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Survey for the incidence of Fusarium wilt of chickpea in Nandyal district of Andhra Pradesh

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ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops grown all over India. Chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceris* is one of the major diseases on chickpea, which is soil and seed borne. In order to determine the prevalence and severity of the disease, a random roving survey was conducted during *rabi* 2023–2024 in the major chickpea growing mandals of the Nandyal district *viz*., Nandikotkur, Jupadu Bunglow, Pamulapadu, Midthur, Panyam, Banaganapalle, Koilakuntla, Uyyalawada, Dornipadu, Allagadda, Gadivemula and Gospadu. The results of the survey showed that average per cent wilt incidence of 37.68 per cent was recorded in Nandyal district and the wilt incidence ranged from 10.00 to 75.70 per cent. Allagadda mandal had the highest mean per cent wilt incidence (59.50%), whereas the lowest mean percent wilt incidence was recorded in Panyam mandal (10.00%).

Keywords: *Chickpea, Chickpea wilt, Fusarium oxysporum f.sp. ciceris and Nandyal.*

Chickpea (*Cicer arietinum* L.) is the world's second-most significant food legume and one of the major pulse crops cultivated in India. During 2021-22 (fourth estimate), chickpea production in India was 13.75 million tonnes with a productivity of 12.6 q/ha, produced on 10.91 million ha of land (Directorate of Economics and Statistics, 2023). In India, it is majorly grown in Madhya Pradesh, Andhra Pradesh, Karnataka, Maharashtra, Rajasthan. In Andhra Pradesh, Nandyal district accounts majority of chickpea area.

In India, several biotic and abiotic factors were responsible for yield losses of chickpea and the crop is attacked by about 52 number of pathogens (Nene *et al*., 1984). Among all, Fusarium wilt incited by *Fusarium oxysporum* f.sp. *ciceris* is one of the major constraints for production and causes losses by reducing the plant population. The pathogen mainly affects plant roots, leading to colonizing and blocking vascular bundle cells, specifically xylem vessels. This blocking results in chlorosis, vascular discoloration, leaf wilting, shortening of plants, and, in severe cases, premature plant death. (Lal *et al.,* 2024). The roots of the wilting plants do not show any external rotting but when split open vertically, dark brown discoloration of internal xylem is seen (Nene *et al.,* 1991).

Chickpea wilt has been reported from 32 countries (Singh *et al*., 2014) and in India, it is a major problem in all growing states. In Andhra Pradesh, it was reported in the range of 0.2 to 15.2 per cent during 2014-15 (Ramanamma *et al.,* 2020).

Thus, the aim of the survey is to determine the prevalence and severity of Fusarium wilt in different regions of Nandyal district as the chickpea crop is widely cultivated in Nandyal district and it helps to identify the areas with high disease pressure that enables the targeted use of resistant cultivars and other management methods in these highly susceptible regions.

MATERIAL AND METHODS

A roving survey was conducted during *rabi* 2023-24 in farmers' fields to assess the disease incidence of Fusarium wilt in 12 predominantly chickpea growing mandals of Nandyal district *viz.,* Nandikotkur, Jupadu Bunglow, Pamulapadu, Midthur, Panyam, Banaganapalle, Koilakuntla, Uyyalawada, Dornipadu, Allagadda, Gadivemula and Gospadu (Fig.1). In each field, a plot size of 1.0 × 1.0 m^2 was

selected diagonally at five locations for recording the disease incidence. The plants were visually examined for wilt incidence and then per cent wilt incidence was calculated based on the number of healthy and wilted plants per square meter, using following formula.

$$\text{Wilt Incidence (\%)} = \frac{\text{Number of diseased plants}}{\text{Total no. of plants}} X100$$

Roots and stem of infected samples were collected from surveyed field. These samples were brought to laboratory for confirmation of *Fusarium oxysporum* f.sp. *ciceris.*

RESULTS AND DISCUSSION

To know the prevalence of chickpea wilt disease incidence, a survey was conducted during *rabi* season 2023-24 in 12 major chickpea growing mandals of Nandyal district. The survey revealed that, the wilt incidence was noticed in all the locations surveyed. Among the 12 mandals, the highest mean percent wilt incidence was recorded in Allagadda mandal (59.50%) with a range of 56.00 to 66.00%. The next highest incidence was recorded in Midthur (49.74% in a range of 45.00 to 57.40%) followed by Gadivemula (46.50%), Koilakuntla (45.14% in a range of 32.25 to 75.70%) and Banaganapalle (43.46% in a range of 36.00 to 65.00%). Other mandals *viz.,* Gospadu, Nandikotkur, Jupadu Bunglow, Pamulapadu Dornipadu and Uyyalawada were recorded with mean per cent incidence of 38.00 per cent, 35.98 per cent (in a range of 12.50 to 57.00%), 35.32 per cent (in a range of 24.00 to 57.00%),35.00 per cent (in a range of 20.50 to 56.50%), 29.81 per cent (in a range of 15.88 to 43.75%), and 23.70 per cent (in a range of 21.50 to 25.60%), respectively. The lowest mean per cent wilt incidence was recorded in Panyam mandal (10%) (Table 1 and Fig. 2).

Among the different villages surveyed, Kalugotla village, (Koilakuntla mandal) found highest per cent wilt incidence of 75.70 per cent and the lowest per cent wilt incidence of 10 per cent was recorded in Bhupanapadu village (Panyam Mandal) in Nandyal district (Table 1). In over all, the mean per cent wilt incidence of 37.68 per cent (in a range of 10.00 to 75.70%) was recorded in Nandyal district. During survey, the data with respect to per cent wilt incidence in different places depicted that, incidence of disease varied by location. The differences in disease incidence might be related to the quantum of inoculum accumulation in soil, environmental conditions, monocropping strategy, meteorological conditions, and farming practices. In this survey, Fusarium wilt was observed at various growth stages of the crop and more severity was noted during vegetative stage. It was also observed that the farmers of Nandyal district were widely growing a variety JG-11. In some of the fields surveyed, drooping of plants with dull green colour were observed and when split open brown to black vascular discoloration was also observed. The data indicates there was difference in disease incidence with respect to different villages that is might be due to different stages of crop, environmental conditions that favoured the pathogenic variability of the wilt pathogen *i.e., Fusarium oxysporum* f.sp. *ciceris.* The present study results were in accordance with Gangwar *et al*. (2013) conducted a survey on Fusarium wilt of chickpea in Rajasthan for two years, *i.e*., 2011–12 to 2012–13 and reported that the disease was found in all the surveyed areas, with an incidence ranging from 27.43 per cent to 45.88 per cent, with an average of 37.48 per cent. Nandeesha *et al*. (2021) reported that Bagalkot district had high disease incidence with 27.19 per cent followed by Kalburgi district with 24.90 per cent in Karnataka. Ramanamma *et al*. (2020) conducted a survey during *rabi*, 2014-2015 in six districts of Andhra Pradesh and reported that lowest mean wilt incidence observed in Nellore district (5.90%) and highest mean wilt incidence in Kadapa district (8.32%). The data with respect to per cent wilt incidence in different places depicted that, incidence of disease varied by location based on inoculum accumulation, meteorological conditions, monocropping strategy and farming practices and due to pathogenic variability of the wilt pathogen *i.e., Fusarium oxysporum* f.sp. *ciceris*. In this survey, Fusarium wilt was observed at various growth stages of the crop and more severity was noted during vegetative stage to reproductive stage.

CONCLUSION

The results of the study concluded that an average per cent wilt incidence of 37.68 per cent was recorded in Nandyal district ranging from 10.00 to

Table 1. Survey for the incidence of Fusarium wilt in Chickpea in different mandals of Nandyal district during *rabi* 2023-24

Mandal	Village	GPS coordinates		Stage of the crop	Per cent Disease Incidence	Per cent Disease Incidence at Mandal	
		Latitude	Longitude			Mean	Range
Nandikotkur	Brahmanakotkur	15.8180° N	78.2052° E	Vegetative	48.48	35.98	12.50 - 57.10
	Bollavaram	15.8273° N	78.2268° E	Vegetative	49.72		
	Bollavaram 2	15.8275° N	78.2295° E	Vegetative	32.9		
	Damagatla	15.8137° N	78.2186° E	Pod filling	37.2		
	Nandikotkur	15.7777° N	78.2895° E	Vegetative	57.1		
	Kanala	15.7879° N	78.1544° E	Flowering	31		
	Allur	15.8646° N	78.2297° E	Vegetative	37		
	Konetampalli	15.8544° N	78.2024° E	Pod filling	17.6		
	Malyala	15.8938° N	78.2422° E	Flowering	12.5		
	Parumanchala	15.8035° N	78.3854° E	Flowering	36.36		
Jupadu Bunglow	Jupadu Bunglow	15.8238° N	78.3949° E	Flowering	28.6	35.32	24.00 – 57.00
	Tharthur	15.8492° N	78.7317 ° E	Flowering	35		
	Bannur	15.8753° N	78.4166° E	Flowering	57		
	Lingapuram	15.8209° N	78.4032° N	Flowering	37.6		
	Tharigopula	15.8544° N	78.4104° E	Flowering	29.7		
	Thudicherla	15.7650° N	78.4560° E	Harvesting	24		
Pamulapadu	Chelimella	15.8543° N	78.4998° E	Pod filling	20.5	35	20.50 - 56.50
	Jutur	15.8597° N	78.4535° E	Flowering	47.5		
	Pamulapadu	15.8408° N	78.4958° E	Vegetative	56.5		
	Kambalapalle	15.8342° N	78.5373° E	Pod filling	45.5		
	Mittakandala	15.8027° N	78.4682° E	Pod filling	30		
	Rudravaram	15.8498° N	78.4700° E	Pod filling	21.5		
	Iskala	15.8613° N	78.5269° E	Pod filling	33.5		
	Erragudur	15.8328° N	78.5318° E	Pod filling	25		
Midthur	Midthur	15.7682° N	78.2797° E	Vegetative	47.1	49.74	45.70 -57.40
	Peerushabpet	15.7692° N	78.2778° E	Vegetative	57.4		
	Nagalooty	15.7905° N	78.2609° E	Pod filling	45.7		
	Kadumur	15.7562° N	78.2221° E	Vegetative	49.5		
	Masapeta	15.7562° N	78.2221° E	Vegetative	49		
Panyam	Bhupanapadu	15.4637° N	78.3342° E	Vegetative	10	10	10
Banaganapalle	Kyapa	15.3193° N	78.2525° E	Vegetative	65	43.46	36.00 – 65.00
	Appalapuram	15.3225° N	78.2798° E	Pod filling	36		
	Abdullapuram	15.3381° N	78.3194° E	Vegetative	41.3		
	Mittapalli	15.3182° N	78.2541° E	Pod filling	37.5		
	Tangutoor	15.3512° N	78.3404° E	Pod filling	37.5		
Koilakuntla	Mogalaiuppaluru	15.2972° N	78.3606° E	Flowering	40	45.14	32.25-75.70
	Revanur	15.3032° N	78.3570° E	Vegetative	46.42		
	Bheemunipadu	15.2294° N	78.3508° E	Flowering	43.5		
	Koilakuntla	15.2091° N	78.4227° E	Vegetative	32.25		
	Tellapuri	15.3539° N	78.3786° E	Pod filling	36.5		
	Kulur	15.3296° N	78.3713° E	Flowering	38		
	Kampamalla	15.3539°N	78.3786 ° E	Flowering	48.47		
	Kalugotla	15.2834° N	78.3544° E	Early flowering stage	75.7		
	Joladarasi	15.2639° N	78.3421° E	Vegetative	45.45		
Uyyalawada	Uyyalawada	15.1030° N	78.4448° E	Vegetative	21.5	23.7	21.50 - 25.60
	Peddachintakunta	15.1030° N	78.4448° E	Vegetative	25.6		
	Alur	15.1321° N	78.3447° E	Flowering	24		
Dornipadu	Gundupapala	15.3248° N	78.3851° E	Vegetative	15.88	29.81	15.88- 43.75
	Dornipadu	15.2068° N	78.4399° E	Vegetative	43.75		
Allagadda	Lingamdinne	15.1135° N	78.4689° E	Vegetative	56.5	59.5	56.00 - 66.00
	Allagadda	15.1537° N	78.5005° E	Vegetative	66		
	Jambuladinne	15.1797° N	78.5017° E	Vegetative	56		
Gadivemula	Gadivemula	15.8040° N	78.2803° E	Vegetative	46.5	46.5	46.5
Gospadu	Rayapadu	15.3533° N	78.3536° E	Vegetative	38	38	38
MEAN						37.68	

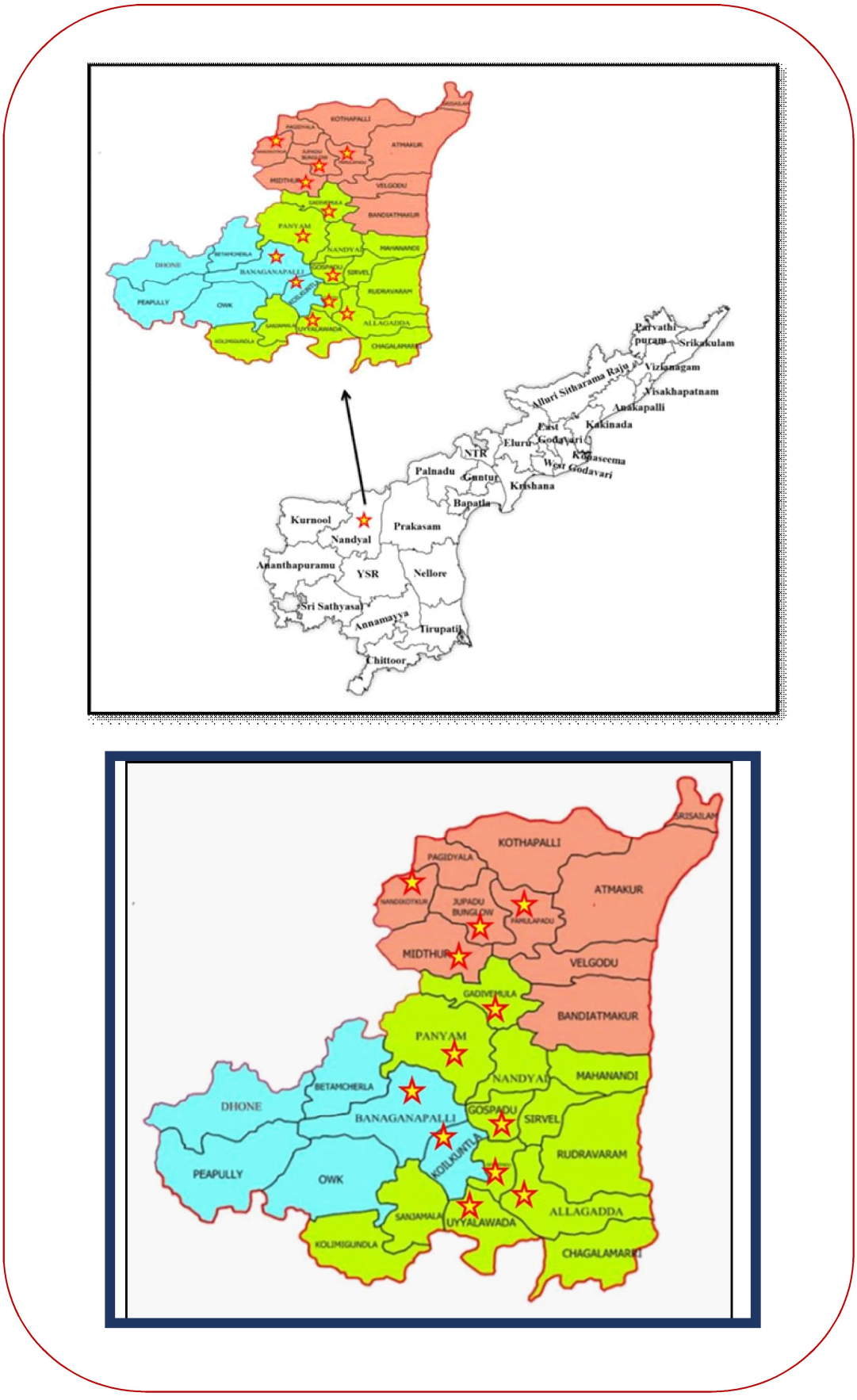

Fig 1. Maps showing the major chickpea growing and surveyed mandals in Nandyal district, Andhra Pradesh

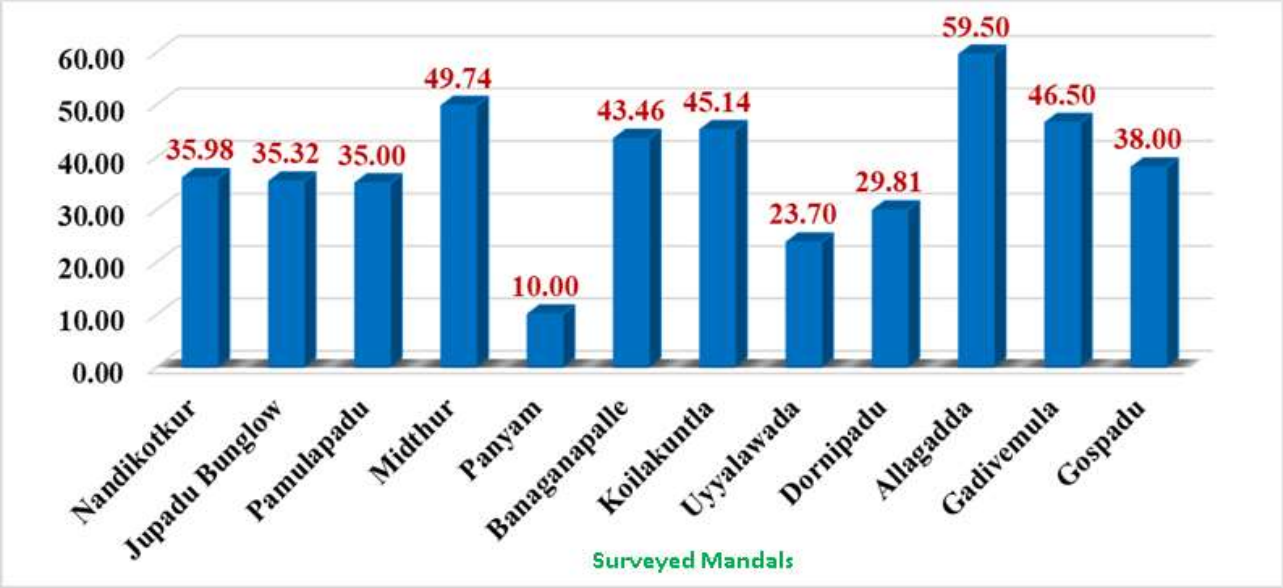

Fig 2: Mean per cent wilt incidence in surveyed mandals of Nandyal district during *rabi* 2023-2024

75.70 per cent during *rabi* 2023-24. The study also indicated that the incidence of disease varied depending on the locations, agroclimatic conditions, crop stage, etc.

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