Girija, G. and Manjunatha, B. (2011). Screening of genotypes and effect of fungicides against purple blotch of onion. *International Journal of Agricultural Technology*., **7**: 1369-1374.

Dipankar, M., Rini, P and Ipsita, K. (2022). Effect of weather parameters on the progression and development of purple blotch of onion. *Journal of Agrometerology*., **24(3)**: 325-327.

Jaggi, R.C. (2005). Sulphur levels and sources affecting yield and yield attributes in onion (*Allium cepa* L). *Indian Journal of Agriculture Science.*, **75**: 154-156

Jakhar, S.S., Duhan, J.C. and Suhag, L.S. (1996). Studies on the epidemiology and survival of *Stemphylium vesicarium* in debris and seeds of onion. *Seed Research*, **24**: 135-140.

Khar, A., Galván, G.A., & Singh, H. (2022). Allium breeding against biotic stresses. In C. Kole (Ed.), *Genomic designing for biotic stress resistant vegetable crops* (Chapter 6). Springer.

Miller, M.E., Taber, R.A. and Amador, J.M. (1978). Stemphylium blight of onion in South Texas.USA. *The Plant Disease Reporter.*, **62**: 851-853.

Mohan, K., Thind, T.S., Prem Raj and Arora, J.K. (2004). Promising activity of triazoles and other fungicides against fruit rot of chilli and Stemphylium blight of onion. *Plant Disease Research.*, **19**: 200-203.

Nisha, P., Pragya, A and Puja, T. (2020). Management of Purple Blotch complex of onion (*Allium cepa*) under field condition in Rukum-West, Nepal. *Malaysian journal of sustainable agriculture*., **4(2)**: 71-74.

Nolla, J. A.B. (1927). A new Alternaria disease of onions (*Allium cepa*). *Phytopathology*., **17**: 115-132.

Rashid, H. and Haque, M. (2015). Effect of different fungicides in combination with poultry manure and neem seed extract on purple blotch disease of onion caused by *Alternaria porri*. *Middle-East Journal of Scientific Research.*, **23**: 1604-1610.

Slimestad, R., Fossen, T. and Vagen, I.M. (2007). Onions: A source of unique dietary flavonoides. *Journal of Agriculture and Food Chemistry.*, **55**: 10067-10080.

Srivastava, P.K., Bharadwaj, B.S. and Gupta, P.P. (1994). Status of field diseases and selected pest of onion in India. Newsletter, National Horticulture Research and Development Foundation., **14**: 11-14.

Uddin, M.N., Islam, M.R., Akhtar, N. and Faruq, A.N. (2006). Evaluation of fungicides against purple blotch complex of onion (*Alternaria porri* and *Stemphylium botryosum*) for seed production. *Journal of Agricultural Education and Technology.*, **9**: 83-86.

Wheeler, B. E. J. (1969). *An Introduction to Plant Disease*. John Wiley, London, pp. 301.

Nivithaa Shree, R. T., Kalpana, K., Ebenezar, E. G., Theradimani, M., Thiruvudainambi, S., &Vellaikumar, S. (2020). Survey for Purple Blotch Disease of Onion (*Allium cepa* L.) caused by *Alternaria porri* (Ellis) Cif. in different regions of Tamil Nadu. *International Journal of Current Microbiology and Applied Sciences.*, ***9*(12)**: 323-329.