Original Research Article

Survey, Occurrence and Management of Purple blotch and Twister disease of Onion (*Allium cepa* L.)

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 purple blotch disease severity in onion during *kharif* 2020 and 2021 in Nashik district. During the survey, 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 were observed more severe than symptoms of 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. On the basis of isolation and morphological study, it is indicated that twister disease of onion was complex of pathogen caused by *Colletotrichum gloeosporioides* and *Fusarium* sp. From the survey concluded that Twister disease was found more serious and threatening disease than purple blotch of onion during *kharif* 2020 and 2021. A field experiment was conducted 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 29.5 SC @ 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.

Keywords: Purple blotch, twister disease, *Fusarium, Colletotrichum, Alternaria,* Fungicides, Onion

1. Introduction

Onion (*Allium cepa* L.) is one of the important bulb crop and most important commercial vegetable crops grown in India. Onion is cultivated round the year throughout the country. The vegetative growth of the crop is supported by lower temperature and short photoperiod whereas bulb development requires higher temperature with longer photoperiod. Maharashtra and Madhya Pradesh are the major onion growing states in India which contributes 40.94% and 16.36% per cent of total area of country, respectively whereas Nasik and Ahmednagar are major onion growing districts in Maharashtra. In India, onion is widely grown in an area of 1285 thousand ha with

production 23262.3 thousand tonnes and with productivity of 18.1 tonnes per ha during 2017-18. Maharashtra is the leading state in 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 accounts for 38.06 percent of the total area in the country (2017- 18). The purple blotch and twister disease of onion was more in *kharif* season as compared to *rabi* season. Theprevalence of pathogens depends upon season, region and variety. Among these diseases, purple blotch (*Alternaria porri*) is the most devastating disease (Marmath *et al.,* 2013). Several factors have been identified for the low productivity of the onion crop in India. The crop is attacked by many fungal, bacterial and viruses. 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. (Kumar and Palakshapra, 2008). The yield losses ranging from 30 to 100 per cent may reach epidemics states during favaourable climatic conditions with high relative humidity (80 to 90 %) and optimum temperature (24 ± 2^0C) Yadav *et al.,* 2013). The typical symptoms appear on foliage and on foliage sheath. Small white sunken spots develop on leaves which enlarge, become zonate and under moist conditions, turn purple and are also prominent on inflorescence and stalk. The disease affects the both bulb and seed production (Munoz *et al.,* 1984). However, there is necessity for systemic survey on occurrence and management of severe disease of onion in major onion growing area in Nashik district of Maharashtra.

1. Materials and Methods

1.1. **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 Nasik district of Maharashtra. In the field, onion plants were randomly selected to score disease severity. Random 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 planted 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 (1986) and 0 to 5 twister disease rating given by Bhangale and Joi, (1985). The per cent disease index (PDI) was

calculated by using formula given by Wheeler (1969).

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

0-5 disease scale

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

Disease rating followed in onion twister (Bhangale and Joi, 1985)

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 discolored roots.

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 washed under tap water and cut into small pieces, surface sterilized with 0.1% mercuric chloride solution, thrice rinsed with sterilised distilled water, transferred aseptically into petri plates containing PDA medium and then small pieces of infected leaves will be kept aseptically on media insidepetri plates. These petri plates were incubated in BOD incubator at 28+2^{0}C. After inoculation, colony growth was observed under microscope for the further identification of pathogen

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.,* $T_{1:}$ Carbendazim drenching @ 2.0g/l, $T_{2:}$ *Trichoderma* drenching @ 10.0 g/l, $T_{3:}$ T_{1+} 4 sprays of Carbendazim 12% + Mancozeb 63% 75 WP, $T_{4:}$ T_{2+} 4 sprays of Carbendazim 12% + Mancozeb 63% 75 WP, $T_{5:}$ T_{1+} Alternate 2 sprays of Tebuconazole 29.5 SC / Azoxystrobin 23 SC @ 1 ml/l , $T_{6:}$ T_{1+} Alternate 2 sprays of Tebuconazole 29.5 SC / Azoxystrobin 23 SC @ 1 ml/l and T_7: 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 P_2O_5: 50 kg K_2O 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 (1985).

2. Results and discussion:

2.1. **Survey of Onion:** The survey was carried out for recording the severity of purple blotch and twister disease 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 at vegetative and bulb development stage and data pertaining to survey work is presented in Table 1.

Overall, the disease survey was carried outd in the month of September to October during *khaif* 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. Maximum severity of purple blotch might be 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.,* (2022) 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^{0}C and minimum temperature range of 13 to 24^{0}C and average range of 60-80% evening relative humidity prevailed during disease development and spread favored disease. Pradnyarani *et al.,* (2014) 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 (2016) 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.,* 2020 conducted survey on purple blotch of onion during *khaif* 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 Nangaon tahasil in onion growing area of Nashik district of Maharashtra.

2.2. **Identification of morphological and pathogenic *A. porri* and *Colletotrichum***: Purple blotchis present in surveyed plots of Nashik district. The infected leaves and pathogenic *A. porri* showed that purple blotchis present in maximum plots surveyed in tahasils of Nashik district. The infected leaves were observed for purple blotch symptoms starts from tip of the leaves particularly on older leaves and then spread to young leaves. Infected leaves showed small, whitish, sunken, oval shaped lesions to elliptical. The lesion was brown to purple at the centre. Concentric light to dark zones are alsoobserved on the infected leaves. The symptoms were characteristics to that of purple blotch disease caused by *Alternaria porri*. The morphological study of fungus was carried out on PDA. The whitish colonies turninto 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 (Singh, 1992). 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 identified morphologically and microscopic observations.

2.3. 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 T_6: *Trichodrerma* drenching @ 10 g/l at transplanting + Alternate 2 sprays of Tebuconazole 25.9 SC / Azoxystrobin 23 SC @ 1 ml/l recorded minimum per cent disease index (7.11%, 9.33%, 11.56%, and 13.78%) after 10 days of each spray respectively which was at par with the combine treatments of T_5, T_4 and T_3. The maximum per cent disease severity was recorded in control treatment at (19.11%, 30.22%, 40.89% and 49.34%) 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 T_6 followed by T_5 (68.32%) and T_4 (64.31%). Manthesha *et al* 2022 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 SC @ 1 ml/l (62.99%PDC) and Azoxystrobin 23 SC @ 1 ml /l (61.47%PDC) which are conformity with the present results.

3. Conclusion:

4.1. Twister disease of onion is complex of pathogen caused by *Colletotrichum gloeosporioides* and *Fusarium* sp.

4.2. Twister disease was found more serious in survey and threatening disease than purple blotch of onion during *kharif* 2020 and 2021.

4.3. The combine application of *Trichoderma* drenching @ 10 g/l along with two alternate sprays of each Tebuconazole 29.5 SC @ 1 ml/l or Azoxystrobin 23 SC@ 1 ml/l was found effective for management of twister disease of onion.

4. References

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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 (MT/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	*Trichoderma* @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 SC/ 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	5.33 (13.35)	7.11 (15.37)	9.33 (17.60)	11.56 (19.69)	14.33 (21.86)	70.82	142.000

	25.9SC/ Azoxystrobin 23SC@ 1.0 ml/l							
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

Fig. 1 Field view symptoms of Twister disease of onion