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Vivek Kashyap
Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Jagdish Kumar Patidar
Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Reeti Singh
Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

RK Pandya
Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Corresponding Author:
Vivek Kashyap
Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh, India

Occurrence and distribution of chickpea wilt in central part of India

Vivek Kashyap, Jagdish Kumar Patidar, Reeti Singh and RK Pandya

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Abstract
A survey was conducted in 2014-2015 *Rabi* season to obtain information on the distribution and incidence of chickpea wilt in respect of soil type and irrigation condition. Local cultivars predominant in most farmer's field. Wilt disease was found at all the sites and incidence ranged from 1.69 to 18.67% irrespective of cultivar type and locations. The result indicated that wilt is recently highly distributed in all visited chickpea growing areas of the central part of India. The wilt incidence was more in rainfed condition (11.37%) as compared to irrigated condition (7.56%). On the basis of the survey, deep black soil was found most suitable for wilt development,

Keywords: Survey, Chickpea wilt, disease incidence, soil type, irrigation condition

1. Introduction
Chickpea (*Cicer arietinum* L.) is an important pulse crop, which belongs to Leguminoceae family, ranking third after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.) The centre of origin of chickpea is in Eastern Mediterranean (Aykoid and Doughty, 1964). India is largest producer of chickpea in world sharing 66.78 per cent in area and 66.13 per cent in production (Anon. 2018a) [1]. In India, chickpea is grown on 10.56 million ha area with production 12.30 million tonnes and productivity 1063 kg/ha. The production of chickpea in Madhya Pradesh is 4.60 million tonnes with productivity 1280 kg/ha which covered nearly 3.59 million ha of area. Madhya Pradesh contributes about 40.92 per cent share in total production of country (Anon., 2018b) [2]. It is the important grain legume grown for protein rich seeds for human consumption and to maintain the soil fertility by its nitrogen fixing capability. Chickpea seeds contain 20% protein, 64% carbohydrates, 47% starch, 5% fat, 6% crude fibre, 6% soluble sugar and 3% ash, minerals such as calcium (202 mg), phosphorus (312mg), iron (10.2mg), vitamin C(3.0 mg),calorific value (360 cal), small amounts of B complex, fibre (3.9g) and moisture (9.8g) (Dhawan *et al*., 1991) [5].
F. oxysporum Schlechtend. Fr. f. sp. *ciceris* (Padwick) Matuo and K. Sato causing Fusarium vascular wilt is the major limiting factor in chickpea production (Jalali and Chand, 1992; Haware, 1990 and Nene and Reddy, 1987) [9,8,14]. It was first reported in Indo-Pak subcontinent (Butler, 1918) [4]. In general, the disease causes substantial yield losses which may reach even 100 per cent under favourable weather conditions (Jalali and Chand, 1992) [9]. A comprehensive survey of chickpea diseases in central parts of India was conducted in 2014-2015. The objectives of the survey were: (1) to find out the occurrence and distribution of chickpea wilt; (2) to find out the incidence of the wilt; 3) to assess the effect of irrigation or rainfed condition on the development of the wilt.

2. Methods
The survey for the occurrence and severity of chickpea wilt was made during crop season 2014-15. Observation was recorded mostly from farmers field under natural conditions. Data were recorded at different places and dates. The five fields of each place were selected at random. Irrigation condition and soil type also recorded for each place. Five hundred plants were taken randomly from the field and the number of diseased and healthy plants were then sorted out. Disease incidence was calculated by using the formula given below and expressed in percentage.

$$\text{Wilt incidence\%} = \frac{\text{Diseased plants}}{\text{Total number of plants}} \times 100$$

The percentage infection of each field in a place was used for calculating the place average. The sample was critically examined for the presence of causal organism.

3. Result and discussion

3.1: Diseases and Regions

During the investigation 40 places visited under 15 districts viz., Gwalior (2), Shivpuri (5), Guna (4) Rajgarh (2), Sajapur (2), Sehore (1), Dewas (1), Indore (1), Khargone (4), Khandwa (2) Burhanpur (2), Barwani (4), Alirajpur (2), Jhabua (2) and Dhar (6) and wilt incidence was recorded. Wilt was found at all the sites and the incidence ranged from 1.69 to 18.67%. The mean maximum wilt incidence incidence was recorded in Jhabua (18.67%) followed by Sardarpur (18.61%), Bhurhanpur (18.28%), Sendwa (17.69%), Bhikangaon (17.68%) and Bagh (17.35%), while Mohana (1.69%) followed by Guna (1.94%), Ghatigaon (2.87%), Binaganj (3.93%), Lukwasa (4.53), Goda (5.29%) and Kolarash (6.14%). Ghosh *et al.* (2013) [7] conducted the survey from central and southern parts of India and reported that the incidence of wilt and black root rot disease ranged from 9.7% - 13.8% and 6.6% - 7.4% respectively. Dubey *et al.* (2010) [6] surveyed different states of India, namely Punjab, Haryana, Delhi, Rajasthan and Jharkhand and reported that the incidence of wilt in the areas surveyed varied from 14.1 to 32.0% with the maximum in the Rajasthan state followed by Jharkhand and the minimum in the state of Punjab.

3.2: Diseases and irrigation conditions

During the investigation, 27 places found in rainfed condition, while 13 places were found in irrigated condition. Data presented in table-1 revealed that the wilt incidence found more severe from rainfed condition (11.37%) compare to irrigated condition (7.65%). Mina and Dubey (2010) reported that soil moisture was found negatively correlated with wilt incidence of chickpea. Abiotic factors, including soil moisture and temperature, can significantly influence the development of Fusarium wilt of chickpeas (Bhatti and Kraft, 1992; Navas-Cortés *et al.*, 2000) [3,13].

Table 1: Prevalence of chickpea diseases in Central Part of India during *rabi* (2014-15)

S. No.	Name of the village visited	District	Rainfed/irrigated	Soil type	Fusarium wilt	
					Rang	Average
1	Ghatigaon	Gwalior	Rainfed	Alluvial Soil	1-5%	2.87
2	Mohana	Gwalior	Rainfed	Alluvial Soil	1-3%	1.69
3	Lukwasa	Shivpuri	Rainfed	Alluvial Soil	2-8%	4.53
4	Goda	Shivpuri	Rainfed	Alluvial Soil	3-7%	5.27
5	Shivpuri	Shivpuri	Rainfed	Alluvial Soil	5-11%	8.81
6	Kolarash	Shivpuri	Rainfed	Alluvial Soil	3-9%	6.14
7	Badarwas	Shivpuri	Rainfed	Alluvial Soil	5-10%	6.97
8	Binaganj	Guna	Rainfed	Alluvial Soil	2-6%	3.93
9	Guna	Guna	Irrigated	Alluvial Soil	0-4%	1.94
10	Raghogarh	Guna	Rainfed	Alluvial Soil	3-11%	7.26
11	Rudhiyai	Guna	Rainfed	Alluvial Soil	5-9%	6.57
12	Biaora	Rajgarh	Irrigated	Medium black soil	3-8%	6.14
13	Sarangpur	Rajgarh	Rainfed	Medium black soil	4-14%	11.24
14	Sajapur	Sajapur	Rainfed	Medium black soil	7-13%	10.63
15	Makshi	Sajapur	Rainfed	Medium black soil	4-15%	9.47
16	Panchor	Sehore	Rainfed	Medium black soil	8-13%	11.98
17	Dewas	Dewas	Irrigated	Medium black soil	6-11%	8.36
18	Mau	Indore	Rainfed	Deep black soil	12-17%	15.09
19	Barwaha	Khargone	irrigated	Deep black soil	5-11%	8.93
20	Bhikangaon	Khargone	Rainfed	Deep black soil	12-22%	17.68
21	Khargone	Khargone	Irrigated	Deep black soil	8-11%	9.57
22	Segaon	Khargone	Rainfed	Deep black soil	11-18%	15.07
23	Deshgaon	Khandwa	irrigated	Deep black soil	5-12%	8.67
24	Khandwa	Khandwa	Rainfed	Deep black soil	12-19%	15.91
25	Asirgarh	Burhanpir	Irrigated	Medium black soil	6-11%	8.73
26	Bhurhanpur	Burhanpir	Rainfed	Medium black soil	15-21%	18.28
27	Jhulwania	Barwani	Rainfed	Medium black soil	12-17%	14.53
28	Sendwa	Barwani	Rainfed	Medium black soil	11-24%	17.69
29	Rajpur	Barwani	Irrigated	Medium black soil	7-11%	9.06
30	Barwani	Barwani	Irrigated	Deep black soil	4-9%	6.54
31	Kukshi	Dhar	Irrigated	Deep black soil	6-9%	7.97
32	Bagh	Dhar	Rainfed	Deep black soil	13-21%	17.35
33	Sardarpur	Dhar	Rainfed	Medium black soil	15-22%	18.61
34	Dhar	Dhar	Rainfed	Medium black soil	11-18%	15.66
35	Ghatabillor	Dhar	Rainfed	Medium black soil	4-14%	10.91
36	Betma	Dhar	Irrigated	Medium black soil	2-8%	6.54
37	Bhabra	Jhabua	Irrigated	Deep black soil	5-11%	7.73
38	Jhabua	Jhabua	Rainfed	Medium black soil	14-23%	18.67
39	Mangode	Alirajpur	Irrigated	Medium black soil	8-13%	9.27
40	Alirajpur	Alirajpur	Rainfed	Deep black soil	12-18%	14.19

Table 2: occurrence of major chickpea diseases in different soil types and irrigation condition

Irrigation conditions	Dry root rot incidence (%)	
	Range	Average
Rainfed	1.69-18.67	11.37
Irrigated	1.94-9.57	7.65
Soil types	**Dry root rot incidence (%)**	
	Range	**Average**
Alluvial	1.69-8.81	5.09
Medium black	6.14-18.67	12.10
Deep black	6.65-17.68	12.06

3.3: Diseases and soil types

During the survey, three types of soil were recorded in which chickpea crop cultivated. Maximum 17 places recorded under medium black soil followed by deep black soil (12 places) and alluvial (11 places). Medium Black (12.10%) and deep black soil (12.06%) found more suitable for development of wilt incidence compared to alluvial soil (5.06%). Manjunatha *et al.* (2011) [11] conducted survey during Rabi season in 2008 revealed that dry root rot of chickpea varied from locality to locality, obviously due to different soil conditions (Black/Red soil conditions). Khan *et al*. (2012) [10] agreed with this finding.

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