



# STUDIES ON THE STATUS OF CHICKPEA WILT IN RAJASTHAN

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## ABSTRACT

Chickpea (*Cicer arietinum* L.) is the third most important pulse crop in the world. Chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceri* posing a threat to the successful cultivation of chickpea crop in Rajasthan. Surveys conducted on the disease incidence during two consecutive years: 2011-12 and 2012-13 showed that it was prevalent in all the areas surveyed with disease incidence ranging from 27.43 to 45.88 per cent depending upon the place and variety with an average incidence of 37.48 per cent. It was the highest (45.88 %) in Mohangarh area of district Jaisalmer and minimum (27.43%) in Ahore area of district Jalore. Division wise highest disease incidence (40.58%) was observed in Jaipur division followed by Jodhpur division (37.48%), Ajmer division (37.46%) and Bikaner division (34.31%). The disease incidence was observed more in the seedling stage *i.e.* 23.96 and 21.90 per cent during 2011-12 and 2012-13, respectively. Whereas it was only 14.50 and 14.60 per cent at maturity stage during 2011-12 and 2012-13, respectively. It was also observed for the first time that bold seeded chickpea varieties *viz.*, RSG 44, RSG 807, RSG 895, KPG-2 and GNG 1488 were more prone in exhibiting the wilt disease than that of small seeded or deshi varieties. The wilt symptoms under Jaipur conditions were appeared on the 20-30 days old seedlings during early November and continued to be observed up to first fortnight of April. Typical wilt symptoms were seen at seedling and maturity stage. The seeds collected from partially wilted plants were wrinkled, shriveled and smaller in size.

**Key Words :** *Wilt, fusarium oxysporum f. sp. ciceri, chickpea, rajasthan.*

Chickpea (*Cicer arietinum* L.) is also known as gram, Bengal gram, or Spanish pea and is considered to be the third most important pulse crop of the world. In India, it is an important source of protein in human diet. It plays a significant role in sustaining production of the subsistence farming system. Major production of chickpea comes from Central and Northern India. However, its area and production are increasing in Southern states. Chickpea was grown on 9.19 million hectares with the production of 8.22 million tonnes and productivity 895 kg/ha. during 2010-11 in India (Anonymous, 2012). Where as it is grown on 1.78 million hectares with the production of 1.60 million tonnes and productivity 899 kg/ha. during 2010-11 in Rajasthan (Anonymous, 2012). Its productivity is quite low due to several abiotic and biotic stresses. Among the biotic stresses, diseases are the major constraint. The major diseases of chickpea crop

are Ascochyta blight, Fusarium wilt, Dry root rot, Botrytis gray mould, Pea leaf roll virus, Alternaria blight and Black root rot. Among the fungal diseases of chickpea, the wilt caused by *Fusarium oxysporum* Schlecht. emend Snyder & Hans. f. sp. *ciceri* (Padwick) Snyder & Hans. is the most serious one. The disease occurs in Algeria, Argentina, Australia, Bangladesh, China, Colombia, Egypt, Ethiopia, Hungary, India, Iran, Iraq, Italy, Kenya, Malaysia, Mexico, Myanmar, Nepal, Pakistan, Peru, Spain, Sri Lanka, Sudan, Syria, Tunisia, Turkey, Uganda, USA, USSR and Zambia (Nene *et al.*, 1996). Depending on the time of occurrence it has been often referred as early or late wilt particularly under North Indian conditions. The wilt observed at the seedling stage *i.e.* from October to November is referred as early wilt, while, that which is encountered at post flowering stage *i.e.* from February to March as late wilt. However, in some parts of India the disease may

occur at any time from seedling to the podding stage. The disease appears throughout all the growth stages of the plants beginning from seedling to pod stage. It cause an average 10 per cent loss in yield and the damage has been observed to extent up to 61 per cent and 43 per cent at seedling and maturity stages, respectively (Nema and Khare, 1973; Singh *et al.*, 1989). Early wilting is known to cause more losses than that of late wilting (Haware and Nene, 1980).

So far as the history of chickpea wilt is concerned, the first mention of the disease was made by Butler in 1918. McKerral (1923) indicated the soil-borne nature of the disease as the specimens collected from Burma invariably yielded *Fusarium* species. Subsequently, the disease was observed in different places of the Karnataka (Padwick, 1940), Madhya Pradesh (Gupta *et al.*, 1987) and Himanchal Pradesh (Kapoor *et al.*, 1991). The incidence of the disease varied from place to place, it was reported 31.5 per cent in Ujjain, M. P. (Gupta *et al.*, 1987) and 43.75 per cent in Solan, H. P. (Kapoor *et al.*, 1991). Grewal *et al.* (1974) estimated a loss of 30-60 per cent in grain yield depending upon the stage of infection. Sattar *et al.* (1953) estimated a loss of approximately 1 million US \$ due to this disease in Pakistan. The survey of main chickpea producing areas in Ankara province during May to August 1992-94 revealed that *Fusarium oxysporum* (49%) was the most important disease of chickpea (Dolar, 1996).

## MATERIALS AND METHODS

To assess the prevalence and incidence of the *Fusarium oxysporum* f. sp. *ciceri* causing chickpea wilt, surveys were conducted during the crop seasons of 2011-12 and 2012-13 in twelve locations of four divisions *viz.*, Jaipur, Ajmer, Bikaner and Jodhpur of Rajasthan, where the chickpea is grown in larger areas. The locations included Phagi (Jaipur), Dudu (Jaipur), Sri Madhopur (Sikar), Udaipur Wati (Jhunjhunu) of Jaipur division, Niwai (Tonk), Kheemsar (Nagour) of Ajmer division, Nokha (Bikaner), Sujangarh (Churu), Nohar (Hanumangarh) of Bikaner division, Osian (Jodhpur), Mohangarh (Jaisalmer), and Ahore (Jalore) of Jodhpur division.

Total ten fields of each location were surveyed from above twelve locations during the crop season of 2011-12 and 2012-13. One hundred randomly selected plants from each field were collected at seedling and maturity stage. The data on wilt incidence at seedling and maturity stages were taken from the same field. All the specimens were examined in the Plant Health Diagnostic Center of Krishi Vigyan Kendra, Chomu (Jaipur) for the presence of disease and casual organism. The disease incidence was calculated in per cent incidence for every location in both the years of crop seasons.

## RESULTS AND DISCUSSION

The results presented in Table show that the disease was present and prevalent in all the areas that were surveyed during crop seasons: 2011-12 and 2012-2013 in the range of 27.43 to 45.88 per cent with an average incidence of 37.48 per cent. The average incidence of wilt amongst all the surveyed areas was found to be 38.46 and 36.50 per cent during the crop seasons 2011-12 and 2012-2013, respectively. The disease incidence (45.88%) was highest in district Mohangarh (Jaisalmer) of the Jodhpur division, followed by Dudu (Jaipur) (44.33%), Phagi (Jaipur) (42.04%), Udaipur Wati (Jhunjhunu) (39.69%), Niwai (Tonk) (39.08%), Nokha (Bikaner) (37.93%), Osian (Jodhpur) (36.27%). Sri Madhopur (Sikar) (36.25%), Kheemsar (Nagour) (35.83%), Sujangarh (Churu) (34.85%) and Nohar (Hanumangarh) (30.14%). It was lowest (27.43%) among all the surveyed areas of Ahore (Jalore).

The division wise maximum (40.58%) disease incidence was found in Jaipur division followed by Jodhpur division (37.48%), Ajmer division (37.46%) and Bikaner division (34.31%). During the survey it was observed that the incidence of wilt was higher at seedling stage. The mean wilt incidences at seedling stage were 23.96 and 21.90 per cent during 2011-12 and 2012-13, respectively, amounting 37.48 per cent of the total wilting whereas it was only 14.50 and 14.60 per cent at maturity stage during 2011-12 and 2012-13, respectively. This study supporting the observations made by Nema and Khare (1973) who reported the disease throughout the crop season with maximum incidence and damage in the chickpea crop at seedling stage. The disease incidence was relatively high in the bold seeded varieties like ., RSG 44, RSG 807, RSG 895, KPG-2 and GNG 1488 as comparison to that observed in small seeded (Deshi) varieties.

Surveys conducted on the disease incidence during two consecutive years: 2011-12 and 2012-13 showed that it was prevalent in all the areas surveyed and supporting the observations of earlier workers (Padwick, 1940; Gupta *et al.*, 1987; Kapoor *et al.*, 1991; Nene *et al.*, 1996) who have reported its occurrence in almost all the chickpea growing areas of India including Karnataka, Madhya Pradesh and Himanchal Pradesh.

The wilt symptoms observed under Jaipur conditions appeared on 20-30 days old seedlings during early November and continued to be observed up to first fortnight of April. The typical wilt symptoms were seen at seedling and adult stage. The wilt symptoms at seedling stage were observed about 2-3 weeks after sowing in first fortnight of November. The whole seedlings were collapsed and lie flat on the ground. The affected seedlings retained almost green colour. Such collapsed seedlings, when uprooted usually show uneven shrinking of the stem above and below the collar region (soil level). The dissected collar region show black discoloration

**Table: Prevalence and incidence of wilt at seedling and maturity stages of chickpea in different locations of Rajasthan**

Sr. No.	Locations	Disease incidence (%)						Pooled mean
		2011-12			2012-13			
		Seedling stage	Maturity stage	Total wilting	Seedling stage	Maturity stage	Total wilting	
A.	Jaipur Division							
1.	Phagi (Jaipur)	27.50 (31.63)*	15.33 (23.03)	42.83 (40.87)	24.71 (29.80)	16.54 (24.00)	41.25 (39.96)	42.04 (40.42)
2.	Dudu (Jaipur)	28.65 (32.36)	17.50 (24.73)	46.15 (42.79)	23.66 (29.10)	18.85 (25.73)	42.51 (40.69)	44.33 (41.74)
3.	Sri Madhopur (Sikar)	24.85 (29.90)	13.66 (21.69)	38.51 (38.36)	22.30 (28.18)	11.70 (20.00)	34.00 (35.67)	36.25 (37.02)
4.	Udaipur wati (Jhunjhunu)	25.33 (30.22)	15.50 (23.18)	40.83 (39.72)	24.75 (29.83)	13.80 (21.81)	38.55 (38.38)	39.69 (39.05)
	Average	26.58 (31.03)	15.50 (23.18)	42.08 (40.44)	23.86 (29.24)	15.22 (22.96)	39.08 (38.69)	40.58 (39.57)
B.	Ajmer Division							
5.	Niwai (Tonk)	23.00 (28.66)	18.50 (25.47)	41.50 (40.11)	22.66 (28.43)	14.00 (21.97)	36.66 (37.26)	39.08 (38.69)
6.	Kheemsar (Nagour)	20.85 (27.17)	13.70 (21.70)	34.55 (36.00)	22.47 (28.30)	14.64 (22.50)	37.11 (37.53)	35.83 (36.77)
	Average	21.93 (27.92)	16.10 (23.66)	38.03 (38.07)	22.57 (28.36)	14.32 (22.23)	36.89 (37.40)	37.46 (37.74)
C.	Bikaner Division							
7.	Nokha (Bikaner)	25.66 (30.43)*	12.70 (20.88)	38.36 (38.27)	22.00 (27.97)	15.50 (23.18)	37.50 (37.76)	37.93 (38.02)
8.	Sujangarh (Churu)	22.50 (28.32)	13.70 (21.72)	36.20 (36.99)	20.60 (26.99)	12.91 (21.06)	33.51 (35.37)	34.85 (36.18)
9.	Nohar (Hanumangarh)	18.50 (25.47)	11.41 (19.74)	29.91 (33.15)	16.71 (24.13)	13.66 (21.69)	30.37 (33.44)	30.14 (33.30)
	Average	22.22 (28.12)	12.60 (20.79)	34.82 (36.16)	19.77 (26.40)	14.02 (21.99)	33.79 (35.54)	34.31 (35.86)
D.	Jodhpur Division							
10.	Osian (Jodhpur)	23.66 (29.11)	14.50 (22.38)	38.16 (38.16)	21.05 (27.31)	13.33 (21.41)	34.38 (35.90)	36.27 (37.03)
11.	Mohangarh (Jaisalmer)	29.75 (33.05)	16.64 (24.07)	46.39 (42.92)	26.66 (31.09)	18.71 (25.63)	45.37 (42.34)	45.88 (42.64)
12.	Ahore (Jalore)	17.33 (24.60)	10.81 (19.20)	28.14 (32.04)	15.21 (22.95)	11.50 (19.82)	26.71 (31.12)	27.43 (31.58)
	Average	23.58 (29.05)	13.98 (21.96)	37.56 (37.80)	20.97 (27.25)	14.51 (22.39)	35.49 (36.57)	36.53 (37.19)
	Overall Average	23.96 (29.31)	14.50 (22.38)	38.46 (38.33)	21.90 (27.90)	14.60 (22.46)	36.50 (37.17)	37.48 (37.75)

\*Angular transformed values are in parenthesis

of internal tissues. The wilt affected mature plants showed typical wilting *i.e.* drooping of the petioles and rachis along with leaflets. The lower leaves became chlorotic, but most of other leaves of the wilted plant retained dull green colour. Gradually, all the leaves turned yellow and then light brown or straw coloured. When transverse cut was given with a sharp blade through the collar region, black discolouration of pith and xylem was seen as described by Dolar (1996) and Nene *et*

*al.* (1996). The seeds collected from partially wilted plants were wrinkled, shriveled and smaller in size.

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