

Survey of Chickpea Wilt caused by *Fusarium oxysporum* f. sp. *ciceri* in Vidisha District of Madhya Pradesh

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ABSTRACT: Chickpea (*Cicer arietinum* L.) is one of the important *rabi* pulse crop grown in Vidisha district of Madhya Pradesh. Madhya Pradesh is leading state in terms of area and production as it contributes around 34 and 41 percent share to the total area and production in the country. The crop is nearly infected by 172 pathogens. Amongst them *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *ciceri* is one of the major disease of chickpea causing losses to the tune of 100 percent in severe condition. Considering the losses caused by wilt disease of chickpea more than 20 percent in Vidisha district of (M.P.). The present study was undertaken to know the status of chickpea wilt in Vidisha district of Madhya Pradesh. Survey was conducted and chickpea wilt disease incidence was recorded during, the *rabi* seasons 2018-19 and 2019-20, covering 180 chickpea fields from 60 locations in 10 tehsils under Vidisha district, distributed under Vindhya plateau zone of M.P. In the two cropping season the mean incidence of chickpea wilt was recorded and it was found maximum in Gyaraspur tehsil (17.87%), followed by Tyonda (17.20 %), Nateran (17.05%), Shamshbad (16.00%), Sironj (15.20%), Kurwai (14.85%), Lateri (13.85%), Vidisha (13.45%), Gulabganj tehsils (12.90%) and Ganjbasoda (12.35 %) respectively. Present study showed that chickpea wilt is highly distributed in all the surveyed areas of Vidisha district of M.P. Variety wise incidence were recorded in Vidisha district where the average mean incidence was more on local cultivar (21.30 %) followed by JG 315 (16.35 %) and JG 74 (15.40 %). However, the minimum incidence of chickpea wilt was recorded on variety JG 12 (15.05%), JG 130 (12.22%) and JG 63 (10.12%).

Keywords: Chickpea, *Fusarium oxysporum*, Survey, Wilt incidence, Vidisha, M.P.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the world's third most important pulse widely grown in many subtropical and warm-temperate regions. M.P. is leading state in terms of area and production as it contributes around 34 and 41 percent share to the total area and production of gram in the country respectively (Annual Report 2017-18, Directorate of Pulses Development). The crop is nearly infected by 172 biotic stress causing agents which includes about 67 fungi, 3 bacteria, 22 viruses and 80 nematodes as reported from 55 countries of the world (Nene *et al.*, 1996). The wilt caused by *Fusarium oxysporum* f. sp. *ciceri* is most devastating, widespread and important throughout the world (Gupta *et al.*, 1997). In India, it has been reported from all the chickpea growing states and causes an annual loss of 10% (Singh and Dahiya, 1973). *Fusarium* wilt results in major economic losses ranging from 10-40% worldwide (Nene *et al.*, 1984).

The disease can strike the crop at any stage of growth (Haware and Nene, 1980). It causes 100% loss under specific conditions (Jalali and Chand, 1992) and at particular growth stages of crop like vegetative and reproductive (Halila and Strange, 1996). The disease causes substantial yield losses which may reach even 100 percent under favorable weather conditions (Jalali and Chand, 1992). It infects chickpea crop with more incidence at flowering and pod formation stage, if crop is subjected to sudden elevation in temperature and water stress (Chaudhry *et al.*, 2007). The yield losses caused by wilt annually under congenial conditions may vary from 10% to 60% (Singh *et al.*, 2007). Depending upon weather condition chickpea wilt can cause 90% yield losses (Venkataramanamma *et al.*, 2018). In early stage of crop wilt incidence is 77-94% whereas, late wilting 24-65% was observed (Sunkad *et al.*, 2019). Considering the losses caused by wilt disease of chickpea. The present study was undertaken to study the present status of chickpea wilt in Vidisha district of Madhya Pradesh.

MATERIALS AND METHODS

A total of 180 samples of farmers fields of chickpea crop exhibiting symptom of wilt were collected from 60 locations of ten tehsils (Sironj, Lateri, Nateran, Vidisha, Gyaraspur, Kurwai, Shamshbad, Tyonda, Gulabganj and Ganjbasoda) of Vidisha district of Madhya Pradesh during *rabi* (2018-19 and 2019-20).

Based on records available at Sub-Divisional Agriculture Officers of the respective districts, roving survey was undertaken to estimate disease incidence and collection of chickpea plants infected with wilt caused by *Fusarium oxysporum* f. sp. *ciceri*. For this purpose, chickpea growing areas of all the ten tehsils of Vidisha district were surveyed. During survey following observations were recorded, total number of chickpea plants/two rows was counted, of which wilt suspected plants were counted separately to calculate percent wilt incidence. Based on numerical data obtained in respect of total number of chickpea plants and wilted plants per field surveyed, percent wilt incidence was calculated (Mayee and Datar 1986).

$$\text{Wilt incidence(\%)} = \frac{\text{Total no. of wilted plants}}{\text{Total no. of plants observed}} \times 100$$

RESULTS AND DISCUSSION

Distribution and tehsil wise incidence of the disease: Results (Table 1) revealed that in the ten tehsils, surveyed during *rabi* (2018-2019), the average incidence of wilt ranged from 12.60 (Ganjbasoda) to 18.25 (Gyaraspur) percent. However, the chickpea crop grown in the tehsil of Gyaraspur was found to suffer more with wilt incidence of 18.25 percent with overall average incidence of wilt (15.38%). The second highest average wilt incidence of 17.60 percent was recorded from the Tyonda followed by the tehsils of Nateran (17.25%), Shamshbad (16.25%), Sironj (15.60%), Kurwai (15.10%), Lateri (14.20%), Vidisha (13.80%), and Gulabganj (13.20%) with average wilt incidence. Comparatively minimum average wilt incidence of 12.60 percent was recorded in the tehsil of Ganjbasoda.

Table 1: Average wilt incidence (%) of chickpea in Vidisha district of Madhya Pradesh during *Rabi* 2018-19.

Sr. No.	Tehsil	Total number of samples collected	No. of locations	Wilt incidence (%)
1.	Sironj	20	5	15.60
2.	Lateri	15	7	14.20
3.	Nateran	15	5	17.25
4.	Vidisha	20	8	13.80
5.	Gyaraspur	15	5	18.25
6.	Kurwai	20	7	15.10
7.	Shamshbad	15	6	16.25
8.	Tyonda	15	5	17.60
9.	Gulabganj	20	5	13.20
10.	Ganjbasoda	25	7	12.60
Total/Mean		180	60	15.38

During *rabi*, 2019-20 wilt incidence (Table 2) was found to be comparatively minimum to that of during *rabi*, 2018-19. The average incidence of wilt ranged from 12.10 (Ganjbasoda) to 17.50 (Gyaraspur) percent. However, the chickpea crop grown in the tehsil of Gyaraspur was found to suffer more with wilt incidence 17.50 percent and with overall average incidence of wilt (14.76 %). The second highest average wilt

incidence of 16.90 percent was recorded from the Tyonda tehsil. This was followed by the tehsils of Nateran (16.75%), Shamshbad (15.75%), Sironj (14.80%), Kurwai (14.60%), Lateri (13.50%), Vidisha (13.10%), and Gulabganj (12.60%) with average wilt incidence. Comparatively minimum average wilt incidence of 12.10 percent was recorded in the tehsil of Ganjbasoda.

Table 2: Average wilt incidence (%) of chickpea in Vidisha district of Madhya Pradesh during *Rabi* 2019-20.

Sr. No.	Tehsil	Total number of samples collected	No. of locations	Wilt incidence (%)
1.	Sironj	20	5	14.80
2.	Lateri	15	7	13.50
3.	Nateran	15	5	16.75
4.	Vidisha	20	8	13.10
5.	Gyaraspur	15	5	17.50
6.	Kurwai	20	7	14.60
7.	Shamshbad	15	6	15.75
8.	Tyonda	15	5	16.90
9.	Gulabganj	20	5	12.60
10.	Ganjbasoda	25	7	12.10
Total/Mean		180	60	14.76

Distribution and variety-wise seasonal disease incidence: In the ten tehsils of Vidisha district of vindhyan plateau zone surveyed for recording wilt disease incidence, a wide range of chickpea cultivars/varieties and local varieties were grown by the farmers. There results obtained on wilt disease incidence are presented in the Table 3 and 4.

During *rabi* 2018-19, average incidence (Table 3) of wilt on chickpea cultivars/varieties ranged from 10.25 (JG 130) to 22.10 (Local) percent. However, Local cultivar of chickpea was found to suffer more with wilt incidence of 22.10 percent; with overall highest average incidence of wilt (15.38%). The second highest average wilt incidence (16.50 %) recorded on JG 315. This was followed by the cultivars *viz.*, JG 74 (15.80 %), JG 12 (15.30%) and JG 130 (12.35 %) with wilt average

incidence. Comparatively minimum average wilt incidence of 10.25 percent was recorded on the chickpea cv. JG 63.

During *rabi* 2019-20, average incidence (Table 4) of wilt on chickpea cultivars/varieties ranged from 10.00 (JG 63) to 20.50 (Local) percent. However, Local cultivar of chickpea was found to suffer more with wilt incidence of 20.50 percent; with overall highest average incidence of wilt (14.76 %). The second highest average wilt incidence of 16.20 percent was recorded on cv. JG 315.

This was followed by the cultivars *viz.*, JG 74 (15.00 %), JG 12 (14.80%) and JG 130 (12.10%) with wilt average incidence. Comparatively minimum average wilt incidence of 10.00 percent was recorded on the chickpea cv. JG 63.

Table 3: Variety wise average wilt incidence (%) of chickpea in Vidisha districts of Madhya Pradesh during Rabi 2018-19.

Sr. No.	Variety	Total number of samples collected	No. of locations	Wilt incidence (%)
1.	Local	30	10	22.10
2.	JG 74	25	08	15.80
3.	JG 315	35	10	16.50
4.	JG 12	30	10	15.30
5.	JG 130	35	12	12.35
6.	JG 63	25	10	10.25
Total/Mean		180	60	15.38

Table 4: Variety wise average wilt incidence (%) of chickpea in Vidisha district of Madhya Pradesh during Rabi 2019-20.

Sr. No.	Variety	Total number of samples collected	No. of locations	Wilt incidence (%)
1.	Local	30	10	20.50
2.	JG 74	25	08	15.00
3.	JG315	35	10	16.20
4.	JG 12	30	10	14.80
5.	JG 130	35	12	12.10
6.	JG 63	25	10	10.00
Total/Mean		180	60	14.76

Thus, perusal of the data obtained during present survey study revealed that in the Vidisha district of vindhyan plateau zone, the chickpea crop grown during *rabi* (2018-2019) season was severely affected with the wilt disease (*Fusarium oxysporum* f. sp. *ciceri*) than that of the crop grown during *rabi* (2019-2020) season. Results (Table 5) revealed that in the ten tehsils of

Vidisha district, surveyed during *rabi* (2018-2019) and *rabi* (2019-2020), the average incidence of wilt ranged from 12.35 (Ganjbasoda) to 17.87 (Gyaraspur) percent. However, the chickpea crop grown in the tehsil of Gyaraspur was found to suffer more with wilt incidence of 17.87 percent with overall average incidence of wilt (15.07%).

Table 5: Average wilt incidence (%) of chickpea in Vidisha district of Madhya Pradesh during Rabi 2018-19 and 2019-20.

Sr. No.	Tehsil	Total number of samples collected	Number of locations	Wilt incidence (%)		Average wilt incidence (%)
				Rabi 2018-19	Rabi 2019-20	
1.	Sironj	20	5	15.60	14.80	15.20
2.	Lateri	15	7	14.20	13.50	13.85
3.	Nateran	15	5	17.25	16.75	17.00
4.	Vidisha	20	8	13.80	13.10	13.45
5.	Gyaraspur	15	5	18.25	17.50	17.87
6.	Kurwai	20	7	15.10	14.60	14.85
7.	Shamshbad	15	6	16.25	15.75	16.00
8.	Tyonda	15	5	17.60	16.90	17.20
9.	Gulabganj	20	5	13.20	12.60	12.90
10.	Ganjbasoda	25	7	12.60	12.10	12.35
Total/Mean		180	60	15.38	14.76	15.07

The second highest average wilt incidence of 17.20 percent was recorded from the Tyonda tehsil. This was followed by the tehsils of Nateran (17.05%), Shamshbad (16.00%), Sironj (15.20%), Kurwai (14.85%), Lateri (13.85%), Vidisha (13.45%), and Gulabganj (12.90%) with average wilt incidence. Comparatively minimum average wilt incidence of 12.35 percent was recorded in the tehsil of Ganjbasoda.

Further, of the chickpea cultivars grown by the farmers in this region, average maximum wilt incidence during *rabi* (2018-2019) and *rabi* (2019-2020) on chickpea local cultivars (21.30 %) followed by the JG 315 (16.35%), JG 74 (15.40%), JG 12 (15.05%), JG 130 (12.22%) and JG 63 (10.12%) were recorded to suffer more by wilt (*Fusarium oxysporum* f. sp. *ciceri*) disease (Table 6).

Table 6: Variety wise average wilt incidence (%) of chickpea in Vidisha district of Madhya Pradesh during Rabi 2018-19 and 2019-20.

Sr. No.	Variety	Total number of samples collected	No. of locations	Wilt incidence (%)		Average wilt incidence (%)
				Rabi 2018-19	Rabi 2019-20	
1.	Local	30	10	22.10	20.50	21.30
2.	JG 74	25	08	15.80	15.00	15.40
3.	JG 315	35	10	16.50	16.20	16.35
4.	JG12	30	10	15.30	14.80	15.05
5.	JG 130	35	12	12.35	12.10	12.22
6.	JG 63	25	10	10.25	10.00	10.12
Total/Mean		180	60	15.38	14.76	15.07

The variation in the wilt incidence within a village of different tehsils of Vidisha district, magnitude of wilt incidence was higher under rainfed conditions this might be due to favorable conditions of low moisture with high temperature prevailed in crop growth period, as wilt pathogen favors dry conditions. The black cotton soil is characterized with higher vegetation which leads to deposition of high organic amendments thereby increasing the carbon levels significantly. Rich carbon source available in black cotton soil also allows significantly high multiplication inoculums of *Fusarium* thereby giving higher incidence. These results obtained in the present studies on occurrence, distribution, yield loss and survey of chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceri* are similar to those reported earlier by several workers on chickpea and other crops. Studies carried by Sharma *et al.*, (1983) surveyed 30 villages in M.P. for occurrence of *Fusarium* wilt and observed that incidence of chickpea wilt caused by *F. oxysporum* was more in low moisture conditions as compared to higher moisture conditions (wet) year. Gupta Om *et al.*, (1983) reported that the wilt incidence 0-60 percent from Jabalpur and central part of M.P. Reddy, (2002) surveyed chickpea fields under rainfed as well as irrigated conditions at 10 locations for variation in wilt incidence was 8.84 to 39.44 percent of chickpea wilt. Ghosh *et al.*, (2013) on survey during *Rabi* 2010-2011 to find information on the occurrence and distribution chickpea diseases in respect to soil type, cultivar, seed treatment in central and Southern parts of India. It was revealed that local cultivars transcendent in most farmer's fields (25 to 48%), whereas, 63% of the farmers were practices seed treatment with fungicide and reported the incidence of chickpea wilt disease ranged from 9.7 to 13.8%. Nikam *et al.*, (2011) conducted survey on chickpea wilt in tehsils of Latur district and described the average wilt incidence to the tune of 12.26 %

with maximum wilt incidence was found in AUSA (15.4 %). A foresaid variation in wilt incidence and wide spread nature of disease have been reported by earlier worker like Nema and Khare (1973); Trapero-Casas and Jimenez-diaz (1985); Jalali and Chand (1992); Navas-Cortes *et al.*, (2000); Reddy, (2002); Jadhav *et al.*, (2006); Pitambar *et al.*, (2010); Abera *et al.*, (2011); Jendoubi *et al.*, (2017); Singh *et al.*, (2017); Mulekar *et al.* (2017); Rao *et al.*, (2019); Yimer *et al.*, (2018).

CONCLUSION

The study revealed that in Vidisha district the mean incidence of chickpea wilt were found maximum in Gyaraspur tehsil (17.87%), followed by Tyonda (17.20 %), Nateran (17.05%), Shamshbad (16.00%), Sironj (15.20%), Kurwai (14.85%), Lateri (13.85%), Vidisha (13.45%), Gulabganj tehsils (12.90%) and Ganjbasoda (12.35 %) respectively. Present study showed that chickpea wilt is highly distributed in all the surveyed areas of Vidisha district of Madhya Pradesh. Variety wise incidence were more on local cultivar (21.30 %) followed by JG 315 (16.35 %) and JG 74 (15.40 %). However, the minimum incidence of chickpea wilt were found on variety JG 12 (15.05%), JG 130 (12.22%) and JG 63 (10.12%).

FUTURE SCOPE

Similar study can be undertaken to know the status of chickpea wilt in different districts of Madhya Pradesh to identify the chickpea wilt incidence. This will be helpful in minimizing the losses and increase the productivity.

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Conflict of Interest. None.

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