



Survey, Occurrence of Major Onion Diseases and Management of Twister Disease of Onion (*Allium cepa* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Purple blotch of onion caused by the fungus *Alternaria porri* is a serious disease in kharif season and more yield losses in onion growing areas of Maharashtra. A survey was conducted to assess disease intensity of major diseases in onion growing area in Nashik district during kharif 2020 and 2021. During the survey, small whitish, leaf curling, twisting, chlorosis of leaves, elongation of neck and cylindrical bulb such symptoms of twister disease were observed more severe than purple blotch on onion in kharif 2020. The per cent disease severity ranged from 17.28 to 45.83 per cent and 8.00 to 23.00 per cent in purple blotch of onion and 20.17 to 54.59 per cent and 12.00 to 35.00 per cent twister disease of onion during kharif 2020 and 2021, respectively. The diseased samples were utilized for isolation of pathogen. After isolation and morphological study, it is indicated that twister disease of onion was complex of pathogen caused by *Colletotrichum gloeosporioides*, *Fusarium* sp. and nematode. Due to climate change, from the survey concluded that twister disease was found more serious and threatening disease than purple blotch of onion during kharif 2020 and 2021. Considering the yield losses caused by twister disease of onion, the investigation was planned for management of twister disease during kharif 21. The combine application of *Trichoderma* drenching @ 10 g/l along with two alternate sprays of each Tebuconazole 25.9 EC @ 1 ml/l or Azoxystrobin 23 SC @ 1 ml/l recorded lowest PDI of twister disease (14.33%) of onion than the control treatment (49.11%) and which was found effective maximum per cent disease over control (70.82%) for management of twister disease of onion.

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1. INTRODUCTION

Onion (*Allium cepa* L.) is most important commercial vegetable crops grown in Nashik district of Maharashtra. Onion is cultivated round the year throughout the country. The vegetative growth of the crop is supported by lower temperature (10-15°C) and short photoperiod whereas bulb development requires higher temperature (20-30°C) with longer photoperiod. Maharashtra and Madhya Pradesh are the major onion growing states in India which contributes 40.94% and 16.36% of total area of India respectively. In India, total area under onion is of 1285 thousand ha with production 23262.3 thousand tonnes and with productivity of 18.1 tonnes per ha whereas in Maharashtra onion crop covered area and production which having an area of 507.96 thousand ha and production of 8854.09 thousand tonnes having productivity 17.73 tonnes per hectare during 2017-18 and Maharashtra contributes for 38.06 per cent of the total area in the country (2017- 18). The purple blotch and twister disease of onion was reported more in kharif season than rabi season. The prevalence of pathogens depends upon season, region and variety. Among these diseases, purple blotch (*Alternaria porri*) is the most devastating disease [1] “The onion crop is mostly attacked by fungal pathogen. The most important factors responsible are diseases like purple blotch, *stemphyllium* blight, *Colletotrichum* and basal rot etc. Among the foliar diseases purple blotch is one of the most destructive disease commonly prevailing in major onion growing area of the world which causes heavy losses in onion under field conditions” [2]. “The yield losses ranging from 30 to 100 per cent may reach epidemics states during favourable climatic conditions with high relative humidity (80 to 90 %) and optimum temperature (24±2°C)” [3]. However, there is necessity for systemic survey on occurrence of major diseases and management of twister disease of onion in major onion growing area in Nashik district of Maharashtra.

2. MATERIALS AND METHODS

2.1 Survey of Onion

The survey for purple blotch and twister of onion was undertaken during kharif 2020 and kharif 2021 to assess the severity of purple

blotch in eight tahasils of major onion growing area in Nashik district of Maharashtra. In the field, onion plants were randomly selected to score disease severity. Roving survey was carried out with random selection of onion plants in eight tahasil of Nashik district viz., Niphad, Sinnar, Yeola, Chandwad, Malegaon, Deola, Satana, Kalwan. The diseased samples were collected for isolation and identification of purple blotch and twister disease of onion. Observations were recorded with respect to disease severity of purple blotch and twister disease. The infected plants were collected for isolation of the pathogen. Scoring of the disease was done in the field by using 0 to 5 scale for purple blotch given by Mayee and Datar [4] and 0 to 5 twister disease rating given by Bhangale and Joi, [5]. The per cent disease index (PDI) was calculated by using formula given by Wheeler [6].

$$PDI = \frac{\text{Sum of all individual disease ratings}}{\text{No. of leaves observed}} \times \frac{100}{\text{Maximum disease grade}}$$

2.2 Isolation and Identification

Isolation of the pathogen was made from onion infected leaves collected from different tahasils of Nashik which showing typical symptoms of purple blotch and curling of leaves and elongated neck and roots of twister disease of onion. The infected sample was washed with tap water and cut into small pieces before being surface sterilised with 0.1% sodium hypochlorite solution, thrice rinsed with sterilised distilled water, transferred aseptically into petri plates containing PDA medium, and small pieces of infected leaves kept aseptically on media inside petri plates. These petri plates were incubated in a BOD incubator at 28±2°C. After incubation, colony growth was studied under a microscope for detection of pathogens.

2.3 Field Experiment for Management of Twister Disease on Onion

A field experiment was conducted to study the effect of fungicides for management of twister disease of onion by using Randomized Block Design with seven treatments and three

replications during kharif, 2021. The treatment comprised with seven treatment combinations viz., T₁: Carbendazim drenching @ 2.0g/l, T₂: *Trichoderma* drenching @ 10.0 g/l, T₃: T₁+ 4 sprays of Carbendazim 12% + Mancozeb 63% 75 WP, T₄: T₂+ 4 sprays of Carbendazim 12% + Mancozeb 63% 75 WP, T₅: T₁+ Alternate 2 sprays of Tebuconazole 25.9 EC / Azoxystrobin 23 SC @ 1 ml/l, T₆: T₂ + Alternate 2 sprays of Tebuconazole 25.9 EC / Azoxystrobin 23 SC @ 1 ml/l and T₇: Control. The variety B-780 of onion was transplanted at a spacing of 15 cm row to row and 10 cm plant to plant. The recommended dose of fertilizer was 100 kg N: 50 kg P₂O₅: 50 kg K₂O per ha was applied during the season as per recommendations. The four sprays were given at an interval of 15 days and observations were recorded with respect to disease severity of twister disease after 10 days of each spray of the disease was done in the field by using 0 to 5 scale given by Bhangale and Joi [5].

3. RESULTS AND DISCUSSION

3.1 Survey of Onion

The survey was conducted for recording the severity of purple blotch and twister diseases in major onion growing tahasils of Nashik district in Maharashtra during kharif 2020 and 2021 season. The survey for disease severity, occurrence and spread was carried out during bulb development stage and data pertaining to survey work is presented in Table 1.

Overall, the disease survey was carried out in the month of September to October during kharif 20 and kharif 21 season. Twister disease reported maximum severity than purple blotch of onion during both seasons. The maximum purple blotch disease per cent disease index (45.83%, 23.00%) was recorded in Deola and Malegaon tahasils and lowest per cent disease index of purple blotch (17.28%, 8.00%) was recorded in Sinnar, Sinnar tahasil respectively, during kharif 20 and kharif 21. The Twister disease of onion recorded maximum per cent disease index (54.59%, 35.00%) was recorded in Niphad and Malegaon tahasils and lowest twister disease per cent disease index (20.17%, 12.00%) was recorded in Sinnar, Sinnar tahasil respectively, during kharif 20 and kharif 21. The less disease intensity of twister disease was recorded in kharif 21 than the kharif 20 due to care in scientific adoptions in nursery management, preventive and curative plant

protection measures at proper time and awareness among farmers with the initiation of season. The purple blotch severity was observed maximum due to mono cropping, existence of inoculum of previous crop in particular location and cultivation of same or local varieties in larger scale which helped in development of disease and perpetuation of pathogen. Similar results are also observed by Mandal et al. [7] in their research on development of purple blotch onion disease indicated that purple blotch incidence was 53.33% cumulative increase's disease with the weather parameters i.e. maximum temperature range of 29 to 40°C and minimum temperature range of 13 to 24°C and average range of 60-80% evening relative humidity prevailed during disease development and spread favored disease. Pradnyarani et al. [8] surveyed "on onion disease and observed that the highest per cent disease index of purple blotch was recorded in the village of Sagreshkoppa (46.00%) and least percent disease index was recorded at Hulkund village (3.00%) in Belgaon district of Northern Karnataka". Priya et al. [9] reported that highest per cent disease index of purple blotch was noticed in Ilkal village of Balkot district and least was noticed in Kerur village of Balkot district. The disease intensity was more in Baglakot and less in Gadag districts in northern Karnataka. Sonawane et al. [10] conducted survey on purple blotch of onion during kharif 19 season and reported that Satana tahasil recorded maximum purple blotch per cent disease index (52.80%) and lowest per cent disease index (27.20%) was recorded in Nandgaon tahasil in onion growing area of Nashik district of Maharashtra.

3.2 Identification of Morphological and Pathogenic *A. porri* and *Colletotrichum*

Purple blotch is present in surveyed plots of Nashik district. The infected leaves and pathogenic *A. porri* showed that purple blotch is present in maximum plots surveyed in tahasils of Nashik district. Purple blotch signs were detected on infected leaves, which began at the tip of the leaves, particularly on older leaves, and progressed to new leaves. Infected leaves have tiny, white, sunken, oval to elliptical blemishes. The lesion's centre was brown to purple. On the afflicted leaves, there are also concentrated light to dark zones. The symptoms resembled those of *Alternaria porri*-caused purple blotch illness. The morphological study of

fungus was carried out on PDA. The whitish colonies turn into purple colour with advancing age of culture. The observations were recorded on 7 days old culture for characters of colony, mycelium, conidia and conidiophores and later their comparison with the characters described in the available literature [11]. The curved, twisted leaves, elongated neck and roots of twister disease (Fig. 1) were isolated same method used for purple blotch of onion. Small whitish or pale-yellow water soaked oval lesion on leaf, curling, twisting, chlorosis of leaves, elongation of neck and cylindrical bulb such symptoms of twister disease produces hyaline fungus, one celled, ovoid to oblong, slightly curve conidia with obtuse ends. *Colletotrichum gloeosporioides* isolated from leaves and neck of infected onion and *Fusarium* sp. isolated from pinkish roots of onion and nematode also observed and identified morphologically and microscopic observations.

3.3 Effect of Fungicidal Sprays for Management of Twister Disease of Onion

The management of onion twister disease by combine application of *Trichoderma* drenching at the time of transplanting @ 10 g/l with 4 foliar sprays of chemical fungicides showed varying

and significant positive response over the control. The per cent disease index recorded 10 days after each spray is presented in Table 2. The treatment T₆: *Trichoderma* drenching @ 10 g/l at transplanting + Alternate 2 sprays of Tebuconazole 25.9 EC / Azoxystrobin 23 SC @ 1 ml/l recorded minimum per cent disease index (7.11%, 9.33%, 11.56%, and 14.33%) after 10 days of each spray respectively which was at par with the combine treatments of T₅, T₄ and T₃. The maximum per cent disease severity was recorded in control treatment at (19.11%, 30.22%, 40.89% and 49.11%) 10 days after each spray, respectively. A similar trend was observed for per cent disease reduction over control. The maximum disease reduction over control 70.82 per cent was observed in T₆ followed by T₅ (68.32%) and T₄ (64.71%). The treatment T₆: *Trichoderma* drenching @ 10 g/l at transplanting + Alternate 2 sprays of Tebuconazole 25.9 EC / Azoxystrobin 23 SC @ 1 ml/l recorded maximum yield 142.00 q/ha than rest of the treatments. Manthesha et al. [12] who also reported that Carbendazim 12%+ Mancozeb 63% 75 WP @ 2.5 g/l application for management of onion twister disease (77%PDC) followed by Tebuconazole 25.9 EC @ 1 ml/l (62.99%PDC) and Azoxystrobin 23 SC @ 1 ml/l (61.47%PDC) which are conformity with the present results.



Fig. 1. Field view symptoms of twister disease of onion



Fig. 2. Twister disease of onion

Chart 1. 0-5 disease scale purple blotch of onion [4]

Grades	Description
0	No symptoms
1	A few spots towards tip covering 10 per cent leaf area
2	Several dark purplish brown patchcovering up to 20 per cent leaf area
3	Several patches with pale outer zone covering up to 40 per cent leaf area
4	Leaf streaks covering up to 75 per centleaf area or breaking of the leaves from centre
5	Complete drying of the leaves or breakingof leaves from centre

Chart 2. Disease rating followed in onion twister [5]

Grades	Twisting (%)	Description
0	No disease	No symptoms
1	Up to 10%	Curling and chlorosis of leaves
2	11 to 20%	Abnormal elongation of leaves and neck
3	21 to 40%	Leaf-sheath showing cluster of acervuli concentric rings along with shallow, sunken necrotic spots and root galling
4	41 to 60%	Elongated neck, slender bulb leaves show dieback symptoms
5	>60%	Severe dieback, rotten bulbs, root system underdeveloped with discoloured roots.

Table 1. Survey of purple blotch and twister disease of kharif onion in Nashik district

Sr No.	Month/Period of survey	Tahasil	Kharif 20		Kharif 21	
			Purple blotch PDI (%)	Twister disease PDI (%)	Purple blotch PDI (%)	Twister disease PDI (%)
1	Sept -Oct	Niphad	18.00-25.00	21.50 -54.59	8.10-15.00	15.00-30.00
2	Aug-Sept	Sinnar	17.28 – 20.99	20.17–38.00	8.00 – 10.00	12.00–18.00
3	Oct	Yeola	20.00 -33.33	23.00-41.00	10.00-15.00	15.00-23.00
4	Sept	Chandwad	18.25 - 25.36	20.25-39.30	13.00-20.00	15.00-25.00
5	Sept	Malegaon	27.78 - 41.98	35.00-51.70	20.00-23.00	25.00-35.00
6	Sept	Deola	28.40 - 45.83	32.60-53.00	10.00-15.00	15.00-20.00
7	Sept-Oct	Satana	20.99 - 35.80	33.10-47.50	15.00-20.00	20.00-25.00
8	Aug	Kalwan	18.00 - 20.00	20.40 -30.00	8.30-15.00	15.00-20.00

Table 2. Effect of fungicides for management of twister disease of onion (kharif-21)

Tr. No.	Treatments	Initial PDI (%)	Per cent Disease Index of Twister disease of onion				Per cent disease over control PDC (%)	Yield (qtl/ha)
			10 days after I spray	10 days after II spray	10 days after III spray	10 days after IV spray		
T ₁	Carbendazim @ 2 g/l drenching	5.33 (13.28)*	14.00 (21.71)*	19.55 (26.23)	24.89 (29.66)	29.33 (32.64)	40.28	117.467
T ₂	<i>Trichoderma</i> @10 g/l drenching	4.00 (11.43)	13.55 (21.58)	19.33 (25.92)	22.67 (28.12)	28.44 (32.18)	42.09	118.633
T ₃	T ₁ + 4 sprays of Carbendazim 12%+ Mancozeb 63% 75WP @ 2.5 g/l	4.44 (11.65)	9.33 (17.43)	12.45 (20.60)	15.56 (23.23)	18.67 (25.50)	61.98	128.833
T ₄	T ₂ + 4 sprays of Carbendazim 12%+ Mancozeb 63% 75WP @ 2.5 g/l	4.45 (11.97)	8.45 (16.82)	12.00 (20.25)	14.67 (22.43)	17.33 (24.52)	64.71	132.100
T ₅	T ₁ + Alternate 2 sprays each of Tebuconazole 25.9 EC/ Azoxystrobin 23 SC@ 1.0 ml/l	4.89 (12.68)	8.00 (16.35)	10.22 (18.53)	12.45 (20.49)	15.56 (22.76)	68.32	136.500
T ₆	T ₂ + Alternate 2 sprays each of Tebuconazole 25.9EC/ Azoxystrobin 23SC@ 1.0 ml/l	5.33 (13.35)	7.11 (15.37)	9.33 (17.60)	11.56 (19.69)	14.33 (21.86)	70.82	142.000
T ₇	Control	5.78 (13.88)	19.11 (25.88)	30.22 (33.28)	40.89 (39.62)	49.11 (44.35)	-	85.567
	SE_±	0.98	1.78	1.68	2.92	3.28	-	7.36
	CD 5%	NS	5.49	5.17	8.98	10.08	-	22.68

* Figures in parenthesis are arc sin transformed values

4. CONCLUSION

Due to climate change, Twister disease of onion was found more serious and threatening disease of onion from last three years. Twister disease of onion is complex and caused by *Colletotrichum gloeosporioides*, *Fusarium* sp. and nematode. For management of twister disease of onion, the combine application of *Trichoderma* drenching @ 10 g/l along with two alternate sprays of each Tebuconazole 25.9 EC @ 1 ml/l or Azoxystrobin 23 SC @ 1 ml/l was found effective for management of twister disease of onion. The technology dissemination needs to Extension workers for advising to farmers use of preventive measures viz., Use raised beds for Nursery, seed treatment of *Trichoderma* and *Paecilomyces* @ 5 g/kg each to onion seed before sowing for management of *Fusarium* sp. and nematodes in Nursery and 1 - 2 spraying of Carbendazim 12%+ Mancozeb 63% 75 WP @ 2.5 g/l in nursery for control of onion twister disease.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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