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Survey, estimation of losses and symptomatology in major cabbage growing areas of Rajasthan by *Alternaria* leaf spot disease

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Abstract

There were distinct variations in symptoms observed in the disease samples collected during *Rabi* 2012 from the four cabbage growing districts of Rajasthan. Isolates of *Alternaria brassicicola* recovered from various samples collected from Udaipur, Jaipur, Bundi, and Ajmer. The fungal pathogens were isolated, purified and identified as *A. brassicicola* and their pathogenicity was confirmed. Fields survey was carried out during *Rabi* season 2012-13 and recorded maximum percent incidence (34.78) and minimum yield (196.2 kg/100m²) and maximum yield loss (34.6%) in Udaipur district. Four isolates showed variations in symptoms on inoculations in pot grown plants and also in growth characteristics, colony diameter, rate of sporulation and the size of conidia.

Keywords: Cabbage, *Alternaria brassicicola*, symptomatology

Introduction

Cabbage (*Brassica oleracea* var. *capitata* L.) belongs to the family Cruciferae (Brassicaceae). Basically, cabbage is a crop of temperate zones but it has spread to both subtropical and tropical regions of the world. In India the traditional cabbage growing areas are the Southern and South-Eastern coastal regions where it is cultivated on a large scale. Faujader *et al.* (2007) [3] reported that *Alternaria* blight one of them causing 35- 40% yield loss in mustard crop. Three species *viz.*, *Alternaria brassicicola*, *A. brassicae* and *A. japonica* (formerly named *A. raphani*) have been reported as the causal organism. The disease responsible for significant reduction in quantity and quality in yield of cabbage and seeds. The initial symptoms of the disease are small, circular, dark spots on older leaf surfaces. As the spots enlarge, concentric rings develop within lesions surrounded by a yellow halo. The tan- coloured centers of lesions may eventually fall out, producing a hole, or under wet conditions, may become covered with masses of black spores. In storage, spots enlarge and soft-rot bacteria may enter lesions. The disease is transmitted through the seeds. The pathogen can over-season on crop debris.

Materials and Methods

Survey and Estimation of Losses

To assess the occurrence or prevalence and distribution of *Alternaria* leaf spot of cabbage at farmers field in four major growing districts of Rajasthan *viz.*, Udaipur, Jaipur, Bundi and Ajmer. Five villages at a random distance were selected *viz.*, Udaipur (Bujhada, Nai, Sisarama, Kanpur Madri, Jaipur (Chomu, Govindgarh, Kalwar, Murlipura, Nayabas), Bundi (Badodiya, Tikarda, Badanayagaw, Amertiya, Satur) and Ajmer (Kharwa, Vijaynagar, Puskar, Rajgarh and Saradhana). These areas were surveyed during *Rabi* season 2012-13. Such intermitted visits were aimed at recording the severity or incidence of disease, exploring possibility of existence of disease at ten farmers' fields in each village or areas were surveyed. Observation on cabbage plants were taken by counting *Alternaria* leaf spot infected and total number of plants in randomly selected 25 sqm areas at 4 random spots (100 sqm) in each field. In each village, ten fields were selected and plants were examined randomly and scored for disease incidence by using following formula and percent yield losses were calculated.

$$\text{Per cent disease index (PDI)} = \frac{\text{No. of } Alternaria \text{ leaf spot infected plant}}{\text{Total No. of plant}} \times 100$$

$$\int \text{Per cent yield loss} = \frac{\text{Mean yield / plot from healthy plant} - \text{Mean yield / plot from diseased plants}}{\text{Mean yield from healthy plant}} \times 100$$

Collection of Diseased Material and Isolation of the Pathogen

Disease samples of cabbage leaves infected with *Alternaria* leaf spot were collected during *Rabi* 2012-2013 from Udaipur (24-09-2012), Jaipur (28-09-2012), Bundi (25-10-2012) and Ajmer (28-10-2012) districts of Rajasthan. The main aim was to explore possibility of existence of different spp. and/or variables of *Alternaria* leaf spot pathogen.

The infected aerial parts of the diseased samples were carefully placed in polythene bags, properly tagged and brought to the laboratory. Isolations of the pathogen were attempted from all samples. These infected aerial parts were thoroughly washed in running tap water to remove the adhering soil. These were then cut into small pieces with the help of a sterilized scalpel, washed in sterilized water, surface sterilized by dipping in 0.1 percent mercuric chloride (HgCl₂) for two minutes, rinsed thrice in sterile distilled water and were incubated at 28±1 °C for growth. Sub cultures were made from the periphery of the mycelial growth which appeared after 3-4 days. Udaipur (UDR) isolate was used for further study purpose.

Identification of the Pathogen

Cultural characters of all isolates were studied by growing them on PDA at 28±1 °C. The colonies frequently showed sectoring. Each sector was carefully separated by transferring on to fresh PDA plates by hyphal tip culture technique and by single spore method using a dummy objective and maintained on PDA slants for further studies and designated as UDR, JPR, BND and AJR isolate. The sporulating cultures of *A. brassicicola* were identified on the basis of morphological characters of somatic and reproductive structures with the help of standard literature (Rao, 1964). These all cultures were maintained on PDA slants at 4 °C for further study.

Results and Discussion

Collection of Disease Samples

The disease samples were collected in *Rabi* season of 2012-13

from severely infected cabbage plants from four different cabbage growing districts of Rajasthan, viz., Udaipur, Jaipur, Bundi and Ajmer to explore the possibility of existence of variable populations of the *Alternaria* leaf spot pathogen. The farmers of these areas mostly grow local land races of cabbage. The isolates of *A. brassicicola* recovered from different plant samples and used in present study are listed in Table-1.

Occurrence, Distribution, Prevalence and Estimation of Losses of *Alternaria* Leaf Spot in Cabbage Growing Areas of Rajasthan

The disease *Alternaria* leaf spot was found to be prevalent in almost all the cabbage growing areas. It was revealed that disease appeared in most of the fields surveyed in the range of 26.3 to 34.8 percent, which evidences its distribution and occurrence in large areas (Table -1).

Among the 25 villages, maximum PDI (37.5%) was recorded at Bujhada village of district Udaipur followed by Rajgarh (23.6%) village of Ajmer district among randomly ten fields each of five villages surveyed in four districts of Rajasthan viz., Udaipur, Jaipur, Bundi and Ajmer.

The average maximum mean PDI 34.8% was recorded at Udaipur district followed by Jaipur district (32.4%), Bundi district (30.3) and minimum PDI (26.3%) was recorded from the fields of Ajmer district. However, maximum yield (220.6 kg/100m²) and minimum yield losses (26.5%) was recorded in Ajmer followed by Bundi district (208.8 kg/100 m²; 30.4%), Jaipur district (203 kg/100 m²; 32.3%), respectively. Whereas, lower yield (196.2 kg/100 m²) and maximum yield losses (34.6%) were recorded in Udaipur district fields. This shows that disease incidence, yield and yield losses may vary in different Agro-climatic zones of Rajasthan because under favorable weather conditions the disease progression is fast, which ultimately affects the yield (Table 1).

Table 1: Survey and estimation of losses in major cabbage growing areas of Rajasthan by *Alternaria* leaf spot disease in year 2012-13

Districts	Isolate designation	Average PDI	Yield kg/100m ²		Yield losses (%)
			Healthy plants	Disease plants	
Udaipur	UDR	34.78 (36.13)	196.2	128.3	34.6
Jaipur	JPR	32.45 (34.72)	203	137.4	32.3
Bundi	BND	30.28 (33.38)	208.8	145.3	30.4
Ajmer	AJR	26.31 (30.84)	220.6	162.2	26.5
Mean		30.96 (33.77)	207.15	143.0	30.95
SEm ⁺		0.58			1.01
CD 5%		1.74			3.11
CD 1%		2.4			4.37
CV%		3.8			7.3

*Average 50farmers of 5 villages

Symptomatology

Natural symptoms

The symptoms of *Alternaria* leaf spot on the samples collected from different areas exhibited considerable variations, which are described below:

Udaipur (UDR)

On Old leaves and stem, the initial symptoms occurred as small spots were differentiated into distinct light brown in the center and black colour margins. After the lesions become fully developed, had black margins and dark brown coloured

center. The fully developed lesions were bigger than those on other samples.

Jaipur (JPR)

On Old leaves the initial small lesions were dark brown in the center with black margins. The fully developed spot become differentiated into light brown coloured center with brown margins.

Bundi (BND)

The initial lesions were dark brown in the center with dark purple margins on old leaves. These soon elongated and

became differentiated into dark brown margin and tanned brown coloured centers. Later on lesions merged and leaves become dried

Ajmer (AJR)

The symptoms in this sample initiated as small lesions black to dark brown in colour and the fully developed lesions has distinct black margins and dark brown center. The lesions were smaller than on other samples.

Alternaria blight is now considered as a potential constraint in realizing good yields and losses up to 35 to 40 percent have been reported in brassicae (Faujadar *et al.*, 2007) [3]. The symptoms of this disease were characterized as small dark-brown spots at appearance and turned black on the leaves. At disease progression, numerous enlarged spots and concentric rings became evident which later on gave a shot hole appearance and leaves turned yellow to brown and die prematurely. EL-Mohamedy (2007) [2] reported severe leaf spot disease caused by *A. brassicicola* and similar symptoms on *Brassica oleracea* var. *gongylodes*.

Survey for occurrence and distribution of disease was necessary because there are no reports and records available on this disease in Rajasthan. It has been found that percent *Alternaria* leaf spot disease incidence was highest in Udaipur district followed by Jaipur, Bundi and Ajmer districts of Rajasthan. The plants are affected by *Alternaria brassicicola* when seedlings reaches to maturity and by this time if it is severely attacked by leaf spot pathogen, causes maximum yield losses. In present study, maximum disease incidence (34.78%) and percent yield losses (34.6%) was recorded in cabbage fields of Udaipur district which was followed by Jaipur district, where 32.45% disease and 32.3% yield losses were recorded. Further, minimum 26.31 percent disease and yield losses (26.5%) were recorded in cabbage growing fields of Ajmer district. These results are in agreement of Azevedo *et al.* 2000 [1] who conducted similar survey for *Alternaria brassicicola* on cabbage in Agreste region of pernmbuco state, North East Brazil. Moreover, they reported 9.14 percent disease incidence and 22.15 percent yield losses. Whereas, perusal of available literature showed that, survey and estimation of losses caused by *Alternaria* leaf spot disease in cabbage is not reported in Rajasthan and India.

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