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**Shubham Patel**  
 Department of Plant  
 Pathology, B.M. College of  
 Agriculture, Khandwa  
 R.V.S.K.V.V., Gwalior,  
 Madhya Pradesh, India

**SK Arsia**  
 Department of Plant  
 Pathology, B.M. College of  
 Agriculture, Khandwa  
 R.V.S.K.V.V., Gwalior,  
 Madhya Pradesh, India

**Corresponding Author:**  
**Shubham Patel**  
 Department of Plant  
 Pathology, B.M. College of  
 Agriculture, Khandwa  
 R.V.S.K.V.V., Gwalior,  
 Madhya Pradesh, India

## Survey for Purple blotch of onion incited by *Alternaria porri* and evaluation of new generation fungicides for management

**Shubham Patel and SK Arsia**

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### Abstract

A survey was conducted at East Nimar, Khandwa (M.P.) during the Rabi (winter) season, 2022-23 on major onion growing farmer's field five blocks viz., Khalwa, Chhaigaon Makhan, Khandwa, Punasa and Pandhana to record Incidence of Purple blotch of onion caused by *Alternaria porri*. The disease affected in all onion grown farmer's field of Khandwa. The mean of percent disease incidence was ranged between 6.10 to 10.13%. The maximum PDI was observed in block Pandhana (10.13%) followed by block Khalwa (8.58%), Punasa (8.20%), Khandwa (7.18%), and the minimum PDI was recorded in Chhaigaon Makhan block (6.10%). In the field experiment, the efficacy of six fungicides was assessed during the Rabi season. The minimum percent disease incidence was observed with Tebuconazole (23.17%), followed by Propiconazole (25.22%), Hexaconazole (28.10%) and the maximum percent disease incidence was recorded with Thiophanate methyl (38.30%). The highest yield was observed with Tebuconazole and lowest yield in the Thiophanate methyl over the control plot.

**Keywords:** Survey, management, Purple blotch, onion, *Alternaria porri*, fungicides

### Introduction

Among vegetables, onion is one of the vegetables that includes lachrymatory agent, a strong antibiotic, with fungicidal, bacterial and nematocidal effects. It has also of high medicinal value in controlling plant and human diseases. The main ingredient responsible for the pungency of the bulbs, that helps in the prevention of cancer is allyl-propyl-di-sulphide. The major anthocyanin pigment in red onion is thought to be cyanidin-3-glucoside. Owing to its therapeutic and nutritive value, onion is often known as "queen of kitchen". It is highly rich in sulphur, potassium, manganese, vitamin B<sub>6</sub>, iron, vitamin C, fiber, anthocyanin and antioxidant particularly quercetin (Cramer, 2020) [6].

After China, India is the world's second-largest producer. The production of onion 26.83 million tones with an area of 1.64 million ha in the year 2020-21. Maharashtra (39.05%), Madhya Pradesh (16.95%), Karnataka (9.92%) are the top three onion producing states in India. In Madhya Pradesh it is mostly grown in the Nimar Valley and Malwa Plateau zones (Ujjain, Neemuch, Ratlam, Indore, Khandwa, and Mandsaur) as an important cash crop Anonymous, (2021) [1]. Among the disease Purple blotch is major devastating one. Purple blotch caused by *Alternaria porri* is one of the major disease of onion. The name Purple blotch for this disease was proposed by (Nolla, 1927) [11]. He named the causal organism as *Alternaria allii* which was later amended to *Alternaria porri*. Symptoms of Purple blotch of onion observed on the infected leaves visible as concentrated zones of light dark. The symptoms of Purple blotch of onion on leaf and flower stalk initiate as small, elliptical and become zonate and result into reddish to purple, surrounded by yellow zone. Leaves become yellow, and later brown and bent downward after 2-3 weeks after the infection and seen as sunken purple blotches with concentric dark and light zones. As the spots increase in size, they become oval-shaped or irregular and the white colour eventually changes to violet. The yield losses ranging from 30 to 100 percent may reach epidemics states during favorable climatic conditions with definitely high relative humidity (80 to 90%) generally optimum temperature (24 °C) (Yadav *et al.*, 2013) [14].

## Materials and Methods

A systematic survey was carried out for recording the incidence of Purple blotch of onion on farmer's field in the vicinity of Khandwa during Rabi 2022 for assessment of the disease incidence for computation of the rate of disease development. For such survey three onion growing farmers were selected from each five randomly selected villages around the Khandwa. Three fields from each village were randomly selected. An area of 1 m × 1 m was marked at five randomly selected spots on each farmer's field. The numbers of diseased plants were recorded in five 1m<sup>2</sup> quadrats in each field. Plants were considered diseased. The quadrates were placed 10-30 m from the edge of a field, usually at each of the four corners and halfway down one side. The surveys were done by standard pattern in rectangular fields, but in all cases quadrat samples were widely dispersed in each field. The systematic survey carried out for information regarding each field were noted as incidence; sowing time and soil colour of the field. The representative disease samples were collected and dried for future studies. In each field observations were recorded on 10 randomly selected but marked plants for each cultivator's field.

The percent disease incidence was computed according to the formula given by (Mckinney, 1923) <sup>[8]</sup>, as:

$$\text{PDI} = \frac{\text{Sum of all numerical rating}}{\text{No of observation maximum disease rating}} \times 100$$

### Assessment of losses

Loss (%) was calculated on different disease incidence (%) by the formula given by (Mousanejad *et al.*, 2010) <sup>[10]</sup>, as:

$$\text{Loss (\%)} = \frac{\text{Yield in intensive protected plot} - \text{Yield in particular treatment}}{\text{Yield in intensive protected plot}} \times 100$$

### Isolation and identification of causal agent

The onion leaves showing typical symptoms of Purple blotch of onion were brought to laboratory for isolation of pathogen responsible for disease. Slide was prepared by mounting small pieces of diseased leaf tissue in a drop of water and observed under microscope for presence of spores and mycelium. The disease infected leaves were washed under tap water and air dried. Leaves were then cut into small pieces in such a manner that each piece covered half healthy and half diseased leaf portion. The pieces were surface sterilized in 0.1% mercuric chloride solution for one minute, washed in three changes of sterilized water to remove traces of mercuric chloride and dried on sterilized blotting paper. The leaf pieces were then aseptically placed on solidified PDA medium already poured in sterilized petri dishes. The plates were incubated at 28 ± 1 °C and observed periodically till visible fungus colony appeared around the leaf pieces. Identification of fungal isolates of pathogen was carried out based on macro and microscopic characters.

### *In vivo* evaluation of agrochemicals against *Alternaria porri*

The field investigation carried out in research field of Plant Pathology, B.M. college of agriculture, Khandwa, R.V.S.K.V.V. Gwalior. Five chemicals *viz.*, Tebuconazole, Propiconazole, Difenconazole, Hexaconazole, Thiophanate methyl and one combination of Azoxystrobin and

Difenconazole. Observations of percent disease incidence were recorded on ten randomly selected plants in each treatment one day before 1<sup>st</sup> spray while last observation was taken 15 days after 2<sup>nd</sup> spray. Percent disease incidence was recorded and the data on yield from each treatment was also recorded.

**Table 1:** List of fungicides used in *In vivo* with their dose

S. No.	Symbol	Treatments	Dose
1.	T <sub>1</sub>	Tebuconazole 25.9% EC	1 ml/litre
2.	T <sub>2</sub>	Propiconazole 25% EC	1 ml/litre
3.	T <sub>3</sub>	Difenconazole 25% EC	1 ml/litre
4.	T <sub>4</sub>	Thiophanate Methyl 70% WP	1 ml/litre
5.	T <sub>5</sub>	Azoxystrobin 18.2% + Difenconazole 11.4% SC	1 ml/litre
6.	T <sub>6</sub>	Hexaconazole 5% SC	1 ml/litre
7.	T <sub>0</sub>	Control (water distilled)	

Data of field experiments were analyzed by RBD (Randomized Block Design) whereas, CRD (Completely Randomized Design) was opted for data of laboratory experiments. The variation in two means was further tested by computing critical difference at 5% probability level. The standard errors of mean difference between treatments were estimated as per the standard statistical procedures (Panse & Sukhatme, 1978) <sup>[12]</sup>.

## Results and Discussion

### Survey on the incidence of Purple blotch of onion disease at East Nimar Khandwa

The survey was conducted during the Rabi season, 2022-23 on major onion growing farmer's field of five blocks *viz.*, Chhaigaon Makhan, Khalwa, Khandwa, Punasa and Pandhana of Khandwa district (M.P.). Data on the percent incidence of onion purple blotch in various blocks was recorded in flowering and bulb formation stage. During the survey disease emergence on onion crop at all the blocks were recorded. The wide variation was recorded on percent among the villages. In this survey, three villages were selected randomly and then five farmer's field were randomly selected from each selected village. The data of percent disease incidence at Khandwa district are given below in table-2.

### Block wise incidence of Purple blotch of onion

The Purple blotch of onion disease was moderately affected in all onion growing farmer's field of Khandwa district and mean of percent disease incidence (PDI) was noticed between 6.10 to 10.13%. The data given in table-2, figure-1 and plate- 2 in which the highest PDI was in block Pandhana (10.13%) followed by block Khalwa (8.58%), Punasa (8.20%), Khandwa (7.18%), and the lowest PDI was recorded in Chhaigaon Makhan block (6.10%). The soil colour varied from the dark brown to black in colour.

In the Pandhana block three village were selected *viz.*, Arud, Rustampur, Gandhwa in which highest PDI recorded in Gandhwa village (11.00%), Rustampur (10.28%), lowest disease incidence recorded Arud (9.11%). Out of three villages of Khalwa block the maximum percent disease incidence was found in Ashapur (9.20%) village, followed by Khedi (8.89%), and the least disease incidence was recorded in village Arakheda (7.65%).

In the block Punasa, the maximum percent disease incidence in the village Karoli (8.73%), Bangarda (8.29%) and the minimum disease incidence in the village Gunjali (7.58%).

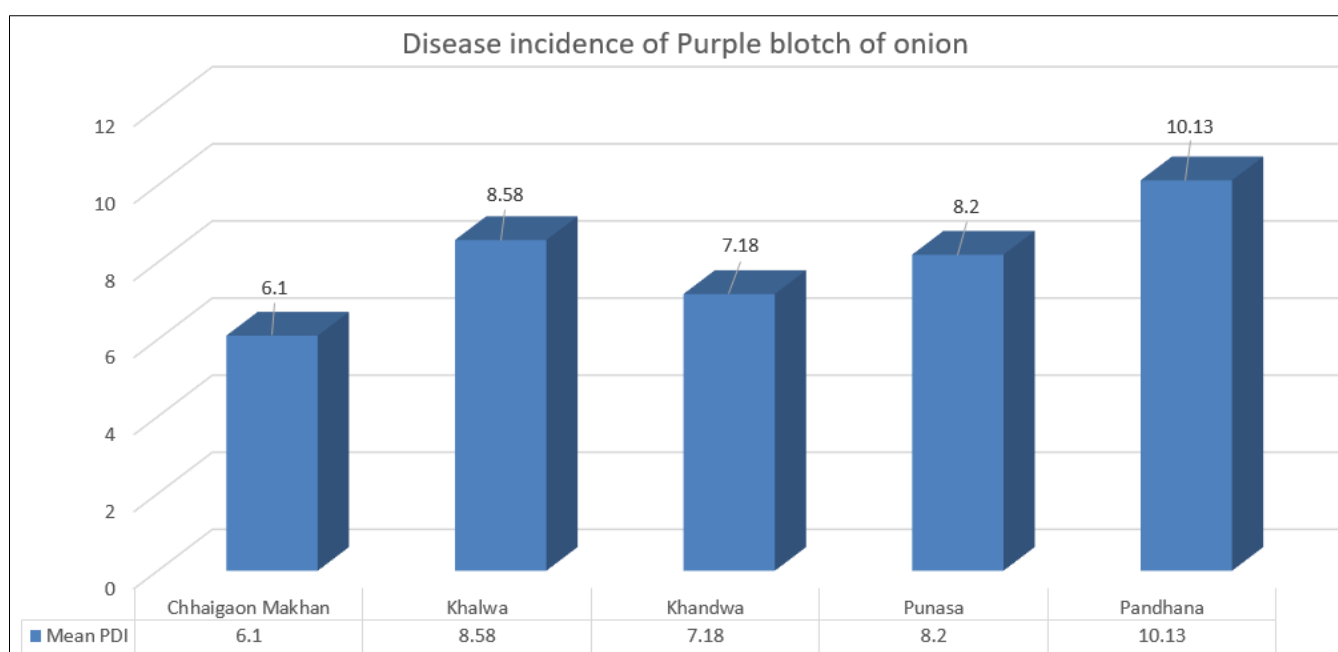
Among the three villages of Khandwa block, highest percent disease incidence Satwada village (8.11%), followed by Bamangaon (7.11%), and lowest PDI reported at Bawadiya kajee (6.31%). In the block Chhaigaon makhan, the highest

percent disease incidence was in the village Chhaigaon devi (6.27%), Haraswada (96.17%) and the lowest percent disease in the village Sirsod (5.86%)

**Table 2:** Block wise purple blotch of onion disease incidence during Rabi season 2022-23 at Khandwa district

Blocks	Villages name	Soil types	Incidence of purple blotch (%)			Mean (%)
			I	II	III	
Chhaigaon Makhan	Chhaigaon devi, Sirsod, Haraswada	Irrigated	6.27	5.86	6.17	6.10
Khalwa	Arakheda, Ashapur, Khedi	Irrigated	7.65	9.20	8.89	8.58
Khandwa	Satwada, Bamangoan, Bawadiyakajee	Irrigated	8.11	7.11	6.31	7.18
Punasa	Gunjali, Karoli, Bangarda	Irrigated	7.58	8.73	8.29	8.20
Pandhana	Arud, Rustampur, Gandhwa	Irrigated	9.11	10.28	11.00	10.13
Average disease incidence (%)			8.03			
SEm(±)			0.45			
C.D. at 5%			1.47			
C.V.			9.72			

\* Mean of three replications



**Fig 1:** Percent disease incidence (PDI) of Purple Blotch of onion different blocks of Khandwa district.

The present findings were supported with the result described by (Mourya *et al.*, 2020) [9] carried out of survey in East Nimar region of Khandwa district during 2017-2018 and recorded disease incidence varied from 6.50 to 10.10% as well as overall mean percent disease incidence observed to 8.72%. (Kumar & Godara 2020) [7]. conducted survey during Rabi season in 2015-16 and 2016-17 in, one district of Punjab, two districts of Haryana and nine districts of Rajasthan in both seasons recorded 10.11% mean disease incidence.

#### ***In vivo* evaluation of agrochemicals against *Alternaria porri***

The field experiment was done in the Rabi season 2022-2023 for evaluation of agrochemicals against *Alternaria porri*. The percent disease incidence are depicted in Table 2 and varied from 23.17% to 38.3% over the control plot (49.57%) which were observed 15 days after first spray.

The lowest percent disease incidence was observed in the Tebuconazole (23.17%), followed by Propiconazole (25.22%), Hexaconazole (28.10%), Azoxystrobin +

Difenconazole (31.23%), Difenconazole (35.13%). The highest percent disease incidence in the Thiophanate methyl (38.3%) was recorded.

The percent disease control depicted in Table-2, which varied from the 22.73% to 53.11% over the control plot after 15 days of the first spray. The maximum percent disease control was recorded in the Tebuconazole (53.11%), followed by Propiconazole (49.12%), Hexaconazole (43.31%), Azoxystrobin + Difenconazole (36.99%), Difenconazole (29.13%). The lowest percent disease control was recorded in Thiophanate methyl (22.73%) over the control plot. Thus, spray treatment of all agrochemical was found significantly superior over control in reducing the disease.

The current observations correspond closely with the earlier studies by (Upamanyu 1999; Beig *et al.*, 2008; Bhatia & Chahal 2014) [13, 4, 5]. describe the superiority of Propiconazole, Tebuconazole, Hexaconazole and Difenconazole over work better than traditional fungicides in controlled the disease in field conditions.

Aujila *et al.*, (2013) [3] assessed nine fungicides against Purple blotch of onion under field conditions maximum percent disease (PDI) control (85.0%) and seed yield (106 kg/acre) in foliar application of Trifloxystrobin 25% +Tebuconazole 50% (75WG) followed by Tebuconazole 25, Propiconazole 25 EC and Difenconazole 25 EC.

**Yield of onion (Qt/ha) under *In vivo* condition**

The yield depicted in Table-3 varied from 222.00 quintal/ha to 275.00 quintal/ha. The highest yield was observed in Tebuconazole (275.00 quintal /ha) after that Propiconazole (260.00 quintal/ha) and Hexaconazole (256.00 quintal /ha) while lowest yield in the Azoxystrobin + Difenconazole

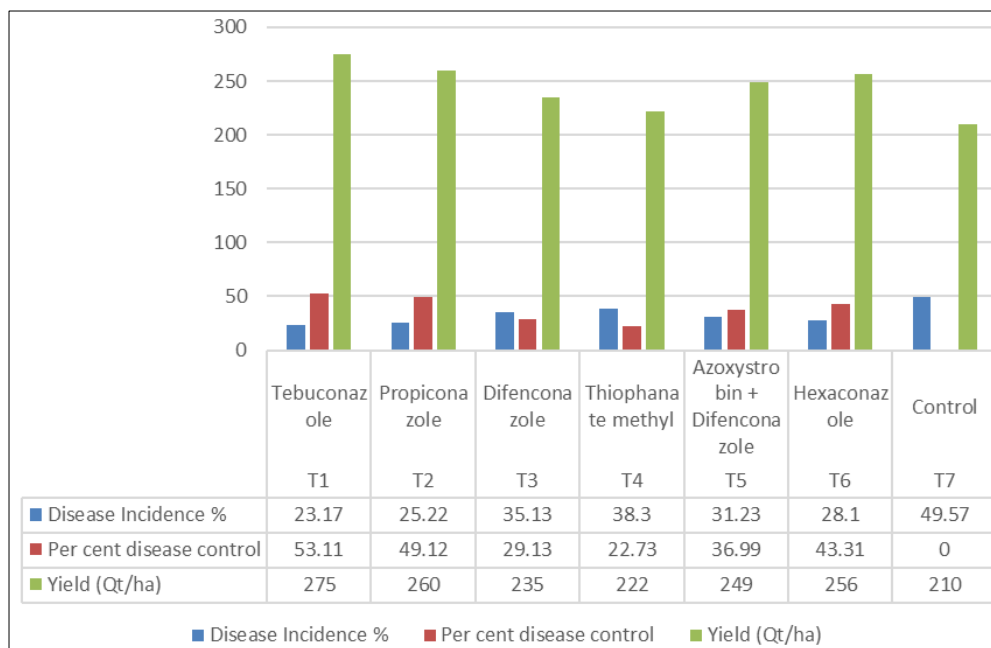
(249.00 quintal/ha) after that Difenconazole (235.00 quintal/ha) and Thiophanate methyl (222.00 quintal/ha) over the control plot (210.00 quintal/ha).

Arunkumar *et al.*, (2016) [2] explored various fungicides during kharif season of 2014-15. Tebuconazole 25 EC was found lowest percent disease 22.68 percent and yield of 271.00 q/ha. Again, during Kharif season 2015-16 minimum percent disease of 22.66 percent and yield of 270.67 q/ha. was recorded with Azoxystrobin 23 EC. Tebuconazole 25 EC was next best treatment found effective by recording disease of 24.00 percent and yield of 267.00 q/ha respectively.

**Table 3:** Disease incidence percent of *Alternaria porri* against agrochemicals

Symbol	Treatment name	Disease Incidence %	Percent disease control	Yield (Qt/ha)
T <sub>1</sub>	Tebuconazole	23.17	53.11	275.00
T <sub>2</sub>	Propiconazole	25.22	49.12	260.00
T <sub>3</sub>	Difenconazole	35.13	29.13	235.00
T <sub>4</sub>	Thiophanate methyl	38.30	22.73	222.00
T <sub>5</sub>	Azoxystrobin + Difenconazole	31.23	36.99	249.00
T <sub>6</sub>	Hexaconazole	28.10	43.31	256.00
T <sub>7</sub>	Control	49.57		210.00
	SEm (±)	0.29		0.61
	CD (5%)	0.88		1.89
	CV (%)	1.77		0.44

\* Mean of three replication



**Fig 2:** Disease incidence percent of *Alternaria porri* against agrochemicals

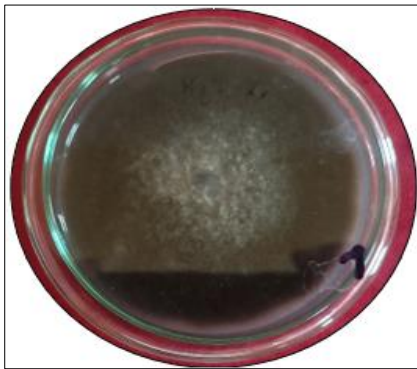


**Plate 1:** View of field experiment on management of Purple blotch of onion during Rabi season (2022-23)





**Plate 2:** Survey on the incidence of purple blotch of onion in East Nimar Khandwa



**Plate 3:** Cultural plate of *Alternaria porri*



**Plate 4:** Microscopic view of *Alternaria porri*

### Conclusion

The result of this study “Studies on Purple blotch of onion incited by *Alternaria porri* and its management” lead to the deduction of the finding that are summarized following paragraphs. Purple blotch of onion extensively throughout blocks with the Pandhana suffering the most severe disease incidence (10.13%) and lowest percent disease incidence recorded in the Chhaigaon Makhan block (6.10%) of East Nimar region of Madhya Pradesh. Onion production varied from 222.00 quintal/ha to 275.00 quintal/ha. The highest yield was recorded in Tebuconazole (275.00 quintal/ha) and lowest yield in the Thiophanate methyl (222.00 quintal/ha) over the control plot 210.00 quintal/ha.

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