

Original Research Article

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Prevalence of Fusarium Wilt of Chickpea in the Agro-ecological condition of Undulating Red and Lateritic zone of West Bengal, India

Suman Patra, Mohan Kumar Biswas* and Asish Mahato

Department of Plant Protection, Palli-Siksha Bhavana, Visva-Bharati,
Sriniketan, West Bengal-731236, India

*Corresponding author

ABSTRACT

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Chickpea (*Cicer arietinum* L.) is one of the major pulses in human diet for essential source of inexpensive protein. Wilt disease is one of the major constraints in production of chickpea caused by *Fusarium oxysporum* f. sp. *ciceri* is widespread in chickpea growing areas resulting in considerable economic losses. Surveys were conducted during the *rabi* season of 2014-2015 and 2015-16 to obtain information on the distribution and natural incidence of chickpea wilt in the Agro-ecological condition of undulating red and lateritic zone of West Bengal, India. A mean disease incidence ranging from 13.90% to 27.76 % was observed during both of the years of survey. Comparison of the incidence level of wilt disease in three districts the pooled analysis indicated that the district Purulia had maximum level of disease incidence ranging from 21.45 to 27.76% followed by Bankura district 19.84 to 24.87%. Birbhum district was noticed with less incidence levels ranging from 13.90 to 23.85% during seasons under surveyed. It was evident from the investigation that the incidences of *Fusarium* wilt disease of chickpea varied with the location, variety and season. The study provided an elementary idea about the disease severity pattern in the zone.

Introduction

Pulses continue to be an important ingredient of human diets especially among the huge vegetarian population in the country. Chickpea (*Cicer arietinum* L.) one of them major pulse crops. It is the native of South-West Asia and Mediterranean region as the primary centers of origin with Ethiopia as the secondary centers. It is an important pulse crop of tropical and subtropical and temperate regions of the world. Chickpea is the third most important pulse crop, after dry bean and peas, produced in the world. It accounts for 20% of the world pulses production. Major producers of chickpea include India, Pakistan

and Mexico. Six countries including India, Australia, Turkey, Myanmar, Pakistan and Ethiopia account for about 90% of world chickpea production. Chickpea is high in protein, low in fat and sodium, cholesterol free and is an excellent source of both soluble and insoluble fiber, as well as complex carbohydrates, vitamins and minerals especially calcium, phosphorous, iron and magnesium (Roy *et al.*, 2010). It stresses by several biotic and abiotic factors. Among of them *Fusarium* wilt is the major limiting factor in chickpea production, caused by fungal pathogen *Fusarium oxysporum* f. sp.

ciceri (Padwick) Matuo and K. Sato. Chickpea wilt is the most destructive disease in India and also first reported from India in 1918 (Patil *et al.*, 2015). This disease has been reported from 33 countries of the world causing 10-15% yield losses annually depending upon the environment condition (Nene *et al.*, 1996). Sometimes under favorable conditions, there is a total loss of crop and yield (Haware and Nene, 1980; Halila and Strange, 1996, Navas-Cortés *et al.*, 2000). The pathogen can infect at all stages of plant growth with more incidences in flowering and pod filling stage. The wilt appeared in field within three to four week after sowing, if the variety is susceptible (Haware, 1990). Pathogen is seed-borne and soil, saprophytic fungus optional in absence of its host, and it can survive on plant debris in soil for 6 years (Haware *et al.*, 1978).

Fusarium wilt disease of chickpea was prevalent at Eastern plateau of India i.e. Ranchi, Dumka, Darisai and Chatra and the disease incidence was varied from 38.7 to 59.2% (Kumar *et al.*, 2012). Therefore the present study was carried to find out the occurrence and distribution pattern of *Fusarium* wilt disease of chickpea in the Agro-ecological condition of undulating red and lateritic zone of West Bengal.

Materials and Methods

The present study was conducted at different locations of different district under the undulating red and lateritic zone of West Bengal during two consecutive year viz., 2014-15 and 2015-16. To conduct the survey, fields of important chickpea growing areas of Birbhum, Bankura and Purulia district were selected viz. Raipur, Bolpur-Sriniketan, Birbhum farmer's field, Sian, Bolpur-Sriniketan, Birbhum farmer's field, Kirnahar, Nanoor, farmer's field, Ghurisa, Illambazar, Birbhum farmer's field, Hetampur,

Dubrajpur, Birbhum farmer's field, Chhatna, Bankura farmer's field, Simlapal farmer's field, Araldihi, Indpur, Bankura, farmer's field, Balarampur, Purulia farmer's field, Daldali, Hura, farmer's field and Muradi, Santuri, Purulia farmer's field were undertaken for the study. In each place, four fields of more or less uniform size were selected at random. The incidence of the disease in chickpea field was assessed by recording the number of plants showing wilt disease symptoms such as root rotting, yellowing of leaves, wilting of plants /m² of a randomly selected area. The observations were taken periodically at 35, 50 and 65 days after sowing.

Per cent disease incidence was calculated by using the following formula,

$$\text{Percent Disease Incidence} = \frac{\text{No. of plants showing wilting symptom}}{\text{Total no. of plants}} \times 100$$

Results and Discussion

To obtain information on the natural incidence of *Fusarium* wilt disease of chickpea, surveys were conducted during the *rabi* season 2014-15 and 2015-16 in different locations of undulating Red and Lateritic zone of West Bengal i.e. Birbhum, Bankura and Purulia districts to record the severity of the disease and the data recorded have been presented in the Table 1 and 2.

It was evident from both the tables that the severity of *Fusarium* wilt disease of chickpea varied with the location, variety and season. A maximum Percentage of Disease Incidence (PDI) of the wilt disease ranging from 11.46 % to 26.37 % was obtained during 2014-15 (Table 1) while during the year 2015-16 it was ranging between 16.34 % and 29.14 % (Table 2). The maximum percent disease incidence of 26.37 was found in district Purulia followed by district Bankura 23.29% and minimum

incidence was observed in Birbhum district 23.07% during the year 2014-15 (Table 1; Fig. 1). While, more or less similar trend was observed during the year 2015-16 with maximum incidence in district Purulia on 29.14% followed by Bankura district on 26.45% and minimum incidence in Birbhum district 24.63% (Table 2; Fig. 2).

Among the locations surveyed, percent disease incidence (PDI) was maximum in the predominant variety B 75 at the village Muradi of Santuri block under Purulia district during both the years of survey (26.37 and 29.14 PDI during 2014-15 and 2015-16 respectively) while, it was minimum on 11.46 and 16.34% at the village Kirnahar of Nanoor block, Birbhum in the variety Anuradha during 2014-15 and 2015-16 respectively. While comparison of the incidence level of

wilt disease in three districts the pooled analysis (Table 3) indicated that the district Purulia had maximum level of disease incidence ranging from 21.45 to 27.76% followed by Bankura districts 19.84 to 24.87%.

Birbhum district was noticed with less incidence levels ranging from 13.90 to 23.85% during seasons under surveyed. Variety B 75 was found to be more infected with wilt pathogen in both the years than others this is may be due to susceptible nature of the variety and its rhizospheric microbial population had in comparison to others variety. Variety Anuradha are moderately resistant to *Fusarium* wilt disease which could be the main reason for low disease incidence.

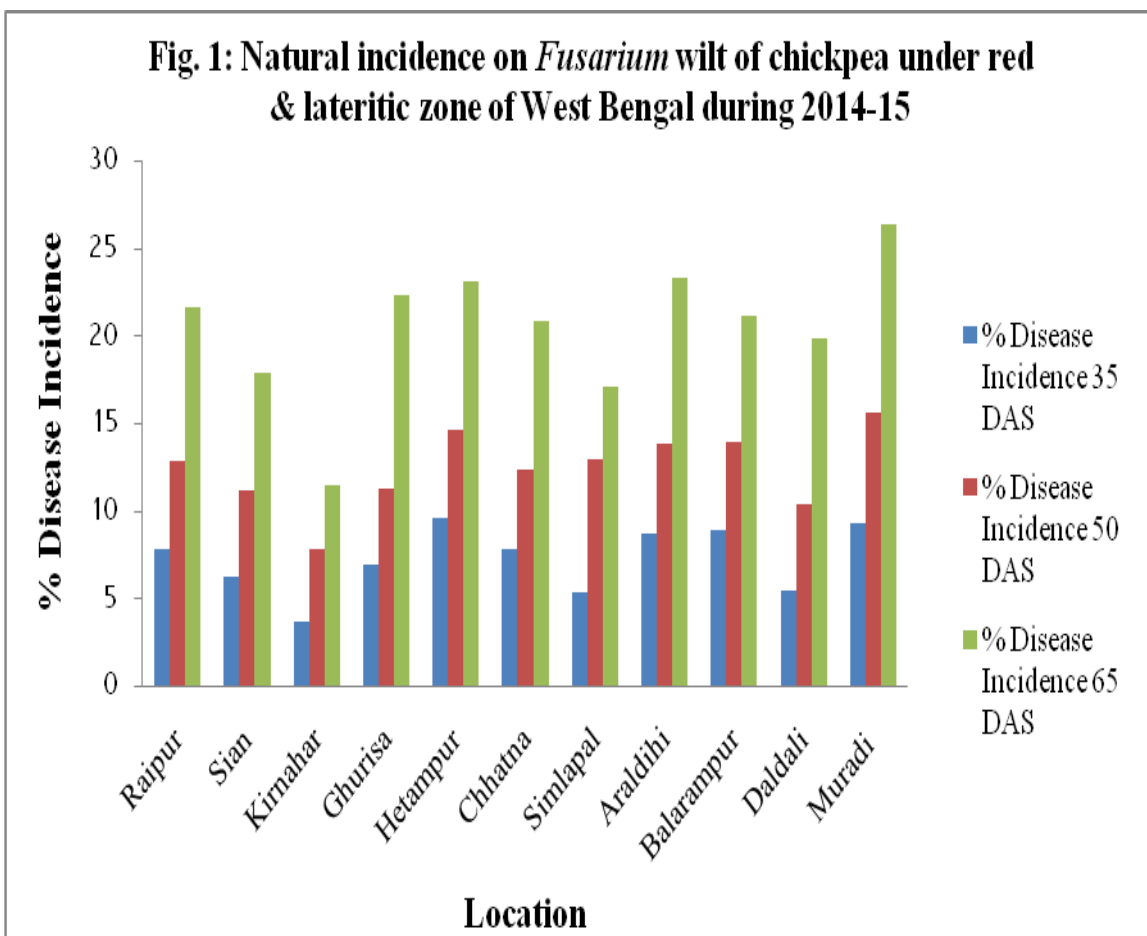


Fig. 2: Natural incidence on *Fusarium* wilt of chickpea under red & lateritic zone of West Bengal during 2015-16

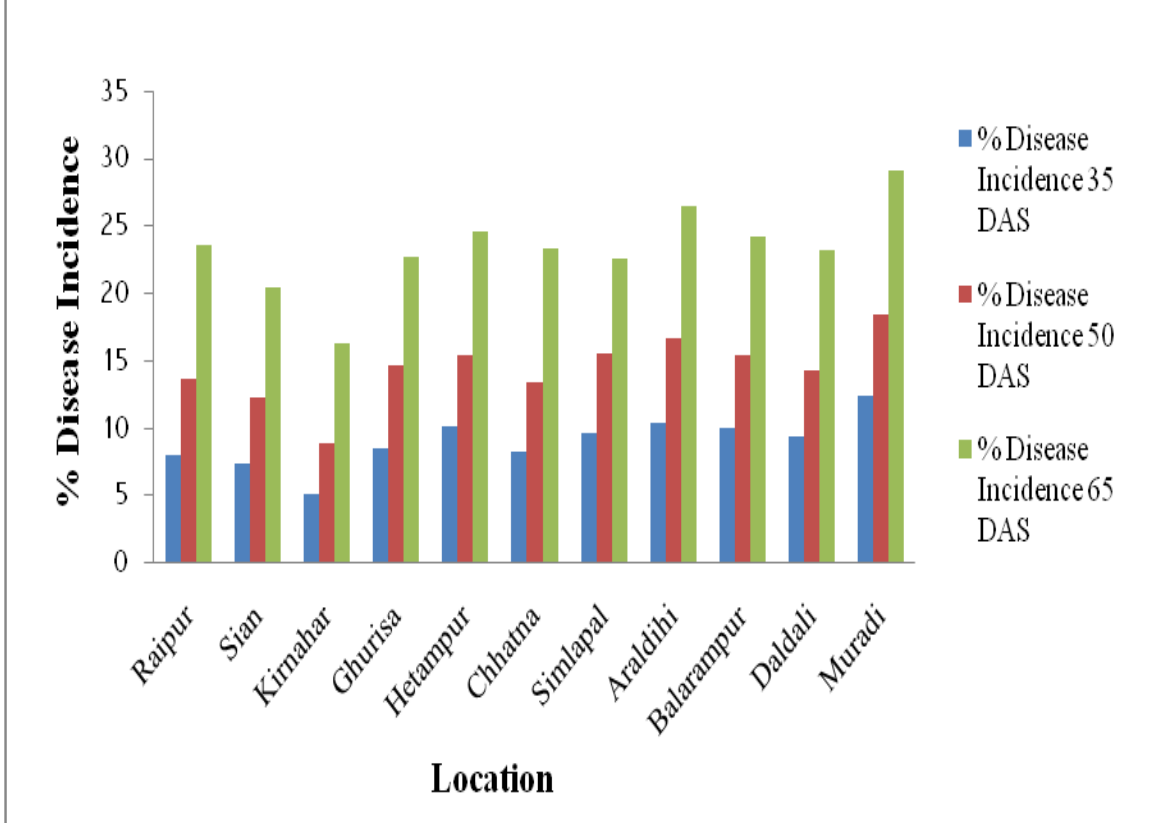


Plate.1 Survey of *Fusarium* wilt incidence



Plate.2 Typical symptoms of *Fusarium* wilt of chickpea

Table.1 Natural incidences of *Fusarium* wilt of chickpea under red and lateritic zone West Bengal during 2014-15

Sl No	District	Block	Village	Variety grown	% Disease Incidence		
					35 DAS	50 DAS	65 DAS
1	Birbhum	Bolpur-Sriniketan	Raipur	Mahamaya-2	7.76	12.86	21.64
			Sian	Mahamaya -1	6.18	11.23	17.89
		Nanoor	Kirnahar	Anuradha	3.67	7.82	11.46
		Illambazar	Ghurisa	B 75	6.91	11.24	22.31
		Dubrajpur	Hetampur	B 75	9.56	14.62	23.07
2	Bankura	Chhatna	Chhatna	Mahamaya -1	7.78	12.35	20.78
		Simlapal	Simlapal	Mahamaya-2	5.35	12.88	17.12
		Indpur	Araldihi	B 75	8.67	13.79	23.29
3	Purulia	Balarampur	Balarampur	Mahamaya-2	8.92	13.87	21.13
		Hura	Daldali	Mahamaya-1	5.46	10.34	19.86
		Santuri	Muradi	B 75	9.23	15.56	26.37

Table.2 Natural incidences of *Fusarium* wilt of chickpea under red and lateritic zone West Bengal during 2015-16

Sl No	District	Block	Village	Variety grown	% Disease Incidence		
					35 DAS	50 DAS	65 DAS
1	Birbhum	Bolpur-Sriniketan	Raipur	Mahamaya-2	8.09	13.71	23.62
			Sian	B 75	7.41	12.26	20.41
		Nanoor	Kirnahar	Anuradha	5.12	8.93	16.34
		Illambazar	Ghurisa	Mahamaya-2	8.56	14.68	22.66
		Dubrajpur	Hetampur	B 75	10.19	15.46	24.63
2	Bankura	Chhatna	Chhatna	Mahamaya -1	8.31	13.43	23.38
		Simlapal	Simlapal	Mahamaya-2	9.67	15.56	22.56
		Indpur	Araldihi	B 75	10.45	16.63	26.45
3	Purulia	Balarampur	Balarampur	Mahamaya-2	10.07	15.43	24.27
		Hura	Daldali	Mahamaya-1	9.42	14.32	23.21
		Santuri	Muradi	B 75	12.46	18.43	29.14

Table.3 Natural incidence of *Fusarium* wilt of chickpea under red and lateritic zone West Bengal (Comparative study) through pooled analysis

Sl No.	District	Block	Village	Terminal Disease Incidence (%)		
				2014-15	2015-16	Average
1	Birbhum	Bolpur-Sriniketan	Raipur	21.64	23.62	22.63
		Bolpur-Sriniketan	Sian	17.89	20.41	19.15
		Nanoor	Kirnahar	11.46	16.34	13.90
		Illambazar	Illambazar	22.31	22.66	22.49
		Dubrajpur	Hetampur	23.07	24.63	23.85
District average				19.27	21.53	20.40
2	Bankura	Chhatna	Chhatna	20.78	23.38	22.08
		Simlapal	Simlapal	17.12	22.56	19.84
		Indpur	Araldihi	23.29	26.45	24.87
District average				20.40	24.13	22.26
3	Purulia	Balarampur	Balarampur	21.13	24.27	22.70
		Hura	Daldali	19.86	23.21	21.45
		Santuri	Muradi	26.37	29.14	27.76
District average				22.45	26.61	24.00

Higher incidence of *Fusarium* wilt of chickpea in Purulia and Bankura districts in comparison to Birbhum districts was probably due to the higher range of soil and atmospheric temperature which help the pathogen *Fusarium oxysporum* f.sp. *ciceri* for faster multiplication and growth in soil. The disease was increased at a slower rate initially but found to be increased at a faster rate between 50 to 65 DAS of crop was probably due to the increased soil temperature and occasional rain during mid-January to mid-February which made atmosphere more congenial for the development of *Fusarium oxysporum* f.sp. *ciceri* in soil of lateritic belt of West Bengal. In general, the disease incidence was more in 2015-16 than 2014-15.

Looking into the block averages (Table 3), Santuri block of Purulia district recorded highest disease incidence in both the years of survey with a mean disease severity of 27.76 % and Nanoor block of Birbhum district recorded least disease incidence with a mean disease severity of 13.90 %. Kapoor *et al.*,

(1991) observed that chickpea wilt disease incidence ranged from 2-90% at Himachal Pradesh, India. Shrivastava *et al.*, (2002) conducted a survey in Vindhyan plateau zone of Madhya Pradesh, India, against prevalence of wilt and dry root diseases in chickpea found greatest wilt incidence at Sehore (25%), followed by Rajgarh, Bhopal and Vidisha (20%). Dubey *et al.*, (2010) surveyed different states of India and found *Fusarium* wilt incidence of chickpea varied from 14.1 to 32.0 %, also said that it is prevalent in almost all chickpea growing areas of the world. Ghosh *et al.*, (2013) reported incidence of chickpea wilt was ranged from 9.7% - 13.8% in central and southern parts of India. These findings also corroborated with the reports of Biswas and Ali (2017) where they noticed similar trends of *Fusarium* wilt of chickpea in lateritic belt of West Bengal.

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