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## Survey of Twister disease in onion growing area of Saurashtra

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Twister/ Anthracnose leaf spot (caused by *Colletotrichum gloeosporioides*) is one of the major constraints in onion cultivation. The roving method of survey was conducted for identification of hot spots and disease-free area in major onion growing tracts of Saurashtra during rabi 2020-21 of Bhavnagar and Amreli district and during kharif 2021, Junagadh and Rajkot district of Gujarat. Among these districts, the highest Twister disease was observed in Bhavnagar (36.36%) and Rajkot district (48.77%), while in Amreli (28.09%) and Junagadh (39.13%) district it was found less in rabi and kharif season, respectively. Among talukas, maximum disease was found in Palitana (53.66%) followed by SavarKundla (51.60%) in rabi season whereas in kharif, maximum disease was found in Gondal (56.87%) followed by Visavadar (56.25%). Among villages during rabi, highest disease intensity was found in Bhandariya (84.00%), Borda (84.00%) and Vijpadi (72.00%), whereas there was no disease observed in the villages viz., Belda, Nana Asarna and Nana Jadra. In case of kharif, highest disease intensity was found in Kantoliya (82.00%), Suki Sejadiali (82.00%), Nana Kotada (74.00%) and Moti monpari (72.00%), whereas there was no disease observed in the Khadiya village. As far as distribution of Twister disease in onion concerned with total 69 and 46 onion fields were visited in kharif and rabi seasons, out of which 89.13 and 78.26 per cent fields found infected, respectively with disease in range of 0.0 to 86.00 per cent.

**Key words:** Twister, disease, roving method, hot spot, disease intensity, season and distribution

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### INTRODUCTION

Onion also known as the bulb onion or common onion, belong to family Amaryllidaceae. It is one of the important spice and vegetable crop grown in temperate, sub-tropical and tropical climate throughout the world and is said to be native of Central Asia and Mediterranean region.

Onion is grown in three seasons i.e., Kharif, Rabi and Summer. About 20 per cent of total area of onion is under kharif season. It is cultivated round the year but maximum during rabi season in India and can be grown under wide range of Agro-climate conditions. Among the different states of India, Maharashtra is one of the leading producing state whereas, productivity is the highest in Gujarat. In Gujarat, Bhavnagar is leading district followed by Amreli and Rajkot (Anon., 2020a and Anon., 2020b). India is producing 22819 thousand metric tons of onion from an area of 1220 thousand hectares with an average productivity of 18.1 MT/ha in year 2018-19 (Anon., 2020a).

In Gujarat, it is grown in about 25.70 thousand hectares with an average production of 724.1 thousand metric tons and productivity of 28.17 MT/ha in year 2018-19 (Anon., 2020b). Onion is now one of the most important crops of Saurashtra region of Gujarat state. It is also noticeable that Saurashtra region solo contributed 22.46 thousand hectares of area in onion cultivation and 633.05 thousand metric tons of onion production in year 2018-19 (Anon., 2020b).

Crop is attacked by several diseases, among these, the Twister/ Anthracnose leaf spot {*Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc.} is one of the major constraints in onion cultivation. This Twister disease indigenously known as in Srilanka called as Disco, in Indonesia Seven whorl and, Karnataka as Haavusuruliroga/ Tirupuroga and in Gujarat some local people said as Jalebiyo rog. The disease has been reported earlier on shallot onions, *Allium cepa* var. *ascalonicum*, that caused yield losses up to 20 to 30 per cent in Kalpitiya Peninsula of Sri Lanka. The seven curls or Twister disease of onion in India is caused by *Glomerella cingulata*, during kharif

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season. The disease in nature caused considerable losses up to 20-60 per cent in bulb yield and ambit of loss depend on infection time and crop growth stage (Hegde *et al.* 2012). It was observed that anthracnose and onion twister are serious diseases of raining season. In several fields of onion, they observed that yield losses are estimated up to 50-100 per cent. Onion twister disease is characterized by chlorosis curling and twisting, of the onion leaves, abnormal elongation of the necks and formation of slender bulbs. Infected plants rotted before harvest and other plants decay rapidly when it is stored.

Very few studies have been done on this disease of onion and the losses caused due to these in different onion growing area. So, the survey was conducted in the major onion growing districts of Saurashtra, Bhavnagar and Amreli during rabi 2020-21 and Rajkot and Junagadh during kharif 2021. This onion cultivating tract is facing severe twister disease and anthracnose leaf spot complex showing severity up to 40-60 per cent and known to infect and influencing on yield adversely with respect to quantity and quality too. This disease, causing heavy yield loss, leads to shortage in supply to the market resulting in higher prices to a consumer and common man.

## MATERIALS AND METHODS

The survey was conducted in the onion growing area of Saurashtra for twister disease during *rabi* 2020-21 and *kharif* 2021. The roving method of survey was conducted in the major onion growing districts of Saurashtra, Bhavnagar and Amreli during *rabi* 2020-21 and Rajkot and Junagadh during *kharif* 2021. In Bhavnagar district, six talukas (Bhavnagar, Talaja, Mahuva, Gogha, Sihor and Palitana), in Rajkot district, two talukas (Rajkot and Gondal), Junagadh district, two talukas (Junagadh and Visavadar) and Amreli two taluka (Amreli, Botad and Savar Kundla) were surveyed. During rabi 2020-21, 45 villages of 6 talukas of 2 districts and in kharif 2021, 31 villages of 4 talukas of 2 districts were surveyed. The observations were taken from ten randomly selected plants from each field adopting the 0 to 5 disease rating grade (Table 1) given by Patil *et al.* (2013) for twister disease of onion.

## RESULTS AND DISCUSSION

Survey on the intensity of disease was carried out for information on the symptomatology, intensity,

distribution, and its spread. The data on survey revealed that, intensity varied from locality to locality, because of varied agro-climatological situations, cropping pattern, varieties grown and cultural practices followed by farmers. A roving survey for the Twister disease of onion was carried out at farmer's field comprising onion growing regions of Gujarat during rabi 2020-21 and kharif. During the survey, the Twister disease was found prevalent in all the regions.

### **Rabi 2020-21**

During rabi 2020-21 survey was conducted for identification of hot spots and disease free area in major onion growing tracts of Bhavnagar and Amreli district of Gujarat (Table 2). Among these two districts, the highest Twister disease was observed in Bhavnagar district 36.36 per cent and in Amreli district, it found low as compared to Bhavnagar district with an average 28.09 per cent. Among talukas, maximum disease intensity was found in Palitana (53.66%) of Bhavnagar district and SavarKundla (51.60%) of Amreli district, whereas lowest disease intensity was found in Sihor (16.66%) of Bhavnagar district and Amreli (14.67%) of Amreli district.

Among villages highest disease intensity was found in Bhandariya (84%) of Bhavnagar taluka, Borda (84.00%) of Talaja taluka, Kumbhan (80.00%) and Rupavati (72.00%) of Mahuva taluka, Panchpipla (72.00%) of Palitana taluka, Vijpadi (72.00%) of SavarKundla taluka, whereas lowest disease intensity was found in Bhadi (8.00% and 2.00%) of Bhavnagar taluka, Gadhesar (4.00% and 2.00%), Padargadh (8.00%) and Padri (10.00%, 6.00% and 2.00%) of Talaja taluka, Bhadrod (10.00%), Longdi (6.00%) and Nana Jadra (2.00%) of Mahuva taluka and Timba (10.00%) of Amreli taluka. There was no disease observed in some villages viz., Belda of Talaja taluka, Nana Asarna and Nana Jadra of Mahuva taluka. However, in some field of Nana Asarna and Nana Jadra higher, 40-45 and 30 per cent disease intensity was recorded, respectively.

### **Kharif 2021**

During kharif 2021, survey was conducted for identification of hot spots and disease free area in major onion growing tracts of Junagadh and Rajkot district of Gujarat (Table 3).

**Table 1:** Disease rating grade for assessment of disease severity against twister disease of onion

Disease rating (Grade)	Twisting (%)	Description
0	No Disease	No disease symptom
1	Up to 10%	Curling and chlorosis leaves
2	11-20%	Abnormal elongation of leaves and neck
3	21-40%	Leaf sheath showing clusters of acervuli in concentric rings along with shallow, sunken necrotic spots and root galling
4	41-60%	Elongated neck, slender bulbs and leaves show dieback symptoms
5	>61%	Complete drying of leaves or breaking of leaves from center

The per cent disease intensity (PDI) was calculated by using the following formula (Wheeler, 1969).

$$PDI = (\text{Sum of the individual disease ratings}) / (\text{No. of plant observed} \times \text{Maximum disease rating grade}) \times 100$$

**Table 2:** Disease intensity of twister in major onion growing regions of Gujarat during *rabi* 2020-21 on farmers' field

Taluka	Villages	Field no.	Latitude – Longitude	Disease intensity (%)	
Bhavnagar District					
Bhavnagar	Bhadi	1	21.607221°N – 72.139473°W	8.00	
		2	21.607221°N – 72.139474°W	2.00	
	Bhandariya	3	21.597367°N – 72.134666°W	84.00	
	Budhel	4	21.696566°N – 72.140781°W	70.00	
	Vartej	5	21.699662°N – 72.131137°W	40.00	
		6	21.699663°N – 72.131136°W	30.00	
	Velavadar	7	21.387381°N – 72.053701°W	30.00	
Mean				46.40	
Talaja	Talaja	8	21.407216°N – 72.028530°W	68.00	
	Talaja farm	9	21.367553°N – 72.027103°W	64.00	
	Belda	10	21.311128°N – 71.905079°W	0.00	
	Borda	11	21.257193°N – 71.930725°W	84.00	
	Gadhesar		12	21.264463°N – 71.941343°W	4.00
			13	21.264462°N – 71.941342°W	2.00
			14	21.310618°N – 71.985297°W	30.00
	Hajipar	15	21.310618°N – 71.985299°W	16.00	
	Padargadh		16	21.302995°N – 71.920158°W	8.00
			17	21.278382°N – 71.951648°W	10.00
			18	21.278382°N – 71.951647°W	6.00
	Padri		19	21.278382°N – 71.951647°W	2.00
			20	21.290751°N – 71.967339°W	70.00
		Pasvi	21	21.291740°N – 71.968401°W	50.00
			22	21.278384°N – 71.951650°W	50.00
	Sakhdasar no.1	23	21.331594°N – 72.000751°W	30.00	

		24	21.421122°N – 72.097333°W	70.00
	Trapaj	25	21.426332°N – 72.107126°W	12.00
		26	21.423755°N – 72.108091°W	30.00
			Mean	31.89
Mahuva	Mahuva	27	21.355023°N – 72.029355°W	40.00
	Bhadra	28	21.134868°N – 71.663294°W	18.00
		29	21.146447°N – 71.819457°W	10.00
	Bhadrod	30	21.134824°N – 71.802778°W	20.00
		31	21.143873°N – 71.643237°W	30.00
	Dudhala no. 1	32	21.143873°N – 71.643237°W	22.00
		33	21.045133°N – 71.705167°W	40.00
	Dudhala no. 2	34	21.143892°N – 71.64334°W	60.00
		35	21.141143°N – 71.653428°W	74.00
		36	21.130934°N – 71.707496°W	80.00
	Kumbhan			
		37	21.222696°N – 71.906777°W	30.00
	Lilvan	38	21.222216°N – 71.907635°W	50.00
		39	21.198511°N – 71.873107°W	6.00
	Longdi	40	21.211974°N – 71.887723°W	40.00
		41	21.132174°N – 71.670150°W	18.00
		42	21.191208°N – 71.555825°W	20.00
	Motivadal	43	21.191368°N – 71.566297°W	70.00
		44	21.193129°N – 71.540719°W	64.00
		45	21.190475°N – 71.566394°W	46.00
	Nana asarna	46	21.175908°N – 71.598647°W	0.00
		47	21.173597°N – 71.600300°W	40.00
		48	21.124604°N – 71.697743°W	30.00
	Nana jadra	49	21.126794°N – 71.691159°W	0.00
		50	21.123534°N – 71.707085°W	2.00
	Nesvad	51	21.662787°N – 72.143291°W	20.00
	Rupavati	52	21.136076°N – 71.705328°W	72.00
	Vadli	53	21.111382°N – 71.777332°W	60.00
			Mean	35.56
Gogha	Sarvdar	54	21.542260°N – 72.107228°W	20.00
	Tansa	55	21.472381°N – 72.113551°W	48.00
			Mean	34.00
Sihor	Aambala	56	21.726072°N – 71.837369°W	16.00
		57	21.711653°N – 71.822934°W	20.00

	Bajud	58	21.711663°N – 71.823601°W	14.00
				Mean 16.66
Palitana	Nanipaniyali	59	21.494134°N – 71.873776°W	40.00
	Palitana	60	21.531576°N – 71.818538°W	46.00
	Panchpipla	61	21.552006°N – 71.726279°W	72.00
				Mean 53.66
				District Mean 36.25
Amreli district				
Amreli	Chital	62	21.718009°N – 71.201162°W	18.00
	Timba	63	21.708486°N – 71.220501°W	10.00
	Jasvantgadh	64	21.717593°N – 71.213039°W	16.00
				Mean 14.67
SavarKundla	Nana zinzuda	65	21.333535°N – 71.390221°W	70.00
	Gadhakda	66	21.265659°N – 71.401251°W	32.00
	Khadsali	67	21.230459°N – 71.446644°W	56.00
	Pithavadi	68	21.347234°N – 71.418518°W	28.00
	Vijpadi	69	21.210074°N – 71.483301°W	72.00
				Mean 51.60
				Mean 28.09

Distribution of twister disease of onion

Diseased Field	54
Field without disease <sup>1</sup>	15
Total Field	69

Field having disease incidence between 0 and d<sup>10</sup> was counted as field without disease

Among these two districts, the highest intensity of Twister disease was observed in Rajkot district 48.77 per cent and in Junagadh district, it found low as compared to Rajkot district with an average 39.13 per cent. Among talukas, maximum disease intensity was found in Gondal (56.87%) of Rajkot district and Visavadar (56.25%) of Junagadh district, whereas lowest disease intensity was found in Rajkot (40.67%) of Rajkot district and Junagadh (22.00%) of Junagadh district.

Among villages highest disease intensity was found in Kantoliya (82.00%) and Moviya (80.00%) of Gondal taluka, Suki Sejadiali (82.00%) of Rajkot taluka, Nana Kotada (74.00%) and Moti monpari (72.00%) of Visavadar taluka and Bagdu (42.00%) of Junagadh taluka, whereas lowest disease

intensity was found Shrinathgadh (10.00%) of Gondal taluka, Sardhar (10.00%) of Rajkot taluka, Prempara (6.00%) of Visavadar taluka and Mevasa (Bavana) (6.00%) of Junagadh taluka. There was no disease observed in the Khadiya village of Junagadh taluka.

From the pooled results of two different season, it was discovered that the kharif season had the high disease intensity of twister disease as compared to the rabi season. This observed may be due to the higher rainfall and relative humidity, which favoured serious outbreaks of *Colletotrichum* spp. In contrast, just a limited fraction of infection was found in several villages, it may be due to dry microclimatic zones with low rainfall and humidity prevailed during crop season.

**Table 3:** Disease intensity of twister in major onion growing regions of Gujarat during *kharif* 2021 on farmers' field

Taluka	Villages	Field no.	Latitude – Longitude	Disease intensity (%)	
Junagadh District					
Junagadh	Anandpur	1	21.405541°N– 70.517174°W	22.00	
	Bagdu	2	21.385308°N – 70.527486°W	42.00	
	Khadiya	3	21.417683°N – 70.519180°W	0.00	
	Jamka	4	21.381957°N – 70.517710°W	40.00	
	Mevasa (Bavana)	5	21.398375°N – 70.519165°W	6.00	
				Mean	22.00
Visavadar	MotiMonpari	6	21.304787°N – 70.674527°W	72.00	
		7	21.290337°N – 70.650541°W	62.00	
	Leriya	8	21.391624°N – 70.729562°W	68.00	
		9	21.407998°N – 70.720006°W	58.00	
	Khambha	10	21.295103°N – 70.649988°W	66.00	
	Dhebar	11	21.413343°N – 70.793570°W	44.00	
	Nana Kotada	12	21.449305°N – 70.679245°W	74.00	
	Prempara	13	21.295137°N – 70.717976°W	6.00	
				Mean	56.25
				District Mean	39.13
Rajkot district					
Rajkot	Halenda	14	22.079263°N – 71.059762°W	42.00	
	Kharachiya	15	22.112087°N – 71.011835°W	30.00	
	Tramba	16	22.226074°N – 70.914966°W	36.00	
	Lakhapar	17	22.155632°N – 70.967237°W	44.00	
	Sardhar	18	22.149783°N – 70.972540°W	10.00	
	Lodhida	19	22.155410°N – 70.921361°W	20.00	
		20	22.155614°N – 70.921070°W	32.00	
	Khokhaddad	21	22.202534°N – 70.820477°W	32.00	
	Kothariya	22	22.227463°N – 70.817793°W	46.00	
		23	22.050785°N – 70.869409°W	16.00	
	Suki Sejadiali	24	22.084645°N – 70.945578°W	82.00	
		25	22.087885°N – 70.939892°W	24.00	
		26	22.091752°N – 70.937410°W	40.00	
	Khorana	27	22.428533°N – 70.827601°W	60.00	
		28	22.326388°N – 70.712964°W	54.00	
Vajdi (Gadh)	29	22.323626°N – 70.710058°W	38.00		
	30	22.316606°N – 70.705439°W	66.00		

Jaliya	31	22.439378°N – 70.809854°W	60.00
			Mean 40.67
Gondal	32	21.929722°N – 70.834766°W	70.00
	33	21.928618°N – 70.835917°W	80.00
Moviya	34	21.898344°N – 70.864289°W	52.00
	35	21.928321°N – 70.835931°W	40.00
Shrinathgadh	36	21.883000°N – 70.884665°W	10.00
	37	21.857364°N – 70.887966°W	62.00
Mandan Kundla	38	21.853841°N – 70.873039°W	58.00
	39	21.845538°N – 70.849635°W	18.00
Shivrajgadh	40	21.839990°N – 70.835401°W	56.00
	41	21.840594°N – 70.816474°W	80.00
	42	21.858884°N – 70.802834°W	58.00
Devchadi	43	21.862656°N – 70.797485°W	48.00
	44	21.866995°N – 70.788409°W	68.00
Bandra	45	21.878645°N – 70.785162°W	72.00
Kantoliya	46	21.905999°N – 70.798806°W	82.00
			Mean 56.87
			District Mean 48.77

## Distribution of twister disease of onion

Diseased Field	41
Field without disease <sup>1</sup>	5
Total Field	46

Field having disease incidence between 0 and d<sup>10</sup> was counted as field without disease

### **Distribution of Twister disease of onion in rabi 2020-21 and kharif 2021**

As far as concerned with distribution of Twister disease of onion with respect to *rabi* 2020-21 and *kharif* 2021. Total 69 fields were visited in *rabi* season, of which 15 fields were free from disease or near about negligible disease intensity whereas 54 fields were recoded infected with disease. In case of *kharif* condition out of 46 fields visited, 5 fields were free from or negligible disease intensity whereas 41 fields were infected with disease. The result showed that in *rabi* season 78.26 per cent and in *kharif* season 89.13 per cent field were infected. This clearly showed that the disease occurred regardless of season; if favourable climate and adequate inoculums available, outbreaks might very well inevitably have occurred.

However, more infected fields were noticed during the *kharif* season, that may be due to the higher rainfall and high relative humidity, which were much more conducive to disease occurrence.

The prevalence of Twister disease was seen lower to higher in both seasons during the survey. The disease's intensity varied, possibly due to differences in agro climatic conditions, cropping patterns, low to high rainfall including environmental conditions in respective zone.

### **Symptoms observed during survey**

Leaf chlorosis, curling and twisting were commonly observed under field circumstances. Lesions developed on twisted leaf and in lesions acervuli with pinkish orange masses of conidia grew in



concentric circles and shot hole symptom also observed, suggested anthracnose symptoms. The leaves became shriveled and dropped. Dieback symptoms and seven curl symptoms were also identified in badly damaged plants. Water-soaked lesions/patches also formed on the neck and twisted abnormally. Root discoloured, often constricted, resulting in the dying of the plant. On the bulb patches covered with a pinkish mass of fungal spores and bulb became rotted. The bulbs yielded by any of these plants were small.

The more or less, similar observations were made by Anon (2005), Hill (2008), Alberto and Aquino (2010) and Nargund *et al.* (2013) working with twister disease of onion in different region. The result was harmonious with Bajad (2017) recorded, onion anthracnose disease in the two districts, Latur and Osmanabad, showed disease intensity 28.08 to 50.00 per cent and 41.38 to 60.00 per cent, respectively. Congruent result was reported by Patil *et al.* (2016), who conducted survey to find out the intensity of onion twister disease in Karnataka. They noticed that the intensity of this disease varied from place to place, depends on cropping pattern, environmental conditions in different region and different varieties sown in various location.

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